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How to use the MICROPAEDIA

The 12 volumes of the MICROPAEDIA contain tens of thousands of shorter articles on specific persons, places, things, and ideas, arranged in alphabetical order. The MICROPAEDIA can be used as an information resource on its own; and it can function as support for the longer articles in the MACROPAEDIA (to which it refers whenever appropriate). The MICROPAEDIA in turn is supported by references in the INDEX and by the lists of suggested readings in the PROPAEDIA. Finally, the MICROPAEDIA is the portion of the *Encyclopædia Britannica* best suited for the reader who wishes to browse among the countless subjects in all fields of human learning and history in all times and places.

Alphabetization

Entry titles are alphabetized according to the English alphabet, A to Z. All diacritical marks (such as in ö, ł, or ñ) and foreign letters without parallels in English (such as ayin [ʿ] and hamza [ʾ]) are ignored in the alphabetization. Apostrophes likewise are ignored. Titles beginning with numbers, such as **1812, War of**, are alphabetized as if the numbers were written out (**Eighteen-twelve, War of**).

Alphabetization proceeds according to the "word-by-word" principle. Thus, **Mount Vernon** precedes **mountain**; any **John** entry precedes **John Henry**, which in turn precedes **Johne's disease**. Any character or string of characters preceding a space, hyphen, or dash is treated as a word and alphabetized accordingly. Thus, **De Broglie** precedes **debenture**, and **jack-o'-lantern** precedes **jackal**. Titles with identical spellings are arranged in the following order: (1) persons, (2) places, (3) things.

For many rulers and titled nobility, chronological order, as well as alphabetical order, governs placement. Rulers of the same given name (*e.g.,* William) may be grouped together, separate from other entries, and indicated by the symbol •. They may be subgrouped alphabetically by country and, within each country, arranged chronologically (**William I**, **William II**, etc.). Nobility or peers of the same titled name (*e.g.,* **Essex, EARLS OF**) are similarly grouped together, separate from other entries; they are indicated by the symbol • and arranged chronologically.

Places with identical names are arranged in the alphabetical order of the countries where they are located. Identical place-names in the same country are alphabetized according to the alphabetical order of the state, province, or other political subdivision where they are found.

Entry arrangement

The titles of entries are arranged according to the forms commonly found in indexes and dictionaries, with some special conventions.

Entry titles for certain physical features, institutions, structures, events, and concepts are ordinarily inverted to place the substantive word first. Thus, the Bay of Bengal is entered as **Bengal, Bay of**; the Bank of England as **England, Bank of**; the Tower of London as **London, Tower of**; the Siege of Vienna as **Vienna, Siege of**; and the balance of power as **power, balance of.** If the name of a physical feature, institution, structure, event, or concept has two or more descriptors, it is entered under the descriptor appearing first. Thus, the Episcopal Church in Scotland is entered as **Episcopal Church in Scotland** (not **Scotland, Episcopal Church in**); the Leaning Tower of Pisa as **Leaning Tower of Pisa**; and the kinetic theory of gases as **kinetic theory of gases**.

The entries for most Western persons are arranged so that one can read a name in correct order by beginning after the first comma, proceeding to the end of the boldface type, returning to the beginning word or words, and proceeding forward to the first comma. Thus, the entry **March, Patrick Dunbar, 2nd Earl of**, is read "Patrick Dunbar, 2nd Earl of March"; the entry **Orléans, Louis, duc d'**, is read "Louis, duc d'Orléans." Names of Far Eastern origin are given in Oriental order, with the surname preceding the personal name (*e.g.,* **Tōjō Hideki**, **Deng Xiaoping**, **Nguyen Cao Ky**).

Cross-references

Some cross-reference entries appear in the MICROPAEDIA for the purpose of leading a reader from names that are familiar to alternate names that may not be. Cross-references also appear frequently within or at the ends of standard entries, where they are identified by *see, see also, see under, q.v.* (*quod vide,* "which see"), or *qq.v.* (*quae vide,* "which see," plural).

Certain entries serve both as relatively brief essays on general subjects and as cross-references to the same subjects treated at greater length and in greater depth in the MACROPAEDIA. Such an entry (*e.g.,* **igneous rock**) begins with a definition of the subject and then provides the following cross-reference: "A brief treatment of igneous rocks follows. For full treatment, *see* MACROPAEDIA: Minerals and Rocks.

Entries on certain broad subjects (*e.g.,* **music**) direct the reader to several relevant articles in the MACROPAEDIA and also to the PROPAEDIA for listings of related articles in the MICROPAEDIA.

Abbreviations

Abbreviations used in the MICROPAEDIA are given in a list that appears at the end of every MICROPAEDIA volume.

Territorial boundaries

In articles and maps indicating disputed geopolitical boundaries and territories, the attribution of sovereignty or administrative subordination to any specific area does not imply recognition of the status claimed by an administering power.

otter, any of several species of semi-aquatic mammals in four genera of the weasel family (Mustelidae). They have the same general proportions as a weasel—the lithe, slender body, long neck, small ears, and short legs. The head is flattened, and the base of the tail is almost as thick as the body. Few other animals produce a fur so highly valued by man and so durable; the darker furs of northern animals are the most prized.

Otters swim easily with webbed feet, and can travel underwater for 0.4 kilometre (¼ mile) without surfacing for air. They prefer to travel by water but, their short legs notwithstanding, can travel on land faster than a man can run. Their food consists of all manner of small aquatic animals, including fish, which they catch sometimes by teamwork; they also prey on other small mammals. A litter of one to five young is born after a gestation of 61–63 days.

River otter (*Lutra canadensis*)

Kenneth W. Fink—Root Resources

Unlike almost all other wild animals, otters are playful as adults. A favourite sport is sliding down a steep bank of mud or snow and plunging into water or a snowdrift. Otters are intelligent, friendly, and inquisitive. When obtained young, they can be trained readily.

Among the best-known otter species are the following:

African small-clawed otter (*Aonyx philippsi*) of western and central Africa, found principally in rain forests and mountain streams; also called Liberian otter; considered as three species (*Paraonyx philippsi, P. congica*, and *P. microdon*) by some authors; length about 95 centimetres (38 inches), including the 35-cm tail; weight about 7 kilograms (15 pounds); shining, dark-brown fur, pale markings on throat and face; claws, blunt and short on the partly webbed forefeet and entirely webbed hindfeet.

Central American otter (*Lutra annectens*) of Central and South America; also called southern river otter; coat, yellowish to reddish brown with grayish brown underparts.

Clawless otter (*Aonyx capensis*) of central and southern Africa, generally found near slow-moving water; also called African (or cape) clawless and giant African otter; length, 95–100 cm exclusive of the flattened, 55-cm tail; weight, 14–27 kg; fur, brown with pale chin and throat patches; claws lacking except for rudimentary claws on third and fourth hindtoes.

Common otter: see Eurasian otter and river otter, below.

Eurasian otter (*Lutra lutra*) of Eurasian and North African rivers; also called common and Old World otter; length, 56–83 cm, exclusive of the 36–55-cm tail; shoulder height, about 30 cm; weight, 6–15 kg; fur, brown, paler below, white on cheeks and throat.

Giant (Brazilian giant) otter (*Pteronura brasiliensis*), very rare species confined to slow-flowing rivers and streams of South America; species endangered as a result of hunting; also called saro and margin-tailed, or flat-tailed, otter for its flattened, ridged tail; feet, completely webbed; fur, brown with a large whitish chest patch; probably the largest otter, attaining a length of 1–1.5 m, excluding the 0.7-m tail.

Hairy-nosed otter (*Lutra sumatrana*) of southern Asia, named for its finely haired nose pad; length about 130 cm, including the 50-cm tail; coat, reddish brown with whitish throat, chin, and cheeks.

Oriental small-clawed otter (*Aonyx cinerea* separated as *Amblonyx cinerea* by some authors), of Southeast Asia; also called Asian clawless and Indian small-clawed otter; sometimes tamed and used to catch fish; weight 2.7–5.4 kg; length 56–61 cm, excluding the 31-cm tail; fur, dark brown, paler below, with whitish throat and face markings.

River otter (*Lutra canadensis*) of North American lakes and streams; also called land, common, North American, and Virginia otter; head and body length, 65–75 cm; tail length, 30–50 cm; weight, 5–12 kg; fur, glossy, dark brown, usually paler ventrally, with contrasting whitish throat and muzzle markings.

Sea (great sea) otter (*Enhydra lutris*), rare, completely marine species of the North Pacific, usually in kelp beds; floats on its back with a stone on its chest, opening mollusks by smashing them on the stone; hindfeet large, broad, flipperlike; forefeet reduced; coat (the most expensive otter fur) thick, lustrous, reddish to dark brown, often grizzled; head and body, 76–120 cm; tail length, 25–37 cm; weight, 16–41 kg; hunted almost to extinction by 1910, now fully protected and gradually increasing in numbers.

Smooth-coated otter (*Lutra perspicillata*) of Southeast Asia, separated as *Lutrogale perspicillata* by some authors; also called smooth, or smooth Indian, otter and simung; coat, sleek reddish to blackish brown, often lighter ventrally and marked by whitish face and throat patches; length 66–74 cm exclusive of the flattened, 43–46-cm tail.

Where the same name may denote a person, place, or thing, the articles will be found in that order

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otter shrew, any of the three species of west equatorial African mammals composing the subfamily Potamogalinae of the tenrec (*q.v.*) family (Tenrecidae). Some authors separate them as the family Potamogalidae (of the order Insectivora). They are carnivorous and semi-aquatic, in streams and estuaries. All are long bodied, with laterally flattened tails, used for propulsion underwater, and dense brown and white fur. The largest species is *Potamogale velox,* often called giant water shrew; it may be 64 centimetres (25 inches) long, including its 29-cm tail. It has skin flaps on the inner sides of the hindfeet. The two species of the genus *Micropotamogale* (including *Mesopotamogale*) are smaller.

Otter shrew (*Potamogale velox*)

Painting by Don Meighan

otterhound, dog breed first described in the 14th century. Developed to hunt otters, it resembles a rough-coated bloodhound and has a large head, pendulous ears, and a dense, shaggy, water-resistant coat. Its webbed feet make it an excellent swimmer. It stands 24 to 26 inches (61 to 66 centimetres), weighs 55 to 65 pounds (25 to 30 kilograms), and is usually blue-gray or yellowish brown with black-and-tan markings.

Ottilien (Papua New Guinea): *see* Ramu River.

Öttingen–Schrattenhofen faience, German tin-glazed earthenware made in Bavaria in the 18th and 19th centuries. The factory was first established at Öttingen in 1735 and two years later was moved to Schrattenhofen. The ware is characteristic of much produced in Bavaria—*e.g.,* cylindrical beer tankards—and the decoration is likewise Bavarian in the Rococo style. The factory also produced less ornate ware and, in later years, like many German faience centres, a cream-coloured earthenware inspired by that of Wedgwood.

Otto, Greek OTHO, name of rulers grouped below by country and indicated by the symbol •.

BAVARIA

•Otto II, also called OTTO OF NORDHEIM, German OTTO VON NORDHEIM (d. Jan. 11, 1083), duke of Bavaria and also a leading noble in Saxony, the most implacable opponent of the German king Henry IV.

In 1061, Agnes of Poitou, regent for her young son Henry IV, invested Otto with the duchy of Bavaria. The following year, however, he helped Archbishop Anno of Cologne to kidnap Henry IV, an act that deprived Agnes of the regency. From then until the end of Henry's minority, Otto was prominent in the government of the German state. Along with other Saxon nobles, he did not hesitate to take advantage of Henry's minority to usurp part of the King's demesne. In 1070 Otto was accused of complicity in a plot to murder the King and was deprived of his Bavarian and Saxon possessions. Taken prisoner in 1071, he was restored to his lands in Saxony in 1072.

Shortly after the Saxon uprising against Henry IV broke out in 1073, Otto assumed its leadership. The short-lived Peace of Gerstungen (1074) stipulated Otto's restoration to Bavaria. But when Henry resumed war in June 1075, Otto was taken prisoner again. Around Christmas of that year, however, Henry not only pardoned Otto but also gave him a high administrative post in Saxony.

Nevertheless, after the excommunication and deposition of Henry by Pope Gregory VII over the investiture of bishops (1076), Otto rejoined the Saxon rebels. As soon as his restoration to Bavaria was assured, he assented to the election of Rudolf of Rheinfelden as German king in opposition to Henry (1077). A skillful fighter, Otto inflicted losses on Henry's forces in 1078 and in January 1080 and won the battle on the Elster River in October of that year; but Rudolf received a mortal wound in the battle. The forces opposing Henry then elected Hermann of Salm as anti-king, but Hermann's chief military support collapsed with Otto's death less than three years later.

•Otto (b. April 27, 1848, Munich—d. Oct. 11, 1916, Schloss Fürstenreid, near Munich), insane king of Bavaria, younger son of King Maximilian II.

Otto fell insane in 1872 and, from 1880 onward, had to be kept under strict surveillance. When his elder brother, King Louis II, likewise insane, died in 1886, he became king under the regency first of his uncle Luitpold, the heir apparent, and then (1912) of Luitpold's son Louis, who made himself king, as Louis III, on Nov. 5, 1913, even though his cousin Otto was still alive.

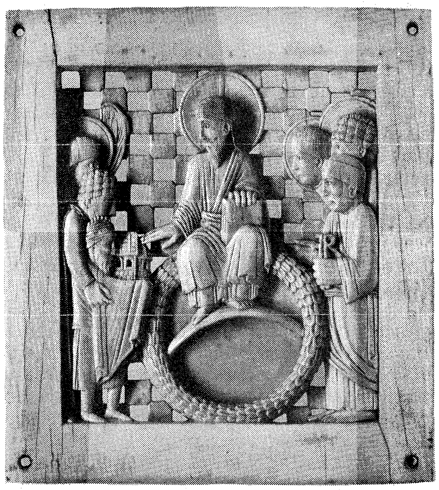
GERMANY/HOLY ROMAN EMPIRE

•Otto I, byname OTTO THE GREAT, German OTTO DER GROSSE (b. Nov. 23, 912—d.

May 7, 973, Memleben, Thuringia), duke of Saxony (as Otto II, 936–961), German king (from 936), and Holy Roman emperor (962–973), who consolidated the German *Reich* by his suppression of rebellious vassals and his decisive victory over the Hungarians. His use of the church as a stabilizing influence created a secure empire and stimulated a cultural renaissance.

Early years. Otto was the son of the future king Henry I, of the Liudolfing, or Saxon, dynasty, and his second wife, Matilda. Little is known of his early years, but he probably shared in some of his father's campaigns. He married Edith, daughter of the English king Edward the Elder, in 930; she obtained as her dowry the flourishing town of Magdeburg. Nominated by Henry as his successor, Otto was elected king by the German dukes at Aachen on Aug. 7, 936, a month after Henry's death, and crowned by the archbishops of Mainz and Cologne.

While Henry I had controlled his vassal dukes only with difficulty, the new king firmly asserted his suzerainty over them. This led immediately to war, especially with Eberhard of Franconia and his namesake, Eberhard of Bavaria, who were joined by discontented Saxon nobles under the leadership of Otto's half-brother Thankmar. Thankmar was



Otto I (left) offering a model of Magdeburg cathedral to Christ in majesty, ivory plaque, *c.* 970; in the Metropolitan Museum of Art, New York City

By courtesy of the Metropolitan Museum of Art, New York City, gift of George Blumenthal, 1941

defeated and killed, the Franconian Eberhard submitted to the King, and Eberhard of Bavaria was deposed and outlawed. In 939, however, Otto's younger brother Henry revolted; he was joined by Eberhard of Franconia and by Giselbert of Lotharingia and supported by the French king Louis IV. Otto was again victorious: Eberhard fell in battle, Giselbert was drowned in flight, and Henry submitted to his brother. Nevertheless, in 941 Henry joined a conspiracy to murder the King. This was discovered in time, and, whereas the other conspirators were punished, Henry was again forgiven. Thenceforward he remained faithful to his brother and, in 947, was given the dukedom of Bavaria. The other German dukedoms were likewise bestowed on relatives of Otto.

Foreign conquests. Despite these internal difficulties, Otto found time to strengthen and to extend the frontiers of the kingdom. In the east the margraves Gero and Hermann Billung were successful against the Slavs, and their gains were consolidated by the founding of the Monastery of St. Maurice in Magdeburg, in 937, and of two bishoprics, in 948. In the north, three bishoprics (followed in 968 by a fourth) were founded to extend the Christian mission in Denmark. Otto's first campaign in Bohemia was, however, a failure, and it was not until 950 that the Bohemian prince Boleslav I was forced to submit and to pay tribute.

Having thus strengthened his own position, Otto could not only resist France's claims to Lorraine (Lotharingia) but also act as mediator in France's internal troubles. Similarly, he extended his influence into Burgundy. Moreover, when the Burgundian princess Adelaide, the widowed queen of Italy whom the margrave Berengar of Ivrea had taken prisoner, appealed to him for help, Otto marched into Italy in 951, assumed the title of king of the Lombards, and married Adelaide himself, his first wife having died in 946. In 952 Berengar did homage to him as his vassal for the kingdom of Italy.

Otto had to break off his first Italian campaign because of a revolt in Germany, where Liudolf, his son by Edith, had risen against him with the aid of several magnates. Otto found himself compelled to withdraw to Saxony; but the position of the rebels began to deteriorate when the Magyars invaded Germany in 954, for the rebels could now be accused of complicity with the enemies of the *Reich.* After prolonged fighting, Liudolf had to submit in 955. This made it possible for Otto to defeat the Magyars decisively in the Battle of the Lechfeld, near Augsburg, in August 955; they never invaded Germany again. In the same year Otto and the margrave Gero also won a victory over the Slavs. A further series of campaigns led, by 960, to the subjection of the Slavs between the middle Elbe and the middle Oder. The archbishopric of Magdeburg was founded in 968 with three suffragan bishoprics. Even Mieszko of Poland paid tribute to the German king.

Coronation as emperor. In May 961 Otto procured the election and coronation of the six-year-old Otto II, his elder son by Adelaide, as German king. Then he went for a second time to Italy on the appeal of Pope John XII, who was hard pressed by Berengar of Ivrea. Arriving in Rome on Feb. 2, 962, Otto was crowned emperor, and 11 days later a treaty, known as the *Privilegium Ottonianum,* was concluded, to regulate relations between emperor and pope. This confirmed and extended the temporal power of the papacy, but it is a matter of controversy whether the proviso enabling the emperor to ratify papal elections was included in the original version of the treaty or added in December 963, when Otto deposed John XII for treating with Berengar and set up Leo VIII as pope. Berengar was captured and taken to Germany, and in 964 a revolt of the Romans against Leo VIII was suppressed.

When Leo VIII died in 965, the Emperor chose John XIII for pope, but John was expelled by the Romans. Otto, therefore, marched for a third time to Italy, where he stayed from 966 to 972. He subdued Rome and even advanced into the Byzantine south of Italy. Prolonged negotiations with Byzantium resulted in the marriage of Otto II to the Byzantine princess Theophano, in 972. Having returned to Germany, the Emperor held a great assembly of his court at Quedlinburg on March 23, 973. He died in Memleben several weeks later and was buried in Magdeburg at the side of his first wife.

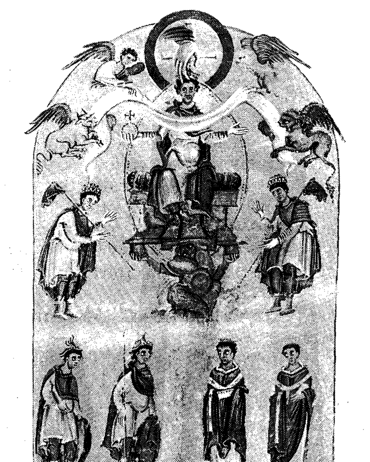
Assessment. Otto I's achievement rests mainly on his consolidation of the *Reich.* He deliberately made use of the bishops to strengthen his rule and thus created that "Ottonian church system of the *Reich*" that was to provide a stable and long-lasting framework for Germany. By his victorious campaigns, he gave Germany peace and security from foreign attack, and the preeminent position that he won as ruler gave him a sort of hegemony in Europe. His Italian policy and the acquisition of the imperial crown constituted a link with the old Carolingian tradition and was to prove a great responsibility for the German people in the future. All areas under Otto's rule prospered, and the resultant flowering of culture has been called the Ottonian renaissance.

(Ku.R.)

BIBLIOGRAPHY. Rudolf Koepke and Ernst Duemmler, *Jahrbücher der deutschen Geschichte: Kaiser Otto der Grosse* (1876; 2nd ed. 1962), a description of the actual events in chronological order and the people involved; Gerd Tellenbach, "Otto der Grosse, 912–973," in *Die grossen Deutschen,* new ed., vol. 1, pp. 35–51 (1956), a short character sketch; Hermann Aubin, *Otto der Grosse und die Erneuerung des abendländischen Kaisertums im Jahre 962* (1962); and Helmut Beumann and Heinrich Buettner, *Das Kaisertum Ottos des Grossen* (1963)—all assess the historical significance of the renewal of the empire. Very little has been published on Otto I in English. John J. Gallagher, *Church and State in Germany Under Otto the Great* (1938); and chapters by C.W. Previte-Orton and A.L. Poole in *The Cambridge Medieval History,* vol. 3 (1964), are of interest.

•**Otto II** (b. 955—d. Dec. 7, 983, Rome), German king from 961 and Holy Roman emperor from 967, sole ruler from 973, son of Otto I and his second wife, Adelaide.

Otto continued his father's policies of promoting a strong monarchy in Germany and of extending the influence of his house in Italy. In 961 he was crowned co-regent king of Italy and Germany with his father and was made co-regent emperor in 967. On April 14, 972, he married the Byzantine princess Theophano. At his father's death in 973 he was accepted without opposition as successor, although revolts in the duchy of Bavaria and in Lorraine occupied the early years of his reign. Bavaria, the most independent of the duchies, rebelled in 974, under the leadership of its duke, Henry II the Quarrelsome, Otto's cousin. It was not until 978 that Bavaria was pacified, the same year that Lothair, king of France, invaded Lorraine. In 979 Otto received the submission of Bohemia and Poland, and in 980 Lothair renounced his claim to Lorraine. Having thus secured his German dominions, Otto marched into Italy in 980, where German rule had been maintained by an imperial party headed by Hugh, marquis of Tuscany. Otto invaded southern Italy and was decisively defeated there by the Arabs in 982. In 983 he summoned a diet at Verona, where his young son, Otto III, was crowned German king. Otto II died in 983 while attempting to bring Venice under imperial control. His absence from Germany had occasioned revolts along its borders, and after his defeat in Calabria in



Otto II enthroned, miniature from his gospel, Reichenau school, *c.* 975; in the treasury of Aachen Cathedral, Germany

Foto Ann Munchow

982 the German position east of the Elbe collapsed because of a revolt by the Danes and an invasion by the Slavs. Nonetheless, Otto left a firmly established realm to his son and successor Otto III.

• **Otto III** (b. July 980—d. Jan. 23, 1002, near Viterbo, Italy), German king and Holy Roman emperor who planned to recreate the glory and power of the ancient Roman Empire in a universal Christian state governed from Rome, in which the pope would be subordinate to the emperor in religious as well as in secular affairs.

Son of the Holy Roman emperor Otto II and Empress Theophano, Otto III was elected German king in June 983 and crowned at Aachen in December, shortly after his father's death. But the child king was seized by Henry II the Quarrelsome, the deposed duke of Bavaria, in an attempt to secure the regency, if not the throne, for himself. In May 984, however, Henry was forced by the imperial diet to turn the child over to his mother, who served as regent until her death in 991; Otto's grandmother, the dowager empress Adelaide, assumed the regency until the King came of age in 994.

In 996, heeding an appeal by Pope John XV for help in putting down a rebellion led by the Roman noble Crescentius II, Otto crossed the Alps. Declared king of Lombardy at Pavia, he reached Rome after the Pope's death, whereupon he secured the election of his 23-year-old cousin, Bruno of Carinthia, as Gregory V, the first German pope. Gregory, who crowned Otto emperor on May 21, 996, was driven from Rome after the Emperor's return to Germany by Crescentius, who then installed John XVI as pope. The Emperor marched back into

Otto III, detail from a miniature, Reichenau school, *c.* 998; in the Bayerische Staatsbibliothek, Munich (Codex Monacensis Graecus 4453)
By courtesy of the Bayerische Staatsbibliothek, Munich

Italy in late 997; taking Rome in February 998, he executed Crescentius, deposed John, and reinstated Gregory.

Otto then proceeded to make Rome his official residence and the administrative centre of the empire. Instituting elaborate Byzantine court ceremonies and reviving ancient Roman customs, he assumed the titles "the servant of Jesus Christ," "the servant of the apostles," and "emperor of the world" and saw himself as the leader of world Christianity. When Gregory V died (999), Otto had the Frenchman Gerbert of Aurillac, his former tutor who agreed with his concept of a theocratic emperor, installed as Pope Sylvester II.

In 1000 Otto made a pilgrimage to the tomb of the mystical archbishop Adelbert of Prague at Gniezno, which he established as the archbishopric of Poland. When in January 1001 Tibur, Italy, rebelled against Otto, he laid siege to the town, forced its surrender, and then pardoned its inhabitants. Angered by this action, the Romans, who wanted the rival town destroyed, rebelled against the Emperor (February 1001) and besieged his palace. After placating the rebels momentarily, Otto withdrew to the monastery of St. Apollinaris, near Ravenna, to do penance. Unable to regain control of the imperial city, he requested military support from his cousin Henry of Bavaria, who was to succeed him as German king and later as emperor. Shortly before the Bavarian troops arrived at his headquarters, Otto died.

• **Otto IV,** also called OTTO OF BRUNSWICK, German OTTO VON BRAUNSCHWEIG (b. *c.* 1175/*c.* 1182—d. May 19, 1218, Harzburg Castle, Lower Saxony), German king and Holy Roman emperor, candidate of the German anti-Hohenstaufen faction, who, after rivalling against two Hohenstaufen kings, was finally deposed.

Otto IV, detail of a statue on the Shrine of the Three Kings, *c.* 1200; in the treasury of Cologne Cathedral
Foto Rathschlag, Cologne

A member of the Welf dynasty, Otto was a son of Henry the Lion of Brunswick and Matilda, daughter of Henry II of England. Brought up at the court of his uncle Richard I of England, Otto was made earl of York in 1190 and count of Poitou and duke of Aquitaine in 1196. Under both kings Richard and John, English diplomatic and financial help were to be of great assistance to Otto in his struggles with the Hohenstaufens.

When the Hohenstaufen emperor Henry VI died in September 1197, his heir, Frederick II, was an infant. Therefore the German princes favouring the Hohenstaufens elected Frederick's uncle, Philip of Swabia, as German king in March 1198. The opposing party, led by Archbishop Adolf of Cologne, however, elected Otto in June 1198.

War ensued between the two factions. In 1201 Otto obtained the support of Pope Innocent III after agreeing to the papacy's territorial claims in central Italy. In 1204, however, some of Otto's chief supporters in Germany, including Archbishop Adolf, went over to Philip's side. When, in early 1208, Otto held only the Welf allodial lands (hereditary possessions independent of any feudal investiture) in Brunswick, even Pope Innocent recognized Philip as king.

When in June 1208 Philip was murdered by a German count to whom he had refused to give one of his daughters in marriage, many of Philip's former supporters made overtures to Otto, who agreed to a new election. Chosen king at Frankfurt in November 1208, he strengthened his position by his betrothal to Philip's 10-year-old daughter Beatrix the Elder. The Pope recognized Otto again after the King reaffirmed the papacy's claims in central Italy.

When in August 1209 Innocent received him at Viterbo, Italy, Otto refused to concede to the church all the lands that the papacy had been claiming from the empire. He agreed, however, not to claim suzerainty over Sicily, of which the young Frederick of Hohenstaufen had in 1198 been crowned king as a vassal of the papacy, because the pope's policy aimed at preventing a reunion of the German and Sicilian crowns. Otto was crowned emperor in Rome on Oct. 4, 1209.

Soon, however, it became evident that Otto did not intend to keep his word. After occupying Tuscany, he invaded the mainland part of Frederick's kingdom of Sicily. Disregarding his excommunication by Innocent, Otto in November 1210 conquered southern Italy. By the time Apulia had fallen, an assembly of princes at Nürnberg declared him deposed and invited Frederick to take his place.

When Otto returned to Germany in March 1212, in order to retain the support of at least part of the Hohenstaufen faction, he married Philip's daughter Beatrix, but lost that support when she died within three weeks of their marriage. Frederick, who arrived in Germany in September 1212, soon prevailed in the southern duchies, but Otto and his supporters held out against him in the lower Rhine district and northeastern Germany. In alliance with his uncle, King John of England, Otto then invaded France, which supported Frederick. Disastrously defeated at the Battle of Bouvines (July 27, 1214), Otto was deserted by nearly all his supporters. He was formally deposed as king in 1215. By the time of his death, three years later, his power was confined again to his Brunswick dominions.

GREECE

• **Otto,** (b. June 1, 1815, Salzburg, Austria—d. July 26, 1867, Bamberg, Bavaria), first king of modern Greece (1832–62), who governed his country autocratically until he was forced to become a constitutional monarch in 1843. Attempting to increase Greek territory at the expense of Turkey, he failed and was overthrown.

The second son of King Louis I of Bavaria, Otto was chosen king of Greece by the great powers at the conference of London in May 1832. The Greek National Assembly confirmed his selection in August 1832, and he arrived in Greece on Feb. 6, 1833, accompanied by several Bavarian advisers. He instituted a new legal code and organized a regular army, but the Bavarians' absolutist rule and heavy taxation led to discontent, which was appeased by the resignation of Otto's chancellor, Joseph Ludwig von Armansperg, in 1837. After failing to annex Crete in 1841, an attempt that alienated Great Britain, the Greeks staged a revolt in 1843. Otto, a Roman Catholic in an Eastern Orthodox country, was forced to grant a constitution specifying that his eventual successor be Orthodox. A Greek oligarchy now replaced the former Bavarian one. The King toyed with the "Great Idea," the reestablishment of the former Byzantine Empire with its capital at Constantinople; but his intervention

Otto, painting by an unknown artist; in the Historical and Ethnological Museum, Athens
Dimitri Papadimos

against Turkey in the Crimean War (1853–56) merely provoked a Franco-British occupation of the Piraeus, and he failed to gain any additional territory for Greece. Otto's backing of Austria in the Italian War of Independence (1859) further damaged his prestige. He was finally deposed in a revolt on Oct. 23, 1862, and returned to Bavaria.

SAXONY

• **Otto II:** *see* Otto I (Germany/Holy Roman Empire).

Otto OF BRUNSWICK: *see* Otto IV *under* Otto (Germany/Holy Roman Empire).

Otto OF FREISING (b. *c.* 1111—d. Sept. 22, 1158, Morimond, Champagne), German bishop and author of one of the most important historico-philosophical works of the Middle Ages.

Otto entered (1132 or 1133) the Cistercian monastery at Morimond in eastern Champagne and became its abbot in 1138 but was immediately called as bishop to Freising in Bavaria. As half-brother of the Hohenstaufen German king Conrad III and as uncle of Frederick I Barbarossa, Otto influenced the policy of the Empire and was present at the imperial diet of Besançon in the County of Burgundy (1157).

Otto's *Chronica sive historia de duabus civitatibus* is a history of the world from the beginning to 1146. Following St. Augustine, it interprets all secular history as a conflict between the *civitas Dei* ("the realm of God") and the world; and it views its contemporary period as that in which Antichrist (the principal personage of power opposed to Christ) is to appear. His second work, the *Gesta Friderici,* deals with the house of Hohenstaufen and with the deeds of Frederick Barbarossa up to 1156.

Otto THE GREAT: *see* Otto I *under* Otto (Germany/Holy Roman Empire).

Otto, Nikolaus August (b. June 10, 1832, Holzhausen, Nassau—d. Jan. 26, 1891, Cologne), German engineer who developed the four-stroke internal-combustion engine, which offered the first practical alternative to the steam engine as a power source.

Otto built his first gasoline-powered engine in 1861. Three years later he formed a partnership with the German industrialist Eugen Langen, and together they developed an improved engine that won a gold medal at the Paris Exposition of 1867.

In 1876 Otto built an internal-combustion engine utilizing the four-stroke cycle (four strokes of the piston for each explosion). The four-stroke cycle was patented in 1862 by the French engineer Alphonse Beau de Rochas, but since Otto was the first to build an engine based upon this principle, it is commonly known as the Otto cycle. Because of its reliability, its efficiency, and its relative quietness,

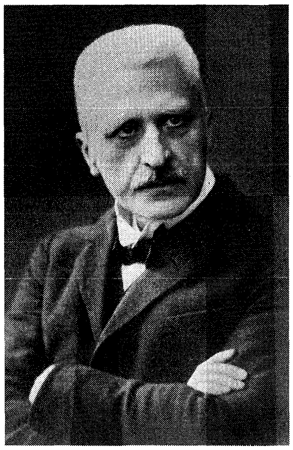
Nikolaus Otto, *c.* 1868
Ullstein Bilderdienst

Otto's engine was an immediate success. More than 30,000 of them were built during the next 10 years, but in 1886 Otto's patent was revoked when Beau de Rochas' earlier patent was brought to light.

Otto, Rudolf (b. Sept. 25, 1869, Peine, Prussia—d. March 6, 1937, Marburg, Ger.), German theologian, philosopher, and historian of religion, who exerted worldwide influence through his investigation of man's experience of the holy. *Das Heilige* (1917; *The Idea of the Holy,* 1923) is his most important work.

Early life and academic career. Otto was the son of William Otto, a manufacturer. Little is known of Otto's early life, except that he was educated at the gymnasium in Hildesheim before becoming a student of theology and philosophy at the University of Erlangen and, later, at the University of Göttingen, where he was made a *Privatdozent* ("lecturer") in 1897, teaching theology, history of religions, and history of philosophy. In 1904 he was appointed professor of systematic theology at Göttingen, a post he held until 1914, when he became professor of theology at the University of Breslau. In 1917 he became professor of systematic theology at the University of Marburg and for one year (1926–27) served as rector of the university. He retired from his university post in 1929, though he continued to live in Marburg the rest of his life.

Otto took time from his scholarly pursuits, more out of a sense of duty than of preference, to participate in community and public



Rudolf Otto, 1925
Foto—Jannasch, Marburg/L.

affairs. He was a member of the Prussian Parliament from 1913 to 1918 and a member of the Constituent Chamber in 1918, where he asserted a liberal and progressive influence. And he was later to concern himself with the political questions of the Weimar Republic. Otto also participated widely in Christian ecumenical activities, both as they related to divisions within the Christian community and as they concerned relations between Christianity and other religions of the world.

Scholarly pursuits. What initially prompted Otto's inquiry into man's experience of the holy was a specifically Christian, even Protestant, concern that had awakened in him while studying the life and thought of Martin Luther. This concern—to elucidate the distinctive character of the religious interpretation of the world—is reflected in his first book, *Die Anschauung vom heiligen Geiste bei Luther* (1898; "The Perception of the Holy Spirit by Luther"). He was to expand his inquiry in his book, *Naturalistische und religiöse Weltansicht* (1904; *Naturalism and Religion,* 1907), in which he contrasted the naturalistic and the religious ways of interpreting the world, first indicating their antitheses and then raising the question of whether the contradictions can be or should be reconciled.

Otto resisted an easy reconciliation between the world view offered by the sciences and the religious interpretation but opposed equally the religionist's hostility toward science and the scientist's disregard of religion. The two perspectives, he insisted, are to be embraced and heeded for what they purport to disclose concerning the world in which men live. It was clear, however, that Otto's principal concern was to justify and to clarify what it is that the religious interpretation of the world, even within its rational aspect, conveys to man as a distinctive dimension of understanding beyond the discoveries of the sciences and the generalized knowledge following from them. Five years later came his work, *Kantische-Fries'sche Religionsphilosophie* (1909; *The Philosophy of Religion Based on Kant and Fries,* 1931), a discussion of the religious thought of the German philosophers Immanuel Kant and Jacob Friedrich Fries, in which he sought to specify the kind of rationality that is appropriate to religious inquiry.

During 1911–12 Otto undertook an extended journey, visiting many countries of the world, beginning with North Africa, Egypt, and Palestine, continuing to India, China, and Japan, and returning by way of the United States. These experiences were to set his problem in a worldwide context, turning him to an extended and searching exploration of the diverse ways in which the religious response had manifested itself among various religions of the world. He proved to be remarkably well equipped for such an exploration, both in his mastery of languages and his knowledge of the history of world religions. In addition to being at home with the languages of Near Eastern religions, he had mastered Sanskrit sufficiently to translate many ancient Hindu texts into German as well as to write several volumes comparing Indian and Christian religious thought.

Influence of Schleiermacher. Otto's initial mentor guiding his inquiry into the specific character of the religious response was the eminent German philosopher and theologian Friedrich Schleiermacher. It was Schleiermacher's early work, specifically his book *Über die Religion. Reden an die Gebilden unter ihren Verächtern* (1799; *On Religion: Speeches to Its Cultured Despisers,* 1893), to which Otto gave particular attention. What appealed to him in this work was Schleiermacher's fresh way of perceiving religion as a unique feeling or awareness, distinct from ethical and rational modes of perception, though not exclusive of them. Schleiermacher was later to speak of this unique feeling as man's "feeling of absolute dependence." Otto was deeply impressed by this formulation and credited Schleiermacher with having rediscovered the sense of the holy in the post-Enlightenment age. Yet he later criticized the formulation on the grounds that what Schleiermacher had pointed up here was no more than a close analogy with ordinary, or "natural," feelings of dependence. For "absolute dependence" Otto substituted "creature-feeling." Creature-feeling, he said,

> is itself a first subjective concomitant and effect of another feeling element, which casts it like a shadow, but which in itself indubitably has immediate and primary reference to an object outside of the self.

Otto called this object "the numinous" or "Wholly Other"—*i.e.,* that which utterly transcends the mundane sphere, roughly equivalent to "supernatural" and "transcendent" in traditional usage.

The Idea of the Holy. Various influences had played upon Otto's reflections through the years, aiding him in reformulating the religious category that was to carry him beyond Schleiermacher. His early teacher at Göttingen, Albrecht Ritschl, had located religion in the realm of value judgments, whereas, more significantly, his theological colleague at Göttingen, Ernst Troeltsch, sought for a religious a priori as the ground of religious interpretation and judgment. Otto was impressed by William James's shrewd insights in *The Varieties of Religious Experience* (1902), yet he found James's empirical method inadequate for interpreting such phenomena. Otto was particularly attracted to the thought of J.F. Fries, already mentioned, whose notion of *Ahndung* (obsolete form of *Ahnung;* literally, "presentiment," or "intuition"), a yearning that yields the feeling of truth, opened up to him a way of dealing with religious phenomena sensitively and appropriately. These "feelings of truth" Otto sought to schematize in his *Idea of the Holy.*

In that work, however, Otto was conscious of moving beyond his previous efforts, exploring more specifically the nonrational aspect of the religious dimension, for which he coined the term numinous, from the Latin *numen* ("god," "spirit," or "divine"), on the analogy of "ominous" from "omen." The numinous, the awe-inspiring element of religious experience, Otto contended,

> evades precise formulation in words. Like the beauty of a musical composition, it is non-rational and eludes complete conceptual analysis; hence it must be discussed in symbolic terms.

Thus, *The Idea of the Holy,* while benefitting from earlier studies, represented for Otto a new venture and a radical shift in the nature and ground of his inquiry. The concern here was to attend to that elemental experience of apprehending the numinous itself. In such moments of apprehension, said Otto,

> we are dealing with something for which there is only one appropriate expression, *mysterium tremendum*. . . . The feeling of it may at times come sweeping like a gentle tide pervading the mind with a tranquil mood of deepest worship. It may pass over into a more set and lasting attitude of the soul, continuing, as it were, thrillingly vibrant and resonant, until at last it dies away and the soul resumes its "profane," non-religious mood of everyday experience. . . . It has its crude, barbaric antecedents and early manifestations, and again it may be developed into something beautiful and pure and glorious. It may become the hushed, trembling, and speechless humility of the creature in the presence of—whom or what? In the presence of that which is a *Mystery* inexpressible and above all creatures.

Although the *mysterium,* which Otto represents as the form of the numinous experience, is beyond conception, what is meant by the term, he insists, is something intensely positive. *Mysterium* can be experienced in feelings that convey the qualitative content of the numinous experience. This content presents itself under two aspects: (1) that of "daunting awfulness and majesty," and (2) "as something uniquely attractive and *fascinating.*" From the former comes the sense of the uncanny, of divine wrath and judgment; from the latter, the reassuring and heightening experiences of grace and divine love. This dual impact of awesome mystery and fascination was Otto's characteristic way of expressing man's encounter with the holy.

Later works. Otto employed the method he had developed in *The Idea of the Holy* in three major publications that followed: *West-Östliche Mystik* (1926; *Mysticism East and West,* 1932); *Die Gnadenreligion Indiens und das Christentum* (1930; *India's Religion of Grace and Christianity,* 1930); and *Reich Gottes und Menschensohn* (1934; *The Kingdom of God and Son of Man,* 1938). Of the three books, the latter is especially important for glimpses of new insight that seem to point beyond the earlier, more widely acclaimed volume; it renders the hint of ultimacy that appears in present history.

Otto's concern with experiencing the numinous also gave rise to experimenting with new forms of liturgy designed to give urgency and vividness to such experiences in Protestant services of worship under critically controlled conditions. Here he employed a "Sacrament of Silence" as a culminating phase, a time of waiting comparable to the Quaker moment of silence, which he acknowledged to have been the stimulus to his own innovation.

Otto took all religions seriously as occasions to experience the holy and thus pressed beyond involvement in his own historic faith as a Christian to engage in frequent encounter with people of other religious traditions. He had much respect for the distinctive characteristics of the various religions and thus resisted universalizing religion in the sense of reducing all to the lowest common denominator. Yet he strongly argued for a lively exchange between representatives of the various religions. It was this concern that led him to create in Marburg the Religious Collection of religious symbols, rituals, and apparatus on a worldwide basis for purposes of inspection and study and to advocate establishing an Inter-Religious League as "a cultural exchange in which the noblest . . . of our art and science and of our whole spiritual heritage would be mutually interpreted and shared."

Personal life and characteristics. Otto never married, but he shared his home with his widowed sister and her daughter. A tall, erect man of subtle mien and movement, Otto created an imposing presence. His students at Marburg called him "Der Heilige" ("the Holy One" or "the Saint"). Someone said of him after his death, "After all, he was something of a king; yet a king who did not lack humility."

Rudolf Otto was first and foremost a scholar, absorbed in his special field of inquiry and rigorous in the pursuit of it. This fact in itself presented him on initial contact as being austere in manner and remote in his reflections. People who encountered him did not readily intrude upon the man or engage him in light conversation. To interrupt his reflections, they felt, one must have something of significance to talk about. That this was in part a facade of their own making, based upon the impressiveness of the man himself, was discovered again and again by those who came to know him well, for, despite this outward austerity, Otto was a gentle person, reticent in his response to people. Yet he could be gracious and outgoing once the barrier of formality had relaxed. Nevertheless, the style of the man was that of a serious and dedicated scholar, and no amount of congeniality or friendliness dispelled that tone of an encounter with him. (B.E.M.)

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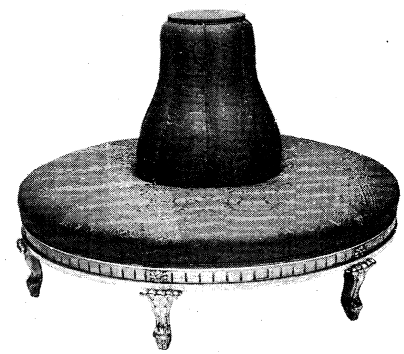
otto of rose (essential oil): *see* attar of roses.

Ottoboni, Pietro Vito: *see* Alexander VIII *under* Alexander (papacy and antipapacy).

Ottokar (name of Bohemian kings): *see under* Otakar.

ottoman, deeply upholstered seat of any shape, with or without a back, introduced into Europe in the late 18th century from Turkey, where, piled with cushions, it was the central piece of domestic seating. One of the early versions was designed as a piece of fitted furniture to go entirely around three walls of a room, and from this evolved a smaller version, designed to fit the corner of a room.



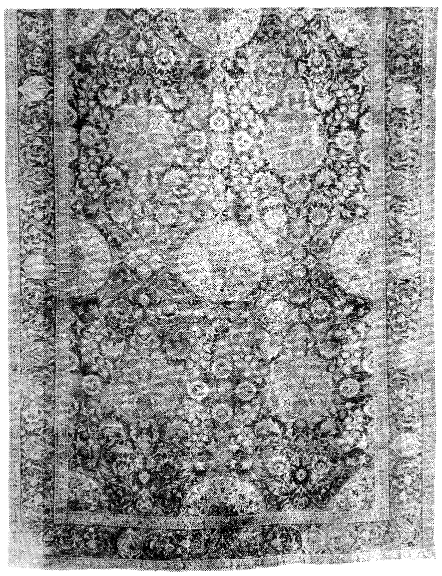
Carved and gilded ottoman by Gottlieb Vollmer, Philadelphia, *c.* 1860; in the White House, Washington, D.C.

Courtesy of White House Historical Association; photograph, National Geographic Society

As the 19th century progressed, ottomans became circular or octagonal, either with arms radiating from the centre, which divided the seating space into sections, or with a central, padded column, which often supported a plant or statue and against which one could lean. The growth of club life stimulated the proliferation of ottomans, many of which also came to have hinged seats underneath for holding magazines and the like. The ottoman footstool, a closely allied piece of furniture, was an upholstered footstool on four legs, which could also be used as a fireside seat.

Ottoman carpet, any floor covering handwoven under the earlier Ottoman sultans of Turkey. Extremely fine, handsome carpets—of wool on a foundation of silk, having floral patterning, often with schemes of large or small circular medallions—and comparable prayer rugs were made for the court, possibly at Bursa in the 16th century.

Coarser, all-wool examples were made in Cairo after the conquest in 1517 and probably also in Anatolia. In due course many of these carpets were exported to southern Europe, where they have been preserved. Although



Detail of an Ottoman carpet from Turkey or Cairo, late 16th century; in the Metropolitan Museum of Art, New York

By courtesy of the Metropolitan Museum of Art, New York, bequest of George Blumenthal, 1941 they are mentioned in old records, all-silk examples do not seem to have survived.

Ottoman Empire, an empire created by Turkish tribes in Anatolia that lasted from the decline of the Byzantine Empire in the 14th century until the establishment of Turkey as a republic in 1922. It was named for Osman (Arabic ʿUthmān), an amīr (prince) in Bithynia who began the conquest of neighbouring regions and who founded the empire's dynasty around 1300.

A brief treatment of the Ottoman Empire follows. For full treatment, *see* MACROPAEDIA: Turkey and Ancient Anatolia.

The first period of Ottoman history, from 1300 to 1481, was one of almost continuous expansion through war, alliance, and outright purchase of territory. Under Osman and his successors Orhan (ruled 1324–60), Murad I (1360–89), and Bayezid I (1389–1402), nearly all of Anatolia was conquered. Alliances with various factions within the Byzantine Empire won the Ottomans a foothold in Europe in about 1346, and from Gallipoli they moved into Thrace, Macedonia, Bulgaria, and Serbia. At Kosovo in 1389 Murad defeated the Balkan allies to complete Ottoman domination of that territory. Bayezid further strengthened Ottoman rule and was awarded the title of sultan by the Caliph of Cairo. The rapid advance of Ottoman power attracted the notice of the Tatar leader Timur, however, who turned from his conquest of India to protect his western flank. He defeated an Ottoman army at Ankara in 1402.

Timur left as quickly as he had come, but years passed before the Ottomans could resume their conquests. Of Bayezid's four sons, Mehmed (Muḥammad) I emerged as sultan in 1413; under him and his successors Murad II (1421–51) and Mehmed II (1451–81), the empire reasserted control of Europe south of the Danube, defeating a crusader army at Varna in 1444. In 1453 Constantinople was taken, and in subsequent years Morea, Trebizond, Bosnia, Albania, the Crimea, and other areas were conquered or annexed.

Of the many unique military and administrative forms evolved by the Ottomans, the most notable included the *devşirme* system, whereby Christian youths from the Balkans were drafted and converted to Islām for a lifetime of service. The military arm supplied by the *devşirme* system was the Janissary corps, an infantry group attached to the person of the sultan. Mehmed II developed the practice of requiring all members of the government and army, Turkish or Balkan, Muslim or non-Muslim, to accept the status of personal slave of the sultan. By that means he hoped to ensure the indivisibility of power, with the entire ruling class sworn to absolute obedience.

Under Selim I (1512–20) Ottoman expansion resumed. His defeat of the Mamlūks in 1516–17 doubled the size of the empire at a stroke by adding to it Syria, Palestine, Egypt, and Algeria. The reign of his son Süleyman I (1520–66), known in Europe as "the Magnificent," was a golden age of Ottoman power and grandeur. He conquered Hungary from the Habsburgs, annexed Tripoli, extended the empire southeastward through Mesopotamia to the Persian Gulf, and made the Ottoman navy dominant in the eastern Mediterranean. After Süleyman's reign, decline set in. Even though territorial expansion continued yet a while—Murad III (1574–95) conquered the Caucasus and seized Azerbaijan from Iran—administrative and social weaknesses became insidious. The decline of the empire after Süleyman is attributed to the increasing lack of ability of the sultans who followed him, the ever-increasing power of the *devşirme* class and the tensions it created within the ruling class, the erosion of Ottoman industry, the decline of Ottoman-controlled trade routes with the development of better navigation, and sudden leaps in population and the subsequent decline of urban centres. Reforms instituted in the 17th century were too weak and narrow to arrest the decline. Meanwhile, the powerful nation-states arising in Europe during this period formed alliances to drive the Ottoman off the continent.

Decline accelerated in the 18th century, which saw the decay of rural administration into small, feudal-like states and increased unrest in the cities, disrupting food supplies and leading to widespread famine. Few of the innovations in technology that underlay Europe's prosperity made their way into the empire. Early in the 18th century some aristocrats did adopt Western styles (the Tulip Period), and later in the century Selim II tried to modernize the government; but in a reactionary revolt led by Mustafa IV in 1807, the empire returned to traditional ways.

By the accession of Mahmud II in 1808, the Ottoman situation appeared desperate. Local authorities openly opposed the central government, while the empire was at war with both England and Russia. In the next few decades Mahmud II reestablished some order with military modernization and governmental reorganization, but the boundaries of the empire continued to shrink. Mahmud's sons, Abdülmecid I and Abdülaziz, enacted a series of liberal and modernizing reforms called the Tanzimat, which were widely viewed in the West as an effort to encourage friendly relations with European powers. Among the reforms were the first comprehensive education system and the westernization of commercial, maritime, and penal codes. The centralization of power removed all checks on the power of the emperor, but in 1876 Abdülhamid II agreed to the first constitution in any Islāmic country. Two years later, by the Treaty of San Stefano and negotiations at the Congress of Berlin, the empire was forced to give up Romania, Serbia, Montenegro, Bulgaria, Cyprus, and other territories. Abdülhamid was able to hold the empire together for the rest of the century by reminding Europeans that the Turks within their own borders were kept peaceful by its preservation, but the final years of his reign were marked by revolts, notably that of the Young Turks in 1908. The Balkan wars of 1912–13 all but completed the empire's expulsion from Europe. After disastrous defeat in World War I and a revolution immediately after, the 36th and final Ottoman emperor, Mehmed VI Vahideddin, was overthrown in 1922 and modern Turkey formed.

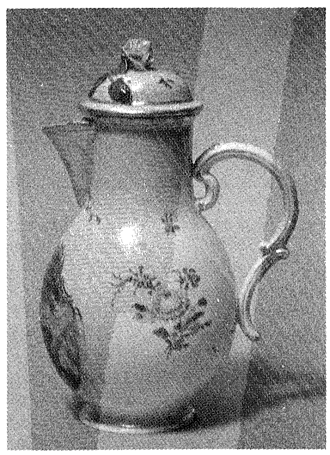
Ottonian art, painting, sculpture, and other visual arts produced during the reigns of the German Ottonian emperors and their first successors from the Salic House (950–1050). As inheritors of the Carolingian tradition of the Holy Roman Empire the German emperors also assumed the Carolingian artistic heritage, the conscientious revival of late antique and Early Christian art forms (*see* Carolingian art). Ottonian art later developed a style of its own, however, distinct from the Carolingian tradition, particularly in painting, ivory carving, and sculpture. Ottonian illuminators were less concerned with naturalism and more with expression through sober, dramatic gesture and heightened coloration. Ivory carving continued to be produced for liturgical purposes; as can be seen in scenes from the ivory plaques of the "Magdeburg Antependium" (*c.* 970), carvings have a characteristic restraint, the narrative is conveyed through simple gestures and enlivened by an original kind of decoration such as that in the strongly patterned background. An important development in Ottonian art was that of large-scale sculpture. Stone sculpture continued to be rare, but wooden crucifixes such as the over-life-size Gero Crucifix (before 986; Cathedral of Cologne) and wooden reliquaries covered with gold leaf began a return to sculpture in the round. Bronze casting, an antique art practiced also by the Carolingians, flourished. Its most impressive manifestation was in relief-covered bronze doors commissioned by Bishop Bernward of Hildesheim (died 1022) for his cathedral.

Ottonian architecture was more conservative, expanding and elaborating Carolingian forms rather than developing a new style. The westwork, or fortress-like construction with towers and inner rooms through which one entered the nave, and outer crypt, or chapel complexes below and beyond the eastern apse (projection at the end of the church), were retained and enlarged; the Carolingian double apses (projections at each end of the nave) were elaborated with double transepts. Ottonian architecture was more regulated than Carolingian, with simple interior spaces and a more systematic layout. St. Michael's (founded *c.* 1001), Hildesheim, exemplifies this regularity, with two crypts, two apses, and two transepts, each with a crossing tower. The achievements of Ottonian artists provided background and impetus for the new monumentality distinguished as Romanesque (*q.v.*).

ottrelite, manganese-rich variety of the silicate mineral chloritoid (*q.v.*).

Ottumwa, city, seat (1844) of Wapello County, southeastern Iowa, U.S., on the Des Moines River, 83 mi (134 km) southeast of Des Moines. Settled in 1843 as Louisville, it was renamed (1845) Ottumwa, an Indian word meaning "rippling waters." Following a damaging flood (1947), the city recovered its position as a commercial and manufacturing centre with a locally financed program of self-help, "Operation Bootstrap." Meatpacking and the manufacture of farm equipment are the chief industries. Ottumwa is the home of Iowa Technical Institute (1962), Ottumwa Heights College (1925), and Indian Hills Community College (1966). The city's airport is the site of the Airpower Museum, which displays more than 20 ancient airplanes, artifacts from early aviation, and several hundred model airplanes. Inc. town, 1851; city, 1857. Pop. (1980) 27,381.

Ottweiler porcelain, true, or hard-paste, German porcelain produced in the Rhineland from 1763 onward. The factory was started by Étienne-Dominique Pellevé, a porcelain maker from Rouen, Fr., under the patronage of Prince Wilhelm Heinrich of Nassau-Saarbrücken. The Ottweiler factory was situated within the Prince's garden. Few specimens of Ottweiler porcelain are known. After 1789



Ottweiler hard-paste porcelain coffee jug, *c.* 1765; in the Victoria and Albert Museum, London

By courtesy of the Victoria and Albert Museum, London; photograph, EB Inc.

the works produced only a kind of stoneware called English Stone porcelain.

Otway, Thomas (b. March 3, 1652, Trotton, near Midhurst, Sussex, Eng.—d. April 14, 1685, London), English dramatist and poet, one of the forerunners of sentimental drama through his convincing presentation of human emotions in an age of heroic but artificial tragedies. His masterpiece, *Venice Preserved,* was one of the greatest theatrical successes of his period.

Otway studied at Winchester College and at the University of Oxford but left in 1671 without taking a degree. He went to London, where he was offered a part by Aphra Behn in one of her plays. He was overcome by stage fright, and his first performance was his last. His first play, a rhyming tragedy called *Alcibiades,* was produced at the Duke's Theatre at Dorset Garden in September 1675. The part of Draxilla in this play was created by the well-known actress Elizabeth Barry, and Otway fell violently in love with her. Six unsigned love letters, said to be addressed to Barry, were published in a collection that appeared in

Otway, miniature by Thomas Flatman, *c.* 1675; in the Victoria and Albert Museum, London

By courtesy of the Victoria and Albert Museum, London

1697, 12 years after Otway's death. His second play, *Don Carlos,* produced in June 1676, had an immense success on the stage and is the best of his rhymed heroic plays. *Titus and Berenice,* adapted from Molière, and *The Cheats of Scapin,* adapted from Jean Racine, were published together in 1677.

In 1678 Otway obtained a commission in an English regiment serving in the Netherlands, and he was abroad when his first comedy, *Friendship in Fashion,* was staged. His next play, *Caius Marius,* a curious mixture of a story from Plutarch with an adaptation of *Romeo and Juliet,* was staged in 1679. He published his powerful, gloomy autobiographical poem, *The Poet's Complaint of His Muse,* in 1680.

Otway's most memorable dramatic work was done in the last years of his short life. In the spring of 1680 his fine blank-verse domestic tragedy *The Orphan* had great success on the stage. On March 1 in the same year his best comedy, *The Souldier's Fortune,* probably drawn from his military experience, was produced. *Venice Preserved,* also written in blank verse, was first performed at the Duke's Theatre in 1682. Until the middle of the 19th century it was probably revived more often than any poetic play except those of Shakespeare. John Dryden, who wrote the prologue, praised it highly. Otway's tragedies, particularly *Venice Preserved,* are notable for their psychological credibility and their clear and powerful presentation of human passions.

Ötztal Alps, German ÖTZTALER ALPEN, Italian ALPI VENOSTE, eastern segment of the Central Alps lying mainly in the southern Tirol (western Austria) and partly in northern Italy. The mountains are bounded by the Rhaetian Alps and Reschenscheideck Pass

Coira Castle in the Venosta valley of the upper Adige River, in the Ötztal Alps, Italy

Marzari—SCALA from Art Resource/EB Inc.

(Italian Passo di Resia, west-southwest), the Inn River valley (north), the Zillertal Alps and Brenner Pass (east), and the Adige River valley (south). Many of the peaks are snow- and glacier-covered, including Wildspitze (12,382 feet [3,774 m]), the highest point both in the range and in the Austrian Tirol. The Ötztaler Ache, a tributary of the Inn River, divides the main part of the range to the southwest from the Stubaier Alpen section to the northeast. The Ortles range across the Adige River in Italy is sometimes considered part of the Ötztal Alps.

Ōu Mountains, Japanese ŌU-SAMMYAKU, range forming the backbone of northeastern Honshu, Japan, and extending for 310 miles (500 km) south from Aomori *ken* (prefecture) to Fukushima *ken.* Geologically, dominant Tertiary sediments are occasionally interrupted by intrusions of the basement granitic and gneissic core. These intrusions, such as Mount Waga, frequently attain much higher elevations than the surrounding formations. The margins of the mountains drop down by fault scarps to the Kitakami River valley in the east and to a row of longitudinal basins in the west.

The elevation of the range is greatly modified by the overlapping of the Nasu Volcanic Zone. From north to south the overtowering volcanic groups, each bearing the name of its major peak, are Hakkōda, Iwate, Sugawa, Funagata, Zaō, Azuma, and Bandai. The eruption of Mount Bandai in 1888 resulted in debris accumulation on its northern flank and the consequent formation of numerous lakes, thereby greatly altering the drainage pattern of the entire area.

A salient feature of the Ōu Mountains is the row of depressions along its axis. Significant among them are, from north to south, the Hanawa and Shizukuishi basins, the Waga River valley, and the Onikōbe and Inawashiro basins.

Ou River, Laotian NAM OU, river in northern Laos, one of the 12 principal tributaries of the Mekong River; it is 236 miles (380 km) long. The Ou River rises on the Chinese frontier north of Muang Ou Nua and flows south and southwest through the gorges and mountain valleys of the northernmost part of Laos before joining the Mekong at Ban Pak Ou, 15 miles (24 km) above Louangphrabang town. The Ou is navigable as far north as Hatsa, just northeast of Phôngsali town. The lower Ou River valley, supporting a Lao rice culture, also carries a part of the road linking northern Vietnam with the Mekong River valley.

Ou-yang Hsiu, Pinyin OUYANG XIU, courtesy name (Wade–Giles romanization) YUNG-SHU, literary name TSUI-WENG, canonized name WEN-CHUNG (b. 1007, Mien-yang, Szechwan, China—d. 1072, Honan), Chinese poet, historian, and statesman of the Sung dynasty, who reintroduced the simple "ancient style" in Chinese literature and sought to reform Chinese political life through classical Confucian principles.

Ou-yang Hsiu was the son of a judge in Mien-yang, Szechwan province. His father died when Ou-yang was three, and he and his mother went to live with his uncle in Hupeh. Although the story that the family was so poor that he had to learn writing in the sand with a reed is apocryphal, they probably lived in straitened circumstances.

In 1030 he placed first in the doctoral examinations and was appointed a judge at the western capital, Lo-yang. He was already known as a brilliant young writer, and at Lo-yang he befriended the renowned essayist Yen Shu and the poet Mei Yao-ch'en. These friendships not only enhanced Ou-yang's status but, more important, reinforced his strong preference for the simplicity and clarity of the "ancient style." Some years before, he had read the works of Han Yü, the great master of T'ang-dynasty literature, whose pure and easy "ancient style," free of outworn metaphors and allusions, had greatly impressed him. Eventually, his leadership and advocacy of that style paved the way for a new literary movement.

In 1034 he was appointed a collator of texts in the imperial library at the capital, K'ai-feng. Two years later, when Fan Chung-yen, a government official, was banished, at the insistence of an imperial counselor, for speaking out against certain official practices and institutions, Ou-yang did not hesitate to attack the counselor in writing. As a result, he, too, was banished and demoted to low judicial office in Hupeh and Hunan provinces, where he wrote the *Hsin Wu-tai shih* ("New History of the Five Dynasties"), a history of a period of political chaos lasting through almost the entire 10th century. Ou-yang's strong sense of fairness led him to devote separate sections to political outcasts such as martyrs, rebels, and traitors, a radical departure from previous dynastic histories.

Highly recommended by Fan Chung-yen, who was back at the capital, and other high officials, Ou-yang was recalled to the capital in 1043 to become imperial counselor. When Fan and others were dismissed for forming a private group of political reformers, Ou-yang, in a notable essay on partisanship, defended associations of gentlemen as politically constructive. His courage and forthright opinions earned the respect of the emperor, Jen Tsung, and he was commissioned to record Jen Tsung's daily life and to draft edicts. His frank opinions and severe criticisms of others created many enemies, and in 1045 he was accused of and tried for having had illicit relations with his niece many years before—a charge to which his romantic life, during his days in Lo-yang, lent support. Although he was finally acquitted, his reputation was seriously impaired.

He was demoted and sent to Anhwei province, where he served as magistrate of one county after another. The beautiful countryside intensified his partiality for wine. He called himself the "Old Drunkard," built a pavilion of that name, and wrote an essay about it, which has become one of the most celebrated works in Chinese literature. After a term (1050) as defense commander of the southern capital of Kuei-te, in Honan Province, he was recalled to the capital in 1054 to become an academician of the Hanlin Academy.

It had been more than nine years since he was exiled from the capital, and the new appointment signified a promotion. As always, his moral courage and outspoken manner did not endear him to his colleagues. He was first ordered to write the *Hsin T'ang shu* ("New History of the T'ang Dynasty"). A year later, with his work only begun, he was sent as ambassador to the Manchurian Khitans, who ruled most of Northern China. In 1057 he was placed in charge of civil service examinations. He favoured those who wrote in the "ancient style" but failed those who employed literary embellishments. For thus imposing his own ideas of literature on the traditional examination system, he was physically attacked by disgruntled candidates. He survived, however, and the literary style championed by him set a new course for Chinese literature. He praised and promoted brilliant young writers such as Wang An-shih and Su Tung-p'o.

When the "New History" was finished in 1060, he was rapidly promoted to the highest councils of state, leaving a remarkable record in social, financial, and military affairs. Eventually his position at court became untenable, however, and at 60 he was approaching the end of his political career. He was falsely accused of having an affair with his daughter-in-law, a charge that injured his prestige and left him increasingly isolated in the capital. He repeatedly asked to be relieved, but instead the new emperor sent him to be magistrate successively in Anhwei, Shantung, and Honan.

In Shantung he opposed the reforms of his former protégé Wang An-shih, particularly a system of loans to farmers at a low interest rate, and refused to carry them out in his districts. It is clear that by this time he had become a disappointed conservative. In 1071 he was retired with the title of grand preceptor of the crown prince. He intended to make his permanent home in beautiful Anhwei, the place of his Old Drunkard Pavilion (Ts'ui-weng T'ing), but within months he died in his 66th year.

The personal influence and many-faceted activity of Ou-yang Hsiu had a lasting effect. As a statesman he worked to regenerate political life through classical Confucian principles; he criticized fearlessly, and he recommended the promotion of able men who eventually led opposing parties. He was early captivated by writings of Han Yü, whose opposition to Buddhism he shared, though in a more moderate form. He revived Han's advocacy of a simpler, more direct prose like that of Mencius, to replace the mannered and excessively rhythmic style then popular, and his writings in the resultant *ku-wen* style established a model emulated thenceforth. He emancipated the *fu* prose-poems from strict conventions and left superb examples of these as well as of the newer *tz'u* (lyrics to popular tunes) and other literary forms. In his "New History of the Five Dynasties" and "New History of the T'ang Dynasty," he amplified the standard history form and praised or censured men and institutions through terse but exact descriptions implying moral judgment, in supposed emulation of Confucius. As a scholar he ignored later commentaries and instead sought a fresh and immediate understanding of early texts. He contributed to archaeological study and as a painter helped create the new *wen-jen-hua* (literati) style. His preserved writings include not only his histories but more than 150 chapters of poems, state papers, letters, and other smaller pieces. His library consisted of 10,000 books and a large collection of literary remains and archaeological records from ancient times. He was honoured posthumously with the title Wen-chung (literary and loyal).

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Ouachita Geosyncline, a linear trough in the Earth's crust in which rocks of the Paleozoic Era (from 225,000,000 to 570,000,000 years ago) were deposited along the southern margin of North America, from Mississippi to eastern Mexico. Most of the belt is overlain by undisturbed, younger rocks of the Mississippi Embayment and the Gulf Coastal Plain, but marginal parts of the belt are exposed in the Ouachita Mountains of Arkansas and Oklahoma, the Marathon uplift of western Texas, and scattered remnants in northeastern Mexico. The oldest exposed rocks are of Cambrian age; the youngest are Middle Pennsylvanian, in the Ouachita Mountains, and Late Pennsylvanian, in the Marathon uplift. The geosyncline's rocks of Cambrian through Devonian age consist of dark, siliceous shales, sandstones, and cherts, which indicate slow deposition over a long period of time. Its Mississippian through Pennsylvanian rocks, on the other hand, consist of thick sequences of shales and sandstones deposited rapidly in a subsiding trough.

Deformation of the geosyncline probably began during Early Paleozoic time in the buried interior portions of the geosyncline, but the marginal exposed portions were not deformed until the Late Pennsylvanian Period in the Ouachita Mountains and Early Permian in the Marathon uplift. Deformation, based on the evidence now available, seems to have shifted through time from the interior portions of the geosyncline northward to the marginal portions. The name Ouachita orogeny is applied to the event that resulted in the folding and northward thrusting of the exposed marginal part of the geosyncline.

The Ouachita Geosyncline may represent a southward continuation of the Appalachian Geosyncline, which was displaced westward by the opening up of the Gulf of Mexico in the Early Mesozoic.

Ouachita Mountains, a rugged range of large hills that continues the Ozark Plateau in the United States. The Ouachita Mountains extend approximately 225 miles (360 km) east to west from Little Rock, Ark., to Atoka, Okla., and north to south, approximately 50–60 miles (80–95 km) from the Arkansas River Valley to the northern margin of the Coastal Plain. The ridges trend generally east–west and are approximately the same height.The highest elevation (2,950 feet [899 m]) in the range is Rich Mountain in Le Flore County, Okla., near the Arkansas line. Hot Springs National Park lies in the Ouachita Mountains. The word Ouachita is derived from an Indian tribal name. Oak and pine forests cloak the hills, and cultivation is restricted to the more favourable valley bottoms.

Ouachita orogeny, a mountain-building event that resulted in the folding and faulting of exposed strata in the Ouachita Geosyncline in the southern portion of the United States in Arkansas, Oklahoma, and the Marathon uplift region of West Texas. The deformation is Late Paleozoic in age, probably culminating between the Late Pennsylvanian and the Early Permian (about 280,000,000 years ago). The orogeny resulted in a northward and westward compression in the geosynclinal strata onto adjacent platform rocks.

Ouachita River, river rising in the Ouachita Mountains of west-central Arkansas, U.S., and flowing in a generally southeasterly direction to join the Red River in Louisiana after a course of 605 miles (973 km). The lower 57 miles (92 km) of the Ouachita (from its confluence with the Tensas River) is known as the Black River (*q.v.*). Most of the Ouachita's 25,000-square-mile (65,000-square-kilometre) drainage basin lies in the upper Coastal Plain of Arkansas and Louisiana and in the alluvial valley of the Mississippi. Chief tributaries are the Boeuf (*q.v.*) and Tensas rivers entering from the east, Bayou Bartholemew from the west, and the Saline River from the north.

The Ouachita has been a navigation route since the late 18th century. Six locks and dams were built on the river prior to 1924. There are three multipurpose dams (hydropower, flood control, recreational facilities) on the upper Ouachita within the Ouachita Mountains: Blakely Mountain (1955) and Carpenter (1931) dams near Hot Springs National Park, impounding Lakes Ouachita and Hamilton, and Remmel Dam (1924), impounding Lake Catherine.

The chief cities along the river are Arkadelphia and Camden, Ark. (the latter linked to the Ouachita by a channel [1950]), and Monroe, La. Formerly called the Washita River, the name Ouachita is derived from that of an Indian tribe.

Ouachita River (U.S.): *see* Washita River.

Ouaddaï, also spelled WADAI, historic and cultural region in eastern Chad, central Africa. The chief city of the region is Abéché. The region's area of savanna grasslands roughly corresponds to the formerly independent Ouaddaï Muslim sultanate (*see* Wadai, Kingdom of).

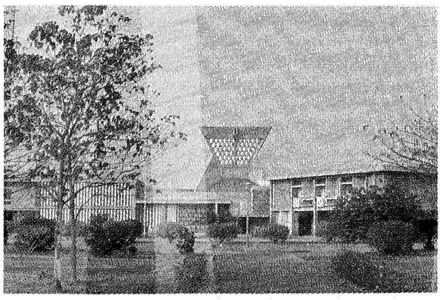
Crossed by caravans linking the Sahara with equatorial Africa and by Muslim pilgrim routes from West Africa toward Mecca, Ouaddaï is an amalgam of cultural and ethnic influences. The dominant people, the Maba, a Negroid, Sudanic people, are Muslims. Their main economic activity is raising cattle. Other inhabitants include Arabs and Fulani and various other peoples.

Though Arab geographers had described the area, Ouaddaï was not generally known to Europeans until after 1873, when it was explored by the German geographer Gustav Nachtigal. The history of Ouaddaï before the 17th century is uncertain, but in about 1640 a Maba chieftan, Abd-el-Kerim, conquered the country and overthrew the Tungur, a dynasty originating in Darfur to the east. For the next 200 years there were intermittent wars with the kingdoms of Bagirmi and Kanem-Bornu, many for the purpose of maintaining Ouaddaï's supply of slaves and eunuchs for shipment to Arab courts in the north.

Muḥammad al-Sharīf, who was sultan of Ouaddaï from 1835 to 1858, introduced the Sanūsīyah Islāmic brotherhood into the region, and it remained the dominant political and religious force until Ouaddaï was conquered by the French. Although it had been recognized as within the French "sphere of influence" according to an Anglo-French agreement of 1899, Ouaddaï retained its effective independence until 1904, when Ouaddaïans attacked French outposts in the Chari region. Fighting continued sporadically until 1908, when the Ouaddaï sultan, Doud Murra, proclaimed a holy war (jihad) against the French. Dividing his army into units under feudal lords, he was no match for French troops and was soundly defeated. By 1912 the French had pacified the area and abolished the sultanate. A famine in 1913–14 devastated Ouaddaï. From an estimated population of more than 2,000,000 in the 1870s, the inhabitants were reduced to about 300,000 by 1917.

After independence in 1960, banditry, long prevalent in Ouaddaï under the French, evolved into guerrilla warfare on the part of the Muslim population against the southern Christians and animists who dominated Chad's government. Fighting in this region continued sporadically into the 1980s because of the country's continuing civil war.

Ouagadougou, also spelled WAGADUGU, capital and largest town of Burkina Faso (formerly Upper Volta), West Africa. It was the capital of the historic Mossi kingdom of Wagadugu (founded in the 15th century) and the seat of the *morho naba* ("great king") of the Mossi people. Islām became the religion of



French embassy building, Ouagadougou, Burkina Faso
Walter Weiss—Ostman Agency

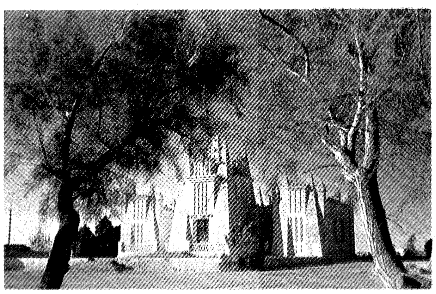
the kings under Naba Dulugu (ruled 1796?–1825?). The *morho naba* still lives in the city, though his powers have been greatly eclipsed by the French colonial and post-independent administrations.

Ouagadougou is a city of large trees and modern public buildings abutting traditional residential neighbourhoods. It has a market, a crafts centre, the national museum, and the University of Ouagadougou (1969). It is connected by rail to the Atlantic port of Abidjan, Côte d'Ivoire (Ivory Coast), and has an international airport. Major products include textiles, carbonated beverages, matches, and footwear. Pop. (1985 est.) 359,801.

Ouahran (Algeria): *see* Oran.

Ouaphris (Egyptian king): *see* Apries.

Ouargla, also spelled (after 1981) WARGLA, town, east-central Algeria. It is situated on the western edge of a sebkha (large, enclosed basin) in the Sahara. One of the oldest settlements in the Sahara was made by the Ibāḍīyah, a Muslim heretical sect, at nearby Sedrata in the 10th century (ruins remain). In the 11th century they were attacked by Sunnite Muslims and fled to Ghardaïa, 118 miles (190 km) west-northwest. The Ouargla site was then set-



The Saharan museum in Ouargla, Alg.
Shostal—EB Inc.

tled by Berbers and black Africans. The town remained autonomous but for a brief period of Turkish control in the 16th century. The French gained possession in 1872, and the present town was built around Fort Lutaud to the south after 1928.

Ouargla is dominated by a large mosque and is walled with six gates. It has an arcaded marketplace and a Saharan museum. The town is surrounded by date palm groves and fruit and vegetable gardens irrigated by numerous wells, tapped from the underground Wadi Mya. There is a trade in livestock, woolen carpets, and basketry. Nearby oil wells to the southwest and at Hassi Messaoud, 50 miles (80 km) east-southeast, with its valuable deposits of oil and natural gas, have boosted the local economy and population. The town also has an airport. Pop. (1977 prelim.) mun., 77,354.

Ouarzazate, town, south-central Morocco. It lies on the Saharan side of the High Atlas mountains and is situated in the valley of the River Ouarzazate near its juncture with the River Drâa. The town originated as a military post during the French occupation (1932–56). Still a military centre with a fortress, it is also an important oasis and road junction linked to Marrakech by way of n'Tichka Pass.

Ouarzazate is situated in an arid region that extends from the crests of the High Atlas southward to the borders of the Sahara. Habitations exist only in the valleys, chiefly those of the Dadès and Drâa. The region's greatest economic resource lies in the manganese mines of Imini and the cobalt mines of Bou-Azzer, but it also has large deposits of copper. The agricultural potential of the Drâa valley was enhanced in the early 1970s with the com-

The fortress, Ouarzazate, Mor.
Ed Scully—Photo Trends

pletion in 1971 of Mansour ed-Dabhabi dam 10 miles (16 km) downstream from Ouarzazate. Pop. (1982) town, 40,485.

Oubangui-Chari: *see* Central African Republic.

Oubangui River (Africa): *see* Ubangi River.

oud (musical instrument): *see* 'ūd.

Oud, Jacobus Johannes Pieter (b. Feb. 9, 1890, Purmerend, near Amsterdam—d. April 5, 1963, Wassenaar, near The Hague), Dutch architect notable for his pioneering role in the development of modern architecture.

Oud was educated in Amsterdam and at the Delft Technical University, after which he worked with a number of architects in Leiden and Munich. In 1916 he met Theo van Doesburg, and together the two men founded in 1917 the influential review *De Stijl,* which set forth the theories of the de Stijl group of avant-garde artists. Oud soon became the chief proponent of the de Stijl idiom in modern architecture. Among his earliest architectural projects in this austere, highly geometric style were theoretical projects for houses at Scheveningen (1917) and for a factory at Purmerend (1919). He designed a hotel at Noordwijkerhout (1917) and the Allegonda villa at Katwijk (1917). These and other buildings featured subtle oppositions of horizontal and vertical lines; long, straight walls wrapping into smoothly rounded corners; building units enclosing an open space; and simplified rectilinear and circular forms that achieve a subtly poised equilibrium despite their assymmetrical arrangement.

In 1918 Oud was appointed housing architect to the city of Rotterdam, in which post he was required to supply sorely needed mass housing for workers. The housing blocks he subsequently designed and built at Spangen (1918), Tusschendijken (1920), and Hoek van Holland (1924–27) had a sober and functional austerity that contrasted strongly with the picturesque elaboration of detail typical of the school of Amsterdam led by Michel de Klerk. His Café de Unie (1924–27, destroyed in 1940) and Kiefhoek estate (1925–27), both in Rotterdam, also emphasized de Stijl principles, although by then he was tending toward separation from the movement. Oud's book *Höllandische Architektur* (1926) gave him an international reputation.

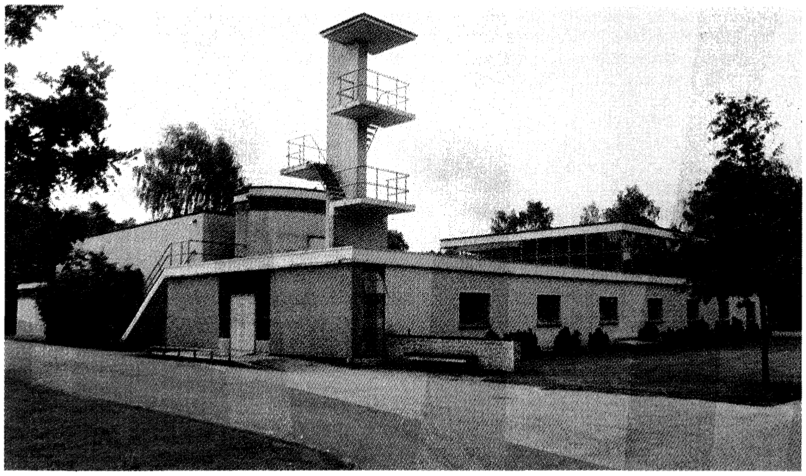
Among his late works are the monumental and somewhat ornate Shell Building (1938) in The Hague, which disappointed some because of Oud's evident abandonment in it of de Stijl principles. The Bio-Children's Convalescent Home (1952–60) near Arnhem, however, convincingly demonstrated Oud's continuing mastery of the elegant geometrical compositions typical of what had become known as the International Style.

Oud-Katholieke Kerk van Nederland: *see* Old Catholic Church of The Netherlands.

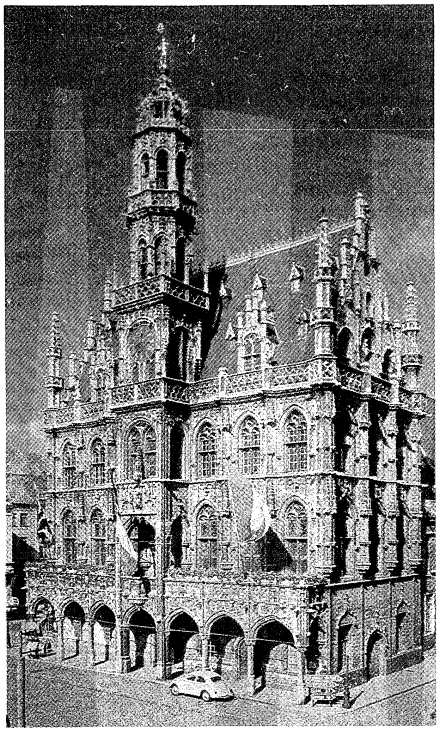
Oudenaarde (Flemish), French AUDENARDE, municipality, East Flanders province, west-central Belgium. It lies along the Scheldt (Schelde) River south of Ghent. A prosperous tapestry-making centre in the Middle Ages, its industry declined in the 15th century with the success of the Gobelin tapestry weavers (trained in Oudenaarde), many of whom later went to Paris. It was at Oudenaarde in 1708, during the War of the Spanish Succession, that the French Army was vanquished by Eugene of Savoy and the duke of Marlborough.

Oudenaarde's landmarks include the town hall (1526–36) with its five-story belfry, the 13th-century Cloth Hall, the Church of St. Walburga with its carillon, and the Church of Our Lady of Pamele (1325). The old bishop's residence (1600) was the birthplace of Margaret of Parma, natural daughter of Charles V and Johanna van der Gheenst.

Beer and textiles are the main products of Oudenaarde, which includes the outly-



Bio-Rehabilitation Centre for physically handicapped children by J.J.P. Oud, 1952–60, Arnhem, Netherlands
By courtesy of the Royal Netherlands Embassy, Department of Cultural Affairs, Washington, D.C.



Town hall, Oudenaarde, Belg.
Nels—Club Iris

ing towns of Bevere, Edelare, Eine, Ename, Leupegem, Nederename, and Volkegem. Pop. (1983 est.) mun., 27,233.

Oudenaarde, Battle of (July 11, 1708), victory over the French won by the duke of Marlborough and Prince Eugene of Savoy during the War of the Spanish Succession; it eventually led to the Allied (Anglo-Dutch-Austrian) recapture of Ghent and Bruges, which had been captured by the French on July 4–5.

The battle was fought north of the town of Oudenaarde between an Allied army of 80,000 men under Marlborough and Eugene and a French army of 85,000 men under the marshal Louis-Joseph, duc de Vendôme, and Louis, duc de Bourgogne. The French were preparing to besiege Oudenaarde and were caught off guard. The Allied army, which had marched 50 miles (80 km) in 65 hours, crossed the Scheldt River on July 11 and immediately attacked before the French could deploy properly. The French command had been divided: Bourgogne had wanted to retreat and only at the last moment consented to Vendôme's plea to stand and fight. All afternoon a bitter and confused battle raged. Unnoticed by the French, Marlborough sent a Dutch force on a long detour to the west. It struck the French right flank while Eugene pressed against the French left. By the time darkness forced a halt, the French had lost 6,000 killed or wounded and another 9,000 captured. The Allies suffered about 4,000 casualties. The next day Vendôme rallied the defeated army and repulsed the Allies at Ghent. Marlborough recaptured Ghent and Bruges in January 1709, and the French withdrew to their own border.

Oudh (India): *see* Ayodhyā.

Oudinot, Nicolas-Charles, DUC (duke) DE REGGIO (b. April 25, 1767, Bar-le-Duc, Fr.—d. Sept. 13, 1847, Paris), general, administrator, and marshal of France in the Napoleonic Wars whose career illustrates the opportunities to rise in the French Army after the Revolution.

Oudinot was the son of a businessman. In 1784 he joined France's royal army but, since commoners were barred from promotion, resigned in 1787. After the French Revolution, however, he became the leader of Meuse volunteers (1792) and was transferred to the regular army the following year, rising to general of brigade (1794) for his heroic resistance at Kaiserslautern. Becoming general of division (1799) and chief of staff under André Masséna, Oudinot fought in Switzerland and Italy and then commanded an elite division of grenadiers (1805–07) in fighting at Austerlitz and Ostrolenka.

Oudinot was promoted to marshal after the Battle of Wagram (1809) and was created duke of Reggio in 1810. After serving as administrator in Holland (1809–12) and fighting in the Russian campaign, he was badly defeated in 1813 at Grossbeeren, Prussia, after which he was superseded by Michel Ney. Following Napoleon's abdication in 1814, Oudinot rallied to Louis XVIII, remaining loyal to him during the Hundred Days (1815). He served in Spain in 1823 and was governor of the Invalides (veterans' hospital) from 1842 until his death.

Oudry, Jean-Baptiste (b. March 17, 1686, Paris—d. April 30, 1755, Beauvais, Fr.), French Rococo painter, tapestry designer, and illustrator, considered one of the greatest animal painters of the 18th century.

"The Calling of the Hounds," tapestry by Jean-Baptiste Oudry, 1742–45; in the Palazzo Pitti, Florence
SCALA—Art Resource/EB Inc.

He first studied portrait painting with Nicolas de Largillière, a portraitist of Parisian society, through whom he made many connections. His early portraits are often arcadian in setting and tender and sentimentally charming in the Rococo tradition. In his early career he executed many still lifes that were used as decorative inserts for paneled rooms. After he was made a member of the French Royal Academy in 1719, his work consisted largely of animal paintings, tapestry designs, and book illustrations.

In 1734 Oudry was made head of the Beauvais tapestry works. Some of his designs brought the company wide fame, such as those for the tapestry series "Country Amusements" (1730), "Moliere's Comedies" (1732), and "The Fables of La Fontaine" (1736). The designs for the last series were related to the 277 illustrations Oudry did for a four volume edition of the *Fables*. His other book illustrations included those for editions of *Don Quixote* and *Le Roman comique*. In 1736 he was made inspector general of the Gobelins tapestry factory and designed a series of tapestries (1736–49) depicting the hunts of Louis XV. He was also commissioned to paint the dogs of the king's pack and was appointed official painter of the royal hunts. Oudry's tapestries, like his paintings, were highly regarded for their tonal subtlety and lively study of nature. Among his later still lifes is the well-known "White Duck" (1753), a tour de force of precise drawing and delicate white-on-white tonalities. Oudry's services were sought not only by Louis XV but by Tsar Peter the Great of Russia, the queen of Sweden, and the prince of Mecklenburg-Schwerin.

Oudtshoorn, town, south-central Cape Province, South Africa. It is located about midway between Cape Town (west) and Port Elizabeth (east) on the banks of Grobbelaars River. First settled in 1847, it was named (in 1863) after a baron who died in 1773 enroute to his governorship at the Cape, and it officially became a town in 1887. Situated in the Little Karroo (a narrow plain between high mountains) at 1,007 feet (307 m) above sea level, Oudtshoorn is sheltered by the Swartberg on the north and by the Outeniqua mountains to the south. It is a centre of agricultural trade for dairy products, alfalfa (lucerne), fruit, vegetables, and tobacco, but it is particularly well-known for its extensive ostrich farms and its ostrich feather industry. Roads and railway link Oudtshoorn with other parts of Cape Province. The C.P. Nel Museum (1953) contains a collection of pioneer antiques. The limestone Cango (Kango) Caves (declared a natural monument in 1938) are known for stalactites and are 17 miles (27 km) to the north of the town in the foothills of the Swartberg. Pop. (1984 est.) mun., 43,347.

oued (dry streambed): *see* arroyo.

Oued, el-, town, largest of the Souf Oases in northeastern Algeria. It lies 50 miles (80 km) west of the Tunisian border. Surrounded by the sand dunes of the Grand Erg (sand dunes) Oriental, the Souf Oases extend for 25 miles (40 km) northwest to southeast. A river (*oued*) once flowed to the east, but it was swallowed by the encroaching sands. The town sits in the midst of the oasis and has narrow, winding streets, with cube-shaped buildings of clay-stone topped by cupolas. The houses are clustered, creating the image of a "Town of a Thousand Domes," so-called by the French writer-adventuress Isabella Eberhardt (1877–1904). The town's fortress mosque and use of arcades and arches reflect both Moorish and Roman influence. Date-palm groves are grown in man-made, funnel-shaped craters that are protected from the sand by woven palm walls and are close enough to groundwater to eliminate irrigation.

Cupola-topped buildings in el-Oued, Alg.
Dominique Darbois

A busy caravan centre, el-Oued exports high-quality dates and is known for its carpets and woven cloth. Its Museum of the Souf contains regional exhibits. Pop. (1977) mun., 71,710.

Ouémé River, Ouémé also spelled WEME, river rising in the Atacora massif in northwestern Benin, West Africa. It is about 310 miles (500 km) in length and flows southward, where it is joined by its main affluent, the Okpara, on the left and by the Zou on the right. It then divides into two branches, one discharging into Lake Nokoué in the Niger Delta near Cotonou and the other into Lagoon Porto-Novo. Rain forests grow along the shores; navigation, although impeded by rapids, is possible during the rainy season. The river's fish, including freshwater and processed, is exported to Nigeria and Togo. Millet, sweet potatoes, and yams are cultivated, and the Ouémé Valley development scheme has been undertaken to improve agriculture.

Ouenza, town, northeastern Algeria. It lies near the eastern border with Tunisia. The nearby Mount Ouenza (4,226 feet [1,288 m]) is the site of extensive iron-ore deposits, making the town one of Algeria's leading mining centres. Pop. (1977 prelim.) mun., 31,867.

Ouessant Island, French ÎLE D'OUESSANT, also called USHANT ISLAND, a rocky island, Finistère *département,* off the western tip of Bretagne, western France. The island, about 5 miles (8 km) long and 2 miles (3 km) wide, has an area of 6 square miles (15 square km). Its lighthouse, the Phare de Créac'h, marks the south entrance to the English Channel, the north entrance light being at Land's End, England. Lampaul, the little port that is the capital of Ouessant, is the chief settlement of the island's fishermen; its fields, which cover only a small fraction of the island, traditionally have been worked by the fishermen's wives. A large but indecisive action was fought off Ouessant in July 1778 between British and French fleets. Pop. (1982) 817.

Ouezzane, city, north-central Morocco. It lies at the southwestern edge of the Rif Mountains. Ouezzane is situated on the northern slope of Mount Bouhelal, at an elevation of 1,066 feet (325 m). It was founded in 1727 as a religious community on the site of a village named Dechra Jebel er-Rihan ("Village of the Mount of Myrtles") by Moulay ʿAbd Allāh, a descendant of Idrīs II. It has served as a *zāwiyah* (monastic complex) of the Taiba (a Ṣūfī [mystical] brotherhood). Ouezzane is considered to be one of the sacred cities of the Maghrib, the region in North Africa comprising the Atlas Massif and the Mediterranean coastal plain of Morocco, Algeria, and Tunisia, and is hence a pilgrimage centre. In 1920 the city was occupied by the French. Cereals and cattle are raised in the vicinity of Ouezzane, and the city also serves as a local market centre. Pop. (1982) mun., 40,485.

Oughtred, William (b. March 5, 1574, Eton, Buckinghamshire, Eng.—d. June 30, 1660, Albury, Surrey), English mathematician and Episcopal minister who invented the earliest form of the slide rule, two identical linear or circular logarithmic scales held together and adjusted by hand. Improvements involving the familiar inner rule with tongue-in-groove linear construction came later.

In 1604 Oughtred became vicar of Shalford, Surrey, and subsequently rector of Albury. Although his years in the ministry included the period of the Commonwealth, when more than 8,000 clerics were deprived of their charges, he was permitted to continue in his parish.

Oughtred's most important published work was the *Clavis Mathematicae* (1631; "The Keys to Mathematics"), which included a description of Hindu-Arabic notation and decimal fractions and a considerable section on algebra. He experimented with many different algebraic symbols and was responsible for the use of the symbol "::" in writing a proportion and the symbol "×" for multiplication. His work on slide rules was an adaptation to a physical scale of the tabular logarithms of John Napier of Scotland. His early form of circular slide rule was invented before 1632 and the pair of rectilinear, relatively slidable members by 1633. His claim of priority of the circular rule was contested by one of his former students, Richard Delamaine the Elder. Oughtred's *Trigonometria* (1657) treated plane and spherical trigonometry.

Oughtred, detail of a watercolour by G.P. Harding after a portrait by W. Hollar, 1644; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

Ouham River, river, one of the main headwaters of the Chari River, central Africa. It rises in two main branches in the elevated plateau country of the western Central African Republic; it then flows north, crossing the international frontier into Chad, where it is known as Baḥr Sara, and joins the Chari just north of Sarh. The Ouham's length, from its longest (eastern) branch to its junction with the Chari, is estimated at 420 miles (676 km); it is navigable for commercial traffic in its lower course.

Ouida, pseudonym of MARIA LOUISE RAMÉ, or DE LA RAMÉE (b. Jan. 1, 1839, Bury St. Edmunds, Suffolk, Eng.—d. Jan. 25, 1908, Viareggio, Italy), English novelist, known for her extravagant melodramatic romances of fashionable life.

Ouida's father was a teacher of French, and the pseudonym "Ouida" derived from a childhood version of "Louisa." Her first novel, *Granville de Vigne* (renamed *Held in Bondage,* 1863), was first published serially in 1860. Her stirring narrative style and a refreshing lack of sermonizing caught the public's fancy and made her books extraordinarily popular. *Strathmore* (1865) and *Chandos* (1866) were followed by *Under Two Flags* (1867). After traveling in Italy, Ouida settled at Florence in 1874, and, among many subsequent novels, *Moths* (1880) was one of her best. She was the author of a number of animal stories, of which *A Dog of Flanders* (1872) was long a children's favourite. Reckless extravagance reduced her to acute poverty in later life.

Ouidah, also spelled WHYDAH, town, southern Benin, West Africa. It lies along the Gulf of Guinea. The town was the main port of the Kingdom of Abomey in the 18th and 19th centuries. Portuguese, French, Dutch, Danish, British, and Americans all vied for a share of the slave and palm-oil trade made available through Ouidah by the efficiently organized and centralized kingdom. In 1893 the area came under French control. Some of the old forts, a cathedral, and a temple of the Abomey traditional religion remain. Coconut, palm, and coffee are grown in the area. Ouidah is connected by road and railway to Cotonou, 20 miles (32 km) east, the major port and commercial centre of Benin. Pop. (1979 prelim.) 6,407.

Ouija board, in occultism, a device ostensibly used for obtaining messages from the spirit world, usually employed by a medium during a séance. The name derives from the French and German words for "yes" (*oui* and *ja*). The Ouija board consists of an oblong piece of wood with letters of the alphabet inscribed along its longer edge in a wide halfmoon. On top of this, a much smaller, heart-shaped board is placed, mounted on casters, which enable it to slide freely.

Each participant lightly places a finger on the small board, which then slides about because of the resultant pressure. The letters pointed out by the apex of the board may in some instances spell out words or even sentences. In the late 19th century, when the Ouija board was a popular pastime, it was fashionable to ascribe such happenings to discarnate spirits; more recent opinion is skeptical.

Ouimet, Francis (b. May 8, 1893, Brookline, Mass., U.S.—d. Sept. 2, 1967, Newton, Mass.), American amateur golfer whose success did much to remove the British upper-class stigma from the game and to popularize it in the United States.

After starting as a caddie and working in a dry-goods store to earn his expenses, he gained a limited recognition until the 1913 U.S. Open championship. In that event he tied the English professionals Harry Vardon and Ted Ray and then defeated them in the playoff. That victory gave golf an impetus in the United States that has accelerated ever since. Ouimet won the U.S. Amateur championship in 1914 (when he also won the French Amateur) and in 1931. He played on the U.S. Walker Cup team from 1922 through 1936 and was nonplaying captain from 1936 through 1949, excluding the war years. Elected captain of the Royal and Ancient Golf Club of St. Andrews in 1951, he was the first non-Briton to receive this honour.

Oujda, city, extreme northeastern Morocco. It lies near the Moroccan–Algerian border. Founded in 944 by Zanātah Berbers, the city was fought over by Berbers, Arabs, and Turks and destroyed and rebuilt so often that it was called Medinet el-Haira, "City of Fear." Peace finally came after the French occupation in 1907. The Moroccan and Algerian railways meet at Oujda, the main function of which is as a frontier post. It is also a tourist centre, has an international airport, and owes some growth to the coal, lead, and zinc mines to the south. There are traces of ancient walls, but the city's appearance is generally modern, with wide avenues and parks. Oujda is near Sidi Yahya oasis, a legendary burial place of John the Baptist and site of the Battle of Isly, where the French defeated the Moors in 1844. It is connected by road and railway with Taza.

Olives and grapes are grown in the irrigated, fertile plain in which the town is situated. Cereals (primarily wheat), sheep, and goats are raised on the plain, and esparto grass, bailed and exported for use in making paper, grows throughout the area. Large deposits of anthracite coal are located near Jerada, a lead mine is at Touissit, and lead metal is produced at Oued el-Heïmer. Pop. (1982) mun., 260,082.

Oulu, in full OULUN LÄÄNI, Swedish ULEÅBORGS LÄN, *lääni* (province), central Finland, bounded on the west by the Gulf of Bothnia and on the east by the Soviet Union. It has a land area of 21,956 square miles (56,866 square km). It was founded in 1776 when the former province of Ostrobothnia was replaced by the *läänit* (provinces) of Oulu and Vaasa. Oulu included all of Finnish Lapland until 1938, when the *lääni* of Lappi was created out of the northern portion. Level along the coast, the province rises in the east to forested hills; the large Oulujärvi (lake) is situated in its south-central part. Economic activities are dominated by agriculture (mostly barley with some oats), forestry, iron mining at Otanmäki, cattle raising, and the manufacture of wood products. Principal towns are Oulu (the administrative capital), Kajaani, and Raahe. Pop. (1986 est.) 431,981.

Oulu, Swedish ULEÅBORG, city, capital of Oulun *lääni* (Oulu province), west-central

Finland, at the mouth of the Oulu River on the Gulf of Bothnia. During the European Middle Ages a trading post was located on the site. In 1590 the prospering settlement was fortified, and town rights were granted in 1610. The fortress was destroyed by an explosion in 1793, and the city was almost completely destroyed by fire in 1822; but it became one of Finland's major commercial centres in the 19th century. An important seaport, the city specialized in the export of wood tar; the tar depots and harbour facilities were destroyed, however, during the Crimean War by the British. During World War II, many sections of the city were destroyed, and postwar building has modernized it considerably.

Oulu has been the seat of a bishopric since 1900, and its cathedral was built in 1830–32, incorporating the remains of an earlier church destroyed in 1822. The city is an important educational centre, with a university (founded 1959), a summer university, and the district hospital. The city's industries include lumber, flour, and cellulose mills, as well as shipyards, fisheries, tanneries, and a foundry. The Meri Rapids, on which the city is located, provide hydroelectric power and are also a major tourist attraction. Oulu is connected by air, rail, and sea to the rest of Finland. Pop. (1986 est.) mun., 97,297.

Oum el-Bouaghi, also called (after 1981) OUM EL-BOUAGUL, formerly CANROBERT, town, northeastern Algeria. The town is situated in the high plains of the Tell Atlas about 40 miles (65 km) southeast of Constantine city. This extensive high-plains region receives about 20 inches (500 mm) of rain annually, and the town is a principal trading centre for the wheat, barley, figs, and olives grown nearby. The area was chosen to demonstrate the *autogestion* (self-managed farms) advocated by Ahmed Ben Bella in the first years of Algerian independence from France, so that workers could share in the management and profits of the land. Salt marshes (chotts) provide seasonal grazing pastures for sheep. Pop. (1987 prelim.) 44,199.

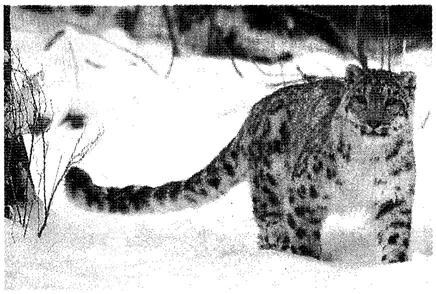
Oum er-Rbia, Wadi, chief river of central Morocco, rising in the Moyen (Middle) Atlas mountains and flowing generally westward for 345 miles (555 km) to the Atlantic Ocean near Azemmour. Although not navigable, it is a perennial, torrential river and a major source of hydroelectric power and irrigation: dams on the river include Afourer, Kasba Zidania, Im Fout, Daourat, Sidi Saïd Maachou, and Bine el-Ouidane (on the Wadi el-Abid). The Tessaout and el-Abid, both of which join the Oum er-Rbia from the south, are the main tributaries. Agricultural products grown in the river's basin include citrus fruits, wheat, grapes, cotton, and flax.

Oun Kham (b. 1811/16—d. Dec. 15, 1895), ruler of the Lao principality of Luang Prabang (1872–94), whose troubled reign ended with the establishment of a French protectorate over Laos.

From the 1870s northern Laos increasingly was beset by invading bands of Chinese (Ho, or Haw) freebooters and bandits, against whom Oun Kham's weak forces were powerless. When he was unable to resist effectively an attack on Luang Prabang in 1885, his overlord, the king of Siam (Thailand), dispatched an army to defend the area, as well as commissioners to run his state. When the Siamese army left in 1887, the band of the Tai pirate Deo Van Tri overwhelmed Luang Prabang, and Oun Kham took refuge at Pak Lay, near the Siamese border, with the assistance of the French vice-consul Auguste Pavie in Luang Prabang. Pavie quickly ingratiated himself with Oun Kham, who felt that the Frenchman had saved his life—a gesture that was not forgotten.

His health in grave condition after his escape, Oun Kham spent two years in Bangkok, the Siamese capital. He was reinstalled as sovereign in Luang Prabang in 1889 and reigned until 1894, when he was replaced by his son, Kham Suk, who reigned as King Zakarine. Following the Franco-Siamese Conflict of 1893, Luang Prabang and the rest of Laos was transferred by treaty from Siam to France.

ounce, also called SNOW LEOPARD (*Leo uncia*), long-haired cat, family Felidae, grouped with the lion, tiger, and others as one of the big, or roaring, cats. The ounce inhabits the mountains of central Asia and the Indian subcontinent, ranging from an elevation of about 1,800 m (about 6,000 feet) in the winter to about 5,500 m (18,000 feet) in the summer. Its soft coat, consisting of a dense, insulating



Ounce (snow leopard)
Russ Kinne—Comstock

undercoat and a thick outercoat of hairs about 5 cm (2 inches) long, is pale grayish with dark rosettes and a dark streak along the spine. The underparts, on which the fur may be 10 cm (4 inches) long, are uniformly whitish. The ounce attains a length of about 2.1 m (7 feet) including the 0.9-metre- (3-foot-) long tail; it stands about 0.6 m (2 feet) high at the shoulder and weighs 23–41 kg (50–90 pounds). It hunts at night and preys on various animals, such as marmots, wild sheep, and domestic livestock. Its litters of two to four young are born after a gestation period of approximately 93 days.

The ounce has often been placed, with the other big cats, in the genus *Panthera*. Because of certain of its skeletal features, it has also been separated by some authorities as the sole member of the genus *Uncia*. The ounce is listed as an endangered species in the *Red Data Book.*

ounce, unit of weight in the avoirdupois system, equal to $^1/_{16}$ pound ($437^1/_2$ grains), and in the troy and apothecaries' systems, equal to 480 grains, or $^1/_{12}$ pound. The avoirdupois ounce is equal to 28.35 grams. As a unit of volume, the fluid ounce is equal to $^1/_{16}$ of a pint, or 29.57 millilitres, in the U.S. Customary System and to $^1/_{20}$ of a pint, or 28.41 millilitres, in the British Imperial System. As a unit of weight, the ounce derives from the Roman uncia (meaning "twelfth part"), which was $^1/_{12}$ of a Roman foot. The standard or physical embodiment of the Roman foot, a copper bar, constituted the Roman pound standard and was divided along its length into 12 equal parts, called unciae. Thus, uncia designated both a unit of weight and one of length and is the source of the modern terms inch and ounce.

Oundle, market town, East Northamptonshire district, county of Northamptonshire, England, on the River Nene. The manor was granted to the feudal landowner John, Earl of Bedford, after the dissolution of the monasteries under Henry VIII in the 1530s. The Church of St. Peter, with its crocketed spire, has work in Early English, Decorated, and Perpendicular styles. Oundle School, a well-known public (independent, fee-paying) school for boys founded in 1556 under the will of Sir William Laxton, lord mayor of London, was granted a royal charter in 1930. The school became famous under the headmastership (1892–1922) of Frederick William Sanderson (*q.v.*). The town itself, small and residential in character, with buildings of local gray limestone, has a twice-yearly fair. Pop. (1980) 3,283.

Ouolof (people): *see* Wolof.

Ouolof empire (West African history): *see* Wolof empire.

Ouologuem, Yambo, pseudonym UTTO RODOLPH (b. Aug. 22, 1940, Bandiagary, Mopti region, French Sudan [now The Sudan]), Sudanese writer who was highly acclaimed for his first novel, *Le Devoir de violence* (1968; *Bound to Violence*), which received the Prix Renaudot. With this work, Ouologuem became the first African writer to receive a major French literary award.

Ouologuem was born to a ruling-class family and attended local schools in addition to a lycée in Bamako, Mali; he received degrees in philosophy, literature, and English in Paris in 1962. He also studied for his doctorate in sociology in Paris.

His best-known work, *Le Devoir de violence,* is an epic about a fictitious Sudanese empire, in which hundreds of years of African history are unfolded and in which three forces down through the centuries are responsible for the black man's "slave mentality"—the ancient African emperors, the Arabs, and finally, since the mid-1800s, the European colonial administrators—reducing the black man to "négraille" (a word coined by Ouologuem, meaning "nigger rabble" in its translation). The work was highly controversial, some critics claiming it to be a new form of African literature, others maintaining that it was highly derivative of Graham Greene's *It's a Battlefield* (1934) and of a work by André Schwarz-Bart, *Le Dernier des Justes* (1959; *The Last of the Just*). Ouologuem viewed the African's lot as a legacy of violence and, in modern times, as a duty of violence toward white misconceptions of blacks that impose on him a slave mentality and character.

Ouologuem's bitterness about white attitudes also appears in some of his poems, and his *Lettre à la France nègre* (1969) attacks the "noble" sentiments that have been expressed by paternalistic French liberals about Africa.

Other works include *Les Milles et un bibles du sexe* (1969; "The Thousand and One Bibles of Sex"), published under his pseudonym, Utto Rodolph. Ouologuem also coauthored French-language textbooks for foreigners under the title *Terres du Soliel* (1971; "Lands of the Sun").

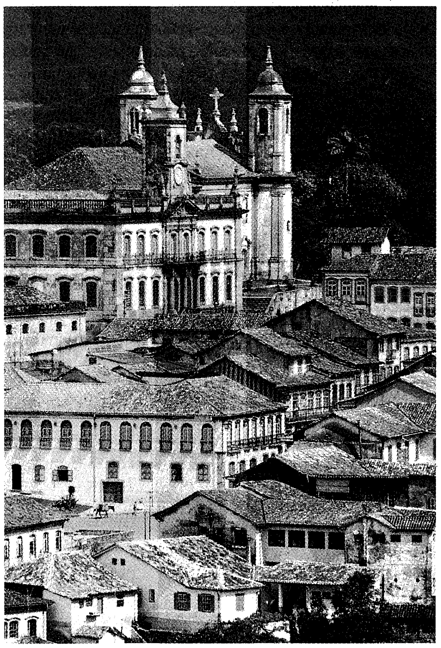
Our Father, the Latin *Pater Noster,* the first words of the Lord's Prayer (*q.v.*).

Ourinhos, city, south-central São Paulo *estado* ("state"), Brazil. It lies at 1,568 feet (478 m) above sea level along the Paranapanema River, near the border of Paraná state. Once called Jacarèzinho, the city was made the seat of a municipality in 1948. Principal crops of the region include coffee, alfalfa, cotton, rice, and corn (maize). Industrial plants in Ourinhos process agricultural products and also manufacture liquor, metal goods, and ammunition. The city is linked by railroad and highway to the state capital, São Paulo, 220 miles (350 km) east, and to neighbouring urban centres in São Paulo and Paraná states. It also has an airfield. Pop. (1980 prelim.) 52,698.

Ouro Prêto, city, southeastern Minas Gerais *estado* ("state"), Brazil. It lies on the lower slopes of the Serra do Oro Prêto, a spur of the Serra do Espinhaço, at 3,481 feet (1,061 m) above sea level, in the Doce River drainage basin.

Within a decade of its founding in 1698 as a mining settlement, Ouro Prêto became the centre of the greatest gold and silver rush in the Americas to that date. It still resembled a boom town when it was given city status in 1711 with the name Vila Rica. It was made capital of the newly created Minas Gerais captaincy in 1720. In 1823, after Brazil's independence was won from Portugal, Ouro Prêto was named capital of Minas Gerais province. In 1897, however, because of transportation difficulties the capital was transferred to Belo Horizonte (40 mi [65 km] northwest), worsening the economic decline that had already begun in Ouro Prêto. The opening of an Alcan aluminum factory at nearby Saramenha in 1979 helped to revive the city's economy. The Universidade Federal de Ouro Prêto (1969) is located there. The city is linked to Belo Horizonte by highway and railroad.

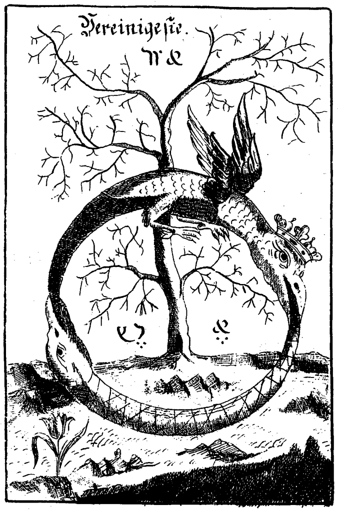
Ouro Prêto lives largely in the past. In 1933 it was decreed a national monument and the surrounding region a national park, so that the city's elaborate (mostly late 18th-century) public buildings, churches, and houses might be preserved or restored; they make the place a veritable open-air museum. In the late 1970s a federally funded restoration project was begun. The old colonial governor's palace houses a mining school (founded 1876) and a museum that contains an outstanding collection of minerals native to Brazil. The massive colonial penitentiary contains the Museum of the Inconfidência, dedicated to the history of gold mining and culture in Minas Gerais. The colonial theatre, restored in 1861–62, is the oldest in Brazil. The city has many Baroque churches. Religious architecture and sculpture attained great perfection in the city under the skillful hands of Antônio Francisco Lisboa, better known as Aleijadinho (Little Cripple). The church of São Francisco de Assis and the facade of the church of Nossa Senhora do Carmo are his masterpieces. Pop. (1980 prelim.) 27,821.



The church of Nossa Senhora do Carmo overlooking Ouro Prêto, Braz.

John Lewis Stage—Photo Researchers

Ouroboros, emblematic serpent of ancient Egypt and Greece represented with its tail in its mouth continually devouring itself and being reborn from itself. A Gnostic and alchemical symbol, Ouroboros expresses the unity of all things, material and spiritual, which never disappear but perpetually change form in an eternal cycle of destruction and re-creation.



Crowned dragon as tail eater, illustration from Eleazar's *Uraltes Chymisches Werk,* 1760

By courtesy of The Beinecke Rare Book and Manuscript Library, Yale University

In the 19th century, a vision of Ouroboros gave the German chemist Friedrich August Kekule von Stradonitz the idea of linked carbon atoms forming the benzene ring.

Ouse, River, also called GREAT OUSE, river in England, draining the East Midlands at the Fens. It rises 5 mi (8 km) west of Brackley, Northamptonshire, and flows past Buckingham, Bedford, Huntington, and St. Ives to Earith and thence via the Fens to The Wash, a shallow inlet of the North Sea. For the first 100 mi it follows an irregular, meandering course, its gradient falling from 20 ft per mi (4 m per km) above Buckingham to 2 ft per mi toward Earith. From Earith to its mouth, a distance of 35 mi, the course is almost entirely artificial, having been straightened and having had its flow controlled by sluices. The average gradient there is very slight. Parts of the upper valley are followed by the Grand Union Canal. Locks make the river navigable upstream to Bedford. Coarse fishing and gravel extraction are important.

The river is sometimes called the Great Ouse to distinguish it from other English rivers of the same name in West Sussex and North Yorkshire.

Ouse, River, river in north central England draining the central Pennines (via its tributaries) and the Vale of York. It is formed by the confluence of the Swale and Ure rivers east of Boroughbridge in central North Yorkshire county. The Ouse flows generally southeastward for 60 mi (99 km) through the city of York and parish (town) of Selby to join the River Aire (at the Humberside county boundary) north of Goole. Nine miles east of Goole the Ouse merges with the north-flowing River Trent to form the River Humber (en route to the North Sea). The average discharge of the Ouse into the Humber is about 3,500 cu ft/sec (100 cu m/sec). The lower Ouse is a major transportation route for industrial products and raw materials (including steel, coal, and textiles); it is connected to the Aire and Calder Navigation, one of England's most important inland waterway systems, that extends into the heavily industrialized county of West Yorkshire. Assorted crops including barley, wheat, potatoes, and sugar beets are grown along its adjacent plain.

Deep-shaft coalfields in the Ouse basin emerged as the United Kingdom's most important new source of coal in the late 1970s, and as new mines opened in the early 1980s north of Selby, the economic significance of the Ouse as a transportation route increased.

ousel (bird): *see* ouzel.

Ousmane, Sembène (b. Jan. 1, 1923, Ziguinchor-Casamance, Senegal), Senegalese writer whose historical-political novels and work as a film director since the mid-1960s earned him an international reputation.

Ousmane spent his early years as a fisherman on the Casamance coast. He studied at the École de Céramique at Marsassoum and then moved to Dakar, where he found work as a bricklayer, plumber, and apprentice mechanic until he was drafted into the French Army in 1939. In 1942, during World War II, he joined the Free French forces and landed in France for the first time in 1944. After demobilization he remained in France, working as a docker in Marseille, and became a militant trade unionist.

Ousmane taught himself to read and write in French and in 1956 published his first novel, *Le Docker noir* ("The Black Docker"), based on his experiences in Marseille. After a spinal disorder forced him to give up physical labour, he made literature his livelihood. Among the works that followed were *O pays, mon beau peuple!* (1957; "O My Country, My Beautiful People"), and *Les Bouts de bois de dieu* (1960; *God's Bits of Wood,* 1970), which depicts the African workers' railroad strike to obtain decent wages and working conditions in 1947–48, an early attempt to combat the most flagrant abuses of colonialism, and which was translated into several languages; a volume of short stories entitled *Voltaïque* (1962), *L'Harmattan* (1964, publ. in *Présence Africaine;* "The Storm"), and *Xala* (1974; Eng. trans. 1976), which also provided the subject of one of his best films. In about 1960 Ousmane became interested in motion pictures, in an attempt to reach an African popular audience, 80 percent of whom didn't know French or have access to books in any language. After studying at the Moscow Film School he returned to Africa, and made three short subject films, all reflecting a strong social commitment, and in 1966 a feature film, *La Noire de . . .* (*Black Girl*), the first ever produced by an African filmmaker. It depicted the virtual enslavement of an illiterate girl from Dakar employed as a servant by a French family. The film won a major prize at the 1967 Cannes Film Festival.

With *Mandabi* ("The Money Order"), a comedy of daily life and corruption in Dakar, Ousmane in 1968 made the revolutionary decision to film not in French but in the Wolof language. All his subsequent films were in Wolof. His masterpiece, *Ceddo* (1977; "Outsiders"), an ambitious, panoramic account of aspects of African religions, was banned in his native Senegal.

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

Out Islands, the islands that make up The Bahamas apart from New Providence Island. Extending eastward off the Florida coast to just north of Hispaniola are about 3,000 islands and rocks, with a combined area of about 4,000 sq mi (10,360 sq km). About 20 of the islands are permanently inhabited. Pop. (1980) 74,068.

Outardes River, French RIVIÈRE AUX OUTARDES, river in Côte-Nord (North Shore) region, east central Quebec province, Canada, rising in the Otish Mountains and flowing southward for 300 mi (480 km) through Lake Plétipi to the St. Lawrence River, 18 mi southwest of Baie-Comeau. Named after the numerous wild geese for which it is famous, the Outardes River, with its many rapids and falls, attracted hydroelectric development in the 1930s and, in the 1960s, the Manicouagan-Outardes Project of Hydro-Quebec.

Outback, in Australia, any inland area remote from large centres of population. Generally, the term is applied to semiarid inland areas of eastern Australia and to the arid centre of the Western Plateau and its semiarid northern plains (in Western Australia) where bodies of water are scattered and frequently dry. The Macdonnell, Musgrave, and Petermann mountain ranges and four major deserts, the Gibson, the Great Sandy, the Great Victoria, and the Tanami, are situated in this latter region. The term has been in use since the 19th century and has many compounds and derivatives, such as "back of Bourke," "back of beyond," "back country," and "backblocks." Terms with similar meaning include "the bush" and "never-never land." Since the mid-1870s, cattle have been raised on the meagre vegetation of the far north, and, beginning in the late 1800s, sheep have been kept on large landholdings called stations. This pastoral activity continues in the Outback together with opal mining and oil production. Stations provide basic economic necessities in the Outback by shipping in supplies from cities. The Royal Flying Doctor Service provides medical assistance to people in the Outback, and correspondence schools of the air instruct pupils using two-way radio equipment and television.

outcaste, in the Hindu caste system, an individual or group that has been thrown out of caste, usually for some ritual offense. The outcasting may be temporary or permanent. In the 19th century, a Hindu faced excommunication for going abroad, where it was presumed he would be forced to break caste restrictions and, as a result, become polluted. Such an offender would be reinstated upon completion of the proper observances, usually culminating in payment of a fine or giving a feast for caste brethren.

To be permanently outcaste was more serious, as it deprived the offender both of a social or economic support group and of a marriage partner. Offspring of certain intercaste unions (traditionally the union of a Brahman mother and a Śūdra father) were considered outcastes. Outcastes might be adopted into an existing caste of low status or form a new caste. Because of their precarious economic position, outcastes frequently were forced to take on polluting jobs no one else wanted to do; thus they became not only outcastes but untouchables.

Some tribal groups in and around India and all foreigners were automatically perceived as *avarṇa* ("casteless," or "out of caste").

Outcault, Richard Felton (b. Jan. 14, 1863, Lancaster, Ohio, U.S.—d. Sept. 25, 1928, Flushing, N.Y.), American cartoonist and creator of the "Yellow Kid," a comic cartoon series that was influential in the development of the comic strip.

Outcault studied art in Cincinnati, Ohio, and in Paris and later contributed to *Judge* and *Life,* humour magazines that had begun publication in the early 1880s. By 1885 he was drawing comic cartoons based on life in the slums for the rejuvenated *New York World,* purchased by Joseph Pulitzer in 1883. Outcault's drawing of an urchin wearing a nightshirt was selected for a colour-production test conducted by the *World* on Feb. 16, 1896. The bright yellow-clad figure attracted such wide attention that the urchin was named the "Yellow Kid." Almost from the first, slangy messages appeared on the nightshirt. Outcault was hired away from the *World* later that year by William Randolph Hearst, owner of *The New York Journal.* Pulitzer outbid Hearst, and then Hearst outbid Pulitzer, at which point Pulitzer gave up and hired George Luks to draw the "Yellow Kid." The press war and the shenanigans over Outcault's services resulted in the expression "yellow journalism" for sensational and unscrupulous publishing. The success of the "Yellow Kid" led to the introduction of many other comics.

In 1897 Outcault left the *Journal* for *The New York Herald,* where in 1902 he created "Buster Brown," his second important cartoon character. Neat and prissy in appearance, Buster was a mischief-maker who carried out his pranks in a genteel setting far removed from the tough, vigorous slum of the "Yellow Kid." The strip is remembered chiefly for the subsequent use of the name Buster Brown in advertising a wide range of products.

Outer Banks, also called THE BANKS, chain of islands extending southward for 175 miles (282 km) along the coast of North Carolina, U.S., from Back Bay, Va., to Cape Lookout, N.C. Generally covered with sand dunes, the islands range from a few feet to more than 100 feet (160 m) in height. They are inhabited by some fishermen and farmers, and the area attracts bird hunters and sports fishermen. The Atlantic Intracoastal Waterway threads its way between Outer Banks and the mainland. The Banks are full of shipwrecks and pirate lore and have several historical sites, notably Roanoke Island (*q.v.*), where an unsuccessful English colony was established in 1585, and Kitty Hawk, where the Wright brothers made the first powered airplane flight.

Outer Hebrides, islands off the northwestern coast of Scotland, administered as the Western Isles Area, one of the three Islands areas of Scotland. As their name suggests, the Outer Hebrides lie farther away from the Scottish mainland than do the islands of the Inner Hebrides. The Outer Hebrides stretch 130 miles (210 km) from Lewis Island in the north to Barra Head Island in the south. They are separated from the Inner Hebrides in the north by the North Minch and Little Minch channels and in the south by the Sea of the Hebrides. The Outer Hebrides lie in a crescent about 40 miles (65 km) from the Scottish mainland. The largest islands of the Outer Hebrides are Lewis, Harris, North Uist, Benbecula, South Uist, and Barra. About 40 miles (65 km) northwest of the main chain is the island of St. Kilda.

Many of the islands in the Outer Hebrides are uninhabited, and almost all of the population lives on Lewis and Harris. There has been considerable depopulation of the islands in the 20th century, primarily because of the lack of economic opportunities. The islands are one of the few areas in Scotland where Scottish Gaelic is still spoken as the everyday language.

Wildlife is abundant in the Outer Hebrides. The more isolated islands contain large seabird populations, including gannets, fulmars, and puffins. Red deer is found on the northern islands, a primitive wild sheep is native to Soay Island, and the Atlantic gray seal inhabits many coastal areas. The vegetation of the islands consists mostly of grassland and tundralike herbage, with peat bogs frequently found in the poorly drained lowlands. The islands' barren and rock-strewn eastern coasts contrast sharply with the white sand beaches backed by grassy plains (the *machair*) found along the western coasts. Trees are few, and for the most part the scenery is open and bleak. The harsh environment and scanty, poor soil limit cultivation to hardy fodder crops, potatoes, and a few vegetables.

Crofting (tenant farming) is the traditional mainstay of the economy and is still widely practiced. The typical croft is just a few acres with a handful of sheep, a cow, and enough crops to supplement the diet and provide a small income. Peat is cut in the extensive moors of the islands' interior and is used to heat the crofters' homes. The islands are also known for their high-quality Harris tweed, which is traditionally woven on handlooms by the crofters at home. Fishing is also important, though it has declined since the heyday of herring fishing during the early part of the century.

The Outer Hebrides have been inhabited for at least 4,000 years, and prehistoric remains are numerous, including the fine Megalithic stone circle at Callanish (Lewis). Equal in importance to Stonehenge, the Callanish megaliths are aligned to make a rough Celtic cross 405 feet (123 m) north to south and 140 feet (43 m) east to west. Several smaller stone circles in the area align with Callanish.

Stornoway on Lewis is the chief town and administrative centre of the islands. It has a good natural harbour and contains ship repair facilities and a construction yard for the nearby offshore oil industry.

Outer Himalayas (Central Asia): *see* Siwālik Hills.

Outer Mongolia: *see* Mongolia.

Outer Space Treaty, formally TREATY ON PRINCIPLES GOVERNING THE ACTIVITIES OF STATES IN THE EXPLORATION AND USE OF OUTER SPACE, INCLUDING THE MOON AND OTHER CELESTIAL BODIES (1967), international treaty binding the parties to use outer space only for peaceful purposes. In June 1966 the United States and the Soviet Union submitted draft treaties on the uses of space to the United Nations. These were reconciled during several months of negotiation in the Legal Subcommittee of the UN Committee on the Peaceful Uses of Outer Space, and the resulting document was endorsed by the UN General Assembly on Dec. 19, 1966, and opened for signature on Jan. 27, 1967. The treaty came into force on Oct. 10, 1967, after being ratified by the United States, the Soviet Union, the United Kingdom, and several other countries.

Under the terms of the treaty, the parties are prohibited from placing nuclear arms or other weapons of mass destruction in orbit, on the Moon, or on other bodies in space. Nations cannot claim sovereignty over the Moon or other celestial bodies. Nations are responsible for their activities in space, are liable for any damage caused by objects launched into space from their territory, and are bound to assist astronauts in distress. Their space installations and vehicles shall be open, on a reciprocal basis, to representatives of other countries, and all parties agree to conduct outer-space activities openly and in accordance with international law.

Outjo, town, northwestern Namibia. The town is situated on a cluster of low hills at an elevation of 4,135 feet (1,260 m). It lies within an arid region that has accessible underground water supplies, and it has the character of a frontier outpost.

Thomas Lambert, the first European settler, arrived there in 1880, and German colonial authorities established a military post at Outjo in 1895. It became a municipality in 1944. The town is a trading centre for the surrounding ranching and stock-raising area, and the local industries for the most part produce meat and dairy products and Karakul lambs' wool. A branch railway from Otjiwarongo, 29 miles (47 km) to the southeast, terminates at Outjo. Repeated raids by Owambo (Ovambo) guerrillas of the South West Africa People's Organization (SWAPO), an Owambo (Ovamboland) and southern Angola-based group demanding South African troop withdrawal from what was then South West Africa/Namibia, plagued ranchers of Outjo and the surrounding area in the late 1970s and '80s. Pop. (1983 est.) 4,380.

outlawry, act of putting a person beyond the protection of the law for his refusal to become amenable to the court having legal jurisdiction. In the past, this deprivation of legal benefits was invoked when a defendant or person was in civil or criminal contempt of court, and, in cases of alleged treason or the commission of a felony (referred to as major outlawry), it amounted to a conviction as well as an extinction of civil rights. In England, on proof of the mere fact of major outlawry, the offender was sentenced to death and was often killed on sight or during the effort to arrest him. Conviction for major outlawry also effected the immediate forfeiture of all property and possessions to the crown and prevented the receipt of any property. In civil proceedings outlawry was formally abolished in England in 1879. Under English law outlawry can now be invoked only for one accused of criminal charges.

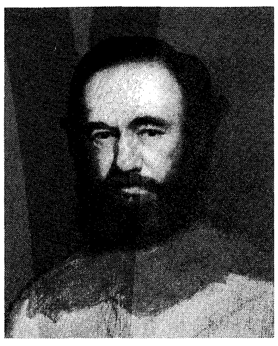
In other countries outlawry in civil actions was virtually unknown, but manifestations of it, ranging from informal social ostracism to formal statutory proscription, were used as a criminal sanction. Conviction did not always result in sentence of death, but often the punishment involved transportation or exile for the offender, thereby completely stripping him of the benefits of his native land.

Some societies practiced a social form of outlawry on people not even accused of an offense but characterized by some manner of physical or mental abnormality. In India, for example, persons affected with leprosy were placed under ban and disability and driven from their communities to live in leper colonies, without the ordinary benefits of society.

Outram, Sir James, 1ST BARONET (b. Jan. 29, 1803, near Butterley, Derbyshire, Eng.—d. March 11, 1863, Pau, Fr.), English general and Indian political officer known, because of his reputation for chivalry, as "the Bayard of India" (after the 16th-century French soldier Pierre Terrail, seigneur de Bayard).

He was educated at Marischal College, Aberdeen, and went to Bombay as a cadet in 1819. After serving with distinction in the early stages of the First Afghan War (1839–42), he was appointed political agent in Sind. Though dismissed on the appointment to Sind of Sir Charles Napier, he persuaded the independent chieftains of Sind to accept a harsh new treaty. According to its terms his prize money amounted to 30,000 rupees, which he gave to charitable institutions in India because he considered the war unjust. He served as resident at Baroda and Lucknow, where he carried out the annexation of the state of Oudh in 1856. He successfully commanded an expedition against Persia in 1857 and was created lieutenant general.

At the outbreak of the Indian Mutiny of 1857 he was recalled from Persia, given command of two divisions, and resumed his commissionership of Oudh. During the mutiny he was appointed to succeed Sir Henry Havelock at Cawnpore (Kānpur), but instead he magnanimously asked to serve under Havelock during the first siege of that city. In 1858 he was awarded a baronetcy and appointed military member of the governor-general's council. In 1860 he returned to England. Outram is buried in Westminster Abbey, and a full-length bronze figure of him stands on the Thames Embankment near Charing Cross, London.



Outram, oil painting by Thomas Brigstocke, *c.* 1863; in the National Portrait Gallery, London
By courtesy of the National Portrait Gallery, London

Outremeuse, Jean d' (b. 1338?—d. 1399?), French author of two romanticized but fascinating historical works. The first, *La Geste de Liège,* is a leisurely account, partly in prose, partly in verse, of the mythical history of his native city. *Ly Myreur des Histors* ("The Mirror of History") is even more ambitious, purporting to be a history of the world from the Flood up to the 14th century.

D'Outremeuse was no accurate historian, but his fictionalized accounts of the past offer insights into the workings of a medieval mind. It is also possible to discover, amidst a great deal of pure invention, unique evidence about the author's time and especially about literature in his age.

Outremont, city, Montréal region, southern Quebec province, Canada. It lies in the centre of Montreal Island, adjoining Montreal city. Originally called Côte-Sainte-Catherine, it was renamed in 1875 for its location in relation to Montreal—on the far side of Mont-Royal. The city, a part of the Montreal Metropolitan Corporation, is now primarily a high-density residential suburb. Inc. town, 1895; city, 1915. Pop. (1981) 24,338.

Consult the INDEX *first*

outwash, deposit of sand and gravel carried by running water from the melting ice of a glacier and laid down in stratified deposits. An outwash may attain a thickness of 100 m (328 feet) at the edge of a glacier, although the thickness is usually much less; it may also extend many kilometres in length. For example, outwash deposits from the Wisconsin Glaciation can be traced to the mouth of the Mississippi River, 1,120 km (700 miles) from the nearest glacial terminus.

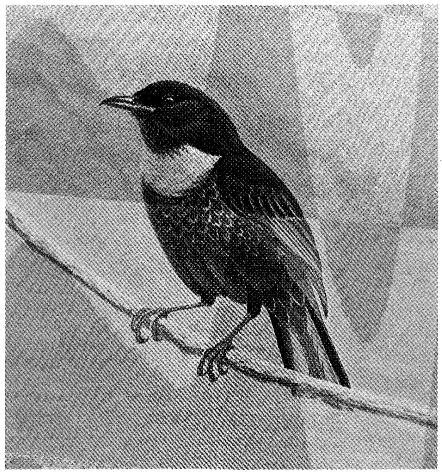
The sheet of outwash may be pitted with undrained kettles or dissected by postglacial streams. Outwash plains are commonly crossbedded with units of alternating grain size. The ordinarily gentle slope causes the larger material to be dropped nearest the glacier, while the smaller grain sizes are spread over greater distances. Striated pebbles are uncommon because the striations are worn away during transport. Outwashes are the largest of the fluvioglacial deposits and provide a considerable source of windblown material. When confined within valley walls, the outwash deposit is known as a valley train.

Ouvéa Island, also called UVÉA, or UEA, ISLAND, French ILE OUVÉA, or UVEA, or UEA, northernmost of the Loyalty Islands, an island group within the French overseas territory of New Caledonia, southwestern Pacific Ocean. Ouvéa is a crescent-shaped atoll, 30 miles (50 km) long and 4½ miles (7 km) wide, with a total area of 51 square miles (132 square km). The most fertile of the group, it is wooded and exports copra. Faiaué (Fayaoué), on the southeast coast, is the chief village and administrative centre. Several tourist facilities lie on the 20-mile (32-kilometre) beach that borders the large lagoon. Both a Samoan and a Vanuatan language are used. Pop. (1983) 2,772.

Ouvrier, Albert l': *see* Albert l'Ouvrier.

Ouyang Xiu (Chinese poet): *see* Ou-yang Hsiu.

ouzel, also spelled OUSEL, also called RING-OUZEL (*Turdus torquatus*), thrush species, family Turdidae (order Passeriformes), characterized by a white crescent on the breast. A blackish bird, 24 cm (9½ inches) long, it breeds locally in uplands from Great Britain and Norway to the Middle East. The name ouzel was formerly applied to a closely related European blackbird (*T. merula; see* blackbird). For a related bird in Mexico, sometimes called black ouzel, *see* robin. The dipper (*q.v.*) is often called water ouzel.



Ring-ouzel (*Turdus torquatus*)
Drawing by John P. O'Neill

ova (female cells): *see* ovum.

Ovambo (people): *see* Ambo.

Ovamboland (South West Africa/Namibia): *see* Owambo.

Ovando, Nicolás de (b. *c.* 1451, Brozas, Castile [now in Spain]—d. *c.* 1511), Spanish military leader and first royal governor of the West Indies. He was the first to apply the encomienda system of Indian forced labour, which became widespread in Spanish America, and he founded a stable Spanish community in Santo Domingo that became a base and model for later settlement.

The son of a noble family, he grew up close to the court of Ferdinand and Isabella and was among the companions of the heir apparent to the throne. As a knight of the military Order of Alcántara, Ovando assisted in reforming the order, and as a reward for his services he was chosen to replace Francisco de Bobadilla as governor of the Spanish colonies in the West Indies. He arrived in Santo Domingo in 1502 with more than 2,000 colonists and the largest fleet that had ever sailed to the New World.

The natives of Santo Domingo, however, were reluctant to work for the Spanish colonists, and Ovando, with royal authority, established the paternalistic encomienda system. Intended to offer the Indians food and security in exchange for their labour, it quickly became a means for simple and brutal exploitation. Perhaps fearing him as a rival, Ovando let Christopher Columbus linger for a year without help in Jamaica, where the explorer had run aground on his fourth voyage to America. On learning of Ovando's harsh treatment of the Indians, the authorities in Spain recalled him in 1509. He returned to Spain, where he wrote his memoirs and published a map of Santo Domingo.

ovary, in botany, enlarged basal portion of the pistil, the female organ of a flower. The ovary contains ovules, which develop into seeds upon fertilization. It will mature into a fruit, either dry and parchmentlike or fleshy, enclosing the seeds.

A simple or unicarpellate ovary is formed from a single carpel, an evolutionarily modified leaf. It has one chamber (locule), within which are the ovules. A multicarpellate ovary consists of more than one carpel and may have one or more locules.

Ovary position is a useful feature in classification. An ovary attached to the receptacle above the attachment of other floral parts is termed superior; when it lies below the attachment of other floral parts, it is inferior. *See also* flower.

ovary, in zoology, female reproductive organ in which sex cells (eggs or ova) are produced. The usually paired ovaries of female vertebrates produce both the sex cells and the hormones necessary for reproduction. In some invertebrate groups such as coelenterates, formation of ovaries is associated with the seasons. Many invertebrates have both ovaries and testes in one animal, and some species undergo sex reversal. *See also* egg; gonad.

In humans, ovaries of the newborn and young child are a mass of elongated tissue; as the female reaches adolescence, the ovaries gradually enlarge and change their shape. The adult ovaries are almond-shaped and are about 4 centimetres (1.6 inches) long, 2 centimetres (0.8 inch) wide, and 1.5 centimetres (0.6 inch) thick; the two ovaries weigh from 4 to 8 grams (0.15 to 0.3 ounce). The ovaries are attached to the uterus and the fallopian tubes by several ligaments. The surfaces of the ovaries are usually uneven and have areas of scar tissue. Hollow balls of cells—follicles—containing immature egg cells are present in the ovaries at birth; there are usually 150,000 to 500,000 follicles at this time. When the female reaches adolescence and young adulthood, the number has been reduced to only about 34,000. As a woman ages, the follicles gradually diminish in number until, at menopause and the cessation of reproductive powers, the few remaining follicles degenerate. During the active child-bearing years, normally between the ages 13 and 50, only 300 to 400 of the follicles undergo maturation. In about every four weeks of the active reproductive years, one follicle from only one of the two ovaries matures; the egg inside the follicle is extruded from the ovary into the rest of the reproductive tract for fertilization. If the egg is not fertilized by the male sperm, it passes from the body during the process of menstruation (*q.v.*).

The ovaries also function as endocrine glands by secreting two hormones, estrogen and progesterone, into the bloodstream. Estrogen, which is secreted by the ovarian follicle, controls the development of the secondary sex characteristics such as enlargement of the breasts, growth of pubic hair, and the increased amount of fat on the hips and buttocks; estrogen also stimulates growth of the uterine lining during the menstrual cycle. Progesterone is secreted from the cells of the corpus luteum, a body that develops at the site of the mature follicle upon release of the egg. Progesterone helps the fertilized egg to secure itself to the uterus and to develop into an embryo.

The centre of the ovary, called the medulla, is a core of connective tissue consisting of blood vessels, lymphatic ducts, and nerve fibres. The thick layer covering the medulla is the cortex, which contains the follicles and ova. As a follicle matures, it enlarges and migrates to the surface of the ovary. When an egg is discharged from a follicle, blood and yellow cells move into the empty follicular cavity to fill it; this tissue becomes the corpus luteum. If the egg is fertilized, the corpus luteum remains until the end of pregnancy; during this time the corpus luteum secretes progesterone. If the ovum is not fertilized, the corpus luteum becomes a whitish scar mass, known as corpus albicans, which, usually, eventually disappears.

After menopause, the ovaries shrink in size and usually consist of old fibrous tissue. The production of estrogen drops considerably but does not totally cease. *See also* ovulation.

For a depiction of the ovaries in human anatomy, shown in relation to other parts of the body, *see* the colour Trans-Vision in the PROPAEDIA: Part Four, Section 421.

ovenbird, any of several species of small birds, named for building a domed nest with a side entrance, especially *Seiurus aurocapillus,* a wood warbler (family Parulidae, order Passeriformes) of North America east of the Rockies; it winters south to Colombia. Brownish-olive above, with a streaked breast, white eye

Ovenbird (*Seiurus aurocapillus*)
Jack Dermid

ring, and black-edged orange crown, the bird looks like a small thrush. Its song, "tee-cher," is repeated with increasing intensity in dank woods. The ovenbird walks, unlike most other wood warblers, which hop. Its nest is a dome of grass placed on the ground.

The term ovenbird is also used broadly for members of the tropical American family Furnariidae (*q.v.*) and especially for members of the genus *Furnarius* (also known by the Spanish name hornero, meaning "baker"). They are 15–20 centimetres (6–8 inches) long, reddish brown, and thrushlike, common in open country throughout most of South America. On a branch, post, or roof ledge, the hornero builds an ovenlike nest of mud and grass, about 30 cm high, with an enclosed nest chamber.

over-the-counter market, trading in stocks and bonds that does not take place on stock exchanges; such trading is most significant in the United States, where requirements for listing stocks on the exchanges are quite strict. It is often called the "off-board market," and sometimes the "unlisted market," though the latter term is misleading because some securities so traded are listed on an exchange. Over-the-counter trading is most often accomplished by telephone, telegraph, or leased private wire.

In this market, dealers frequently buy and sell for their own account and usually specialize in certain issues. Schedules of fees for buying and selling securities are not fixed, and dealers derive their profits from the markup of their selling price over the price they paid. The investor may buy directly from a dealer willing to sell stocks or bonds that he owns or with a broker who will search the market for the best price.

Bonds of the U.S. government ("treasuries"), as well as many other bond issues and preferred-stock issues, are listed on the New York Stock Exchange but have their chief market over-the-counter. Other U.S. government obligations, as well as state and municipal bonds, are traded over-the-counter exclusively.

A third market has developed because of the increased importance of institutional investors, such as the mutual funds, who deal in large blocks of stock. Trading is done in shares listed on the exchanges but takes place over-the-counter; this permits large-quantity discounts not possible on the exchanges, where brokerage fees are fixed.

Much of the regulation of the over-the-counter market is effected through the National Association of Securities Dealers, Inc., created in 1939 by an act of Congress to establish rules of conduct and protect members and investors from abuses. Although retail prices of over-the-counter transactions are not publicly reported, the NASD began publishing interdealer prices for the issues on its national list in February 1965.

Overami (king of Benin): *see* Ovonramwen.

Overbeck, Johann Friedrich (b. July 3, 1789, Imperial Free City of Lübeck—d. Nov. 12, 1869, Rome), Romantic painter of Christian religious subjects, who was leader of a group of German artists known as the Nazarenes, or Lucas Brotherhood (Lukasbund).

In 1806 Overbeck entered the Academy of Vienna, where, disappointed in the academic approach to teaching, he and Franz Pforr in 1809 founded the Lucas Brotherhood. They sought to revive the medieval artists' guilds and to renew the arts through Christian faith (in 1813 Overbeck joined the Roman Catholic Church). For artistic inspiration they turned to Albrecht Dürer and to Italian Renaissance art, particularly the works of Perugino and early Raphael.

In 1810 the Lucas Brotherhood went to Rome. Their style was characterized by precise outlines; clear, bright colours; and an emphasis on Christian symbolism. Communally, the

"Italia and Germania," by Johann Friedrich Overbeck, 1811–28; in the Neue Pinakothek, Munich
By courtesy of the Neue Pinakothek, Munich

brotherhood executed the frescoes of "Joseph Sold by His Brethren" at the Casa Bartholdy (1816) and the interior pavilion (1817–29) at the Villa Massimo in Rome. In the Portiuncula Chapel at Assisi, Overbeck painted "Rose Miracle of St. Francis" (1829), usually considered his major work.

As he advanced in years, Overbeck's painting became pallid and stereotyped. Yet these late works greatly influenced Christian devotional art of the 19th century and the paintings of the Pre-Raphaelite Brotherhood. His more vital early pictures and drawings, however, were rediscovered and appreciated early in the 20th century.

Overbury, Sir Thomas (baptized June 18, 1581, Compton Scorpion, Warwickshire, Eng.—d. Sept. 15, 1613, London), English poet and essayist, victim of an infamous intrigue at the court of James I. His poem *A*

Wife, which pictured the virtues that a young man should demand of a woman, played a large role in the events that precipitated his murder.

Overbury was educated at Oxford and entered the Middle Temple, London, in 1598.

Overbury, detail of an oil painting by Cornelius Johnson, 1613; in the Bodleian Library, Oxford
By courtesy of the curators of the Bodleian Library, Oxford

Having traveled in the Low Countries, in 1606 he became secretary and close adviser to Robert Carr, the king's favourite who was to become earl of Somerset. Overbury was knighted in 1608, and Carr became Viscount Rochester in 1611.

In 1611 Rochester became enamoured of Frances Howard, wife of the Earl of Essex. Lady Essex soon secured a divorce from her husband with the intention of marrying Rochester. Overbury feared that Rochester's prospective marriage would reduce his own influence over Rochester, however, and he tried strongly to dissuade the latter from marrying her. Overbury also circulated manuscript copies of *A Wife* at court, where the poem was interpreted as an indirect attack on Lady Essex. This incurred the displeasure of the king and enabled Lady Essex' powerful relatives to have Overbury imprisoned in the Tower. Rochester acceded to Overbury's imprisonment only until he could marry Lady Essex, but she herself was evidently determined to have Overbury murdered there. She secretly arranged to have him slowly poisoned to death, which he was.

Three months after Overbury died, Rochester, now Earl of Somerset, married Lady Essex. Two years passed before public suspicions were aroused over what had taken place, but then investigations were undertaken and the participants in Overbury's murder were put on trial. Four accomplices in the murder were convicted and executed; the Earl and Countess of Somerset were also convicted but were pardoned by the king.

Overbury's *A Wife* was published in 1614 and went through several editions within a year because of the publicity aroused by Overbury's victimization. Its real literary value lies in the *Characters,* ultimately 82, that were added to the second and subsequent editions. These prose portraits of Jacobean types, drawn with wit and satire, give a vivid picture of contemporary society and are important as a step in the development of the essay. A few were by Overbury, but most were contributed by John Webster, Thomas Dekker, and John Donne.

Overijssel, *provincie* (province), northeastern Netherlands, extending northward "beyond the IJssel," a distributary of the Rhine, from the provinces of Gelderland to Drenthe and Friesland and lying between Germany (east) and Flevoland Province (west). Drained by the IJssel, Vecht, Zwarte Water, and Regge rivers and the Twente, Overijssel, and numerous smaller canals, it occupies an area of 1,289 square miles (3,339 square km). Its capital is Zwolle. First known as the lordship of Oversticht, a part of the secular domain of the bishops of Utrecht, it was sold to Charles V in 1527 and was incorporated in the Dutch dominions of the Habsburgs. Overijssel was one of the seven original United Provinces of the Netherlands. In medieval times its Hanseatic towns—Kampen, Deventer, and Zwolle—were among the most important in the Netherlands, until the ascendancy of Amsterdam *c.* 1500.

Most of Overijssel is a varied glaciated delta with sandy soil and low hills that were originally covered with heath, patches of woodland, and moist swampy meadows. High-peat regions once extended to the northeast. The largely coastal area north of Zwolle consists of low peat, partly covered with clay. This northwestern part is primarily pasture, supporting cattle and dairying; in the sand regions there is dairying as well as mixed farming. The central Salland district has orchards.

The province has become highly industrialized. The Twente district in the southeast, where cotton spinning, weaving, and bleaching came into prominence in the 19th century, is one of the principal centres of the Dutch textile industry. The main centres are Enschede, Almelo, Hengelo, and Oldenzaal. Other important industrial centres are Deventer, Kampen, and Zwolle. There are two national parks (1934; 1957) in the northwest, preserving peat bogs and marsh plants and providing sanctuaries for waterfowl. Pop. (1986 est.) 998,751.

Øverland, Arnulf (b. April 27, 1889, Kristiansand, Nor.—d. March 25, 1968, Oslo), Norwegian poet and Socialist whose poems helped inspire the Norwegian resistance movement during the German occupation in World War II.

He studied philology briefly at King Frederick's University. His first book of poems, *Den ensomme fest* (1911; "The Lonely Feast"), was immediately acclaimed for its style, its clarity, and its economy. All his life Øverland was an uncompromising defender of the oppressed, but not until after World War I, in his *Brød og vin* (1919; "Bread and Wine"), did he develop a radical opposition to bourgeois society and to Christianity and recognize a need to make his poetry into a social weapon. His poems of the 1930s were intended to alert Norwegians to the danger of Fascism and Nazism. The best-known of these is "Du må ikke sove!" (1937; *You Must Not Sleep!*). The poems that he directed against the Nazi occupation and that he wrote and distributed secretly in 1940 led to a four-year imprisonment in a German concentration camp. When he was liberated in May 1945, the Norwegian government presented him with the old home of the great national poet, Henrik Wergeland, as an expression of gratitude.

Øverland
By courtesy of the Norwegian Information Service, New York

Overland Mail: *see* Southern Overland Mail Company.

Overland Park, city, Johnson County, northeastern Kansas, U.S. It is a southern suburb of Kansas City, near the Missouri border. Settled in 1906, it lies on the old Santa Fe Trail and was laid out as a stop on an interurban railway from Kansas City to Olathe; later it was the home of the first aviation school in the western United States. The city is now mainly residential and is the site of Johnson County Community College (1967). Inc. city, 1960. Pop. (1985 est.) 85,515.

Overlord, Operation: *see* Normandy Invasion.

Overseas Surveys, Directorate of, surveying, mapping, and aerial photography agency of the Overseas Development Administration (ODA) of the United Kingdom, founded in 1946 to provide advice to the ODA and foreign governments and organizations on technical matters concerning all aspects of surveying and mapping. The maps are produced by modern aerial photography and photogrammetric methods. Aerial photography missions are flown mainly by air survey companies of the United Kingdom, and directorate surveyors are sent overseas to establish horizontal and vertical ground control for the photography. Survey control is permanently marked and coordinated so that the surveys may form the basis for future work. After maps are compiled from the aerial photography, plots of the maps are checked and annotated by the local survey department. Final maps are drawn at directorate headquarters and printed by the Ordinance Survey of Great Britain. The directorate's technical libraries provide facilities for consultation of survey data and maps of the countries in which the directorate has worked. The directorate also disseminates information on new techniques and equipment in the fields of surveying, photogrammetry, and cartography.

Overton, Richard (fl. 1631–64), English pamphleteer and a Leveler leader during the English Civil Wars and Commonwealth.

The details of Overton's early life are obscure, though he probably lived in Holland and studied at Queens' College, Cambridge, before becoming a professional actor and playwright in Southwark. In 1640 he became a political activist, writing some 50 tracts attacking the Church of England, monopolies, the Earl of Strafford (Charles I's controversial adviser), and civil law. In *Man's Mortality* (1643), he argued that the soul as well as the body dies and must be resurrected. His tracts of 1645–46, published under the pseudonym Martin Marpriest, castigated the Presbyterians and the Westminster Assembly of Divines for their intolerance. In a series of 40 tracts published between 1645 and 1649 and 20 editorials in the Leveler newspaper, *The Moderate* (1648–49), he enunciated his radical political theory, with its key ideas of popular sovereignty, the equality of all men under natural law, republican government, and the social contract as the foundation of government and society. He also demanded major social and legal reforms, including the abolition of mandatory tithes, the return of enclosed lands to communal use, and university reform.

Within the Leveler movement, of which he was a key leader, Overton worked as a theorist, a journalist, and a political organizer. He was especially effective with the use of mass petitions espousing the Leveler cause. For his efforts he was imprisoned in Newgate (1646–47) and the Tower of London (1649). By the time of his release in November 1649, the government had suppressed the Leveler movement, but in 1654 Overton was still trying to create an alliance of Levelers, army republicans, and Royalists to topple Oliver Cromwell. Although Overton had to flee to the Continent, he was back and plotting again by 1656. He apparently continued to support republican causes into the early 1660s, after which nothing is known of him. His career is recounted in M. Gimelfarb-Brack, *Richard Overton* (1980).

overtone, faint tone sounding above the fundamental tone when a string or air column vibrates as a whole, producing the fundamental (first partial, or first harmonic); if it vibrates in sections, it produces overtones (upper partials, or harmonics). The listener normally hears the fundamental pitch clearly; with concentration he can hear the faint overtones.

Harmonics are a series of overtones resulting when the partial vibrations are of equal sections (*e.g.,* halves, thirds, fourths). As the vibrating sections become smaller, the harmonics are higher in pitch and successively closer together. The frequencies of the upper harmonics form simple ratios with the frequency of the first harmonic, or fundamental (*e.g.,* 2:1, 3:1, 4:1).

Some musical instruments—among them those whose sounds result from the vibration of metal, wood, or stone bars; of cylinders; of plates (*e.g.,* cymbals, bells, marimbas); or of membranes (drums)—produce nonharmonic overtones, or partials—that is, tones the frequencies of which (and, therefore, the pitches of which) lie outside the harmonic series. Musical timbre, or tone colour, is greatly affected by the particular overtones favoured by a given instrument. Thus, the clarinet owes much of its mellow sound to lower overtones, as opposed to the more nasal oboe, which lacks them. *See also* combination tone.

overture, musical composition, usually the orchestral introduction to a musical work (often dramatic), but also an independent instrumental work. Early operas opened with a sung prologue or a short instrumental flourish, such as the trumpet "Toccata" that opens Claudio Monteverdi's *Orfeo* (1607). Subsequent 17th-century operas were sometimes preceded by a short instrumental piece called a sinfonia, sonata, or, often in Venice, canzona. The first significant use of a full-scale overture, however, was made by Jean-Baptiste Lully, in works such as his opera *Thésée.* His musical form, known as the French, or Lullian, overture, opens with a slow section in dotted rhythms, followed by a quick section in fugal, or imitative, style; it often concluded with a slow passage that sometimes was expanded into a full third section—either a repetition of the initial slow section or a dance form such as a minuet or gavotte.

Lully's overture form was widely copied, by composers of not only opera (Henry Purcell in *Dido and Aeneas*) but also oratorios (Handel in the *Messiah*). Lully's use of a dance form to conclude an overture influenced the development of the orchestral suite, in which a French overture is followed by a series of dances. J.S. Bach's four orchestral "Overtures" are examples of this form of suite, which persisted into the mid-18th century.

The Italian overture became firmly established after 1680 in the operas of Alessandro Scarlatti. It is in three sections, the first and third in quick time and the second in slow time (allegro–adagio–allegro). It provided the model for the earliest symphonies, which consisted of three movements. The works of both C.P.E. Bach and Jiří Antonín Benda contain Italian overtures.

A more modern form of the opera overture was established by Christoph Gluck, who in the dedication of his opera *Alceste* (1767) declared that the overture should prepare the audience for the plot of the play. In *Alceste* and in *Iphigénie en Tauride,* the overtures, instead of closing before the curtain rises, merge into the mood of the opening act. Richard Wagner later used a similar technique in operas, such as *Tristan und Isolde.* Mozart in his overtures also set the emotional tone of the drama to follow. In his *Don Giovanni* and *Die Zauberflöte* (*The Magic Flute*) he alludes to themes from the operas. Similar thematic anticipation occurs in the works of Beethoven, Wagner, and Carl Maria von Weber.

Another trend, particularly in French operas by Daniel Auber and François Boieldieu (early 19th century), was established by the overture made up of a potpourri of tunes from the opera—a form common in musical comedies and operettas. In Italy during the same period, the overture simply served to attract the audience's attention; Gioacchino Rossini, for example, often used one overture for more than one opera.

Many overtures of the 18th and 19th centuries were derived from the sonata form. But toward the end of the 19th century the overture was frequently replaced by a short prelude in free form, which led directly into the opening scene—Wagner's *Lohengrin* and Giuseppe Verdi's *Aida* contain such preludes. Introductions to Claude Debussy's *Pelléas et Mélisande* and Benjamin Britten's *Peter Grimes* likewise consist only of a few bars of music. In Pietro Mascagni's *Cavalleria rusticana* the prologue is an aria sung in front of the curtain.

The concert overture, based on the style of overtures to romantic operas, became established in the 19th century as an independent, one-movement work, which took either the classical sonata form or the free form of a symphonic poem. Examples of such works include Felix Mendelssohn's *Hebrides* overture and Sir William Walton's *Portsmouth Point* overture. Concert overtures were also written for performance on special occasions, *e.g.,* Brahms's *Academic Festival Overture.* Other works, such as Mendelssohn's *Overture to A Midsummer Night's Dream* and Beethoven's overture to Goethe's *Egmont,* originally were intended to be performed as an introduction to a spoken play.

Overweg, Adolf (b. July 24, 1822, Hamburg—d. Sept. 27, 1852, Maduari, Chad), German geologist, astronomer, and traveller and the first European to circumnavigate and map Lake Chad. Overweg was also a member of a pioneering mission to open the Central African interior to regular trade routes from the north coast of the continent.

In 1849 Overweg joined an expedition, headed by the English explorer James Richardson, which was mounted by the British government for the purpose of opening commercial relations with the kingdoms of Central Africa. The expedition left Tripoli, in Libya, in the spring of 1850 and crossed the Sahara southward. Early in 1851 the group split up, and Overweg went on alone by way of Zinder (in present south central Niger) to Kukawa (northeast Nigeria), where he joined Heinrich Barth (*q.v.*), the expedition's scientist (and, after the death of Richardson, leader). The two spent 18 months exploring southward to Adamawa emirate (Nigeria) and the Benue River, around Lake Chad and to the southeast, till Overweg's death.

Ovetum (Spain): *see* Oviedo.

Ovid, Latin in full PUBLIUS OVIDIUS NASO (b. March 20, 43 BC, Sulmo, Roman Empire—d. AD 17, Tomis, Moesia), Roman poet noted especially for his *Ars amatoria* (*Art of Love*) and *Metamorphoses.* On unrevealed charges of immorality, the emperor Augustus banished him in AD 8 to Tomis, a remote corner of the empire on the Black Sea, where he continued to write, notably the *Tristia* (*Sorrows*).

Early years. Publius Ovidius Naso was, like most Roman men of letters, a provincial. He was born at Sulmo (modern Sulmona), a small town about 90 miles (140 kilometres) east of Rome. More than once in his poetry

Ovid, detail of a marble bust; in the Uffizi, Florence
By courtesy of the Galleria degli Uffizi, Florence

he refers affectionately to the green and pleasant fields of his native land. His family was old and respectable, sufficiently well-to-do for his father to be able to send him and his elder brother to Rome to be educated. At that time Ovid must have been about 12 years old, having passed rapidly through the primary and secondary stages of his education. At Rome he embarked, under the best teachers of the day, on the third stage, that of the schools of rhetoric.

In these establishments Roman boys studied to achieve absolute mastery of the art of fluent extempore speaking on any subject. For the majority, since philosophy tended to be despised by practical men, this was the final and most important part of their education. The method used was that of formal declamation on prescribed themes, usually of a legal or pseudo-legal character. These themes were based on imaginary situations that were often improbable and sometimes bizarre. In contrast to his brother, whose early death robbed the Roman bar of a promising recruit, Ovid had no liking for the legalistic exercises most in vogue. The elder Seneca (*c.* 55 BC–*c.* AD 37), who has left us a valuable account of Ovid at this period of his life, remarks that he was irked by formal argument and preferred the themes called "ethical," in which the point at issue turned on moral and psychological considerations. There is no doubt that Ovid's time in the schools profoundly affected his poetry. Oratory as there practiced was "rhetorical" in the most extreme sense, dominated by constant striving for effect, by the search for point, paradox, and antithesis and by the ambition to outdo the previous speaker by some fresh and ingenious perversion of probability. The intensely competitive atmosphere was calculated to foster Ovid's natural gift for effective expression and to encourage his interest in the communication of emotion.

As a member of the Roman knightly class (whose rank lay between the commons and the Senate) Ovid was marked by his position, and intended by his father, for an official career. First, however, he spent some time at Athens (then a favourite finishing-school for young men of the upper classes) and travelled in Greek lands with his friend Pompeius Macer, like himself a poet. This experience bore fruit in his poetry, in the form of mythological associations that are firmly rooted in the classical landscapes. Afterward, Ovid dutifully held some minor judicial posts, the first steps on the official ladder, but he soon decided that public life did not suit him. One legacy of this period would seem to be the predilection for legal phrases and metaphors that he shows in his earlier poems. From now on Ovid abandoned business to cultivate poetry and the society of poets, including his contemporary Sextus Propertius and the somewhat older Horace. Virgil he had not met, and Tibullus died before he could get to know him well. It is interesting and may be significant that the warmest tribute Ovid pays to a contemporary poet is to Tibullus, in a funeral elegy on his death. Tibullus, like himself, was a member of the literary circle of the patron Marcus Valerius Messala, whereas Virgil, Horace, and Propertius all belonged to the group around Gaius Maecenas, which was more representative of what might be called the Augustan establishment. Certainly the type of poetry he wrote during the first period of his career reflects a view of life, love, and poetry at odds with the "official" moral attitudes encouraged by Augustus.

His first poems, the *Amores* (*Loves*), were published at intervals, beginning in about 20 BC, in five books. They form a series of short poems in the elegiac metre depicting the various phases of a love affair with a woman called Corinna. Inspiration and treatment, however, are more intellectual than emotional, and the collection verges on a tongue-in-cheek mockery of the genre. A poem that was later to play a part in his downfall, the *Ars amatoria*, was published *c.* 1 BC. The message of this brilliant treatise on the art of seduction and intrigue was essentially subversive of the official program of moral reforms then being fostered by Augustus, and it cannot have been well received by those who were seriously committed to the goals and aspirations of Augustanism. It also included a number of references, in their contexts both flippant and tactless, to symbols of Augustus' personal prestige. A mock recantation that soon followed, the *Remedia amoris* (*Cure for Love*), cannot have helped matters. During this period Ovid also published his *Epistulae Heroidum* (*Letters from Heroines*), a series of clever, though in sum perhaps monotonous, dramatic soliloquies. While the theme of these character sketches is love, the material is mythological; and here can be seen, in embryo, the *Metamorphoses*.

Maturity: the major poems. As a writer of love elegy, Ovid had spoken in character, claiming the respect and attention due to experience and even revelation. Perhaps the fruits of some wild oats may be detected in the *Amores, Ars amatoria,* and *Remedia amoris,* but the biographer must discount most of Ovid's protestations as properly belonging to a conventional literary pose. In fact Ovid seems to have been, by contemporary standards, a respectable family man. He was first married for a short time, when very young, to a wife of whom he says no more than that she was unsuitable. To his second wife he imputes no blame, but this marriage also was brief. His third union, to a member of an important noble family, was stable and apparently based on mutual affection. We hear also of one daughter, perhaps of the second marriage. Having published a substantial body of highly original work, Ovid was by now established as the leading living poet of Rome (Horace, the last of the great Augustans, had died in 8 BC, and there were no other possible rivals). In the last poem of the *Amores,* Ovid had promised that he would soon turn to more ambitious themes. This promise he now redeemed by the publication of work in three major genres.

His tragedy *Medea* has been lost. It was praised by the critic Quintilian and the historian Tacitus and can hardly have failed to influence Seneca's play on the same theme.

Ovid's *Fasti* (*Calendar*) is an account of the Roman year and its religious festivals, consisting of 12 books, one to each month, of which the first six survive. The various festivals are described as they occur and are traced to their legendary origins. Such "aetiological" poetry was characteristic of poets of the Hellenistic Age (after 323 BC), especially of Callimachus; and in choosing this genre Ovid was deliberately challenging Propertius' claim to be "the Roman Callimachus." Thus the *Fasti* was a national poem, intended to take its place in the Augustan literary program and perhaps designed to rehabilitate its author in the eyes of the ruling dynasty. It contains a good deal of flattery of the imperial family and much patriotism, for which the undoubted brilliance of the narrative passages does not atone.

The *Metamorphoses* must also be interpreted against its contemporary literary and political background. Even Virgil and Horace, the most "Augustan" of the Augustans, had shown reluctance to produce on demand the sort of official poetry that is apt to be expected of a poet laureate—martial epics celebrating important victories and the like. When Virgil did finally write his epic, the *Aeneid,* it was a very different poem from what contemporaries had been led to expect. The unique character of Virgil's poem, which immediately became canonized as the national epic, posed a problem for his successors. After Virgil, a straightforward historical or mythological epic would represent an anticlimax. Ovid was warned against this pitfall alike by his instincts and his intelligence; he chose, as Virgil had done, to write an epic on a new plan, unique and individual to himself.

The *Metamorphoses* is a long poem in 15 books, written (unlike all Ovid's other surviving works) in hexameter verse. It is a collection of mythological and legendary stories in which metamorphosis (transformation) plays some part, however minor. The stories are told in chronological order from the creation (the first metamorphosis, of chaos into order) to the death and deification of Julius Caesar (the culminating metamorphosis, again of chaos—that is, the Civil Wars—into order—that is, the Augustan Peace). The importance of metamorphosis is more apparent than real; the essential theme of the poem is passion, and this gives it more unity than all the ingenious linking and framing devices the poet uses. The erotic emphasis that had dominated Ovid's earlier poetry has now been broadened and deepened into an exploration of nearly every variety of human emotion—for his gods are nothing if not human. This undertaking brought out, as his earlier work had not, Ovid's full powers: his wit and rhetorical brilliance, his mythological learning, his gifts of narrative and description, and the peculiar qualities of his fertile imagination. Like most classical Latin poetry, the *Metamorphoses* is a highly literary work. The vast quantities of verse in both Greek and Latin that Ovid had read and assimilated are transformed, through a process of creative adaptation, into original and unforeseen guises. The style also represents an individual modification of inherited usage. It is designed to respond unobtrusively to the many variations of genre and tone within the poem and also to carry the reader at an equable and agreeable pace through its considerable length. In both material and treatment the *Metamorphoses* is not merely un-Augustan: it is, language apart, as much Greek as Roman. By AD 8, if not yet formally published, it was complete; and it was at that precise moment, when Ovid seemed securely placed on a pinnacle of successful achievement, that there fell a blow that shattered his life.

Banishment and death. Ovid was at the time on the island of Elba. He was recalled to Rome for a personal interview with Augustus, in which, after a dressing down, he was banished to Tomis on the Black Sea. The reasons for his punishment are mentioned several times by Ovid himself: a poem—the *Ars amatoria*—and another unnamed offense. What the latter was he does not specify beyond insisting that it was an indiscretion, not a crime. The precise relationship between the two charges is obscure: the *Ars amatoria* had been published several years previously; that it was brought up against its author now seems to imply that it was connected in some way with the more recent *error.* Whatever this was, it was taken as a personal affront to Augustus and his family and bitterly resented as such.

No successful man lacks enemies, as Ovid himself had remarked in the *Remedia amoris.* Not only in the *Ars amatoria* but also in some parts of the *Metamorphoses* is there apparent disrespect for certain officially approved values that might have been enough, skillfully exploited, to create an image of their author as a social and political dissident. If Augustus' mind had already been poisoned against Ovid, or if he had been abruptly reminded of these earlier pinpricks by Ovid's *error,* whether or not it was serious, he may have grasped at the opportunity to rid Rome of a man who, if not dangerous, was personally offensive to him.

Ovid's situation was curious. The charge on which he was arraigned was one of high treason (Latin *majestas*), which could cover a multitude of sins. He was tried in the Emperor's private court, and the sentence was personally decided and pronounced by the Emperor. In effect he was to be detained at Augustus' pleasure. He was deprived of neither his citizenship nor his property, nor was he forbidden to write poetry or to communicate with his family and friends. Yet his books were removed from the public libraries, and none of the poems sent from Tomis in the first years of his exile, except those to his wife and to Augustus, is addressed to its recipient by name. Clearly, Ovid was unsafe to know; and until the death of Augustus, at least, his poetry must have circulated privately. The mystery that still surrounds the episode itself shows that Augustus was successful in stifling overt comment.

Toward the end of AD 8 Ovid set out for Tomis, where he arrived in the spring of the following year. The place (modern Constanţa, Rom.) was a semi-Hellenized port on the extreme edge of the Roman Empire, exposed to periodic attacks by the surrounding barbarian tribes. Books and civilized society were lacking; little Latin was spoken; the climate was severe. From time to time there was actual danger and, with other able-bodied citizens, Ovid took his turn in the home guard. He was alone, for his wife had stayed in Rome to protect his property and to make what intercession she could through influential friends. She was never to see him again. In his solitude and depression, he turned again to poetry, now of a more personal and introspective sort. The *Tristia* and *Epistulae ex Ponto* (*Letters from the Black Sea*) are all, in various guises, appeals for clemency. All, even those to his wife, are "public" poems, intended to present his case to the Emperor and, eventually, to the world. Though not written as spiritual autobiography, they nevertheless offer a unique document of the life of a poet in exile. Properly understood, they are as revealing of their author as anything he ever wrote. Particularly interesting is the apologia that forms the second book of the *Tristia:* a puzzling poem that may have damaged his case more than it helped because, to whatever flattery and self-abasement he descends in this and the other poems of exile, he never withdraws from the one position with which his personal self-respect was identified—his status as a poet. Again and again it is implied or even stated outright that over poetry the Emperor has no power. Critics who find Ovid's conduct in adversity unmanly have failed to see that, in what mattered most to him, he never yielded.

That his poetical powers were not as yet seriously impaired is shown by his poem *Ibis.* This, written not long after his arrival at Tomis, is a long and elaborate curse directed at an anonymous enemy. It is a tour de force of abstruse mythological learning, composed largely without the aid of books. But in the absence of any sign of encouragement from home, Ovid lacked the heart to continue to write the sort of poetry that had made him famous, and the later *Epistulae ex Ponto* make melancholy reading. Yet life was not uniformly gloomy. As Ovid settled down and became reconciled to the fact that Tomis was his home, he began to see some virtues in the place and its inhabitants. He took an interest in local history and politics and even wrote poetry in the local language, Getic. He seems to have been genuinely touched by the honours which the Tomitans paid him. Nevertheless, death, when it came, cannot have been wholly unwelcome.

In classical antiquity, Ovid's influence on later poetry was primarily technical. He had perfected both the elegiac couplet and the hexameter as all-purpose metres and as instruments of fluent communication. Even the poets most obviously indebted to Virgil betray Ovid's influence in nearly every line. In the European Middle Ages, like most ancient writers, he was regarded as an authority, a source of doctrine and erudition. The *Metamorphoses,* in particular, offered one of the most accessible and attractive avenues to the riches of Greek mythology. But his chief appeal, then and subsequently, stems from the humanity of his writing: its gaiety, its sympathy, its exuberance, its pictorial and sensuous quality. It is these things, together with his apparently genuine liking for women as a sex, that have recommended him, down the ages, to the troubadours and the poets of courtly love, to Chaucer, Shakespeare, Goethe, and Ezra Pound. (E.J.Ke./Ed.)

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oviduct (anatomy): *see* fallopian tube.

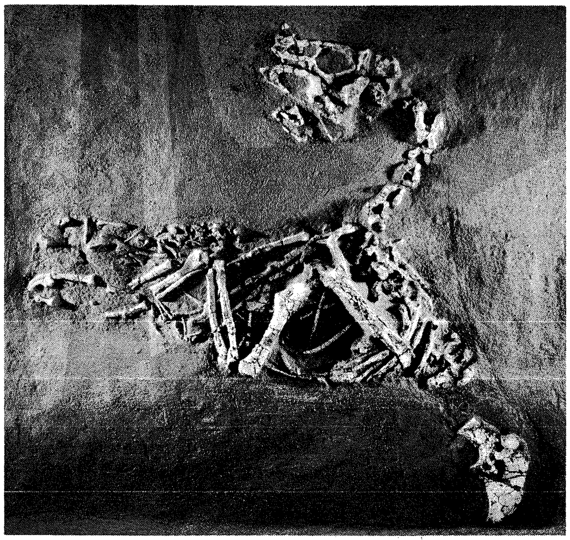
Oviedo, *provincia,* coextensive with the northern half of the historic kingdom of Asturias and the modern Asturias *comunidad autónoma* ("autonomous community"), northern Spain. Its area of 4,079 square miles (10,565 square km) is largely mountainous, with a rugged coastline dented by *rías* (inlets) of the Bay of Biscay. The main river is the Nalón, though the Sella and Navia are also important. Oak, chestnut, and apple trees abound, and apple cider is the typical drink of the region and one of its exports. Corn (maize) and rye are grown, and the province is one of Spain's largest producers of potatoes. It also has a substantial cattle and dairy industry.

The wealth of Oviedo, however, is in its coalfields, which extend throughout the Nalón basin and cover more than 1,000 square miles (2,600 square km). Oviedo is the most important mining and metallurgical province in Spain. A great industrial complex has been built up at Avilés and has resulted in a large increase in its population. Mieres is a busy mining and smelting centre. Gijón's seaport, Puerto del Musel, is Spain's foremost coal-exporting port. There is an armaments factory at Trubia. The provincial capital, Oviedo (*q.v.*), is a cultural and communications hub. Pop. (1982 est.) 1,140,239.

Oviedo, Latin OVETUM, capital of Oviedo *provincia,* in the *comunidad autónoma* ("autonomous community") of Asturias, northern Spain, on a hill surrounded by mountains and a fertile plain. It lies 18 miles (29 km) southwest of Gijón. Founded as a monastery by Fruela I in 757, it became the capital of the kingdom of Asturias in 810. It was one of the few Spanish towns never conquered by the Moors during the Middle Ages. Outstanding landmarks include the cathedral (begun in 1388, on the site of the original monastery), the sacristy of which houses part of the chapel built by Alfonso II in 802 to guard Christian relics rescued from the Moors; the bishop's palace (*c.* 1500–1700); and the Convent of San Vicente (1493), which now houses the provincial museum. The University of Oviedo was founded in 1608.

The city's economy relies heavily on the mining (coal and iron) in its environs. Industry includes food processing and some light manufacturing. Pop. (1988 est.) 190,073.

Ovimbundu, also called UMBUNDU, people inhabiting the tree-studded grasslands of the Benguela Highlands in Angola. They speak Umbundu, a Bantu language.



Oviraptor philoceratops, from Djadochta Cretaceous beds, Shabarkh Uso, Mongolia
By courtesy of the American Museum of Natural History, New York

The ruling families entered the highlands from the northeast in the 17th century, subduing and incorporating the indigenous cattle-keeping peoples. They divide into 22 chiefdoms about half of which were tributary to a larger chiefdom before effective Portuguese occupation in the 20th century. Each chiefdom had a paramount chief, council, and subchiefs.

A household usually comprises the male head, his several wives, and dependent children. The kinship system features double descent, land being inherited in the paternal line and movable property in the maternal. Initiation schools exist for boys and girls of certain families only. Agriculture is the chief economic activity, main crops being corn (maize) and beans. Most Ovimbundu men and boys hunt, but there are also professional hunters. Domestic animals include cows, sheep, and goats; oxen are used for transport. Cattle are a measure of wealth, but few families own large herds. Beeswax was and still is an important item of trade.

Ovimbundu were formerly traders with other African peoples and with the Portuguese. Each trading caravan had a professional leader and diviner. Trade agreements linking the independent chiefdoms led to development of regional specialization, such as metalwork and corn-meal production. Large-scale trading activities declined with the suppression of the slave trade and the construction of the Benguela Railway in 1904. In the late 20th century, the Ovimbundu provided the major popular support for Jonas Savimbi and the National Union for the Total Independence of Angola (UNITA) guerrillas.

oviparity, expulsion of undeveloped eggs rather than live young. The eggs may have been fertilized before release, as in birds and some reptiles, or are to be fertilized externally, as in amphibians and many lower forms. In general, the number of eggs produced by oviparous species greatly exceeds the number of offspring from species that bear live young, but the chances of survival are diminished because of the lack of maternal protection. *Compare* viviparity.

Oviraptor, genus of small, light predaceous dinosaurs found as fossils in Late Cretaceous deposits of eastern Asia (the Late Cretaceous epoch occurred 97.5 to 66.4 million years ago). *Oviraptor,* about 1.3 m (4 feet) long, was a biped that walked on two long, well-developed hind limbs. The forelimbs were long and slender, with three long, clawed fingers clearly suited for grasping, ripping, and tearing. *Oviraptor* had a short skull, with very large eyes surrounded by a bony ring. It possibly was capable of stereoscopic vision and must have been able to judge distances quite well; it apparently was more dependent upon sight than upon smell for procuring food. The jaws lacked teeth but were probably sheathed with a horny, beaklike covering. The remains of *Oviraptor* have been found in association with the nests of other dinosaurs, and the likelihood that it ate dinosaur eggs led to its name (Latin *ovum,* "egg"; *raptor,* "robber").

Ovonramwen, also called OVERAMI (d. January 1914, Calabar, Southern Nigeria [now Nigeria]), West African ruler who was the last independent oba (king) of the 500-year-old kingdom of Benin (in present-day Nigeria). Ovonramwen tried to maintain his independence in the face of increasing British pressure but was able to delay for only a few years the annexation of his kingdom by the colony of Nigeria.

He was called Idugbowa until he took the title Ovonramwen upon becoming oba. He succeeded to a kingdom much reduced by growing British commercial and colonial encroachment from its greatest extent (*c.* 1700). He attempted to seal Benin to Europeans but by 1892 was forced to sign a protection treaty with the British administration. Disputes over trade along the Benin River (1892–94) led to a campaign against Benin; the murder of the

British acting consul general in January 1897 precipitated a full-scale military expedition, which captured Benin City in February 1897. Ovonramwen surrendered to the British in August and died in exile.

Øvre Anarjåkka National Park, Norwegian ØVRE ANARJÅKKA NASJONALPARK, national park in the southeastern Finnmark Plateau region, northern Norway, bordering the Lemmenjoki National Park of Finland. The largest Norwegian national park, it covers an area of about 537 square miles (1,390 square km) and ranges in elevation from 705 to 1,938 feet (215 to 591 m). Low hills covered by birch forest and pine forest and dotted by bogs and lakes are characteristic of the area. Large numbers of reindeer graze in the park during winter, and its other animals and plant life are quite varied.

Øvre Dividal National Park, Norwegian ØVRE DIVIDAL NASJONALPARK, national park in the eastern part of the Dividal valley, Troms county, Norway. With an area of about 286 square miles (741 square km), it was established in July 1971 by royal decree. The landscape varies from lowland forests of pine and birch to low hills and mountain plateaus with lakes and bogs interspersed throughout. A sparse pine forest supports bear, lynx, wolverine, and wolf. Large numbers of tame reindeer from Sweden come to graze in the park during summer.

ovulation, release of a mature egg from the female ovary; the release enables the egg to be fertilized by the male sperm cells. Normally, in human beings, only one egg is released at one time; occasionally, however, two or more erupt during the menstrual cycle. The egg erupts from the ovary on the 14th to 16th day of the approximately 28-day menstrual cycle. If fertilization does not occur, the egg is passed from the reproductive tract during menstrual bleeding, which starts about two weeks after ovulation. Occasionally, cycles occur in which an egg is not released; these are known as anovulatory cycles.

Prior to eruption from the ovary, an egg first must grow and mature. Until stimulated to grow, the primary egg cell passes through a period of dormancy that may last several years. The egg cell is surrounded by a capsule of cells known as the follicle. The follicular wall serves as a protective casing around the egg and also provides a suitable environment for egg development. As the follicle ripens, the cell wall thickens and a fluid is secreted to surround the egg. The follicle migrates from within the ovary's deeper tissue to the outer wall. Once the follicle reaches the surface of the ovary, the follicular wall thins. Pressure caused by the follicle and fluid against the ovary's surface causes bulging of the ovarian wall. When the follicle ruptures, the egg and fluid are released along with some torn patches of tissue. The cells, fluid, and egg are directed into the nearby fallopian tube, which serves as a passageway by which the egg reaches the uterus and as a site for fertilization of the released egg by sperm.

The hormones that stimulate ovulation are produced in the pituitary gland; these are known as the follicle-stimulating hormone and luteinizing hormone. After the egg leaves the ovary, the walls of the follicle again close, and the space that was occupied by the egg begins to fill with new cells known as the corpus luteum. The corpus luteum secretes the female hormone progesterone, which helps to keep the uterine wall receptive to a fertilized egg. If the egg is not fertilized, the corpus luteum stops secreting progesterone about nine days after ovulation. If the egg becomes fertilized, progesterone continues to be secreted, first by the corpus luteum and then by the placenta, until the child is born. Progesterone blocks the release of more hormones from the pituitary gland, so that further ovulation does not normally occur during pregnancy. *See also* menstruation; oogenesis.

ovule, plant structure that develops into a seed when fertilized. In gymnosperms (conifers and allies) the ovules lie uncovered on the scales of the cone. In angiosperms (flowering plants), one or more ovules are enclosed by the ovary (portion of the carpel, or female reproductive organ). Each ovule is attached by its base to the stalk (funiculus) that bears it. A mature angiosperm ovule consists of a food tissue covered by one or two future seed coats. A small opening (the micropyle) in the integuments at the apex of the ovule permits the pollen tube to enter and discharge its sperm nuclei into the embryo sac, a large oval cell in which fertilization and development occur. Variations in form and position of the ovule are significant in plant classification: orthotropous ovules stand out straight into the cavity of the ovary; campylotropous ovules are at right angles to the funiculus; anatropous ovules are directed back toward the funiculus. Intermediate forms also occur.

ovum, plural OVA, single cell released from either of the female reproductive organs, the ovaries, which is capable of developing into a new organism of the same species when fertilized (united) with a sperm cell.

The outer surface of each ovary is covered by a layer of cells (germinal epithelium); these surround the immature egg cells, which are present in the ovaries from the time of birth. A hollow ball of cells, known as the follicle, encompasses each ovum. Within the follicle the ovum gradually matures (*see* oogenesis). It takes approximately four months for a follicle to develop once it is activated. Some follicles lie dormant in the ovaries for 40 years before they mature; others degenerate and never develop. During a woman's child-bearing years, 300 to 400 follicles mature and emit eggs capable of being fertilized. By the time a woman reaches menopause, most of the remaining follicles have degenerated.

A follicle-stimulating hormone, secreted into the bloodstream by the pituitary, causes ovum growth. After the egg matures, a second hormone from the pituitary, luteinizing hormone, is liberated; this causes the egg's release, called ovulation (*q.v.*).

As the ovum develops, the walls of the follicle expand by adding new cells. The follicle and ovum slowly migrate through the tissue of the ovary until they cause a bulge in the surface of the organ. The hollow cavity between the egg and the follicular wall usually contains a fluid secreted by the follicular cells. This keeps the ovum moist and provides a suitable growing environment. When the follicle ruptures, the egg is released from the ovary and is then captured and guided by the fallopian tubes. Muscular contractions of the fallopian tubes move the egg to the cavity of the uterus.

The ovum itself has a central nucleus that contains the female's genetic material; this, with the genetic material in the sperm cell, determines the inherited characteristics of the child. Surrounding the nucleus is a cell plasma, or yolk, that contains nutritional elements essential to the developing egg cell.

If an egg does not become fertilized within 24 hours of its eruption, it begins to degenerate. After the egg is fertilized it undergoes a series of cell divisions. If at an early stage of its development the fertilized egg splits into two parts that continue to grow, identical twins will result; incomplete division will result in Siamese twins, born physically joined. Fraternal twins result when two separate eggs are released and independently fertilized. *See also* implantation.

Owain, also spelled OWEN, name of Welsh princes, grouped below chronologically and indicated by the symbol •.

•Owain AP GRUFFUDD: *see* Glendower, Owen.

•Owain CYFEILIOG (b. *c.* 1130—d. *c.* 1197), Welsh warrior-prince of Powys and poet of distinct originality among the *gogynfeirdd* (court poets).

After ruling over the people of Powys from 1149 to 1195, Owain retired to the Cistercian monastery of Strata Marcella (Ystrad Marchell), which he had established in 1170. He died and was buried there, despite his previous excommunication (1188) for failing to support the Third Crusade. As prince of Powys he was known for his sympathetic attitude toward the English.

Hirlas Owain ("The Drinking Horn of Owain"), the only poem that remains of Owain's compositions, is noteworthy for its dramatic presentation. It is set at court, where his warriors, weary from battle, are gathered at the banquet table. Each stanza begins with instructions to the cupbearer to pour a drink for a hero; he then bestows praise on the man as the drink is poured.

•Owain GWYNEDD, also called OWAIN AP GRUFFYDD, Gruffydd also spelled GRUFFUDD (d. 1170), last great king of North Wales (Gwynedd) who helped advance Welsh independence against Norman and English dominance.

Together with his brother Cadwaladr, Owain led three expeditions (1136–37) against the English stronghold of Ceredigion to the south. The brothers ravaged the region and established themselves there. Upon his father's death in 1137, Owain took the throne of North Wales. During the reign of the English king Stephen, Owain extended the boundaries of northern Wales almost to the city of Chester. Henry II, who succeeded to the English throne in 1154, challenged Owain in 1157. Both sides fared badly, and an agreement was reached whereby Owain withdrew to Rhuddlan and the River Clwyd and rendered homage. He kept the terms of the agreement until 1165, when he combined forces with Rhys ap Gruffydd, his nephew and the prince of South Wales, and with Owain Cyfeiliog (of the Powys region) against Henry. Thwarted by bad weather and unequal knowledge of the region, Henry was forced to turn back and yield the region to the Welsh. Owain once more regained the castles of Basingwerk and Rhuddlan and pushed the borders of Gwynedd to the estuary of the River Dee. He maintained northern Welsh independence throughout his lifetime, but succeeding generations were unequal to the task and Gwynedd officially fell to the English in 1283.

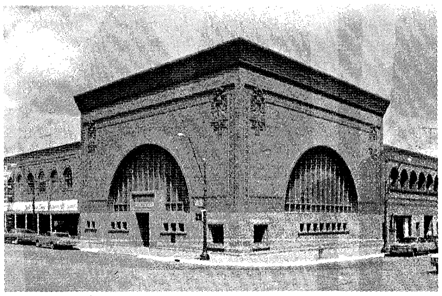
Owambo, also called OVAMBOLAND, geographic region, northern Namibia. Owambo is bordered by the Kaokoland (Kaokoveld) region on the west and by the Kavango region on the east. The border with Angola lies to the north. Most of semiarid Owambo is an extremely flat plain covered by white sands. It is crossed by a series of low-gradient, often parallel, south-oriented dry watercourses (*oshanas*), collectively called the Cuvelai, which occasionally feed the Etosha Pan (a huge salt pan) to the south of Owambo with rainwater. The water supplied by the *oshanas* and the man-made feeder canals of Owambo has been augmented by a project sponsored by the South African government to connect the main irrigation canals from the Calueque Dam (on the Kunene River in southern Angola) to Owambo and to develop the hydroelectric potential of the complex above the Ruacana Falls (at the Namibia and Angola border, 40 miles [64 km] downriver from the Calueque Dam). Owambo is generally grass-covered, and dispersed clusters of baobab, palm, and wild fig trees are commonplace in the area of greater rainfall in the north.

According to tradition, the Owambo (Ovambo; or Ambo as called in Angola) people, for whom the region is named, migrated to their present location from central Africa. Consisting of seven different tribes, they comprise about half of South West Africa/Namibia's population. They live mostly alongside the *oshanas*; grow corn (maize), millet, pumpkins, and melons; and raise goats and dairy cattle.

Finnish Lutheran missionaries arrived at Owambo in 1870, and Anglican and Roman Catholic missionaries entered the area later. The Finns, in particular, have continued to supply the Owambo with hospitals and churches. Owambo became a part of the German Empire in 1884. Upon the defeat of the Germans in World War I, Owambo, together with the rest of South West Africa, became a mandated territory administered by South Africa. Fighting between the South West Africa People's Organization (SWAPO; an Owambo- and southern Angola-based group protesting South Africa's continued political control of the mandated territory) and South African forces intensified in Owambo between the late 1960s and the 1980s.

The main road through the region links it with Angola and the copper- and lead-mining centre of Tsumeb to the southeast. The region's population is concentrated in the central north along the Angolan border. Oshakati, Ondangwa, Oshikango, and Ombalantu are the principal settlements.

Owatonna, city, seat of Steele County, southeastern Minnesota, U.S. Settled in the early 1850s as a trading post on a river known to the Indians as Owatonna (meaning "straight"), it was the site of the state's first known health spa, now in Mineral Springs Park. Owatonna State School for handicapped children was founded in 1886. The innovative American architect Louis Sullivan designed the National Farmers' Bank Building (1908) in the city. Owatonna developed as a trade, industrial,



National Farmers' Bank Building designed by Louis Sullivan, 1908, Owatonna, Minn.
Milt and Joan Mann from CameraMann

and transportation centre for a mixed-farming area with many cooperative creameries and a high butter production. Jewelry, tools, and farm equipment are among its manufactures. Village of Yesteryear (pioneer buildings) is in the county fairgrounds. Inc. town, 1854; city, 1957. Pop. (1984 est.) 18,217.

To make the best use of the Britannica, consult the INDEX *first*

Owen, Alun (Davies) (b. Nov. 24, 1925, Liverpool), Welsh dramatist for radio, television, screen, and stage whose work often reflects the cultural and religious conflicts of the city where he was born.

Of Welsh origin, he attended school in Wales and Liverpool and began his theatrical training as an assistant stage manager in repertory theatre (1942) and then became a stage and screen actor. He started writing for radio and television in 1957, quickly proving his sharp ear for dialogue and his gift for characterization. His television plays, numbering more than 50, sometimes concentrated on the seamier aspects of city life, as in *No Trams to Lime Street* (1959; published 1961). His quartet of plays, televised as *Male of the Species* (1969), with Laurence Olivier, Paul Scofield, Sean Connery, and Michael Caine, was immensely successful and was produced for the stage in 1974. But, although the play set out to depict the exploitation of women, the protagonist of the piece, Mary MacNeil, emerges as a willing victim and the men in her life as attractive. Critics cited this as "unconscious male chauvinism."

Owen won critical acclaim for his stage plays, which included *Progress to the Park* (published 1962) and *The Rough and Ready Lot* (published 1960), both of which were broadcast in 1958 and produced for the stage in 1959 and which depicted religious and cultural bigotry. The former concerns the destruction of the love between a Protestant boy and a Catholic girl in Liverpool of the late 1950s; the play offers no solutions, but through its characterizations it clearly represents the situation as Owen perceived it. In *The Rough and Ready Lot,* the four main characters, "soldiers of fortune" fighting for the independence of South American Indians, all represent opposing views of life. Three extremists—a political revolutionary, a fanatical Catholic, and a "realist"—all expound eloquently their respective positions, yet the theme of the work becomes clear when the fourth protagonist—the one who makes no judgments on life—is the only one to survive the ordeal.

In 1961 Owen received the Screenwriters Guild Award for *The Rose Affair* (produced for television 1961; published 1962; produced for stage 1966), a modern-day version of the fairy tale "The Beauty and the Beast," and another play, *A Little Winter Love,* was produced in 1963. Among Owen's screen credits is the script for the Beatles' first film, *A Hard Day's Night* (1964). In the 1970s and '80s Owen produced plays mainly for television, such as *Colleagues* (1982).

Owen, Daniel (b. Oct. 20, 1836, Mold, Flintshire, Wales—d. Oct. 22, 1895, Mold), writer, considered the national novelist of Wales. He was a natural storyteller whose works, set in his own time, introduced a wealth of vivid and memorable characters that have given him a place in his national literature comparable to that of Dickens in English.

The son of a coal miner and the youngest of six children, he received little formal education and at the age of 12 was apprenticed to a tailor. In 1864 he started to preach, and in the following year he enrolled in Bala Calvinistic Methodist College but returned home before completing the course. He resumed preaching and soon began writing for publication.

His works include the novels *Hunangofiant Rhys Lewis* (1885; "Autobiography of Rhys Lewis"); *Profedigaethau Enoc Huws* (1891; "The Trials of Enoc Huws"); and *Y Dreflan, ei Phobl a'i Phethau* (1881; "Dreflan, Its People and Its Affairs"), which describes the life around the Welsh chapel. *Offrymau Neilltuaeth* (1879; "Offering of Seclusion") is a volume of sermons and portraits of Methodists; *Y Siswrn* (1888; "The Scissors") is a collection of poems, essays, and stories. Besides the vigour of his diction, his works contain pungent humour and freedom from didacticism, qualities not generally found in 19th-century Welsh literature.

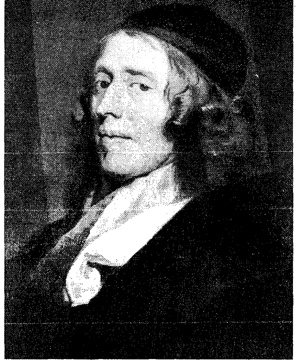
Owen, Goronwy (b. Jan. 1, 1723, Llanfair Mathafarn Eithaf, Anglesey, Wales—d. July 1769, Brunswick, Va. [now in U.S.]), clergyman and poet who revived classicism in modern Welsh literature. He reintroduced the *cywydd* and the *awdl,* poetic forms used by the medieval Welsh bards, with their traditional correctness but with fresh content.

It was while he was at Donnington, Shropshire, serving as master of the local school and curate of Uppington, that Owen attracted attention as a poet. Other poets gathered around him, establishing a classical school of poetry that is still alive. In 1757, despite his excessive drinking, he obtained an appointment, through the efforts of friends, as headmaster of the grammar school attached to the College of William and Mary, in Williamsburg, Va. After losing this mastership ("for riotous living"), he became minister of St. Andrew's, Brunswick County, where he remained until he died.

Among his best known poems are "The Day of Judgment," "The Gem or the Precious Stone," "The Lineage and Attributes of the Muse," and "Cywydd in Answer to Huw the Red Poet."

Owen, John (b. 1616, Stadhampton, Oxfordshire, Eng.—d. Aug. 24, 1683, London), English Puritan minister, prolific writer, and controversialist. He was an advocate of Congregationalism and an aide to Oliver Cromwell, the lord protector of England from 1653 to 1658.

Appointed rector of Fordham, Essex, in 1642, Owen was made vicar at nearby Coggeshall in 1646 after preaching a notable sermon before



John Owen, oil painting by an unknown artist; in the National Portrait Gallery, London
By courtesy of the National Portrait Gallery, London

Parliament the same year. At Coggeshall he came out in favour of Congregational autonomy in church government; his compendium of principles of church polity was published as *Eschol: . . . or Rules of Direction for the Walking of the Saints in Fellowship* (1648). His frequent preaching before Parliament led to his attachment to Cromwell, whose policies against the monarchy Owen began to support. After the execution of King Charles I by Cromwell's partisans in January 1649, Owen accompanied Cromwell on his military ventures to Ireland and Scotland (1649–50).

As chancellor of Oxford, Cromwell appointed Owen vice chancellor in 1652, a post he held until 1657. He was also dean of Christ Church Cathedral (1651–60) and was elected in 1654 to represent Oxford in Parliament, but he was later disqualified because of his clerical vocation. Reserved in his support of Cromwell, Owen opposed plans to offer the English crown to him and avoided participation in Cromwell's installation in the office of lord protector in 1653. Owen abandoned politics on the restoration of the monarchy in 1660, when the House of Commons removed him from his position as Christ Church dean.

Among his works are historical treatises on religion, several studies of the doctrine of the Holy Spirit, and defenses of Nonconformist, or Puritan, views. An edition of his *Works,* edited by W.H. Goold, fills 24 volumes (1850–55).

Owen, Sir Richard (b. July 20, 1804, Lancaster, Lancashire, Eng.—d. Dec. 18, 1892, London), British anatomist and paleontologist who is remembered for his contributions to the study of fossil animals and for his strong opposition to the views of Charles Darwin.

Owen was educated at Lancaster Grammar School and was apprenticed in 1820 to a group of Lancaster surgeons. In 1824 he went to Edinburgh to continue medical training, but in 1825 he transferred to St. Bartholomew's Hospital in London. He was admitted to the Royal College of Surgeons of England, where he was engaged as curator of the Hunterian Collections (made by John Hunter, the renowned anatomist) and set up in medical practice. In 1830 he met Georges Cuvier, a celebrated French paleontologist, and the following year visited him in Paris, where he studied specimens in the National Museum of Natural History. Elected a Fellow of the Royal Society in 1834, in 1836 Owen became Hunterian professor at the Royal College of Surgeons and in 1837 its professor of anatomy and physiology, as well as Fullerian professor of comparative anatomy and physiology at the Royal Institution. Leaving medical practice and devoting himself to research, he was appointed superintendent of the natural history departments of the British Museum in 1856. From then until his retirement in 1884 he was largely occupied with the development of the British Museum (Natural History) in South Kensington, London. On retirement he was created a knight of the Order of the Bath.

Sir Richard Owen, detail of an oil painting by H.W. Pickersgill, 1845; in the National Portrait Gallery, London
By courtesy of the National Portrait Gallery, London

Among Owen's earliest publications were the Descriptive and Illustrated Catalogue of the physiological series of Comparative Anatomy contained in the Museum of the Royal College of Surgeons in London (1833), which enabled him to acquire a considerable knowledge of comparative anatomy. His *Memoir on the Pearly Nautilus* (1832) was a classic, and he became a highly respected anatomist. By 1859, the year of the publication of Charles Darwin's *Origin of Species,* however, Owen's judgment was muddied by his sense that his own preeminence in biology was about to be lost, and he set about to discredit Darwin, who had been a good friend and colleague for 20 years. Owen wrote a very long anonymous review of the book (*The Edinburgh Review,* 1860), on which Darwin commented:

> It is extremely malignant, clever, and I fear will be very damaging.... It requires much study to appreciate all the bitter spite of many of the remarks against me.... He misquotes some passages, altering words within inverted commas....

Owen is also said to have coached Bishop Wilberforce in his debate against Thomas Huxley, one of Darwin's chief defenders. As Darwin's thesis began to become more accepted in the scientific community, Owen shifted his position somewhat; although he denied Darwinian doctrine, he admitted the accuracy of its basis, claiming to have been the first to have pointed out the truth of the principle on which it was founded.

Among Owen's notable writings are *Odontography* (1840–45), a major study of the structure of teeth; *Lectures on Comparative Anatomy and Physiology of the Vertebrate Animals* (1846); *A History of British Fossil Mammals and Birds* (1846); *A History of British Fossil Reptiles* (1849–84); and *On the Anatomy of Vertebrates* (1866–68).

Another notorious error by Owen involved *Archaeopteryx,* the first known fossil bird, an object Owen had obtained for the museum and had described for publication in 1863. The fossil was reexamined in 1954, and scientists determined that Owen had got it upside down, dorsal for ventral, and had missed its two most important features: the breastbone, which was flat, proof that the bird could not fly but glided; and the natural cast of the brain case, which was like that of a reptile.

BIBLIOGRAPHY. The only biography of the subject is *The Life of Richard Owen,* 2 vol. (1894–95, reprinted 1975), written by his grandson, Richard Owen. It contains a full bibliography of Owen's work.

Owen, Robert (b. May 14, 1771, Newtown, Montgomeryshire, Wales—d. Nov. 17, 1858, Newtown), Welsh manufacturer turned reformer, one of the most influential utopian socialists of the early 19th century. His New Lanark mills in Lanarkshire, with their social and industrial welfare programs, became a place of pilgrimage for statesmen and social reformers. He also sponsored or encouraged many experimental "utopian" communities, including one at New Harmony, Ind., U.S.

Robert Owen, detail of a watercolour by A. Hervieu, 1829; in the National Portrait Gallery, London
By courtesy of the National Portrait Gallery, London

Early life. Owen attended local schools until the age of 10, when he became an apprentice to a clothier. His employer had a good library, and young Owen spent much of his time reading. He did so well in business that by the time he was 19 he had become superintendent of a large cotton mill in Manchester, which he soon had made one of the foremost establishments of its kind in Great Britain. Owen made use of the first American sea island cotton (a fine, long-staple fibre) ever imported into the country and made improvements in the quality of the cotton spun. On becoming manager and a partner in the Manchester firm, Owen induced his partners to purchase the New Lanark mills in Lanarkshire.

The success at New Lanark. In the town of New Lanark lived 2,000 people, 500 of whom were young children from the poorhouses and charities of Edinburgh and Glasgow. The children, especially, had been well treated by the former proprietor, but the condition of the people was unsatisfactory. Crime and vice bred by demoralizing conditions were common, education and sanitation alike were neglected, and housing conditions were intolerable. Owen improved the houses and, mainly by his own personal influence, encouraged the people in habits of order, cleanliness, and thrift. He opened a store at which goods of sound quality could be bought at little more than cost price and at which the sale of alcoholic beverages was placed under strict supervision. His greatest success, however, was in the education of the young, to which he devoted special attention. In 1816 he opened the first infant school in Great Britain at the New Lanark mills and thereafter gave it his close personal supervision.

Though Owen at first was regarded with suspicion as an outsider, he soon won the confidence of the people. The mills continued to thrive commercially, but some of Owen's schemes entailed considerable expense, which displeased his partners. Finally, frustrated by the restrictions imposed on him by his partners, who wished to conduct the business along more ordinary lines, he organized a new firm in 1813. Its members, content with a 5 percent return on their capital and ready to give freer scope to his philanthropy, bought out the old firm. Stockholders in the new firm included the legal reformer Jeremy Bentham and the Quaker William Allen.

His philosophy of social reform. In the same year (1813) Owen published two of the four essays in *A New View of Society; or, Essays on the Principle of the Formation of the Human Character,* in which he expounded the principles on which his system of educational philanthropy was based. Having at an early age lost all belief in the prevailing forms of religion, he had thought out for himself a creed that he took to be an entirely new and original discovery.

The chief points in Owen's philosophy were that man's character is formed by circumstances over which he has no control and that he is not a proper subject either of praise or of blame. These convictions led him to the conclusion that the great secret in the right formation of man's character is to place him under the proper influences from his earliest years. The irresponsibility of man and the effect of early influences are the keynote of Owen's whole system of education and social amelioration.

For the next few years, Owen's work in New Lanark was to have a national, even European, significance. New Lanark became a place of pilgrimage for social reformers, statesmen, and royal personages. According to the unanimous testimony of all who visited it, the results achieved by Owen were singularly good. Children brought up on his system were generally felt to be graceful, genial, and unconstrained; health, plenty, and relative contentment prevailed. The business was a commercial success.

In 1815 Owen, apparently single-handedly, started agitation for factory reform, with only little effect, and by 1817 his work as a practical reformer had given way to ideas—still vital—that were to make him the forerunner of socialism and the cooperative movement. Owen argued that the competition of human labour with machinery was a permanent cause of distress and held that the only effective remedy lay in the united action of men and the subordination of machinery to man. His proposals for the treatment of pauperism were based on those principles.

Owen recommended that villages of "unity and cooperation" be established for the unemployed. Each village would consist of about 1,200 persons living on 1,000 to 1,500 acres

(400 to 600 hectares); all would live in one large structure built in the form of a square, with public kitchen and messrooms. Each family would have its own private apartment and the entire care of the children until the age of three, after which they would be raised by the community. Parents would have access to them at meals and all other proper times. Such communities, Owen believed, might be established by individuals, by parishes, by counties, or by the state; in each case there would be supervision by duly qualified persons. Work and the enjoyment of its results would be shared in common.

The size of the projected community had been suggested by that of the village of New Lanark, and Owen soon advocated an extension of the scheme to the reorganization of society in general. Under his plan, largely self-contained communities of from 500 to 3,000 would first be set up, mainly agricultural and possessing the most modern machinery. As they increased in number, he wrote, "unions of them, federatively united, should be formed in circles of tens, hundreds, and thousands," until they embraced the whole world in a common interest.

The community at New Harmony. Owen's plans for the cure of pauperism were received with considerable favour until, at a large meeting in London, Owen declared his hostility to the received forms of religion. Many of his supporters believed that this action made him suspect to the upper classes, though he did not lose all support from them. To carry out his plan for the creation of self-contained communities, in 1825 he bought 30,000 acres of land in Indiana from a religious community and renamed it New Harmony. For a time, life in the community was well ordered and contented under Owen's practical guidance, but differences about the form of government and the role of religion soon appeared, and numerous attempts at reconstruction failed to compose them, though it is agreed that an admirable spirit prevailed amid all the dissensions. Owen withdrew from the community in 1828, having lost £40,000—80 percent of his fortune. The other chief Owenite community experiments were in Great Britain—at Queenwood, Hampshire (1839–45), in which Owen took part for three years; at Orbiston, near Glasgow, Lanarkshire (1826–27); and at Ralahine, County Cork (1831–33); he was not directly concerned with either of the later communities.

Leadership of the trade union movement. In his "Report to the County of Lanark" (a body of landowners) in 1820, Owen declared that reform was not enough, that a transformation of the social order was required. His proposals for communities attracted the younger workers, brought up under the factory system, and between 1820 and 1830 numerous societies were formed and journals organized to advocate his views. The growth of labour unionism and the emergence of a working-class point of view caused Owen's doctrines to be accepted as an expression of the workers' aspirations, and when he returned to England from New Harmony in 1829 he found himself regarded as their leader. In the unions, Owenism stimulated the formation of self-governing workshops. The need for a market for the products of such shops led to the formation of the National Equitable Labour Exchange in 1832, applying the principle that labour is the source of all wealth.

The unprecedented growth of labour unions made it seem possible that the separate industries and eventually all industry might be organized by these bodies. Owen and his followers carried on ardent propaganda all over the country, with the result that the new National Operative Builders Union turned itself into a guild to carry on the building industry, and the Grand National Consolidated Trades Union was formed (1834). Though the enthusiasm of the unions and the numbers of labourers joining them were remarkable, determined opposition by employers and severe repression by the government and law courts ended the movement within a few months. It was two generations before socialism, first popularly discussed at this time, again influenced unionism. Throughout these years Owen's community ideas maintained a hold, and ultimately they provided the basis for the worldwide consumers' cooperative movement. After 1834 Owen devoted himself to preaching his educational, moral, rationalist, and marriage-reform ideas. At the age of 82 he became a spiritualist. He died six years later at Newtown.

Owen's autobiography, *The Life of Robert Owen,* was published in two volumes in 1857–58 (reprinted 1971). (D.F.Do./Ed.)

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Owen, Robert Dale (b. Nov. 9, 1801, Glasgow, Scot.—d. June 24, 1877, Lake George, N.Y., U.S.), American social reformer and politician. The son of the English reformer Robert Owen, Robert Dale Owen was steeped in his father's socialist philosophy while growing up at New Lanark in Scotland—the elder Owen's model industrial community. In 1825 father and son immigrated to the United States to set up another self-sufficient socialist community at New Harmony, Ind.

Robert Dale Owen edited the community's newspaper, the *New Harmony Gazette,* until 1827, when he became associated with the controversial reformer Fanny Wright. They traveled together to Wright's experimental community of Nashoba, Tenn., which was dedicated to the education and gradual emancipation of slaves, and from there went on to Europe.

Upon returning to the United States, Owen and Wright revisited the Nashoba and New Harmony communities, then in a state of decay. They settled in New York, where Owen edited the *Free Enquirer.* The paper opposed evangelical religion and advocated more liberal divorce laws, more equal distribution of wealth, and widespread industrial education; it was at the centre of radical free thought in New York. For two years, Owen, with Wright and other radicals, sought to turn the New York Workingmen's Party away from Thomas Skidmore's belief in an equal division of property. They successfully ousted Skidmore, but later their own program of social reform through public education was also repudiated.

After a brief trip to England in 1832, Owen returned to New Harmony. He served three terms in the Indiana legislature (1836–1838), where he advocated the allocation of government funds for public schools, and two terms in the U.S. House of Representatives, where he introduced the bill creating the Smithsonian Institution.

Owen was defeated for a third term in Congress and went back to Indiana, where he advocated property rights for married women and liberalization of divorce laws. Appointed chargé d'affaires at Naples in 1853 and minister to Italy in 1855, Owen spent much of the 1850s abroad. Upon his return in 1858, he became an outspoken proponent of emancipation; at the outbreak of the American Civil War, he urged an end to slavery in a letter to President Lincoln, a letter that Secretary of the Treasury Salmon Chase said greatly influenced the president.

In 1863 Owen headed a committee to investigate the condition of the freedmen and wrote a book on his findings, *The Wrong of Slavery* (1864). In it he surprised many people by counseling a 10-year delay in granting the newly emancipated slaves the right to vote.

Owen spent his final years writing a novel (*Beyond the Breakers,* 1870) and his autobiography (*Threading My Way,* 1874).

To make the best use of the Britannica, consult the INDEX *first*

Owen, Wilfred (b. March 18, 1893, Oswestry, Shropshire, Eng.—killed in action Nov. 4, 1918, France), English poet noted for his anger at the cruelty and waste of war and his pity for its victims. He also is significant for his technical experiments in assonance, which were particularly influential in the 1930s.

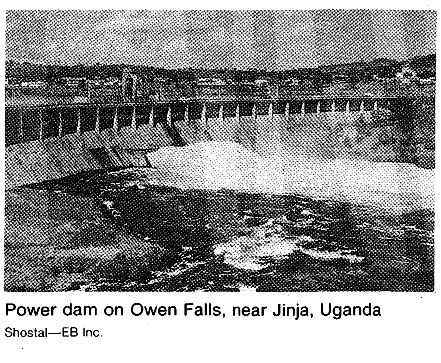
Owen was educated at the Birkenhead Institute and matriculated at the University of London; after an illness in 1913, he lived in France. He had already begun to write and, while working as a tutor near Bordeaux, was preparing a book of "Minor Poems—in Minor Keys—by a Minor," which was never published. These early poems are consciously modeled on John Keats; often ambitious, they show enjoyment of poetry as a craft.

In 1915 Owen enlisted in the Artists' Rifles. The experience of trench warfare brought him to rapid maturity; the poems written after January 1917 are full of anger at war's brutality, an elegiac pity for "those who die as cattle," and a rare descriptive power. In June 1917 he was invalided home and while in a hospital near Edinburgh met Siegfried Sassoon, who shared his feelings about the war and who became interested in his work. Reading Sassoon's poems and discussing his work with Sassoon revolutionized Owen's style and his conception of poetry. Despite the plans of well-wishers to find him a staff job, he returned to France in August 1918 as a company commander. He was awarded the Military Cross in October and was killed a week before Armistice Day.

Published posthumously by Sassoon, Owen's single volume of poems contains the most poignant English poetry of the war. His collected poems, edited by C. Day-Lewis, were published in 1964; his collected letters, edited by his younger brother William Harold Owen and J. Bell, were published in 1967.

BIBLIOGRAPHY. Harold Owen, *Journey from Obscurity,* 3 vol. (1963–65), is a memoir written by his brother. Jon Stallworthy, *Wilfred Owen* (1974, reprinted 1988), emphasizes the war's effect on Owen's poetic development.

Owen Falls, waterfall on the Victoria Nile at Jinja, Uganda, below the river's outlet from Lake Victoria. The falls are the site of Owen Falls Dam, 2,726 feet (831 m) long and 102 feet (31 m) high, which was completed in 1954, using Lake Victoria as a reservoir. The fall from the lake is harnessed by a hydroelec-



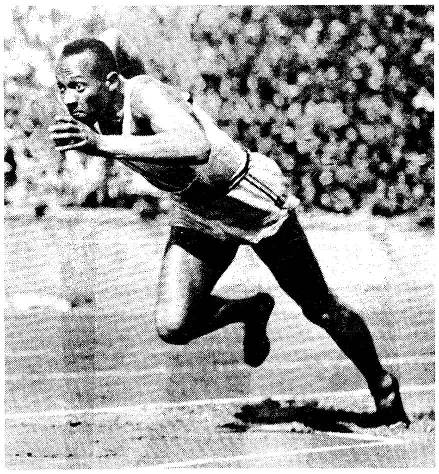
Power dam on Owen Falls, near Jinja, Uganda
Shostal—EB Inc.

tric installation to provide power for Uganda's industry and for western Kenya.

Owen Stanley Range, segment of the central highlands of New Guinea, occupying the southeastern "tail" of the island. The range rises abruptly from the coastal plain to a height of 9,000 feet (2,750 m) and extends for 200 miles (300 km). The massif ranges in width from 25 to 70 miles (40 to 115 km). Its highest point is Mount Victoria (13,240 feet [4,040 m]). Rainfall on the forested slopes gives rise to several rivers, including the Kemp Welch and Yodda (flowing south) and the Musa (north). The range is named after British Captain Owen Stanley, who explored the coast of New Guinea from 1845 to 1850. In 1942 Japanese forces began an overland crossing of the range in an attempt to capture Port Moresby. They were met by Allied troops and, after a prolonged fight, had to concede their first land defeat of World War II.

Owendo, deepwater port, northwestern Gabon, on the north shore of the Gabon Estuary; it serves the national capital, Libreville (9 miles [15 km] north-northwest), and was designed to handle ore vessels. It has a seaplane base and road connections with Libreville, Cocobeach, Médouneu, and Kango. In 1978 the first 115-mile (185-kilometre) segment of the Trans-Gabon Railway was opened, linking Owendo with Ndjolé in the interior. Further construction extended the line toward the mineral-rich northeast, to carry iron ore from Belinga (as well as timber and agricultural products from Belinga, Makokou, Booué, Alembé, and Kango) to the coast for export. In Owendo, sawmills and a plywood factory process hardwoods (notably okoumé) for export, and there is a pelletization factory for iron ore and a hydroelectric power station. An experimental stock-raising station and a technical school are in the town.

Owens, Jesse, byname of JAMES CLEVELAND OWENS (b. Sept. 12, 1913, Danville, Ala., U.S.—d. March 31, 1980, Phoenix, Ariz.), outstanding American track-and-field athlete, who set a world record in the running



Owens, 1936
AP/Wide World Photos

broad jump (also called long jump) that stood for 25 years and who won four gold medals in the 1936 Olympic Games in Berlin. His four Olympic victories were a blow to Adolf Hitler's intention to use the games to show Aryan superiority.

As a student in a Cleveland high school, Owens won three events in the 1933 National Interscholastic Championships, Chicago. In one day, May 25, 1935, while competing for Ohio State University (Columbus) in a Western Conference (Big Ten) track-and-field meet at the University of Michigan (Ann Arbor), Owens equaled the world record for the 100-yard dash (9.4 s) and broke the world records for the 220-yard dash (20.3 s), the 220-yard low hurdles (22.6 s), and the running broad jump (8.13 m [26 feet 8¼ inches]). As a member of the United States team in the 1936 Olympic Games, Owens tied the Olympic record in the 100-metre run (10.3 s); broke Olympic and listed world records in the 200-metre run (20.7 s) and the running broad jump (8.06 m; his world-record leap in 1935 had not yet been officially accepted); and ran the final segment for the world-record-breaking U.S. 400-metre relay team (39.8 s). For a time, Owens held alone or shared the world records for all sprint distances recognized by the International Amateur Athletic Federation.

After retiring from competitive track, Owens engaged in boys' guidance activities, made goodwill visits to India and the Far East for the U.S. Department of State, served as secretary of the Illinois State Athletic Commission, and worked in public relations.

BIBLIOGRAPHY. A recent biography is William J. Baker, *Jesse Owens: An American Life* (1986).

Owensboro, city, seat (1815) of Daviess county, on the Ohio River in northwestern Kentucky, U.S., 38 miles (61 km) southeast of Evansville, Ind. Founded about 1800, it was known to early flatboat men as Yellow Banks, from the colour of the clay along its high riverbanks. The town, laid out in 1816, was first named Rossborough but was later changed to Owensboro to honour Colonel Abraham Owen, a veteran of early Kentucky wars. During the American Civil War, it was the site of the Federal Camp Silas B. Miller. A Confederate attack was repelled in 1862, but, in August 1864, guerrillas attacked and burned part of the town, including the courthouse.

The city is the centre of a rich oil and agricultural (tobacco, corn [maize], wheat, soybeans, and fruit) region. Manufactures include bourbon whiskey, alloy steel, chemicals, furniture, radio tubes, and cigars. It is the site of Kentucky Wesleyan (1858) and Brescia (1950) colleges and the Natural Science Museum. Annual events include the Festival of the Arts (September) and the Owensboro Hydroplane Regatta (June). Inc. town, 1817; city, 1866. Pop. (1987 est.) city, 56,289; (1988 est.) metropolitan area (MSA), 87,800.

Owerri (people): *see* Itsekiri.

Owerri, town, capital of Imo state, southern Nigeria, at the intersection of roads from Aba, Onitsha, Port Harcourt, and Umuahia. It is the chief trade centre (yams, cassava, taro, corn [maize], and palm products) for a region of modified rain forest that also yields rubber for export. Although there is as yet little industrial development, one factory produces galvanized sheet-iron. The town is the seat of the New (Federal) University of Imo, Alvan Ikoku College of Education, and several secondary schools. It is known for its handicraft centres. Owerri is also served by a general hospital. The town is located in one of the most densely populated areas of Nigeria and is inhabited by the predominantly Christian Ibo people. Pop. (1983 est.) 35,010.

owl, any member of the order Strigiformes, nocturnal birds of prey.

A brief treatment of owls follows. For full treatment, *see* MACROPAEDIA: Birds.

According to some classifications, there are three extant families in the order: Strigidae (typical owls), Tytonidae (barn owls and grass owls), and Phodilidae (bay owls). Unlike other birds of prey, owls have virtually noiseless flight, the butterfly-like flapping of wings being muffled by the velvety surface of the flight feathers. Owls are protectively coloured, generally in shades of brown. Many species, such as the scops and screech owls, show two phases of coloration, one in which the brown tends toward red and one in which it tends toward gray. The females are usually larger than the males. Owls often go unnoticed because of their nocturnal habit. They nest in buildings, holes in trees, or nests abandoned by other birds. Some, such as the burrowing owl, nest on the ground or in holes abandoned by other animals. The white eggs are usually nearly round.

With their round, forward-looking eyes, large heads, and sharply hooked beaks, owls are easily recognized. Their hearing and vision are acute. The disk framing the face on most nocturnal species helps reflect sound to the ears, thus aiding the bird in locating its prey. In many species the ear openings are asymmetrical, further increasing the ability to localize sounds. Some species can turn their heads as much as 270° in one direction. Most owls are nocturnal and prey on insects, birds, or small mammals. The fish owl, with bristly foot pads that help hold fish, and the hawk owl, which often hunts by day, are less typical. All these birds produce "owl pellets," composed of the regurgitated, indigestible portions of their prey, such as bone, fur, and chitin.

Barn owls have heart-shaped facial disks, weakly forked tails, long legs, relatively small eyes, and no ear tufts; bay owls are similar, but the facial disk does not cross the forehead.

The approximately 120 species of typical owls (Strigidae) have larger, more prominent eyes and rounded tails. Many species have ear tufts. They range in size from the tiny 13–15-centimetre (5–6-inch) elf owl to the 70-centimetre (2.3-foot) eagle owl. Found worldwide except for Antarctica, owls occur in habitats ranging from tundra to scrubby desert, although most species, such as the horned and wood owls, prefer wooded areas.

owl-faced monkey, also called HAMLYN'S MONKEY (*Cercopithecus hamlyni*), arboreal guenon found in heavy forest of the Congo basin. The owl-faced monkey is greenish gray with black underparts and forelimbs and silver-gray on the lower back and base of the tail. The distinguishing feature is a white streak that runs the length of the nose and gives it an owllike appearance. *See also* guenon.

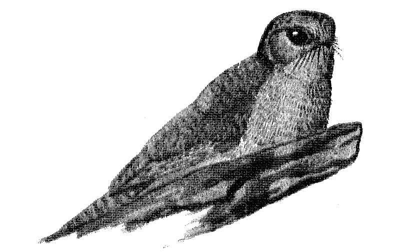
owl-fly, large neuropteran fly of the family Ascalaphidae, having membranous wings and long, clubbed antennae. The larva camouflages itself with debris or hides beneath bark to await prey. The adults are found mainly in the tropics but are quite common in the southwestern and southern United States. They are frequently mistaken for dragonflies.

owl monkey (primate): *see* durukuli.

owl parrot, also called KAKAPO, New Zealand parrot species of the subfamily Strigopinae. *See* parrot.

owlet, commonly, any young owl; the term is also used as the general name for several diminutive African and Southeast Asian species of *Glaucidium* (*see* pygmy owl) and two little owls (*Athene*) of southern Asia (*see* little owl).

owlet frogmouth, also called OWLET NIGHTJAR, any of seven or eight species of shy and

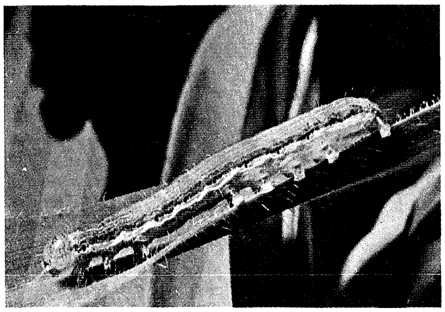


Owlet frogmouth (*Aegotheles cristatus*)
Painting by Gene M. Christman

solitary night birds belonging to the genus *Aegotheles* and comprising the family Aegothelidae. They are closely related to frogmouths, in the order Caprimulgiformes. These inhabitants of forests resemble small owls with very wide mouths nearly hidden by long bristles; they also perch like owls but have tiny feet. They eat insects, which they catch either on the wing or by pouncing from a branch. Their call is a soft churring or whistling. They lay three to five eggs in a hole in a tree or sandbank.

The best-known species is the owlet nightjar (*A. cristatus*)—in Australia often called the moth owl—22 cm (9 inches) long, gray above and brown below. Other species, 19–30 cm (7–12 inches) long, occur in New Guinea, New Caledonia, and the Moluccas.

owlet moth, also called MILLER, any of the more than 20,000 species in the cosmopolitan insect family Noctuidae (order Lepidoptera), having powdery, dusky wings. This large group is divided by some authorities into many families.



Armyworm, larva of the owlet moth *Pseudaletia unipuncta*
William E. Ferguson

The wingspan of these triangular-shaped, stout-bodied moths ranges from 8 to 305 mm (1/3 to 12 inches). Although most have dull coloration, some tropical species are bright and iridescent. Owlet moths are mainly night fliers, and many are attracted to lights. Hearing organs on the thorax consist of a tightly stretched membrane that is protected by an expanded hood. Most adults, using their well-developed mouthparts, feed on fruits, sap, or sweet fluids. Some species migrate northward after breeding in tropical regions. Many species have protective coloration.

The larvae vary from dull to colourful and from smooth to hairy. Many species feed on foliage and seeds, others bore in stems and fruits, and a few prey on scale insects. Larvae of some species known as cutworms attack such plants as corn (maize), grasses, tomatoes, and beans at night, severing roots and stems near ground level. Larvae of other species may eat foliage or fruits; still others (*e.g.,* the glossy cutworm, *Crymodes devastator*) live underground and feed on plant roots. The larvae of *Pseudaletia unipuncta,* called armyworms, travel along the ground in large groups, destroying corn, small grains, sugarcane, cotton, and other crops. The name armyworm is also generally applied to caterpillars of several other lepidopteran species that may migrate to new feeding grounds in large groups. The corn earworm, the destructive larval stage of the cosmopolitan moth *Heliothis zea,* is also known as the cotton bollworm, tomato fruitworm, vetch worm, or tobacco budworm, depending upon its host. Many larvae pupate underground with cocoons; others make strong silken cocoons incorporating wood chips, larval hairs, and other material.

ownership, the legal relation between a person (individual, group, corporation, or government) and an object. The object may be corporeal, such as furniture, or completely the creature of law, such as a patent, copyright, or annuity; it may be movable, such as an animal, or immovable, such as land. Because the objects of property and the protected relations are different in every culture and vary according to law, custom, and economic system and the relative social status of those who enjoy its privileges, it is difficult to find a least common denominator of "ownership." Ownership of property probably means at a minimum that one's government or society will help to exclude others from the use or enjoyment of one's possession without one's consent, which may be withheld except at a price.

Legal relations with respect to objects are described in the following articles: property law; copyright; patent; trademark; trust. Related information may be found in the articles bankruptcy; contract; mortgage.

Owo, town, Ondo state, southwestern Nigeria, at the southern edge of the Yoruba Hills (elevation 1,130 feet [344 m]) and at the intersection of roads from Akure, Kabba, Benin City, and Siluko. A major collecting point for cocoa, it also serves as a market centre (yams, cassava, corn [maize], rice, palm oil and kernels, pumpkins, okra). Cotton and teak are cultivated in the surrounding area, which was originally covered with dense tropical rain forest. Owo has secondary schools, a Federal Polytechnic, St. John's Teacher Training College, a government trade institute, a museum, and several hospitals. Pop. (1989 est.) 193,900.

Owon (Korean painter): *see* Chang Sŭng-ŏb.

Owyhee River, river formed by the junction of several forks in the southwestern corner of Idaho, U.S. It flows northwest across the Oregon boundary and north through Malheur county and empties into the Snake River south of Nyssa, Ore., after a course of 250 miles (402 km). The Owyhee Dam (1932) impounds Lake Owyhee. The river was named Owyhee (an early spelling of Hawaii) in memory of Hawaiians killed near the stream in 1819.

ox (*Bos taurus,* or *B. taurus primigenius*), a domesticated form of the large horned mammals that once moved in herds across North America and Europe (whence they have disappeared) and Asia and Africa, where some still exist in the wild state. South America and Australia have no wild oxen. Oxen are members of the Bovidae family.

The castrated male of *B. taurus* is a docile form especially useful as a draft animal in many less developed parts of the world. Oxen are also used for food in some areas.

oxalic acid, also called ETHANEDIOIC ACID, a colourless, crystalline, toxic organic compound belonging to the family of carboxylic acids. Oxalic acid is widely used as an acid rinse in laundries, where it is effective in removing rust and ink stains because it converts most insoluble iron compounds into a soluble complex ion. For the same reason, it is the chief constituent of many commercial preparations used for removing scale from automobile radiators.

The formula of oxalic acid is ($C_2H_2O_4$); its usual form is that of the crystalline hydrate, $(COOH)_2 \cdot 2H_2O$. Known as a constituent of wood sorrel as early as the 17th century, oxalic acid was first prepared synthetically in 1776. It is manufactured by heating sodium formate in the presence of an alkali catalyst, by oxidizing carbohydrates with nitric acid, by heating sawdust with caustic alkalies, or by fermentation of sugar solutions in the presence of certain molds.

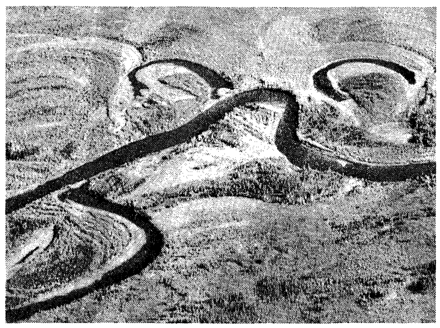
Oxalis, genus of small herbaceous plants, in the family Oxalidaceae, comprising about 850 species, native primarily to southern Africa and tropical and South America. A few South American species have edible tubers or roots, but most members of the genus are familiar as garden ornamentals. The name is derived from the Greek word *oxalis* ("acid") because the plants have an acidic taste. The common wood sorrel (*O. acetosella*) of eastern North America and Great Britain is a small, stemless plant with cloverlike three-parted leaves. The leaves arise from a creeping, scaly rootstock, and the flowers are borne singly on a stalk that arises from the leaf axil. The flowers have five white, purple-veined petals. The fruit is a capsule that splits open by valves. The seeds

Common wood sorrel (*Oxalis acetosella*)
Ian Rose—Eric and David Hosking

have a fleshy coat, which curls back elastically, ejecting the true seed. The leaflets, as in other species of the genus, fold back and droop at night. Besides the wood sorrel, about 20 other species occur in North America, among which are the yellow wood sorrel (*O. stricta*), of the eastern United States and Canada, with yellow flowers; the violet wood sorrel (*O. violacea*), of the eastern United States, with rose-purple flowers; the redwood wood sorrel (*O. oregana*), of the coast redwood belt from California to Oregon, with pink to white flowers; and *O. cernua,* known as Bermuda buttercups, with showy yellow flowers, native to southern Africa and naturalized in Florida and the Bermudas. Another yellow-flowered kind is the weedy, creeping oxalis (*O. corniculata*). Both *O. stricta* and *O. corniculata* are widely naturalized in the Old World. The tubers of *O. tuberosa,* the oca of South America, and the roots of *O. deppei,* a bulbous Mexican species, are edible.

oxbird, any of certain small sandpipers, especially the dunlin (*q.v.*). In Africa the buffalo weaver (*q.v.*) and the oxpecker are called oxbirds.

oxbow lake, small lake located in an abandoned meander loop of a river channel. It is generally formed as a river cuts through a meander neck to shorten its course, causes

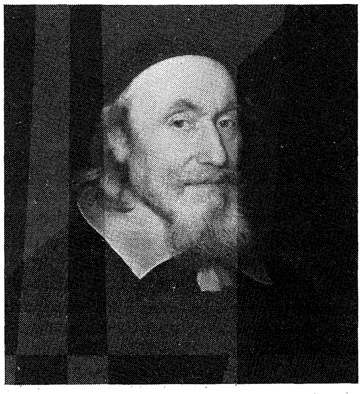


Oxbow lakes formed by the Mudjatik River, northern Saskatchewan
By courtesy of the National Air Photo Library, Department of Energy, Mines, and Resources

the old channel to be rapidly blocked off, and then migrates away from the lake. If only one loop is cut off, the lake formed will be crescent shaped, whereas if more than one loop is cut off, the lake will be serpentine or winding. Eventually, oxbow lakes are silted up to form marshes and finally meander scars, marked by different vegetation or the absence of cultivation. The lakes commonly are filled with clay-sized sediment that is less easy to erode than surrounding material and thus may cause a more complex meandering system in its parent stream.

Oxenstierna (af Södermöre), Axel, Greve (Count), Oxenstierna also spelled OXENSTJERNA (b. June 16, 1583, Fånö, near Uppsala, Swed.—d. Aug. 28, 1654, Stockholm), chancellor of Sweden (1612–54), successively under King Gustav II Adolf and Queen Christina. He was noted for his administrative reforms and for his diplomacy and military command during the Thirty Years' War. He was created a count in 1645.

Rise to chancellorship. Oxenstierna was born of a noble family that had played a considerable part in Sweden's history. After



Axel Oxenstierna, detail of an oil painting by David Beck; in the Nationalmuseum, Stockholm

By courtesy of the Nationalmuseum, Stockholm

receiving his education at Rostock and other German universities, he was appointed to a post in the exchequer and later he was made a member of the council of state. He soon established an ascendancy in that body, and on the death of Charles IX in 1611, it was he who extorted from the new king, Gustav II Adolf, a charter guaranteeing the nation against the royal abuses that had latterly prevailed. One of Gustav's first acts was to appoint Oxenstierna chancellor (January 1612).

Oxenstierna had emerged as the champion of the aristocracy against the violence of the monarchy, and the charter might well have initiated a constitutional struggle if strong ties of respect and affection had not soon developed between the King and Chancellor. They became, indeed, ideal collaborators and share the credit for the achievements of the reign. Oxenstierna's contributions were in the spheres of administrative reform and diplomacy.

He drafted the *riksdagsordning* ("parliamentary law") of 1617, which stabilized the constitution of the Riksdag; he drew up the ordinance of 1619 on the development of the towns; he carried through a reform in local government in 1623; and he issued a chancery ordinance in 1626 that organized the business of that office. He was mainly responsible for the building of the house of the nobility in Stockholm and for the *riddarhusordning* ("upper house law"; 1626), which divided the nobility into three classes and specified the members of each. As a diplomat he was entrusted with a long succession of major negotiations, including the Peace of Knäred (with Denmark, 1613), the Truce of Ogra (with Poland, 1622), and the negotiations with Denmark at Sjöaryd (1624).

When Gustav transferred his war against Poland to Prussia in 1626, Oxenstierna was brought over and installed as governor general, and it was he who negotiated the advantageous Truce of Altmark with Poland in 1629. In November 1631 the King called him to Germany.

Oxenstierna had been more reluctant than Gustav to intervene in Germany and would probably have preferred, in the first instance, a final settlement with Denmark—always, in his view, Sweden's main enemy. Moreover, he disliked the French alliance, considered that Gustav made a capital error in not marching on Vienna after the Battle of Breitenfeld, disapproved the King's candidature for the Polish throne in 1632, and tacitly opposed the project for marrying Christina to the electoral prince of Brandenburg, Frederick William. His removal to Germany placed the main burden of Swedish diplomacy again on his shoulders, but the King also now entrusted him with military commands, such as the formation and leadership of the army that relieved Gustav at Nürnberg in August 1632.

The war after Gustav's death. The death of Gustav, in November 1632, put the supreme direction of the Swedish cause in Germany into Oxenstierna's hands. Preserving to himself much of the king's authority and prestige, he negotiated with electors as an equal, and the project of making him elector of Mainz was canvassed. In the League of Heilbronn (1633), he created a *corpus evangelicorum* of the kind that Gustav had planned, with himself as its director, but he never managed to persuade the North German princes to join it. The disaster at Nördlingen (1634) destroyed his hopes of keeping Sweden's allies loyal, and many of them made peace at Prague in 1635. The renewal of the truce with Poland was purchased (to Oxenstierna's indignation) only by sacrificing the tolls that the Swedes had been levying in the Prussian harbours from 1627. Faced with overwhelming financial and military difficulties, he was for a time the virtual prisoner of his mutinous unpaid soldiery. He hesitated long between buying a peace on the best terms that he could get and accepting a French alliance and indefinite continuation of the war; it was not until 1638 that the intransigence of the Holy Roman emperor, Ferdinand III, forced him to the second alternative. Thenceforward he was the strongest advocate of fighting on until peace could be had on really favourable terms. Political enemies at home accused him of prolonging the war for his own ends, but the terms obtained by Sweden under the Peace of Westphalia, in 1648, justified his obstinacy. Meanwhile, he had launched the sudden attack on Denmark in 1643; the morality of it was dubious, but at Brömsebro in 1645 he was able to dictate a peace that wiped out the humiliations suffered at Knäred in 1613.

Oxenstierna and Queen Christina. As chancellor, Oxenstierna was one of the five regents who were to govern Sweden during Christina's minority; he also drew up (probably with Gustav's approval) the *regeringsform* ("form of government") accepted by the Riksdag in 1634. It was not until his return to Sweden in 1636 that he participated in the regency's government, but for the next eight years or so he was the real ruler of the country. His relations with the Queen, after she attained her majority (1644), were never as cordial as with her father; she saw in him the leader of an aristocracy anxious to limit the crown's powers and perhaps even to set up a republic. Others disliked him as the defender of noble privileges and noble encroachments on the liberties of the peasantry, though he repeatedly urged moderation on his colleagues in this regard. He had to face the intrigues of a hostile party at court, and he clashed with Christina on foreign and ecclesiastical policy, on the question of the succession, and on her proposal to abdicate. After 1650, however, relations improved, and he was as firmly established in office as at any time in his career when he died in 1654.

Sagacious, imperturbable, courageous, and industrious, unhurried in negotiation, and not without a pungent humour, Oxenstierna felt the service of the state to be equally congenial and obligatory. Though he never forgot the interests of his class, it may fairly be said that as a rule his single-minded patriotism transcended them. (M.Ro.)

BIBLIOGRAPHY. No full biography of Oxenstierna exists. Nils Ahnlund's magisterial monograph, *Axel Oxenstierna intill Gustav Adolfs död* (1940), stops short at 1632. Wilhelm Tham, *Axel Oxenstierna: Hans ungdom och verksamhet intill år 1612* (1935), is indispensable for the early years. Oxenstierna's enormous correspondence has been in course of publication since 1888. The first series has reached volume 15 and the year 1636; of the second, 12 volumes have so far appeared—*Rikskansleren Axel Oxenstiernas skrifter och brevväxling.*

Oxenstierna, Bengt Gabrielsson, Greve (Count) (b. July 16, 1623, Morby Castle, Sweden—d. July 12, 1702, Stockholm), Swedish statesman who, as the principal foreign policy adviser of King Charles XI, established a virtually neutral foreign policy for Sweden, breaking the existing alliance with France and forming ties with the Netherlands, England, and the Holy Roman Empire.

Bengt Oxenstierna, a relative of Axel Oxenstierna, began his career as a diplomat at the Congresses of Osnabrück and Nürnberg,

Bengt Oxenstierna, detail from a portrait by David Klöcker von Ehrenstrahl, 1690; in Gripsholm Castle, Sweden

By courtesy of the Svenska Portrattarkivet, Stockholm

which were held in connection with the Peace of Westphalia (1648), which ended the Thirty Years' War. After serving as president of the tribunal at Wismar (now in Germany), one of Sweden's German possessions, he joined (1655) the Polish campaign of King Charles X and fought with distinction in the defense of Toruń (1658). A councillor of state from 1654, he helped negotiate the Treaty of Oliva (1660), by which Poland ceded to Sweden its last Baltic territories.

After diplomatic service in Livonia, Wismar, and Vienna, Oxenstierna helped negotiate the treaties of Nijmegen (1678, 1679), which concluded the Dutch War (1672–78), in which Sweden had fought on the French side. Appointed head of the chancellery in 1680, Oxenstierna soon assumed control of Sweden's foreign affairs. By negotiating an alliance with the Netherlands and the Holy Roman emperor in the Treaty of The Hague (1681), he reversed Sweden's long-standing policy of alliance with France.

Recognizing the threat to the European balance of power posed by the personal alliance of England and the Netherlands under William III in 1688, Oxenstierna helped maintain the neutrality of Sweden during the ensuing War of the Grand Alliance (1689–97) between France and the major European powers. He gained a mediating role for Sweden in the Treaty of Rijswijk (1697), which ended the war. After the accession of Charles XII in 1697, Oxenstierna's influence declined greatly. After the outbreak of the Great Northern War (1700–21), Charles disregarded Oxenstierna and made his decisions in the field.

oxeye, in Britain, any of certain small sandpipers (especially the dunlin; *q.v.*) and the great tit (titmouse). *See also* tit.

OXFAM, abbreviation of OXFORD COMMITTEE FOR FAMINE RELIEF, privately funded, British-based agency that provides relief and development aid to impoverished or disaster-stricken communities worldwide. The original OXFAM was founded at Oxford, Eng., in 1942 to raise funds for the feeding of hungry children in war-torn Greece. The organization grew as it provided aid to refugees in the years following World War II. Its aid emphasis shifted in the 1960s to helping improve agriculture and food production in the more impoverished countries of the world. OXFAM developed an overseas network of field directors to administer its aid projects, but its goal was to provide manpower and training funds so that indigenous peoples could learn to help themselves. A large network of British volunteers helped in raising local funds for such projects. During the 1970s associate OXFAM organizations were formed in the United States, Canada, Belgium, and Australia. OXFAM organizations also continued to provide emergency aid for areas stricken by droughts, floods, earthquakes, and other natural catastrophes.

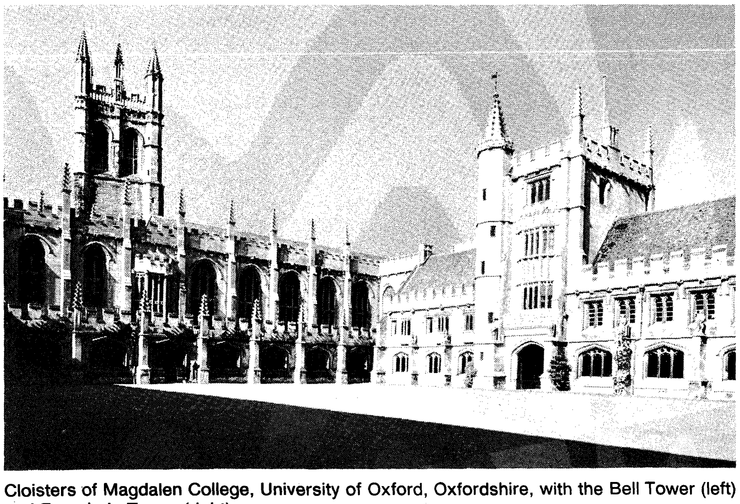
Oxford, district (city), county of Oxfordshire, England, best known for the University of Oxford, which is located within it.

Situated between the Upper River Thames (known in Oxford as the Isis) and the Cherwell, just north of their confluence, the town was first occupied in Saxon times as a fording point. Earlier peoples had spurned the valley lowlands in favour of the drier uplands to the north and south. Oxford eventually became a Thames *burg*, built to defend the northern frontier of Wessex from Danish attack. The first written mention of the town was in the Anglo-Saxon Chronicle (912), when it was observed that Edward the Elder "held Lurdenbryg [London] and Oxnaford and all the lands pertaining thereto." Except for the Saxon Romanesque tower of St. Michael's Church in Cornmarket Street, little remains of the Saxon settlement at Oxford.

Robert d'Oilly was appointed the first Norman governor of Oxford and was responsible for building Oxford Castle, of which all that remains is the motte (mound) and the tower of the Church of St. George in the castle. The site today is occupied by the local prison. Robert also built Oxford's first bridges (Magdalen, Folly, and Hythe). The Normans constructed a stone wall around the settlement. This wall enclosed an area of approximately 95 acres (38 hectares). Little now remains of it except for a few short sections, such as that standing in the grounds of New College. Established as a diocese in 1542, the first Oxford see was Osney Priory (destroyed), but in 1546 this designation was bestowed on St. Frideswide Priory, the "chapel" of Christ Church College and the smallest of all the cathedrals in England.

Oxford is known as the "City of Spires" because of its beautiful skyline of Gothic towers and steeples. Most of these belong to the university, which is the oldest in England. The University of Oxford's buildings were mostly built in the 15th, 16th, and 17th centuries. The earliest colleges of Oxford were University College (1249), Balliol (1263), and Merton (1264). Each college is built around two or three quadrangles, with a chapel, hall, library, and walled gardens. After the university was founded in the second half of the 12th century Oxford remained a market town, but this function declined in importance from the 13th century on. The town's subsequent history became the history of the university, although there was always a certain antipathy between "town and gown." This found its most violent expression in the Massacre of St. Scholastica's Day in 1355.

In the English Civil War Oxford's strategic importance made the city the Royalist headquarters to which the King retired after his defeats at Edgehill, Newbury, and Naseby. In May 1646 the Parliamentary commander in chief, Lord Fairfax, besieged the city, which finally surrendered to him on June 24th. The town became an important stagecoach junction point, and a considerable number of inns from the stagecoach era still exist. During the 18th century a canal network linking Oxford with various parts of the country was also developed, and in 1835 the Great Western Railway from London to Bristol was begun.



Cloisters of Magdalen College, University of Oxford, Oxfordshire, with the Bell Tower (left) and Founder's Tower (right)
A.F. Kersting

In 1801 Oxford was still a small market town of about 12,000 persons, many of whom depended on the university for a livelihood, but by the beginning of the 20th century printing and publishing industries had become firmly established in the town, and the manufacture of preserves (especially marmalade) was also important. By 1901 there were about 50,000 people in Oxford. The English industrial magnate William Morris (later Lord Nuffield) started a motor-car industry at Cowley, just outside the city, and today this, together with associated heavy and electrical engineering enterprises, is the main industrial concern in the local economy. In 1926 a pressed-steel factory for car bodies was also set up in Cowley, and in 1929 the city's boundaries were extended to include this industrial quarter. Oxford Polytechnic, one of England's newest major institutions of higher education, was founded in 1970. Pop. (1981) 99,195.

Oxford, city, Lafayette County, northern Mississippi, U.S. It is situated 62 miles (100 km) southeast of Memphis, Tenn. Originating as a trading post, it was incorporated in 1837 as the county seat and named for the English centre of learning, reflecting the townspeople's early desire for a university. The University of Mississippi (Ole Miss), chartered 1844, was opened there in 1848. The university served as a hospital when the city was occupied by Federal forces during the Civil War (December 1862–August 1864). In the fall of 1962 Oxford was torn by white rioting over the enrollment of a black student, James H. Meredith, at the University of Mississippi during the desegregation of the state educational system. The novelist William Faulkner, who was born in New Albany, 32 miles (51 km) east-northeast, lived in Oxford. Rowan Oak, his home from 1930 until his death in 1962, where he wrote his tales of Jefferson (Oxford) and Yoknapatawpha (Lafayette) County, is on Garfield Street. The city has economic interests in agriculture (poultry, dairying, truck farming, corn [maize], and cotton), lumbering, and manufacturing (electric motors, appliances). The Sardis Reservoir and Holly Springs National Forest are located nearby. Pop. (1984 est.) 10,263.

Oxford, EARLS OF, titled English nobility of three creations, in the families de Vere, Harley, and Asquith, grouped below chronologically and indicated by the symbol •.

• Oxford, Robert de Vere, 9th earl of (b. 1362—d. 1392, Louvain, Neth.), favourite of King Richard II of England (ruled 1377–99) during that monarch's minority. He led the group of courtiers who unsuccessfully supported Richard's efforts in 1385–87 to wrest control of the government from powerful nobles.

Through his mother, a descendant of King Henry III (ruled 1216–72), de Vere succeeded to his father's earldom in 1371. After the accession of his close friend Richard II, Oxford, who was already great chamberlain by hereditary right, became a privy councillor and Knight of the Garter. He was made marquess of Dublin—the first Englishman to be granted the title marquess—in 1385 and duke of Ireland in 1386.

Oxford's elevation caused much resentment among the King's ambitious enemies, such as his uncle Thomas of Woodstock, duke of Gloucester. Oxford further enraged Gloucester by divorcing the Duke's niece in 1387. Further, Oxford and his Royalist party acquired a reputation for frivolity and incompetence. On Nov. 17, 1387, Gloucester demanded the arrest of Oxford and other leading Royalists. Oxford organized an army in northwest England, but his force was routed by Gloucester at Radcot Bridge, Oxfordshire, on December 20. He escaped in disguise to the Netherlands and died in exile. As a result of Oxford's defeat, Richard was forced to submit to the Merciless Parliament of 1388 and to the five lords appellant who controlled the realm until 1389, when the King asserted his authority by proclaiming his minority at an end.

• **Oxford, John de Vere, 13th earl of** (b. Sept. 8, 1442—d. March 10, 1513), English soldier and royal official, a Lancastrian leader in the Wars of the Roses. He helped to restore the deposed King Henry VI (1470) and later (1485) to secure the English throne for the last surviving male claimant from the House of Lancaster, Henry Tudor, earl of Richmond, afterward King Henry VII.

He was the second son of John de Vere, 12th earl, who, with his eldest son, Aubrey, was executed (February 1462) under the Yorkist king Edward IV. Several years later, the younger John de Vere fled to France with the "kingmaker," Richard Neville, earl of Warwick. Returning with Warwick in a successful attempt to restore Henry VI (September–October 1470), he was made constable of England, supplanting John Tiptoft, earl of Worcester, who had put de Vere's father and brother to death and was in turn executed by de Vere. After leading the Lancastrian vanguard in the Battle of Barnet, Hertfordshire (April 14, 1471), in which Warwick was killed and the Yorkists were victorious, de Vere was again exiled to France.

Once more returning to Britain, he captured the island of St. Michael's Mount, Cornwall (1473), but surrendered after a siege and was imprisoned. On escaping (August 1484), he joined Henry Tudor, who was preparing to invade Wales and then England from France. For his service as commander of the right wing in Henry's victory at Bosworth Field, Leicestershire (Aug. 22, 1485), de Vere was again restored to his title and estates and was made chamberlain and admiral of England. Subsequently, he fought in the victory of Henry VII's army at Stoke, Nottinghamshire (June 16, 1487), the last battle of the Wars of the Roses, and crushed the 7th Baron Audley's Cornish rebels at Blackheath, south of London (1497).

• **Oxford, Edward de Vere, 17th earl of** (b. April 12, 1550, Castle Hedingham, Essex, Eng.—d. June 24, 1604, Newington, Middlesex), lyric poet and dramatist, patron of the acting company Oxford's Men, who became, in the 20th century, the strongest candidate proposed (next to Shakespeare himself) for the authorship of Shakespeare's plays.

Edward de Vere, 17th Earl of Oxford, detail of an oil painting after a portrait by an unknown artist, 1575; on loan to the National Portrait Gallery, London

By courtesy of the Duke of Portland, K.G.; photograph, National Portrait Gallery, London

He studied at Cambridge and succeeded to the earldom in 1562. He was the ward of Queen Elizabeth's principal minister, William Cecil (later Lord Burghley), whose daughter, Ann Cecil, he married in 1571. He travelled on the Continent (1574–76) and became for awhile estranged from his wife and Lord Burghley. Because of his extravagance he fell into disgrace at court but was restored to favour in 1583. In 1586 he was granted an annuity by the Queen, perhaps for his services in maintaining the company of actors he had taken over from the Earl of Warwick in 1580.

In his youth he had written some plays, none of which is extant. He was a notable patron of writers and employed John Lyly, the author of the novel *Euphues,* as his secretary for many years.

The Oxfordian theory of Shakespearean authorship was first advanced in 1920 in *"Shakespeare" Identified in Edward de Vere, the Seventeenth Earl of Oxford,* a study by J. Thomas Looney.

Oxford's death date (1604) has proved a major embarrassment to the advancement of the Oxfordian theory, because according to standard chronology, 14 of Shakespeare's plays, including many of the most important ones, were staged after that time.

• **Oxford (and Mortimer), Robert Harley, 1st earl of,** EARL MORTIMER, BARON HARLEY OF WIGMORE (b. Dec. 5, 1661, London—d. May 21, 1724, London), statesman who headed the Tory ministry from 1710 to 1714. Although by birth and education he was a Whig and a Dissenter, he gradually over the years changed his politics, becoming the leader of the Tory and Anglican party.

Robert Harley, 1st Earl of Oxford, detail of an oil painting by Sir Godfrey Kneller, 1714; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

Harley came from a Presbyterian family; he was first elected to Parliament in 1688. Within several years he became, with Paul Foley, leader of a coalition of Whigs and moderate Tories opposed to the government of King William III. Convinced (wrongly) that the Peace of Rijswijk (1697) would usher in an era of pacific relations, he called for a smaller army than that favoured by William, and he further angered his sovereign by attacking royal largesse and insisting on a reduced budget.

Harley was speaker of the House from 1701 to 1705 and secretary of state from 1704 to 1708. During this period Harley, along with John Churchill, 1st duke of Marlborough, and Lord Treasurer Sidney Godolphin, dominated the government of Queen Anne (ruled 1702–14) and directed the war against the French (War of the Spanish Succession, 1701–14).

Although Harley became the Queen's favourite, his anti-Whig attitudes brought him into conflict with his two colleagues, who in February 1708 forced him to resign. He then allied with the Tories, while the Whigs occupied all major government offices. Because of the growing closeness of his cousin and ally, Lady Abigail Masham, to the Queen, Harley remained influential. In 1710 public dissatisfaction with the Whig-directed war and with the handling of the Sacheverell affair (*see* Sacheverell, Henry), enabled Anne to dismiss Godolphin and install Harley as chancellor of the Exchequer at the head of a Tory ministry. Although he secured a great majority at the general election, his new ministry was more radically Tory than Harley wished. He now reached the peak of his career; and, after surviving a murderous assault by the Marquis de Guiscard, a French spy who had been arrested and was being interrogated at a privy council meeting, Harley was created earl of Oxford and made lord treasurer and Knight of the Garter in 1711. By funding the most pressing portion of the national debt in the South Sea Company stock (1711) and by securing a reasonable peace at Utrecht (1713), Oxford dealt with two crucial issues, but he was now threatened by the intrigues of his protégé and colleague, Henry Saint John, Viscount Bolingbroke. Avid for power, Bolingbroke, like Godolphin earlier, could argue the need for an alliance with a party; and the Schism Act (1714) abolishing the Dissenting academies, in one of which Oxford himself had been educated, was his pledge to the high Tories. The struggle between them became the more desperate, because both had been discountenanced by George, the Hanoverian heir to the throne, for making peace at Utrecht, and both engaged in questionable, if not treasonable, correspondence with James Edward, the Old Pretender, with whom the relations of both were shattered by his refusal to change or dissemble his Catholicism, finally announced in March 1714. Oxford, now preoccupied with nepotism, was in physical and mental decline, but Anne stubbornly kept him in office till July 27, 1714, five days before her death.

Permanently exiled from power by the Hanoverian succession, Oxford was imprisoned in 1715; an impeachment of him collapsed in 1717 because of differences between the two houses of Parliament and among the Whigs themselves, but Oxford played no further part of importance in parliamentary politics or Jacobite conspiracy.

Oxford formed a great library and collection of manuscripts, both of which were enlarged by the second earl. In 1753 the manuscripts were bought by the nation to form the Harleian Collection in the British Museum and Library. His life is recounted in O.B. Miller's *Robert Harley, Earl of Oxford* (1925), and A. McInnes's *Robert Harley* (1970).

• **Oxford and Asquith, H(erbert) H(enry) Asquith, 1st earl of:** *see* Asquith, H(erbert) H(enry).

Oxford, Provisions of (1258), a plan of reform accepted, in return for the promise by his barons of financial aid, by the English king Henry III. It can be regarded as England's first written constitution.

Henry, bankrupted by a foolish venture in Sicily, summoned Parliament in the spring of 1258 (the Easter Parliament, or the so-called Mad Parliament). In return for a badly needed grant of revenue, Henry grudgingly agreed to abide by a program of reform to be formulated by a 24-man royal commission, half of whom were to be chosen by the king, half by the baronial party. The report of the commission (issued *c.* June 10) is known as the Provisions of Oxford.

The Provisions, confirmed by an oath of "community" of the magnates, were to remain in effect for 12 years and provide the machinery through which the necessary reforms could be accomplished. The government was placed under the joint direction of the king and a 15-member baronial council that was to advise the king on all important matters. All high officers of the realm were to swear allegiance to the king and the council. Parliament was to meet three times a year to consult on further reforms. A justiciar was appointed (for the first time since 1234) to oversee local administration, and the majority of sheriffs were replaced by knights holding land in the shires that they administered.

Annulled by papal bulls in 1261 and 1262 and by Louis IX of France in the Mise of Amiens (January 1264), the Provisions were restored by baronial action in 1263 and, in modified form, in 1264 but finally annulled by the Dictum of Kenilworth (October 1266).

Oxford, University of, English autonomous institution of higher learning at Oxford, Oxfordshire, Eng. It lies along the Upper River Thames (called by Oxonians the Isis), 50 miles (80 km) north-northwest of London.

Sketchy evidence indicates that schools existed at Oxford as soon as the early 12th century. By the end of that century a university was well established, perhaps resulting from the barring of English students from the University of Paris about 1167. Oxford was modeled on the University of Paris, with initial faculties of theology, law, medicine, and the liberal arts.

In the 13th century the university gained added strength, particularly in theology, with the establishment of several religious orders, principally Dominicans and Franciscans, in the town of Oxford. The university had no buildings in its early years; lectures were given in hired halls or churches. The various colleges of Oxford were originally merely endowed boardinghouses for impoverished scholars. They were intended primarily for masters or bachelors of arts who needed financial assistance to enable them to continue study for a higher degree. The earliest of these colleges, University College, was founded in 1249. Balliol College was founded in about 1263, and Merton College in 1264.

During the early history of Oxford its reputation was based on theology and the liberal arts. But it also gave more serious treatment to the physical sciences than did the University of Paris: Roger Bacon, after leaving Paris, conducted his scientific experiments and lectured at Oxford from 1247 to 1257. Bacon was one of several influential Franciscans at the university during the 13th and 14th centuries. Among the others were Duns Scotus and William of Ockham. John Wycliffe (*c.* 1330–84) spent most of his life as a resident Oxford doctor.

Beginning in the 13th century the university was strengthened by charters from the crown, but the religious foundations in Oxford town were suppressed during the Reformation. In 1571 an act of Parliament led to the incorporation of the university. The university's statutes were codified by its chancellor, Archbishop William Laud, in 1636. In the early 16th century professorships began to be endowed, and in the latter part of the 17th century interest in scientific studies increased substantially. During the Renaissance, Desiderius Erasmus carried the new learning to Oxford, and such scholars as William Grocyn, John Colet, and Sir Thomas More enhanced the university's reputation. Since that time Oxford has traditionally held the highest reputation for scholarship and instruction in the classics, theology, and political science.

In the 19th century the university's enrollment and its professorial staff were greatly expanded. The first women's college at Oxford, Lady Margaret Hall, was founded in 1878, and women were first admitted to full membership in the university in 1920. In the 20th century Oxford's curriculum was modernized. Science came to be taken much more seriously and professionally, and many new faculties were added, including ones for modern languages, political science, and economics. Postgraduate studies also expanded greatly in the 20th century.

The colleges and collegial institutions of the University of Oxford include All Souls (1438), Balliol (1263–68), Brasenose (1509), Christ Church (1546), Corpus Christi (1517), Exeter (1314), Green (1979), Hertford (1874), Jesus (1571), Keble (founded 1868, inc. 1870), Lady Margaret Hall (founded 1878, inc. 1926), Linacre (1962), Lincoln (1427), Magdalen (1458), Merton (1264), New (1379), Nuffield (founded 1937, inc. 1958), Oriel (1326), Pembroke (1624), Queen's (1340), St. Anne's (founded 1879, inc. 1952), St. Antony's (1950), St. Catherine's (1962), St. Cross (1965), St. Edmund Hall (1278), St. Hilda's (founded 1893, inc. 1926), St. Hugh's (founded 1886, inc. 1926), St. John's (1555), St. Peter's (founded 1947, inc. 1961), Somerville (founded 1879, inc. 1926), Trinity (1554–55), University (1249), Wadham (1612), Wolfson (1966), and Worcester (1283, inc. 1714).

Oxford houses the Bodleian Library and the Ashmolean Museum (*qq.v.*). The Oxford University Press, established in 1478, is one of the largest and most prestigious university publishers in the world.

Oxford has been associated with many of the greatest names in British history, from John Wesley and Cardinal Wolsey to Oscar Wilde and Sir Richard Burton to Cecil Rhodes and Sir Walter Raleigh. The astronomer Edmond Halley studied at Oxford, and the physicist Robert Boyle performed his most important research there. Prime ministers who studied at Oxford include William Pitt the Elder, George Canning, Sir Robert Peel, William Gladstone, Lord Salisbury, H.H. Asquith, Clement Atlee, Anthony Eden, Harold Macmillan, Edward Heath, Sir Harold Wilson, and Margaret Thatcher.

Oxford English Dictionary, The (OED), definitive historical dictionary of the English language, originally consisting of 12 volumes and a one-volume supplement. The dictionary is a corrected and updated revision of *A New English Dictionary on Historical Principles* (*NED*), which was published in 10 volumes from Feb. 1, 1884, to April 19, 1928, and which was designed to provide an inventory of words in use in English since the middle of the 12th century (and in some cases even earlier). In 1933 the *New English Dictionary* was reissued in 12 volumes (along with a one-volume supplement) as *The Oxford English Dictionary.* Both the *NED* and *OED* were published by the Clarendon Press of Oxford.

Arranged in order of historical occurrence, the definitions in the *OED* are illustrated with about 5,000,000 dated quotations from English-language literature and records. The aim of the dictionary (as stated in the 1933 edition) is "to present in alphabetical series the words that have formed the English vocabulary from the time of the earliest records down to the present day, with all the relevant facts concerning their form, sense-history, and etymology."

The publication of the dictionary was first suggested to the Philological Society (London) in 1857, and the collection of materials began soon thereafter. Editorial work began in 1879 with the appointment of James Murray, who was at that time president of the Philological Society, as editor in chief. Murray, during his term as editor, was responsible for approximately one-half of the dictionary, including the letters *a* through *d, h* through *k, o, p,* and *t.* Succeeding editors included Henry Bradley, William Alexander Craigie, and C.T. Onions.

A micrographically reproduced two-volume edition of the 1933 12-volume *OED* and its supplement appeared in 1971, entitled *The Compact Edition of the Oxford English Dictionary.*

A Supplement to the Oxford English Dictionary, 4 vol. (1972–86), treating words that came into use in the English-speaking world after the preparation of the *OED,* was begun in 1955 under the editorial direction of R.W. Burchfield and was published by the Clarendon Press.

The second edition of *The Oxford English Dictionary,* known as *OED2,* was published in 20 volumes in 1989 by the Oxford University Press. Its coeditors were John A. Simpson and Edmund S.C. Weiner. The second edition includes in one alphabetical sequence all the words defined in the original 12-volume *OED* and the 5 supplementary volumes. During the making of the *OED2,* the text of the entire dictionary was transferred to an electronic data base.

Oxford Group (revivalistic movement): *see* Moral Re-Armament.

Oxford Movement, 19th-century movement centred at the University of Oxford that sought a renewal of "catholic," or Roman Catholic, thought and practice within the Church of England in opposition to the Protestant tendencies of the church. An immediate cause of the movement was the change that took place in the relationship between the state and the established Church of England from 1828 to 1832. Laws that required members of municipal corporations and government-office holders to receive the Eucharist in the Church of England were repealed, and a law was passed that removed most of the restrictions formerly imposed on Roman Catholics. For a short time it seemed possible that the Church of England might be disestablished and that it might lose its endowments. Consequently, many loyal Anglicans wished to assert that the Church of England was not dependent on the state and that it gained its authority from the fact that it taught Christian truth and its bishops were in the apostolic succession (*i.e.,* able to trace their authority and office back in an unbroken line to the Apostles). The movement rapidly became involved in theological, pastoral, and devotional problems.

Leaders of the movement were John Henry Newman (1801–90), a clergyman and subsequently a convert to Roman Catholicism and a cardinal; Richard Hurrell Froude (1803–36), a clergyman; John Keble (1792–1866), a clergyman and poet; and Edward Pusey (1800–82), a clergyman and professor at Oxford.

The ideas of the movement were published in 90 *Tracts for the Times* (1833–41), 24 of which were written by Newman, who edited the entire series. The Tractarians asserted the doctrinal authority of the catholic church to be absolute, and by "catholic" they understood that which was faithful to the teaching of the early and undivided church. They believed the Church of England to be such a catholic church.

Some of the movement's followers gradually moved closer to the beliefs of the Roman Catholic Church, and controversies over the Tractarians' ideas developed. In 1845 Newman joined the Roman Catholic Church, and, subsequently, several others also joined.

Keble and Pusey remained active leaders of the movement, which gradually spread its influence throughout the Church of England. Some of the results were increased use of ceremony and ritual in church worship, the establishment of Anglican monastic communities for men and for women, and better-educated clergy who were more concerned with pastoral care of their church members.

Oxfordshire, county of south-central England, bounded on the north by Warwickshire and Northamptonshire, on the west by Gloucestershire and Wiltshire, on the south by Berkshire, and on the east by Buckinghamshire. It comprises five districts—Cherwell, Oxford, South Oxfordshire, Vale of White Horse, and West Oxfordshire—with an area of 1,007 square miles (2,608 square km).

The county consists of two upland areas divided by a broad vale, about 10 miles (16 km) wide. The North Oxfordshire Heights, rising to 700 ft (210 m) at Edgehill in the northeast of the county, are developed on oolitic limestone and related strata of the Jurassic period. The Berkshire Downs and White Horse Hill are developed on Cretaceous chalk. The intervening clay vale stretches from northeast to southwest. It is divided into the Oxford Clay Vale and the White Horse Vale by an outcrop of Corallian limestone, giving rise to the Oxford Heights.

Oxfordshire is located almost entirely within the Thames Basin. The river flows northeastward along the Oxford Clay Vale, receiving the Rivers Windrush, Evenlode, and Cherwell from the north and the Ock and its tributaries from the south. There is an elbow of capture, where the drainage system has become connected to a former portion of a neighbouring system, to the east of Oxford, from which the Thames flows southward through the Goring Gap. There is little glacial drift except in the northeast corner of the county. Gravel deposits, both plateau (North Leigh, Combe, and Tiddington) and flood plain (Bampton, Oxford, and Dorchester) are important economically.

Numerous Paleolithic and Mesolithic artifacts have been recovered from the flood-plain gravels that border the Thames. Neolithic tools and pottery have similarly been located at many points in the county. A number of long barrows and the Rollright Stones on the Oxfordshire–Warwickshire border also date from this period. The major archaeological monument in the county, dating from the Iron Age, is the Uffington White Horse, which is carved into the chalk of the White Horse Hill. The monument is 360 ft long and has a maximum height of 130 ft. Dorchester and Alchester, situated on the Roman road from Silchester to Watling Street and Towcester, were the most important sites in Roman Oxfordshire. Subsequent Saxon settlement in the county was concentrated at valley sites along the line of the Thames and its major tributaries, and Oxfordshire was successively part of the Anglo-Saxon kingdoms of Wessex and Mercia. During the 10th and 11th centuries the area was overrun by the Danes.

At the time of Domesday Book (1086), the record of William I the Conqueror's land survey of England, the county was fairly well populated, the major centres being Oxford itself, Wallingford, Abingdon, and Bampton. All were incipient towns with regular markets. The medieval period is commemorated by numerous ecclesiastical and domestic buildings. Iffley church, just south of Oxford, is one of the best examples of pure Romanesque style in England; Adderbury, south of Banbury, has a cruciform Decorated style church, and that at Minster Lovell is pure Perpendicular style. Secular buildings include Broughton Castle (14th century), Stonor Park, Stanton Harcourt (1450), Chastleton, and Blenheim Palace (early 18th century), built near Woodstock for the Duke of Marlborough, a member of one of the great political dynasties of England. The county saw action during the English Civil War (1642–51). The towns of Oxford, Banbury, and Wallingford were all besieged by Parliamentary forces at some time, and Oxford was the Royalist headquarters.

The economy of modern Oxfordshire is basically agricultural. The North Oxfordshire Heights are important for sheep and arable farming, mostly on large farms. From medieval times until quite recently wool was a mainstay of the economy. The clay vale is mainly sown to grass, milk and beef being produced. The White Horse Vale and the northern slope of the Downs are noted for fruit production.

Ironstone is mined near Banbury, and clay, sand, and gravel are also worked in various parts of the county. Cowley, a suburb of Oxford, is the major industrial centre, producing motor vehicles and pressed steel. Banbury, with light engineering, and Witney, with blanket manufacture, are also important centres. Paper mills are located at Wolvercote, Shiplake, Sandford, and Eynsham, using pure stream water. Pop. (1983 est.) 550,300.

oxidation-reduction reaction, also called REDOX REACTION, any of a large and diverse class of chemical processes mostly involving the transfer of oxygen atoms, hydrogen atoms, or electrons from one substance to another.

A brief treatment of oxidation-reduction reactions follows. For full treatment, *see* MACROPAEDIA: Chemical Reactions.

Before the role of electrons in chemical reactions was elucidated, the term oxidation was applied to reactions in which an element gained oxygen, as in the burning of carbon, $C + O_2 \rightarrow CO_2$, or the rusting of iron, $4Fe + 3O_2 \rightarrow 2Fe_2O_3$; the term reduction designated a reaction by which an element lost oxygen, such as the reduction of copper by hydrogen, $CuO + H_2 \rightarrow Cu + H_2O$.

Today it is understood that most oxidation-reduction processes (usually called redox reactions) involve the transfer of oxygen atoms, hydrogen atoms, or electrons. These reactions are characteristically coupled—*i.e.,* whenever an oxidation reaction occurs, a reduction reaction also takes place. When hydrazine, for example, loses hydrogen and is oxidized to nitrogen gas in the reaction $N_2H_4 \rightarrow N_2 + 2H_2O$, oxygen gains hydrogen and is thereby reduced, forming water.

Many substances in water solution ionize. Nickel chloride ($NiCl_2$), for example, dissociates into its charged constituents as symbolized by the reaction $NiCl_2 \rightarrow Ni^{2+} + 2Cl^-$. The electrolysis of such solutions results in an oxidation process at the anode and a reduction process at the cathode. For the electrolysis of $NiCl_2$ the anode reaction is $2Cl^- \rightarrow Cl_2 + 2e^-$ and the cathode reaction $Ni^{2+} + 2e^- \rightarrow Ni$. These reactions involving electrons are called half reactions or oxidation-reduction couples. In theory, every oxidation-reduction reaction may be broken up into two couples that indicate the mechanism by which electrons are transferred. Oxidation and reduction occur simultaneously and in equivalent amounts; *i.e.,* the number of electrons lost is equal to the number gained. The relative potentials of the two couples determine the direction in which the reaction will proceed.

The most powerful reducing agents include such highly electropositive metals as sodium, which readily reduce the compounds of the noble metals and also liberate hydrogen from water. Among the most powerful oxidizing agents are fluorine and ozone. These readily liberate oxygen from water.

Each atom that participates in a redox reaction is assigned an oxidation number that signifies the atom's excess or deficiency of electrons. For instance, the Na^+ ion has an oxidation number of +1 because it is deficient of one electron. Sulfate ion (SO_4^{2-}) has an overall oxidation number of −2, which is the sum of the oxidation numbers of its constituent atoms. Each oxygen atom has two spare electrons; their total contribution to the sulfate oxidation number therefore is −8. Sulfur has an oxidation number of +6, which, when added to the contribution from oxygen, gives a total oxidation number of −2 for the sulfate ion. In an electronically neutral substance, the sum of the oxidation numbers is zero—*e.g.,* sodium sulfate (Na_2SO_4). The oxidation number of the two sodium atoms (+2 in total) balances the negative oxidation number of the sulfate ion (−2). Hence, if an atom or ion increases its oxidation number, it has been oxidized through loss of electrons; whereas if its oxidation number decreases, it has been reduced.

Certain elements assume the same oxidation number in different compounds; others, notably the nonmetals and the transition elements, can assume a variety of oxidation numbers. For example, fluorine, the most electronegative of the elements, has the oxidation number −1 in all of its compounds; nitrogen can have any oxidation number between −3 (as in ammonia, NH_3) and +5 (as in nitric acid, HNO_3).

In the nomenclature of inorganic compounds, it is accepted practice to indicate the oxidation number of an element that may exist in more than one oxidation state by a roman numeral in parentheses after the name of the element; *e.g.,* iron(II) chloride ($FeCl_2$) and iron(III) chloride ($FeCl_3$).

oxide, any of a large and important class of chemical compounds in which oxygen is combined with another element.

Nearly all the elements form oxides, which vary in properties from those of typical metal oxides—crystalline solids containing the oxide ion, O^{2-}, that react with water to form alkalies or with acids to form salts—to those of typical nonmetal oxides—volatile compounds in which the oxygen atoms are covalently linked to the nonmetal atom and that react with water to form acids or with alkalies to form salts. Thus, calcium, a metal, forms calcium oxide (CaO), which reacts with water to form calcium hydroxide, a strong alkali, and with hydrochloric acid to form calcium chloride, a salt; sulfur, a nonmetal, forms sulfur trioxide (SO_3), which reacts with water to form sulfuric acid, a strong acid, and with sodium hydroxide to form sodium sulfate, a salt. Oxides, such as those of aluminum, zinc, or tin, that form salts by reacting with either acids or alkalies, are called amphoteric; for example, aluminum oxide (Al_2O_3) reacts with hydrochloric acid to form aluminum chloride and with sodium hydroxide to form sodium aluminate.

Certain organic compounds react with oxygen or other oxidizing agents to produce substances called oxides. Thus, amines, phosphines, and sulfides form amine oxides, phosphine oxides, and sulfoxides, respectively, in which the oxygen atom is covalently bonded to the nitrogen, phosphorus, or sulfur atom. The so-called olefin oxides are cyclic ethers.

oxide mineral, any naturally occurring inorganic compound with a structure based on close-packed oxygen atoms in which smaller, positively charged metal ions occur in interstices. Oxides are distinguished from other oxygen-bearing compounds such as the silicates, borates, and carbonates, which have a readily definable group containing oxygen atoms covalently bonded to an atom of another element. Hydroxides are usually not included with oxide minerals.

The oxide minerals can be grouped as simple oxides and multiple oxides. Simple oxides are a combination of one metal and oxygen, whereas multiple oxides have two nonequivalent metal sites. The oxide structures are usually based on cubic or hexagonal close-packing of oxygen atoms with the octahedral or tetrahedral sites or both occupied by metal ions; symmetry is typically cubic, hexagonal, trigonal, or tetragonal.

The simple oxides can be subdivided on the basis of the ratio of the numbers of atoms of metal and oxygen, giving general formulas of the A_xO_y type. In such formulas A represents a metal atom, and x and y represent integers. Chemical compositions then fall into categories such as those designated AO, A_2O, A_2O_3, AO_2. Specific simple oxide minerals include periclase (MgO), cuprite (Cu_2O), hematite (Fe_2O_3), and uraninite (UO_2).

Complex oxides show a more varied chemistry, often with extensive solid solution. Most common is the spinel group, with the general formula AB_2O_4, in which A and B are ions of different metals, the same metal with differ-

Oxide minerals

name formula	colour	lustre	Mohs hardness	specific gravity	habit	fracture or cleavage	refractive indices or polished section data	crystal system space group	remarks
anatase TiO_2	brown to indigo blue and black; also variable	adamantine to metallic adamantine	5½–6	3.8–4.0	pyramidal or tabular crystals	two perfect cleavages	ω = 2.561 ε = 2.488 extremely variable	tetragonal I$\frac{4}{a}$md	strong dispersion; has the same chemical composition as but different symmetry than rutile and brookite
boehmite AlO(OH)	white, when pure		3	3.0–3.1	disseminated or in pisolitic aggregates	one very good cleavage	α = 1.64–1.65 β = 1.65–1.66 γ = 1.65–1.67	orthorhombic Amam	has the same chemical composition as but different symmetry than diaspore
brookite TiO_2	various browns	metallic adamantine to submetallic	5½–6	4.1–4.2	only as crystals, usually tabular	subconchoidal to uneven fracture	α = 2.583 β = 2.585 γ = 2.700–2.741	orthorhombic Pcab	has the same chemical composition as but different symmetry than anatase and rutile
brucite $Mg(OH)_2$	white to pale green, gray, or blue	waxy to vitreous	2½	2.4	tabular crystals; platy aggregates; fibrous or foliated massive	one perfect cleavage	ω = 1.56–1.59 ε = 1.58–1.60	hexagonal P3m	pyroelectric
cassiterite SnO_2	reddish or yellowish brown to brownish black	adamantine to metallic adamantine, usually splendent	6–7	7.0	repeatedly twinned crystals; crusts and concretions	one imperfect cleavage	ω = 1.984–2.048 ε = 2.082–2.140 light gray; strongly anisotropic	tetragonal P$\frac{4}{m}$nm	
chromite $FeCr_2O_4$	black	metallic	5½	4.5–4.8	granular to compact massive	no cleavage; uneven fracture	n = 2.08–2.16 brownish gray-white; isotropic	isometric Fd3m	sometimes feebly magnetic; forms solid solution series with magnesiochromite in which magnesium replaces iron in the molecular structure
chrysoberyl $BeAl_2O_4$	variable	vitreous	8½	3.6–3.8	tabular or prismatic, commonly twinned, crystals	one distinct cleavage	α = 1.746 β = 1.748 γ = 1.756	orthorhombic Pmnb	
columbite $(Fe,Mn)Nb_2O_6$	iron black to brownish black; often with iridescent tarnish		6–6½	5.2 (columbite) to 8.0 (tantalite)	prismatic crystals, often in large groups; massive	one distinct cleavage	brownish gray-white; weakly anisotropic	orthorhombic Pcan	forms a solid solution series with tantalite in which tantalum replaces niobium in the magnetic structure; paramagnetic
corundum Al_2O_3	red (ruby); blue (sapphire); also variable	adamantine to vitreous	9 (a hardness standard)	4.0–4.1	pyramidal or barrel-shaped crystals; large blocks; rounded grains	no cleavage; uneven to conchoidal fracture	ω = 1.767–1.772 ε = 1.759–1.763	hexagonal R$\bar{3}$c	asterism frequently noted; fluorescent or phosphorescent; the only natural form of alumina
cuprite Cu_2O	various shades of red	adamantine to earthy	3½–4	6.1	octahedral, cubic, or capillary crystals; granular or earthy massive	conchoidal to uneven fracture	n = 2.849 bluish white; anomalously anisotropic and pleochroic	isometric Pn3m	
delafossite $CuFeO_2$	black	metallic	5½	5.4–5.5	tabular crystals; botryoidal crusts	one imperfect cleavage	rosy brown-white; strongly anisotropic; distinctly pleochroic	hexagonal R$\bar{3}$m	
diaspore $HAlO_2$	white, grayish white, colourless; variable	brilliant vitreous	6½–7	3.2–3.5	thin, platy crystals; scaly massive; disseminated	one perfect cleavage, one less so	α = 1.682–1.706 β = 1.705–1.725 γ = 1.730–1.752	orthorhombic Pbnm	dimorphous with boehmite
euxenite $(Y,Ca,Ce,U,Th)(Nb,Ta,Ti)_2O_6$	black	brilliant submetallic to greasy or vitreous	5½–6½	5.3–5.9	prismatic crystals; massive	conchoidal to subconchoidal fracture	n = 2.06–2.25	orthorhombic Pcan	forms a solid solution series with polycrase in which titanium replaces niobium and tantalum in the molecular structure; radioactive; metamict
franklinite $ZnFe_2O_4$	brownish black to black	metallic to semimetallic	5½–6½	5.1–5.2	octahedral crystals; granular massive		n ~ 2.36 white; isotropic	isometric Fd3m	weakly magnetic; forms solid solution series with

Oxide minerals (continued)

name formula	colour	lustre	Mohs hardness	specific gravity	habit	fracture or cleavage	refractive indices or polished section data	crystal system space group	remarks
franklinite (continued)									magnesioferrite, magnetite, jacobsite, and trevorite in which magnesium, iron, manganese, and nickel, respectively, replace zinc in the molecular structure
gibbsite $Al(OH)_3$	white; grayish, greenish, reddish white	vitreous	2½–3½	2.3–2.4	tabular crystals; crusts and coatings; compact earthy	one perfect cleavage	α = 1.56–1.58 β = 1.56–1.58 γ = 1.58–1.60	monoclinic $P\frac{2_1}{n}$	
goethite $HFeO_2$	blackish brown (crystals); yellowish or reddish brown	adamantine-metallic	5–5½	3.3–4.3	prismatic crystals; massive	one perfect cleavage, one less so	α = 2.260–2.275 β = 2.393–2.409 γ = 2.398–2.515 gray; strongly anisotropic	orthorhombic Pbnm	has the same chemical composition as but different symmetry than lepidocrocite
hausmannite Mn_3O_4	brownish black	submetallic	5½	4.8	pseudo-octahedral crystals; granular massive	one nearly perfect cleavage	ω = 2.43–2.48 ε = 2.13–2.17 gray-white; distinctly anisotropic	tetragonal $I\frac{4_1}{a}md$	
hematite Fe_2O_3	steel gray; dull to bright red	metallic or submetallic to dull	5–6	5.3	tabular crystals; rosettes; columnar or fibrous massive; earthy massive; reniform masses	no cleavage	ω = 2.90–3.22 ε = 2.69–2.94 anisotropic; weakly pleochroic; often shows lamellar twinning	hexagonal $R\bar{3}c$	
ilmenite $FeTiO_3$	iron black	metallic to submetallic	5–6	4.7–4.8	thick, tabular crystals; compact massive; grains	no cleavage; conchoidal fracture	n ~ 2.7 grayish white; anisotropic	hexagonal $R\bar{3}$	
lepidocrocite FeO(OH)	ruby red to reddish brown	submetallic	5	4.0–4.1	flattened scales; isolated rounded crystals; massive	one perfect cleavage, one less so	α = 1.94 β = 2.20 γ = 2.51 gray-white; strongly anisotropic and pleochroic	orthorhombic Amam	has the same chemical composition as but different symmetry than goethite
litharge PbO	red	greasy to dull	2	9.1–9.2	crusts; alteration product on massicot	one cleavage	ω = 2.665 ε = 2.535	tetragonal $P\frac{4}{n}mm$	has the same chemical composition as but different symmetry than massicot
magnetite Fe_3O_4	black to brownish black	metallic to semimetallic	5½–6½	5.2	octahedral crystals; granular massive		n = 2.42 brownish gray; isotropic	isometric Fd3m	strongly magnetic; good electrical conductor; forms solid solution series with magnesioferrite, franklinite, jacobsite, and trevorite in which magnesium, zinc, manganese, and nickel, respectively, replace ferrous iron in the molecular structure
manganite MnO(OH)	dark steel gray to iron black	submetallic	4	4.3–4.4	prismatic crystals, often in bundles; fibrous massive	one very perfect cleavage, two less so	α = 2.25 β = 2.25 γ = 2.53 brownish gray-white; anisotropic; weakly pleochroic	monoclinic $B\frac{2_1}{d}$	
massicot PbO	sulfur to orpiment yellow	greasy to dull	2	9.6	earthy or scaly massive	two cleavages	α = 2.51 β = 2.61 γ = 2.71	orthorhombic	has the same chemical composition as but different symmetry than litharge
periclase MgO	colourless to grayish; also green, yellow, or black	vitreous	5½–6	3.6–3.7	irregular, rounded grains; octahedral crystals	one perfect cleavage	n = 1.730–1.746	isometric Fm3m	
perovskite $CaTiO_3$ (often containing rare earths)	black; grayish or brownish black; reddish brown to yellow	adamantine to metallic	5½	4.0–4.3	cubic crystals	uneven to subconchoidal fracture	n = 2.30–2.38 dark bluish gray	orthorhombic Pnma	ferroelectric

ent oxidation states, or a combination of the two; *A*-divalent, *B*-trivalent is the commonest. Frequently occurring divalent ions include magnesium, iron, zinc, and manganese, while common trivalent ions are aluminum, iron, manganese, and chromium.

Oxide minerals occur as decomposition products of sulfide minerals, in pegmatites, early crystallizing minerals in ultrabasic rocks, and as accessory minerals in many igneous rocks.

oxidoreductase, any member of a class of enzymes, commonly known as dehydrogenases or oxidases, that catalyze the removal of hydrogen atoms and electrons from the compounds on which they act. Substances called coenzymes, associated with the oxidoreductase enzymes and necessary for their activity, accept the hydrogen and electrons, which—in metabolic systems of animals—eventually are transferred to oxygen. Other enzymes of this group catalyze such reactions as the oxidation of aldehydes and ketones to carboxylic acids and the dehydrogenation of amino acids.

oxime, any of a class of nitrogen-containing organic compounds usually prepared from hydroxylamine and an aldehyde, a ketone, or a quinone. Oximes have the structure

$$\begin{matrix} X \\ & \searrow \\ & & C=N-OH, \\ & \nearrow \\ Y \end{matrix}$$

in which X and Y are hydrogen atoms or organic groups derived by removal of a hydrogen atom from an organic compound. Because most oximes are solids with characteristic melting points, they are useful in identifying liquid aldehydes and ketones.

Oximes can also be made by the action of hydrogen-donating reagents upon certain nitro compounds or by the isomerization of nitroso compounds. The oximes obtained from aldehydes (aldoximes) can be dehydrated to form nitriles. Other useful chemical reactions of oximes include conversion to amines (by treatment with hydrogen or other reducing substances) and to amides (by the action of strong acids or of phosphorus pentachloride). A large-scale application of this conversion to amides is the transformation of cyclohexanone oxime to caprolactam, the starting material for nylon 6.

oxisol, intensely weathered soil type of the humid tropics and subtropics. Diagnostic of these soils is a subsurface horizon depleted in most of the common soil minerals and containing only hydrated oxides of iron and aluminum, plus kaolinite clays and quartz sand. Where exposed to repeated wetting and drying, the iron oxides cement soil particles to form ironstone "hardpans" (also called laterite). Oxisols develop on heavily eroded ancient upland land surfaces, commonly in association with ultisol soils. The world's two largest areas of oxisols are in the Amazon Basin of South America and the Congo Basin of Africa. With careful fertilization, oxisols on the islands of Hawaii and the Caribbean yield large crops of sugarcane, bananas, pineapple, coffee, and rice.

Oxley, John (Joseph William Molesworth) (b. 1783/85?, near Westow, Yorkshire, Eng.—d. May 26, 1828, Kirkham, Australia), surveyor-general and explorer who played an important part in the exploration of eastern Australia and also helped open up Van Diemen's Land (later Tasmania).

Oxley joined the British navy as a midshipman in 1799 and arrived in Australia as a master's mate in 1802. He worked on coastal surveys and in 1805 was put in command of the *Buffalo* by Governor Philip King, and in 1806 he commanded another ship to Van Diemen's Land. Commissioned a lieutenant in England in 1807, he returned to Sydney (1808) with a land grant of 600 acres (240 hectares), bringing goods as an investment. In 1809 he wrote a report on the settling of Van Diemen's Land and returned to England.

Oxley was appointed surveyor-general of New South Wales, retired from the navy, and returned to Sydney in 1812. He then explored as much territory as he had surveyed in the early years: in 1817 with George Evans in the Lachlan River region and in 1818 along the Macquarie River, failing to find these rivers' sources but opening up much land for sheepherding. His *Two Expeditions into the Interior of New South Wales* (1820) was the first description of the area and provided the basis for later explorations by Charles Sturt and T.L. Mitchell.

Oxide minerals (continued)

name formula	colour	lustre	Mohs hardness	specific gravity	habit	fracture or cleavage	refractive indices or polished section data	crystal system space group	remarks
psilomelane $BaMnMn_8O_{16}(OH)_4$	iron black to dark steel gray	submetallic to dull	5–6	4.7	massive; crusts; stalactites; earthy masses			orthorhombic	
pyrochlore $NaCaNb_2O_6F$	brown to black (pyro); pale yellow to brown (micro)	vitreous or resinous	5–5½	4.2–6.4	octahedral crystals; irregular masses	subconchoidal to uneven fracture	n = 1.93–2.02	isometric Fd3m	forms a solid solution series with microlite in which tantalum replaces niobium in the molecular structure
pyrolusite MnO_2	light steel gray to iron black	metallic	2–6	4.4–5.0	columnar or fibrous massive; coatings and concretions	one perfect cleavage	cream-white; distinctly anisotropic; very weakly pleochroic	tetragonal $P\frac{4_2}{m}nm$	
rutile TiO_2	reddish brown to red; variable	metallic adamantine	6–6½	4.2–5.5	slender to capillary prismatic crystals; granular massive; as inclusions, often oriented	one distinct cleavage	ω = 2.556–2.651 ε = 2.829–2.895	tetragonal $P\frac{4}{m}nm$	photosensitive; has the same chemical composition as but different symmetry than anatase and brookite
spinel $MgAl_2O_4$	various	vitreous	7½–8	3.55 (pure $MgAl_2O_4$)	octahedral crystals; round or embedded grains; granular to compact massive		n = 1.715–1.725	isometric Fd3m	forms a solid solution series with hercynite, gahnite, and galaxite in which iron, zinc, and manganese, respectively, replace magnesium in the molecular structure
tenorite CuO	steel or iron gray to black	metallic	3½	5.8–6.4	thin aggregates or laths; curved plates or scales; earthy masses	conchoidal fracture	light gray-white; strongly anisotropic; pleochroic	monoclinic $C\frac{2}{c}$	
thorianite ThO_2	dark gray to brownish black and bluish	hornlike to submetallic	6½	9.7–9.9	rounded cubic crystals	uneven to subconchoidal fracture	n ~ 2.20 (variable) isotropic	isometric Fm3m	radioactive
uraninite UO_2	steel to velvet black; grayish, greenish	submetallic to greasy or dull	5–6	6.5–8.5 (massive); 8.0–10.0 (crystals)	crystals; massive; dendritic aggregates of crystals	uneven to conchoidal fracture	light brownish gray; isotropic	isometric Fm3m	radioactive

His coastal surveys included the charting of Jervis Bay and Port Macquarie (1819). In 1823, returning from Port Curtis, he explored Moreton Bay and 50 miles (80 km) up the Brisbane River. His reports resulted in penal settlements at Port Macquarie and Port Curtis.

From his return in 1812, Oxley had business interests; he was agent for companies and creditors, engaged in cattle raising, and was a breeder of prize sheep; he also served as bank director and agricultural adviser. On his expanded holdings he built his estate at Kirkham in 1815. Oxley was also active in the Bible Society, institutions for orphans, and the Philosophical Society and served as a magistrate and legislator. He died in straitened circumstances.

Oxnard, city, Ventura County, California, U.S., near the Pacific coast, between Los Angeles and Santa Barbara. Founded in 1898, it developed around a sugar-beet factory financed by Henry Oxnard. The surrounding alluvial plain was the basis for agricultural industries. With the development of harbour facilities at adjacent Port Hueneme and nearby military installations, the city grew rapidly and acquired diversified manufactures. Oxnard College opened in 1975. Oxnard Air Force Base is 5 miles (8 km) northeast. Oxnard is the headquarters of the offshore Channel Islands National Monument. Inc. 1903. Pop. (1986 est.) city, 130,800; Oxnard–Ventura metropolitan area (PMSA), 611,000.

oxpecker, also called TICKBIRD, either of the two species of the African genus *Buphagus,* of the family Sturnidae (order Passeriformes). Both species—the yellow-billed (*B. africanus*) and the red-billed (*B. erythrorhynchus*)—are brown birds 20 cm (8 inches) long, with wide bills, stiff tails, and sharp claws. They cling to cattle and big-game animals to remove ticks and maggots from their hides; when alarmed, the birds hiss, alerting their hosts to possible danger. Though they rid animals of pests, oxpeckers also take blood from the sores, which may be slow to heal.

Oxus River (Asia): *see* Amu Darya.

oxygen (O), nonmetallic chemical element of Group VIa of the periodic table. Oxygen is a colourless, odourless, tasteless gas, the most plentiful element in the Earth's crust; its most important compound is water.

Oxygen was discovered in about 1772 by a Swedish chemist, Carl Wilhelm Scheele, who obtained it by heating potassium nitrate, mercury(II) oxide, and many other substances. An English chemist, Joseph Priestley, independently discovered oxygen in 1774 by the thermal decomposition of mercury(II) oxide and published his findings the same year, three years before Scheele published. A French chemist, Antoine Lavoisier, first recognized the gas as an element (1775–77), coined its name, and (in opposition to the phlogiston theory) explained combustion as a union of oxygen with the burning material.

Occurrence, properties, and uses. The proportion of oxygen by volume in the atmosphere is 21 percent, by weight in seawater 85.7 percent, and in the Earth's crust 46.6 percent. (Certain recent figures suggest an even higher percentage of oxygen in seawater and in the Earth's crust.)

During respiration, animals and lower plants take oxygen from the atmosphere and return to it carbon dioxide, whereas by photosynthesis, higher (green) plants assimilate carbon dioxide in the presence of sunlight and evolve free oxygen. Almost all the free oxygen present in the atmosphere is the result of photosynthesis. About 3 parts of oxygen by volume dissolve in 100 parts of freshwater at 20° C (68° F) and slightly less than this in seawater. Dissolved oxygen is essential for respiration of fish and other marine life.

Below −183° C (−297° F), oxygen is a pale blue liquid; it becomes solid at about −218° C (−360° F). Gaseous oxygen on Earth and in the lower atmosphere consists almost entirely of molecules of two atoms, O_2. Triatomic oxygen, O_3, called ozone (*q.v.*), and monatomic oxygen, O, are more predominant in the upper atmosphere, where ozone shields the Earth from the Sun's ultraviolet radiation. Pure oxygen is 1.1 times heavier than air.

The chief source of commercial oxygen is the atmosphere, from which it is separated by liquefaction and by fractional distillation. Of the main components of air, oxygen has the highest boiling point and therefore is less volatile than nitrogen and argon. Since the 1970s commercial oxygen or oxygen-enriched air has gradually replaced ordinary air in steelmaking and other metallurgical processes and in the chemical industry for the manufacture of such oxidation-controlled chemicals as acetylene, ethylene oxide, and methanol. Medical applications of oxygen include use in oxygen tents, inhalators, and pediatric incubators. Oxygen-enriched gaseous anesthetics insure life support during general anesthesia. Oxygen is a significant element in a number of industries that use kilns. Oxygen in its liquid state is also used to fuel rocket engines.

Natural oxygen consists of a mixture of three stable isotopes: oxygen-16 (99.759 percent), oxygen-17 (0.037 percent), and oxygen-18 (0.204 percent). Four artificially prepared radioactive isotopes of mass numbers 14, 15, 19, and 20 are known. The longest lived, oxygen-15 (124-sec half-life), has been used to investigate respiration in mammals.

Compounds. Oxygen has a valence of two and forms a large range of covalently bonded compounds, among which are oxides of nonmetals, as water (H_2O), sulfur dioxide (SO_2), and carbon dioxide (CO_2); organic compounds such as alcohols, aldehydes, and carboxylic acids; common acids such as sulfuric (H_2SO_4), carbonic (H_2CO_3), and nitric (HNO_3); and corresponding salts, such as sodium sulfate (Na_2SO_4), sodium carbonate (Na_2CO_3), and sodium nitrate ($NaNO_3$). Oxygen is present as the oxide ion, O^{2-}, in the crystalline structure of solid metallic oxides such as calcium oxide, CaO; metallic superoxides, such as potassium superoxide, KO_2, contain the O_2^- ion, whereas metallic peroxides, such as barium peroxide, BaO_2, contain the O_2^{2-} ion. For further information about the various classes of oxygen compounds, *see* oxide; peroxide.

atomic number	8
atomic weight	15.9994
melting point	−218.4° C (−361.1° F)
boiling point	−183.0° C (−297.4° F)
density (1 atm, 0° C)	1.429 g/l
valence	2
electronic config.	2-6 or $1s^2 2s^2 2p^4$

oxygen cycle, circulation of oxygen in various forms through nature. Free in the air and dissolved in water, oxygen is second only to nitrogen in abundance among uncombined elements in the atmosphere. Plants and animals use oxygen to respire and return it to the air and water as carbon dioxide (CO_2). CO_2 is then taken up by algae and terrestrial green plants and converted into carbohydrates during the process of photosynthesis, oxygen being a byproduct. The waters of the world are the main oxygen generators of the biosphere; their algae are estimated to replace about 90 percent of all oxygen used. Oxygen is involved to some degree in all the other biogeochemical cycles.

Despite the burning of fossil fuel and the reduction of natural vegetation (on land and in the sea), the level of atmospheric oxygen appears to be relatively stable because of the increase in plant productivity resulting from agricultural advances worldwide.

oxygen group element, also called CHALCOGEN, any of the five chemical elements comprising Group VIa of the periodic classification—namely, oxygen (O), sulfur (S), selenium (Se), tellurium (Te), and polonium (Po).

A brief treatment of the oxygen group elements follows. For full treatment, *see* MACROPAEDIA: Chemical Elements. *See also* MICROPAEDIA for entries on each member of this group.

In cosmic abundance oxygen ranks fourth among the elements, after hydrogen, helium, and neon. In mass, however, it makes up approximately 20 percent of the Earth's lower atmosphere, about 46 percent of its solid crust, and nearly 90 percent of its waters. Sulfur is widely scattered throughout the universe, but is only ninth among all elements in total abundance. It accounts for about 12 percent of the mass of certain meteorites, but constitutes only from 0.03 to 0.06 percent of the Earth's crust. Selenium, tellurium, and polonium are much rarer than sulfur.

The chalcogens are distinguished by an electron configuration in which six electrons occupy the outermost shell. Any atom having such an electronic structure tends to form a stable shell of eight electrons by adding two more and producing an ion with a double negative charge. This tendency to form negatively charged ions is quantitatively expressed in terms of two properties: electronegativity (the assumption of a partial negative charge when present in covalent combination) and electron affinity (the ability of a neutral atom to take up an electron and form a negative ion). With the exception of fluorine, oxygen has the highest electronegativity and electron affinity of any known element. Both these properties decrease in intensity among the other chalcogens with increasing atomic number and mass.

Another property common to all the chalcogens except polonium is catenation—*i.e.,* the bonding of an atom to an identical atom. Sulfur manifests this mode of combination most distinctly.

oxyntic cell (anatomy): *see* parietal cell.

Oxyrhynchus, also spelled OXYRYNKHOS, ancient capital of the 19th Upper Egyptian nome (province), on the western edge of the Nile Valley, in al-Minyā *muḥāfaẓah* (governorate). It is best-known for the numerous papyri uncovered there, first by B.P. Grenfell and A.S. Hunt (1897–1907), and later by Italian scholars early in the 20th century. The papyri—dating from about 250 BC to AD 700 and written primarily in Greek and Latin but also in demotic Egyptian, Coptic, Hebrew, Syriac, and Arabic—include religious texts (*e.g.,* miracles of Sarapis, early copies of the New Testament, and such apocryphal books as the *Gospel of Thomas*) and also masterpieces of Greek classical literature. Among the papyri were texts once considered lost, including selections of early Greek lyric poetry, Pindar, dramatists such as Menander and Callimachus, and innumerable prose works of oratory or history, such as those of the Oxyrhynchus historian. The modern village of al-Bahnasā is located on the site.

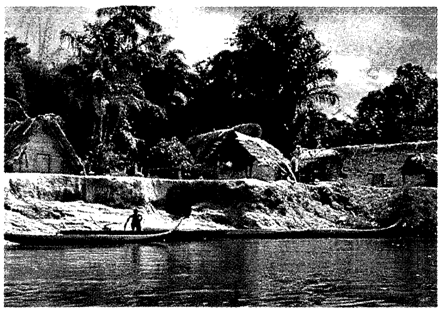
oxytocin, hormone used clinically to help begin or to continue labour, to control bleeding following delivery, and to stimulate the secretion of breast milk. Oxytocin was first synthesized (along with the related antidiuretic hormone [ADH]) by Vincent du Vigneaud in 1953, and he received the Nobel Prize for Chemistry in 1955 for this work. Synthetic oxytocin has since become widely used in obstetric practice.

Natural oxytocin is secreted by the posterior pituitary gland, which holds and secretes oxytocin produced by the hypothalamus. Oxytocin causes milk to be ejected from the breasts during lactation; the amount of oxytocin produced naturally, however, has little effect on uterine contractions and does not stimulate labour. When synthetic oxytocin is infused in larger amounts, however, it causes smooth muscle in the wall of the uterus to contract and initiate the process of labour. Smooth muscle cells in the uterus contain proteins that bind specifically to oxytocin; the number of these oxytocin receptors increases during late pregnancy. Oxytocin's effect on uterine smooth muscle is dependent on the presence of estrogen, and for that reason oxytocin has little effect on the uterus during the early stages of pregnancy; near term, however, it is very effective and successfully produces uterine contractions in 80–90 percent of the women to whom it has been administered.

Oya Current, Japanese OYASHIO, also called KURIL CURRENT, surface oceanic current flowing southwest along the Kamchatka Peninsula and the Kuril Islands. Meeting the Kuro Current Extension east of Japan, part of the cold, less saline water of the Oya Current sinks below the Kuro Current and continues southward; the confluence of these currents is marked by fogbanks. The Oya Current is thought to transport about 530,000,000 cubic feet (15,000,000 cubic m) of water per second.

Oyama, city, Tochigi *ken* (prefecture), Honshu, Japan, on the Omoi River. A castle town during the Middle Ages, it became a post station and river port during the Tokugawa era (1603–1867). The transport centre of southern Tochigi prefecture, Oyama is the hub of three major railways. Communication facilities and proximity to Tokyo made the city an industrial suburb of the Tokyo–Yokohama metropolitan area after World War II. Major industries include the manufacture of mining and transport equipment and the refining of aluminum. The commercial sector of the economy has shown only slow growth; dried gourd shavings are a special product of the surrounding region. The Oyama Radio Transmitting Station, one of the largest in the Orient, is located outside the city. Pop. (1986 est.) 135,218.

Oyapock River, Portuguese RIO OIAPOQUE, river in northeastern South America. It rises in the Tumuc-Humac Mountains and flows northeast for 311 miles (500 km) to empty into the Atlantic near Cape Orange. It forms the border between French Guiana and the Brazilian territory of Amapá. Near its mouth are the ports of Saint-Georges, French Guiana; and Oiapoque and Ponta dos Índios, Braz.



Saramacao, an Indian village near the mouth of the Oyapock River
P. Braun

Oyem, town, northern Gabon, on a plateau at an elevation of about 3,000 feet (900 m). It is an administrative and transport centre for an agricultural area. Cocoa and coffee, grown on mixed plantations, are the most important cash crops and are trucked northwest to the Cameroon ports of Kribi and Douala for export. Rubber and potatoes are also cultivated. Oyem has a hospital, Roman Catholic and Protestant churches, an agricultural school, a government secondary school, and a customs station. Pop. (1985 est.) 89,600.

Oyo, state, western Nigeria, comprising former Oyo and Ibadan provinces carved out of the former Western State in 1976. With an area of 14,558 square miles (37,705 square km), it is bounded by the states of Kwara on the north, Ogun on the south, and Ondo on the east, and by the Republic of Benin on the west. The state has tropical rain forest in the southeast and a "derived" savanna in the north that is largely the result of clearing and burning the former forest cover to provide land for cultivation. The Ogun and the Oshun are the most important rivers. Oyo State is inhabited mainly by the Yoruba people.

The economy of Oyo is based chiefly on agriculture and handicrafts. Agricultural products include yams, corn (maize), cassava, beans, millet, plantains, tobacco, cocoa, palm oil and palm kernels, cotton, kola nuts, indigo, and fruits. The state is also noted for its cottage industries consisting of cotton spinning, weaving, dyeing, leatherworking (sheep and goat skins), wood carving, and mat making. Industries in Ibadan, the state capital and second largest city in Nigeria, include a cannery, a brewery, a publishing industry, a tobacco processing factory, wood and steel furniture factory, and a motor vehicle assembly plant. Oshogbu has a textile industry, a food-processing plant, and a steel-rolling mill. Deposits of tin, columbite, gold, and marble are worked. Ibadan is the site of the International Institute of Tropical Agriculture, the Cocoa Research Institute of Nigeria, and the Federal Agricultural Research Institute. Among the state's tourist attractions are the Ibadan University Zoo, the Agodi Zoological Garden, the Mbari Arts Center at Oshogbo, and the residential palaces of Yoruba rulers in Ilesha, Oyo, Ife-lodun, and Ogbomoso. There are universities at Ife-lodun and Ibadan, a college of arts and sciences at Ife-lodun, a college of education at Ilesha, and a number of teacher training colleges. The Lagos–Ibadan highway links the northern and southern parts of the state. Pop. (1984 est.) 8,732,300.

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

Oyo, town, central Oyo State, southwestern Nigeria. It was declared the new seat of the *alafin* of Oyo (the political leader of all Yoruba people) by Alafin Atiba in the mid-1830s, after Old Oyo, also called Katunga (80 miles [129 km] north-northeast), the capital of the Oyo Empire, was completely destroyed by Fulani conquerors from Ilorin (60 miles [97 km] northeast). New Oyo was aligned with Ibadan (32 miles [51 km] south) in the mid-19th-century Yoruba civil wars. Following an invasion by Dahomeyan forces in 1887, the *alafin* of Oyo joined with Lagos against the French and, in the treaty of 1888, placed all of Yorubaland under British protection.

The *alafin,* now a traditional ruler, has only nominal sovereignty over other traditional Yoruba chiefs. From the *ida oranyan* ("sword of state") given to him by the traditional *oni* ("king") of Ife (who is the spiritual head of the Yoruba people), the *alifin* derives the spiritual authority for his rule. At nearby Koso is the Shango shrine to the Yoruba god of thunder and lightning, which plays a ceremonial role in the installation of a new *alafin.*

The economy of modern Oyo is based chiefly on agriculture and handicrafts. Products include tobacco (for the cigarette factory at Ibadan), teak, and cotton. The town is a traditional centre of cotton spinning, weaving, and dyeing (with locally grown indigo). It is also famous for carved calabashes (gourds), leatherwork (especially cushions) in goatskins and sheepskins, wood carving, and mat making. Local trade is primarily in yams, corn (maize), sorghum, cassava, poultry, okra, and beans.

By the 1860s a Yoruba Mission (Anglican) was established in Oyo, which is now the site of St. Andrew's College (founded 1897), one of the oldest teacher-training institutes in Nigeria. The town also has secondary schools, a government vocational centre, and several hospitals. It lies on the main highway north from Lagos city and is a hub for local roads serving the state. Pop. (1983 est.) 185,300.

Oyo empire, Yoruba state north of Lagos, in present-day Nigeria, that dominated, during its apogee (1650–1750), most of the countries between the Volta River in the west and the Niger River in the east.

According to traditions, Oyo derived from a great Yoruba ancestor and hero, Oduduwa, who came from the east to settle at Ile-Ife and whose son became the first *alafin,* or ruler, of Oyo. Linguistic evidence suggests that two waves of immigrants came into Yorubaland between 700 and 1000, the second settling at Oyo in the open country north of the Guinea forest. This second state became preeminent among all Yoruba states because of its favourable trading position, its natural resources, and the industry of its inhabitants.

Early in the 16th century Oyo was a minor state, powerless before its northern neighbours Borgu and Nupe—by whom it was conquered in 1550. The power of Oyo was already growing, however, by the end of the century, thanks to the *alafin* Orompoto, who used the wealth derived from trade to establish a cavalry force and to maintain a trained army.

Oyo subjugated the kingdom of Dahomey in the west in two phases (1724–30, 1738–48) and traded with European merchants on the coast through the port of Ajase (Porto-Novo). As Oyo's wealth increased so did its leaders' political options; some wished to concentrate on amassing wealth, while others advocated the use of wealth for territorial expansion. This difference was not resolved until the *alafin* Abiodun (reigned approximately 1770–89) conquered his opponents in a bitter civil war and pursued a policy of economic development based primarily on the coastal trade with European merchants.

Abiodun's neglect of everything but the economy weakened the army, and thus the means by which the central government maintained control. His successor, the *alafin* Awole, inherited local revolts, an administration tenuously maintained by a complex system of public service, and a decline in the power of tributary chiefs. The decline was exacerbated by quarrels between the Alafin and his advisers; it continued throughout the 18th century and into the 19th, when Oyo began to lose control of its trade routes to the coast. Oyo was invaded by the newly risen Fon of Dahomey, and soon after 1800 it was captured by militant Fulani Muslims from Hausaland in the northeast.

Ōyōmeigaku, one of the three major schools of Neo-Confucianism that developed in Japan during the Tokugawa period (1603–1867). *See* Neo-Confucianism.

Oyono, Ferdinand Léopold (b. Sept. 14, 1929, Ngoulemakong, Cameroon), African statesman, actor, and comic writer whose two best-known works—*Une Vie de boy* (1956; *Houseboy*) and *Le Vieux Nègre et la médaille* (1956; *The Old Man and the Medal*), written while he was studying law and administration in Paris—reflect the growing sentiment of anticolonialism of the 1950s.

During the 1950s, while writing his first two books, Oyono worked in Paris as an actor on stage and on television. In 1960, however, he returned to Cameroon and entered the diplomatic corps, becoming special envoy in 1961–62 to Guinea, Mali, Senegal, and Morocco. Between 1963 to 1975 he was ambassador to Liberia, the Benelux countries, the European Common Market, France, Italy, Tunisia, Morocco, and Algeria. He then served the United Nations (UN) as chairman of the Security Council, of the UNICEF Board, of the Security Council's Political Committee, and of the Council on Namibia. After serving as ambassador to the United Kingdom (1984–85), Oyono returned to Cameroon to take posts in the Cabinet.

Oyono's first book, *Houseboy,* is written in the form of a diary. It depicts honestly but with humour the often brutal life of a houseboy in the service of a French commandant. *The Old Man and the Medal* satirizes colonialism through the eyes of a God-fearing and loyal old villager who completely reverses his opinion of the white man on the same day that he is to receive a medal for his "service" (sacrifices of his sons and land) to France. In both novels Oyono's indictment of paternalistic missionaries and administrators is clear. He perfected an ironic tone that conveys the full tragedy and pain of the lives of the common people, usually illiterate peasant farmers, who naively accept the doctrines of French colonialism. In mocking the foibles of the self-deluded colonial masters as well as the simple villagers, Oyono often paints hilarious portraits, putting his early experience as an actor in theatrical farce to good use. A third novel, *Chemin d'Europe* (1960; "The Road from Europe"), tackles the somewhat different problem of a young man who is better educated than his peers but still lacks the skills needed to assure him of success.

Oyono-Mbia, Guillaume (b. 1939, Mvoutessi, Cameroon), African dramatist and short-story writer, one of bilingual Cameroon's few writers to achieve success both in French and in English. Oyono-Mbia attended the Collège Evangélique at Limbamba and then went to England, graduating from the University of Keele in 1968. With skills often compared to those of Molière, Oyono-Mbia exercised an unusual ability to create comedies that play well both on stage and on radio. Among them are *Trois prétendants . . . un mari* (1962; *Three Suitors . . . One Husband*), *Until Further Notice* (1967), *Notre fille ne se mariera pas!* (1969; "Our Daughter Will Not Marry!"), and *His Excellency's Train* (1969), all written on his favourite theme of youth versus adult, modernity versus tradition.

In the 1970s his penchant for satire was also evident in three volumes of amusing tales of life in his native village, *Chroniques de Mvoutessi* (1971–72; "Chronicles of Mvoutessi"). From 1969 Oyono-Mbia was professor of literature at the University of Yaoundé in Cameroon. Between 1972 and 1975 he was chief administrative officer in the Office of Cultural Affairs in the Ministry of Information and Culture.

Oyrat, also spelled OIRAT, any of the peoples speaking western dialects of the Mongol language group.

In the 13th century the western Mongols were enemies of the eastern Mongols of Genghis Khan's empire. During the following centuries the western Mongols maintained a separate existence under a confederation known as the Dörben Oyrat (Four Allies, from which the name Oyrat is derived); at times they were allies, at times enemies, of the eastern Mongols in the Genghis Khan line. Part of the western Mongols remained in their homeland, northern Sinkiang, or Dzungaria, and western Mongolia. Another part of the Oyrat confederation, including all or some of the Torgut, Khoshut, Dorbet (or Derbet), and other groups, moved across southern Siberia to the southern Urals at the beginning of the 17th century. From there they moved to the lower Volga; and for a century and a half, until 1771, they lived as nomads both to the east and to the west of the lower Volga. During the course of the 18th century they were absorbed by the Russian Empire, which was then expanding to the south and east. In 1771 those on the left bank, to the east of the Volga, returned to China. The right-bank Kalmyk (*q.v.*), comprising the contemporary Torgut, Dorbet, and Buzawa, remained in Russia.

Considerable numbers of Oyrat still live in the Sinkiang and Tsinghai regions of northwest China, where an estimated 100,000 speak Oyrat dialects; another 50,000 speakers live in the western portions of the Mongolian People's Republic, where they have been dominated by the numerically preponderant Khalkha.

Oyrot autonomous oblast (Russian S.F.S.R.): *see* Gorno-Altay autonomous oblast.

Øystein I MAGNUSSON (Norwegian king): *see* Eystein I Magnusson.

oyster, any member of the families Ostreidae (true oysters) or Aviculidae (pearl oysters), bivalve mollusks found in temperate and warm coastal waters of all oceans. Bivalves known as thorny oysters (*Spondylus*) and saddle oysters (*Anomia*) are sometimes included in the group.

True oysters have been cultivated as food since pre-Christian times. Pearl oysters also have long been valued for the precious pearls that develop in them. (*See also* pearl.)

The two valves of the oyster shell, which differ in shape, have rough surfaces that are often a dirty gray. The upper valve is convex, or higher at the middle than at the edges. The lower valve, fixed to the bottom or to another surface, is larger, has smoother edges, and is rather flat. The inner surfaces of both valves are smooth and white.

European flat oyster (*Ostrea edulis*)
G. Tomsich—Photo Researchers/EB Inc.

The valves are held together at their narrow ends by an elastic ligament. A large central muscle serves to close the valve against the pull of the ligament. As the valves are held slightly open, tiny hairlike structures (cilia) draw water inward by means of wavelike motions. Two to three gallons may pass through the oyster in an hour. Minute organic particles, filtered from the water, serve as food.

Oysters, in turn, are eaten by birds, starfishes, and snails, as well as by fishes, including skates. The oyster drill (*Urosalpinx cinenea*), a widely occurring snail, drills a tiny hole through the oyster shell with its tongue, then sucks out the living tissue.

Like other bivalves, most oysters are either male or female, although hermaphroditism also occurs. *Ostrea edulis* exhibits a phenomenon called rhythmical hermaphroditism, in which an individual alternates sexes seasonally or with changes in water temperature. Oysters breed in the summer. The eggs of some species are released into the water before fertilization by the sperm; the eggs of others are fertilized within the female. The young are released as ciliated spheres known collectively as spat, which swim for several days before attaching themselves permanently to a site. Edible oysters are ready for harvesting in three to five years.

True oysters (family Ostreidae) include species of *Ostrea, Crassostrea,* and *Pycnodonte.* Common *Ostrea* species include the European flat, or edible, oyster, *O. edulis;* the Olympia oyster, *O. lurida;* and *O. frons. Crassostrea* species include the Portuguese oyster, *C. angulata;* the North American, or Virginia, oyster, *C. virginica;* and the Japanese oyster, *C. gigas.* Pearl oysters (family Aviculidae) are mostly of the genus *Meleagrina,* sometimes called *Pinctada* or *Margaritifera.*

O. edulis occurs from the coast of Norway to waters near Morocco, through the Mediterranean Sea, and into the Black Sea. It is hermaphroditic and attains lengths of about 8 cm (about 3 inches). *O. lurida,* of the Pacific coastal waters of North America, grows to about 7.5 cm (3 inches). *C. virginica,* native to the Gulf of Saint Lawrence to the West Indies and about 15 cm (6 inches) long, has been introduced into Pacific coastal waters of North America. Up to 50,000,000 eggs may be released by the female at one time. Commercially, *C. virginica* is the most important North American mollusk. *C. angulata* occurs in coastal waters of western Europe. *C. gigas,* of Japanese coastal waters, is among the largest oysters, attaining lengths of about 30 cm (1 foot). Like *C. virginica,* the Sydney rock oyster (*Crassostrea commercialis*) changes sex; born male, it changes to female later in life. It is the most economically important Australian edible oyster.

Oysters are shucked and eaten raw, cooked, canned, or smoked; small quantities are frozen. Popular varieties include the blue point and lynnhaven—forms of *C. virginica* (harvested, respectively, from the Blue Point, Long Island, and Lynnhaven Bay, Va., regions); as well as the colchester of Britain and the marennes of France. The colchester and marennes are forms of *O. edulis.*

Pearls are formed in oysters by the accumulation of nacre, the material lining the oyster shell, around a solid piece of foreign matter that has become lodged inside the shell. Pearls formed in edible oysters are lustreless and of no value. The best natural pearls occur in a few Oriental species, particularly *Meleagrina vulgaris,* native to the Persian Gulf. This species is found mainly at depths of 8 to 20 fathoms (48 to 120 feet). Pearls are taken mostly from oysters more than five years old. Cultured pearls are grown around bits of mother-of-pearl inserted manually into the oyster. Most cultured pearls are grown in Japanese or Australian coastal waters.

Oyster Bay, town (urbanized township), Nassau County, southeastern New York, U.S., that occupies 108 square miles (280 square km), extending from the north to south shores on central Long Island, and comprises more than 30 incorporated villages and unincorporated communities. The first settlers, led by Peter Wright, Samuel Mayo, and the Reverend William L. Leverich, arrived at Oyster Bay Harbor from Rhode Island in 1653. The first town meeting was held in 1660, and the town was granted a governor's patent in 1667. During the Revolutionary War, Raynham Hall (1738, now a museum) served as British Army headquarters, and Sally Townsend, who lived there, provided information that led to the capture of Major John André, a British spy. Notable colonial landmarks in the area include Wisteria House at Oyster Bay, the Friends Meeting House at Matinecock, and Tryon House and Carman Homestead at Massapequa Park. By the early 19th century the town was essentially rural, although the whaling industry flourished. After the arrival of the Long Island Rail Road in 1836, followed by the trolley car at the turn of the century, a number of large estates were built by financial and industrial tycoons. Oyster Bay gained fame through its most notable resident, President Theodore Roosevelt, whose three-story mansion "Sagamore Hill" (built 1880 at Cove Neck) became the summer White House (1901–09); it is now a national historic site. The Theodore Roosevelt Memorial and Trailside Museum are nearby, and Roosevelt's grave is in the adjacent Young's Cemetery.

The town continued to be almost entirely rural-residential until it experienced a pre-World War II growth of the aircraft industry at Bethpage and Farmingdale. Oyster Bay now has a broad-based diversified economy with planned industrial parks at Bethpage, Farmingdale, Hicksville, Jericho, Plainview, Syosset, and Woodbury. Educational institutions in the town include the State University of New York Agricultural and Technical College (established 1912) at Farmingdale, the State University of New York College (1968) at Old Westbury, and the C.W. Post Center of Long Island University (1955) at Brookville. The Nassau County Charter of 1936 preserved the rights of existing incorporated villages but denied the right of unincorporated communities to incorporate. Villages include Massapequa Park (Inc. 1931) and Oyster Bay Cove (Inc. 1931). Important unincorporated communities are Oyster Bay "village," Jericho, Massapequa, East Massapequa, Hicksville, Plainview, and South Farmingdale. Pop. (1984 est.) 312,-268.

oyster plant: *see* salsify.

oystercatcher, any of several shorebirds, notable for their long, flattened, orange-red bills, constituting the genus *Haematopus,* family Haematopodidae. Found in temperate to tropical parts of the world, oystercatchers are stout-bodied birds measuring 40 to 50 cm (16 to 20 inches) long, with thick, pinkish legs; long, pointed wings; and a long, wedge-shaped bill. Their plumage varies from black and white,

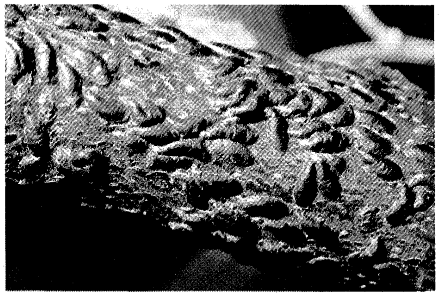
European oystercatcher (*Haematopus ostralegus*)
Stephen Dalton—EB Inc.

including a bold white wing patch, to entirely black.

Oystercatchers feed largely on mollusks (such as oysters, clams, and mussels), attacking them as the tide ebbs, when their shells are exposed and still partially open. These birds nest on the ground, usually laying their two to four eggs in the sand.

There are about seven species. Among them is the European oystercatcher (*H. ostralegus*), of Europe, Asia, and Africa, which is black above and white beneath. The American oystercatcher (*H. palliatus*), of coastal regions in the Western Hemisphere, is dark above, with a black head and neck, and white below. The black oystercatcher (*H. bachmani*), of western North America, and the sooty oystercatcher (*H. fuliginosus*), of Australia, are dark except for the pinkish legs.

oystershell scale (*Lepidosaphes ulmi*), an insect (order Homoptera) whose protective covering resembles a miniature oystershell. The oystershell scale inflicts great damage on the trees and shrubs on which it lives. Control is by dormant spray and natural enemies—*i.e.,* birds, mites, and parasitic wasps.



Oystershell scale (*Lepidosaphes ulmi*)
E.S. Ross

The life histories of the oystershell scale, as well as the cover of the adult female, vary according to the host. The oystershell scale is found on lilacs, beeches, maples, willows, and many ornamentals. The oystershell scale occurs in almost every state in the United States and was probably introduced from Europe.

Oz, Amos (b. May 4, 1939, Jerusalem), Israeli novelist and short-story writer. He also edited the influential Israeli periodical *Siach lochamium* ("The Seventh Day").

Oz was educated at the Hebrew University of Jerusalem and at the University of Oxford. He served in the Israeli army (1957–60, 1967, and 1973) and, in addition to writing, worked as a part-time schoolteacher and labourer.

Oz's symbolic, poetic novels reflect the splits and strains in Israeli life. Locked in conflict are the traditions of intellect and the demands of the flesh, reality and fantasy, rural Zionism and the longing for European urbanity, and the values of the founding settlers and the perceptions of their skeptical offspring. Unable to share the optimistic outlook and ideological certainties of Israel's founding generation, Oz presents an ironic view of reality in which Israeli society is unapologetically scrutinized. His works include *Maʿkom aḥer* (1966; *Elsewhere, Perhaps*), *Mikhaʾel sheli* (1968; *My Michael*), *Ad mʿavet* (1971; *Unto Death*), *La-gaʿat ba-mayim, la-gaʿat ba-ruwaḥ* (1973; *Touch the Water, Touch the Wind*), *Artsot ha-tan* (1976; *Where the Jackals Howl, and Other Stories*), *Po ya-sham be-Erets-Yiśraʾel bi-setay* (1982; *In the Land of Israel*), and *Menu hah nekhonah* (1982; *A Perfect Peace*).

Öz Beg, also spelled UZBEK, in full GHIYATH AL-DIN MUHAMMAD ÖZ BEG (fl. 14th century), Mongol leader and khan of the Golden Horde, or Kipchak empire, of southern Russia, under whom it attained its greatest power; he reigned from 1313 to 1341. Öz Beg was a convert to Islām, but he also welcomed Christian missionaries from western Europe into his realm. Öz Beg encouraged the predominance of the princes of Moscow among his Christian vassals; his name survives today in that of the Uzbek people of the Soviet Union.

Ozaki Kōyō, pseudonym of OZAKI TOKUTARŌ (b. Jan. 28, 1869, Edo [now Tokyo]—d. Oct. 30, 1903, Tokyo), novelist, essayist, and haiku poet, one of the pioneers of modern Japanese literature.

In 1885, with a group of friends, he formed the *Kenyūsha,* a magazine and literary association that exercised a major influence in the development of the Japanese novel for nearly 20 years. Through his study of Tokugawa-period (1603–1867) literature, he led a revival of interest in the 17th-century writer Ihara Saikaku, whose sharp perceptions he blended with his own poetic aesthetic to create a style of romantic realism. Kōyō was active in the movement to create a new colloquial literary language. His elaborate style was well-suited to love themes and descriptions of women. Early fictional works such as *Ninin bikuni iro zange* (1889; "Amorous Confessions of Two Nuns") and *Kyara makura* (1890; "The Perfumed Pillow") reflect his interest in 17th- and 18th-century literature. Later he displayed a more realistic tendency in *Tajō takon* (1896; "Tears and Regrets") and *Kokoro* (1903; "The Heart"). His masterpiece was the novel *Konjiki yasha* (1897–1902; *The Golden Demon*), which portrayed the social cost of modernization when the power of money wins out over human affection and social responsibility. Kōyō's guidance was eagerly sought by young writers. Two of his best-known disciples were the romantic-short-story writer Izumi Kyōka and the naturalistic novelist Tokuda Shūsei.

Ozaki Yukio (b. Dec. 24, 1858, Kanagawa, Sagami province, Japan—d. Oct. 6, 1954, Zushi, Kanagawa prefecture), noted democratic politician who was elected to the Japanese House of Representatives a total of 25 times and is considered the "father of parliamentary politics" in that country.

Originally a journalist, Ozaki joined the government as a follower of the politician and later prime minister Ōkuma Shigenobu. When Ōkuma resigned in 1881 as a result of the Cabinet's failure to adopt his radical proposals for the creation of a new constitution, Ozaki followed him into opposition. In 1898 Ozaki was back in the government, serving as education minister in the new, and short-lived, Ōkuma Cabinet. He was forced to resign, however, after a slip of the tongue in which he referred to the imperial Japanese state as a republic. From 1903 to 1912 he served as mayor of Tokyo, and in 1912 he led the rank-and-file members of the Friends of Constitutional Government (Rikken Seiyūkai) party into the streets to rally popular support against the oligarchical Cabinet of the former general Katsura Tarō. Within a few months the movement that Ozaki had helped form resulted in the fall of Katsura's government and the gradual creation of a cabinet responsible to the majority party in the Japanese Diet, or parliament.

In 1915, while serving as minister of justice in Ōkuma's second Cabinet, Ozaki denounced the bribery and corruption carried on by Ōkuma during the election. He thereafter refused to affiliate with any faction or party but remained until his death a powerful force, always fighting for the expansion of democratic politics in Japan. He was especially active in the struggle for universal manhood suffrage, which was established in 1925.

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Ozamiz, city, on Zamboanga peninsula, northwestern Mindanao, Philippines. The city lies on Panguil Bay, an extension of Iligan Bay of the Bohol (Mindanao) Sea. It was the site of Spanish fortifications dating from 1574, with one extant fort surviving from 1707. Incorporated in 1948, it is the largest population centre in the area. The city is an active port and an important centre for processing coconuts. It has an airport. Pop. (1980) 77,832.

Ozanam, Antoine Frédéric (b. April 23, 1813, Milan—d. Sept. 8, 1853, Marseille), French historian, lawyer, and scholar who founded the Society of St. Vincent de Paul.

While a student at a Roman Catholic school in Lyon, he underwent a "crisis of doubt" but came through the experience with a deep-rooted belief in both Catholicism and the religious necessity for charity. In Paris, where he went to study law, Ozanam met the leaders of the French Catholic revival.

In 1833 he and fellow students at the Sorbonne organized a Conference of Charity to help the poor. Two years later, the group adopted the formal title and rules of the Society of St. Vincent de Paul, now highly regarded for its charitable acts. Before Ozanam's death the society numbered about 2,000 centres in 29 countries.

Ozanam was also known for his brilliant papers on law, literature, history, and social doctrine. Among his principal writings are *Dante et la philosophie catholique au XIII^e siècle* (1845; "Dante and Catholic Philosophy in the 13th Century"); *Les Poètes franciscains en Italie au XIII^e siècle* (1852; "Franciscan Poets in Italy in the 13th Century"), an edition of early Franciscan poetry; and *La Civilisation chrétienne chez les Francs* (1849; "Christian Civilization Among the Franks").

Ozanam was notable for his insistence that charity be extended to non-Catholics and to other countries, at the time an unusual belief. He encouraged Roman Catholics to play a part in the evolution of the democratic state, and he remained a clear-sighted theorist of social reform while opposing both the abuses of laissez-faire economic liberalism and any recourse to socialism. His exposition of Roman Catholic social doctrine in his lectures while teaching commercial law at Lyons foreshadowed in their authoritative orthodoxy Pope Leo XIII's encyclical *Rerum novarum* of 1891. The cause for Ozanam's beatification was presented in 1923.

Ozark, city, seat of Dale county, southeastern Alabama, U.S. It was known as Woodshop until renamed in 1851 for the Ozark Indians. Following World War II, its economy was boosted by the expansion of nearby Fort Rucker as an aviation centre, a complex that includes the U.S. Army Aviation Center and Aviation School and the Army Aviation Museum. Ozark is a shipping centre for livestock, peanuts (groundnuts), pecans, corn (maize), cotton, and timber. It is the site of the Alabama Aviation and Technical College (1955). Inc. 1870. Pop. (1988 est.) 14,979.

Ozark Mountains, also called OZARK PLATEAU, heavily forested group of highlands in the south-central United States, extending southwestward from St. Louis, Mo., to the Arkansas River. The mountains occupy an area of about 50,000 square miles (130,000 square km), of which 33,000 square miles (85,500 square km) are in Missouri, 13,000 square miles (33,700 square km) in northern Arkansas, and the remainder in southern Illinois and southeastern Kansas. The Ozarks and the adjacent Ouachita Mountains represent the only large area of rugged topography between the Appalachians and the Rockies. The highest peaks, many exceeding 2,000 feet (600 m), are in the Boston Mountains in Arkansas. The highest point in Missouri is Taum Sauk Mountain (1,772 feet [540 m]), west of Ironton, in the St. Francois Mountains. The Ozark region, characterized by many underground streams and springs, is drained by the Osage, Gasconade, White, and Black rivers. Lake of the Ozarks, impounded by Bagnell Dam on the Osage River, provides power and recreation facilities. Taneycomo Lake, Bull Shoals Lake, and Table Rock State Park also are recreation areas.

Tourism, one of the region's chief industries, was given impetus by Harold Bell Wright's novel *The Shepherd of the Hills* (1907), which romanticized the Missouri Ozarks. Other economic assets include timber (mainly hardwoods), agriculture (livestock, fruit, and truck farming), and lead and zinc mining.

The word Ozark is probably a corruption of Aux Arc, the name of a French trading post established in the region in the 1700s.

Ozark National Forest, national forest embracing parts of the Ouachita and Boston mountains in northwestern Arkansas, U.S. It is drained by tributaries of the Arkansas River and surrounded by large reservoirs. Established in 1908, it covers a total area of 2,339 square miles (6,058 square km). Apart from its main section (devoted primarily to timber, watershed, and wildlife protection), there are five smaller divisions: Magazine Mountain, Arkansas' highest point, 2,753 feet (839 m); Boston Mountain, encompassing Devil's Den State Park; Lake Wedington; Henry Koen Experimental Forest; and Sylamore (Blanchard Springs). Headquarters are at Russellville.

ozarkodiniform, conodont, or small fossil that is toothlike in form and structure, that has a prominent, centrally located denticle flanked on either side by smaller, less pointed denticles. In some forms the row of denticles may be straight, whereas in others it is curved. Ozarkodiniforms are especially useful as index, or guide, fossils in studies of the Silurian period (438 to 408 million years ago).

Ozarks, Lake of the, lake in south-central Missouri, U.S., one of the largest man-made lakes in the United States. It is impounded by Bagnell Dam, built (1931) across the Osage River to provide hydroelectric power for the St. Louis area. Covering an area of 93 square miles (242 square km), the lake is 125 miles (200 km) long and has a shoreline of about 1,300 miles (2,100 km). In the scenic Ozark Mountains, the lake, with facilities for fishing and water sports, is a popular recreation and resort area. There are several limestone caverns nearby, and Lake of the Ozarks State Park includes most of the Grand Glaize arm of the lake, with 89 miles (143 km) of shoreline. The Harry S. Truman Dam and Reservoir, completed in 1981, impounds the Osage and Grand rivers to further extend facilities at the lake's western end.

Ozawa, Seiji (b. Sept. 1, 1935, Hoten, Manchukuo), Japanese American conductor, especially noted for his energetic style and his sweeping performances of 19th-century Western symphonic works.

Ozawa evinced interest in Western music as a child in Japan and hoped to become a pianist. At the age of 16, however, he sustained injuries to his hands, and turned then to conducting, studying with Hideo Saito at the Toho School in Tokyo. After conducting with Japanese orchestras, in 1959 he went to Europe, where he won the Besançon International Conductors' Competition. During the following summer he studied under Charles Munch at the Berkshire Music Festival in the United States, where he won the Koussevitzky Prize. At that time he began a long and fruitful association with the Boston Symphony Orchestra. After a further year of study with Herbert von Karajan in Berlin, Ozawa was engaged as an assistant conductor of the New York Philharmonic by Leonard Bernstein. Subsequently, he was music director of the Ravinia Festival in Chicago (1964–68). He became music director of the Toronto Symphony Orchestra in 1965 and of the San Francisco Symphony Orchestra in 1970. In 1973 he was appointed conductor and music director of the Boston Symphony Orchestra, for years the exclusive preserve of European conductors.

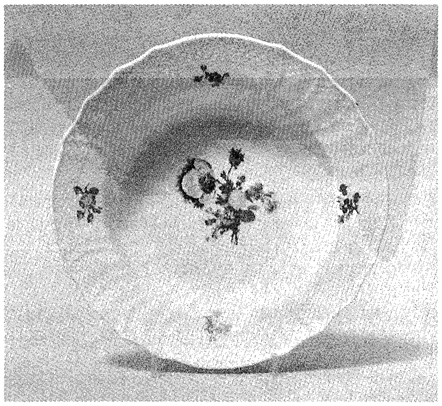
Ozenfant, Amédée (b. April 15, 1886, Saint-Quentin, Fr.—d. May 4, 1966, Cannes), French painter and art theoretician who cofounded the 20th-century art movement known as Purism.

Ozenfant studied art in his hometown and in 1906 went to Paris to study painting and architecture at the Académie de La Palette, where he was influenced by Pointillism. He became enamoured of Cubism, and in 1915 he founded with Max Jacob and Guillaume Apollinaire the review *L'Élan,* in which they touted the movement's principles. By 1917, however, Ozenfant had become disillusioned with Cubism, feeling that it had sacrificed its original purity and rigour and had become instead a mere decorative vehicle. He became associated with Le Corbusier, and within a year they formulated and published the manifesto of what they called Purism in *Après le Cubisme* (1918; "After Cubism"). In 1919 they founded the avant-garde review *L'Esprit Nouveau,* in which they explored the sources and directions of contemporary art. Ozenfant's definitive work on this subject, the two-volume *L'Art* (*The Foundations of Modern Art*) was published in 1928. From 1931 to 1938 he worked on a massive figural composition done in the Purist style and entitled "Vie" ("Life"). Ozenfant moved to London in 1935 and founded there the Ozenfant School of Fine Arts, which he relocated to New York City three years later. He returned to France in 1955.

As a theoretician Ozenfant advanced the principles of order, rationality, and precision and called for a new classicism based upon the aesthetic of modern technology. His own painting stressed clarity, serenity, and economy of means; in his still lifes the objects are reduced to flat planes of colour existing in a rigid architectonic framework.

Ozias (king of Judah): *see* Uzziah.

ozier pattern, in tableware, molded basket-weave pattern produced in Germany in the 1730s on Meissen porcelain tableware. It was probably one of the numerous inventions of the celebrated modeler Johann Joachim Kändler. There are four basic types of ozier molding: the *ordinair-ozier* ("ordinary ozier"), a kind of zigzag basket weave; the *alt-ozier* ("old ozier"), which has radial ribs; the *neu-ozier* ("new ozier"), the ribs of which resemble the curves of an *S,* appearing around 1742; and the *Brühlsches Allerei-Dessin* ("Brühl's varied design"), a pattern of basketwork and molded motifs, such as shells and flowers, surrounded by Rococo scrollwork. Like much else that originated at Meissen, ozier molding was copied by other German porcelain factories, as well as porcelain factories in Chantilly, Fr.; Copenhagen; and Chelsea, Eng.



Painted porcelain dish with an *alt-ozier* border, Copenhagen, c. 1780; in the Victoria and Albert Museum, London

By courtesy of the Victoria and Albert Museum, London; photograph, EB Inc.

Ozma, Project, attempt undertaken in 1960 to detect radio signals generated by hypothetical intelligent beings living near stars other than the Sun. Some 150 hours of intermittent observation during a four-month period detected no recognizable signals. Frank D. Drake, director of the search, named the project for the princess of Oz, an imaginary and marvelous distant place described in tales by the American writer L. Frank Baum.

The search was carried out with the aid of a special receiver attached to a radio telescope 26 m (85 feet) in diameter at the U.S. National Radio Astronomy Observatory at Green Bank, W.Va. The receiver was tuned to wavelengths near 21 cm, which is the wavelength of radiation emitted naturally by interstellar hydrogen; it was thought that this would be familiar, as a kind of universal standard, to anyone attempting interstellar radio communication. The telescope was aimed at two nearby stars (Epsilon Eridani and Tau Ceti, both about 11 light-years from the Earth) that resemble the Sun and seem reasonably likely to have inhabited planets.

A second experiment, called Ozma II, was conducted at the same observatory by Benjamin Zuckerman and Patrick Palmer, who intermittently monitored more than 650 nearby stars for about four years (1973–76).

ozokerite, also spelled OZOCERITE (from Greek *ozokēros,* "odoriferous wax"), naturally occurring, light yellow to dark brown mineral wax composed principally of solid paraffinic hydrocarbons (compounds chiefly of hydrogen and carbon atoms linked in chains). Ozokerite usually occurs as thin stringers and veins filling rock fractures in areas of mountain building. It is believed to have been deposited when the petroleum containing it percolated through the rock fissures; in Utah, U.S., this process is exposed in fissures cut by mine drifts. Large deposits occur in Galicia (in modern Poland), Romania, the Soviet Union, and Utah.

The deposits in Galicia and Utah have been mined, but production decreased after 1940 because of competition from paraffin wax obtained by cooling from distilled petroleum. Mined ozokerite is purified by boiling in water (its melting point is 58°–100° C [130°–212° F]); the wax rises to the surface and is refined with sulfuric acid and decolorized with charcoal. Ozokerite has a higher melting temperature than typical synthetic petroleum wax, a desirable property in the manufacture of carbon paper, leather polishes, cosmetics, electrical insulators, and candles.

Ozolua, original name OKPAME (d. 1504), African king, the greatest warrior-king of Benin (in present Nigeria).

Ozolua was able to extend the boundaries of Benin from the Niger River in the east virtually to Lagos in the west. Tradition calls him the first ruler in West Africa to have had contact with the Portuguese explorers who were just then exploring the western coast of sub-Saharan Africa.

The youngest son of another great Benin ruler, Ewuare the Great, Ozolua embarked on his systematic reduction of surrounding peoples from the moment he was named oba (king) in 1481. Known as "the Conqueror," he is said to have consolidated the area he subjugated by a complicated network of marriage and diplomatic obligations. He encouraged trade with the Portuguese (*c.* 1500) and allowed them to establish missionary stations.

ozone (O_3), triatomic allotrope of oxygen (a form of oxygen in which the molecule contains three atoms instead of two as in the common form) that accounts for the distinctive odour of the air after a thunderstorm or around electrical equipment. The odour of ozone around electrical machines was reported as early as 1785; ozone's chemical constitution was established in 1872. Ozone is an irritating, pale-blue gas that is explosive and toxic, even at low concentrations. It occurs naturally in small amounts in the Earth's stratosphere, where it absorbs solar ultraviolet radiation, which otherwise could cause severe damage to living organisms on the Earth's surface. Under certain conditions, photochemical reactions between nitrogen oxides and hydrocarbons in the lower atmosphere can produce ozone in concentrations high enough to cause irritation of the eyes and mucous membranes.

Ozone usually is manufactured by passing an electric discharge through a current of oxygen or dry air. The resulting mixtures of ozone and original gases are suitable for most industrial purposes, although purer ozone may be obtained from them by various methods; for example, upon liquefaction, an oxygen–ozone mixture separates into two layers, of which the denser one contains about 75 percent ozone. The extreme instability and reactivity of concentrated ozone makes its preparation both difficult and hazardous.

Ozone is 1.5 times as dense as oxygen; at −112° C (−170° F) it condenses to a dark blue liquid, which freezes at −251.4° C (−420° F). The gas decomposes rapidly at temperatures above 100° C (212° F) or, in the presence of certain catalysts, at room temperatures. Although it resembles oxygen in many respects, ozone is much more reactive; hence, it is an extremely powerful oxidizing agent, particularly useful in converting olefins into aldehydes, ketones, or carboxylic acids. Because it can decolorize many substances, it is used commercially as a bleaching agent for organic compounds; as a strong germicide it is used to sterilize drinking water as well as to remove objectionable odours and flavours. *See also* ozonosphere.

ozonide, any of a class of chemical compounds formed by reactions of ozone (*q.v.*) with other compounds. Organic ozonides, often made from olefins (*q.v.*), are unstable, most of them decomposing rapidly into oxygen compounds, such as aldehydes, ketones, and peroxides, or reacting rapidly with oxidizing or reducing agents. A few inorganic ozonides are known, containing the negatively charged ion O_3^-; an example is potassium ozonide (KO_3), an unstable, orange-red solid formed from potassium hydroxide and ozone that, upon heating, decomposes into oxygen and potassium superoxide (KO_2).

ozonosphere, region in the upper atmosphere between about 10 and 50 km (6 and 30 miles) altitude, in which there are appreciable concentrations of ozone and in which the temperature distribution is largely determined by the radiative properties of ozone.

Ozone has the formula O_3; it is always present in trace quantities in the Earth's atmosphere, but its largest concentrations are in the ozonosphere. There it is formed primarily as a result of shortwave solar ultraviolet radiation (wavelengths shorter than 242 nanometres), which dissociates normal molecular oxygen (O_2) into two oxygen atoms. These oxygen atoms then combine with nondissociated molecular oxygen to yield ozone. Ozone, once it has been formed, can also be easily destroyed by solar ultraviolet radiation of wavelengths less than 300 nanometres.

Because of the strong absorption of solar ultraviolet radiation by molecular oxygen and ozone, solar radiation capable of producing ozone cannot reach the lower levels of the atmosphere, and the photochemical production of ozone is not significant below about 20 km (12 miles). This absorption of solar energy is very important in producing a temperature maximum at about 50 km (30 miles), called the stratopause, or the mesopeak. Also, the presence of the ozone layer in the upper atmosphere, with its accompanying absorption, effectively blocks almost all solar radiation of wavelengths less than 290 nanometres from reaching the Earth's surface, where it would injure or kill most living things.

Certain air pollutants, particularly chlorofluorocarbons, halons (chlorofluorobromine compounds), and nitrogen oxides, can diffuse into the ozonosphere and destroy ozone. (*See* chlorofluorocarbon.) In the mid-1980s scientists discovered that a "hole" developed periodically in the ozonosphere above Antarctica; it was found that the ozone layer there was thinned by as much as 40–50 percent from its normal concentrations. This severe regional ozone depletion was explained as a natural phenomenon, but one that was probably exacerbated by the effects of chlorofluorocarbons and halons. Concern over increasing global ozone depletion led to international restrictions on the use of chlorofluorocarbons and halons, to scheduled reductions in their manufacture, and to regulation of the permissible amount of nitrogen oxides in automobile exhaust gases.

Even though the ozone layer is about 40 km (25 miles) thick, the total amount of ozone, compared with more abundant atmospheric gases, is quite small. If all of the ozone in a vertical column reaching up through the atmosphere were compressed to sea-level pressure, it would form a layer only a few millimetres thick.

Ozu Yasujirō (b. Dec. 15, 1903, Tokyo—d. Dec. 12, 1963, Tokyo), motion-picture director who originated the *shomin-geki* ("common-people's drama"), a genre of film dealing with lower-middle-class Japanese family life. Because of the centrality of domestic interrelationships in his films, their detailed character portrayals, and the pictorial beauty of their images, Ozu was considered the most typically Japanese of all directors and received more honours in his own country than did any other director.

Raised in Tokyo, Ozu became an assistant cameraman for the Shōchiku Motion Picture Company, Tokyo, in 1923. By the mid-1920s he was a director, but not until the early 1930s did he establish his reputation by such outstanding *shomin-geki* silent comedies as *Daigaku wa deta keredo* (1929; *I Graduated, But . . .*) and *Umarete wa mita keredo* (1932; *I Was Born, But . . .*). Ten years later *Toda-ke no kyodai* (1941; *The Toda Brother and His Sisters*), a consideration of Japanese attitudes toward motherhood, was his first box-office success.

Ozu made no films from 1942 to 1947. In 1947 *Nagaya shinshi roku* (*The Record of a Tenement Gentleman*) initiated a series of pictures in which a further refinement of style was combined with a concern for postwar conditions. Plot was almost eliminated, while atmosphere and detailed character studies became preeminent. He almost totally abandoned such devices as camera movement in favour of straight pictorial shots. *Banshun* (1949; *Late Spring*), *Bakushu* (1951; *Early Summer*), *O-chazuke no aji* (1952; *The Flavour of Green Tea over Rice*), *Tōkyō monogatari* (1953; *Tokyo Story*), and *Sōshun* (1956; *Early Spring*) exemplify this style and helped to establish Ozu as an internationally prominent director. Such later films as *Early Autumn* (1961) and *An Autumn Afternoon* (1962) show Ozu's mastery of the decorative use of colour in motion pictures.

P-38, also called LOCKHEED LIGHTNING, fighter-interceptor aircraft, a single-seat, twin-engine, mid-wing monoplane used by the U.S. Army Air Force during World War II. The P-38 was the first military aircraft produced by the Lockheed Aircraft Corporation, on a development specification calling for a speed of at least 360 miles per hour (580 kilometres per hour) at 20,000 feet (6,100 m). After an unsuccessful version was flown by the Royal Air Force in late 1941, the P-38F appeared in early 1942; it had a top speed of 395 mile/h (636 km/h) at 25,000 feet (7,620 m). Later versions could attain 414 mile/h (666 km/h).

The P-38 became the principal U.S. fighter escort for medium bombers in Europe, and it was also widely used in the Pacific. The pilot's position was protected with armour and a windshield of bulletproof glass. Armament varied in successive models, but most of the Lightnings carried a 20-millimetre cannon and four .50-calibre machine guns in the nose. It could carry 1,600 pounds (725 kg) of bombs on racks beneath the pilot's nacelle, and late in the war it carried clusters of rockets on wing racks. After the P-38 was superseded as a bomber escort (by the P-51), many of the planes were modified as two-seat fighter-bombers and others for photoreconnaissance (under the designations F-4 and F-5, respectively).

P-47, also called THUNDERBOLT, fighter and fighter-bomber aircraft used by the Allied air forces during World War II. A single-seat, single-engine, low-wing monoplane, it was developed in the United States by Republic Aviation to meet the need for a high-speed long-range fighter. It first flew in 1941 and went into production the following March; it was in action from British bases a year later. Variously modified as production went on, the P-47 had an armour-protected cockpit and carried eight .50-calibre machine guns. It had a maximum bomb load of 2,500 pounds (1,135 kg), and could carry 10 5-inch (13-centimetre) rockets beneath its wings. With all its arms and armour, it had a maximum speed of 440 miles per hour (708 kilometres per hour) and a ceiling of 40,000 feet (12,200 m). More Thunderbolts—15,683—were built for the Allied air services than any other fighter. It remained in service until 1955.

P-51, also called MUSTANG, one of the finest fighter aircraft of World War II, a single-seat, single-engine, low-wing monoplane that was produced by North American Aviation for Britain's Royal Air Force (RAF) and later was adopted by the U.S. Army Air Force (USAAF). Its prototype was designed to British specifications and first flew in late 1940, just months after the design work began. It went into service in November 1941. With a low-altitude-rated Allison engine and a maximum speed of about 390 miles per hour (628 kilometres per hour), it was used for low-level tactical photoreconnaissance duties, with a camera mounted behind the pilot. The Mustang was equipped with four .50-calibre and four .30-calibre machine guns, although one model had four 20 mm cannons, and another (the A-36A) was a dive bomber for the USAAF. In late 1942 the airframe was adapted for the Rolls-Royce Merlin engine and, starting in late 1943 with the P-51B, was built in vast numbers for the USAAF and some for the RAF. With a maximum speed of about 440 mile/h (708 km/h), the P-51D version (six .50-calibre machine guns, three in each wing) was a superb long-range offensive fighter, escorting U.S. bombers from England to Berlin in 1944, and to Tokyo from the Pacific island bases in 1945. It played a significant part in the final defeat of the German Luftwaffe and remained operational until the 1950s, being used for ground attack in the early days of the Korean War. A few were still being used for civil air racing as late as 1987.

p–n junction, in electronics, the electrical contact in transistors and related devices between two different types of material called *p*-type and *n*-type semiconductors. These materials are formed by the deliberate addition of impurities to pure semiconductor materials, such as silicon. Materials of *p*-type contain holes, vacancies formerly occupied by electrons (negatively charged particles), simulating positively charged particles, whereas *n*-type materials contain electrons. Electrical current flows more easily across such a junction in one direction than in the other.

If the positive pole of a battery is connected to the *p*-side of the junction, and the negative pole to the *n*-side, the Fermi levels of the two materials are altered in such a way as to promote the flow of charge across the junction. If the battery is connected in the opposite direction, the Fermi levels are altered in the reverse direction, so that very little charge can flow. This property of the *p–n* junction is called rectification.

Pa, Pinyin BA, ancient tribe and later an ancient Chinese feudal state that came into being in the 11th century BC, under the Western Chou. It was situated in the Chia-ling valley of what is now central Szechuan. Pa established relations with the mid-Yangtze kingdom of Ch'u in the 5th century BC. Shortly before 316 BC, the state was conquered by the Ch'in and incorporated into the Ch'in empire. In the middle of the 3rd century BC, the Pa region became part of the kingdom of Shu and was totally independent of northern and central China. The central region of Szechuan is still sometimes known as the Pa region.

Pa-an, Burmese HPA-AN, town, capital of Karen state, southern Myanmar (Burma). Situated on the left bank of the Salween River, 27 miles (43 km) north of Moulmein (Mawlamyine), it has an airfield and is linked by road west to Thaton and across the Dwana Range to Thailand. Pop. (1983) 282,069.

Pa Chin (Chinese author): *see* Ba Jin.

Pa Hsien, Pinyin BA XIAN, English EIGHT IMMORTALS, heterogeneous group of holy Taoists, each of whom earned the right to immortality and had free access to the Peach Festival of Hsi Wang Mu, Queen Mother of the West. Though unacquainted in real life, the eight are frequently depicted as a group—bearing gifts, for instance, to Shou Hsing, god of longevity, to safeguard their immortality.

Pa Hsien, the Eight Immortals, Chinese painting of the 18th century; in the Musée Guimet, Paris
Giraudon—Art Resource/EB Inc.

In Chinese art they sometimes also stand alone or appear in smaller groups. Four of them, for example, recline beneath a pine tree: Chung-li Ch'üan and Lü Tung-pin are drinking wine heated by Li T'ieh-kuai while Lan Ts'ai-ho entertains them on a flute. Lists vary, but the other four immortals are usually identified as Chang Kuo-lao, Han Hsiang, Ts'ao Kuo-chiu, and Ho Hsien-ku (*qq.v.*).

Pa Sak River, river in central Thailand. It rises in the northern portion of the Phetchabun Range and flows south through a narrow valley for 319 miles (513 km). It empties into the Lop Buri River at Phra Nakhon Si Ayutthaya, north of Bangkok. Lomsak, Phetchabun, and Sara Buri are the main towns on its banks. Below Sara Buri town, the Pa Sak is dammed for irrigation.

Paamiut (Greenland): *see* Frederikshåb.

Paarl, town, Cape province, South Africa, east of Cape Town, on the Groot-Berg River between the Paarl Mountain and the Drakenstein Range. Settled in 1688 by Huguenots, who introduced viticulture, it is still known for its vineyards and wine making; it also produces citrus fruits, tobacco, and olives. Manufactures include cigarettes, textiles, and processed foods. Paarl is an educational centre, and the movement to recognize Afrikaans as a national and written language originated there. Pop. (1985) mun., 63,671.

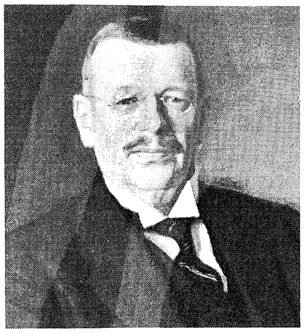
Paasche index, index developed by German economist Hermann Paasche for measuring current price or quantity levels relative to those of a selected base period. It differs from the Laspeyres index (*q.v.*) in that it uses current-period weights; that is, in computing the index, a commodity's price relative (ratio of current price to base-period price) is weighted by the commodity's relative importance to all purchases in the current period. The index is arrived at by taking the ratio of the total cost of purchasing a specified bundle of current-period commodities valued at current prices to the value of those same commodities at base-period prices and multiplying by 100.

The Paasche price index tends to understate price increases, since it already reflects some of the change in consumption patterns with which consumers respond to price increases—*i.e.,* increased consumption of goods that show little or no price change.

Paasikivi, Juho Kusti (b. Nov. 27, 1870, Tampere, Fin.—d. Dec. 14, 1956, Helsinki), Finnish statesman and diplomat who, as prime minister (1918, 1944–46) and then president (1946–56) of Finland, cultivated harmonious relations with the Soviet Union in an effort to ensure some measure of independence for Finland.

Paasikivi studied law and history at the universities of Stockholm, Uppsala, and Leipzig and from 1902 to 1903 was a lecturer in law at the University of Helsinki. He subsequently turned to financial administration and banking and insurance activities. Paasikivi was a political realist who took the view that small nations could not permanently hope to oppose the power politics of large ones. Thus, in the struggle to preserve Finland's autonomy under Russian rule (the country was then a grand duchy within the Russian Empire), he sided with the Compliers of the Old Finnish Party, who were willing to "comply" with recent illegal Russian decrees affecting Finnish internal affairs. In 1907 Paasikivi was elected a member of the Finnish Eduskunta (Parliament), and the following year he became minister of finance. He resigned in 1909 in protest against Russian attempts to illegally carry out the Russification of his country.

Paasikivi briefly served in 1918 as prime minister of the first government of newly independent Finland, in which capacity he favoured



Paasikivi, detail of a painting by Eero Järnefelt, 1931; in the collection of Kansallis-Osake-Pankki, Helsinki
By courtesy of Kansallis-Osake-Pankki, Helsinki

a pro-German policy and a monarchy for his country. He headed the Finnish delegation that on Oct. 14, 1920, signed at Tartu, Estonia, the peace treaty with the U.S.S.R., after warning his government against trying to take advantage of Russia's temporary weakness. In independent postwar Finland he became prominent as a banker and businessman.

In 1936 Paasikivi was appointed minister to Sweden. He was recalled from Stockholm in October 1939 to lead the delegation that unsuccessfully attempted to reach a peace settlement with the U.S.S.R. over that nation's demands for strategically important bits of Finnish territory; he advocated acceding to the Soviets' demands. In March 1940 Paasikivi was the logical choice to negotiate peace with the U.S.S.R. and thus end the Russo-Finnish War that Finland was clearly losing; as chairman of the Finnish-Russian Peace Commission, he signed the treaty whereby Finland ceded to Russia approximately one-tenth of its territory, with a population of almost 500,000. Soon afterward, in March 1940, he was appointed minister to Moscow, but he resigned from this position in May 1941 when it became clear that his government would side with Nazi Germany in the approaching conflict with the Soviet Union. Virtually retired from politics for the next three years, Paasikivi was recalled to service to take part in the abortive peace negotiations between Finland and the U.S.S.R. in the spring of 1944. In November 1944, after the approaching Soviet victory over Germany had become apparent even to pro-Nazi Finns, the conciliatory Paasikivi was asked to serve as prime minister of a government pledged to peaceful cooperation with the Soviet Union. Until the end of his prime ministry in March 1946 he made sure that the peace conditions of the Russo-Finnish armistice of September 1944 were faithfully carried out.

Paasikivi succeeded Marshal C.G. Mannerheim as president of the Finnish republic in March 1946, and he served in that capacity until February 1956. As president he stood more aloof from party politics than any of his predecessors. His aims, which he pursued with considerable success, were to remain absolutely uncompromising over Finnish independence while so handling Finland's foreign relations as to avoid all conflict with Soviet interests and inspire the Soviet Union with confidence in Finnish sincerity. Paasikivi was instrumental in regaining Porkkala (1955), which had been leased to the Soviet Union for a naval base in 1944. Although pursuing a policy of cooperation with his powerful neighbour, he firmly resisted Communist penetration in Finland; Paasikivi's strategy became the fundamental basis of Finland's foreign policy in the post-World War II era.

PABA: *see* para-aminobenzoic acid.

pabbajjā (Pāli: "to wander forth"), Sanskrit PRAVRAJYĀ, Buddhist rite of ordination by which a layman becomes a novice (Pāli *sāmaṇera;* Sanskrit *śrāmaṇera*). The ceremony is also the preliminary part of higher ordination, raising a novice to a monk (*see* upasampadā).

In some Theravāda countries such as Burma, the rite is normally held for every Buddhist boy at the age of puberty. In Tibet and China a probationary period of study is required before the candidate becomes a novice, during which he does not receive tonsure and is not exempt from military service.

Details of the ceremony vary from country to country. In most instances, the candidate appears before an assembly of 10 (in some cases fewer) ordained monks and asks for admission to the order as a novice. His head and face are shaved, and he presents the upper and lower robes of the novice for consecration by the officiating abbot or senior monk. The candidate puts on the monastic robes and returns. He then asks for the Threefold Refuge (in the Buddha, the teaching, and the order) and the 10 precepts (ethical code; *see* sīla) to be administered to him. The rite is concluded with his obeisance to the senior monks and his request for forgiveness of his faults.

The novice lives in the monastery for a period varying from a few days to several months and accompanies the monk on the daily alms rounds, but he is not allowed to participate in the fortnightly recitation of the patimokkha (the rules of monastic discipline).

Pabianice, town and suburb of Łódź city, in Łódź *województwo* (province), central Poland, in the Łódź highlands on the Dobrzynka River. The second most important town in the Łódź industrial region, it lies on the Łódź–Wrocław rail line and is a major textile centre. The oldest community in the region, it was first settled in the 11th century and was granted town rights in 1297. Because it lay on the trade route between Kraków and Gdańsk (Danzig), it prospered. A late 16th-century Renaissance castle in the town now houses a museum. Pop. (1985 est.) 72,600.

Pābna, also spelled PUBNA, city, west-central Bangladesh. It lies along the Ichāmati River, which is a tributary of the Padma (Ganges). An industrial centre, Pābna has jute mills and is noted for its hosiery and handloomed products. Historical remains include the Hindu temple of Jor Bāṅgla and the Pābna Jubilee tank (water reservoir; excavated 1887). Pābna was incorporated a municipality in 1876; it has Jinnah Park, a mental hospital, and two government colleges affiliated with the University of Rājshāhi.

The surrounding area lies within the angle formed by the confluence of the Padma and Jamuna rivers. A wide alluvial plain is intersected by a network of streams, and many villages are accessible only by boat during the rainy season. The soil, enriched by flood deposits, supports rice, jute, sugarcane, and pulses. Pop. (1981) city, 101,080.

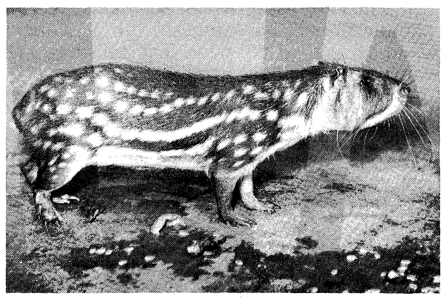
Pabst, G(eorg) W(ilhelm) (b. Aug. 27, 1885, Raudnice, Bohemia, Austria-Hungary—d. May 29, 1967, Vienna), German motion-picture director whose films were among the most artistically successful of those produced in the 1920s. Pabst's films are marked by his deep insight into the human personality and his ability to create moving and original characters, particularly female ones; by his constant concern with social and political issues, as well as with the impact that societal problems have on individual human beings; and by powerful editing that gave meaning to each shot while creating smooth transitions between scenes.

Pabst was educated in Vienna and at 20 began a career as a stage actor in Zürich. He performed in Salzburg, Austria, Berlin, and New York City before turning to the cinema. Pabst's first film was *Der Schatz* (1923; *The Treasure*), about the passions aroused while its characters search for hidden treasure. His first successful film as a director was *Die freudlose Gasse* (1925; *The Joyless Street*), which became internationally famous as a grimly realistic portrayal of life in inflation-ridden postwar Vienna. His second successful film was *Geheimnisse einer Seele* (1926; *Secrets of a Soul*), a realistic consideration of psychoanalysis that harked back to Expressionist themes in its detailed examination of a disturbed consciousness. *Die Liebe der Jeanne Ney* (1927; *The Love of Jeanne Ney*) was a love story that incorporated documentary shots to heighten the realism of its postwar setting. The picture is most highly praised, though, for its photography and its smooth cuts of one scene into another. With these three films Pabst became an internationally prominent director.

His films of the late 1920s and '30s contained a stronger emphasis on the interrelationship between social conditions and the individual. Outstanding motion pictures of this type were *Abwege* (1928; *Crisis*), *Die Büchse der Pandora* (1929; *Pandora's Box*), and *Das Tagebuch einer Verlorenen* (1929; *Diary of a Lost Girl*). The latter two films are particularly notable for the performances in them of the actress Louise Brooks, who epitomized Pabst's ideal of feminine eroticism. In the early 1930s Pabst took up a left-wing viewpoint in such films as *Westfront 1918* (1930), a realistic portrayal of the trench warfare of World War I, *Die Dreigroschenoper* (1931; *The Threepenny Opera*), and *Kameradschaft* (1931; *Comradeship*), in which a mine disaster is met by the combined rescue efforts of French and German workers in an example of international cooperation.

By the mid-1930s the overall quality of Pabst's films was declining. He moved to Paris and attempted a ponderous three-language version of *Don Quixote* (1933) as well as several melodramas. Returning to Germany at the outbreak of World War II, he reluctantly directed films such as *Komödianten* (1941; *Comedians*) and *Paracelsus* (1943). His most outstanding postwar film was *Der letzte Akt* (1955; *The Last Act,* or *The Last Ten Days*), a re-creation of the final days of the Hitler regime.

paca, also called SPOTTED CAVY (*Cuniculus paca*), stout-bodied, tailless rodent, family Dasyproctidae (order Rodentia), found chiefly in lowland forests from Mexico to Brazil.



Paca (*Cuniculus paca*)
Lloyd G. Ingles

A white-spotted, brown animal, large for a rodent, the paca may attain a length of about 75 cm (29 inches). It has a relatively large head and bony swellings on its cheekbones that serve as resonating chambers in sound production. The paca is nocturnal and eats leaves, roots, and fruit, occasionally damaging sugarcane or other crops. It lives in a burrow, swims well, and when pursued heads for water in an attempt to escape. The female usually bears one young per litter.

The mountain paca (*Stictomys,* or *Cuniculus, taczanowskii*) is a highland paca found in the Andes. It is smaller than the lowland form and has thicker fur. Both species are locally valued as food. For false paca, *see* pacarana.

Pacaraima Mountains, also spelled PAKARAIMA, Portuguese SERRA PACARAIMÃ, Spanish SIERRA PACARAIMA, also called (in Guyana) PAKARAIMA MOUNTAINS, central tabular upland of the Guiana Highlands in Brazil, Venezuela, and Guyana. The Pacaraima Mountains form the drainage divide between the Orinoco Valley to the north and the Amazon Basin to the south. Extending for 250 mi (400 km) in an east–west direction, the mountains mark the borders between Brazil and southeastern Venezuela and between Brazil and west central Guyana. Mount Roraima (9,094 ft [2,772 m]) is highest in elevation. The rivers that rise on the plateau tops pour over the cliffed edges in spectacular waterfalls, such as the Kaieteur Falls in Guyana.

pacarana, also called BRANICK'S RAT (*Dinomys branickii*), rare South American rodent of the valleys and lower slopes of the Andes Mountains. The only living member of the family Dinomyidae (order Rodentia), the pacarana is a diurnal, terrestrial rodent that eats leaves, fruit, and other vegetation.

The pacarana is heavy bodied and has small ears, a relatively large head, and coarse, white-spotted, black or brown fur. Large for a rodent, it attains a length of about 90 to 100 centimetres (35 to 39 inches) including its thick, hairy tail.

Pacatus Drepanius, Latinius, Latinius also spelled LATINUS (fl. *c.* AD 390), Gallo-Roman orator and poet, the author of an extant panegyric addressed to Theodosius I at Rome in 389 after the defeat of the usurper Maximus. He was a friend of Symmachus, the champion of paganism, and of the Christian poet Ausonius.

It is uncertain whether Pacatus was pagan or Christian; in his speech he denounced Maximus' persecution of the Priscillianist heretics. In 390 Pacatus received the proconsulship of Africa and later held other high offices.

paccaya (in Buddhist philosophy): *see* pratyaya.

pacceka-buddha (Buddhism): *see* pratyeka-buddha.

Pacelli, Eugenio Maria Giuseppe Giovanni (pope): *see* Pius XII.

pacemaker, electronic cardiac-support device that produces rhythmic electrical impulses that take over the regulation of the heartbeat in patients with certain types of heart disease.

A healthy human heart contains its own electrical conducting system capable of controlling both the rate and the order of cardiac contractions. Electrical impulses are generated at the sinoatrial node in the right atrium, one of the chambers of the heart. They then pass through the muscles of both atria to trigger the contraction of those two chambers, which forces blood into the ventricles. The wave of atrial electrical activity activates a second patch of conductive tissue, the atrioventricular node, initiating a second discharge along an assembly of conductive fibres called the bundle of His, which induces the contraction of the ventricles. When electrical conduction through this system is interrupted, as is the case in a number of diseases including congestive heart failure and as an aftereffect of heart surgery, the condition is called heart block. An artificial pacemaker may be employed temporarily until normal conduction returns, or permanently to overcome the block.

In temporary pacing, a miniature electrode attached to fine wires is introduced into the heart through a vein, usually in the arm. The pacing device, an electric generator, remains outside the body and produces regular pulses of electric charge to maintain the heartbeat. In permanent pacing, the electrode may again be passed into the heart through a vein or it may be surgically implanted on the heart's surface; in either case the electrode is generally located in the right ventricle. The electric generator is placed just beneath the skin, usually in a surgically created pocket below the collarbone.

The first pacemakers were of a type called asynchronous, or fixed, and they generated regular discharges that overrode the natural pacemaker. The rate of asynchronous pacemakers may be set at the factory or may be altered by the physician, but once set they will continue to generate an electric pulse at regular intervals. Most are set at 70 to 75 beats per minute. More recent devices are synchronous, or demand, pacemakers that trigger heart contractions only when the normal beat is interrupted. Most pacemakers of this type are designed to generate a pulse when the natural heart rate falls below 68 to 72 beats per minute. These instruments have a sensing electrode that detects the atrial impulse.

Once in place, the electrode and wires of the pacemaker usually require almost no further attention. The power source of the implanted pulse generator, however, requires replacement at regular intervals, generally every four to five years. Most current pacemakers use batteries as a power source, but there has been some exploration of generators energized by radioactive isotopes such as plutonium-238.

Pachacamac, creator deity worshipped by the pre-Inca maritime population of Peru; it was also the name of a pilgrimage site in the Lurín Valley (south of Lima) dedicated to the god and revered for many centuries. After the Incas conquered the coast, they did not attempt to replace the ancient and deeply rooted worship of Pachacamac but instead incorporated him into their own pantheon. Pachacamac was believed to be a god of fire and a son of the sun god; he rejuvenated the world originally created by the god Viracocha and taught men the crafts. Pachacamac was also believed to be invisible and thus was never represented in art.

The ruins of the shrine in the Lurín Valley include several pyramids and temples and are partially restored. The site may have served as the central city of a coastal "kingdom" from *c.* 1000 to *c.* 1440.

Pachacamac, large pre-Columbian ruin located in the Lurin Valley on the central coast of present-day Peru. The earliest major occupation and construction of Pachacamac dates to the Early Intermediate Period (*c.* 200 BC–AD 600) and to a culture generally known as Early Lima (Maranga, Interlocking style). The terraced adobe pyramid and temple known as the Temple of Pachacamac belongs to this time and culture, and Pachacamac's fame as the seat of an oracle probably began in the Early Intermediate Period. During the Middle Horizon (AD 600–1000) it continued as a major centre and place of pilgrimage and was probably the principal establishment of the Huari Empire on the coast. In late pre-Columbian times the Inca constructed the large Temple of the Sun at the site, and the Oracle of Pachacamac, to which the early Spanish explorers refer, probably was associated with a shrine in this temple. The shrine and temple were sacked by Francisco Pizarro's soldiers during the Spanish conquest (*c.* 1532).

Pachacuti Inca Yupanqui, also called PACHACUTEC (fl. 15th century), Inca emperor (1438–71), an empire builder who, because he initiated the swift, far-ranging expansion of the Inca state, has been likened to Philip II of Macedonia. (Similarly, his son Topa Inca Yupanqui is regarded as a counterpart of Philip's son Alexander III the Great.)

Pachacuti first conquered various peoples in what is now southern Peru and then extended his power northwesterly to Quito, Ecuador. He is said to have devised the city plan adopted for his capital, Cuzco (in present southern Peru).

Pachaimalai Hills, range of hills in Tamil Nādu state, southern India, an eastward extension of the Eastern Ghāts in the northeastern Tamilnād Uplands. The Pachaimalai Hills, together with the Javādi, Shevaroy, and Kalrāyan hills, separate the Cauvery River basin in the south from the Pālār River basin in the north. Extending over approximately 5,200 sq mi (13,500 sq km), they form a discontinuous line of highlands with a general elevation of from 1,770 ft (540 m) to 4,620 ft. The region consists of rounded hills composed of granitic gneiss. The hills have scrub jungles on broken ground and sal (*Shorea*) forests on the flat hilltops. Loamy and clayey soils are found in the valleys. The Vellār, Pālār, and Ponnaiyār rivers are dry for much of the year. The economy of the region is based on agriculture; rice, jowar (sorghum), sugarcane, gram (chick-pea), peanuts (groundnuts), and bajra (pearl millet) are subsistence crops. Coffee, cashews, and pepper are important plantation crops raised for export. Large-scale industries produce textiles, foodstuffs, and chemicals; engineering is also important. Cottage industries include mat and basket weaving, carpentry, blacksmithing, and the manufacture of *bidi* (cigarettes). Iron ore, manganese, beryl, and zinc are mined. About three-fifths of the area's population live in the Coimbatore-Madurai Uplands. The *caṅkam* period in Tamil literature flourished in the area during the Cēra, Cōla, and Pāṇḍya dynasties. Roads from the northern upland region to the eastern seaboard run along the valleys or other gaps between the hill ranges. Tiruvannāmalai, Āttūr, Rānipet, and Chengam are important towns. The hills are named after the Pachaimalaiyali peoples who live in the region.

Pacheco, Francisco (b. 1564, Sanlúcar de Barrameda, Spain—d. 1654, Seville), Spanish painter, teacher, and scholar. Although an undistinguished artist himself, he is remembered as the teacher of both Velázquez and Alonso Cano and as the author of *Arte de la pintura* (1649), a treatise on the art of painting that is the most important document for the study of 17th-century Spanish art.

Moving to Seville early in his life, he studied painting under Luis Fernández, learning primarily by copying the work of Italian Renaissance masters. After visiting (1611) Madrid and Toledo, where he studied the work of El Greco, he returned to Seville and opened an academy. His instructions were marked by an emphasis on academic correctness. The official censor of the Inquisition in Seville, he concerned himself with the proper way of depicting religious themes and images.

Such paintings as the "Last Judgment" (1614) in the convent of Santa Isabel and the "Martyrs of Granada" (Granada) are highly imitative and rigid works, monumental but unimpressive. Although Velázquez became Pacheco's son-in-law, he was uninfluenced by his father-in-law's art.

Pacheco's *Arte de la pintura,* in addition to chapters on iconography and the theory and practice of painting, includes a series of biographies of contemporary Spanish painters that is most valuable to scholars.

Pacheco, José Emilio (b. June 30, 1939, Mexico City) Mexican critic, novelist, short-story writer, translator, and poet. His poetry transmits his metaphysical concerns in brilliant images.

Pacheco was educated at the National Autonomous University of Mexico. He wrote several plays there that were never produced, and he edited the literary supplement of the review *Estaciones* (1957–58). His first published work, a collection of short stories—*La sangre de Medusa* (1958; "The Blood of Medusa")—shows the influence of Jorge Luis Borges. *Los elementos de la noche* (1963; "The Elements of the Night") is a collection of his poems published in periodicals from 1958 to 1962. The poems of *El reposo del fuego* (1966; "The Sleep of the Fire") contemplate a world in disintegration, and the novel *Morirás lejos* (1967; "You Will Die Far Away") documents the purges of Jews throughout history. *No me preguntes cómo pasa el tiempo* (1969; *Don't Ask Me How the Time Goes By,* 1978) includes poems in which there is a nostalgic desire to relive the past, sometimes coupled with a fine sense of irony. The short stories in *El principio del placer* (1972; "The Pleasure Principle") are united by the recurrent theme of anguish, reinforcing Pacheco's concept of history as a cyclical series of events that continue to haunt mankind. In the poems of *Islas a la deriva* (1976; "Islands Adrift"), Pacheco reinterprets history and mythology.

Pacheco's later books include *Ayer es nunca jamás* (1978; "Yesterday Is Not Ever"), *Desde entonces: poemas 1975–1978* (1980; "Since Then: Poems 1975–1978"), and *Tarde o temprora* (1980; "Sooner or Later"). His works in English include *Tree Between Two Walls* (1969), *The Lost Homeland* (1976), and *Signals From the Flames* (1980). He also edited *La poesía mexicana de siglo XIX* (1965) and *Antología del Modernismo, 1884–1921* (1978).

Pacheco Pereira, Duarte (fl. late 15th–early 16th century), Portuguese sea captain and explorer who may have discovered Brazil in 1498, two years before Pedro Alvarez Cabral explored the Brazilian coast. Because of his military exploits in India, the poet Camões called him Aquiles Lusitano (the Portuguese Achilles).

Pacheco Pereira, reared at the Portuguese court, was an educated man, serving as a squire to King John II. He became an expert cartographer as well as a pilot and shipmaster. He explored the coast of Africa in 1488, returning with Bartolomeu Dias, who had discovered the Cape of Good Hope. Pacheco Pereira sailed with Dias in 1500 on the voyage during which Dias claimed Brazil for the King of Portugal. In 1505 Pacheco Pereira helped defend the Portuguese trading station at Cochin, India, against attacks by the ruler of Calicut. With about 200 Portuguese, Pacheco Pereira successfully held off armies that numbered well over 20,000 men.

Returning to Portugal in 1505, Pacheco Pereira received many honours. He collected his logbooks and charts and wrote a valuable account of Portuguese exploration (published in modern editions in 1892 and 1903). He was appointed governor of São Jorge da Mina but fell into disgrace when enemies reported that he had embezzled official funds. He was exonerated, but he died shortly thereafter in poverty.

Pachelbel, Johann (baptized Sept. 1, 1653, Nürnberg—d. March 3, 1706, Nürnberg), German composer known for his works for organ and one of the great organ masters of the generation before J.S. Bach.

Pachelbel studied organ at Altdorf and Regensburg and held posts as organist in Vienna, Stuttgart, and other cities. In 1695 he was appointed organist at the St. Sebalduskirche in Nürnberg, where he remained until his death. He also taught organ, and one of his pupils was Johann Christoph Bach, who in turn gave his younger brother Johann Sebastian Bach his first formal keyboard lessons.

All Pachelbel's work is in a contrapuntally simple style. His organ compositions show a knowledge of Italian forms derived from Frescobaldi through J.J. Froberger. Of special importance are his chorale preludes, which did much to establish the chorale melodies of Protestant northern Germany in the more lyrical musical atmosphere of the Catholic south. His popular *Canon in D Major* was written for three violins and continuo and was published with a gigue in the same key. His son, Wilhelm Hieronymous Pachelbel, was also an organist and composer.

Pacher, Michael (b. *c.* 1435, County of Tirol—d. August 1498, Salzburg?, Archbishopric of Salzburg), late Gothic painter and wood-carver, one of the earliest artists to introduce the principles of Renaissance painting into Germany.

Little is known of Pacher's early life, but he is thought to have gone to Italy, where he was much impressed by the experiments in perspective of two eminent northern Italian artists of the Renaissance, Jacopo Bellini and Andrea Mantegna. That trip must have occurred sometime before Pacher began work on the St. Wolfgang altarpiece of the Pilgrimage Church of Sankt Wolfgang in Upper Austria (centre completed in 1479; wings completed in 1481). The large figures placed close to the picture plane and seen from a low viewpoint, the deep architectural perspective, and the dramatic foreshortening in such scenes as the "Expulsion of the Money Changers from the Temple" and the "Nativity" betray knowledge of Mantegna's frescoes in the Church of the Eremitani in Padua. Pacher, however, rejected Mantegna's statuesque compositions in favour of a dynamic sense of movement. In contrast to the painted wings, the carved and painted centre of the altarpiece, showing the "Coronation of the Virgin," exhibits no Italian characteristics. Instead, its intricate carving that accentuates minute detail, the bright polychrome and sweeping draperies are wholly northern in spirit.

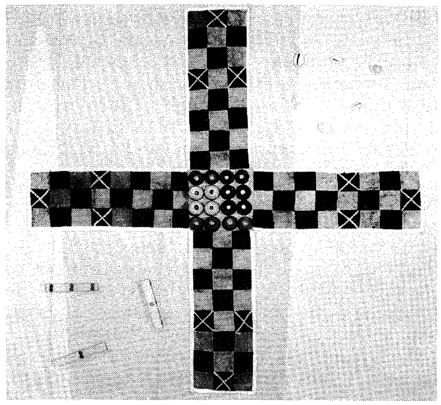
In the "Altarpiece of the Church Fathers" (*c.* 1483; Alte Pinakothek, Munich), Pacher uses direct and reflected light to create a convincing spatial ambience within a shallow depth.

The "Expulsion of the Money Changers from the Temple," panel from the St. Wolfgang altarpiece by Michael Pacher, 1478–81; in the Pilgrimage Church of Sankt Wolfgang in Upper Austria

Meyer Erwin—EB Inc.

His narrow niches are dominated by the four monumental figures of the Fathers of the Church. The back of the altarpiece exhibits scenes from the life of St. Wolfgang and is notable for its attenuated male nude, whose idealized form and sharp outline again reflect Pacher's knowledge of Mantegna's art. Such late works as the "Betrothal of the Virgin" and the "Flagellation" (both *c.* 1484; Museum Mittelalterlicher Österreichischer Kunst, Vienna) repudiate his early dynamic compositions and introduce a new, static serenity. The faces and drapery are more idealized and more monumental than in his early works, and the figures are emphasized at the expense of the architectural background.

Pachisi, also called LUDO, or PARCHEESI, board game, sometimes called the national



Indian Pachisi board of cloth with painted wood pieces and cowrie shells as dice; in the collection of R.C. Bell

R.C. Bell

game of India. Four players in opposing partnerships of two attempt to move pieces around a cross-shaped track. Moves are determined by throws of cowrie shells or dice. Each player has four pieces, which begin at the centre space, move down the middle track nearest the player, and counterclockwise around the outer track of the board. The partnership whose pieces first complete the course by returning to the centre space is the winner.

Marked squares along the course represent castles in which the occupying pieces cannot be captured. An occupied castle is open to the player's other pieces or those of his partner but closed to those of his opponents. Pieces resting on other squares are captured and sent back to the centre to begin again if an opposing piece lands on the square they occupy.

Pachmann, Vladimir von, also called VLADIMIR DE PACHMAN (b. July 27, 1848, Odessa, Ukraine—d. Jan. 6, 1933, Rome), Russian pianist known for his performances of Frédéric Chopin. Pachman studied in Vienna and made his debut in 1869 in Odessa. Though his early concerts were successful, he was extremely self-critical and withdrew for long periods of study. He later toured widely in Europe and the United States Pachmann's performances were almost exclusively devoted to works of Chopin, which he played in an intimate, miniature style. His playing was noted for its fine pianissimo shadings and for its smooth touch. His concerts were enlivened by his eccentric gestures, muttered comments, and remarks addressed to the audience.

Pachomius, SAINT (b. *c.* 290, probably in Upper Egypt—d. 346; feast day May 9), founder of Christian cenobitic (communal) monasticism, whose rule (book of observances) for monks is the earliest extant.

Of Egyptian origin, Pachomius encountered Coptic, or Egyptian, Christianity among his cohorts in the Roman emperor Constantine's North African army and, on leaving the military in about 314, withdrew alone into the wilderness at Chenoboskion, near his Theban home. Soon after, he joined the hermit Palemon and a colony of solitaries (anchorites) in the same area at Tabennisi, on the east bank of the Nile. With a talent for administration, Pachomius built the first monastic enclosure, replacing the scattered hermits' shelters, and he drew up a common daily program providing for proportioned periods of work and prayer patterned about a cooperative economic and disciplinary regimen.

This rule was the first instance in Christian monastic history of the use of a cenobitic, or uniform communal, existence as the norm, the first departure from the individualistic, exclusively contemplative nature that had previously characterized religious life. Pachomius, moreover, instituted a monarchic monastic structure that viewed the relationship of the religious superior's centralized authority over the community as the symbolic image of God evoking obedient response from man striving to overcome his egocentrism by self-denial and charity. By the time he died, Pachomius had founded 11 monasteries, numbering more than 7,000 monks and nuns.

Though none of Pachomius' manuscripts has survived, his life and bibliography have been preserved by the 5th-century historian Palladius in his *Lausiac History.* The Rule of Pachomius is extant only in the early-5th-century Latin translation of St. Jerome.

Pachuca, in full PACHUCA DE SOTO, capital city, Hidalgo *estado* ("state"), east-central Mexico. It was one of the first settlements in New Spain and lies in a rich mining district in the Sierra Madre Oriental, 7,959 feet (2,426 m) above sea level. Its first silver mine was discovered in 1534, although it is said that some of the mines were known to pre-Columbian Indians. The nearby Real del Monte mine, begun in 1739 and still in operation, is one of the most extensive mining properties in the world. The patio, or Mexican, process of separating silver from the ore by amalgamation with mercury was perfected in Pachuca by Bartolomé de Medina in the 16th century, and the Pachuca tank used in the cyanide process was developed there in the 20th century. The government has sought to counteract declining mineral production by increasing industrialization. Industries include smelting works and numerous metallic-ore reduction plants. Pachuca has a school of mines and metallurgy, founded in 1877, and it houses the Autonomous University of Hidalgo (1961). Pop. (1980) 110,351.

Pachycephalosaurus, genus of large and unusual dinosaurs found as fossils in Late Cretaceous deposits of North America (the Cretaceous period dates from 144 to 66.4 million years ago). *Pachycephalosaurus,* which grew to be about 9 m (30 feet) long, was a biped with strong hind limbs and much less developed forelimbs. The unusual and distinctive feature of *Pachycephalosaurus* is the high, domelike skull formed by a thick mass of solid bone grown over the tiny brain. The growth of bone obliterated normal openings found in the skulls of related forms. Abundant bony knobs in front and at the sides of the skull further added to the unusual appearance. *Pachycephalosaurus* and closely related forms thus are known as the bone-headed dinosaurs.

Pachymeres, George (b. 1242, Nicaea, Empire of Nicaea [now İznik, Turkey]—d. *c.* 1310, Constantinople [now Istanbul]), outstanding 13th-century Byzantine liberal-arts scholar, whose chronicle of the Palaeologus emperors is the period's main historical source.

Upon the fall in 1262 of the Latin Eastern Empire (established in 1204) and the return of the Byzantine emperor Michael VIII Palaeologus, Pachymeres went to Constantinople and was ordained to the Greek Orthodox ministry. While executing ecclesiastical and political functions, he taught the liberal arts at the patriarchal academy of the Basilica of Hagia Sophia.

Strongly opposed to union of the Eastern church with the Latin, Pachymeres recorded with studied neutrality the tumultuous upheavals marking the reigns of two Palaeologus emperors, the pro-unionist Michael VIII and the anti-unionist Andronicus II. This chronicle, the *Hrōmaikē historia* ("Roman [*i.e.,* Eastern] History"), a 13-volume continuation of the work of George Acropolites, is Pachymeres' principal work. A unique eyewitness record, *Hrōmaikē historia* emphasizes the theological nature of the events it describes, a characteristic that marked subsequent Byzantine chronicles. Pachymeres depicts the period of the two Palaeologus emperors in the light of the dispute between Eastern patriarchal autonomy and Western papal supremacy. Despite its turgid style, *Hrōmaikē historia* is particularly valuable for its accounts of Latin military campaigns throughout Byzantium, the construction of frontier defenses against Slavic and Turkish incursions, and the growth of the Byzantine feudal nobility by astute manipulation of land deeds at the expense of centralized imperial authority.

Pachymeres also composed a theological treatise on the doctrine of the Trinity and proposed a compromise between the Greek and Latin speculative interpretations of the Holy Spirit's relationship to the Father and the Son.

Pachymeres' lectures at Constantinople's academy evolved into the *Syntagma tōn tessarōn mathēmatōn* ("Compendium of Four Mathematics"), a type of classical handbook on mathematics, music, geometry, and astronomy. The *Syntagma,* with its innovative use of Arabic numbers, became the standard academic text in Greek Byzantine culture.

Other works include a compendium of the philosophy of Aristotle, of which only the book on logic has been published; a paraphrase of texts from Pseudo-Dionysius the Areopagite; and a series of exercises in rhetoric.

Pacific, War of the (1879–83), conflict involving Chile, Bolivia, and Peru, which resulted in Chilean annexation of valuable disputed territory on the Pacific coast. It grew out of a dispute between Chile and Bolivia over control of a part of the Atacama Desert that lies between the 23rd and 26th parallels on the Pacific coast of South America. The territory contained valuable mineral resources, particularly sodium nitrate.

National borders in the region had never been definitively established; the two countries negotiated a treaty that recognized the 24th parallel as their boundary and that gave Chile the right to share the export taxes on the mineral resources of Bolivia's territory between the 23rd and 24th parallels. But Bolivia subsequently became dissatisfied at having to share its taxes with Chile and feared Chilean seizure of its coastal region where Chilean interests already controlled the mining industry.

Peru's interest in the conflict stemmed from its traditional rivalry with Chile for hegemony on the Pacific coast. Also, the prosperity of the Peruvian government's guano (fertilizer) monopoly and the thriving nitrate industry in Peru's Tarapacá province were related to mining activities on the Bolivian coast.

In 1873 Peru agreed secretly with Bolivia to a mutual guarantee of their territories and independence. In 1874 Chilean–Bolivian relations were ameliorated by a revised treaty under which Chile relinquished its share of export taxes on minerals shipped from Bolivia, and Bolivia agreed not to raise taxes on Chilean enterprises in Bolivia for 25 years. Amity was broken in 1878 when Bolivia tried to increase the taxes of the Chilean Antofagasta Nitrate Company over the protests of the Chilean government. When Bolivia threatened to confiscate the company's property, Chilean armed forces occupied the port city of Antofagasta on Feb. 14, 1879. Bolivia then declared war on Chile and called upon Peru for help. Chile declared war on both Peru and Bolivia (April 5, 1879).

Chile easily occupied the Bolivian coastal region (Antofagasta province) and then took the offensive against more powerful Peru. Naval victories at Iquique (May 21, 1879) and Angamos (Oct. 8, 1879) enabled Chile to control the sea approaches to Peru. A Chilean army then invaded Peru. An attempt at mediation by the United States failed in October 1880, and Chilean forces occupied the Peruvian capital of Lima the following January. Peruvian resistance continued for three more years, with U.S. encouragement. Finally, on Oct. 20, 1883, Peru and Chile signed the Treaty of Ancón, by which Tarapacá province was ceded to the latter.

Chile was also to occupy the provinces of Tacna and Arica for 10 years, after which a plebiscite was to be held to determine their nationality. But the two countries failed for decades to agree on what terms the plebiscite was to be conducted. This diplomatic dispute over Tacna and Arica was known as the Question of the Pacific. Finally, in 1929, through the mediation of the United States, an accord was reached by which Chile kept Arica; Peru reacquired Tacna and received $6,000,000 indemnity and other concessions.

During the war Peru suffered the loss of thousands of people and much property, and, at the war's end, a seven-month civil war ensued; the nation foundered economically for decades thereafter. In 1884 a truce between Bolivia and Chile gave the latter control of the entire Bolivian coast (Antofagasta province), with its nitrate, copper, and other mineral industries; a treaty in 1904 made this arrangement permanent. In return Chile agreed to build a railroad connecting the Bolivian capital of La Paz with the port of Arica and guaranteed freedom of transit for Bolivian commerce through Chilean ports and territory. But Bolivia continued its attempt to break out of its landlocked situation through the La Plata river system to the Atlantic coast, an effort that led ultimately to the Chaco War (1932–35) between Bolivia and Paraguay. *See also* Chaco War.

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Pacific Coast, region, western North America, possessing two unifying geologic and geographic properties—the Pacific Ocean, which constitutes a natural western border, and the coastal mountain ranges that form the eastern border of the region. The most commonly accepted definition of the Pacific Coast is largely a political one: it defines the region as comprising the U.S. states of California, Oregon, Washington, Idaho, Alaska, and western Montana and the Canadian province of British Columbia, formerly a part of the old Oregon Country. Hawaii is frequently included statistically in the "Pacific" states of the United States, even though, as a group of Polynesian volcanic and coral islands lying more than 2,000 miles (3,200 km) off the U.S. Pacific Coast, it has little in common geologically or sociologically with the mainland states.

Before Europeans reached North America, the Pacific Coast was inhabited by native peoples belonging to several culture areas and language families, including the California Indians, the Salishan- and Nadene-speaking Indians of the Pacific Northwest, the Eskimo-Aleut groups of the Bering Sea area, and the Indians of the Columbia Plateau. The Spaniards were the first to explore the Pacific Coast following Vasco Núñez de Balboa's discovery of the Pacific Ocean in 1513. By the time of the American Revolution the Spaniards had already gained familiarity with the California coast, cruised in Alaskan waters, established a base of sorts in Nootka Sound on Vancouver Island, and used the coastal waters for part of the famed Manila–Acapulco galleon trade. The Spanish hold on California was to remain unchallenged for three centuries.

During the first half of the 19th century, the presence of Americans in California and U.S. official desire to acquire West Coast ports were among the significant factors bringing on the war with Mexico in 1846–48. By the terms of the Treaty of Guadalupe Hidalgo in 1848, California was included in the Mexican territory ceded to the United States. The discovery of gold in California on Jan. 24, 1848, led the next year to the famous gold rush of the forty-niners, and in 1850 California was admitted to the Union as the 31st state.

The northern portion of the Pacific Coast, called the Pacific Northwest, had a somewhat different history from that of California. Initial Russian interest in the Bering Strait area led to the formation in 1799 of the Russian-American Company, which established trading posts in parts of Alaska. In 1867 Russia sold Alaska to the United States, and in 1958 Alaska became the 49th state in the Union.

North of California lay the Oregon Country, a region roughly as large as Alaska and possessing strikingly varied physical features, soil, and climate bound together by the mighty Columbia River. The discovery of Oregon's rich fur resources led, at the beginning of the 19th century, to an accelerated British and U.S. competition in the establishment of inland trading operations, resulting in overlapping claims to the Oregon Country. After a period of agreed-upon joint occupation, the 49th parallel was established in 1846 as a permanent boundary line to Puget Sound (but not including Vancouver Island). What had begun as a small American overland migration to Oregon in 1841 (by way of the Oregon Trail) gained momentum, and after the boundary settlement the tide of migration grew steadily; in 1848 Oregon was made a U.S. territory. Oregon was admitted to the Union in 1859, Washington in 1889, and Idaho in 1890.

The British area north of the 49th parallel was dominated by the fur trade until the gold strike of 1858. Vancouver Island united with the booming Colony of British Columbia in 1866, and in 1871 the colony became a province of Canada. First connected to the eastern provinces by railroad in 1885, British Columbia developed its timber and agriculture and its Pacific shipping trade. By the second half of the 20th century it had become one of Canada's wealthiest, most urbanized, and most racially diverse provinces.

Until the admission of Hawaii as a state in 1959, the American Pacific Coast represented the western borderland area of the United States. As such, the people and the press of this region displayed over the years a degree of regional self-consciousness. Isolation from the rest of the country was early corrected by Pacific Coast efforts to bring about a union of Eastern and Western lines of transportation and communication, an enhancement of maritime trade, and adequate Pacific Coast military defenses. Since then the Pacific Coast has been obliged to cope with many problems of a peculiarly Western nature. For example, Oriental and Mexican immigration has been a major Pacific Coast concern, as was the rapid urban population growth as a result of World War II. Another problem peculiar to this region has been the heavy dependence of West Coast business enterprises upon Eastern capital investment.

The people of the Pacific Coast are generally credited with being individualistic, exuberant, and optimistic in spirit, casual in dress, and innovative in business management.

Pacific Coast Ranges, mountain ranges that constitute a major physical feature of western North America. They run parallel to the Pacific coasts of California, Washington, and Oregon for 4,500 miles (7,250 km) in the United States and extend north into Canada for about 1,000 miles (1,600 km) and south into Mexico for about 800 miles (1,300 km).

A brief treatment of the Pacific Coast Ranges follows. For full treatment, *see* MACROPAEDIA: North America.

The Coast Ranges are separated from the higher Sierra Nevada and Cascade mountains to the east by broad depressions known in Oregon and Washington as the Willamette Valley–Puget Sound region and in California as the Central Valley. On the west the coastal plain is very narrow, and deep water occurs within 25 miles (40 km) of the coast. The Coast Ranges can be divided into six distinct sections, each of different geological origin and with its own distinctive topography. The sections include, from north to south, the coastal ranges of British Columbia, the marginal Coast Ranges of Washington and Oregon, the northern Coast Ranges between the Klamath Mountains of Oregon and San Francisco, the central Coast Ranges south of San Francisco, the Transverse Ranges near Los Angeles, and the Peninsular Ranges extending into Baja California. The average elevation is about 3,300 feet (1,000 m) above sea level, but some peaks and ridges rise to more than 6,600 feet (2,000 m) in elevation. The highest peak, San Gorgonio, reaches 11,500 feet (3,506 m) in the eastern Transverse Ranges. The upper slopes of the Olympic Mountains in the extreme northwestern corner of Washington support the largest active glaciers in the United States outside of Alaska.

The climate of the Pacific Coast Ranges is characterized by cool summers and mild winters in the north and drier summers in the south. The rain forests of the northern Coast Ranges, including the giant redwood forests, are among the most lush in the world. Fauna includes big-game animals such as bear, elk, and deer and small fur-bearing animals such as beaver, muskrat, rabbit, and bobcat. Resource-rich, the California region is noted for gold, petroleum, vineyards, and a large supply of fruits, nuts, and vegetables. The region is subject to occasional earthquakes, landslides, and forest fires.

Pacific Grove, resort and residential city, Monterey county, western California, U.S. It lies along Monterey Bay and adjoins the city of Monterey. Founded in 1874 by Methodists as a religious retreat, the city remains a centre for conferences of religious and other groups. Pacific Grove is the northern terminus of the scenic Seventeen Mile Drive from Carmel. The famous Butterfly Trees on Lighthouse Avenue are covered each winter by monarch butterflies that migrate from Canada and Alaska. Point Pinos Lighthouse is on the bay. The city is the site of the Hopkins Marine Station of Stanford University and has a natural-history museum. Inc. 1889. Pop. (1986 est.) 16,746.

Pacific Islands, island geographical region of the Pacific Ocean. It comprises three ethnogeographic regions—Melanesia, Micronesia, and Polynesia—but conventionally excludes the neighbouring island continent of Australia. The Pacific Island region covers almost 500,000 square miles (1,300,000 square km) of land, of which New Zealand and New Guinea island make up approximately 90 percent, and millions of square miles of ocean. It is a mixture of independent states, associated states, integral parts of non-Pacific Island nations, and dependent states.

The great arc of islands located north and east of Australia and south of the equator is called Melanesia (from the Greek words *melas,* "black," and *nēsos,* "island") after the predominantly dark-skinned peoples of New Guinea island, the Bismarck Archipelago, the Solomon Islands, Vanuatu (the New Hebrides), New Caledonia, and Fiji.

North of the equator and east of the Philippines is another island arc that ranges from Palau (Belau), Guam, and the Northern Mariana Islands in the west through the Federated States of Micronesia (the Caroline Islands), Nauru, and the Marshall Islands all the way to Kiribati (the Gilbert Islands). This is Micronesia, so named because of the smaller size of these islands and atolls.

In the eastern Pacific, and largely enclosed within a huge triangle formed by the Hawaiian Islands in the north, New Zealand to the southwest, and Easter Island far to the east, are the "many" (poly) islands of Polynesia. Other components of this widely scattered collection, again generally from west to east, are Tuvalu (the Ellice Islands), Wallis and Futuna Islands, Tokelau, Western Samoa, American Samoa, Tonga, Niue, the Cook Islands, and French Polynesia (including the Society, Tuamotu, and Marquesas islands). In this, the last section of the Pacific Ocean to be inhabited, the islanders share a cultural tradition that relates them closely to many Fijians. Fiji, indeed, is actually a transitional territory between Melanesia and Polynesia. The estimated population of the Pacific Islands (excluding New Zealand and Papua New Guinea, but including the Hawaiian Islands) was 3,364,000 in 1988.

The Pacific Islands are treated in a number of MACROPAEDIA articles. For treatment of the region and individual island groups and states, *see* Pacific Islands. For treatment of Hawaii, *see* United States of America. For treatment of New Zealand, *see* New Zealand.

For current history and for statistics about the administration, society, and economy of the Pacific Islands, *see* BRITANNICA WORLD DATA ANNUAL.

The land. The main Pacific Islands span the equator obliquely from northwest to southeast and can be divided into two major physiographic regions by island type: continental and oceanic. The continental islands, lying southwestward of the Andesite Line of extreme volcanic and earthquake activity, are associated with the ancient continental platforms of Asia and Australia (now partly submerged) and differ in a number of ways from the oceanic islands to the northeast in the deeper Pacific basin. The continental type of island derives from volcanic rock high in silica and alumina (andesite). Continental islands are generally larger (the Marianas, New Guinea, the Bismarcks, the Solomons, Vanuatu, Fiji, New Caledonia, and the North and South islands of New Zealand) and have richer mineral-bearing soils than their oceanic counterparts.

The parent lava material of the oceanic type of island is basalt. Oceanic islands are differentiated as high volcanic-based islands, such as Hawaii, or low coral islands and atolls, such as the Marshalls.

The climate of the Pacific Islands is generally tropical (except in New Zealand, which has a temperate climate), with temperatures, humidity, and rainfall relatively uniform throughout the year; there is slightly less rainfall from December to February north of the equator and from June to September south of the equator. Temperature varies from an annual average at both Nauru and Kiribati of 82° F (28° C) to an average of 66° F (19° C) at Norfolk Island, one of the southernmost Pacific Islands. Precipitation decreases generally southward and eastward from more than 120 inches (3,050 mm) at the island of Yap (Federated States of Micronesia) in the northwest to about 30 inches (750 mm) at Kanton (Canton) Island to the east (along the equator).

Most vegetation in the Pacific Islands is derived from Indonesia and New Guinea, and generic variety declines eastward across the Pacific. Local environmental differences and relative isolation have resulted in the evolution of numerous new endemic species. The introduction of new species from throughout the world has also markedly altered island flora. About 2 percent of the total land area is arable and, outside of New Zealand and Papua New Guinea, is devoted mostly to the cultivation of coconut and cassava. Most of the larger islands also support some livestock. As much as three-fifths of the Pacific Islands' total land area is forested. Most Pacific Islands are poor in mineral resources.

The people. People of European origin account for as much as one-third of the Pacific Islands' population if New Zealand is included in the total and less than one-tenth if it is not; outside of New Zealand the largest concentration of people of European origin is in Hawaii. If the Melanesians in Papua New Guinea are excluded from the Melanesian total, then the Polynesians are the largest indigenous group in the Pacific Islands. Otherwise the Melanesians are the largest indigenous group in the Pacific Islands, with those in Papua New Guinea accounting for two-fifths of the Melanesian total. Polynesians are concentrated in New Zealand (with two-fifths of the Polynesian total), Hawaii, Western Samoa, French Polynesia, and Tonga. Several hundred distinct languages are spoken in the Pacific Islands and are mostly Austronesian in origin. Most islanders have some familiarity with English or French; one or the other of these is the official language of virtually all Pacific Islands. Christianity has largely supplanted traditional animism.

The population of the Pacific Islands (excluding New Zealand with its majority of people of European descent and Papua New Guinea with its majority of Papuans) is concentrated in Hawaii (which has one-third of the region's total population), Fiji (more than one-fifth of the region's total), and the Solomon Islands. Western Samoa, French Polynesia, New Caledonia, Vanuatu, and Guam have populations in excess of 100,000. Most Pacific Islands are densely populated; the population density ranges from about 21 persons per square mile (8 per square km) in New Caledonia to almost 1,000 per square mile in Nauru. The population of the Pacific Islands is concentrated along the coasts. The crude birth rate is relatively high by world standards in all but a few Pacific Islands; the generally high rate of natural increase on most of the smaller islands is partially offset by emigration to the United States, Australia, and New Zealand.

The economy. Except for Hawaii and New Zealand, the Pacific Islands have a generally developing mixed economy in which both public and private sectors participate. The gross national product (GNP) per capita varies widely among the Pacific Islands, from very low in Tuvalu, Kiribati, and the Solomons to within the range of developed countries in New Zealand and French Polynesia. The Hawaiian Islands have the highest GNP per capita.

Agriculture, fishing, and services are generally the largest sectors of most of the islands' economies, and mining is important on a few of the islands. Subsistence farming predominates on all but the largest Pacific Islands (excluding Hawaii and New Zealand), where generally some cash crops besides coconuts are also grown. Sweet potatoes, cassava, taro, breadfruit, and bananas are the main subsistence crops of most of the islands. Almost all the islands grow coconuts, which, with copra, are a major export. Sugarcane, pineapple, citrus fruits, mango, papaya, coffee, and cacao are cash crops in Hawaii, Fiji, French Polynesia, New Caledonia, Papua New Guinea, Western Samoa, and the Cook Islands.

Pastureland is available only on the larger islands, including Hawaii, New Caledonia, Fiji, Vanuatu, and the Solomons; all raise pigs, cattle, and chickens commercially and are self-sufficient in milk and meat. New Zealand is noted for sheep and cattle rearing. Villagers on the smaller Pacific Islands and New Guinea rear pigs and some goats on subsistence farms.

There are commercially exploitable forests in Fiji, New Caledonia, New Zealand, Papua New Guinea, the Solomons, Western Samoa, and Vanuatu that produce timber, sawn wood, and wood products for domestic consumption and export. The other islands generally must import quality lumber.

Subsistence fishing is important on all the islands (except Hawaii and New Zealand) and forms a major source of protein in local diets. The Solomons, Kiribati, and Fiji account for approximately four-fifths of the regional catch (excluding that from Hawaii and New Zealand), much of it by commercial fishing operations. Deep-sea fishing, mostly for tuna, is conducted throughout the Pacific.

Mineral production is limited to a few of the high continental islands. New Caledonia produces nickel, ferronickel, chromite, cobalt, stone, sand, and gravel. Fiji produces gold and telluride ores, silver, and lime. Nauru mines phosphates. The Solomon Islands produce gold, silver, and lime from seashells. New Guinea produces copper and gold, and New Zealand extracts coal and natural gas.

The manufacturing sector, except in Hawaii and New Zealand, is mostly undeveloped and limited to processing fish and agricultural products and producing handicrafts. The only islands outside Hawaii and New Zealand with significant manufacturing industries, most of which produce import substitution goods, are Guam, Fiji, New Caledonia, French Polynesia, Papua New Guinea, and the Solomons. Regional electricity is generated primarily from imported fuels.

Tourism is very important to the Pacific Ocean islands. It centres on fine beaches, good fishing and boating, and local customs and crafts and has benefited from the development of overseas jet air transport. French Polynesia, Guam, Hawaii, Fiji, and New Zealand have the most developed tourist industry, but the other islands are rapidly developing facilities. Most dependent Pacific Islands states receive budgetary and development aid, mainly from the continental governing nations, while the smaller independent island states receive aid particularly from Australia and New Zealand, as well as from Japan, the United Kingdom, and the United States.

Air transport and interisland shipping are the principal means of transport. American Samoa, the Cook Islands, Fiji, French Polynesia, Guam, Hawaii, the Marshalls, New Caledonia, New Zealand, Papua New Guinea, the Solomons, and Western Samoa have international airports. Extensive road networks are limited to the large high islands.

Most Pacific Islands' annual imports (excluding New Zealand and Papua New Guinea) far exceed exports. Remittances from expatriates and tourism only partially offset the trade deficits. Copra, minerals, coffee, tea, cocoa, spices, sugar, and frozen or tinned fish are among the leading exports, mainly to Japan, France, the United States, and Australia. Machinery and transport equipment, mineral fuels, food, and manufactured goods are among the chief imports and come mainly from Australia, France, Japan, and the United States. Only a very small percentage of the Pacific Islands' external trade is intraregional.

Government and social conditions. The independent states of the Pacific Islands include six constitutional monarchies (Fiji, New Zealand, Papua New Guinea, Tonga, Tuvalu, and Western Samoa), three republics (Kiribati, Nauru, and Vanuatu), and one parliamentary state (the Solomon Islands). Dependent islands and island groups include the unincorporated U.S. territories (American Samoa, Guam, Johnston, Midway, and Wake islands), the self-governing states associated with New Zealand (the Cook Islands and Niue and the New Zealand territory of Tokelau), the islands governed by Australia (Norfolk, Lord Howe, and the Torres Strait islands), the French overseas territories (French Polynesia, New Caledonia, and Wallis and Futuna), and the U.K. colony of Pitcairn Island. Integral parts of non-Pacific Island nations include the U.S. state of Hawaii and Easter Island (a province of Chile). The former United Nations Trust Territory of the Pacific Islands was a U.S.-administered mandated trust territory comprising Palau (Belau), the Federated States of Micronesia, the Marshall Islands, and the Northern Mariana Islands. In 1986 the Trust Territory was dissolved for all but Palau, whose political status remains contested. The other island groups achieved full self-government under various political arrangements with the United States, except for the Northern Mariana Islands, which remained a U.S. commonwealth.

Except for Easter Island, which is governed by a governor from Chile, all the inhabited island states and territories have varying degrees of autonomy and self-government with representatives elected by universal or limited adult suffrage. Traditional chiefs retain considerable influence where indigenous peoples remain in the majority. Judicial systems variously follow American, British, and French models, with some indigenous input on certain islands. Easter Island follows the legal system of Chile.

Only a few islands have social-security and pension systems, mainly because indigenous island culture includes community provisions for caring for the elderly and the disabled. Health conditions vary throughout the region. The best conditions and highest ratio of medical personnel to population are found in American Samoa, the Cook Islands, Fiji, French Polynesia, Guam, Hawaii, Nauru, New Caledonia, New Zealand, Niue, Tokelau, Wallis and Futuna, and Western Samoa. The principal diseases on those islands are hypertension, diabetes, cancer, heart disease, and respiratory diseases. On other islands, poor sanitation and poor hygiene result in a prevalence of malaria, gastrointestinal illness, diarrhea, filariasis, parasitic infections, tuberculosis, influenza, and skin diseases; infant mortality rates are high and life spans are relatively short. Isolated atolls frequently lack freshwater sources other than rain and generally have the lowest levels of health care.

Primary and secondary education is available in virtually all island groups. Schools are usually operated by both government and church or missionary organizations. Secondary, technical, and teacher-training schools are usually found on the main islands of each state. Universities are located in Fiji, Guam, Hawaii, New Zealand, Papua New Guinea, the Solomon Islands, and Western Samoa. Fiji's University of the South Pacific maintains branch campuses on other islands.

Cultural life. Polynesian and Melanesian cultures tend to be best-represented on islands that retain majority indigenous populations. Micronesian culture has survived best in Yap, Truk, and Palau. In other islands, such as Hawaii, French Polynesia, and New Caledonia, indigenous culture has blended with European, Japanese, and American cultures, and integrated societies have evolved.

Missionary activity during the 19th century in most islands resulted in the destruction of statues, carvings, religious sites, and artifacts and the abandonment of dances, songs, and ceremonies of the pre-European cultures. There are notable pre-European archaeological remains in Easter Island, Fiji, throughout French Polynesia, the Solomon Islands, Palau, and Pohnpei (Federated States of Micronesia), all of which were indigenous political and religious centres.

Independence and tourism have led to some resurgence of indigenous costumes, dances, rituals, and handicrafts, all of which are attractions for visitors, though in many places their original religious meanings have been lost. The extension of air service and the growing impact of technologically advanced Western culture, however, increasingly infringe on traditional island life-styles, even on the remotest islands and atolls, as well as in the interior of New Guinea. Moreover, the Pacific islanders, traditionally a mobile people, have increased their movement both within and out of the region as economic opportunities have shifted.

History. The peopling of the Pacific Islands is clouded with uncertainty. Western Melanesia was probably settled by Austronesians from the Philippines and Indonesia between 3000 and 2000 BC. Eastward migrations by these peoples extended to western Micronesia, central and eastern Melanesia, and western Polynesia (2000–1000 BC) and was followed by the settlement of uninhabited adjacent islands. During the 1st millennium AD the greatest migrations to Polynesia took place. Polynesian and some Micronesian cultures developed highly stratified social structures with hereditary chieftainships. Melanesian cultures were less concerned with hereditary social rank than with gaining individual prestige.

The first European exploration of the Pacific Islands was led by Ferdinand Magellan between 1520 and 1521. Spanish, Dutch, and English explorers followed during the 16th, 17th, and 18th centuries, one of the more renowned being Captain James Cook in the mid-18th century. European missionaries and trading societies were established on many of the islands in the 18th and 19th centuries. By the late 19th century the major European powers had established colonial spheres of influence and trade throughout the Pacific. The Germans and Spanish dominated Micronesia. The English became established in parts of Melanesia and Polynesia (including New Zealand), while the French annexed Tahiti and nearby islands, creating French Polynesia. In 1898 the United States annexed the Hawaiian Islands and in 1899 acquired Guam after defeating Spain in the Spanish-American War. Spain's loss to the United States prompted the Spanish to sell what were to become the Trust Territory Islands—*i.e.*, the Marshalls, the Carolines, and Palau—to Germany.

During World War I the colonial structure of the Pacific Islands was altered as Japan occupied the German possessions, while New Zealand took Samoa. Following the end of the war these islands were mandated to Japan and New Zealand by the League of Nations.

Between the world wars, Japan fortified its Pacific acquisitions and used them as launching bases for invading much of the rest of Micronesia and Melanesia during World War II. Many of the islands, such as Guadalcanal in the Solomons, were occupied by U.S. forces after bitter fighting in 1943–45. In 1947 the United Nations granted the former Japanese possessions of Micronesia to the United States as a strategic trust territory, and French Polynesia, New Caledonia, and Wallis and Futuna became overseas territories of France. The United States admitted Hawaii as its 50th state in 1959.

Many of the Pacific Islands achieved independence or a degree of self-government after World War II. Western Samoa (1962), Nauru (1968), Fiji and Tonga (1970), Solomon Islands and Tuvalu (1978), Kiribati (1979), and Vanuatu (1980) have all achieved independence. The individual states of the U.S. Trust Territories achieved self-government in the mid-1980s. There has also been a movement for independence in French Polynesia.

Pacific Islands, Trust Territory of the, former United Nations strategic-area trusteeship that was administered by the United States from 1947 to 1986. The territory consisted of more than 2,000 islands scattered over about 3,000,000 square miles (7,770,000 square km) of the tropical western Pacific Ocean, north of the equator between latitudes 1° and 22° N and longitudes 130° and 172° E. Most of the islands are quite small, the total land area amounting only to about 700 square miles (1,800 square km). The trust territory covered the region known as Micronesia ("tiny islands") and was composed of three major island groups—the Marianas, the Carolines, and the Marshalls. Guam, the southernmost of the Marianas, was excluded from the trust territory. The islands of Kapingamarangi and Nukuoro, which are culturally Polynesian rather than Micronesian, were included. The trust territory's seat of government was Saipan in the Northern Marianas.

Portuguese and Spaniards first began to explore the Micronesian region in the 16th century. Later explorers, traders, and whalers included the British, Germans, Russians, Japanese, and Americans. Spain at first expanded its control throughout Micronesia with little opposition from the other European powers. In the late 19th century, however, Spain's domination of the region was challenged by Germany and the United Kingdom. To consolidate its hold in the region, Spain proclaimed sovereignty over the Marshall and Caroline groups in 1874. Germany moved into the Marshall Islands uncontested, and the two countries shared power in Micronesia until the Spanish-American War (1898). Spain's defeat in that conflict caused it to cede Guam to the United States and sell its remaining possessions in Micronesia to Germany, which then controlled virtually the entire region.

At the outbreak of World War I Japan immediately moved militarily to take over Germany's possessions in Micronesia. After Germany was defeated, Japan sought to incorporate Micronesia into its empire, but the League of Nations made the islands a mandate to be administered by Japan. Nevertheless, the Tokyo government developed the territory as though it exercised full sovereignty. The region became a strategic battleground during World War II, the United States finally securing the islands in the course of its Pacific campaign. After Japan's defeat the United States remained in control of the islands, and in 1947 they became a United Nations trusteeship under U.S. administration.

The legal basis for government within the area was laid down in the Code of the Trust Territory, enacted in 1952. The code defined citizenship, provided a formal law code, and created six administrative districts. The code recognized customary law and allowed for appointed, rather than elected, officials. The U.S. government was responsible for the territory's civil administration. During the 1950s, criticisms of the administration of the territory from the UN Trusteeship Council and from within the United States brought increased attention to a movement toward autonomy. In 1965 the territory elected the Congress of Micronesia, endowing it with legislative powers. In a 1975 plebiscite the Northern Marianas group voted to become a commonwealth of the United States and, from 1976, was administered separately from the rest of the territory. The remaining island groups were reorganized again into six districts, which in 1978 voted on a proposed constitution for the Federated States of Micronesia. Four of these districts (Kosrae, Pohnpei, Truk, and Yap; all in the Carolines) approved the constitution and were established as the new federation in 1979. The two dissenting districts, the Marshall Islands and Palau (or Belau, in the Carolines), formed republics in 1979 and 1981, respectively. The Federation and two republics approved and voted in popular referenda (1982–83) for compacts of free association with the United States. Free association, as defined in the compacts, gave the republics full internal self-government and substantial authority in foreign affairs, but vested the United States with full responsibility and authority for their defense for a number of years.

In 1986 the U.S. government declared the Trust Territory agreements no longer in effect. (The approval of the UN Security Council was technically necessary for the cessation of the trusteeship, but politically motivated efforts by the Soviet Union to obstruct the decolonization process necessitated a unilateral U.S. termination of the trusteeship, which was approved by a majority vote of the Trusteeship Council of the UN.) The Federated States of Micronesia and the Republic of the Marshall Islands thus became sovereign, self-governing states with the United States responsible for their security and defense, and the Northern Mariana Islands formally became a commonwealth of the United States. The Republic of Palau's entry into a compact of free association was delayed pending formal Palauan approval of the compact.

Pacific League, one of the two leagues of professional baseball teams in Japan (the other being the Central League). The Pacific League was founded in 1950. It has six teams, some of whose names and hometown designations have changed over the years. The league consists of the Orix Braves, Kintetsu Buffaloes, Lotte Orions, Daiei Hawks, Nippon Ham Fighters, and Seibu Lions. The regular playing season culminates in the Japan Series, a seven-game series between the respective champion teams of the Pacific and Central leagues.

Pacific Ocean, body of salt water extending from the Antarctic region in the south to the Arctic in the north and lying between the continents of Asia and Australia on the west and North and South America on the east.

A brief treatment of the Pacific Ocean follows. For full treatment, *see* MACROPAEDIA: Pacific Ocean.

The Pacific Ocean occupies about one-third of the surface of the Earth and is by far the largest of the world's oceans. Its area, excluding adjacent seas, encompasses approximately 63,800,000 square miles (165,250,000 square km). It has twice the area and more than twice the water volume of the Atlantic—the next-largest ocean. Its area exceeds that of the whole land surface of the globe, Antarctica included. The mean depth of the Pacific (excluding adjacent seas) is 14,050 feet (4,280 m). The western Pacific is noted for its many peripheral seas. From north to south they include the Bering Sea, Sea of Okhotsk, the Sea of Japan, the Yellow Sea, the East China Sea, and the South China Sea. The great rivers of eastern Asia—including the Amur, the Huang Ho, the Yangtze, the Hsi, and the Mekong—enter the Pacific indirectly by way of peripheral seas.

To the east of the meridian of 150° W, the relief of the Pacific Ocean floor is considerably less pronounced than it is to the west. Submerged oceanic ridges found at depths of less than 2,000 feet (600 m) rise at points to form several archipelagos in the western Pacific. These ridges include the Aleutian ridge in the northwestern Pacific; the series of ridges extending southward through the

Kurils, Bonin, the Marianas, Yap, and Palau (Belau); those extending eastward from Palau, including the Bismarck, the Solomons, and Santa Cruz ridges; and finally the ridges extending southward from the Samoan islands, those of Tonga, Kermadec, Chatham, and Macquarie.

Water temperatures in the northern Pacific tend to be higher than those in the southern Pacific because the ratio of land to sea areas is larger in the north than in the south and because the ice-clad continent of Antarctica influences water temperature. The Pacific waters within the belt of calms and variable winds near the Equator have lower salinities than those in the trade-wind belts.

The most important influence on the vertical circulation of the Pacific is the cold water generated around the Antarctic continent. This dense circumpolar water sinks and then spreads northward to form the bottom layer of the greater part of the Pacific. Cold, deep water flows northward in the western Pacific in a relatively well-defined current from the vicinity of Antarctica to Japan. Branches from this deep mainstream convey cold water eastward and then poleward in both hemispheres.

Deepwater circulation is influenced by the descent of surface water at zones of convergence of neighbouring water flows. In the zone known as the Pacific Tropical Convergence, water sinks to a depth of about 300 feet (91 m) before it spreads laterally. The Pacific Subtropical convergences are located between the parallels of 35° and 40° N and S. Water that sinks at the convergences spreads laterally at increasing depths as the distance from the Equator increases. The most important convergence in the Pacific is the Antarctic Convergence, which lies about 55° to 65° south in the southern Pacific.

Pacific Railway Acts (1862, 1864), two measures that provided federal subsidies in land and loans for the construction of a transcontinental railroad across the United States.

The first Pacific Railway Act (July 1, 1862) authorized the building of the railroad and granted rights of way to the Union Pacific to build westward from Omaha, Neb., and to the Central Pacific to build eastward from Sacramento, Calif. The act also granted 10 alternate sections of public domain land per mile on both sides of the railway, and it provided loan bonds for each mile of track laid. The loans were repayable in 30 years, and the dollars per mile escalated in accord with the difficulty of the terrain.

Two years later, the railroads were still hampered in their quest for sufficient capital for the vast construction project. Congress obliged with the second Pacific Railway Act (July 2, 1864), which doubled the size of the land grants and allowed the railroads to sell their own bonds. After the transcontinental railroad was completed in 1869, congressional investigations revealed that some railroad entrepreneurs had illegally profiteered from the two Pacific Railway Acts.

Pacific Scandal (1872–73), charges of corruption against Canadian prime minister John Macdonald in awarding the contract for a transcontinental railroad; the incident resulted in the downfall of Macdonald's Conservative administration.

One of the conditions under which British Columbia entered the Dominion of Canada (1871) was that a railway to link that province with the east be constructed within 10 years. In 1872 a contract for construction of such a railway was awarded to a syndicate headed by Sir Hugh Allan, a Canadian shipowner and financier. Allan was a heavy contributor to the Conservative campaign in the 1872 election, and Macdonald's Liberal opponents accused him of having awarded the contract in return for this financial support (April 1873). The charges led to the resignation of the Macdonald government on November 5 and to the cancellation of the contract. In the election of January 1874, the Conservatives were badly beaten.

Pacific Ten Conference, byname PAC TEN, West Coast American collegiate athletic association that grew out of the Athletic Association of Western Universities (AAWU), itself a descendant of the Pacific Coast Intercollegiate Athletic Conference (PCIAC), which began in 1915. Members are the University of California at Berkeley, the University of California at Los Angeles (UCLA), the University of Southern California (USC), the University of Oregon, Oregon State University, Stanford University, the University of Washington, Washington State University, the University of Arizona, and Arizona State University.

The original PCIAC foundered during a series of withdrawals from the conference in 1959 and 1960, resulting from dissatisfaction with penalties assessed several members for conference rule violations. Later Washington, California, UCLA, and USC formed the AAWU, which evolved into the present-day conference.

Pacific yew (tree): *see* western yew.

Pacifico Affair: *see* Don Pacifico Affair.

pacifism, the opposition to war and violence as a means of settling disputes. Pacifism may entail the belief that the waging of war by a state and the participation in war by an individual are absolutely wrong, under any circumstances.

In the ancient world, war was taken for granted as a necessary evil by some societies, while in others it was not even regarded as an evil. Individual voices in various lands decried the evils of war, but the first genuinely pacifist movement known came from Buddhism, whose founder demanded from his followers absolute abstention from any act of violence against their fellow creatures. In India the great Buddhist-influenced king Aśoka in the 3rd century BC definitely renounced war, but he was thinking primarily of wars of conquest. In succeeding ages Buddhism does not seem to have been very successful in restraining the rulers of countries in which it was adopted from making war. This may be because the Buddhist rule of life, as generally understood, served as a counsel of perfection which comparatively few could be expected to follow in its entirety.

In classical antiquity, pacifism remained largely an ideal in the minds of a few intellectuals. The Greek conceptions of peace—including Stoicism—were centred on the peaceful conduct of the individual rather than on the conduct of whole peoples or kingdoms. In Rome the achievement of *pax,* or peace, was defined as a covenant between states or kingdoms that creates a "just" situation and that rests upon bilateral recognition. This judicial approach was applicable only to the "civilized world," however. Thus the Pax Romana of the 1st and 2nd centuries AD was not really universal because it was always regarded as a peace for the civilized world alone and excluded the barbarians. And since the barbarian threat never ended, neither did the wars Rome waged to protect its frontiers against this threat.

Christianity, with its evangelical message, offered considerations in support of individual nonviolence as well as of collective peacefulness. Jesus' spoken words as recorded in the New Testament could be interpreted as a kind of pacifism and in fact were so interpreted by many of Jesus' early radical followers. As a rule, however, the "peace" that Jesus spoke of was only open to minorities or to sects that practiced a rigorous ethics, while the Christian Church itself had to compromise with worldly necessities. "The question of soldiers"—the inconsistency between the pursuit of peace and fighting in wars—was disturbing to Christians from the time of Jesus. However, in the early 3rd century, certain passages in the Gospels were interpreted to indicate that armies were not only acceptable but necessary in order to fight against demons. In the early 5th century, St. Augustine wrote *De Civitate Dei* (*The City of God*), which presented a distinction between worldly and supraworldy peace. He felt that worldly peace was acceptable only if it was in accord with Christian law, and it was the duty of the worldly state to serve the church and to defend itself against those who wished to undermine the church's authority. These ideas prevailed throughout the Middle Ages and were often tied with the myth of an eschatological emperor who would suppress nonbelievers and lead the world to peaceful times. Like the Roman *pax,* Christian peace needed to be perpetually defended. There was a never-ending threat posed by non-Christians, who were viewed as demonic.

Since the Renaissance, concepts of pacifism have been developed with varying degrees of political influence. A great deal of pacifist thought in the 17th and 18th centuries was based on the idea that a transfer of political power from the sovereigns to the public was a crucial step toward world peace, since wars were thought of as arising from the dynastic ambitions and power politics of kings and princes. Thus was propagated the illusion that monarchies tended toward wars because the sovereigns regarded their states as their personal property and that compared to this, a republic would be peaceful. The offshoot of these theories was the creation of pacifist organizations in 19th-century Europe in which such ideas as general disarmament and the instigation of special courts to hear international conflicts were entertained. The theme of pacifism thereby caught the public interest and inspired an extensive literature. Some of these ideas were later realized in the Court of Arbitration in The Hague, the League of Nations, the United Nations, and temporary disarmament conferences, but their overall effect was limited. In the 19th century, for instance, the real maintenance of a relative peace resulted from the statesmanlike political establishment of a balance of power among the five great European states. The succeeding century, with its two world wars, its nuclear stalemate, and its unending succession of conflicts among developed and developing nations, has been notable chiefly for the utter irrelevance of pacifist principles and practices.

Pacifism is not a part of Communist ideology. Lenin rejected it outright, and in the work of Karl Marx, "revolution" and "war" are synonymous. Their theories and those of Friedrich Engels advocate the necessity of "just" war against the capitalistic classes, with the goals of a classless society and universal peace following the world-revolutionary victory of the international proletariat.

There are two general approaches or varieties of pacifist behaviour and aspirations. The one rests on the advocacy of pacifism and the complete renunciation of war as a policy to be adopted by a nation. The other stems from the conviction of an individual that his personal conscience forbids him to participate in any act of war and perhaps in any act of violence whatsoever.

The arguments for pacifism as a possible national policy run on familiar lines. The obvious and admitted evils of war are stressed—the human suffering and loss of life, the economic damage, and perhaps above all, the moral and spiritual degradation war brings. Since World War II increasing emphasis has also been laid on the terrible powers of destruction latent in nuclear weapons. Pacifist advocates often assume that the abandonment of war as an instrument of national policy will not be possible until the world community has become so organized that it can enforce justice among its members. The nonpacifist would, in general, accept what the pacifist says about the evils of war and the need for international organization. But he would claim that the pacifist has not faced squarely the possible evils that would result from the alternative policy of a nation's nonresistance in the face of external aggression: the possible mass deportations and even mass exterminations and the subjection of conquered peoples to totalitarian regimes that would suppress just those values which the pacifist stands for.

Pacifists may claim that these evils can be met by nonviolence, *i.e.,* the general attitude of friendliness and benevolence which, it is claimed, may disarm even the most savage aggressors. Nonviolence could also mean nonviolent resistance, which relies on the difficulties and inconvenience that can be caused to the conqueror or oppressor by a general refusal of the public to cooperate. But 20th-century history shows a striking number of occasions on which nonviolent tactics such as these entirely failed to disarm the enemy or even to preserve the communities practicing them. Pacifist Christian sects have often been the objects of the most ruthless persecution in a time period stretching from the European Middle Ages to the Nazi regime of Adolf Hitler. The story of the persecution of the Jews over many centuries is only too familiar, though for generations they practiced nonviolence toward their persecutors. It seems that pacifist or nonviolent methods can only be effective against a power that has no very strong motives for going to extremes of suppression or one that is governed at least in part by the same moral scruples that actuate the pacifists themselves. It seems clear to most nonpacifists that complete nonresistance to external aggression would sooner or later lead to foreign domination of one's country, perhaps by the most fanatical and ruthless powers.

Personal pacifism is a relatively common phenomenon compared to national pacifism. Members of several small Christian sects who try to literally follow the precepts of Jesus Christ have refused to participate in military service in many nations and have been willing to suffer the criminal or civil penalties that followed. Not all of these and other conscientious objectors are pacifists, but the great majority of conscientious objectors base their refusal to serve on their pacifist convictions. There are, moreover, wide differences of opinion among pacifists themselves about their attitude toward a community at war, ranging from the very small minority who would refuse to do anything that could help the national effort to those prepared to offer any kind of service short of actual fighting.

pacing, in horse racing, one of two gaits seen in harness racing (*q.v.*).

pacinian corpuscle, oval, layered structure serving as the terminal capsule of certain sensory nerve endings. They are particularly found in the deeper skin and subcutaneous tissues of the hands and feet. They are thought to be sensitive to pressure and to vibrations up to 400 cycles per second. Pacinian corpuscles are named for the 19th-century Italian anatomist Filippo Pacini, who first described them. *See also* Meissner corpuscle; Ruffini ending.

Pack, Otto von (b. 1480?—d. Feb. 8, 1537, Brussels), German politician whose intrigues and forgeries almost caused a general war between Germany's Catholic and Protestant princes in 1528.

Pack, a Saxon nobleman, studied law at the University of Leipzig, after which he entered the service of George, duke of Saxony. By 1519 most important governmental matters in Saxony were entrusted to him, and he represented his ruler at the Reichstag (imperial Diet) from 1522 to 1526. His perpetual lack of funds, however, soon led him into a number of fraudulent schemes. The most serious of these became known as the Pack Affairs (Packsche Händel). After a meeting between the Holy Roman emperor Ferdinand I and a number of Catholic princes at Breslau (1527), Pack reported to Philip the Magnanimous, the Protestant landgrave of Hesse, that an offensive alliance had been formed against Germany's Protestant rulers. Philip immediately formed a defensive league with the elector John the Steadfast of Saxony (1528) and attacked the cities of Würzburg and Bamberg. Simultaneously, he published a copy of the alleged Catholic treaty, provided by Pack. The document was immediately exposed as a forgery, but Philip, unconvinced, protected the culprit until 1529. After being expelled from Hesse, Pack became a fugitive until captured and beheaded in Brussels almost seven years later.

pack ice, floating mass of ice formed from seawater in the Earth's polar regions. Pack ice expands during winter to cover about 5 percent of the northern oceans and 8 percent of the southern oceans. When melting occurs in spring and summer, the margins of the pack ice retreat.

A brief treatment of pack ice follows. For full treatment, *see* MACROPAEDIA: Ice and Ice Formations.

As seawater freezes, minute pools of salty water called brine pockets are entrapped. Once an ice field has formed, brine pockets migrate downward through the ice block in response to gravity and thermal gradients. After a few weeks to a few months, the surface of the ice becomes lower in salt content than the deeper layers. In the summer, when the ice temperature rises, there is a rapid increase in the migration of salt out of the ice. The sea-ice surface becomes potable and, in fact, is used by Eskimos as a source of fresh water.

Also characteristic of frozen salt water is that, even after freezing, the water below the ice will continue to turn over, or circulate. As the surface water near the ice becomes colder, it becomes heavier and sinks, resulting in a continuous turnover or vertical circulation of the water beneath the ice.

In the Northern Hemisphere during September and October, the air temperature lowers sufficiently to form a thin sheet of ice on some polar seas. The freezing temperature for average northern ocean water of about 3.5 percent salt composition by weight (usually designated 35 parts per thousand) is −1.8° C (28.7° F). Initially the ice film is entirely fresh, but as more ice crystals form, brine pockets become entrapped between lamellae (very fine layers) of tiny ice plates. Owing to slight breezes and water motion, the thin sheets of ice jostle about and, after a few hours, form a field of ice paddies; these disks of ice are known as pancake ice. If the temperature remains below freezing, the pancake ice coalesces as more ice forms, and within a few days the ice cover can be 8–10 cm (3–4 inches) thick with a slightly corrugated surface. As seawater continues to freeze at the bottom edges and sides of ice floes and fields, pressures associated with the stresses and strains caused by water and wind movement result in a hummocking and ridge development in some places and open water in others. With alternating freezing, partial melting, snow, and wind and swell, the ice field develops over a matter of a few weeks to a month into ocean cover 15–60 cm (6 inches–2 feet) deep. At this point the ice field is still navigable by most large vessels; however, if a vessel finds itself in the far north two weeks after the commencement of active surface freezing (in late October), it is in peril of being locked in for the remainder of the winter.

The pack ice of the Northern Hemisphere covers an average area of about 10,600,000 square km (4,100,000 square miles), filling the Arctic Ocean Basin and adjacent North Atlantic Ocean. The polar ice field consists of about 4,700,000 square km (1,800,000 square miles) of 3–6-metre- (10–20-foot-) thick polar ice that never melts. The motion of the polar ice follows a giant clockwise eddy with a centre at approximately 85° N, 170° W. Together with Arctic Basin seasonal sea ice, this Arctic pack exits into the northern Atlantic through two ice streams. The major exit of drifting pack ice from the Arctic Basin is along the eastern side of Greenland. The second icy arm of the north consists of a discharge through the Canadian-Arctic Archipelago and along the eastern North American shore.

Approximately twice as much pack ice forms in the oceans surrounding Antarctica as is found in the Arctic. The maximum area of Antarctic pack ice is about 20,000,000 square km (7,700,000 square miles). The Antarctic pack ice forms a fairly constant band of drifting sea ice around the continent in a giant clockwise eddy, with the farthest northern extent occurring at the end of the austral (southern) winter in October. The greatest extension of pack ice in the South Pacific sector is found in about latitude 62° S, and in the South Atlantic pack ice extends to 52° S.

pack rat: *see* wood rat.

packaging, the technology and art of preparing a commodity for convenient transport, storage, and sale.

Though the origins of packaging can be traced to the leather, glass, and clay containers of the earliest Western commercial ventures, its economic significance has increased dramatically since the start of the Industrial Revolution. Packages on the contemporary market are designed to protect goods from the hazards of handling and environmental conditions; to provide a manageable unit of the packaged product for the producer, distributor, and consumer; and to identify the product in a way that appeals to the potential purchaser. Packages must also be easy to manufacture and to fill, and they must be inexpensive relative to the price of the final, packaged product.

Materials used in the transport of substantial loads of goods include corrugated or solid cardboard for lighter materials, metal for liquid goods, and wood for heavy or bulky loads. Timber cases and crates are widely used for weights of more than 220 pounds (100 kg), while below this weight fibreboard, either solid or corrugated, is the favoured material. Wooden pallets have replaced crates in some instances. Plastic has also been used extensively as an impact buffer and, because of its high durability and insulation qualities, as a shipping material for liquids and perishable foodstuffs. The most widely used material in the packaging of goods for consumers is the cardboard carton, since it is light in weight and inexpensive and can be easily manufactured, printed, and stored. Cartons are made in a great variety of shapes and sizes. Nearly half of these containers serve as containers of food. Cans of tin-plated steel, both those that are permanently sealed and those with tops that can be lifted and replaced, are also used predominantly for food storage. Tin-plate containers are also used to hold paints and varnishes and tobacco, medical, and cosmetic products. While such tin plate is durable and highly resistant to chemical and mechanical damage, aluminum is lighter and more malleable but interacts more readily with chemical agents. Aluminum provides bottle caps and easy-open tops for cans. Most aerosol (pressurized) containers, which deliver liquid products in the form of a spray, are based on metal cans.

Glass containers are easily mass-produced using high-temperature furnaces and molding machines, and they can also be reused. Containers made of glass are durable, chemical resistant, and can be kept highly sanitary and are therefore ideal for the storage of solid and liquid foods, drugs, and cosmetic products. Recent developments in the plastics industry have also provided polyvinyl chloride, polypropylene, polyethylene, and polystyrene as packaging materials. Plastics are often produced in the form of trays, bags, bottles, boxes, and transparent film, through thermoforming and injection- or blow-molding processes. Their light weight, flexibility, and insulating qualities make them especially useful for pressurized packages and containers of foods to be boiled or frozen. Collapsible plastic tubes are widely used to hold cosmetics, toiletry, and pharmaceutical substances.

The particular nature of the packaged products requires care in the selection and design of container materials. The movement of fragile materials requires a thorough assessment of the degree of fragility, the potential hazards of transport, and the cost and efficiency of practical containers, in order to maximize protection and minimize shipping expenses. A variety of containers have also been designed to handle products that are sensitive to light, temperature, air, moisture, and contact with chemicals.

Other packaging considerations include the nature of the intended market, the role of packaging in product use, and the expense of package production. When the product handled is food, packaging must be designed to retard spoilage and prevent physical damage and exposure to contaminants. Package closures must provide adequate sealing, and they must be sanitary and mechanically safe. Labeling for packages must be easy to print and to affix to the container material.

The most efficient and economical method of filling liquid containers is often through the application of vacuum suction around the container opening, which draws the liquid from a feeding tube into the container until it is full and the vacuum seal breaks. Liquids can also be packaged in amounts premeasured by volume or determined by gravity-powered flow into the container for a measured length of time. Powders, granular products, and capsules or tablets are also commonly filled in units of volume or weight, though tablets are sometimes counted before packaging. Sophisticated mechanized processes have been developed that can open, fill, and seal cardboard containers with maximum efficiency. The same technique is applicable to the filling of bags, whether they are made of plastic, paper, or textiles, although many products are still packaged in bags by hand.

Packard, David (b. Sept. 7, 1912, Pueblo, Colo., U.S.), American electrical engineer and entrepreneur, a cofounder of the Hewlett-Packard Company, a manufacturer of electronic measurement equipment.

After receiving his B.A. from Stanford University, Stanford, Calif., in 1934, Packard worked for the General Electric Company in Schenectady, N.Y. In 1938 he returned to Stanford, where he earned the degree of electrical engineer, and in 1939 he and William R. Hewlett established their firm in Packard's garage with capital of $538. The company, in which Packard proved to be an expert administrator and Hewlett provided many technical innovations, grew into the world's largest producer of electronic testing and measurement devices. Packard served as Hewlett-Packard's president from 1947 to 1964, chief executive officer from 1964 to 1968, and chairman of the board from 1964 to 1968 and from 1972.

In 1968 President Richard M. Nixon appointed Packard deputy to Secretary of Defense Melvin Laird. Packard served until 1971, when he resigned and returned to Hewlett-Packard the next year as chairman of the board. In the 1970s and '80s Packard was a prominent adviser to the White House on defense procurement and management. Packard received numerous awards, including the Presidential Medal of Freedom and the Encyclopædia Britannica Achievement in Life Award.

packing, in mathematics, a type of problem in combinatorial geometry that involves placement of figures of a given size or shape within another given figure—with greatest economy or subject to some other restriction. The problem of placement of a given number of spheres within a given volume of space is an example of a packing problem.

Pacorus, also called PACORUS I (d. 38 BC), Parthian prince, son of King Orodes II (reigned *c.* 57–37/36 BC); he apparently never ascended the throne.

In the summer of 51 BC Pacorus was sent to invade Syria with an army commanded by Osaces, an older warrior. Osaces, however, was killed in battle, and early the next year Orodes, learning that one of his satraps was conspiring to make Pacorus king, recalled his son. In 45 Pacorus intervened in Roman politics by leading a Parthian force to help one of Pompey's generals who was besieged in Apamea (a city in northwestern Mesopotamia) by Augustus' forces.

Orodes later decided to support the refugee republican general Quintus Labienus; thus Pacorus led an army into Syria and Palestine while Labienus occupied Cilicia and overran southern Anatolia. In 39 Mark Antony sent Publius Ventidius against Labienus, who was defeated and killed. Pacorus returned to Syria, was lured into battle by Ventidius, and was defeated and killed. His head was displayed in the cities of Syria to convince them of the futility of hoping for Parthian support against the Romans.

Pacorus II (fl. 1st and 2nd centuries AD), king of Parthia (reigned AD 78–*c.* 115/116). Little is known of his reign, which seems to have been filled with rebellions and the rule of counterkings (Artabanus IV, Osroes, and Vologases II).

Pacorus II, coin, 2nd century AD

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & C., Ltd.

In 110 Pacorus sold the Parthian client kingdom of Osroëne to Abgar VII, son of Izates, ruler of Adiabene. It is uncertain whether Pacorus was alive when the Roman emperor Trajan invaded Mesopotamia (114–115).

Pact of ———: *see under* substantive word (*e.g.,* Locarno, Pact of).

Pacuvius, Marcus (b. 220 BC, Brundisium, southern Italy—d. *c.* 130, Tarentum), the greatest Roman tragic dramatist before Accius.

The bearer of an Oscan name, he was probably educated at Tarentum and must have been equally at home in Oscan, Latin, and Greek, as was his uncle and teacher, the poet Quintus Ennius. As a young man he followed Ennius to Rome, where he joined the circle of the younger Scipio, becoming known for his painting as well as for his knowledge of Greek dramatists and of Greek poetics. He confined himself almost entirely to writing tragedies, although he is said to have composed some satires in the manner of Ennius.

Thirteen titles and fragments amounting to about 440 lines are all that survive of Pacuvius' dramatic output. Apart from one Roman national drama, *Paullus* (celebrating the victory of Lucius Aemilius Paullus over Perseus of Macedonia in 168 BC), the 12 plays that he translated and adapted from original plays by Sophocles and other Greeks may represent his entire output.

As a playwright, Pacuvius was admired by the Romans for his elevated style, his command of pathos, and his scholarly treatment of obscure Greek mythological themes. Cicero considered him the greatest Roman writer of tragedy up to that time. Other ancient Roman writers, however, ridiculed Pacuvius for his pompous style and for certain peculiarities of diction that are evident even in the surviving fragments of his work. His plays continued to be produced until the end of the Roman Empire.

Padang, *kotamadya* (municipality) and *kabupaten* (regency), capital of Sumatera Barat *provinsi* ("province"), Indonesia. Padang is the chief port on Sumatra's western coast and is now the main city of the Minangkabau people of West Sumatra. It was the site of Dutch settlements early in the 17th century, and warehouses and a small fort were erected in 1667. The town was held by the British (1812–18) and prospered during the 19th century with the opening up of the highlands' mineral wealth, tourist traffic, and construction of coastal and inland railways. The city's port, formerly Emmahaven, lies at the mouth of the Padang River at a point 5 miles (8 km) south of the city on Teluk Bay. Originally a bunker port for coal from the Umbilin coalfields, it now ships principally coffee and copra. Padang has an airport and is the site of Andalas University. Pop. (1980) city, 408,922; regency, 459,660.

Padang, Urang (Indonesian ethnic group): *see* Minangkabau.

Padang Highlands, region near the western coast of the island of Sumatra, Indonesia. It is part of the Barisan Mountains of Sumatera Barat *provinsi* ("province"). The highest among several volcanoes in the highlands is Mount Merapi (9,485 feet [2,891 m]). A favourite resort area because of its climate, the region has superb scenery and is the source of four major rivers (the Rokan, Kampar, Inderagiri, and Batanghari). The Umbilin coalfields are also located in the region. Good roads connect with Padang, Medan, and Pakanbaru. The two major towns of the region are Bukittinggi and Sawahlunto, both connected by rail to Padang. The region produces rice, coffee, coconuts, tobacco, and tea and is homeland to the Minangkabau people.

padauk, any of several species of tropical trees of the genus *Pterocarpus.* Padauks of the Indo-Malaysia region have a tendency to be larger than related species elsewhere. They are highly prized as shade trees and for their red or reddish brown wood. The blood-red sap is used commercially; a red dyewood known as "Red Saunders," which is obtained from the padauk, was formerly exported in quantity from India.

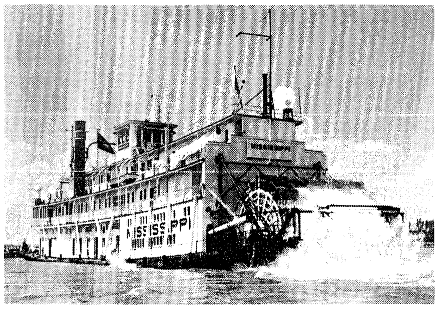
paddle tennis, small-scale form of tennis similar to a British shipboard game of the 1890s. Frank P. Beal, a New York City official, introduced paddle tennis on New York playgrounds in the early 1920s. He had invented it as a child in Albion, Mich. It became popular, and national championship tournaments are still held in the United States. Platform tennis, a later development, is sometimes called paddle tennis.

Instead of rackets, short-handled, rectangular wooden bats, or paddles, are used with a slow-bouncing ball of sponge rubber. Courts, about half the size of regulation lawn-tennis courts, at first were 39 by 18 ft (11.9 by 5.5 m), about one-fourth the size of a regulation tennis court. Adults used a court measuring 44 by 20 ft. In 1959 the United States Paddle Tennis Association (founded 1923; until 1926 the American Paddle Tennis Association) enlarged the court to 50 by 20 ft and revised the ball and the rules to speed up the game.

Rules and scoring are similar to tennis, except that adults are allowed only one serve. If it is a fault, the server loses the point. Children may take two serves overhand and play on a smaller court.

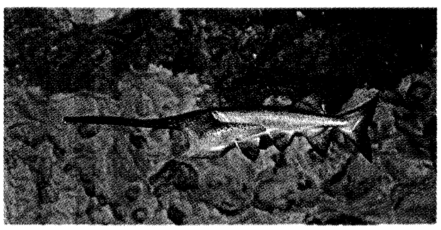
paddle wheel, method of ship propulsion that was once widely employed but is now almost entirely superseded by the screw propeller. Early experiments with steam-driven paddles acting as oars led several inventors, including Robert Fulton, to mount the paddles in a wheel form, either at the stern or at the sides of the vessel.

The device is highly efficient and is competitive even with modern propellers; it was supplanted by the latter because of the paddle wheel's vulnerability to damage in storms and its emergence from the water when the ship rolled heavily, which made steering difficult. For inland navigation these defects were insignificant, and paddle-wheel steamers long continued to operate on many rivers.



Paddle-wheel steamboat
By courtesy of the U.S. Corps of Engineers

paddlefish, also called DUCKBILL CAT, either of two species of archaic freshwater fish with a paddle-like snout, wide mouth, smooth skin, and cartilaginous skeleton. A relative of the sturgeon, the paddlefish is of the family Polyodontidae and the order Acipenseriformes. It feeds with mouth gaping open, gill rakers straining plankton from the water.



American paddlefish (*Polyodon spathula*)
Russ Kinne—Photo Researchers

The American paddlefish (*Polyodon spathula*), also called spoonbill, is greenish or gray and averages about 18 kilograms (40 pounds). It lives in open waters of the Mississippi Basin. The other known species (*Psephurus gladius*), a larger fish with more slender snout, inhabits the Yangtse River Basin. The flesh of both species is somewhat like catfish; the roe can be made into caviar.

Paddock, Charlie, byname of CHARLES WILLIAM PADDOCK (b. Aug. 11, 1900, Gainesville, Texas, U.S.—d. July 21, 1943, near Sitka, Alaska), U.S. sprinter, world-record holder for the 100-metre dash (1921–30) and the 200-metre dash (1921–26). He also held the world record for the 100-yard dash (1921, 1924–26) and the 220-yard dash (1921–26). In addition, he was a member of a world-record-holding 4 × 100-metre team (1920–24).

Paddock ran for the University of Southern California (Los Angeles), from which he was graduated in 1922. He served in the U.S. Field Artillery (1918–19) during World War I. In the 1920 Olympic Games at Antwerp, he won the gold medal for the 100-metre race, the silver medal for the 200-metre race, and a gold medal as a member of the 4 × 100-metre relay team. In the 1924 Olympic Games at Paris, he placed fifth in the 100-metre race and won the silver medal in the 200-metre race.

After his retirement from running, Paddock went into the newspaper business and was a successful writer, editor, and publisher. He died in a plane crash while serving in the Marine Corps during World War II.

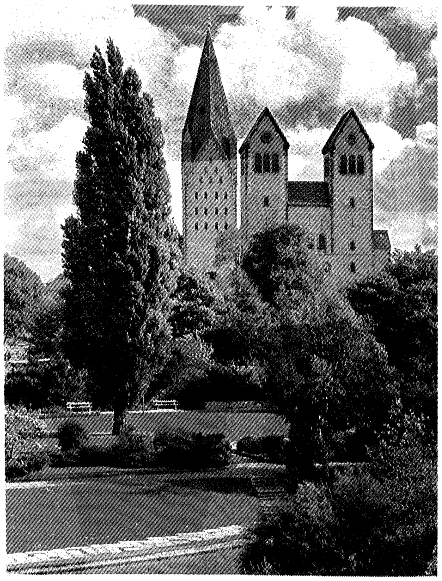
paddy, also called RICE PADDY, small, level, flooded field used to cultivate rice in southern and eastern Asia. Wet-rice cultivation is the most prevalent method of farming in the Far East, where it utilizes a small fraction of the total land yet feeds the majority of the rural population. Rice was domesticated as early as 3500 BC, and by about 2,000 years ago it was grown in almost all of the present-day cultivation areas, predominantly deltas, floodplains and coastal plains, and some terraced valley slopes.

Many paddies are flooded by rivers and rainfall during monsoon season, while others must be irrigated. The paddies have an impermeable subsoil and are bordered by earthen bunds to hold an average of 4–6 inches (10–15 centimetres) of water in the field for three-quarters of the growing season. In all countries, excluding India, paddies are worked by family labour alone and by the same methods as were used 2,000 years ago: hand cultivation with hoe and spade, or water-buffalo-, horse-, or ox-drawn plough with metal share.

Paderborn, city, North Rhine-Westphalia *Land* (state), central Germany, on the Pader River, a small affluent of the Lippe, formed from rain seepage on the slope of the Eggegebirge and emerging from below the cathedral in about 200 springs. Paderborn was the birthplace of the Holy Roman Empire when Charlemagne met Pope Leo III there in 799 to discuss the founding of a German nation. Excavation of Charlemagne's palace began in 1964. Paderborn has been the seat of a bishopric from 805; it joined the Hanseatic League in the 13th century. It was ruled by prince-bishops from *c.* 1100 until 1802, when it passed to Prussia under an agreement with France.

Massive destruction in World War II greatly altered the town's appearance, but some old buildings survived, and many have been restored. Particularly notable are the three-gabled Renaissance town hall (1613–16), the Baroque Franciscan church (1681) with a fine facade by Antonio Petrini, and the cathedral (11th–13th century) with a typically Westphalian tower and a monumental carved portal. Other buildings include several 11th–13th-century churches, the classical Gymnasium (high school; 1612), the philosophy and theology academy, and the Jesuit church (1682–86). The diocesan museum contains the "Madonna" of Bishop Imad, an important 11th-century sculpture.

A road and rail junction and cultural centre,

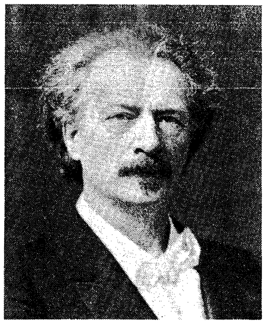


The cathedral (left) and Abdingshofkirche (right), Paderborn, Ger.
Toni Schneiders—Bruce Coleman Inc./EB Inc.

Paderborn is the marketing and export centre for the surrounding agricultural region; Paderborn bread, cattle, and beer are well known. The city is also a centre of heavy industry and of the manufacture of textiles, chemicals, and building materials. Pop. (1989 est.) 114,148.

Paderewski, Ignacy (Jan) (b. Nov. 18, 1860, Kuryłówka, Podolia province in Russian Poland—d. June 29, 1941, New York City), Polish pianist, composer, and statesman, who was prime minister of Poland in 1919.

The son of a steward of a Polish landowner, he studied music from 1872 at the Warsaw Conservatory and from 1878 taught piano there. In 1880 he married one of his pupils, Antonina Korsak, who died in childbirth the following year. Encouraged and financed by the actress Helena Modrzejewska (Modjeska), he studied in Vienna from 1884 to 1887 under Theodor Leschetizky, who did much to improve a limited technique. During this period he also taught at the Strasbourg Conservatory. Between 1887 and 1891 he made his first public appearances as a pianist, in Vienna, Paris, London, and New York City. His success with the public was overwhelming; his personality on the concert platform, like that of Liszt, his predecessor among piano virtuosos, generated a mystical devotion. Among his colleagues, however, he was more envied than respected. Chopin (whose works he edited), Bach, Beethoven, and Schumann were the chief composers of his repertory. In 1898 he settled at Riond Bosson near Morges in Switzerland and the following year married Helena Gorska, Baroness von Rosen. In 1901 his opera *Manru*, dealing with life in the Tatra Mountains, was given at Dresden. In 1909 his *Symphony in B Minor* was given at Boston,



Paderewski
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and in the same year he became director of the Warsaw Conservatory.

Throughout his life Paderewski was a staunch patriot. In 1910 he presented to the city of Kraków a monument commemorating the victory of the Poles over the Teutonic Order. During World War I he became a member of the Polish National Committee and was appointed its representative to the United States, where he urged President Woodrow Wilson to support the cause of Polish independence. Wilson included Poland's cause as the thirteenth of his Fourteen Points of Jan. 8, 1918.

After the war the provisional head of state, Józef Piłsudski, asked Paderewski to form in Warsaw a government of experts free from party tendencies. This was formed on Jan. 17, 1919. Paderewski reserved the portfolio of foreign affairs for himself, but his premiership was not a success. As a virtuoso Paderewski was accustomed to flattery, and he resented criticism. His ambition was to be elected president of the Polish Republic, but he was supported by no political party. On Nov. 27, 1919, he resigned the premiership and returned to Riond Bosson. He never revisited Poland. In 1921 he resumed his musical career, giving concerts in Europe and the United States, mainly for war victims.

At the beginning of World War II, in October 1939, a Polish government-in-exile, formed in Paris with General Władysław Sikorski as prime minister, offered Paderewski the chairmanship of the Polish National Council. After the French capitulation in 1940, he went to the United States. He died soon after and was buried in Arlington National Cemetery.

Padilla, Juan (b. *c.* 1500, Andalusia, Spain—d. 1542, near modern Herington, Kan., U.S.), first Christian missionary martyred within the territory of the present United States.

After serving as a soldier, Padilla joined the Franciscans in Andalusia. He went to Spanish Mexico in 1528 and in the following year accompanied an expedition to Nueva Galicia (northwestern Mexico). There he spent most of his remaining years, except for a trip in 1533 to Tehuantepec, in southern Mexico, with the Spanish conqueror Hernán Cortés. He founded the first Franciscan friaries at Zapotlán, Tamazula, and Tulantizingo, where he became abbot.

In 1540–41 he accompanied the Spanish explorer Francisco Vázquez de Coronado in his fruitless quest for a legendary kingdom of riches called Quivira, probably in modern Kansas. The disappointed Coronado and his company returned to Mexico, but Padilla decided to go back to Quivira with some companions. After working for many months among the Wichita Indians, he was on his way to visit the Guas tribe but was ambushed by them while within sight of his companions, who escaped to Mexico.

Padilla, Juan de (b. 1490?, Toledo, Castile—d. April 24, 1521, Villalar, Spain), aristocratic Spanish military leader of the Castilian Comunidades (Communeros) in their unsuccessful revolt (1520–21) against the government of the Habsburg emperor Charles V (King Charles I of Spain).

Padilla was a member of an ancient noble family of Toledo. Charles, who came to the Spanish throne in 1516, had inflamed national opinion by his appointing to high posts foreigners who carried out arbitrary and exploitative actions. Demands soon arose for the imposition of traditional Castilian constitutional checks on royal power. Padilla had personal grievances against Charles as well and took part in dissident activities in Toledo in late 1519 and early 1520. Summoned in April 1520 to appear before the king at Santiago, Padilla instead took up arms in support of a popular uprising in Toledo.

A circular letter from Toledo to other Castilian cities in revolt invited them to meet at Avila. When the municipalities, supported by the nobles and clergy, set up the Junta Santa (a revolutionary junta) there (July–August 1520), Padilla was named captain general of its forces, and on August 29 he took Tordesi-

Juan de Padilla, lithograph
By courtesy of the Biblioteca Nacional, Madrid

llas, thereby assuring the junta's control over Charles's mother, the hereditary queen Joan the Mad, who had been living there since she had gone insane in 1506.

The junta soon alienated the nobility by its popular demands, and Charles cleverly moved to secure the nobility's loyalty. The junta also courted defeat in the field by replacing Padilla with Don Pedro Girón, an important nobleman. After Charles's troops had recovered Tordesillas (December 5) and Girón had defected, the Junta Santa recalled Padilla. Padilla's reappointment was received with a great outpouring of popular enthusiasm. He occupied Torrelobatón on Feb. 28, 1521. Seven weeks later, however, on the advance of royal forces, he attempted to retreat but was defeated and captured at Villalar (April 23, 1521). He was executed the next day along with other leaders of the revolt.

Padjelanta National Park, park in Norrbotten *län* (county), northwestern Sweden, adjoining Norway (west) and Sarek National Park (east). It is the largest of the Swedish national parks and one of the largest parks in Europe, with an area of 776 square miles (2,010 square km). It was established in 1962. Padjelanta National Park contains several lakes, the largest of which are Virihaure, Vastenjaure, and Salojaure, as well as mountains, valleys, and glaciers. Some species of its alpine flora are not found elsewhere in Sweden, *e.g.,* the sandwort *Arenaria humifusa,* the cinquefoil *Potentilla hypartica,* and the felwort *Gentianella aurea.* Among its fauna are the wolverine, Arctic fox, and brown bear; its birdlife includes the golden eagle and merlin.

Padma 'byung-gnas (Buddhist mystic): *see* Padmasambhava.

Padma River, main channel of the Ganges River below its bifurcation into the Bhagirathi and Padma rivers in extreme western Bangladesh. Flowing southeastward, the Padma receives the mighty Jamuna (Brahmaputra) River near Rājbāri and then continues southeastward through central Bangladesh to join the Meghna River through a channel 2 miles (3 km) wide, known as the Kirtimasa. The combined streams continue south as the Meghna before entering the Bay of Bengal. The Padma is navigable for its entire 190-mile (300-kilometre) course by river steamer. Its main tributary is the Mahānanda; its principal distributary is the Madhumati.

Padmasambhava, also called GURU RIMPOCHE, Tibetan SLOB-DPON ("Teacher"), or PADMA 'BYUNG-GNAS ("Lotus Born") (fl. 8th century), legendary Indian Buddhist mystic who introduced Tantric Buddhism to Tibet and who is credited with establishing the first Buddhist monastery there.

According to tradition, he was a native of Udyāna (now Swat, Pak.), an area famed for its magicians. Padmasambhava was a Tantrist and a member of the Yogācāra sect and taught at Nalanda, a centre of Buddhist studies in India. He was invited to Tibet in 747 by King Thī-srong-detsan and arrived at Samye (Bsan-yas), where he is said to have exorcised demons that were inhibiting the construction of a Buddhist monastery by causing earthquakes. He supervised the completion of the monastery in 749.

The Tibetan Buddhist sect Rnying-ma-pa (the Old Order) claims to follow most closely Padmasambhava's teachings, emphasizing Tantric ritual, worship, and Yoga. Texts basic to the sect's teachings, which were said to have been buried by Padmasambhava, began to be found around 1125. He also had many Tantric books translated from the original Sanskrit into Tibetan.

Padova (Italy): *see* Padua.

Padre Island, barrier reef, 113 miles (182 km) long and up to 3 miles (5 km) wide, lying along the Gulf Coast of Texas, U.S. The reef extends south from Corpus Christi to Port Isabel and is separated from the mainland by Laguna Madre. The island consists largely of grassy dunes and a broad beach that yields shellfish such as clams and marine snails. The area is well known for its mackerel, sailfish, and tarpon fishing and for its abundant variety of birds, particularly the heron, tern, white pelican, and frigate bird. In 1962 most of Padre Island was designated a national seashore.

Padri War (1821–37), armed conflict in Minangkabau (Sumatra) between reformist Muslims, known as Padris, and local chieftains assisted by the Dutch. In the early 19th century the puritan Wahhābīyah sect of Islām spread to Sumatra, brought by pilgrims who entered the island through Pedir, a northern port. The Padris, as these Sumatran converts to Wahhābīyah came to be known, objected to local institutions that were not in accordance with the pure teaching of Islām. This jeopardized the power of the local chiefs, whose authority was based on adat, or customary law. In the ensuing conflict between the Padris and local chiefs, the Padris, using Bondjol as their base, launched guerrilla war against the chiefs. The Dutch, afraid of the influence of the Muslim reformists, sided with the chiefs but were still engaged in the Java War (1825–30) and thus unable to send troops to crush the Padris until the end of that war. Tuanku Imam Bondjol, the leader of the Padris, surrendered to the Dutch in 1832 but soon renewed his rebellion. The war continued until 1837, when the Dutch seized Bondjol. The war allowed the Dutch to extend their control into the interior regions of Sumatra.

Padua, Italian PADOVA, Latin PATAVIUM, city, capital of Padova province, Veneto region, northern Italy, on the River Bacchiglione, west of Venice. The Roman Patavium, founded, according to legend, by the Trojan hero Antenor, it was first mentioned in 302 BC, according to the Roman historian Livy, who was born there (59 BC). The town prospered greatly and, in the 11th–13th century, was a leading Italian commune. The poet Dante lived there, and St. Anthony of Padua is buried there. It was governed by the Carrara family from 1318 to 1405, when it passed to Venice, which held it until 1797. Under Austrian dominion from 1815 to 1866, it was active in the Risorgimento (movement for Italian independence); a rising took place there in February 1848. It was heavily bombed in World War II, and the frescoes by Andrea Mantegna in the Church of the Eremitani were almost completely destroyed.

Prato della Valle and the cupolas of the Church of Santa Giustina, Padua, Italy

J. Allan Cash

The Scrovegni Chapel (1303–05) contains famous frescoes by Giotto, and the Scuola del Santo ("School of the Saints," a medieval trade-guild building) has frescoes by Titian. The cathedral (rebuilt 1552) has a Romanesque baptistery. The Basilica of San Antonio (1232–1307) contains the tomb of the saint and has statues and reliefs by Donatello on the high altar. In the piazza before the basilica is Donatello's magnificent equestrian bronze statue (set up in 1453) of the Venetian condottiere Erasmo da Narni (called Gattamelata). Other notable secular landmarks include the Ragione Palazzo (1218–19; rebuilt 1306); the Capitano Palazzo (1532), now the university library; and the 16th–17th-century Bo Palazzo, which forms the nucleus of the university. Founded in 1222, the university is the oldest in Italy after Bologna.The civic museum has a fine art gallery as well as historical and archaeological exhibits, libraries, archives, and collections of sculpture and coins. The botanical garden, which dates from 1545, is the oldest in Europe. West of the botanic garden is the Prato della Valle, a large oval piazza surrounded by a canal and bordered by a group of statues of well-known Paduans.

An important rail and road junction, the city is a lively agricultural, commercial, and industrial centre. Manufactures include electrical and agricultural machinery, motorcycles, chemicals, and artificial and synthetic textiles. Pop. (1988 est.) mun., 223,907.

Padua, University of, Italian UNIVERSITÀ DEGLI STUDI DI PADOVA, autonomous coeducational state institution of higher learning in Padua, Italy. The university was founded in 1222 by a secession of about a thousand students from the University of Bologna, reinforced by additional migrations from Bologna in 1306 and 1322. Like Bologna, it was a student-controlled university, with students electing the professors and fixing their salaries. In 1228 a number of students seceded from Padua to Vercelli, but the university survived the secession and the vicissitudes of local despotism to achieve its greatest distinction in the 15th and 16th centuries, becoming one of the two or three leading universities of Europe. Among its professors were famous Renaissance philosophers, humanists, and scientists, including Galileo.

In the Middle Ages Padua was mainly a school of civil and canon law, and its faculties of philosophy, law, theology, and medicine grew only gradually. The university's students were originally organized into four groups according to their geographic origin. In 1399 the university was divided into two separate schools, one for the arts and medicine and one for law. The two schools were not reunited under one administration until the early 19th century.

The university's botanical garden, founded in 1545, is the oldest in Europe. Its astronomical observatory was founded in 1761. Modern faculties include law, political science, arts and literature, philosophy, education, mathematics, physics and natural sciences, economics and commerce, statistics, pharmacy, agriculture, engineering, and medicine. The Geologic Institute contains a geological museum.

Paducah, city, seat of McCracken county, southwestern Kentucky, U.S., at the confluence of the Ohio (there bridged to Brookport, Ill.) and Tennessee rivers. The site, known as Pekin, was part of a grant to George Rogers Clark, soldier and frontiersman. At his death his brother William, who was coleader of the Lewis and Clark Expedition, received the land, laid out the town in 1827, and named it for Paduke, a Chickasaw Indian chief who lived in the vicinity. During the American Civil War, because of its strategic river facilities, the city was occupied by Union forces under General Ulysses S. Grant and was raided by General Nathan B. Forrest, a Confederate cavalry leader.

Paducah is now an important market for tobacco, timber, strawberries, corn, livestock, and coal. Located in one of the world's greatest power-generating areas, its growth has been greatly stimulated by the Tennessee Valley Authority and Atomic Energy Commission (now U.S. Department of Energy) projects. Recreational facilities are provided by nearby Kentucky Lake and Kentucky Dam Village State Park. Paducah Community College was founded in 1932. Inc. city, 1856. Pop. (1986 est.) 28,370.

Padus (river, Italy): *see* Po River.

paean, solemn choral lyric of invocation, joy, or triumph, originating in ancient Greece where it was addressed to Apollo in his guise as Paean, physician to the gods. Paeans were sung at banquets following the boisterous dithyrambs, at the festivals of Apollo, and at public funerals. It was the custom for them to be sung by an army on the march and before going into battle, when a fleet left the harbour, and after a victory. Paeans were later addressed to other gods as well as to men like the 5th-century-BC Spartan commander Lysander, who were more or less deified for their achievements.

paedo- (combining form, "child"): *see under* pedo-, except as below.

paedogenesis, also spelled PEDOGENESIS, reproduction by sexually mature larvae, usually without fertilization. The young may be eggs, such as are produced by *Miastor,* a genus of gall midge flies, or other larval forms, as in the case of some flukes. This form of reproduction is distinct from neotenic reproduction in its parthenogenetic nature (*i.e.,* no fertilization occurs) and the eventual maturation or metamorphosis of the parent organism into its adult form.

paedomorphosis, also spelled PEDOMORPHOSIS, retention by an organism of juvenile or even larval traits into later life. There are two aspects of paedomorphosis: acceleration of sexual maturation relative to the rest of development (progenesis) and retardation of bodily development with respect to the onset of reproductive activity (neoteny).

Classic examples include certain amphibian species in which development is arrested so that the larval form and aquatic habit persist as the organism attains sexual maturity and becomes capable of reproduction. In some species only a few morphological features are retarded, but the number of features retarded may differ from species to species. Adult humans, for example, display various neotenic body features that other adult primates do not.

In other species all morphological development is retarded; the organism is juvenilized but sexually mature. Such shifts of reproductive capability would appear to have adaptive significance to organisms that exhibit it. In terms of evolutionary theory, the process of paedomorphosis suggests that larval stages and developmental phases of existing organisms may give rise, under certain circumstances, to wholly new organisms.

Paekche, one of three kingdoms into which ancient Korea was divided before 660. Occupying the southwestern tip of the Korean peninsula, Paekche is traditionally said to have been founded in 18 BC in the Kwangju area by a legendary leader named Onjo. By the 3rd century AD, during the reign of King Koi (234–286), Paekche emerged as a fully developed kingdom. By the reign of King Kŭnch'ogo (346–375), it had established control over a region that included the whole Han River basin in central Korea.

In the late 5th century the northern Korean kingdom of Koguryŏ deprived Paekche of its territory in the Han River basin, and it moved its capital south to Ungjin (present Kongju). In the reign of King Sŏng (523–554), the kingdom was forced to move its capital even further south to Sabi (present Puyŏ), as more of its territory was occupied by Koguryŏ.

The kingdom was divided into five administrative districts. There were 16 official grades in the central government, and the 6 officials of the first grade formed a kind of cabinet. The highest-ranking official, called *sangjwapyong,* was elected every three years.

Buddhism flourished, and many temples were built. Confucianism also prospered, producing a large number of eminent scholars. Paekche visual arts reveal technical maturity along with warm human qualities, sometimes held to reflect the influence of southern Chinese art of the Six Dynasties period. These qualities are evident, for example, in softly modeled Buddha statues in relaxed poses, with their distinctive and expressive "Paekche smile."

In an attempt to contain Koguryŏ's attacks and recover some of its lost territory in the Han River basin, Paekche allied itself with Silla, the other southern Korean state, but it eventually lost this territory to Silla. In 660 its defeat by the allied forces of Silla and the Chinese T'ang dynasty (618–907) brought an end to its rule. Eight years later Silla's forces defeated the northern Korean state of Koguryŏ and united the Korean peninsula under the Unified Silla dynasty (668–935).

Paeligni, ancient people of central Italy, whose territory lay inland on the eastward slopes of the Apennines. Though akin to the Samnites, they formed a separate league with their neighbours the Marsi, Marrucini, and Vestini. This league appears to have broken up after the Second Samnite War (304 BC), when each tribe came into an alliance with the Romans that lasted until the Social War (90–88 BC). This war ended when the Paeligni and the other allies were finally granted Roman citizenship.

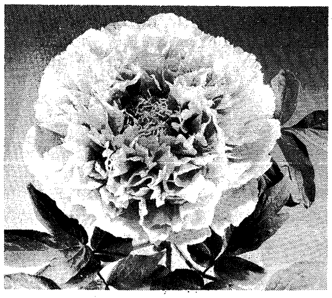
The Paeligni's oldest Latin inscriptions probably date from shortly after the Social War, although the Paelignian dialect doubtlessly lasted to about 50 BC. Similar dialects were spoken by the Marrucini and Vestini; together they formed a group known as Northern Oscan.

paella, in Spanish cuisine, a dish of saffron-flavoured rice cooked with meats, seafood, and vegetables. Originating in the rice-growing areas on Spain's Mediterranean coast, the dish is especially associated with the region of Valencia. The paella takes its name from the *paellera*, the utensil in which it is cooked, a flat round pan with two handles; paella is traditionally eaten from the pan.

To prepare the paella, pieces of meats such as chicken, pork, or rabbit and seafood such as clams, shrimps, mussels, crayfish, and squid are sauteed in olive oil with onions, garlic, and herbs and removed from the pan. Rice, tomatoes, saffron, and stock are simmered together, the meats and seafood mixed in, and the dish is garnished with peas, pimientos, and other vegetables. Traditional paellas are made out of doors over a wood fire.

Paeonia, the land of the Paeonians, originally including the whole Axius (Vardar) Valley and the surrounding areas, corresponding to parts of what is now northern Greece, southern Yugoslavia, and western Bulgaria. The Paeonians, probably of mixed Thraco-Illyrian origin, were weakened by the Persian invasion (490 BC), and those tribes living along the Strymon River fell under Thracian control. The growth of Macedonia forced the remaining Paeonians northward, and in 358 BC they were defeated by Philip II of Macedonia. The native dynasty, however, continued to be highly respected: about 289 BC, King Audoleon received Athenian citizenship, and his daughter married Pyrrhus, king of Epirus. Under the Romans, Paeonia was included in the second and third districts of Macedonia. By AD 400, however, the Paeonians had lost their identity, and Paeonia was merely a geographical term.

Paeoniales, the peony order of dicotyledonous flowering plants comprising the peony family (Paeoniaceae) and the genus *Paeonia*, with about 33 species distributed in Europe, Asia, and western North America. They are perennial (long-lived) herbs or sometimes shrubby plants up to about two metres (six feet) tall that grow from stout rootstocks. The leaves are alternately produced along the stems and are divided into three lobes, each lobe being further divided into three smaller lobes. The flowers are radially symmetrical, bisexual, and large, with 5 sepals, 5 petals (some-



Japanese double tree peony (horticultural variant of *Paeonia suffruticosa*)
Roche

times 10), and an indefinitely large number of stamens (male pollen-producing structures). The female parts are superior (*i.e.,* positioned above the attachment point of the other flower parts) and consist of two to five separate, large, more or less fleshy pistils or ovaries containing many ovules, which develop into large seeds that are at first red in colour, later turning a shining black and bearing a fleshy appendage called an aril.

The order is considered to be related to the order Dilleniales, although traditionally it has been placed near the buttercup family (Ranunculaceae), a position still defended by some authorities.

Economically the group is important for the very popular flower garden peony (*q.v.*) in a wide range of form and colour. Several species of southern Europe and Asia were cultivated for food and as a medicinal herb.

Paeonius (fl. 450–400 BC), Greek sculptor, native of Mende in Thrace, a contemporary and follower of the sculptors Phidias and Polyclitus who is famous for his statue of the Nike, or "Winged Victory" (*c.* 420 BC; Archaeological Museum, Olympia) found in Olympia in 1875. An inscription on its pedestal states that the statue commemorated a victory of the Messenians and the Naupactians over an unnamed enemy, probably the Spartans. The inscription also states that Paeonius won a competition for the construction of the *akrōtērion* (the ornamental device at the peak or corner of a gable) for a temple.

Paer, Ferdinando (b. June 1, 1771, Parma, Duchy of Parma—d. May 3, 1839, Paris), composer who, with Domenico Cimarosa and Nicola Antonio Zingarelli, was one of the principal composers of Italian opera buffa of his period. Paer produced his first opera, *Orphée et Euridice*, in Parma in 1791. From 1797 to 1802 he was in Vienna, where his most successful opera, *Camilla*, was produced in 1799. He was in Dresden from 1802 to 1807 and then went to Paris, where he became chapelmaster to Napoleon, conducted at the Opéra-Comique, and (1812–27) directed the Italian Opera. His most successful opera of this period was *Le Maître de chapelle* (1821; *The Chapelmaster*). In addition to his 43 operas he also composed religious and chamber music and secular cantatas.

Paeroa, borough, northern North Island, New Zealand, on the Ohinemuri River near its junction with the Waihou. Paeroa (from a Maori word meaning "long ridge") was founded in the early 1880s as a port for the Ohinemuri goldfield, 5 mi (8 km) southeast. Mining was shifted to the underground Komata Reefs (6 mi northeast) from 1891 to the 1930s. Gazetted a borough in 1915, Paeroa was regularly served by river shipping until 1947. It is a hub of rail lines and highways to Auckland and Tauranga. Basically a farming centre, Paeroa is nationally known for its mineral drinking water. Pop. (1983 est.) 3,680.

Paesiello, Giovanni (Italian composer): *see* Paisiello, Giovanni.

Paestum, Greek POSEIDONIA, ancient city in Lucania, Italy, 22 miles southeast of modern Salerno and five miles south of the Silarus (modern Sele) River, noted for its Greek ruins and for what are believed to be the only examples of classical Greek wall painting. Founded probably *c.* 600 BC by colonists from Sybaris, it became a flourishing town by 540. Paestum came under Lucanian domination from *c.* 390 until 273, when Rome made it a Latin colony. The city supported Rome during the Second Punic War. The gradual silting up of the mouth of the Silarus created a malarial swamp, and Paestum was finally deserted after being sacked by Muslim raiders in AD 871.

The so-called Temple of Ceres at Paestum
Alinari—Art Resource/EB Inc.

The site, rediscovered in the 18th century, contained pottery and excellently preserved walls and temples. Its best known buildings are the so-called Temple of Ceres (in fact dedicated to Athena), the basilica probably dedicated to Hera, and a temple of Hera called the Temple of Neptune. In July 1969 a farmer uncovered the limestone roof of an ancient Lucanian tomb that contained frescoes in the early classical style.

Paetus, Thrasea (Roman senator): *see* Thrasea Paetus, Publius Clodius.

Páez, Indians of the southern highlands of Colombia. The Páez speak a Chibchan language very closely related to that of the now extinct Pijao and Coconuco (*see* Chibchan languages).

The Páez inhabit the high mountains and plateaus, their chief crop being potatoes. Many also grow such nontraditional crops as wheat and coffee. Each family farms its own land, but the lands of the church are cultivated by communal labour. Most planting is done with digging sticks. Settlements are dispersed, each family living on its own land. Houses are made of poles, sometimes being double walled with mud and stones between.

Clothing formerly consisted simply of a small woollen blanket, but after the Spanish conquest rough cotton shirts and later trousers and shirts were introduced for men and skirts and ponchos for women. Modern crafts include pottery, weaving, and basketry. Before Spanish rule, stone and gold and copper were worked. Polygyny was also common, but Roman Catholicism has enforced monogamy. Traditional puberty rites and menstrual taboos continued to be observed well into the 20th century. The Páez were estimated to number about 60,000 in the 1970s.

Páez, José Antonio (b. June 13, 1790, Aricagua, Venezuela—d. May 7, 1873, New York City), soldier and politician, a leader in Venezuela's independence movement and its first president. In the crucial early years of Venezuelan independence, he served his country as a moderate dictator.

José Antonio Páez, detail of a portrait by an unknown artist
By courtesy of the Library of Congress, Washington, D.C.

Páez was a part-Indian *llanero,* one of the horsemen of the plains. Beginning as a ranch hand, he quickly acquired both land and cattle. In 1810 he joined the revolutionary movement against Spain as the leader of a band of *llaneros.* Becoming chief Venezuelan commander to Simón Bolívar, the liberator of northern South America, Páez and his men helped secure victories at Carabobo (1821) and Puerto Cabello (1823) that resulted in the complete withdrawal of the Spanish. In 1826, after rebelling against the authority of Gran Colombia, of which Venezuela was a province, Páez was appointed military and civilian head of his country. In 1829 he successfully led the movement that resulted in Venezuela's becoming a sovereign nation.

He was elected president in 1831 and controlled the country either as chief executive or as a power behind titular presidents until 1846. He usually respected the constitution, permitted limited freedom of the press, and promoted agriculture and industry. He curbed the power of the church in secular affairs but supported its religious authority.

In 1846 his own candidate for president turned against him, and he was imprisoned and later forced into exile. He returned to Venezuela in 1861, ruling for a short period as a severely repressive dictator, only to be forced again into exile in 1863. He spent most of his remaining years in New York City, where he published his autobiography in 1867–69.

Páez (Xaramillo), Pedro, also called PERO PÁEZ (b. 1564, Olmedo, Spain—d. May 20, 1622, Gorgora, Eth.), learned Jesuit priest who, in the tradition of Frumentius—founder of the Ethiopian Church—went as a missionary to Ethiopia, where he became known as the second apostle of Ethiopia.

Páez entered the Society of Jesus in 1582 and sailed for Goa, in India, in 1588. En route to Ethiopia (1589) he was captured by Turkish pirates and enslaved until 1596, when he returned to Goa. He finally reached Ethiopia in 1603. There he learned two of the main languages, translated a catechism, and wrote a treatise on the theological errors of the Ethiopian Church and a history of the country. Páez succeeded in converting the formerly Monophysite king Susenyos of Ethiopia to orthodoxy, and for a while most of Ethiopia was Roman Catholic. Páez was the first European to visit Lake Tana, the source of the Blue Nile in northwestern Ethiopia, where he died of fever.

Páfos (Cyprus): *see* Paphos.

Pagadian, chartered city, western Mindanao, Philippines. Located on Pagadian Bay (a northern extension of Illana Bay), it is an important port shipping rice and corn (maize); coconuts are the principal commercial crop in the region. Fishing is the primary occupation of the city's inhabitants, and lumbering is also important. The city is a major point of entry for Visayan (Cebuano) migrants, who have resettled in the adjacent areas. Inc. city, 1969. Pop. (1980) 80,861.

Pagalu, formerly ANNOBÓN, volcanic island in the South Atlantic Ocean near the Equator. Located about 350 miles (565 km) southwest of continental Equatorial Guinea, it occupies an area of 6.5 square miles (17 square km) and rises to an elevation of 2,200 feet (671 m). A part of Equatorial Guinea, the island constitutes one of the three provinces of the country. Fishing and lumbering activities are centred in San Antonio, the chief settlement. Pop. (1983 prelim.) 3,000.

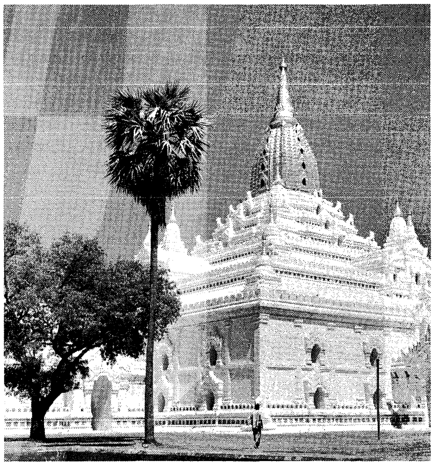
Pagan (d. 1880, Mandalay, Burma), king of Burma (1846–53), whose government suffered defeat in the Second Anglo-Burmese War, after which Rangoon, the province of Pegu, and other areas in southern Burma were annexed by the British.

Pagan deposed his father, the insane king Tharrawaddy, in 1846. Although Pagan was not one of Burma's more enlightened monarchs, he acted with tact and restraint during the crisis preceding the war. Part of his undoing was the aggressive policy of Lord Dalhousie, the governor general of India, who declared that "of all the Eastern nations with which the Government of India has had to do, the Burmese were the most arrogant and overbearing."

In 1851 Pagan's governor in Rangoon, Maung Ok, charged the captains of two British merchant ships with murder, embezzlement, and evading customs fees. They were forced to pay several hundred rupees before being allowed to return to Calcutta, where they demanded compensation from the Burmese government. Dalhousie sent an emissary with a letter to the King requesting compensation that amounted to £920 and the dismissal of Maung Ok. Pagan agreed to replace Maung Ok, but the emissary's lack of tact and violation of his instructions made it impossible for the new governor to deal with him. On Jan. 6, 1852, the British were evacuated, and the harbour blockaded. Three days later British warships began firing on the city.

On Feb. 7, 1852, Pagan wrote Dalhousie, protesting the acts of aggression in Rangoon and expressing hope that the governor general would repudiate them. A few days before, the governor of Rangoon had offered to pay the compensation for the two ship captains. On February 13, however, Dalhousie sent an ultimatum to the King, demanding an indemnity equivalent to £100,000. Pagan did not answer the ultimatum, which expired on April 1, and a few days later British troops entered Burmese territory. Rangoon was taken and, by December 1852, Lower Burma was occupied. On Feb. 18, 1853, Pagan was deposed by his brother, Mindon, who favoured reconciliation with the British.

Pagan, village, central Upper Burma, on the left bank of the Irrawaddy River and about 90 miles (145 km) southwest of Mandalay. The site of an old capital city of Burma, Pagan is a pilgrimage centre and contains ancient Buddhist shrines that have been restored and redecorated and are in current use. Ruins of other shrines and pagodas cover a wide area. An earthquake on July 8, 1975, severely damaged more than half of the important structures and irreparably destroyed many of them. The whole of the Buphaya pagoda, for nine centuries a landmark for river boatmen, tumbled into the Irrawaddy and was carried off by the waters. The village also has a school for lacquer ware, for which the region is noted. Pop. (latest census) 2,825.



The Ananda temple, Pagan; its top portion, a restoration, was broken off in an earthquake in 1975
Van Bucher—Photo Researchers

Pagan's importance lies in its heritage rather than its present. It was first built probably in AD 849 and, from the 11th century to the end of the 13th, was the capital of a region roughly the size of modern Burma. In 1287 it was overrun by the Mongols in the course of their wide-ranging conquests, and it never recovered its position thereafter, although a little desultory building continued on Buddhist shrines.

Old Pagan was a walled city, its western flank resting on the Irrawaddy River. It was the focus of a network of highroads by means of which its rulers could command a large region of fertile plains and could dominate other major Burmese dynastic cities, such as Pegu. From the port of Thiripyissaya, further down the river, important overseas trade was conducted with India, Ceylon, and other regions of Southeast Asia. The walls of the old city, within which lies a substantial area of the modern town, probably originally contained only royal, aristocratic, religious, and administrative buildings. The populace is thought to have lived outside in homes of light construction closely resembling those occupied by the present-day Burmese. The walled city, whose moats were fed by the Irrawaddy, was thus a sacred dynastic fortress. The circuit of its walls and river frontage is some two and a half miles, and there is evidence that perhaps as much as a third of the old city has been washed away by the river. Because building was principally in brick, decoration was carried out in carved brick, in stucco, and in terra-cotta. The earliest surviving structure is probably the 10th-century Nat Hlaung Gyaung. The shrines that stand by the Sarabha Gate in the eastern wall, although later than the wall they adjoin, are also early. These are shrines of protecting *nats*—the traditional spirit deities of the animist ethnic Burmese.

Between *c.* 500 and 950, people of the Burmese ethnic group had been infiltrating from the north into a region occupied by other peoples; these people already had been converted to Indian religion, especially the Mahāyāna Buddhism of Bihār and Bengal. Under King Anawrahta (reigned 1044–77) the ethnic Burmese finally conquered the other peoples of the region, including a people called the Mon, who were previously dominant in the south. They transported the Mon royal family and their scholars and craftsmen to Pagan, making it the capital and centre of an official, fundamentalist form of Hīnayāna (Theravāda) Buddhism adopted from Ceylon (*c.* 1056). This initiated the period of Pagan's greatness, which was sustained at first by Mon artistic traditions. The construction and existence of the enormous number of monasteries and shrines built during the next 200 years was made possible both by the enormous wealth of the royal exchequer and by the large number of slaves, skilled and unskilled, whose working lives were dedicated to the support of each institution. The city became one of the most important centres of Buddhist learning in the East.

Lesser buildings are grouped around the more important pagodas and temples. Scattered around these are smaller pagodas and buildings, some of which may once have been aristocratic palaces and pavilions later adapted to monastic uses—*e.g.,* as libraries and preaching halls. All are based on Indian prototypes, modified during subsequent development by the Mon. The principal architectural theme is the Buddhist stupa, a tall bell dome, designed originally to contain near its apex the sacred relics of Buddhist saints. Another is the high, terraced plinth, which may be supplemented by stairs, gateways, extra stupas, and pinnacles and symbolizes a sacred mountain. During the course of artistic evolution the themes were frequently combined, and the combination opened into a complex rectangular hall with porticos extended from the sides, crowned by a stupa or, in some cases, by a rectangular tower of curved outline reminiscent of the contemporary Indian Hindu shrine tower. Interior arches and vaults, both rounded and pointed, are, however, constructed by a true radiating-arch technique that was not used in India. A vista across the site of Pagan shows a series of variations and combinations of the themes. Many buildings, especially those no longer in use and hence unrestored, bear substantial remains of external, decorative stucco and terra-cotta, adding flamboyance to the finely proportioned rectilinear structures, and internal paintings and terra-cottas recording Buddhist legend and history.

Anawrahta constructed the Shwezigon pagoda. Nearby he built a *nat* shrine with images. The Shwezigon is a huge, terraced pyramid, square below, circular above, crowned by a bell-shaped stupa of traditional Mon shape and adorned with stairways, gates, and decorative spires. It is much revered and famous for its huge golden umbrella finial encrusted with jewels. It was considerably damaged in the earthquake of 1975. Also revered are the late 12th-century pyramidal Mahābodhi, built as a copy of the temple at the site of the Buddha's enlightenment at Bodh Gayā, in India, and the Ananda temple mountain just beyond the east gate, founded in 1091 under King Kyanzittha. By the time the Thatpyinnyu temple was built (1144), Mon influence was waning, and a Burmese architecture had evolved. Its four stories, resembling a two-staged pyramid, and its orientation are new. Its interior rooms are spacious halls, rather than sparsely lit openings within a mountain mass, as in the earlier style. This building combined the functions of stupa, temple, and monastery. The Burmese style was further developed in the great Sulamani temple and culminated in the Gawdawpalin, dedicated to the ancestral spirits of the dynasty (late 12th century), whose exterior is decorated with miniature pagodas, the interior with extremely lavish, coloured surface ornament. (P.S.R.)

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Paganelli di Montemagno, Bernardo (pope): *see* Eugenius III, Blessed.

Paganini, Niccolò (b. Oct. 27, 1782, Genoa—d. May 27, 1840, Nice, Fr.), Italian composer and principal violin virtuoso of the 19th century. A popular idol, he inspired the Romantic mystique of the virtuoso and revolutionized violin technique.

Paganini, etching by Luigi Calamatta after a drawing by J.-A.-D. Ingres, 1818
The Granger Collection, New York City

After initial study with his father, he studied with a local violinist, G. Servetto, and then with the celebrated Giacomo Costa. He made his first appearance in 1793 and then studied with Alessandro Rolla and Gaspare Ghiretti at Parma. In 1797, accompanied by his father, he toured Lombardy, where with each concert his reputation grew. Gaining his independence soon after, he indulged excessively in gambling and romantic love affairs. At one point he pawned his violin because of gambling debts; a French merchant lent him a Guarneri violin to play a concert and, after hearing him, gave him the instrument.

Between 1801 and 1807 he wrote the *24 Capricci* for unaccompanied violin, displaying the novel features of his technique, and the two sets of six sonatas for violin and guitar. He reappeared in Italy as a violinist in 1805 and was appointed director of music at Piombino by Napoleon's sister, Élisa Bonaparte Baciocchi. He later gave recitals of his own compositions in many towns in Italy and in 1815 formed his long attachment with the dancer Antonia Bianchi.

In 1828 Paganini had great success in Vienna, and his appearances in Paris and London in 1831 were equally sensational. His tour of England and Scotland in 1832 made him a wealthy man. In 1833 he settled in Paris, where he commissioned Berlioz to write his symphony *Harold en Italie*. Paganini thought the challenge of its viola solo was too slight, however, and he never played it. Following the failure of the Casino Paganini, a gambling house in which he had invested, he went to Marseille in 1839, then to Nice.

Paganini's romantic personality and adventures created in his own day the legend of a Mephistophelean figure. Stories circulated that he was in league with the devil and that he had been imprisoned for murder; his burial in consecrated ground was delayed for five years. He was long regarded as a miser, but a more accurate portrait would consider his desire to be free from a train of dependent followers and their importunities for his largesse. His gift of 20,000 francs to the struggling composer Berlioz was an act of generosity seemingly uncharacteristic; possibly Paganini, recognizing in "Beethoven's successor" a worthy talent, thought it was his duty to come to the composer's aid.

His violin technique, based on that of his works, principally the *Capricci*, the violin concertos, and the sets of variations, demanded a wide use of harmonics and pizzicato effects, new methods of fingering and even of tuning. In performance he improvised brilliantly. He was also a flamboyant showman who used trick effects such as severing one or two violin strings and continuing the piece on the remaining strings. His technical innovations were imitated by later virtuosi, notably Pablo Sarasate and Eugène Ysaÿe. His other works include 6 violin concertos, of which the first, in D major, is especially popular; 12 sonatas for violin and guitar; and 6 quartets for violin, viola, cello, and guitar. The influence of his virtuosity extended to orchestral as well as to piano music. His influence on Liszt was immense. Themes from the *Capricci* inspired works by Liszt, Schumann, Brahms, and Rachmaninoff.

Pagasaí, Gulf of, Modern Greek PAGASITIKÓS KÓLPOS, historically GULF OF PAGASAE, gulf of the Aegean Sea, *nomós* (department) of Magnisía, Thessaly, Greece. Known also as the Gulf of Vólos, it is almost landlocked by a fishhook prong of the Magnesia peninsula, which forms the Dhíavlos (strait) Tríkkeri. At the head of the gulf is Vólos, the primary port of Thessaly. It lies on the site of ancient Iolcos and its port, Pagasae, from whence is derived the gulf's present name. In Greek myth the king of Iolcos, Pelias, dispatched Jason from Pagasae in the ship "Argo" to search for the Golden Fleece.

page, in medieval Europe, a youth of noble birth who left his home at an early age to serve an apprenticeship in the duties of chivalry in the family of some prince or man of rank. Beginning as assistants to squires who attended knights and their ladies, pages were trained in arms and in the art of heraldry and received instruction in hunting, music, dancing, and such other accomplishments as befitted their social status. Later, pages were promoted to be squires and from that status were frequently advanced to knights.

In Great Britain, pages of honour are boys from 13 to 17 years of age who act as ceremonial attendants to the sovereign. In the United States, Capitol pages are boys and girls from 14 to 18 years of age who are appointed from the home districts of the members of Congress to run errands and carry messages for the House of Representatives, Senate, and the Supreme Court.

Page, Sir Earle (Christmas Grafton) (b. Aug. 8, 1880, Grafton, New South Wales—d. Dec. 20, 1961, Sydney), Australian statesman, co-leader of the federal government (1923–29) in coalition with Stanley M. Bruce. As head of the Country Party (1920–39), he was a spokesman for the party's goal of rural

Sir Earle Page
By courtesy of the Australian Information Service

economic development and was briefly prime minister of Australia in 1939.

A physician in New South Wales, Page entered the federal Parliament in 1919. In 1920 he helped found the Australian Country Party (now National Party of Australia), and in the following year he became the party's leader. He formed a coalition with the Nationalist Party to create the Bruce–Page ministry of 1923–29, which was noted for its economic program. As federal treasurer in the ministry, he was responsible for the National Insurance Bill, coordination of federal loan policy, and strengthening of the commonwealth bank. Although he served in the federal Cabinet for the next three decades, his influence was greatest in the 1920s.

Page was minister of commerce (1934–39, 1940–41) under Joseph Lyons and Robert Menzies and served as prime minister for 19 days following Lyon's death. In 1934 he established the Australian Agricultural Council, which sought government emphasis on rural production. He was knighted in 1938. As minister of health under Menzies (1949–56), he introduced a comprehensive national health plan. Page became the first chancellor of the University of New England, then Australia's only rural university, in 1955 and remained in Parliament until 1961. His autobiography, *Truant Surgeon*, was published in 1963.

Page, Sir Frederick Handley (b. Nov. 15, 1885, Cheltenham, Gloucestershire, Eng.—d. April 21, 1962, London), British aircraft designer who built the Handley Page 0/400, the world's first twin-engine bomber and one of the largest planes used in World War I.

Trained as an electrical engineer, Page turned his interest to flight and in 1909 founded Handley Page, Ltd., the first British aircraft manufacturing corporation. During World War

I he produced the first twin-engine bomber, which was capable of carrying 1,800 pounds (815 kg) of bombs. He then designed the V-1500 four-engine bomber, built to fly from England to Berlin with a bomb load of three tons. The war ended before it could be used. Handley Page Transport, Ltd., was formed in 1919 to conduct airline flights from Britain to France, Belgium, The Netherlands, and Switzerland; it later merged to form Imperial Airways.

Page's company manufactured transports and the Halifax heavy bomber during World War II. His Victor B.2, a long-range medium bomber, was deployed with the Royal Air

Sir Frederick Handley Page
Camera Press

Force Bomber Command beginning in 1962. Page was knighted in 1942.

Page, Geraldine (b. Nov. 22, 1924, Kirksville, Mo., U.S.—d. June 13, 1987, New York City), versatile American actress noted primarily for her interpretations of the heroines of Tennessee Williams' plays.

Page attended the Goodman Theatre School of Drama in Chicago (1942–45) and later studied at the Herbert Berghof School and the American Theatre Wing drama school in New York City. She appeared regularly in stock productions in the Chicago area until 1952, when she was offered the role of Alma in the Off-Broadway production of Williams' *Summer and Smoke,* which was acclaimed by audience and critics alike. In 1953 she did a radio version of Williams' *Glass Menagerie* and began to appear in Broadway productions, most notably in Andre Gide's *The Immoralist* (1954), N. Richard Nash's *The Rainmaker* (1954–55), Terrance Rattigan's *Separate Tables* (1957–58), Williams' *Sweet Bird of Youth* (1959–60), Eugene O'Neill's *Strange Interlude* (1963), Williams' *Clothes for a Summer Hotel* (1980), and John Pielmeier's *Agnes of God* (1982). Much of her best work on the stage was done with the director José Quintero.

Page's motion pictures included *Hondo* (1954), *Summer and Smoke* (1961), *Sweet Bird of Youth* (1962), *The Day of the Locust* (1975), *Interiors* (1978), and *Harry's War* (1981). She received an Oscar for her lead performance in *The Trip to Bountiful* (1985), and she won Emmy awards for her appearances in Truman Capote's television plays *A Christmas Memory* (1966) and *The Thanksgiving Visitor* (1968).

Page, Thomas Nelson (b. April 23, 1853, Oakland plantation, near Beaver Dam, Va., U.S.—d. Nov. 1, 1922, Oakland, Calif.), American author whose work fostered romantic legends of Southern plantation life.

Page attended Washington College (now Washington and Lee University), taught for a year, and in 1874 graduated in law from the University of Virginia. He practiced until 1893, when he moved to Washington, D.C., and devoted himself to writing and lecturing. He first won notice with the story "Marse

Thomas Nelson Page
By courtesy of the Library of Congress, Washington, D.C.

Chan" in the *Century Illustrated Magazine.* This and similar stories were collected in what is probably Page's most characteristic book, *In Ole Virginia, Marse Chan, and Other Stories* (1887), reflecting the glamorous life of the old antebellum regime and the tumults of the Civil War. His essays and social studies, including *Social Life in Old Virginia* (1897) and *The Old Dominion—Her Making and Her Manners* (1908), have the same tone as his fiction. From 1913 to 1919 Page served as U.S. ambassador to Italy. His other works include *Two Little Confederates* (1888), a children's tale; *The Burial of the Guns; and Other Stories* (1894); *The Old Gentlemen of the Black Stock* (1897); and *Red Rock* (1898), which told of Southerners rebelling against Reconstruction.

Page, Walter Hines (b. Aug. 15, 1855, Cary, N.C., U.S.—d. Dec. 21, 1918, Pinehurst, N.C.), journalist, book publisher, author, and diplomat who, as U.S. ambassador to Great Britain during World War I, worked strenuously to maintain close relations between the two countries while the United States remained neutral and who, from an early stage of the war, urged U.S. intervention on an unwilling President Woodrow Wilson.

Page worked as a journalist in various parts of the United States in the 1880s and '90s and from 1898 to 1899 was editor of *The Atlantic Monthly.* In January 1900 he and Frank N. Doubleday founded the publishing house of Doubleday, Page and Company (afterward Doubleday and Company, Inc.) and the magazine *The World's Work,* which he edited until 1913. In 1911 he was one of the first to propose Woodrow Wilson as a presidential candidate. One of Wilson's first acts after his inauguration in March 1913 was to appoint Page ambassador to Great Britain.

A firm believer in Anglo-American superiority in cultural and political matters, Page at first worked amicably with both Wilson and the British government and was largely responsible for the repeal of a U.S. Panama Canal toll schedule that the British considered discriminatory. By the outbreak of war in August 1914 he had become popular with the upper class and the general public in Great Britain. Unlike Wilson, however, Page

Walter Hines Page, detail of a portrait by P.A. de Laszlo; in the collection of the Department of Archives and History, North Carolina
By courtesy of the Department of Archives and History, North Carolina

soon came to view the war as an attempt by imperial Germany to rule Europe and to substitute Prussian militaristic autocracy for the democratic ideal. Outwardly conforming to U.S. neutrality, Page expressed his disagreement with Wilson's policy of noninvolvement in private messages to the president. When the British steamship *Lusitania* was sunk by a German submarine (May 7, 1915), with the loss of more than 100 American lives, Page called for a U.S. declaration of war. He insisted then and later that U.S. intervention at that time would have resulted in a swift victory for the Allies. In April 1917, when Wilson did ask Congress to declare war on Germany, he used the arguments that Page had been using for two and a half years.

Always in precarious health and further weakened by his labours as ambassador, Page became so ill in August 1918 that Wilson acquiesced in his retirement. Page died shortly after returning home. An authoritative work on his career is Burton J. Hendrick's *Life and Letters of Walter H. Page,* 3 vol. (1922–25).

Page, William (b. Jan. 23, 1811, Albany, N.Y., U.S.—d. Oct. 1, 1885, Tottenville, Staten Island, N.Y.), American painter known for his sedate portraits of prominent mid-19th-century Americans and Britons.

Page was trained and initially influenced by the famed inventor and Romantic painter Samuel F.B. Morse. From 1849 to 1860 he lived in Rome, where he painted portraits of friends such as Robert and Elizabeth Barrett Browning. His best-known works, "Self-Portrait" (1860; Detroit Institute of Arts) and

"Self-Portrait," oil on canvas by William Page, 1860; in the Detroit Institute of Arts
By courtesy of the Detroit Institute of Arts

"Portrait of Mrs. William Page" (1860–61; Detroit Institute of Arts), typify the serene dignity of his likenesses, his monumental and sculptural handling of the figure, and his use of warm, resonant tonalities of dark colours. All these stylistic hallmarks show Titian's influence upon him.

pageant, a large-scale, spectacular theatrical production or procession. In its earlier meanings the term denoted specifically a car or float designed for the presentation of religious plays or cycles. By extension, the term came to mean not only the apparatus for the presentations but the presentations themselves. Because these plays were generally accompanied by great ceremony and showmanship, pageant has come to mean also any lavish production, whether indoors or outdoors, without regard to any specifically religious content. The showy public procession known as a parade is a type of pageant.

Pageants are usually used as a means of expressing national, communal, religious, or other kinds of group purpose or identity. In primitive societies processions have always been one of the most basic demonstrations of communal unity. The occasions for such processions varied greatly, ranging from fertility rites to the casting out of evil spirits to displays of military strength. Once such periods of festivity and spectacle have been established, they and the customs and processions connected with them have tended to be passed down from one culture to the next. Thus, for example, the carnival processions that precede Lent in many Roman Catholic countries are probably derived from the ancient Roman pagan feasts of the Saturnalia, the Lupercalia, and the Bacchanalia, which were occasions for parades, music, sacrifices, and general merrymaking.

An essential feature of pageantry through the ages has been the element of drama, in which the theme of a procession is illustrated with spoken words or simple dramatic action. Pageant dramas were an integral part of the major festivals of the Roman Catholic church, and these religious pageants gradually developed into the mystery plays and other theatrical precursors of Western secular drama. In some pageants, the staged presentation or dramatic storytelling is completely preeminent over simple spectacle and crowd-pleasing display. Two such pageant dramas are especially notable. Among the Shīʿite Muslims, a passion play known as the *taʿziyah* ("consolation") is performed during the first 10 days of the month of Muharram. Recounting, in often highly emotional and graphic detail, the martyrdom of the descendants of ʿAli, the son-in-law of Muḥammad, the pageant retains elements that date back to the 10th century. The *Passionsspiel* (a presentation of Christ's last hours on earth) of the village of Oberammergau in Bavaria is perhaps the best-known religious pageant drama in the West.

Coronations, royal weddings, and state visits have been the occasion for pageantry since ancient times and were especially prominent in Europe during the Middle Ages and afterward. Such entertainments included both processions and set pieces of entertainment, the latter usually representing allegorical figures who delivered their speeches against a backdrop of spectacular mechanical effects. The marriage of Louis XII of France to Mary Tudor in 1514 and the meeting of Henry VIII of England and Francis I of France in 1520 are examples of notable occasions that were marked by sumptuous and elaborate pageantry. The elaborate court masques staged for the English monarchs of the 16th and 17th centuries were a form of pageantry; essentially, these were entertainments that led up to a dance or a masked ball. Ben Jonson wrote and Inigo Jones designed some of the most famous of these masques, which illustrated a simple theme with lavish embellishments of music, poetry, costumes, and ever-changing scenery.

The use of such lavish pageantry by a single privileged class (*i.e.,* the court and aristocracy) has necessarily disappeared in the modern world, where all members of the community demand equal rights to enjoyment of the splendour of a pageant. These democratic tendencies are particularly apparent in modern carnival processions, such as those in Rome, Venice, Nice, and Rio de Janeiro; the Fasching carnivals in Munich and Cologne; and the Mardi Gras in New Orleans, in which thousands or tens of thousands of these cities' inhabitants dress up in showy costumes and take part in a procession along with floats, displays, flowers, music, and general merriment. Japan is particularly rich in such public festivals, with each city and many towns having their own particular and individualized celebrations, often involving processions of carriages and boats, effigies and shrine cars, contests, and colourful costumes.

State and military functions have long provided notable opportunities for parades and pageantry. State pageants celebrate such events as national independence, military victories, or other important historical events. Perhaps the highest expression of military pageantry was the ancient Roman custom of the triumph (*q.v.*), in which a victorious general took part in a procession through Rome along with his troops, the prisoners and spoils of war, and magistrates and members of the Senate. Modern examples of military pageantry include the gigantic victory parades held in the Allied capitals after World Wars I and II. Communist countries have adopted May 1 as the occasion for great military parades. The military parade, either by active servicemen or by veterans of past wars, remains one of the pillars of modern pageantry.

Much pageantry through the centuries has focused on contests or races. In medieval Europe, for example, jousts and tournaments were often the scenes of elaborately staged martial demonstrations. The town of Siena, Italy, is the annual setting for the Corsa del Palio, a horse race and festival that shows many elements of a pageant: jockeys are dressed in traditional medieval costumes, horses and riders are blessed in local churches, and the prize, a religious banner, is solemnly carried in procession the day before the race. The Rose Bowl Parade in Pasadena, Calif., one of the most famous parades in the world, precedes the annual Rose Bowl college football game.

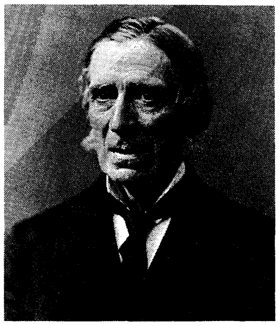
The early 20th century saw a revival of a "pure" form of pageant (one that is first and foremost historical drama), most notably in the works of Louis N. Parker. Parker's insistence on accurate retellings of history, use of natural settings with little or no artificial scenery, and reliance on amateur actors served to repopularize the pageant as historical drama. Max Reinhardt also made notable contributions to modern pageant drama with his efforts to stage plays in many different kinds of locales. These efforts to emulate the past, however, have remained subsidiary to the main surviving forms of pageantry, namely the parade, the carnival, and the festival procession, at least one of which is practiced in practically every nation and which fulfill the assertion of national or communal identity in modern mass societies.

pageant wagon, wheeled vehicle used in the processional staging of medieval vernacular cycle plays. Processional staging is most closely associated with the English cycle plays performed from about 1375 until the mid-16th century in such cities as York and Chester as part of the Corpus Christi festival, but it was also common in Spain, Belgium, and the Netherlands. Each play in the cycle may have been mounted on an individual pageant wagon and performed at different locations throughout the vicinity. The pageant wagon may also have been drawn alongside a scaffold wagon, using the scaffold as a temporary stage, or been pulled up to a fixed platform stage for the duration of the play.

The pageant wagons, or large carts, each containing from one to three mansions, or scenic locales, were constructed by the trade guilds and were dismantled at the close of the season each year and stored. As no detailed description of English pageant wagons or the particulars of staging plays on the wagons had survived, there is considerable scholarly controversy both as to the actual appearance of the wagons and as to the method used for staging the plays.

Paget, Sir James, 1ST BARONET (b. Jan. 11, 1814, Great Yarmouth, Norfolk, Eng.—d. Dec. 30, 1899, London), British surgeon and physiologist who is considered (with Rudolf Virchow) to be a founder of the science of pathology.

Working at St. Bartholomew's Hospital, London (1834–71), Paget discovered (1834) in human muscle the parasitic worm that causes trichinosis. Paget was a professor of anatomy and surgery (1847–52) and was later vice president (1873–74) and president (1875) of the Royal College of Surgeons. He rendered



Paget
BBC Hulton Picture Library

excellent descriptions of breast cancer, an early indication of breast cancer known as Paget's disease (1874; an inflammatory cancerous condition around the nipple in elderly women), and Paget's disease of bone (1877; a bone inflammation also known as osteitis deformans). Also named for him is Paget's abscess, one recurring about the remains of a former abscess. He was one of the first to recommend surgical removal of bone-marrow tumours (myeloid sarcoma) instead of amputation of the limb.

A surgeon of international repute, he served as surgeon extraordinary (1858–67), sergeant surgeon extraordinary (1867–77), and sergeant surgeon (1877) to Queen Victoria. He was created a baronet in 1871. Among his works are *Lectures on Tumours* (1851), *Lectures in Surgical Pathology* (1863), and *Clinical Lectures and Essays* (1875).

Paget's disease of bone, also called OSTEITIS DEFORMANS, moderately common chronic disease of middle age, characterized by local disorganized bone-destructive processes alternating with bone-constructive activity. The disease leads to deformity, fracture, and imbalance in calcium metabolism and carries with it an increased risk of cancer, particularly osteosarcoma. The long bones, vertebrae, pelvis, and skull are most commonly affected, in men more often than in women. In the bone-destructive stages, bones soften and become a site for the pooling of blood, which may lead to heart or circulatory trouble; calcium builds up in the blood as it is lost from bones, sometimes resulting in kidney stones or systemic calcium poisoning. In bone-constructive stages, bones are dense and brittle and fracture easily. There is no generally accepted treatment for the disease, which is named for Sir James Paget, who first described it.

Pagninus, Santes, also called PAGNINI, or PAGNINO (b. Oct. 18, 1470, Lucca, Republic of Lucca [now in Italy]—d. Aug. 24, 1536, Lyon, Fr.), Dominican scholar whose Latin version of the Hebrew Bible—the first since St. Jerome's—greatly aided other 16th-century scriptural translators.

In 1487 he joined the Dominicans at Fiesole, Republic of Florence, where he became a disciple of Girolamo Savonarola. In 1516 he went to Rome, where Pope Leo X encouraged his work. From 1523 to 1526 he lived in Avignon, then settled in Lyon, where in 1528 he published his Latin translation of the entire Bible, apparently the first to divide chapters into numbered verses. In 1529 Pagninus issued a Hebrew lexicon, *Thesaurus linguae sanctae* ("Thesaurus of the Sacred Language"), which was frequently republished.

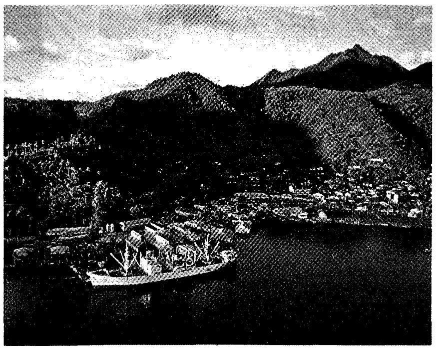
Pagninus' translation was remarkably literal, so, despite his inelegant, even crude, style, his Bible was reprinted several times. Although more accurate than the Vulgate, and hence more useful to other translators needing help with Hebrew or Greek, Pagninus' version was not intended to supersede the Vulgate except for purely scholarly purposes; it is now chiefly of historical interest.

Pagnol, Marcel Paul (b. Feb. 25, 1895, Aubagne, Fr.—d. April 18, 1974, Paris), French writer and motion-picture producer-director who won both fame as the master of stage comedy and critical acclaim for his filmmaking. He was elected to the French Academy in 1946, the first filmmaker to be so honoured.

Pagnol's father was superintendent of the town's schools, and Pagnol likewise trained for a teaching career. He obtained his teacher's diploma from the faculty of letters of the University of Montpellier. He wrote poetry, novels, and plays while working as a teacher. After World War I Pagnol published the novel *Pirouettes* and had several plays produced in the provinces. He transferred to teach at a school in Paris in 1922, and there, three years later, his play *Les Marchands de gloire* (1925; *The Merchants of Glory*), written with Paul Nivoix, opened to high critical praise. Because of its unpopular subject matter, war profiteering, the play did not have wide appeal and closed after a few performances. Undaunted, Pagnol finally in 1926 had a hit with *Jazz,* which won both critical and popular success. *Topaze* (1928) secured Pagnol's reputation as a major French playwright. *Topaze* ran for two years in Paris and was later adapted for the Broadway stage and made into a film in 1933. His next three comedies—*Marius* (1929), *Fanny* (1931), and *César* (1936), known as the Marseille trilogy—deal with the lives of a Marseille fishmonger, Fanny, her lover Marius who goes off to sea, César the father, and his friend Panisse. The salty language of the people and Pagnol's ability to capture the atmosphere of the port at Marseille made the plays universally appealing, and the films made from them influenced the later Neorealists. The plays also inspired the Broadway musical *Fanny,* which was later adopted into a motion picture.

In 1931 Pagnol decided to become a filmmaker. He opened his own movie studio in 1933 and went on to direct such award-winning films as *Angèle* (1934), *Regain* (1937; *Harvest*), *La Femme du boulanger* (1938; *The Baker's Wife*), *La Fille du puisatier* (1940; *The Well Digger's Daughter*), and *Les Lettres de mon moulin* (1954; *Letters from My Windmill*). His films are set in Provence and were often adapted from stories by Jean Giono. They depict the lives of the farmers and shopkeepers of rural southern France and feature tightly constructed plots and realistic dialogue. Pagnol wrote extensively on filmmaking and was the author of three autobiographical volumes.

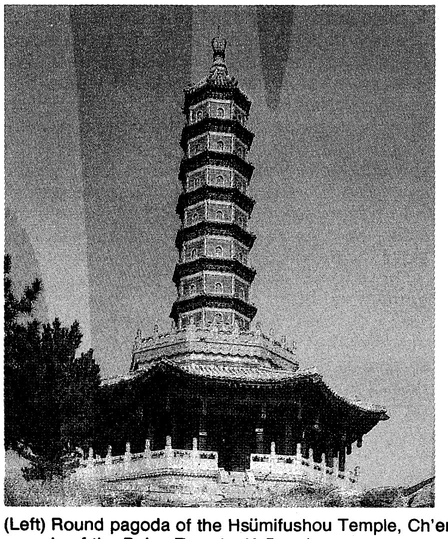
Pago Pago, formerly PANGO-PANGO, port and administrative capital (since 1899) of American Samoa, on the south shore of Tutuila island, southwestern Pacific Ocean. It is situated at the head of a densely wooded and steep-sided inlet forming a deeply indented, landlocked harbour. The site was chosen in 1872 by Commander R.W. Meade, who negotiated facilities for a coaling station for the U.S. Navy from the Samoan high chief Mauga. It remained an active naval base from

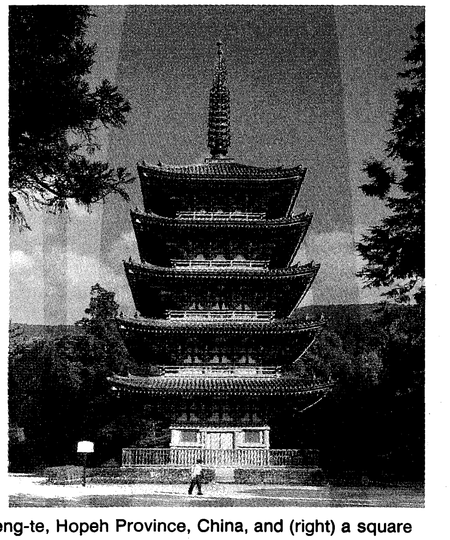


Pago Pago harbour beneath Mount Matafao (right), Tutuila, American Samoa
David Moore—Black Star/EB Inc.

1900 to 1951 and is now a regular port of call for all types of vessels. Canned tuna is the dominant export. Pago Pago International Airport (formerly Tafuna), built partly on a fringing reef, opened in 1964 and has stimulated tourist traffic. Pago Pago is no longer the shabby place depicted by Somerset Maugham in his short story "Rain" but has assumed a modern look, with new homes, roads, and other amenities. It has worldwide radio and telegraph communications. Pop. (1985 est.) 3,400.

pagoda, in East and Southeast Asia, a towerlike, multistoried structure of stone, brick, or wood, usually associated with a Buddhist temple complex. The pagoda derives from the stupa of ancient India, which was a dome-shaped commemorative monument, usually erected over the remains or relics of a holy man or king. The hemispherical domed stupa of ancient India evolved into several distinct forms in various parts of Southeast and East Asia. The finial, or decorative crowning ornament of the stupa, became more elongated and cylindrical until the stupa's upper portion took on an attenuated, towerlike appearance. This stupa form was adopted by Buddhism as an appropriate form for a monument enshrining sacred relics and became known to Westerners as a pagoda. The Buddhist pagoda was elaborated in Tibet into a bottle-shaped form; it took pyramidal or conical designs in Burma, Thailand, Cambodia, and Laos; and in China, Korea, and Japan, it evolved into the best-known pagoda form. The latter was a tall tower consisting of the vertical repetition of a basic story unit in regularly diminishing proportions. The stories can be circular, square, or polygonal. Each story in an East Asian pagoda has its own prominent projecting roof line, and the whole structure is capped by a mast and disks. The pagoda form is intended primarily as a monument and has very little usable interior space.





(Left) Round pagoda of the Hsümifushou Temple, Ch'eng-te, Hopeh Province, China, and (right) a square pagoda of the Daigo Temple, Kyōto, Japan
(Left) Kurt Scholz/Shostal Associates, (right) Manley Features/Shostal Associates

pagoda tree, any of several trees of erect, conical form suggesting a pagoda, particularly *Sophora japonica,* commonly called the Japanese pagoda tree, or the Chinese scholar tree. A member of the pea family (Fabaceae), it is native to East Asia and is sometimes cultivated in other regions as an ornamental. It grows 12–23 m (about 40–75 feet) tall. The alternate, compound leaves consist of 7 to 17

Pagoda tree (*Sophora*)
G.R. Roberts

leaflets. The yellowish white flowers, about 1 cm (0.4 inch) long, grow in loose, showy clusters 30–35 cm (12–14 inches) long. The fruit is a pod 5–7.5 cm (2–3 inches) long.

The pagoda dogwood is *Cornus alternifolia,* a member of the family Cornaceae; it is used in landscaping for its horizontal branching habit.

Pahang, region, eastern West Malaysia (Malaya). Its eastern coastline stretches along the South China Sea. Pahang occupies the vast Pahang River basin, which is enclosed by the Main Range to the west and the eastern highlands to the north.

A Chinese chronicle by Cha Ju Kua (*c.* 1225) mentions the Pahang region as subject to the Sumatran kingdom of Srivijaya. After the 15th century it was part of the kingdom of Malacca and later came under the control of Johore to the south. The representatives from Johore eventually established an independent sultanate, which received British protection in 1887. Pahang became one of the Federated Malay States in 1895 and after World War II joined the Federation of Malaya.

Although most of the region is dense jungle, its central plains are intersected by numerous rivers, and along the coast there is a 20-mile (32-kilometre) wide expanse of alluvial soil that includes the deltas and estuarine plains of the Kuantan, Pahang, Rompin, Endau, and Mersing rivers. The region's thinly settled population consists of Malays, Chinese, and seminomadic Aboriginals. Malay farmers and fishermen live along the rivers and coast. Chinese dominate the larger towns to the west. Kuantan and Pekan are the largest settlements in the region.

The Pahang region is linked by road to Kuala Lumpur and Singapore, and the centrally located Gemas–Kelantan railway passes through the Pahang region, terminating in the Kelantan region to the north. Kuantan, the Malay Peninsula's most important east coast port, is supplemented by new port facilities at Tanjung Gelang; river transport, though highly localized, is important in the roadless interior.

Rubber estates are located along the Pahang River, the railway, and the major roads. Rice is extensively farmed in the coastal river deltas. Other products include coconuts, tobacco, gutta-percha (a tough latex derivative), rattan, and hemp. Large-scale development projects have resulted in the clearing of hundreds of square miles of jungle forest for oil-palm and rubber plantations and the resettling of several hundred thousand people in new villages. There are large iron ore reserves at Rompin (mining ceased in 1970), gold is mined at Raub, and at Sungai Lembing one of Malaya's major mines for deep-vein tin has been in operation since 1888. Malaysia's substantial oil and natural gas fields lie offshore in the South China Sea.

Taman Negara (national park), with an area of 1,677 square miles (4,343 square km) and the site of Mount Tahan (7,185 feet [2,190 m]), highest mountain of the Malay Peninsula, is in the northeast portion of Pahang. The Kerau Wildlife Reserve is located in the centre of the region.

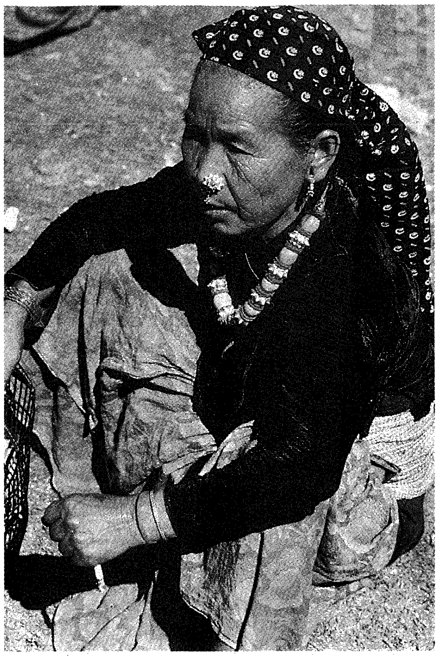
Pahang River, river in Pahang region, West Malaysia (Malaya). It is the longest river on the Malay Peninsula. It rises in two headstreams, the Jelai and Tembeling, about 10 miles (16 km) north of Jerantut and flows south past Temerloh, paralleling the Main Range to Mengkarak, where, at the break of slope between the mountains and the plains, it abruptly turns eastward. The river then completes its 271-mile (436-kilometre) course, through alluvial plains more than 20 miles (32 km) wide, to empty into the South China Sea at Pekan.

Navigable upstream by shallow-draft boats for about 250 miles (400 km), the Pahang was a vital link in the porterage route between the Malay Peninsula's east and west coasts during the 15th and 16th centuries. Settlers later moved upriver, establishing rubber and coconut plantations along its banks. Deforestation in the river's basin has led to heavy flooding during the monsoon season (November–February).

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

Pahāṛī, also called PARBATE, KHĀSĀ, or CHETRĪ, people of mixed descent who constitute about three-fifths the population of Nepal and a majority of the population of neighbouring Himalayan India (in Himachal Pradesh and northern Uttar Pradesh). They speak languages belonging to the Indo-Aryan branch of the Indo-European family; the people are historically ancient, having been mentioned by the authors Pliny and Herodotus and figuring in India's epic poem, the *Mahābhārata*. Their numbers were estimated to be about 20,000,000 in the late 20th century.

The great majority of the Pahāṛī are Hindus, but their caste structure is less orthodox and less complex than that of the plains to the south. Usually they are divided into the



Pahāṛī woman of Pokhara, Nepal
W.H. Hodge

high "clean" or "twice-born" castes (Khasia, or Ka) and the low "unclean" or "polluting" castes (Dom). Most of the high-caste Pahāṛī are farmers; the Dom work in a variety of occupations and may be goldsmiths, leatherworkers, tailors, musicians, drummers, and sweepers.

Polyandry is apparently widespread (several brothers, in particular, may share one or more wives), but other marital arrangements are certainly more common; some families have an equal number of husbands and wives; in a few, one husband has several wives; and some families have only one husband and one wife. Most girls are married before they are 10 years old, though they do not cohabit with their husbands until they are mature. There is a double standard of sexual behaviour for women, who must be faithful to their husbands while living with them; when a married woman goes home to visit her parents, however, she is permitted the liberties of an unmarried girl.

The Pahāṛī are an agricultural people, cultivating terraces on the hillsides. Their chief crops are potatoes and rice. Other crops include wheat, barley, onions, tomatoes, tobacco, and various vegetables. Sheep, goats, and cattle are kept. The spinning of wool is done by everyone, while weaving is carried on by members of a lower caste.

Pahari languages, group of Indo-Aryan languages spoken in the lower ranges of the Himalayas (*pahāṛī* is Hindi for "of the mountains"). Three divisions are distinguished: Eastern Pahari, represented by Nepali of Nepal; Central Pahari, spoken in the north of Uttar Pradesh state; and Western Pahari, found around Simla in Himachal Pradesh state. The most important language is Nepali (Naipali), also called Khas-kura and Gorkhali (Gurkhali). Because many of the inhabitants of Nepal speak Tibeto-Burman languages, Nepali has borrowed many Tibeto-Burman idioms. The Nepali language was taken to Nepal by the Gurkha conquerors in 1769. The chief Central Pahari languages are Garhwali and Kumauni. Western Pahari includes a great number of dialects, of which the most important are Sirmauri, Kiunthâli, Jaunsari, Chameali, Churahi, Mandeali, Gadi, and Kuluhi. Pahari dialects have several linguistic features in common with Rajasthani and Kashmiri.

Pahari painting, style of miniature painting and book illustration that developed in the independent states of the Himalayan foothills in India. The style is made up of two markedly contrasting schools, the bold intense Basohli and the delicate and lyrical Kangra. Pahari painting—sometimes referred to as Hill painting (*pahārī*, "of the hills")—is closely related in conception and feeling to Rājasthanī painting and shares with the Rājput art of the North Indian plains a preference for depicting legends of the cowherd god Krishna.

The earliest known paintings in the hills (*c.* 1690) are in the Basohli idiom, a style that continued at numerous centres until about mid-18th century. Its place was taken by a transitional style sometimes referred to as pre-Kangra, which lasted from about 1740 to 1775. During the mid-18th century, a number of artist families trained in the late Mughal style apparently fled Delhi for the hills in search of new patrons and more settled living conditions. The influence of late Mughal art is evident in the new Kangra style, which appears as a complete rejection of the Basohli school. Colours are less intense, the treatment of landscape and perspective is generally more naturalistic, and the line is more refined and delicate.

By 1770 the lyrical charm of the Kangra school was fully developed. It reached its peak during the early years of the reign of one of its important patrons, Rājā Sansār Chand (1775–1823).

The school was not confined to the Kangra state but ranged over the entire Himalayan foothill area, with many distinctive idioms. As the independent states in the foothills were

Rādhā dancing before Krishna, Pahari painting in the Kāngra style, *c.* AD 1780; in the Lalbhai collection, Ahmadābād, Gujarāt, India
P. Chandra

small and often very close to each other, it is difficult to assign a definitive provenance to much of the painting.

The life and loves of Krishna as expressed in the poetic works the *Bhāgavata-Purāṇa* and the *Gītagovinda* make up the commonest theme of the paintings, together with other Hindu myths, hero-heroine and *rāgamālā* (musical modes) series, and portraits of hill chiefs and their families. After 1800 the school began to decline, though painting of inferior quality continued to be done through the remainder of the 19th century.

Pahiatua, borough, southern North Island, New Zealand, at the confluence of the Mangatainoka River and Mangaramarama Creek, 80 mi (130 km) northeast of Wellington. It was founded in 1881 by Scandinavian immigrants and gazetted a borough in 1892. The town was almost totally destroyed in 1897 when a fire occurred in the surrounding Forty Mile Bush Forest. Pahiatua now serves an area of dairy, mixed, and fat-lamb farming and has various light industries. On the Napier–Palmerston North State Highway, it is linked to the North Island Main Trunk Railway by a 1.5-mi spur. The name Pahiatua comes from a Maori term meaning "the place of a god." Pop. (1983 est.) 2,600.

Pahlavī (Iran): *see* Anzalī, Bandar-e.

Pahlavī, Bandar-e (Iran): *see* Anzalī, Bandar-e.

Pahlavi, Mohammad Reza Shah (shah of Iran): *see* Mohammad Reza Shah Pahlavi.

Pahlavi, Reza Shah (shah of Iran): *see* Reza Shah Pahlavi.

Pahlavi alphabet, Pahlavi also spelled PEHLEVI, writing system of the Persian people from the 2nd century BC until the advent of Islām (7th century AD); the Zoroastrian sacred book, the Avesta, is written in a variant of Pahlavi called Avestan. The Pahlavi alphabet developed from the Aramaic alphabet and occurs in at least three local varieties: northwestern, called Pahlavik or Arsacid; southwestern, called Parsik or Sāsānian; and eastern. All were written from right to left. Of the 22 letters in Aramaic, most came to represent more than one sound in Pahlavi; several were not used at all, and one evolved into two letters in Pahlavi. Northwestern Pahlavi had 20 letters, and southwestern had 19. Avestan, a cursive script, has 50 distinct letters and was perhaps separately invented, patterned after Pahlavi.

A peculiarity of the Pahlavi writing system was the custom of using Aramaic words to represent Pahlavi words; these served, so to speak, as ideograms. An example is the word for "king," in Pahlavi *shāh,* which was consistently written *m-l-k* after the Aramaic word for "king," *malka,* but read as *shāh.* A great many such ideograms were in standard use, including all pronouns and conjunctions and many nouns and verbs, making Pahlavi quite difficult to read.

Pahlavi Dam: *see* Dez Dam.

Pahlavi language, also spelled PEHLEVI, major form of the Middle Persian language (*see* Persian language), which existed from the 3rd to the 10th century and was the official language of the Sāsānian Empire (AD 226–652). It is attested by Zoroastrian books, coins, and inscriptions. Pahlavi books were written in a confusing writing system of Aramaic origin called the Pahlavi alphabet. The major part of Pahlavi literature is religious, including translations from and commentaries on the Avesta. Little has survived from pre-Islāmic times, and the *Bundahishn* and *Dēnkart,* both Zoroastrian religious works, date from the Islāmic period. Manuscripts were preserved by the Parsis (Zoroastrians) of Bombay and elsewhere. Pahlavi was superseded by Modern Persian, written in the Arabic alphabet.

Pai, Pinyin BAI, also spelled PO, also called MIN-CHIA, people of Yunnan Province in southwest China. Min-chia is the Chinese (Wade-Giles) name for them; they call themselves Pai or Po in their own language, which has been classified in the Yi group of the Tibeto-Burman languages. Until recently the language was not written. It contains many words borrowed from Chinese but is itself a non-Chinese, tonal, polysyllabic language with a markedly different grammatical structure.

Occupying a triangular area from Shih-ku on the upper Yangtze River down to Hsia-kuan at the foot of Erh Hai (lake), the Pai in the late 1970s were estimated to number nearly 1,000,000, of whom 480,000 lived on the fertile plain between the Ts'ang Shan (mountains) and the lake.

Since the establishment of the People's Republic of China, the Pai, in accordance with the Communist policy toward non-Chinese peoples, have been given status as a national minority and are now organized in the Ta-li Pai Autonomous Prefecture. Ta-li, a county seat, was from the 6th to 9th century the capital of the kingdom of Nan-Chao. The Pai probably already formed the bulk of the population of the district at that time.

Most of the Pai are cultivators of wet rice, along with various vegetables and fruits. Those in the hills grow barley, buckwheat, oats, and beans. The lake is heavily fished.

They have their own social and kinship organization, based on the village and the extended family (parents, married sons, and their families). Marriages are generally monogamous, although the well-to-do may take concubines. Cousins may marry. Their religion differs little from that of the Chinese; they venerate local deities and ancestral spirits as well as Buddhist and Taoist gods.

Pai-ch'eng, also called T'AO-AN, Pinyin BAICHENG or TAOAN, city, Inner Mongolian Autonomous Region (*tzu-chih-ch'ü*), China. It is a county-level municipality (*shih*) and the administrative centre of Pai-ch'eng Prefecture (*ti-ch'ü*). The region was originally a hunting ground reserved for the Mongols and was not opened for legitimate colonization by the Chinese until 1902; it is an area of extensive agriculture with pastoral activities playing a major role.

Pai-ch'eng was first established as a county seat, called Ching-an, in 1904; it remained a place of minor importance until the opening of the railway from Tsitsihar to Ssu-p'ing in 1920. In 1930 another line was opened to Wu-lan-hao-t'e (now K'o-erh-ch'in-yu-i-ch'ien-ch'i, in Inner Mongolia), enabling Pai-ch'eng to become the market centre for the Mongolian border area; another line to the east was constructed by the Japanese in the 1930s.

P'ai-cheng had only a small population at the end of World War II; it had a small generating plant and a paper mill but little industry. Since 1949 more small-scale industry has been established, based on local agriculture. Pai-ch'eng, however, remains essentially an administrative and commercial centre. Coal mines are located nearby. Pop. (mid-1970s est.) 100,000–300,000.

Pai Chiang (China): *see* Pei Chiang.

pai-hua (Chinese: "colloquial language"), vernacular style of Chinese adopted as a written language in a movement to revitalize the Classical Chinese literary language and make it more accessible to the common people. Started in 1917 by the philosopher and historian Hu Shih, the *pai-hua* literary movement succeeded in making *pai-hua* the language of textbooks, periodicals, newspapers, and public documents, thus causing a definite change in Chinese cultural life.

Pai Marire (religio-military cult): *see* Hauhau.

pai-miao (Chinese: "plain drawing"), Pinyin BAIMIAO, in Chinese painting, brush technique that produces a finely controlled, supple ink outline drawing without any colour or wash (diluted ink or paint applied in broad sweeps) embellishment. It is commonly used for figure painting, in which precise description is important.

Painting, chiefly of flowers or bamboo, characterized by distinctly outlined coloured areas, is called *kou-le-hua.* Painting without outline but rather with forms achieved by washes of ink and colour is known as *mo-ku,* or "boneless."

Pai River, Wade–Giles romanization PAI HO, Pinyin BAIHE, river in Hopeh Province, northern China, rising near the Great Wall near Kuyüan and flowing generally southeast past Tunghsien, east of Peking, to join the Yungtin Ho (river) after a course of 300 mi (480 km).

Pai-se, also called PO-SE, Pinyin BAISE or BOSE, city in western Kwangsi Chuang Autonomous Region (*tzu-chih-ch'ü*), China. It is a county (*hsien*) seat and the administrative centre of Pai-se Prefecture (*ti-ch'ü*) on the borders of Yunnan and Kweichow provinces. Pai-se is on the Yu Chiang (river), which flows southeast to Nan-ning, and is situated at its junction with its tributary, the Ssu-ch'eng Ho. It is at the limit of navigation on the Yu Chiang for small craft and is also at the centre of a highway network radiating to the north and west. Transport routes also lead into the neighbouring provinces of Yunnan and Kweichow, linking them with Nan-ning and central Kwangsi. Until comparatively recent times, Pai-se was in the territory of non-Chinese tribes and was only loosely controlled by the Chinese. A subdistrict (*t'ing*), Pai-se was set up and fortified in 1730 as a garrison among the tribes, but not until 1875 was a regular civil administration established. During the late 19th century, Pai-se became a trading centre, and a considerable colony of merchants from Canton settled there. The goods collected for export include kapok (floss used as stuffing), ramie (a textile fibre), aniseed, edible fungi, and various herbs. In the 19th and the early 20th centuries it was a centre of the opium traffic, with processed opium from Yunnan and Kweichow being collected there by Cantonese merchants for shipment to Nan-ning, Canton, Hong Kong, and Shanghai. Since 1949 some minor industry has developed, including sugar refining, tobacco curing, rice milling, and ceramic manufacture. Pop. (mid-1970s est.) 10,000–50,000.

Pai-yin T'ai-lai (China): *see* T'ung-liao.

paiche (fish): *see* pirarucu.

paideia (Greek: "education," or "learning"), system of education and training in classical Greek and Hellenistic (Greco-Roman) cultures that included such subjects as gymnastics, grammar, rhetoric, music, mathematics, geography, natural history, and philosophy. In the early Christian era the Greek *paideia,* called *humanitas* in Latin, served as a model for Christian institutions of higher learning, such as the Christian school of Alexandria in Egypt, which offered theology as the culminating science of their curricula. The term was combined with *en kykōi* ("complete system," or "circle") to identify a large compendium of general education, hence "encyclopaedia."

Paiea (Hawaiian king): *see* Kamehameha I.

Paige, Satchel, byname of LEROY ROBERT PAIGE (b. July 7, 1906?, Mobile, Ala., U.S.—d. June 8, 1982, Kansas City, Mo.), U.S. athlete, a professional baseball pitcher who earned legendary fame during his many years in the Negro leagues; he finally was allowed to enter the major leagues in 1948, after the unwritten rule against black players was relaxed. A right-handed, loose-jointed "beanpole" standing 6 feet 3½ inches, Paige had considerable pitching speed and developed a comprehensive mastery of slow-breaking deliveries.

In his later years Paige, a humorous man, derived much amusement from the controversy about his age; his birth date is sometimes placed as early as Dec. 18, 1899. He was surely well past his prime in 1948 when team owner Bill Veeck signed him for the Cleveland Indians, but he helped to spark that team to American League pennant and World Series victories that year. When Veeck purchased the

Paige, 1942
UPI—EB Inc.

St. Louis Browns, Paige joined that team and was its most effective relief pitcher from 1951 through 1953.

Before his major league career, Paige was a pitcher for various teams in the Negro Southern Association and the Negro National League. Wearing a false red beard, he also played for the bearded House of David team. A true "iron man," he pitched in the Caribbean, Central America, and South America during the northern winter. As a barnstormer he would travel as many as 30,000 miles a year while pitching for any team willing to meet his price. In 1935 he pitched every day for 29 days.

Despite the colour bar, Paige faced the best major league players in exhibition games before 1948. He once struck out Rogers Hornsby, probably the greatest right-handed hitter in baseball history, five times in one game. In Hollywood in 1934 Paige scored a spectacular 1–0 victory in 13 innings over Dizzy Dean, who won 30 games for the St. Louis Cardinals that year. Paige was elected to the Baseball Hall of Fame in 1971.

Päijänne, Lake, lake located in parts of the *läänit* (provinces) of Keski-Suomi, Häme, and Mikkeli, south central Finland. It has an area of 421 sq mi (1,090 sq km), making it the largest single Finnish lake. It has a maximum depth of 305 ft (93 m) and is about 85 mi (135 km) long and between 2 and 18 mi wide. The lake is broken by thousands of islands. Jyväskylä, at the northern tip of the lake, and Heinola, on a southeastern branch of the lake, are the principal towns. They are connected by ship service with the major city of Lahti to the south of Lake Päijänne via the Vesijärven Kanava (canal) and lake. The Päijänne lake system is drained southward to the Gulf of Finland by the Kymijoki (river). The irregular shoreline around Lake Päijänne is heavily forested and supports important timber operations that use the lake as a means of transport. Numerous villages dot the shore of the lake, and many private villas are located on the quiet bays off its southern end.

paille-maille (game): *see* pall-mall.

pain, experience associated with injury or some type of damage to the body. Pain helps to preserve the organism by securing withdrawal from harmful agents. Alternatively, in sick people, pain may secure the rest that is needed for healing. Nature often is overabundant, however, and pain at times appears unnecessarily severe. This happens especially in some cases of damage to the nervous system.

Although the experience of pain is psychological and subjective, scientists know much about its anatomical and physiological bases. A minimal effective condition for the experience of pain is any stimulus that can cause tissue damage, even if slight and easily reversible. There is evidence that persons learn to discriminate the experience of pain as a result of events in infancy. Withdrawal from damaging stimuli occurs readily and early in humans and other animals. There are indications, however, that undue protection from the experience of damage reduces the ability to feel pain or to discriminate the stimuli that give rise to it. Not only does the unburned child not fear the fire, he may less readily have pain or know what it is when he is ultimately burned.

There is a very small number of persons born without the ability to feel pain at all, or else very little. Although they may survive without disability, they are at greater risk of suffering, or neglecting, burns, fractures, or infections. A similar effect has been produced in one recorded case by accidental damage to part of the midbrain. The life expectancy in these cases is shorter than average.

Even in people without this disability severe injury quite often does not cause pain; on the other hand, pain in adults often occurs for psychological reasons, in circumstances such that a physical basis for this bodily experience is, apparently, either absent or secondary. Thus an important proportion of persons with pain have their pain not because of any physical disease but because of emotional disorders (see below, *Psychological and emotional factors*). Nevertheless, pain is primarily associated with injury. To allow for this, for the learning of pain, for its usual subjective patterns, and for the frequent lack of evidence of a physical basis, pain has been defined operationally as an unpleasant experience, primarily associated with injury to tissue, and described in terms of such damage.

Neurophysiological bases. Before the 19th century, theorists, physicians, and others tended to think of pain as an emotion rather than as a sensory experience. Anatomical and neurophysiological discoveries overwhelmingly resulted in its later classification as a sensory activity. More modern research, however, does not sustain such a limited sensory classification, although the neurophysiological basis remains extremely important.

Pain is generally reported after injurious stimuli (or others, such as electric shock, which are not always damaging) are applied to normal skin or other tissues that contain microscopic structures called free nerve endings. Free nerve endings seem to subserve other experiences besides pain and are widely distributed to internal and external body surfaces; from them nerve fibres conduct impulses to the spinal cord. A stimulated point on the skin that is supplied by free nerve endings can, under varying circumstances, give rise to reports of other experiences (*e.g.,* heat, cold) as well as pain. Thus it can be argued that pain can best be related to variable anatomic and physiological *patterns* rather than to specific, unchanging neural pathways, each resembling the track of an isolated single railway line.

Nevertheless, there is also evidence that some nerve fibres in the vicinity of their receptors (*i.e.,* near such peripheral parts of the body as the skin) do respond in a fairly specific way to noxious stimulation. Accordingly, even at the most peripheral level it seems that there are some fixed elements that contribute to the physiological basis for the experience of pain. Their effects, however, seem to be modified by other concomitant patterns of activity deeper within the nervous system. In general, the nerve fibres that respond in a fixed way to noxious stimulation belong to the smaller myelinated and to the unmyelinated groups of fibres. (Myelinated fibres are those covered with a fatty sheath that seems to have an insulating function.) These conduct impulses more slowly than the larger fibres, which have been related to such sensory experiences as touch and pressure.

Some of the so-called pain fibres are distributed to what is named (from its appearance) the posterior horn of gray matter in the spinal cord. Here they appear to be in close relationship to the substantia gelatinosa, an area lying at the tip of the posterior horn. Additional fibres cross from the two posterior horns to the opposite side of the spinal cord where they run in an area of white matter known as the anterolateral column. Several tracts run in this column, including a spino-thalamic tract that goes to the thalamus, which serves as a kind of relay centre in the brain. There is a wealth of evidence that interruption of this tract either by injury or disease (sometimes very highly localized damage) results in loss of the ability to feel pain from stimuli applied to the opposite side of the body in parts below the level of interruption.

Such loss is found to be an invariable consequence of full interruption of the pathways mentioned; more spatially restricted loss occurs after injuries to individual nerves. In a small proportion of cases, damage to the pathways may result in the spontaneous occurrence of pain, referred to the area supplied by the pathway, as well as a loss of sensory input. When this pain follows from damage to peripheral nerves, it is usually reported as burning in character and is called causalgia. After a limb is lost, the amputee normally still experiences the impression that it remains; this effect of a phantom limb is also sometimes accompanied by phantom pain (often very unpleasant). Spontaneous discomfort similar to causalgia can occur when there is damage to more centrally located structures (such as the spinal cord or the thalamus) and is known as central pain. It is convenient to call central pain, phantom-limb pain, and causalgia, jointly, neurogenic pain.

A coherent theory is thus available to account for experienced variations in pain by invoking the influence both of local peripheral events and of higher levels in the nervous system. Stated in neurophysiological language, this theory accounts for many of the observed phenomena. While it allows for fixed peripheral input, it also places particular weight on the pattern of input and on the possibility of psychological influence associated with relevant brain processes.

Psychological and emotional factors. Some theories of pain are given primarily in psychological terms without specifying possible neural bases for them. As noted above, pain frequently is attributed to psychological (*e.g.,* emotional) factors. Secondly, an emotional state (*e.g.,* anxiety) often can enhance or abate pain that arises from observable physical sources. In consequence it is often convenient to talk of pain in introspective terms whenever its possible neurophysiological basis remains incompletely explained.

Limited evidence indicates that persistent muscle tension will give rise to pain, as in holding an unfamiliar posture on a long journey. Similarly, there may be contraction of muscles as a result of anxiety, particularly in the neck and scalp. Tension in these muscles produces pain, notably headache, which generates further anxiety and alarm; this makes the pain even worse, in what seems to be a vicious circle. Relaxation and the easing of anxiety frequently bring relief. Such pain may be called psychosomatic; *i.e.,* it seems to be a bodily effect stemming from a psychological disturbance.

Sometimes pain seems to arise from an idea. The psychoanalyst Sigmund Freud reported the case of a man who attended an operation in which his brother's hip joint was to be straightened under an anesthetic. The joint was frozen in place by some abnormal adhesions that had to be broken; when a loud crack was heard, the man said he felt a pain in his own hip at the same moment, in what might be interpreted as sympathetic identification. Pain can arise as a hallucination as well; this may happen among people who are severely depressed and occasionally among those who suffer from schizophrenia or epilepsy.

Alleviation of pain. In addition to physical lesions in the body generally and in the nervous system especially, factors related to pain include age, sex, occupation, social circumstances, learning effects, and anxiety. There is much evidence that pain can be alleviated by drugs and psychiatric techniques designed to reduce anxiety. Although analgesics such as acetylsalicylic acid (aspirin) have a special pharmacological effect in the relief of pain, any drug or other measure that increases confidence and abates fear also will ease pain.

When drugs work by altering mood, their effect is partly attributable to the effects of suggestion and the expectation that relief will occur. This commonplace placebo effect (*e.g.,* relief by swallowing sugar pills) seems actually to result in less pain to the extent that the sufferer believes he will improve, becomes more confident, has more hope, and less anxiety. With such drugs as aspirin, part of the benefit is attributable to direct pharmacological effects on anxiety and hence on pain, and part to the psychological expectation of relief.

The abolition of pain by trance states, including hypnosis, has long been accepted. Without taking all claims at their face value, it can be accepted that the modification of attitudes does at times abate pain. While this holds for moderate and slowly rising intensities of pain, it seems much less effective for sudden or severe pain. Nevertheless, under special circumstances (as in battle), severe wounds may not be noticed until later.

Pain seems alleviated to a very similar extent by hypnosis, placebos, suggestion, psychotherapy, and other means that relieve anxiety, including sedatives and the milder analgesics. For effective relief, more severe pain with a mainly organic basis tends to require potent drugs, local anesthesia, or neurosurgery. Surgical operations on selected portions of the brain may be effective in pain relief, although such methods are applied highly selectively and are not routine.

Since the 1970s, it has been known that the perception of pain is mediated by neurochemicals called endorphins, which seem to function as the body's own analgesics. High concentrations of endorphins alleviate pain, apparently by binding to specific brain tissues that are involved in the perception of pain. It is probable that many of the therapeutic measures that help relieve pain do so by increasing the level of endorphins. For example, acupuncture appears to function at least partly in this way. In addition, morphine, heroin, and other opiates—which are among the most potent (and dangerous) analgesics known—are chemically similar to endorphins and seem to achieve their pain-relieving effects by binding to the same sites as do endorphins.

Chronic pain. Chronic pain is a much more complex problem than acute or short-term pain, and invariably has behavioral components that are best dealt with by a combination of psychological and physical approaches. Pain control for the chronic sufferer can employ a variety of methods: acupuncture, hypnosis, drugs, biofeedback, electrical stimulation, chemical nerve blocks, severing of peripheral or spinal cord nerves, and even brain surgery. For many chronic sufferers, however, pain is a learned phenomenon that can persist even in the absence of an organic basis. Pain has proved to be a highly malleable response, conditioned partly by anxiety and fear but also susceptible to rewards derived from the disability, such as financial gain, increased leisure time, freedom from work and interpersonal demands, and extra attention.

Psychologist Wilbert Fordyce, a pioneer in the behavioral approach to pain treatment, distinguishes between the type of pain that is a direct response to a stimulus and the type that is learned and therefore susceptible to "unlearning." Many pain clinics operate on Fordyce's principle that pain behaviours (*e.g.,* complaining and limping) may have been reinforced by some of the rewards of pain. These behaviours are closely tied to the actual experience of pain, and if they can be eliminated, the pain will be at least partly ameliorated. In such clinics patients are rewarded for "well" behaviour.

Insight therapy (*e.g.,* psychoanalysis or Gestalt therapy) may be another means for helping patients understand why they are emotionally dependent on their pain and learn less debilitating ways to get their needs satisfied. In some cases, pain may be a manifestation of depression, in which case therapy and antidepressant medication may bring relief. *See also* behaviour therapy; biofeedback.

Paine, John Knowles (b. Jan. 9, 1839, Portland, Maine, U.S.—d. April 25, 1906, Cambridge, Mass.), U.S. composer and organist, the first American to win wide recognition as a composer and the first professor of music at a U.S. university.

After a thorough musical grounding in Portland, Paine completed his studies in Berlin (1858–61). In 1861 he initiated a series of organ recitals and lectures in Boston that led to his appointment (1862) as professor of music at Harvard. The music department he organized there became a model for those of many other American universities.

Both as a teacher and as a composer he was a major influence on the development of music in the United States. His works, generally modelled on the German classics, include two symphonies, a *Mass in D* (1866–67), and the oratorio *St. Peter* (1872).

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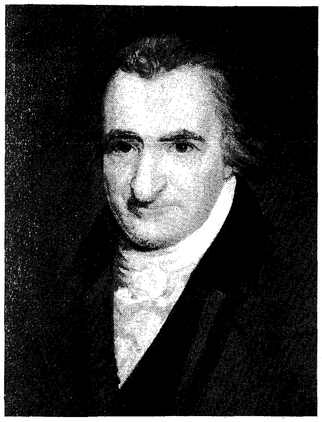
Paine, Robert Treat (b. March 11, 1731, Boston—d. May 11, 1814, Boston), American politician, jurist, member of the Continental Congress (1774–78), and signer of the Declaration of Independence.

Paine graduated from Harvard in 1749 and, after trying teaching and the ministry, turned to the study of law and was admitted to the Massachusetts bar in 1757. An early champion of the patriot cause, he gained recognition throughout the colonies in 1770 when he was chosen as a prosecuting attorney in the murder trial of British soldiers involved in the Boston Massacre of March 5, 1770. He was elected several times to the Massachusetts legislature in the 1770s, and became the state's first attorney general in 1777. He helped draft the state constitution in 1780, and from 1790 to 1804 served as a judge of the state supreme court. Long interested in astronomy, Paine was a founder of the American Academy of Arts and Sciences in 1780.

Paine, Thomas (b. Jan. 29, 1737, Thetford, Norfolk, Eng.—d. June 8, 1809, New York City), English-American writer and political pamphleteer whose "Common Sense" and "Crisis" papers were important influences on the American Revolution. Other works that contributed to his reputation as one of the greatest political propagandists in history were *Rights of Man,* a defense of the French Revolution and of republican principles; and *The Age of Reason,* an exposition of the place of religion in society.



Thomas Paine, detail of a portrait by John Wesley Jarvis; in the Thomas Paine Memorial House, New Rochelle, N.Y.

By courtesy of the Thomas Paine National Historical Association

Life in England and America. Paine was born of a Quaker father and an Anglican mother. His formal education was meagre, just enough to enable him to master reading, writing, and arithmetic. At 13 he began work with his father as a corset maker and then tried various other occupations unsuccessfully, finally becoming an officer of the excise. His duties were to hunt for smugglers and collect the excise taxes on liquor and tobacco. The pay was insufficient to cover living costs, but he used part of his earnings to purchase books and scientific apparatus.

Paine's life in England was marked by repeated failures. He had two brief marriages. He was unsuccessful or unhappy in every job he tried. He was dismissed from the excise office after he published a strong argument in 1772 for a raise in pay as the only way to end corruption in the service. Just when his situation appeared hopeless, he met Benjamin Franklin in London, who advised him to seek his fortune in America and gave him letters of introduction.

Paine arrived in Philadelphia on Nov. 30, 1774. His first regular employment was helping to edit the *Pennsylvania Magazine.* In addition Paine published numerous articles and some poetry, anonymously or under pseudonyms. One such article was "African Slavery in America," a scathing denunciation of the African slave trade, which he signed "Justice and Humanity."

Paine had arrived in America when the conflict between the colonists and England was reaching its height. After blood was spilled at the Battle of Lexington and Concord, April 19, 1775, Paine argued that the cause of America should not be just a revolt against taxation but a demand for independence. He put this idea into "Common Sense," which came off the press on Jan. 10, 1776. The 50-page pamphlet sold more than 500,000 copies within a few months. More than any other single publication, "Common Sense" paved the way for the Declaration of Independence, unanimously ratified July 4, 1776.

During the war that followed, Paine served as volunteer aide-de-camp to General Nathanael Greene. His great contribution to the patriot cause was the 16 "Crisis" papers issued between 1776 and 1783, each one signed "Common Sense." "The American Crisis. Number I," published on Dec. 19, 1776, when George

Washington's army was on the verge of disintegration, opened with the flaming words: "These are the times that try men's souls." Washington ordered the pamphlet read to all the troops at Valley Forge.

In 1777 Congress appointed Paine secretary to the Committee for Foreign Affairs. He held the post until early in 1779, when he became involved in a controversy with Silas Deane, a member of the Continental Congress, whom Paine accused of seeking to profit personally from French aid to the United States. But in revealing Deane's machinations, Paine was forced to quote from secret documents to which he had access as secretary of the Committee for Foreign Affairs. As a result, despite the truth of his accusations, he was forced to resign his post.

Paine's desperate need of employment was relieved when he was appointed clerk of the General Assembly of Pennsylvania on Nov. 2, 1779. In this capacity he had frequent opportunity to observe that American troops were at the end of their patience because of lack of pay and scarcity of supplies. Paine took $500 from his salary and started a subscription for the relief of the soldiers. In 1781, pursuing the same goal, he accompanied John Laurens to France. The money, clothing, and ammunition they brought back with them were important to the final success of the Revolution. Paine also appealed to the separate states to cooperate for the well-being of the entire nation. In "Public Good" (1780) he included a call for a national convention to remedy the ineffectual Articles of Confederation and establish a strong central government under "a continental constitution."

At the end of the American Revolution, Paine again found himself poverty-stricken. His patriotic writings had sold by the hundreds of thousands, but he had refused to accept any profits in order that cheap editions might be widely circulated. In a petition to Congress endorsed by Washington, he pleaded for financial assistance. It was buried by Paine's opponents in Congress, but Pennsylvania gave him £500 and New York a farm in New Rochelle. Here Paine devoted his time to inventions, concentrating on an iron bridge without piers and a smokeless candle.

In Europe: "Rights of Man." In April 1787 Paine left for Europe to promote his plan to build a single-arch bridge across the wide Schuylkill River near Philadelphia. But in England he was soon diverted from his engineering project. In December 1789 he published anonymously a warning against the attempt of Prime Minister William Pitt to involve England in a war with France over Holland, reminding the British people that war had "but one thing certain and that is increase of taxes." But it was the French Revolution that now filled Paine's thoughts. He was enraged by Edmund Burke's attack on the uprising of the French people in his *Reflections on the Revolution in France,* and, though Paine admired Burke's stand in favour of the American Revolution, he rushed into print with his celebrated answer, *Rights of Man* (March 13, 1791). The book immediately created a sensation. At least eight editions were published in 1791, and the work was quickly reprinted in the U.S., where it was widely distributed by the Jeffersonian societies. When Burke replied, Paine came back with *Rights of Man, Part II,* published on Feb. 17, 1792.

What began as a defense of the French Revolution evolved into an analysis of the basic reasons for discontent in European society and a remedy for the evils of arbitrary government, poverty, illiteracy, unemployment, and war. Paine spoke out effectively in favour of republicanism as against monarchy and went on to outline a plan for popular education, relief of the poor, pensions for aged people, and public works for the unemployed, all to be financed by the levying of a progressive income tax. To the ruling class Paine's proposals spelled "bloody revolution," and the government ordered the book banned and the publisher jailed. Paine himself was indicted for treason, and an order went out for his arrest. But he was en route to France, having been elected to a seat in the National Convention, before the order for his arrest could be delivered. Paine was tried in absentia, found guilty of seditious libel, and declared an outlaw, and *Rights of Man* was ordered permanently suppressed.

In France Paine hailed the abolition of the monarchy but deplored the terror against the royalists and fought unsuccessfully to save the life of King Louis XVI, favouring banishment rather than execution. He was to pay for his efforts to save the King's life when the radicals under Robespierre took power. Paine was imprisoned from Dec. 28, 1793, to Nov. 4, 1794, when, with the fall of Robespierre, he was released and, though seriously ill, readmitted to the National Convention.

While in prison, the first part of Paine's *Age of Reason* was published (1794), and it was followed by Part II after his release (1796). Although Paine made it clear that he believed in a Supreme Being and as a deist opposed only organized religion, the work won him a reputation as an atheist among the orthodox. The publication of his last great pamphlet, "Agrarian Justice" (1797), with its attack on inequalities in property ownership, added to his many enemies in establishment circles.

Paine remained in France until Sept. 1, 1802, when he sailed for the United States. He quickly discovered that his services to the country had been all but forgotten and that he was widely regarded only as the world's greatest infidel. Despite his poverty and his physical condition, worsened by occasional drunkenness, Paine continued his attacks on privilege and religious superstitions. He died in New York City in 1809 and was buried in New Rochelle on the farm given to him by the state of New York as a reward for his Revolutionary writings. Ten years later, William Cobbett, the political journalist, exhumed the bones and took them to England, where he hoped to give Paine a funeral worthy of his great contributions to humanity. But the plan misfired, and the bones were lost, never to be recovered.

Assessment. At Paine's death most U.S. newspapers reprinted the obituary notice from the *New York Citizen,* which read in part: "He had lived long, did some good and much harm." This remained the verdict of history for more than a century following his death, but in recent years the tide has turned: on Jan. 30, 1937, *The Times* of London referred to him as "the English Voltaire," and on May 18, 1952, Paine's bust was placed in the New York University Hall of Fame. (P.S.F.)

BIBLIOGRAPHY. The first comprehensive edition of Paine's works is that of Moncure D. Conway, *The Writings of Thomas Paine,* 4 vol. (1894–96). This has been replaced by Philip S. Foner, *The Complete Writings of Thomas Paine,* 2 vol. (1945). Several later discoveries of Paine's writings are in A.O. Aldridge, "Some Writings of Thomas Paine in Pennsylvania Newspapers," *American Historical Review,* 56:832–838 (1951). Richard Gimbel, *Thomas Paine Fights for Freedom in Three Worlds* (1961), offers an annotated bibliography of Paine's works. The first worthwhile biography, though entirely uncritical, was Moncure D. Conway, *The Life of Thomas Paine,* 2 vol. (1892). A.D. Aldridge, *Man of Reason* (1959), is an insightful, scholarly biography with chapter notes. David Freeman Hawke, *Rebel!* (1974), includes an invaluable bibliography.

Painesville, city, seat (1840) of Lake County, northeastern Ohio, U.S., near the mouth of the Grand River and Lake Erie, 30 mi (48 km) northeast of Cleveland. The site, first settled permanently by Gen. Edward Paine with a party of 66, was laid out around 1805; it was known variously as The Opening, Oak Openings, and Champion (for Henry Champion, original owner of the plot). In 1816 the community was renamed to honour Paine and was incorporated as a village in 1832. Jonathan Goldsmith, an architect of the Western Reserve period, built many elegant homes there in the 1820s, some of which survive. The Cleveland, Painesville and Ashtabula (now Penn Central) Railroad came through in 1853, and the nursery business, now extensive, began in 1854. Lake Erie College (founded as Willoughby Seminary for women in 1847) was moved to Painesville in 1856. The village remained mainly residential and became a city in 1902. Since 1940 it has developed industrially as part of Lake Erie's "chemical shore." Pop. (1980) 16,391.

Painlevé, Paul (b. Dec. 5, 1863, Paris—d. Oct. 29, 1933, Paris), French politician, mathematician, and patron of aviation who was premier at a crucial period of World War I and again during the 1925 financial crisis.

Educated at the École Normale Supérieure and the University of Paris, where he received

Painlevé, drawing by A. Bilis, 1930
By courtesy of the Bibliotheque Nationale, Paris

his doctorate in mathematics in 1887, Painlevé taught at the universities of Lille and Paris and the École Polytechnique. He was a distinguished mathematician, and among his awards was the Grand Prix des Sciences Mathématiques (1890). He returned to the École Normale Supérieure to teach in 1897.

Painlevé took special interest in the infant science of aviation, becoming a theoretician of heavier-than-air flight. He was the first Frenchman to fly with Wilbur Wright, at Auvours in 1908, and the following year created the first course in aeronautical mechanics at the École Aéronautique.

Becoming interested in politics, Painlevé was elected to the Chamber of Deputies from a Paris constituency in 1906. He served as minister of education and minister of inventions in the wartime government of Aristide Briand, and, as war minister from March to September 1917, made the controversial decision to replace Gen. Robert-Georges Nivelle with Gen. Philippe Pétain after the costly failure of Nivelle's offensive in May. In September 1917 he formed his own ministry and the following month agreed to the establishment of the Supreme Allied Council at Versailles, choosing as the French representative Gen. Ferdinand Foch, who later became Allied commander. Painlevé resigned in November, however, and was succeeded as prime minister by Georges Clemenceau.

Painlevé was one of the founders of the Cartel des Gauches, a coalition of Socialists and radicals, which defeated the rightist Bloc National in the general elections of 1924. He became premier in April 1925 but resigned in November because neither his ministers nor French financial interests could agree on a solution to the financial crisis engendered by the devaluation of the franc. Subsequently, he served as war minister in the governments of Aristide Briand and Raymond Poincaré and was air minister in 1930–31 and 1931–32.

Although not an outstanding political leader, Painlevé was a brilliant mathematician. He is remembered for his work in transformations and, especially, in differential equations and in the theory of functions; one type of function became known as Painlevé's transcendants. He was elected a member of the Académie des Sciences in 1900.

paint, decorative and protective coating commonly applied to rigid surfaces as a liquid consisting of a pigment suspended in a vehicle, or binder. The vehicle, usually a resin dissolved in a solvent, dries to a tough film, binding the pigment to the surface.

A brief treatment of paint follows. For full treatment, *see* MACROPAEDIA: Industries, Chemical Process.

Paint was used for pictorial and decorative purposes in the caves of France and Spain as early as 15,000 BC. The earliest pigments, which were natural ores such as iron oxide, were supplemented by 6000 BC in China by calcined (fired) mixtures of inorganic compounds and organic pigments; vehicles were prepared from gum arabic, egg white, gelatin, and beeswax. By 1500 BC the Egyptians were using dyes such as indigo and madder to make blue and red pigments. The exploitation of linseed oil (a drying oil useful as a vehicle) and zinc oxide (a white pigment) in the 18th century brought a rapid expansion of the European paint industry. The 20th century saw important developments in paint technology, including the introduction of synthetic polymers as vehicles and of synthetic pigments; a new understanding of the chemistry and physics of paints; and coating materials with greater fire retardancy, corrosion resistance, and heat stability. Most significant was a return to water-based paints in the form of latex paints that combine easy application and cleanup with reduced hazard of fire.

In modern paint manufacture, pigment particles are dispersed in the vehicle by cylindrical mills that tumble heavy metal or ceramic balls through the paint, or by sand grinders that circulate a suspension of sand through the paint at high speed.

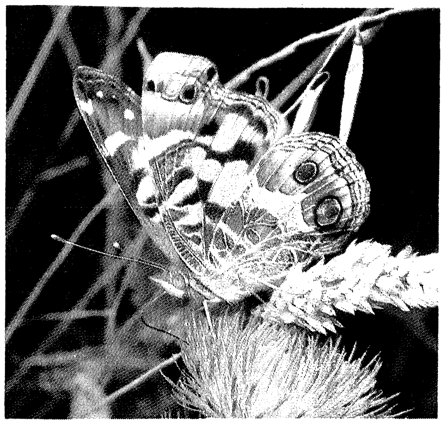
The basic white pigments include zinc oxide, zinc sulfide, lithopone, and titanium dioxide. Most black pigments are composed of elemental carbon. Common red pigments include the minerals iron oxide, cadmium, and cuprous oxide and various synthetic organic pigments. Yellow and orange pigments include chromates, molybdates, and cadmium compounds. Blue and green pigments are either inorganic (synthetic ultramarines and iron blues) or organic (phthalocyanines). Extenders or fillers are sometimes added to paint to increase its spreadability and strength.

paint brush, also called PAINTED CUP (plant): *see* Indian paint brush.

Painted Desert, section of the high plateau in north central Arizona, U.S., extending from the Grand Canyon in a southeasterly direction along the north side of the Little Colorado River to Holbrook. It is approximately 150 mi (240 km) long and 15–50 mi wide and covers an area of 7,500 sq mi (19,400 sq km). The name was first used in 1858 by a government explorer, Lieut. Joseph C. Ives, to describe the area's brilliantly coloured shales, marls, and sandstones, which are banded with vivid red, yellow, blue, white, and lavender. At times the air glows with a pink mist or purple haze of desert dust. Elevations range from 4,500 ft (1,370 m) to 6,500 ft. The rolling surface is broken by isolated buttes and is bounded on the north by vermilion cliffs, rising to broad, flat-topped mesas. Marks of volcanic activity are abundant and widely scattered. The region is barren and arid, with 5–9 in. (127–229 mm) of annual precipitation and temperature extremes of −25° to 105° F (−31° to 41° C). Part of the eastern section is within the Petrified Forest National Park and contains the Black Forest, one of the four remarkable areas of petrified trees of Mesozoic age, about 170,000,000 years old. Navajo and Hopi Indian reservations occupy a large part of the Painted Desert, and these tribes use the variegated, brightly coloured sands for their famous ceremonial sand paintings.

Painted Desert, Arizona
David Muench—EB Inc.

painted lady, any of certain butterflies of the genus *Vanessa* (family Nymphalidae, order Lepidoptera), specifically *V. virginiensis* in North and Central America and *V. cardui* in Africa and Europe. The adults have broad wings (span about 4 to 5 centimetres [1½ to 2 inches]), with beautifully elaborate patterns of reddish-orange, brown, white, and blue scales. Vast numbers travel northward in spring across the Mediterranean from Africa to Europe, migrating thousands of kilometres. A few of the next generation travel southward during late summer, but most perish in the northern winter. Painted lady larvae in the Americas feed on plants that are members of the family Compositae, while larvae in Africa and Europe eat thistles and stinging nettles.



American painted lady (*Vanessa virginiensis*)
E.S. Ross

painted lady (plant): *see* Indian paint brush.

painted snipe, either of two species of marsh birds comprising the family Rostratulidae (order Charadriiformes). They are boldly marked birds with a snipelike body and bill. Painted snipes are about 25 centimetres (10 inches) in length and are brown and white in colour.

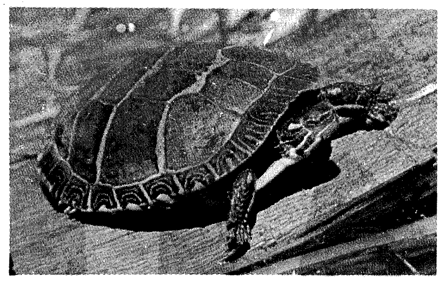
Painted snipe (*Rostratula benghalensis*)
Peter Slater—Photo Researchers

The Old World painted snipe (*Rostratula benghalensis*) ranges from Africa to Australia and Japan and has yellowish "spectacles" around the eyes. The South American painted snipe (*Nycticryphes semicollaris*) is a darker bird with a yellow-striped back.

In both species the female is larger and brighter in colour than the male. She courts the male, and he undertakes most of the nesting duties. Painted snipes nest on the ground, the Old World painted snipe laying four eggs, the South American species laying two eggs. The downy young readily take to the water.

For other snipe species (family Scolopacidae), *see* snipe.

painted turtle (*Chrysemys picta*), brightly marked North American turtle (family Emydidae) found from southern Canada to northern Mexico. The painted turtle, is a smooth-shelled reptile with a shell about 10 to 18 cen-



Painted turtle (*Chrysemys picta*)
Leonard Lee Rue III—The National Audubon Society Collection/Photo Researchers

timetres (4 to 7 inches) long. It has red and yellow markings on its relatively flat, black or greenish-brown upper shell.

The painted turtle usually lives in quiet, shallow bodies of fresh water, especially those with thickly planted mud bottoms. It feeds on plants, small animals, and some carrion. It often basks in large groups on logs and other objects, and in many areas it hibernates during the winter.

painter (cat): *see* puma.

Painter, Theophilus Shickel (b. Aug. 22, 1889, Salem, Va., U.S.—d. Oct. 5, 1969, Fort Stockton, Texas), American zoologist and cytologist who first identified individual genes in the chromosomes of fruit flies.

He received a Ph.D. degree from Yale (1913) and was a member of the faculty there (1913–16). In 1916 he joined the faculty of the University of Texas, where, in 1946, he became president. Painter early realized that the unusually large cells of the salivary glands of *Drosophila* fruit flies are particularly well suited for studies of genes and chromosomes. In 1933 he published a drawing of a section of a *Drosophila* chromosome showing more than 150 bands, which, for the first time, allowed determination of the precise loci, or positions, of genes.

Painter, William (b. *c.* 1540—d. February 1594, London), English author whose collection of tales, *The Palace of Pleasure,* based on classical and Italian originals, was a sourcebook for many Elizabethan dramatists.

Educated at St. John's College, Cambridge, he was ordained in 1560. In 1561 he became a clerk of the ordnance in the Tower of London, a position in which he appears to have amassed a fortune out of public funds. In 1591 his son Anthony confessed that he and his father had abused their trust, but Painter retained his office until his death.

The first volume of *The Palace of Pleasure,* which appeared in 1566, contained 60 tales. It was followed in the next year by a volume including 34 new stories. An improved edition (1575) contained seven more new stories. To its popularity, and that of similar collections, is due the high proportion of Elizabethan plays with Italian settings.

The early tragedies *Appius and Virginia, a Tragedy,* by John Webster, and *The Tragedy of Tancred and Gismund,* by Robert Wilmot, were taken from Painter's book, and it was also the source for Shakespeare's *Timon of Athens* and *All's Well That Ends Well* (and probably for details in *Romeo and Juliet* and *The Rape of Lucrece*), for Beaumont and Fletcher's *Triumph of Death,* and for James Shirley's *Loves Crueltie.*

painting, a form of aesthetic expression in which designs—representational, imaginative, or abstract—are created in two dimensions by the application of pigments or other coloured media to a flat surface. The elements of design are line, form, colour, tone, and texture, and they may be combined in an infinite variety of ways. Painting may be done for ceremonial, devotional, decorative, rhetorical, or other motives. The range of possible media includes oil paints, watercolours, pastels, lacquer, sand, and light itself.

Painting is treated in a number of articles in the MACROPAEDIA. For general treatments of painting, its history and place among the arts, *see* Aesthetics; Arts, Classification of the; Folk Arts; Painting, The Art of; Painting, The History of Western. For discussions of related art forms, *see* Drawing; Decorative Arts and Furnishings. For treatments of painting as practiced by various non-European peoples, *see* African Arts; American Indians; Central Asian Arts; East Asian Arts; Egyptian Arts and Architecture, Ancient; Islāmic Arts; Oceanian Arts; Prehistoric Peoples and Cultures; South Asian Arts; Southeast Asian Arts.

For a description of the place of painting in the circle of learning and for a list of both MACROPAEDIA and MICROPAEDIA articles on the subject, *see* PROPAEDIA: Part Six, Division II.

pair production, in physics, formation or materialization of two electrons, one negative and the other positive (positron), from a pulse of electromagnetic energy traveling through matter, usually in the vicinity of an atomic nucleus. Pair production is a direct conversion of radiant energy to matter. It is one of the principal ways in which high-energy gamma rays are absorbed in matter. For pair production to occur, the electromagnetic energy, in a discrete quantity called a photon, must be at least equivalent to the mass of two electrons. The mass m of a single electron is equivalent to 0.51 million electron volts (MeV) of energy E as calculated from the equation formulated by Albert Einstein, $E = mc^2$, in which c is a constant equal to the velocity of light. To produce two electrons, therefore, the photon energy must be at least 1.02 MeV. Photon energy in excess of this amount, when pair production occurs, is converted into motion of the electron–positron pair. If pair production occurs in a track detector, such as a cloud chamber, to which a magnetic field is properly applied, the electron and the positron curve away from the point of formation in opposite directions in arcs of equal curvature. In this way pair production was first detected (1933). The positron that is formed quickly disappears by reconversion into photons in the process of annihilation with another electron in matter.

Internal pair production, a species of gamma decay (*q.v.*), occurs when an unstable nucleus that has at least 1.02 MeV of excess energy directly ejects an electron–positron pair created within its own electromagnetic field without first producing a gamma photon.

Páirtí Lucht Oibre (Ireland): *see* Labour Party.

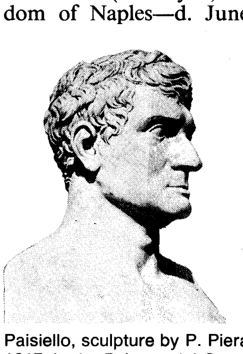
País, El (Spanish: "The Country"), daily newspaper published in Madrid, an independent paper dedicated to the promotion of democratic ideals in post-Franco Spain.

Established in 1976, it was enthusiastically received from the start. The idea of founding such a journal originated with the son of the philosopher José Ortega y Gasset, and he set up the company in 1972. The venture was approved by the government about the time of Franco's death, and six months later the first issue appeared.

El País set out to be a highly readable, serious, literate national newspaper appealing to diverse interests and schools of political thought. It covers local, national, and international news thoroughly and offers sections on culture and society, sports, and business and finance.

País Vasco (Spain): *see* Basque Country.

Paisiello, Giovanni, Paisiello also spelled PAESIELLO (b. May 9, 1740, Taranto, Kingdom of Naples—d. June 5, 1816, Naples), Neapolitan composer of operas admired for their robust realism and dramatic power.



Paisiello, sculpture by P. Pierantoni, 1817; in the Palazzo dei Conservatori, Capitoline Museum, Rome

By courtesy of Palazzo dei Conservatori, Musei Capitolini, Rome

Paisiello's father, a veterinary surgeon who intended him for the legal profession, enrolled him, at the age of five, at the Jesuit school in Taranto. When his talent for singing became obvious, he was placed in the Conservatorio di S. Onofrio at Naples. Paisiello's earliest efforts in composition were for the church. For the theatre of the conservatory he wrote some intermezzi, one of which attracted so much notice that he was invited to write two operas, *La Pupilla,* for Bologna, and *Il Marchese Tulipano,* for Rome. His reputation established, he settled for some years at Naples, where he produced a series of successful operas. In 1776 Paisiello was invited by the empress Catherine II to St. Petersburg, where he remained for eight years.

Among the works he produced for Catherine was *Il Barbiere di Siviglia* (1782; *The Barber of Seville*), which some consider his masterpiece, on a libretto by Giuseppe Petrosellini, after Beaumarchais' comedy *Le Barbier de Séville.*

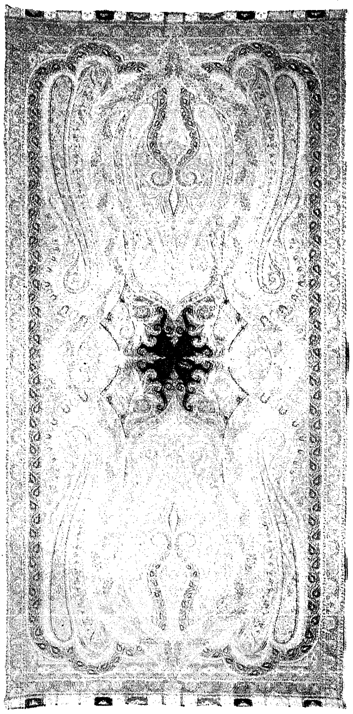
In 1784 Paisiello left Russia and, after a brief sojourn in Vienna, where he composed for Joseph II, entered the service of Ferdinand IV of Naples. During his 15 years as music director there, he composed several of his best operas, including *La Molinara* (1788) and *Nina* (1789). After many vicissitudes resulting from political and dynastic changes, he was invited to Paris in 1802 by Napoleon. Paisiello conducted the music of the court in the Tuileries; the Parisian public, however, received his opera *Proserpine* (1803) without enthusiasm. Disappointed at the failure of his only opera with a French libretto, he returned to Naples. There he was reinstated in his former appointment by Joseph Bonaparte and Joachim Murat, but he was unable to meet the demands for new works. The power of the Bonaparte family was tottering, and Paisiello's fortunes fell with it.

Paisiello is known to have composed about 100 operas. His church music comprises about 40 masses and many smaller works. His instrumental music includes symphonies, a harp concerto, string quartets, and sonatas for harp and for violin and cello. In the 20th century, *Il Barbiere* and *La Molinara* were revived, and several of his operas and piano concerti, string quartets, and keyboard pieces were republished.

Paisley, large burgh, industrial centre, and seat of Renfrew district, Strathclyde region, Scotland, situated on the River White Cart, a tributary of the Clyde. Paisley developed as a village clustered around a Cluniac abbey founded in 1163. The original abbey was burned down in 1307, and the present building dates from the 15th century.

By the early 18th century, Paisley had developed into a manufacturing centre for the hand-loom weaving of linen. At the end of the century the new town was laid out over much of the ground that once belonged to the abbey. Paisley became famous for its Paisley shawls in silk and cotton and later in wool that were copies of the Asian shawls sent back by soldiers serving in India. A priceless collection is on exhibit in the Paisley museum. Later, the manufacture of linen thread gave way to that of cotton, and Paisley grew rapidly. The town's modern industry includes chemical and dye production; engineering, shipbuilding, and food-processing industries; and textile and thread manufacturing. A government-sponsored industrial estate, opened in 1937, contains more than 150 factories. Paisley has many fine buildings, including the town hall, public library and museum, the Coats Observatory, the Thomas Coats Memorial Church, and a modern College of Technology. Pop. (1981) 84,593.

paisley, textile pattern characterized by colourful, curved abstract figures; it is named for the shawls manufactured at the town of Paisley, Scot. When, *c.* 1800, patterned shawls made from the soft fleece of the Kashmir goat began to be imported to Britain from India,



Paisley shawl, English, 19th century; in the Victoria and Albert Museum, London
By courtesy of the Victoria and Albert Museum, London; photograph, A.C. Cooper

machine-woven wool equivalents were made at Paisley to supply the insatiable demand that had been created for "cashmere" shawls. Paisley shawls, in fine wool and sober colouring, were beautiful in their own right. Their rich, abstract, curvilinear patterns, modified from their Kashmir counterparts and deriving ultimately from Mughal art, have continued to be widely adopted in modern textiles, especially for clothing. A motif resembling an enlarged comma (well-known in Mughal decorative art) is the one by which most people recognize a paisley pattern.

Paisley, Ian (Richard Kyle) (b. April 6, 1926, Armagh, County Armagh, N.Ire.), militant Protestant leader in the sectarian strife that divided Northern Ireland from the 1960s.

Son of a Baptist minister who broke away from his Armagh congregation and established his own church in Ballymena, County Antrim, Paisley likewise became a maverick churchman. After studying at schools of the Reformed Presbyterian Church in South Wales and Ireland, he was ordained in 1946. In 1951 he and his followers formed a new sect, the Free Presbyterian Church of Ulster, which, in two decades, expanded rapidly, establishing some 30 churches and acquiring about 20,000 members and perhaps 200,000 sympathizers in Northern Ireland.

From the 1960s to the 1980s Paisley became the voice of extreme Protestant opinion, leading demonstrations and rallies throughout Northern Ireland. He was repeatedly sentenced to imprisonment for unlawful assembly, once (in 1966) for leading a march through a Roman Catholic area of Belfast. Repeatedly he attacked the government ministers in London for conferring with the ministers in Dublin, arguing vitriolically that the British were siding with the Roman Catholic hierarchy against Ulster. He also sought to demonstrate in Rome and Geneva against the papacy and ecumenism.

In 1970 he was elected to a seat in the British House of Commons, and in 1979 he was elected to the European Parliament. He co-founded the Democratic Unionist Party in 1972 and organized a parliamentary group of Protestant fighters called the Third Force.

Paiute, also spelled PIUTE, two distinct American Indian groups that speak languages of the Numic (formerly called Plateau Shoshonean) group of the Uto-Aztecan family. The Southern Paiute, who speak Ute, at one time occupied southern Utah, northwestern Arizona, southern Nevada, and southeastern California, the last group being known as Chemehuevi. The Spaniards who traversed some of the Paiute territories in the 16th and 17th centuries left them undisturbed. Although encroached upon and directed into reservations by the U.S. government in the 19th century, the Southern Paiute had comparatively little friction with whites; and many stayed scattered in the territories, working on the ranches of whites or remaining on the fringes of white settlements.

The Northern Paiute (called Paviotso in Nevada) are related to the Mono (*q.v.*) of California; they have been known derogatorily as Diggers, and occupied east central California, western Nevada, and eastern Oregon. An offshoot, the Bannock (*q.v.*), lived with the Shoshoni in southern Idaho, where they were buffalo hunters. After 1840, with the rush of European prospectors and farmers and the consequent despoiling of their already meagre supply of food plants, the Northern Paiute acquired guns and horses and fought at intervals with the whites until 1874, when the last Paiute lands were appropriated by the U.S. government.

The Northern and Southern Paiute were traditionally food collectors who subsisted primarily on seed, pine nuts, and small game, although many Southern Paiute planted small gardens. They occupied temporary brush shelters, wore little or no clothing except rabbit-skin blankets, and made a variety of baskets for gathering and cooking food. Families were affiliated through intermarriage; but there were no formal bands or territorial organizations, except in the more fertile areas such as the Owens Valley in California. Little of the old customs survive, except for shamanism. In the late 20th century the Northern and Southern Paiute numbered about 4,000, living largely near or on reservations.

Paiute woman weaving a basket, 1873
By courtesy of the Smithsonian Institution, Washington, D.C., Bureau of American Ethnology

pajamas, also spelled PYJAMAS, loose, lightweight trousers worn in the East, or a loose two-piece suit of silk, cotton, or synthetic material worn for sleeping or lounging.

They were introduced in England as lounging attire in the 17th century but soon went out of fashion. About 1870 they reappeared in

Man wearing pajamas, illustration from the *Catalogue of Welch Margetson,* English, 1910
By courtesy of Welch Margetson

the Western world as sleeping attire for men, after returning British colonials brought back with them the pajamas worn by Hindus. At the beginning of the 20th century, pajamas were introduced as women's sleepwear and in about 1920 as at-home evening wear.

Pajjusaṇa (religious festival): *see* Paryuṣaṇa.

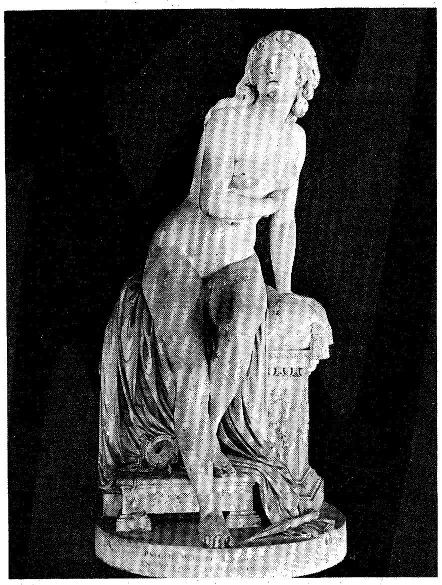
Pajon, Claude (b. 1626, Romorantin, near Blois, Fr.—d. Sept. 27, 1685, Orléans), French Protestant theologian who was influential during the later Reformation.

Pajon studied at Saumur and became a pastor at Machenoir. He was made a professor of theology at Saumur in 1666, but had to resign in 1668 after controversy arose over his views. Though he repeatedly declared his allegiance to orthodox Reformed views as set forth by the Synod of Dort (1618–19), Pajon's teaching that sins were caused by ignorance led some of his colleagues to question his orthodoxy.

In 1668 Pajon became a pastor at Orléans. There again he was the subject of controversy; he was accused of Pelagianism and Arminianism and was examined on his views in 1676 by the Reformed theologian Jean Claude. The outcome was unsatisfactory to the authorities, who took measures against theological candidates who echoed Pajon's views. He did not set forth his tenets in a systematic treatise but in his correspondence and lectures. He held that the spirit of God operated through human reason, which will accept the Word if circumstances are propitious, a view that was in conflict with the Calvinist doctrine of salvation by grace alone.

Pajou, Augustin (b. Sept. 19, 1730, Paris—d. May 8, 1809, Paris), French sculptor and decorator known mainly for his portrait busts of figures, such as his patroness, Madame du Barry (Louvre, Paris), and for directing the decoration of the Versailles opera house.

Pajou, a student of the sculptor Jean-Baptiste Lemoyne, won the Prix de Rome (1748) and spent a dozen years in Italy. He was elected to the Paris Academy in 1760. He executed bas-reliefs and small decorative fig-



"Psyche Abandoned," marble sculpture by Augustin Pajou, 1791; in the Louvre, Paris
Giraudon—Art Resource/EB Inc.

ures in bronze, silver, and marble and later did work on the court of the Palais Royal, Paris, and the cathedral at Orléans. A directive from King Louis XVI for the creation of statues honouring great Frenchmen led him to do many busts, including those of such persons as Georges Buffon, René Descartes, and J.-B. Bossuet. Appointed keeper of the king's antiquities (1777), he was commissioned to complete the Fontaine des Innocents, Paris, in the manner of Jean Goujon. Pajou's "Psyche Abandoned" (1791) offers an example of his graciously seductive style. It is one of the few creations in which he restrained his usual decorativeness in favour of classical purity.

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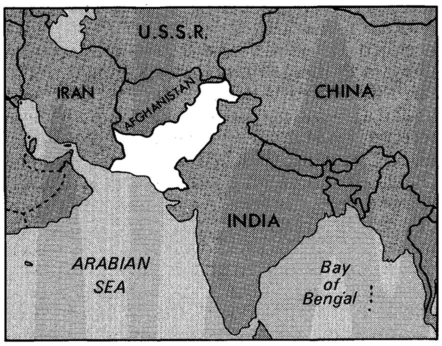
Pakaraima Mountains (South America): *see* Pacaraima Mountains.

Pakhto language: *see* Pashto language.

Pakhtun (people): *see* Pashtun.

Pakistan, officially ISLĀMIC REPUBLIC OF PAKISTAN, Urdu ISLĀM-Ī JAMHŪRĪYA-E PĀKISTĀN, Asia's seventh largest country, occupying the northwestern portion of the Indian subcontinent. It covers an area of 307,374 square miles (796,095 square km), excluding



Pakistan

the Pakistani-held part of Jammu and Kashmir in the northeast. The capital is Islāmābād. The country extends for more than 990 miles (1,600 km) from south to north and for about 550 miles (880 km) from west to east. It is bounded to the west by Iran, to the north by Afghanistan, to the northeast by China, to the east and southeast by India, and to the south by the Arabian Sea. The population in 1990, including Afghan refugees and residents of Pakistani-occupied Jammu and Kashmir, was estimated to be 122,666,000.

A brief treatment of Pakistan follows. For full treatment, *see* MACROPAEDIA: Pakistan.

For current history and for statistics on society and economy, *see* BRITANNICA WORLD DATA ANNUAL.

The land. Pakistan can be divided physiographically into four regions: the great highlands, the Baluchistan Plateau, the Indus Plain, and the desert areas. The Himalayan and Trans-Himalayan mountain ranges (the Karakoram and the Pamirs), rising to an average elevation of more than 20,000 feet (6,000 m) and including some of the world's highest peaks, such as K2 (28,251 feet [8,611 m]) and Nānga Parbat (26,660 feet [8,126 m]), make up the great highlands, which occupy the northernmost portion of the country. The Baluchistan Plateau, a broken highland region about 1,000 feet (300 m) in elevation with many ridges crossing it from northeast to southwest, occupies the western and southwestern sectors of the country. The Indus Plain, the most prosperous agricultural region of Pakistan, covers an area of 200,000 square miles (520,000 square km) in the east and extends for 650 to 700 miles (1,000 to 1,100 km) from the rim of the Potwar Plateau in northern Pakistan southward to the Arabian Sea. In the southeast are the desert areas, from north to south, the Thal, the Cholistan, and the Thar, all three northward or westward extensions of the Thar Desert of western India. The southwestward-flowing Indus is the principal river; its major tributaries are the Chenāb, Jhelum, Rāvi, and Sutlej. Most of the country has little seismic activity, but the Quetta region and northern Pakistan are subject to severe earthquakes.

The climate is continental and is characterized by extreme variations of temperature. January (winter) temperatures range from 57° F (14° C) in the Indus Plain to 68° F (20° C) along the coast and to 4° F (−20° C) in the high mountains (above 15,000 feet [460 m]). July (summer) temperatures range from 32° F (0° C) in the high mountains to 84° F (29° C) along the coast and to 95° F (35° C) in the southeastern deserts. The southwest monsoon (July–October) provides rainfall of about 6 to 8 inches (150 to 200 mm) on the coast, 15 inches (380 mm) in the river valleys, and 40 inches (1,000 mm) or more in the mountainous northern areas. Rainfall varies from year to year, and successive periods of flooding and drought are not uncommon.

Pakistan's natural vegetation, except for forested mountain slopes, is largely limited to tough grasses, dry bushes, and scrub trees, though some riverine forests occur along the lower Indus River. Wildlife abounds in the northern mountains and includes brown bear, black Himalayan bear, leopard, and several species of wild sheep.

Pakistan has known deposits of coal, iron ore, chromite, gypsum, copper, rock salt, marble, and other mineral resources that remain largely unexploited. Natural gas is by far the most valuable resource, with proven reserves accounting for about 0.5 percent of the world's total.

The people. Pakistan's population is a complex mixture of indigenous peoples. The population's racial characteristics have been affected by successive waves of Aryans, Persians, Greeks, Pashtuns (Pathans), and Mughals coming from the northwest. Arabs have also left their mark on the population. Each of Pakistan's languages has a strong regional focus, and no single language can be said to be common to the whole population. The predominant linguistic group in Pakistan is Punjabi (almost one-half of the population); others include Pashto (one-eighth), Sindhi (one-eighth), Saraikī (one-tenth), Urdu, and Baluchi. In addition, there are refugees from Afghanistan and Iran in Pakistan. Urdu is the language used by most educated Punjabis and is the nation's official language. Almost all of the population is Muslim; Hindus and Christians make up small minority groups.

Birth and death rates are high, and measures have been taken to reduce them. By encouraging female employment and family planning, the government attempted, though unsuccessfully, to lower fertility levels. Almost one-half of the population is less than 15 years of age. The population is concentrated in the fertile Indus River valley and along that river's major tributaries in the northeastern and northern portions of the country. By contrast, western and southwestern Pakistan are sparsely inhabited. Although only one-third of the nation's population is urban, the influx of rural migrants to Pakistan's few and crowded cities causes housing shortages and slums and overburdens transportation. Karāchi is the country's largest city. Hyderābād, Multān, Lahore, Rāwalpindi, and Faisalābād are other major cities.

The economy. Pakistan has a developing mixed economy that is largely based on agriculture, light industries, and services. Many of the nation's heavy industries were nationalized in the early 1970s and have been undermined by poor management. Banks were nationalized in 1974. Although the gross national product (GNP) is increasing more rapidly than the population, the GNP per capita is among the lowest in Asia.

Agriculture accounts for approximately one-fifth of the GNP and employs more than one-half of the work force. Agricultural output has been kept low by the prevalence of sharecroppers who have little incentive to increase production; land reform and progressive taxes have been introduced in an attempt to reduce the number of sharecroppers. One-fourth of the total land area is arable, and most of the arable land is under irrigation. Irrigation, however, is inefficiently allocated. Dramatic increases in wheat production were made possible in the 1960s and '70s by the use of improved strains. These increases enabled Pakistan to become agriculturally self-sufficient, though there are occasional shortages of staples.

Wheat is the chief staple, and sugarcane is widely grown. Cotton and rice are major export crops. The number of livestock per person is high, but the production of meat and milk remains low because of inadequate feed and poor management. Goats and sheep are the most numerous animals, followed by cattle, buffalo, and camels.

Forests cover less than 4 percent of the total land area, and most of the wood removed annually is used for fuel. Fishing, mostly in the Indian Ocean, is an important industry.

Mining, which is largely controlled by the government, accounts for about 2 percent of the GNP, and large quantities of petroleum, iron, and steel must be imported. Coal and iron ore, both of which are mostly low-grade, some petroleum, and substantial quantities of natural gas are extracted. Limestone, chromite, and gypsum are widely mined.

Manufacturing accounts for approximately one-sixth of the GNP and employs one-eighth of the work force. Textiles, particularly cotton textiles, are the chief manufacture and are a leading export. Small-scale industries are generally more productive than the heavy industries controlled by the government. Trade and commerce employ about one-sixth of the work force.

Pakistan's major exports of raw cotton, cotton yarn, cotton fabrics, rice, leather, and woolen carpets are imported by Japan, the United States, West Germany, the United Kingdom, and Italy. Imports, mainly from these same countries, include nonelectric machinery, mineral oils, chemicals, transport equipment, and edible oils.

About half of Pakistan's electricity is generated by hydroelectric power plants. Most of the remainder is produced by fossil fuels, with a small portion from nuclear power.

Underemployment is widespread. Emigration has depleted the skilled work force, and there is a shortage of technicians, engineers, doctors, and various craftsmen. Remittances from Pakistanis working abroad are a major source of foreign exchange.

Budgetary revenue is derived primarily from tariffs and excise taxes. Expenditures are directed primarily to defense, payment of the public debt, development, grants to the provinces, and government administration.

Government and social conditions. After several years of military rule, full civilian government was restored with parliamentary elections held in 1988. Under the amended 1973 constitution, the president appoints as prime minister the leader of that political party which can muster a voting majority in the National Assembly. Pakistan's judicial system is headed by the Supreme Court, and each province has a high court. The Federal Shariat Court, a court of Islāmic law (Sharīʿah), was set up in the 1980s.

Pakistan's social-welfare services are limited. Health facilities and medical personnel are scarce and often inaccessible, serious infectious diseases are widespread, and diet is often deficient.

Only about one-fourth of Pakistan's overall population is literate, and the proportion for women is even lower at about one-sixth. Primary education is free, but less than half of all school-aged children are enrolled. Newspapers, which have been periodically censored, cover political news almost exclusively. Because of the extent of illiteracy, radio is the most important communications medium; government radio broadcasts in more than 20 languages.

Recent domestic and international emphasis on Islāmic ideology has brought about a strong identification with Islāmic culture in Pakistan. *Qawwālī*, a form of devotional singing, is very popular. Public poetry recitations called *mushāʿirah*s are organized like musical concerts. Urdu, Sindhi, and Pashto poets are regional and national heroes. Western-style literary activity is carried on in all of the modern languages of Pakistan, but especially in Urdu, Baluchi, Pashto, Punjabi, Sindhi, and English. The preeminent cultural figure in Urdu is the 19th–20th-century poet and philosopher Muḥammad Iqbāl, acclaimed as the spiritual father of modern Pakistan.

History. Early settlements in the Baluchistan region of Pakistan date from about 3500 BC. By the end of the 4th millennium BC, many settlers had migrated eastward from Baluchistan to the Indus River valley, where several urban civilizations arose, such as the Harappan. The Indus Valley Civilization ended abruptly about 1500 BC. During the 2nd millennium BC, Aryan-speaking peoples migrated into the region.

Buddhist writings of the 6th and 5th centuries BC mention the state of Gandhāra in the Indus River valley. In 327 BC Alexander the Great entered Gandhāra seeking to conquer the extremities of the Achaemenid empire of Persia.

Pakistan was subsequently part of the Indic Mauryan empire during the 3rd century and part of the 2nd century BC and later, in the 1st and 2nd centuries AD, part of the Indic Kuṣāṇa (Kushān) kingdom.

The Guptas ruled over northern India, including the Indus River valley, during a period in which Hindu culture crystallized (320–540).

The first Muslim conquests occurred in Baluchistan during the 8th century, and Muslims were active in the region from that time. In the 13th century Muslim power was consolidated into a sultanate centred on Delhi that continued to rule most of the subcontinent until the early 16th century.

The Mughal dynasty controlled the subcontinent between 1526 and 1761. The British East India Company ousted other colonial powers and then subdued the Mughal state in 1757. For a century the East India Company controlled most of the subcontinent, but in 1858 the British government assumed responsibility for the region following the 1857 mutiny of the Indian recruits in the Bengal army. During the period of British colonial rule, what is now (Muslim) Pakistan was administratively part of (largely Hindu) India.

Early expressions of Indian nationalism crystallized in the Hindu-dominated Indian National Congress (1885) and in the All-India Muslim League (1906).

In the decades following 1857 the Muslims sought to cooperate with the British, but, after World War I and the partition of the Ottoman Empire, they began to oppose British rule. The Muslim nationalist leader in this period was Mohammed Ali Jinnah (1876–1949).

By 1940 the Muslim League, led by Jinnah, endorsed the concept of the partition of British India into separate Hindu and Muslim nations (*i.e.,* India and Pakistan). The new state of Pakistan (a geographically discontinuous nation composed of East Pakistan and West Pakistan, separated from each other by Indian territory) came into existence as a dominion within the Commonwealth in August 1947, with Jinnah as governor-general. The comparatively backward areas of Sind, Baluchistan, and the North-West Frontier came to Pakistan intact; the Punjab and Bengal were divided between Pakistan and India, while Kashmir remained disputed territory. Tension with India over Kashmir gradually increased, resulting in full-scale war in 1965.

In East Pakistan demands grew for Bengali autonomy, and civil war between East and West Pakistan erupted in 1971. Aided by an invasion of the Indian army, East Pakistan became the independent country of Bangladesh in 1972. West Pakistan retained the name Pakistan. Zulfikar Ali Bhutto led Pakistan from 1971 until he was overthrown by General Mohammad Zia-ul-Haq in a military coup in 1977. After Zia's death in 1988, Bhutto's daughter, Benazir, became prime minister after winning the parliamentary elections held that year. She was the first woman leader of a Muslim state in the modern era.

Pakistan, Church of, denomination inaugurated in Pakistan in 1970 and comprising former Anglican, Methodist, Scottish Presbyterian, and Lutheran churches and mission bodies. It is the only church in the world joining Lutherans with Anglicans, Methodists, and Presbyterians and one of three in which Anglicans and Methodists unite, the others being the churches of North and South India.

Next to the Roman Catholic church, the Church of Pakistan is the largest Christian body in a country that is 97 percent Muslim. Christian missions in what is now Pakistan originated in the 16th century, proselytizing among Hindus, Sikhs, and Muslims. Until the partition of India in 1947, missionary activities were concentrated on Hindu Punjabis. Members of the church are mostly from lower income levels, often landless farm workers.

In addition to initiating development projects, the Church of Pakistan provides teachers, social workers, and medical personnel. Most colleges and schools founded by this denomination have been nationalized. Two theological seminaries, two colleges, and a hospital remain affiliated with the church. Headquarters are in Sialkot, Pak.

Pakokku, town, central Myanmar (Burma), on the Irrawaddy River below its junction with the Chindwin. A trading centre for the Chindwin and Yaw river valleys, the town deals in timber and palm sugar and is the head of downstream Chindwin navigation. It has an airfield and a diesel-electric plant. The model village of Kyauksauk is immediately northwest.

The area east of Pakokku is characteristic of Myanmar's dry zone, with undulating gravelly and sandy land. The Chindwin and Irrawaddy rivers provide alluvium and are utilized for irrigation. To the west, over the Shinmataung and Tangyi ridges, the region is drained by the Yaw and Myittha rivers. Peanuts (groundnuts), millet, and sesame are the principal crops. In the riverine areas sugar is produced from the toddy palm. Rice, gram, peas, beans, tobacco, and corn (maize) are also grown, the latter primarily for its husk, which is used for cheroot wrappers under the name of *yawpet.* The western forests yield teak. In the Yaw River valley, cutch, a yellow dye, is extracted from a type of small acacia tree. The Yenangyat oil field is to the south of the town. Nearby riverine towns include Gangaw and Tilin on the Myittha and Pauk and Seikpyu on the Yaw. The inhabitants are mainly Burman. Pop. (latest est.) 33,138.

Pakxé, also spelled PAKSE, town, in the southern panhandle of Laos at the confluence of the Xédôn and Mekong rivers. Before 1966 Pakxé functioned as the chief port of entry of Laos. East of Pakxé begins the rolling Bolovens Plateau, nearly 3,300 feet (1,000 m) high, for whose products—teak, tea, cinchona, kapok, and cardamom—Pakxé is the distributing centre. The town's industries include several sawmills, manufacture of bricks and tiles, and an ice plant; there is also an agricultural experimental station, a criminal court of appeals, and a secondary school. In 1970 the Selabam Dam of the Mekong River Valley Plan opened on the lower Xédôn, providing electricity for Pakxé and irrigation for the surrounding region. Pakxé is linked by road to the Thailand border and to Kampuchea (Cambodia). Pop. (1985) 47,000.

Pāla DYNASTY, ruling dynasty in Bihār and Bengal, India, from the 8th to the 12th century. Its founder, Gopāla, was a local chieftain who rose to power in the mid-8th century during a period of anarchy. His successor, Dharmapāla (reigned *c.* 770–810), greatly expanded the kingdom and for a while was in control of Kannauj. Pāla power was maintained under Devapāla (reigned *c.* 810–850), who carried out raids in the north, the Deccan, and the peninsula; but thereafter the dynasty declined in power, and Mahendrapāla, the Gurjara-Pratihāra emperor of Kannauj in the late 9th and early 10th centuries, penetrated as far as northern Bengal. Pāla strength was restored by Māhīpāla I (reigned *c.* 988–1038), whose influence reached as far as Vārānasi (Benares), but on his death the kingdom again weakened.

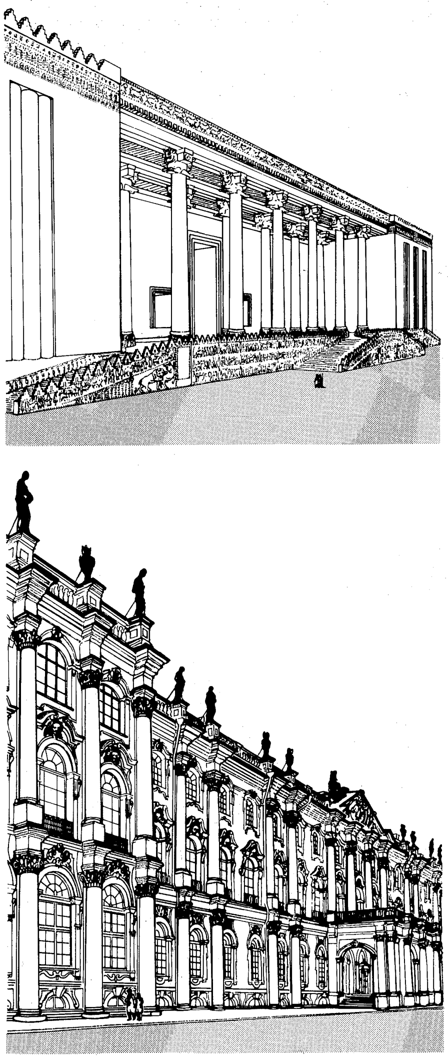
Rāmapāla (reigned *c.* 1077–1120), the last important Pāla king, did much to strengthen the dynasty in Bengal and expanded its power in Assam and Orissa; he is the hero of a Sanskrit historical poem, the *Rāmacarita* of Sandhyākara. On his death, however, the dynasty was virtually eclipsed by the rising power of the Senas, although Pāla kings continued to rule in southern Bihār for 40 years. The main capital of the Pālas appears to have been Mudgagiri (Monghyr) in eastern Bihār.

The Pālas were supporters of Buddhism, and it was through missionaries from their kingdom that Buddhism was finally established in Tibet. Under Pāla patronage a distinctive school of art arose, of which many noteworthy sculptures in stone and metal survive.

Pāla painting: *see* Eastern Indian painting.

Palabora (South Africa): *see* Phalaborwa.

palace, royal residence, and sometimes a seat of government or religious centre. The word is derived from the Palatine Hill in Rome, where the Roman emperors built their residences. As a building it should be differentiated from a castle, which was originally any fortified dwelling.



(Top) The apadana, or audience hall, of the palace of Darius (built 528–450 BC) at Persepolis, used as a public gathering area; (bottom) the Winter Palace (built 1754–62, reconstructed in 1839), Leningrad, former principal residence of the tsars of Russia

(Top) Adapted from F. Krefter, *Persepolis Rekonstruktionen* (1971), G. Mann Verlag, Berlin

Later, the ornate homes of the nobility of all ranks in England, France, and Spain came to be known as palaces (as did the residence of the exiled popes in Avignon), and eventually the name was applied to a number of large and imposing buildings, both public and private. In the United States, for example, there are colonial governor's palaces located in Williamsburg, Va.; Santa Fe, N.M.; and San Antonio, Texas. Because of its colonial connotations the name Presidential Palace was rejected in favour of Executive Mansion for the White House. Also, France has the so-called Palaces of Justice.

Palaces, because of the power of the patron and the money and labour available for their construction, often represented the epitome (or in some cases, extreme examples) of the architectural and social values of the culture and age in which they were built. For this reason, they are of prime interest to archaeologists.

The earliest-known palaces are those built in Thebes by King Thutmose III (reigned 1504–1450 BC) and by Amenhotep III (reigned 1417–1379 BC) of Egypt. Excavations of Amenhotep's palace reveal a rectangular outer wall enclosing a labyrinth of small, dark rooms and courtyards, a pattern broadly repeated in Eastern palaces of later ages. In Assyria, for instance, much larger palaces were built at Nimrūd, at Nineveh, and at Khorsabad, where the palace of Sargon II (reigned 721–705 BC) extended over more than 23 acres (9 hectares), built on a platform within two sets of city walls and containing two huge central courts and a disorganized mass of smaller courtyards and rooms.

The architects of ancient Babylon achieved greater symmetry, using hallways and repeated groupings of rooms. In the 6th, 5th, and 4th centuries BC, vast Persian palaces were built at Susa and at Persepolis, where the residences of three kings (Darius I, Xerxes I, and Artaxerxes III) perch on three low platforms raised upon a main platform that was within the city walls. Minoan palaces on Crete at Phaestus, Knossos (where one staircase rose three stories), and elsewhere achieved even greater grandeur. It was in Rome and the eastern Roman empire, however, that palaces in the sense of centres of power reached their peak. More than 1,000,000 square feet (90,000 square m) of the Palatine Hill were devoted to palaces built by emperors between AD 3 and 212. At Constantinople the Sacred Palace is a conglomeration of Byzantine churches, schools, and residences that covers an area of 400,000 square yards (334,000 square m).

More recent Eastern palaces, such as those in the Forbidden City of China and the Imperial palaces of Japan, also consist of a series of buildings (in these cases, low pavilions mostly of highly decorated wood construction) within vast walled gardens.

In the New World, palaces tended to be less complex, such as the Mayan governor's palace at Uxmal (*c.* AD 900) and the Zapotec palace at Mitla (*c.* AD 1000), which were one-storied carved structures with many rooms. As in the East, though, these palaces were the centres of government as well as the residences of the culture's leaders.

In western Europe after the Middle Ages (when palace building declined in favour of castle construction), palaces tended to be single buildings, ornately designed and decorated in the style of the era, and often but not always set in richly landscaped gardens. In Renaissance Italy every prince had his royal *palazzo,* such as the Pitti Palace (begun 1458) in Florence and the many splendid palaces lining the Grand Canal in Venice. France built royal *palais* throughout the country (notably the Louvre [begun 1546] and Versailles [begun 1661]), and Spanish *palacios* include El Escorial (1559–84) outside Madrid and the Alhambra (1238–1358) in Granada. The British have three royal palaces—Buckingham, St. James's, and Whitehall—all of which are today symbols and residences rather than true seats of government.

palace, mayor of the: *see* mayor of the palace.

Palace Chapel: *see* Palatine Chapel.

Palace Museum, also called IMPERIAL PALACE MUSEUM, Chinese (Wade–Giles romanization) KU-KUNG PO-WU YÜAN, Pinyin GUGONG BOWUYUAN ("Ancient Palace Museum"), in Peking, museum housed in the main buildings of the former Imperial Palaces. The museum displays valuable objects from Chinese history.

The palace itself consists of many separate halls and courtyards. The outer buildings of the palace became a museum in 1914, although the Imperial family lived in the private apartments until 1924. Many of the halls surrounding the museum are presented as they would have appeared in dynastic times. The main buildings of the museum include the Hall of the Preservation of Harmony, which displays a fine collection of works of art, many from the imperial treasures. Among the more impressive works is a 47-foot- (14-metre-) long Yüan fresco that was taken from the Xinghua (Hsing-hua) Temple. A large number of clocks and clockwork figures are displayed in the gallery behind the Palace of Earthly Tranquillity. Other areas of the palace contain displays of bronzes, sculptures, pottery and porcelain, jade, and silks. Some of the treasures are exhibited in the northeast corner of the palace, known as the Palace of Peace and Longevity. These include priceless objects of precious metals and jewels and some examples of the 3,000 pieces that formed the imperial tableware.

Palace Museum of Venice, Italian MUSEO DEL PALAZZO DI VENEZIA, in Rome, museum occupying part of the papal apartment of the first great Renaissance palace of Rome. Dating from the middle of the 15th century, the palace was built for Cardinal Pietro Barbo, later Pope Paul II. Displayed are fine medieval and Renaissance sculptures and a series of 15th-century carved and inlayed *cassoni,* or chests. Paintings include works attributed to Giovanni Bellini, Giorgione, Taddeo Zuccari, Benozzo Gozzoli, and other Renaissance masters. Sculptures by Andrea Sansovino, Alessandro Vittoria, Alessandro Algardi, Pompeo Leoni, and Giambologna as well as fine examples of 17th-century Chinese porcelain and tapestries and maiolica are also in the collection; it includes many examples of minor decorative arts as well.

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Palacio Valdés, Armando (b. Oct. 4, 1853, Entralgo, Spain—d. Feb. 3, 1938, Madrid), one of the most popular 19th-century Spanish novelists, distinguished by his optimism, his charming heroines, his realism, and his qualities of moderation and simplicity.

After studying law at the University of Madrid, he began his literary career as a critic but soon turned to the novel. His novels are largely autobiographical, particularly *Riverita* (1886), *Maximina* (1887), and *La novela de un novelista* (1921; "The Novel of a Novelist"). He had an early interest in science, and his work reveals a temporary phase of Naturalism, notably *La espuma* (1890; *The Froth*) and *La fe* (1892; *Faith*). *Marta y María* (1883), with its biblical Martha and Mary theme, is his most profound work. Local colour of Asturias, his native province, abounds in *Marta y María,* as it does in his other Asturian novels, *José* (1885), a realistic picture of seafaring life, and *La aldea perdida* (1903; "The Lost Village"), on the destruction of rural life by civilization. His occasionally excessive sentimentality is mitigated by sincerity and humour.

Palacký, František (b. June 14, 1798, Hodslavice, Moravia, Austrian Empire [now in Czechoslovakia]—d. May 26, 1876, Prague), the founder of modern Czech historiography and a leading figure in the political life of 19th-century Bohemia.

He early came into contact with the resurgence of national feeling that had begun to influence Czech and Slovak intellectuals. His early writings were concerned with aesthetics. In 1823 he settled in Prague, where he was enabled by noble patronage and by an advantageous marriage to devote himself to his scholarly and patriotic interests. In 1827 he became editor of the journal of the Bohemian museum, in which he published articles on aesthetics and on the Czech language (arguing against any far-reaching changes).

In 1832 he began his magnum opus, a history of the Czech nation in Bohemia and Moravia to 1526. Published as *Geschichte von Böhmen,* 5 vol. (1836–67), and *Dějiny národu českého* (1848–76), the work lucidly presents Palacký's conception of the nature of Czech history as "the constant contact and conflict between the Slavs on the one hand and Rome and the Germans on the other." Thus the Hussite period became the central episode of Czech history, epitomizing the national and the religious struggle.

As a politician, Palacký supported the Austro-Slavic conception of a federal Austria, composed of nationalities with equal rights. He was chairman of the Prague Slavic congress in 1848 and attended the constituent assembly that met in Kroměříž (Kremsier) in 1848–49. After the failure of the revolutionary movements Palacký retired from active politics until 1861, when he became a deputy in the Reichsrat.

In his *Idea státu rakouského* (1865; "Idea of the Austrian State"), Palacký propounded a federalism based not on nationalities but on the historic provinces of the Habsburg empire. His influence on Czech political thought and historiography was immense. The liberal nationalism of Tomáš Masaryk and his generation owed much to Palacký.

Palade, George E(mil) (b. Nov. 19, 1912, Iaşi, Rom.), Romanian-born American cell biologist who developed tissue-preparation methods, advanced centrifuging techniques, and conducted electron microscopy studies that resulted in the discovery of several cellular structures. With Albert Claude and Christian de Duve he was awarded the Nobel Prize for Physiology or Medicine in 1974.

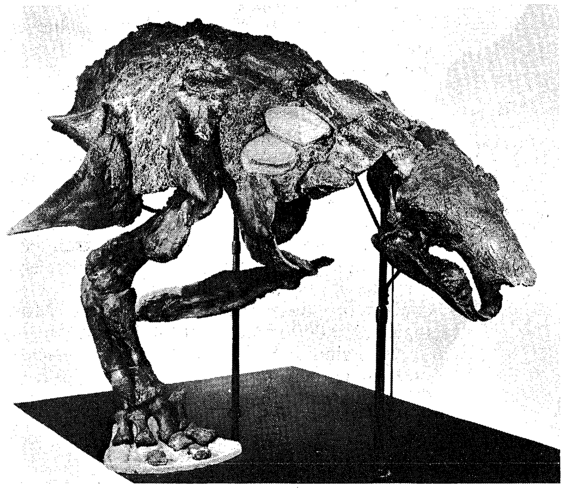
Palade received a degree in medicine from the University of Bucharest in 1940 and remained there as a professor until after World War II. He immigrated to the United States in 1946 and began work at the Rockefeller Institute in New York.

Palade performed many studies on the internal organization of such cell structures as mitochondria, chloroplasts, the Golgi apparatus, and others. His most important discovery was that microsomes, bodies formerly thought to be fragments of mitochondria, are actually parts of the endoplasmic reticulum (internal cellular transport system) and have a high ribonucleic acid (RNA) content. They were subsequently named ribosomes. He became a naturalized citizen of the United States in 1952 and in 1958 a professor of cytology at Rockefeller Institute, which he left in 1972 to direct studies in cell biology at Yale University Medical School.

palaeo- (combining form): *see under* paleo-.

Palaeologus FAMILY, Byzantine family that became prominent in the 11th century and the members of which married into the imperial houses of Comnenus, Ducas, and Angelus. Michael VIII Palaeologus, emperor at Nicaea in 1259, founded the dynasty of the Palaeologi in Constantinople in 1261. His son Andronicus II (reigned 1282–1328) and his grandson Michael IX (d. 1320) succeeded Michael as co-emperors. Michael IX's son Andronicus III (1328–41) left the throne to his infant son John V (1341–91), whose rule was disputed by John VI Cantacuzenus (1347–54) and later by his grandson, John VII (1390). John V was succeeded, however, by his second son, Manuel II (1391–1425). John VIII (1425–48) was a son of Manuel II, and his brother Constantine XI (1449–53) became the last Byzantine emperor. Other brothers were Demetrius and Thomas, despots of the Morea until 1460. Thomas died at Rome in 1465; his daughter Zoë married Ivan III of Russia. Another branch of the family, descended from Theodore, son of Andronicus II, held the marquisate of Montferrat from 1305 to 1533.

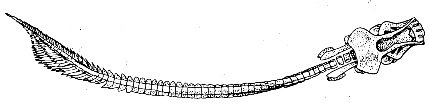
Palaeoscincus, genus of armoured herbivorous dinosaurs of the Late Cretaceous epoch (97.5 to 66.4 million years ago). *Palaeoscincus,* heavily protected by bony armour, was a massive animal that may have weighed as much as 3½ tons and was rather clumsy in appearance. The teeth were poorly developed, and the brain was very small and primitive.



Palaeoscincus, skeleton

By courtesy of the American Museum of Natural History, New York

Palaeospondylus, genus of enigmatic fossil vertebrates that were very fishlike in appearance but of uncertain relationships. *Palaeospondylus,* from the Middle Devonian epoch (387 to 374 million years ago), has been found in the Old Red Sandstone rocks in the region of Achannaras, Scot. Hundreds of specimens are known, yet the position of this genus in relation to other fishlike vertebrates is still poorly understood. *Palaeospondylus* was about 5 cm (about 2 inches) long. Unlike most of the contemporary forms of the Middle Devonian, the skeleton of *Palaeospondylus* was very well ossified, and no dermal armour was present, a feature prominent among the placoderms. A well-developed caudal, or tail, fin was present.



Skeletal structure of *Palaeospondylus*

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Palaic language, ancient Indo-European language of northwest Anatolia. Modern knowledge of the language comes from 21 passages dealing with the cult of the deity Ziparwa that appear in the cuneiform tablets found in the ruins of the Hittite archives at Boğazköy (the ancient Hattusa, in modern Turkey). In its inflectional systems and pronoun forms, it appears to be very close to the Hittite and Luwian languages, with which it is placed in the Anatolian subgroup of the Indo-European language family.

Palaiopréveza (Greece): *see* Nicopolis Actia.

Palais-Royal Theatre, French THÉÂTRE DU PALAIS-ROYAL, Paris playhouse most noted for 17th-century productions by Molière.

The Palais-Royal traces its history to a small private theatre in the residence of Cardinal Richelieu. Designed by architect Jacques Lemercier, this theatre became known by the name of the residence, the Palais-Cardinal; it was the first theatre in France with movable scenery wings and a permanent proscenium arch. It opened, with the royal court attending, with a production of Jean Desmarets's *Mirame* in 1641. Following Richelieu's death, the palace became royal property, and, as the Palais-Royal, the theatre was used for courtly entertainments. In 1660 the theatre was given to Molière and his troupe, who occupied it until the dramatist-actor's death in 1673. Jean-Baptiste Lully requisitioned the Palais-Royal for his Royal Academy of Music, and it became the home for his opera productions. The theatre burned down in 1763 and was rebuilt, only to burn again in 1781. The entire area was then redeveloped into an amusement area by its owner, the Duke de Chartres. It contained a number of theatres, many called Palais-Royal at various times. One of these, which had opened in 1790 as the Variétés-Amusantes, was renamed the Théâtre de la République by the actor François-Joseph Talma and his compatriots during the Revolution; under Napoleon it was made the home of the Comédie-Française and became known as the Théâtre-Français. In 1831 a theatre at the opposite end of the palace was renamed the Théâtre du Palais-Royal; it was dedicated to popular comedy.

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

Palamas, Saint Gregory (b. Nov. 11/14, 1296, Constantinople [now Istanbul, Tur.]—d. 1359, Thessalonica, Byzantine Empire [now in Greece]; canonized 1368), Orthodox monk, theologian, and intellectual leader of Hesychasm, an ascetical method of mystical prayer that integrates repetitive prayer formulas with bodily postures and controlled breathing. He was appointed bishop of Thessalonica in 1347. In 1368 he was acclaimed a saint and was named "Father and Doctor of the Orthodox Church."

Born at Constantinople of a distinguished family with ties to the imperial court, Palamas mastered the classical philosophies of antiquity at the imperial university. In 1316, however, he renounced a political career in order to become a monk at Mount Athos in northeastern Greece, the spiritual centre of Greek Orthodoxy. For 25 years he immersed himself in study and reflection on the sacred Scriptures and the writings of the Church Fathers; he was introduced to contemplative prayer by a spiritual master and in turn became a master for other initiates. Raids by the Turks in about 1325 forced him to interrupt his monastic life on Mt. Athos and to flee to Thessalonica and Macedonia. He was ordained a priest in 1326 and later, with 10 companions, retired to a hermitage in Macedonia.

He returned to Mt. Athos in 1331 to the community of St. Sabas and *c.* 1335 was chosen a religious superior (*hēgoumenos*) of a neighbouring convent. Because of differences with the monks who considered his spiritual regimen too strict, he resigned after a short term and returned to St. Sabas.

In 1332 Palamas entered into a theological dispute that lasted for a quarter of a century and involved polemics with a series of Greek and Latin Scholastic theologians and certain rationalistic Humanists. His first adversary was Barlaam the Calabrian, a Greek monk residing in Italy who visited Constantinople and other Orthodox monastic centres to engage in philosophical disputation for intellectual prestige. Expounding a mode of theological agnosticism, Barlaam denied that any rational concepts could express mystical prayer and its divine–human communication even metaphorically. Subsequently, he composed a satirical work defaming Hesychasm by referring to its adherents as "men with their souls in their navel" (Greek *omphalopsychoi*). The image derived from the Hesychast meditative posture of focussing the eyes on a spot below the chest in order to heighten the mystical experience. Palamas responded to this attack by composing his "Apology for the Holy Hesychasts" (1338), also called the "Triad" because of its division into three parts.

The "Apology" established the theological basis for mystical experience that involves not only the human spirit but the entire human person, body and soul. This doctrine attempts to articulate a prayer experience that devotees call "the deification of the entire man," a reference to the Hesychasts' claim of an inner transformation effected by a mystical illumination uniting man with God in the depths of his spirit. Hesychast spirituality strove to bridge the gulf between human and divine existence. It held the necessity of an intermediary relationship between man's world (immanence) and God's eternity (transcendence). Hesychast prayer aspires to attain the most intense form of God–man communion in the form of a vision of the "divine light," or "uncreated energy," analogous to the Gospel account of Christ's transfiguration on Mt. Tabor, as noted in the Gospel According to Matthew 16:17 and Mark 8:9. The corporeal disposition for this contemplative state involves intense concentration and a methodical invocation of the name of Jesus (the Hesychastic "Jesus prayer"). Palamas emphasized the nonmaterialistic nature of Hesychast spirituality by explaining that the experience of inner light was not available to all but only to the "pure of heart" empowered by grace to perceive it.

After a succession of public confrontations with critical theologians and Humanists, and a politically motivated excommunication in 1344, Palamas had his teaching systematized in the *Hagioritic Tome* ("The Book of Holiness"), which became the fundamental textbook for Byzantine mysticism. The Hesychast controversy became part of a larger Byzantine political struggle that erupted in civil war. At its conclusion in 1347, Palamas, with support from the conservative, anti-Zealot party, was appointed bishop of Thessalonica. His administrative duties, together with continued writings against his Humanist critics, occupied him for the rest of his life.

In his fusion of Platonic and Aristotelian philosophy, used as a vehicle to express his own spiritual experience, Palamas set a definitive standard for Orthodox theological acumen. At the provincial Council of Constantinople in 1368, nine years after his death, he was acclaimed a saint and titled "Father and Doctor of the Orthodox Church," thus placing him among the ranks of those who determined the ideological shape of the Eastern Church.

(A.H.Ao.)

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Palamás, Kostís (b. Jan. 25 [Jan. 13, old style], 1859, Patras, Greece—d. Feb. 27, 1943, Athens), Greek poet who played an important part in the evolution of modern Greek literature.

He was educated at Mesolongion and at Athens. The central figure in the Demotic movement of the 1880s, which sought to shake off traditionalism and draw inspiration for a new literary and artistic style from the life and language of the people, Palamás became the founder of the "new school of Athens," which condemned romantic exuberance and reverted to a purer and more restrained type of poetry. In 1886 Palamás published his first collection of poems, the *Tragoudia tes Patridos mou* ("Songs of My Country"), followed by the *Iamboi kai Anapaestoi* ("Iambs and Anapaests"; 1897), the *Asalefte Zoe* (1904; Eng. trans. by A.E. Phoutrides, *Life Immovable,* 1904), the *Dodecalogos tou Gyftou* (1907; "The Twelve Lays of the Gypsy") and the *I flogera tou Vasilia* (1910; "The King's Flute").

Palamás was the first poet to express the national sufferings and aspirations of the Greeks, and with his lyricism, metrical variety, and robust language he remoulded a great deal of Greek history, mythology and philosophy, fusing it with many Western European and even Eastern ideas. His play, the *Trisevgene* (1903; "The Thrice Noble"), has lyric rather than dramatic merits. He also wrote short stories and his criticism raised the standard of modern Greek literary criticism.

Palāmau, district, Bihār state, northeastern India. Its area (about 4,940 sq mi [12,800 sq km]) consists of lower spurs of the Choṭa Nāgpur plateau, drained by tributaries of the Son River and the North Koel River. Rice, corn (maize), and oilseeds are the major crops, and forest products (including lac) are important. Coal, bauxite, dolomite, and iron ore deposits are worked. Daltonganj is the district headquarters. Pop. (1981) 1,917,528.

Pālamcottah (India): *see* Pālayankottai.

Palamedes, in Greek legend, the son of Nauplius, king of Euboea, and a hero of the Trojan War. During the siege of Troy, Palamedes alternated with two other Greek heroes, Odysseus and Diomedes, in leading the army in the field, but his ability aroused their envy. In the epic version they drowned him while fishing or persuaded him to seek treasure in a well, which they thereupon filled with stones. In the tragic version Agamemnon (king of Mycenae, or Argos), Diomedes, and Odysseus had an agent steal into his tent and conceal a letter that contained money and purported to come from King Priam of Troy. They then accused Palamedes of treasonable correspondence with the enemy, and he was stoned to death.

Palamedes had a reputation for sagacity, and the ancients attributed a number of inventions to him, including the alphabet, numbers, weights and measures, coinage, and the practice of eating at regular intervals. He is now generally considered to be a personification of Phoenician culture, the source of many of these developments.

Palana, urban settlement and centre of Koryak autonomous *okrug* (area), Kamchatka *oblast* (administrative region), far eastern Russian Soviet Federated Socialist Republic, on the western coast of Kamchatka Peninsula on the Palana River, 5 mi (8 km) from its mouth on the Sea of Okhotsk. The area was formed in 1930. The settlement has a regional museum. Pop. (1974 est.) 3,300.

Palangkaraya, *kotamadya* (city), capital of Kalimantan Tengah *propinsi* (Central Borneo province), Borneo, Indonesia, situated to the west of the Sungai (stream) Kahayan. It was occupied by the Japanese during World War II and was the principal city of Great Dayak, an autonomous state (one of five) created in 1945 that became part of the Republic of Indonesia in 1950. The population consists mainly of the native Dayaks together with Chinese and Japanese settlers. Most of the Dayaks have retained traditional animist beliefs, although some have been converted to Christianity. Household industries include wood carving, plaiting, weaving, and beadwork. Riverine transport connects the city with Kualakurun and Banjarmasin. An airport links it with Sampit, Balikpapan, and Pangkalangbuun. The Universitas Palangka Raya (founded 1963) is located in the city. Pop. (1980) 60,447.

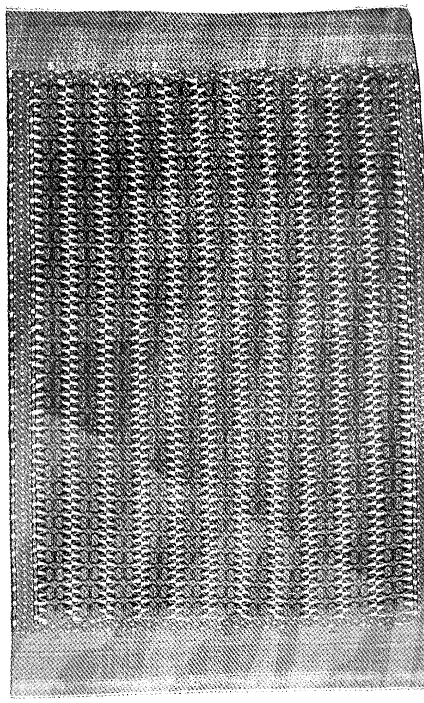
Pālanpur, town, administrative headquarters of Banās Kāntha district, Gujarāt state, west central India, in the lowlands between the Arāvalli Range and the Kāthiāwār Peninsula. The former capital of the princely state of Pālanpur, the town is now a trade and processing centre for agricultural produce and a rail and road junction. Pālanpur is also known for its handicrafts. Pop. (1981) 61,262.

Pālār River, river in southern India, rising near the Ponnaiyār River, southwest of Chintāmani, Karnātaka state, and flowing 183 mi (295 km) southeastward through Tamil Nādu state to the Bay of Bengal, south of Madras. Its major tributaries are the Ponnai and Cheyyār rivers.

The flow of the Pālār is irregular, with considerable variations from year to year. Although it generally does not flood, heavy rains have caused the river to remain in flood for as long as six months. The river has been dammed for irrigation, especially in North Arcot and Chingleput districts of Tamil Nādu. The largest towns along its banks are Vellore, Arcot, and Chingleput.

palas, plural PALASY, flat-surfaced handwoven floor covering from the Caucasus, Turkistan, or parts of Iran. In the rest of Iran, the Balkans, and Anatolia, the name for similar pieces is kilim. The Caucasian *palas* is a slit tapestry in technique, the Shirvan variety designed without a border as a series of transverse bands carrying bold polygonal ornaments in vivid colouring. A Karabagh rug may be planned with diagonal rows of highly geometric palmette forms within a narrow border on all sides.

A Kurdish *palas* might have a honeycomb pattern of ornamented hexagons with no real border or a set of transverse bands much narrower than those in the Shirvan *palas*. Turkmen *palasy,* usually of Yomut workmanship,



Yomut *palas* from Russian Turkistan, about 1900; in the H. McCoy Jones Collection
Collection of H. McCoy Jones; photograph, Bruce A. Humphrey

are brocadings of several types, the most common showing a diamond grid with a narrow border on all sides and long aprons at both ends. Much of the ground shows through between and around the brocaded motifs.

Palāshi (India): *see* Plassey.

palatal, in phonetics, a consonant sound produced by raising the blade, or front, of the tongue toward or against the hard palate just behind the alveolar ridge (the gums). The German *ch* sound in *ich* and the French *gn* (pronounced *ny*) in *agneau* are palatal consonants. English has no purely palatal consonants, except for the *y* sound (a semivowel) in "you." (The *sh* sound in "ship" and the *zh* sound represented as *z* in "azure" are usually classified as palato-alveolar sounds.)

palatalization, in phonetics, the production of consonants with the blade, or front, of the tongue drawn up farther toward the roof of the mouth (hard palate) than in their normal pronunciation. Palatalized consonants in Russian are pronounced as if attempting simultaneously to pronounce a particular consonant and a *y* sound; in English, the *ny* in "canyon" approximates a palatalized sound. Palatalized consonants may be distinguished from palatal consonants, in which the front of the tongue and the hard palate form the primary articulation.

Palatalization also refers to the process of sound change in which a nonpalatal consonant, like *k,* changes to a palatal consonant, like *ch* or *sh*; *e.g.,* French *chaîne* (pronounced with an initial *sh* sound) developed from Latin *catena* (pronounced with an initial *k* sound).

palate, in vertebrate anatomy, the roof of the mouth, separating the oral and nasal cavities. It consists of an anterior hard palate of bone and, in mammals, a posterior soft palate that has no skeletal support and terminates in a fleshy, elongated projection called the uvula.

The hard palate, which composes two-thirds of the total palate area, is a plate of bone covered by a moist, durable layer of mucous-membrane tissue, which secretes small amounts of mucus. This layer forms several ridges that help grip food while the tongue agitates it during chewing. The hard palate provides space for the tongue to move freely and supplies a rigid floor to the nasal cavity so that pressures within the mouth do not close off the nasal passage. In many lower vertebrates the hard palate bears teeth.

The soft palate is composed of muscle and connective tissue, which give it both mobility and support. This palate is very flexible. When elevated for swallowing and sucking, it completely blocks and separates the nasal cavity and nasal portion of the pharynx from the mouth and the oral part of the pharynx. While elevated, the soft palate creates a vacuum in the oral cavity, which keeps food out of the respiratory tract.

The first well-developed palates are found in the reptiles, although only in the form of a hard partition. Palates similar to those in humans occur only in birds and some mammals. In a few whales the mucous membrane forms toughened plates known as baleen, or whalebone.

In the human abnormality of cleft palate, the separation between the nose and mouth is incomplete, allowing food to enter the nose and interfering with speech. This condition can be corrected surgically.

Palatinate, German PFALZ, in German history, the lands of the count palatine, a title held by a leading secular prince of the Holy Roman Empire. Geographically, the Palatinate was divided between two small territorial clusters: the Rhenish, or Lower, Palatinate and the Upper Palatinate. The Rhenish Palatinate included lands on both sides of the middle Rhine River between its Main and Neckar tributaries. Its capital until the 18th century was Heidelberg. The Upper Palatinate was located in northern Bavaria, on both sides of the Naab River as it flows south toward the Danube, and extended eastward to the Bohemian forest. The boundaries of the Palatinate varied with the political and dynastic fortunes of the counts palatine.

In early medieval Germany, counts palatine served as stewards of royal territories in the absence of the Holy Roman emperors. In the 12th century the lands of the counts palatine of Lotharingia (Lorraine) were formed into the separate territory of the (Rhenish) Palatinate. In 1214 the Holy Roman emperor Frederick II granted these lands to Louis I, Duke of Bavaria, of the house of Wittelsbach. This ancient Bavarian dynasty, in one or another of its branches, was to rule the Palatinate through its subsequent history. In 1329, in an internal dynastic settlement, the North Mark of Bavaria was detached from the Bavarian Wittelsbachs and given to the branch of the family which also held the Rhenish territories. The North Mark thereafter was known as the Upper Palatinate. In the 14th and 15th centuries, the counts palatine brought firm rule and prosperity to their lands. They fought for the rights of the German princes against the universalist ambitions of popes and emperors. They won the right to participate in the election of the emperor, a right confirmed by the Golden Bull of 1356, which made the elector palatine the chief secular prince of the Holy Roman Empire.

The Palatinate remained Roman Catholic during the early Reformation but adopted Calvinism in the 1560s under Elector Frederick III. The Palatinate became the bulwark of the Protestant cause in Germany. Elector Frederick IV became the head of the Protestant military alliance known as the Protestant Union in 1608. His son Frederick V's acceptance of the Bohemian crown in 1619 contributed to the beginning of the Thirty Years' War, a war that proved disastrous to the Palatinate. Frederick V was driven from Bohemia in 1620 and, in 1623, was deprived of his German lands and electoral dignity, which were given to Bavaria. Catholic troops devastated the Rhenish Palatinate. The Peace of Westphalia (1648) restored the Rhenish lands, as well as a new electoral dignity, to Frederick's son Charles Louis. The Upper Palatinate, however, remained with Bavaria thereafter.

During the War of the Grand Alliance (1689–97), the troops of the French monarch Louis XIV ravaged the Rhenish Palatinate, causing many Germans to emigrate. Many of the early German settlers of America (the Pennsylvania Dutch) were refugees from the Palatinate. During the French Revolutionary and Napoleonic wars the Palatinate's lands on the west bank of the Rhine were incorporated into France, while its eastern lands were divided largely between neighbouring Baden and Hesse. After the defeat of Napoleon (1814–15), the Congress of Vienna gave the east-bank lands to Bavaria. These lands, together with some surrounding territories, again took the name of Palatinate in 1838. French troops temporarily occupied the Rhineland territories after Germany's defeat in World War I.

After World War II, parts of the Rhenish territories were incorporated into the newly constituted federal *Land* (state) of Rheinland-Pfalz (Rhineland-Palatinate) in (then West) Germany. *See* Rheinland-Pfalz.

palatine, any of diverse officials found in numerous countries of medieval and early modern Europe. Originally the term was applied to the chamberlains and troops guarding the palace of the Roman emperor. In Constantine's time (early 4th century), the designation was also used for the senior field force of the army that might accompany the emperor on his campaigns.

During the early European Middle Ages the term palatine applied to various officials among the Germanic peoples. The most important of these was the count palatine, who in Merovingian and Carolingian times (5th through 10th century) was an official of the sovereign's household, in particular of his court of law. The count palatine was the official representative at court proceedings such as oath takings or judicial sentences and was in charge of the records of such proceedings. At first he examined cases in the king's court and was authorized to carry out the decisions; later he had his own court in which he was allowed certain discretion in making decisions. In addition to his judicial responsibilities, the count palatine had administrative functions dealing with the king's household.

Under the German kings of the Saxon and Salian dynasties (919–1125), the function of the counts palatine corresponded to those of the Carolingian *missi dominici,* who were representatives of the king in the provinces, responsible for the administration of the royal domain and for the disposition of justice in certain duchies, such as Saxony and Bavaria, and, in particular, Lotharingia (Lorraine). When other palatine rights were absorbed by ducal dynasties, local families, or, in Italy, by bishops, with little of the authority retained, the count palatine of Lotharingia, whose office had been attached to the royal palace at Aachen from the 10th century onward, became the real successor to the Carolingian count palatine. From his office grew the Countship Palatine of the Rhine, or simply the Palatinate, which, from the time of the emperor Frederick I Barbarossa (d. 1190), became a great territorial power. The term palatine recurs in the 14th century, when the emperor Charles IV instituted a court body of household counts palatine, but they had only voluntary jurisdiction and some honorific functions.

In England the term palatinate, or county palatine, was applied in the Middle Ages to counties the lords of which, whether lay or ecclesiastical, exercised powers normally reserved to the crown. Likewise, there were palatine provinces among the English colonies in North America: Lord Baltimore was granted palatine rights in Maryland in 1632, as were the proprietors of Carolina in 1663.

The word *palatinus* and its derivatives also translate the titles of certain great functionaries in eastern Europe, such as the Polish *wojewoda,* a military governor of a province.

Palatine Chapel, also called PALACE CHAPEL, German PFALZKAPELLE, also called OCTAGON, German OKTOGON, the imperial chapel of Charlemagne, now forming part of the Cathedral of Aachen, Germany. Aachen was the capital of Charlemagne's kingdom, and the Palatine Chapel was part of a complex of buildings that was erected in 790–805 to serve as his court and as the national church of his empire. The chapel is the only surviving structure of these and is in fact the most important surviving example of Carolingian architecture. It was designed by Odo of Metz and was modeled by him after the Byzantine-style Church of San Vitale at Ravenna. The chapel itself is a domed central octagon that is surrounded by a 16-sided ambulatory. The cupola crowning the chapel's dome rises to a height of 101.5 feet (30.9 m); the chapel was for many centuries the tallest stone building in Germany. The chapel contains Charlemagne's marble-slab throne, which was used for the coronations of 32 Holy Roman emperors in the period from 936 to 1531. During the Gothic period, a choir, several chapels, and a vestibule were added to the chapel, and the enlarged building subsequently was designated the Cathedral of Aachen.

Palatine Hill, Italian MONTE PALATINO, four-sided plateau rising 131 feet (40 m) south of the Forum in Rome and 168 feet (51 m) above sea level. It has a circumference of 5,700 feet (1,737 m). The city of Rome was founded on the Palatine, where archaeological discoveries range from prehistoric remains to the ruins of imperial palaces.

The Palatine is topographically intricate and scenically attractive, despite a general starkness that is allayed by the artistically landscaped vegetation. Level upon level of multistory buildings has been built on previous sites and structures. According to ancient Roman legend, the founders of Rome, Romulus and Remus, twin sons of Mars, were abandoned as infants on the flooding Tiber River and were deposited by the receding waters at the foot of the Palatine. The legend purports that they were nurtured by a she-wolf whose cave, or Lupercal, was on the slopes of the Palatine and were raised by a shepherd who kept his flocks on the slopes of the Palatine, the centre from and around which Rome grew. The Palatine consisted originally of three summits: the Germalus to the north; the Velia, a kind of isthmus that linked the Palatine to the neighbouring Esquiline Hill; and the Palatium to the south. The Palatium was the highest of the summits and later gave its name to the entire hill.

During the Republican era many temples and houses of leading citizens were built on the Palatine, and during the empire it became the city's aristocratic quarter. Augustus was born and established his imperial residence there; Domitian had the topography greatly transformed by the architect Rabirius.

With the fall of the empire, the architecture upon the Palatine, too, fell into disrepair. It was transformed in the European Middle Ages into a stronghold but was later completely abandoned. The Italian Renaissance brought about a resurgence in the value of the land, and noble Roman families again built their houses there.

Palau (Caroline Islands): *see* Babelthuap.

Palau, also spelled BELAU, or PELEW, officially REPUBLIC OF PALAU, internally self-governing republic of the western Pacific Ocean, composed of an island group known as the Palau islands to the north and the four small, isolated coral islands of Sonsorol, Merir, Pulo Anna, and Tobi and the adjacent atoll of Helen Reef to the southwest. Encompassing about 340 islands and having a land area of 188 square miles (488 square km), the islands form the western end of the Caroline Islands chain. Palau has a northeast-southwest extent of about 400 miles (640 km). Its nearest neighbours include the Philippines (west), Yap Island in the Federated States of Micronesia (northeast), and Irian Jaya province of Indonesia (south). The population in 1990 was estimated at 14,300.

A brief treatment of Palau follows. For information about regional aspects of Palau, *see* MACROPAEDIA: Pacific Islands.

The land. Palau's major populated islands are Babelthuap, Koror, Malakal, Arakabesan, and Peleliu. All of these islands lie within a single barrier reef enclosing a 489-square-mile (1,267-square-kilometre) lagoon on the west side. Nearby Angaur Island (southwest) and Kayangel Atoll (north) lie outside the barrier reef, however. Babelthuap is the largest island (153 square miles [137 square km]) of the main group. Koror Island, just south of Babelthuap, is the provisional capital and largest population centre. It rises to 2,061 feet (628 m). Arakabesan and Malakal islands are of volcanic origin; Babelthuap and Koror are partly elevated limestone, partly volcanic; and Auluptagel, Ngargol, Urukthapel, Peleliu, and Angaur are of raised coral limestone. Of the Palau island group, Peleliu alone is flat.

Palau's climate is tropical and shows little monthly variation, with a mean annual temperature on Koror of 81° F (27° C) and rainfall of 150 inches (3,800 mm) a year on Koror and 130 inches (3,302 mm) on Angaur. The islands of the Palau group are fertile, with mangrove swamps along the coasts, backed by savanna and coconut and pandanus palms rising to rain forests in the hills. The outlying coral islands are mostly wooded and support coconut palms. Crocodiles, poisonous sea snakes, and the almost extinct dugong, or sea cow, are found in the Palau island group.

The people. The Palau islands' position on the western threshold of Oceania and their proximity to insular Southeast Asia have led to a considerable admixture of peoples. Palauans are of mixed Malay, Melanesian, Filipino, and Polynesian ancestry. About three-fifths of the total population lives in Koror and about one-third on Babelthuap. Most of the people live in traditional villages, and they are predominantly Christian. Palauan (related to Indonesian), Sonsorolese-Tobian, and English are spoken.

The economy. The major source of employment in Palau is government service. Subsistence farming, the raising of pigs and poultry, and fishing are the principal economic activities in the rural areas. Taro, cassava, and sweet potatoes are staples; oranges, breadfruit, and bananas are also grown. Coconut-oil, tuna, copra-cake, and scrap-metal exports are the main sources of revenue. There is also some tourism. Imports include foodstuffs and manufactured goods.

Koror has a good system of paved roads. Most transportation between the islands is by boat or air, but Koror is connected by bridge with Babelthuap and by causeways with Arakabesan and Malakal islands. The main port, a radio station, and a television station are at Koror. An international airport is located on Babelthuap.

Government and social conditions. The Palauan government is headed by a popularly elected president and has a bicameral legislature consisting of a House of Delegates and a Senate. A hospital on Koror and dispensaries on the inhabited islands provide health care. The populated islands have primary schools, and Koror has secondary schools. The Micronesian Occupational College on Koror was established in 1969.

History. Visited by the Spanish navigator Ruy López de Villalobos in 1543, the islands remained under nominal Spanish ownership for more than three centuries. In 1899 the Palau group, together with the Mariana and Caroline islands, was sold to Germany. Copra production was increased, and phosphate deposits on Angaur were mined (these were exhausted in 1955). The Palau islands were occupied in 1914 by Japanese forces, who further developed mining, plantation agriculture, and commercial fishing. A major Japanese naval stronghold in World War II, the group fell to U.S. forces in 1944.

Palau became part of the United Nations Trust Territory of the Pacific Islands under U.S. administration in 1947. A constitution was adopted in 1981 (following two prior referenda), and elections were held in the same year. The country became an internally self-governing republic in 1981. Palau signed a Compact of Free Association with the United States in 1982; this compact required the United States to provide economic aid to Palau in exchange for the right to build and maintain U.S. military facilities on the island group. In separate referenda since 1983 the compact repeatedly failed to gain the 75 percent popular approval required to override Palau's constitutional ban on vessels armed with or powered by nuclear materials. In the late 20th century Palau was the last trusteeship of the original United Nations trust territory. The other three Pacific island groups dissolved their trusteeships in 1986—the Marshall Islands and the Federated States of Micronesia entering into free association with the United States and the Northern Mariana Islands becoming a U.S. Commonwealth territory.

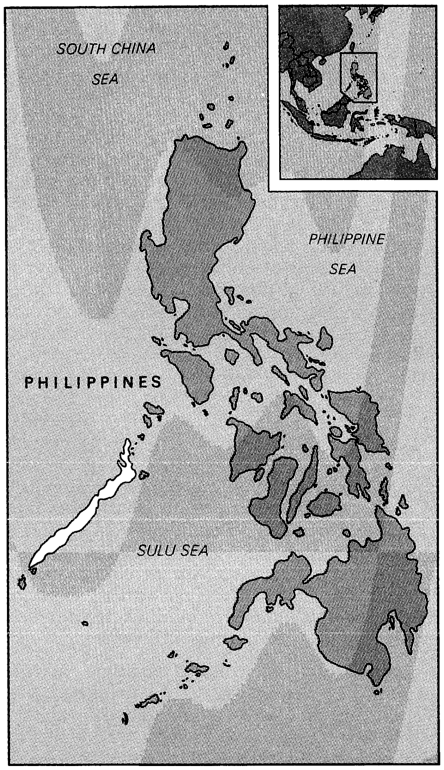
Palauan language, major language of the Republic of Palau, which is situated in the western Pacific Ocean. The language is classified as belonging to the eastern branch of the Austronesian (Malayo-Polynesian) family of languages. Like Chamorro, which is spoken in the Mariana Islands, it is considered to be of the Indonesian type of languages, with closest relations to the Philippine languages. Palauan, with about 12,000 speakers in the late 20th century, is characterized by a small phonemic inventory and the use of phonemic stress.

Palaung, also called TA-ANG, hill people of the Shan region and adjacent areas of eastern Myanmar (Burma), as well as southwestern Yunnan province of China. They numbered about 240,000 in the late 20th century and speak dialects of the Palaungic branch of Austro-Asiatic languages. The Palaung's language is quite distinct from the Tai speech of the Shan (*see* Tai), with whom they live closely intermingled. Their area has a long history as a centre of tea production.

Some Palaung groups are organized in patrilineal lineages similar to those of the Kachin, their neighbours to the north; elsewhere their organization is more like that of the Shan. Shan-type Buddhism coexists with various local cults based on ancestor worship. The Palaung language resembles that of the head-hunting Wa farther east, but there is otherwise no close cultural connection between the two groups.

Palaungic languages, also called PALAUNG-WA, branch of the Mon-Khmer group of the Austro-Asiatic languages. Palaungic languages are spoken primarily in Myanmar (Burma) and secondarily in Thailand, Vietnam, and Yunnan province in China. Included are Palaung, spoken in Myanmar; Mang, spoken in Vietnam; Lawa, a Thai language; and Danaw, Kawa-Yunnan, Angku, Khamed, and Wa (or Kwa), spoken in Myanmar and China. The Khmuic languages, spoken primarily in Laos, are sometimes classified together as an eastern branch of the Palaungic languages.

Palawan, island, the southwesternmost large island of the Philippines. Palawan is long and narrow and trends northeast–southwest between the South China and Sulu seas. It has an area of 4,550 square miles (11,785 square km), a maximum width of 24 miles (39 km),



Palawan

and a mountainous backbone that runs its entire 270-mile (434-kilometre) length, with Mount Mantalingajan (6,840 feet [2,085 m]) in the south as its highest peak. The Balabac–Bugsuk group of islands off the southern tip is a remnant of a land bridge that connected Palawan and Borneo during the Pleistocene epoch (1,600,000 to 10,000 years ago); for this reason the animal life and vegetation are more closely related to those of Borneo than to those of the other Philippine islands. Palawan's long, irregular coastline is fringed with coral reefs and has numerous offshore islets. A discontinuous coastal plain that seldom extends more than 5 miles (8 km) inland supports most of the island's population. The plain, which is best developed on the southeastern coast, constitutes the main agricultural area and has the island's only all-weather road.

About 1,800 smaller islands and islets lie near Palawan; the main island groups are the Calamian (north), the Dumaran–Cuyo (northeast), and the Balabac–Bugsuk (south). Puerto Princesa, on the east-central coast of Palawan island, is the island's largest city.

Scattered settlement and shifting agriculture predominate, with rice as the main food crop. Corn (maize), beans, and sweet potatoes are also grown. Large-scale commercial fishing operations are carried out at Puerto Princesa and Taytay. Mineral resources include mercury, silica, and chromite. Most of the island is the forest homeland of the Batah, Palawan, and Tagbanuas ethnic groups. Christian migrants (Visayans, Tagalogs, Ilocanos, and Bicolanos) have settled in the north and east. There are some Moro (Muslim) villages in the south. The Tabon Caves on the isolated southwestern coast of Palawan are an important archaeological site. Pop. (1980) 311,548.

Pālayankottai, also called PĀLAMCOTTAH, town, southern Tamil Nādu state, southeastern India. It lies across the Tāmbraparni River from its twin city of Tirunelveli. Pālayankottai is a residential and educational centre in the Tirunelveli urban agglomeration. It is a major centre of Christian missions in southern India and has private Christian schools and Christian and other colleges affiliated with Madurai-Kamaraj University. Cotton and palmyra are the chief commercial agricultural products grown in the surrounding region. Pop. (1981) 87,302.

Palazzo Ducale (Venice): *see* Doges' Palace.

Palazzolo Acreide, town, Siracusa *provincia,* southeastern Sicily, Italy, in the Iblei Mountains, west of Syracuse. The successor to the Syracusan colony of Acrae (founded nearby in 664 BC), which was ravaged by the Muslims in the 9th century, the town was ruled by a succession of families in the European Middle Ages, later passing to the Kingdom of the Two Sicilies and eventually to the Kingdom of Italy. It was largely destroyed by the earthquake of 1693, and most of the buildings date from the 18th century.

On the site of Acrae (Akrai) are the remains of a Greek theatre and council house. The *templi ferali* ("temples of the dead"), carved in the rock, contain Greek inscriptions and votive niches. The Santoni are 12 life-size rock carvings of deities, including Cybele, the Great Mother of the Gods, dating from the 3rd century BC. The Iudica Palace houses objects from the ruins.

Palazzolo Acreide has a hydroelectric-power plant, and olives, grain, citrus fruits, and almonds are grown. Pop. (1988 est.) mun., 10,007.

pale (from Latin *palus,* "stake"), district separated from the surrounding country by defined boundaries or distinguished by a different administrative and legal system. It is this definition of pale from which the phrase "beyond the pale" is derived.

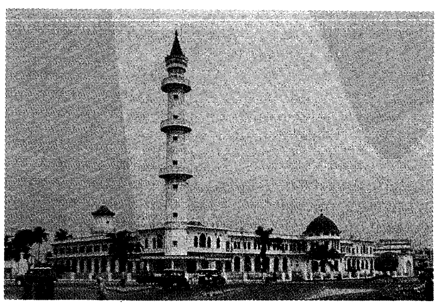
In imperial Russia, what came to be called the Pale of Settlement (Cherta Osediosti) came into being as a result of the introduction of large numbers of Jews into the Russian sphere after the three partitions of Poland (1772, 1793, 1795). Adjusting to a population often banned from Russia altogether was a problem that Russian leadership solved by allowing Jews to remain in their current areas of residence and by permitting their settlement in areas of the Black Sea littoral annexed from Turkey, where they could serve as colonists. In three decrees, or ukases, issued in 1783, 1791, and 1794, Catherine II the Great restricted the commercial rights of Jews to those areas newly annexed. In ensuing years, this area became a strictly defined pale, as legal restrictions increasingly proscribed Jewish settlement elsewhere.

During the 1860s a few exceptions were made to the increasing restriction of Jews to settlement only in the pale—which by the 19th century included all of Russian Poland, Lithuania, Belorussia, most of the Ukraine, the Crimea, and Bessarabia. Some merchants and artisans, those with higher educations, and those who had completed their military service could settle anywhere but in Finland. In the 1880s, however, the pendulum swung back toward restriction. A period of reaction arrived with the ascension of Tsar Alexander III in 1881. That year, the new tsar promulgated the "Temporary Laws," which, among many regressive measures, prohibited further Jewish settlements outside the pale; and Christians within the pale were allowed to expel Jews from their areas. Occasionally, new areas were proscribed, such as the city and province of Moscow in 1891. Nevertheless, the census of 1897 indicated that most Jews remained confined to the pale. Almost 5,000,000 lived within it; only about 200,000 lived elsewhere in European Russia. The pale ceased to exist during World War I, when Jews in great numbers fled to the interior to escape the invading Germans. The Provisional Government formally abolished it in April 1917.

Other examples of pales include the English pales in Ireland and France. "The Pale" in Ireland (so named after the late 14th century) was established at the time of Henry II's expedition (1171–72) and consisted of the territories conquered by England, where English settlements and rule were most secure. The pale existed until the entire area was subjugated under Elizabeth I (reigned 1558–1603). Its area, which varied considerably depending upon the strength of the English authorities, included parts of the modern counties of Dublin, Louth, Meath, and Kildare. The Calais pale in northern France (1347–1558) had a perimeter extending from Gravelines in the east to Wissant in the west and enclosing a hinterland 6–9 miles (10–14 km) deep.

Palembang, *kotamadya* (municipality) and capital, Sumatera Selatan *provinsi* (province), Indonesia, lying on both banks of the Musi River. Sumatra's largest city, it was long the chief town of the Palembang sultanate. The city served as the capital of the Buddhist Śrivijaya empire from the 7th century until the kingdom was overthrown by the Hindu Majapahit empire in the 14th century. Palembang subsequently fell under Islāmic rule about 1500. In 1617 the Dutch East India Company set up a trading post there and in 1659, following several massacres of its employees, built a fort. Intermittently under British suzerainty (1811–14; 1818–21), the sultanate was finally abolished by the Dutch (1825). Occupied by Japan during World War II, the city was temporarily capital of the autonomous state of South Sumatra (from 1948) until included in the Republic of Indonesia (1950).

Important landmarks are the Great Mosque (1740; minaret 1753), tombs of several sultans, a museum, a centre for training in public administration, Sriwijaya University (1960), and the provincial-parliament building. The port city is accessible to ocean traffic on the Musi River and has considerable trade with ports



The Great Mosque in Palembang, Sumatra, Indon.
Richard Allen Thompson—EB Inc.

on the Malay Peninsula, Thailand, and China as well as other Indonesian ports. Exports include rubber, coffee, timber, petroleum products, coal, tea, spices, resin, rattan, cinchona, and pepper. There are also shipyards, iron foundries, machine shops, rubber plants, and a fertilizer factory. The suburbs of Sungaigerong and Pladju, located to the east, have large oil refineries. Served by rail and road, the city of Palembang also has an airport. Pop. (1984 est.) 903,000.

Palencia, inland *provincia,* in the Castile-León *comunidad autónoma* ("autonomous community"), northern Spain, bounded by the provinces of Cantabria (north), Burgos (east), Valladolid (south), and Valladolid and León (west). Formed in 1833, it has an area of 3,102 square miles (8,035 square km). The north is traversed by the Cantabrian Mountains, rising to 6,644 feet (2,025 m) in the Brezo Mountains. The remainder of Palencia, the fertile Campos Plain, belongs to the great Castilian tableland. In the south is a marsh or lake, known as Nava Lake; and the principal rivers are the Pisuerga and Carrión. Minerals have been found in the mountains, but only coal and small quantities of copper are worked. The Castilla Canal (built 1753–1832), on which the provincial capital, Palencia, is located, connects the province with Valladolid and is used for irrigation as well as transport.

Wheat and other cereals, vegetables, sugar beets, hemp, and flax are grown; sheep raising is extensive; and there are manufactures of linen and woolen stuffs, porcelain, leather, paper, and rugs. Apart from Palencia, the capital city, the chief centres are Venta de Baños, Barruelo de Santullán, Dueñas, and Paredes de Nava. Pop. (1988 est.) 190,167.

Palencia, capital of Palencia *provincia,* in the Castile-León *comunidad autónoma* ("autonomous community"), north-central Spain, on the Campos Plain southwest of Burgos. Called the Pallantia by the ancient Greek geographers Strabo and Ptolemy, it was the chief town of the Vaccaei, an Iberian tribe. Its history during the Gothic and Moorish periods is obscure, but it was the seat of the Castilian kings and their Cortes (courts of a parliamentary or advisory nature) in the 12th and 13th centuries. In 1520 Palencia participated in the ultimately unsuccessful revolt of the Castilian cities (*comuneros*) against the Holy Roman emperor Charles V. The university founded there in 1208 by Alfonso VIII was removed in 1239 to Salamanca. The Gothic cathedral, begun in 1321, completed in 1504, and dedicated to San Antolín, occupies the site of a church erected (1026–35) by Sancho III Garcés of Navarre and Castile over the cave of San Antolín. The cathedral contains El Greco's "St. Sebastian" and other valuable paintings, old Flemish tapestry, and magnificent carved woodwork and stonework. Portions of the hospital of San Lázaro are said to date from the time of the Cid, the Spanish soldier-hero celebrated in Spain's epic poem *El cantar de mío Cid,* who married Jimena in Palencia in 1074.

Palencia is an important communications centre. Its economy is based on the manufacture of iron, rugs, alcohol, leather, soap, porcelain, linen, cotton, wool, machinery, and matches. Pop. (1988 est.) 76,692.

Palenque, also called GUARINE, Indian tribe of northern Venezuela at the time of the Spanish conquest (16th century). The Palenque were closely related to the neighbouring Cumanagoto (*q.v.*); their language probably belonged to the Arawakan family. They were a tropical-forest people known to eat human flesh, to be warlike, and to live in settlements surrounded by palisades (*palenques*). The Patángoro (*q.v.*) of Colombia were also sometimes called Palenque because of their fortified settlements.

Palenque, ruined ancient Mayan city of the Classic period (*c.* AD 300–900) in what is now Chiapas state, Mexico, about 80 miles (130 km) south of Ciudad del Carmen. Its original name was lost, and thus it was named after the neighbouring village of Santo Domingo del Palenque. The Palenque builders used plaster to obtain a smooth finish unlike the usual Mayan tooled-limestone construction. They used carving, however, on the interior walls; the best examples are on tablets affixed to the

The watchtower and Palace with the North Group ruins in the background, Palenque
Georg Gerster from Rapho/Photo Researchers—EB Inc.

walls with plaster. Stucco and terra-cotta images have been found. The Palace shows three parallel walls housing two corridors covered with pointed vaults of the Palenque style.

One of the largest and best-preserved structures, the Temple of the Inscriptions, is noted for its hieroglyphic inscriptions. In 1952 a crypt was discovered under the temple, in which were found the jade-ornamented remains of what may have been a ruler-priest of the 7th century AD. The small Temple of Beau Relief is noted for a large stucco bas-relief of a beautifully modeled, enthroned figure.

Paleo-Asiatic languages: *see* Paleosiberian languages.

paleo-Christian art: *see* Early Christian art.

paleoanthropology, also spelled PALAEOANTHROPOLOGY, also called HUMAN PALEONTOLOGY, interdisciplinary branch of anthropology concerned with the origins and development of early humans. Fossils are assessed by the techniques of physical anthropology, comparative anatomy, and the theory of evolution. Artifacts, such as bone and stone tools, are identified and their significance for the physical and mental development of early humans interpreted by the techniques of archaeology and ethnology. Dating of fossils by geologic strata, chemical tests, or radioactive-decay rates requires knowledge of the physical sciences.

Paleocene epoch, also spelled PALAEOCENE EPOCH, major worldwide division of Early Tertiary rocks and time that began about 66.4 million years ago and lasted about 8.6 million years; the earliest division of the Tertiary period, it precedes the Eocene epoch and follows the Cretaceous period. Because marine rocks of the Paleocene epoch are limited in occurrence, much of the information about the Paleocene comes from terrestrial deposits. Subdivisions of the Paleocene vary from region to region; in Europe, for example, at least three stages of the Paleocene are recognized—the Danian, the Montian, and the Thanetian. In North America, especially in the San Juan River basin of New Mexico and southern Colorado, where Paleocene continental deposits are well developed and sequences are based on mammalian evolution, local names (such as the Puercan, the Torrejonian, and the Tiffanian) were assigned to the various stages.

The Paleocene record of North America affords the most complete picture of Paleocene life and environments; elsewhere, Paleocene animals, especially mammals, are lacking, rare, or of late Paleocene age. Late Paleocene faunas are known from the regions of Cernay, Fr.; Gashato, Mong.; and the Chico River region of Patagonian Argentina.

The Paleocene of North America was characterized by a general warming trend in climatic conditions, with little or no frost; seasonal variations probably consisted of alternations of dry and wet seasons. Among the most prominent features of Paleocene vertebrate faunas are the complete absence of dinosaurs and other reptilian groups that were dominant during the Cretaceous and the rapid proliferation and evolution of the mammals. Paleocene mammals include representatives of many groups or orders that are still extant, although the Paleocene forms are mostly archaic or highly specialized. In terms of proportions and relative abundance, however, Paleocene faunas are dominated by mammals that have no living representatives. Paleocene mammalian faunas include Cretaceous species such as opossum-like marsupials and, especially, the archaic and unusual multituberculates, herbivorous animals that had teeth very similar in some respects to those of the later, more advanced rodents. The condylarths, very important elements of Paleocene faunas, include forms that were trending toward herbivorousness while still retaining primitive traits of their insectivore-carnivore progenitors. Primates became more abundant in the middle Paleocene and displayed characteristics intermediate between the insectivores and lemurs, especially in terms of dental anatomy.

Late in the Paleocene, mammalian evolution showed a trend toward larger forms and more varied assemblages. The primitive mammalian carnivores, the creodonts, appear late in the Paleocene, as do large herbivores, ancestral rodents, and the first tarsioid primates. The Gashato fauna from Mongolia contains the remains of the earliest-known hare, *Eurymylus,* and among Paleocene mammals from South America are many early representatives of animals that dominated later Tertiary faunas in the region.

paleoclimatology, also spelled PALAEOCLIMATOLOGY, scientific study of the extended climatic conditions of past geologic ages. Paleoclimatologists seek to explain climate variations for all parts of the Earth during any given geologic period, beginning with the time of the Earth's formation. Many related fields contribute to the field of paleoclimatology, but the basic research data are drawn mainly from geology and paleobotany; speculative attempts at explanation have come largely from astronomy, atmospheric physics, meteorology, and geophysics.

Two major factors in the study of both ancient and present-day climatic conditions of the Earth are the changes in the relationship between the Earth and the Sun (*e.g.,* the slight alteration in the configuration of the Earth's orbit) and the changes in the surface of the planet itself (such phenomena as volcanic eruptions, mountain building, and the dispersal of the continents after the breakup of the supercontinent Pangaea). Some of the questions that were studied in the past have been largely explained. Paleoclimatologists found, for example, that the warmth of the northern hemispheric landmasses during at least 90 percent of the last 570 million years is mainly due to the drift of the continents across the latitudes; until about 150 million years ago, both North America and Europe were much closer to the equator than they are today. Other questions, such as the reasons behind the irregular advances and retreats of the ice sheets (*i.e.,* glacial and interglacial episodes), are much more difficult to explain, and no completely satisfactory theory has been presented.

Paleogene period, also spelled PALAEOGENE PERIOD, older of the two stratigraphic divisions of the Cenozoic era (the Cenozoic era began about 66.4 million years ago and extends to the present). The Paleogene, whose beginning coincides with that of the Cenozoic era, lasted about 42.7 million years and was followed by the Neogene period. The Paleogene, which means "ancient-born," includes the Paleocene (Palaeocene), Eocene, and Oligocene epochs. The term Paleogene was devised in Europe to emphasize the similarity of marine fossils found in rocks of the first three Cenozoic epochs, as opposed to the later fossils of the Neogene period. In North America the designations Paleogene and Neogene have not gained wide usage, and the Cenozoic is divided only into the Tertiary period (about 66.4 million to 1.6 million years ago) and the Quaternary period (about 1.6 million years ago to the present). Thus, the Paleogene period may also be considered to be roughly equivalent to the first two-thirds of the Tertiary period.

paleogeography, also spelled PALAEOGEOGRAPHY, the geography of selected portions of the Earth's surface at specific times in the geologic past. This geography consists of interpreted reconstructions, produced in map form, which represent visual summaries of a wide variety of complex geologic information. The maps provide a series of relatively instantaneous views of the Earth through geologic time. Paleogeographic maps may be as simple as those that merely give the former distribution of ancient lands and seas. They may be extremely comprehensive, however, showing the occurrence and distribution of fossil, plant, and animal communities, environments of sedimentation (*e.g.,* deltas, reefs, deserts, or deep-sea basins), areas undergoing uplift and erosion or subsidence and deposition, and major climatic zones. Interpretations of the distant geologic past are based largely on observations of the rocks of the Earth's crust in light of knowledge of present geologic processes. Virtually all the scientific specialties within the geologic sciences contribute to paleogeography. The disciplines of stratigraphy and sedimentology, paleontology and paleoecology, structural geology and geophysics, and petrology and geochemistry are particularly important.

Usually, a paleogeographic map covers a certain interval of time and thus represents the average geologic situation during that interval. Time intervals for any particular paleogeographic reconstruction should, however, be short, relative to the rates of geologic change in the area.

There are three main techniques for determining geologic time intervals. One is by measuring the radioactivity of rocks. The technique of dating rocks by measuring ratios of radioactive parent-to-daughter isotopes always involves certain intrinsic sources of error, and the time of formation of a rock is given as a range of years rather than as a unique point in time. The second technique for dating rocks is by correlating the similarity of fossil remains. Differing evolutionary stages of organisms provide a useful chronology for establishing the time equivalence of rocks in separate parts of the world. Rates of evolutionary change, however, usually are not sufficiently great to discriminate events of less than several million years' duration. A relatively new technique for establishing instants in time is that provided by study of paleomagnetic reversals. At specific times in the past the polarity of the Earth's magnetic field reversed, and each reversal was essentially instantaneous. A sequence of reversals has been established for the last 7 million years from the polarity and orientation of fine-grained iron oxides found in deep-sea sediments and terrestrial lava flows. Paleomagnetic reversals may ultimately provide the instant-time signatures so necessary for accurate reconstruction of the Earth's geologic history.

The simplest kind of paleogeography is that showing the location of ancient lands and seas. The data that bear on such a reconstruction include the distribution of marine and nonmarine sedimentary rocks as defined by their fossil flora or fauna. Fossil organisms, however, can provide much more detailed information than whether their enclosing sedimentary rocks were deposited on land or in the sea. Terrestrial and marine environments include a wide range of habitats (*e.g.,* upland plains or plateaus, deserts, forests, river valleys, swamps and lakes, tidal flats, beaches, lagoons, reefs, deltas, or open ocean) in each of which there lives an assemblage of animals and plants specially adapted to the ecology of the particular habitat. Knowledge of the ecologic requirements of fossil organisms thus allows more refined interpretation of the paleogeography than simply designating "land" or "sea."

Fossil land plants have long been used as climatic indicators in paleogeographic studies. When internal cellular structure is preserved, it is possible to determine if the plant lived in an arid or wet climate and if there were marked seasonal changes in temperature or rainfall. In geologically younger rocks containing fossil plants that have living descendants, one can define the past climate from the environmental preferences of the living form.

Plants provide other fossil traces besides bits and pieces of leaves, stems, or fruits. In fact, most paleoclimatological interpretation is based upon the study of fossil spores and pollen, the microscopic reproductive bodies of plants that have extremely resistant outer coverings. Because of the great durability of spores and pollen, and their very great initial abundance, fossil spores and pollen can be obtained from many terrestrial or even marginal marine sedimentary deposits that may otherwise lack larger plant remains.

Marine plants, especially the calcareous algae, are also found and recognized in the fossil state. Not only will they indicate the marine origin of the rocks in which they occur but, because of the need for light for photosynthesis, the marine environment will be identified as being relatively shallow (solar radiation does not penetrate much beyond several hundred feet of seawater).

Fossil vertebrates, whether fish, amphibians, reptiles, birds, or mammals, are also useful in paleogeography. Like plants, individual vertebrate species have characteristic adaptations to their environment, so that their distribution in ancient rocks is a guide to the occurrence and extent of those environments.

Shelly marine invertebrates, including microscopic calcareous and siliceous protists, sponges, corals, ectoproct bryozoans, brachiopods, mollusks, echinoderms, and arthropods, are also used regularly by paleontologists to define environments within ancient seas.

Not all evidence of past life found in rocks is so direct as the presence of the hard skeletal remains of shelly invertebrates, calcareous algae, or plants. Indeed, much of the evidence is quite indirect. The occurrence of oil and gas whose organic constituents are derived from fossil marine life usually defines the origin of the containing strata as marine, although, after formation in the source rock, oil and gas can migrate to the reservoir rocks whose origin might actually be nonmarine. Coprolites, which are the fossilized fecal remains of animals, can occasionally provide some paleogeographic data. Other interesting indirect evidence of life is that of tracks, trails, and burrows made by ancient animals.

Paleogeographic data are not confined to fossil remains. Rocks of all sorts, fossiliferous or not, are used for paleogeographic reconstruction. Igneous, sedimentary, and metamorphic rocks are the products of a variety of processes occurring at the Earth's surface or within its crust. The environments in which rocks originate are distributed along geographic trends, and the composition, texture, and internal structures characteristic of these environments are often recorded within the individual rock types. Analysis of the rock record at a specific point in the geologic past allows definition and interpretation of these major rock-forming environments and indicates their geographic distribution.

paleogeology, also spelled PALAEOGEOLOGY, the geology of a region at any given time in the distant past. Paleogeologic reconstructions in map form show not only the ancient topography of a region but also the distribution of rocks beneath the surface and such structural features as faults and folds. Maps of this kind help investigators to better determine the instances of deformation events in a region, the stream-drainage patterns now buried under layers of sediment, and the extent of ancient oceans and seas. They also provide a useful tool for petroleum geologists, enabling them to identify geologic structures where oil or natural gas may be trapped.

paleography, also spelled PALAEOGRAPHY, study of ancient and medieval handwriting. The primary tasks of the paleographer are to read the writings of the past and to assign them a date and a place of origin. As a rule, paleography deals with Greek and Latin scripts and their derivatives, excluding Egyptian, Hebrew, and Middle and Far Eastern scripts.

A brief treatment of paleography follows. For full treatment, *see* MACROPAEDIA: History, The Study of.

Paleography is the study of handwriting found on ancient and medieval documents of papyrus, parchment, and paper. From its beginnings as a science in 1681, paleography has been concerned with correctly reading such writings and assigning to them a date and a place of origin. The paleographer must know the language of the texts, the abbreviations used, and the various styles of handwriting.

A knowledge of writing materials is essential to the study of ancient handwriting. The oldest material, papyrus, used as early as 3500 BC, was made by pasting together a crosshatch of papyrus reeds and treating the surface until it was smooth. Climate was instrumental in its preservation. The dry climate of Egypt kept documents intact, but the dampness of Europe destroyed them. Parchment (sheepskin or goatskin) and vellum (calfskin) were used in ancient times and are still used today. Because writing material made from animal skins was expensive, it was often scraped clean and used again. Inexpensive writing material was provided by wax tablets: wooden frames filled with melted black wax. Although wax tablets were primarily used as notebooks are used today, many permanent documents were written on wax. Paper, first used in China, became readily available in the Arab world in the 9th century and in Europe in the 14th.

The properties of the writing material used determined the form of the book. In Greece, papyrus sheets were pasted together, slightly overlapping, and made into a roll. The codex, the book form known today, was made of parchment because papyrus was too brittle to be folded. First used for account books, the codex became popular when Christians used it for the Gospels.

Implements for writing on these surfaces were of great variety. A reed pen, and later a metal pen, was used in Greek and Roman times; a stylus of a hard substance like bone or metal was used to inscribe the wax tablets. Where reeds did not grow, the quill of a feather became the writing instrument. Ink either came from the cuttlefish's black secretion or was a concoction made from soot and gum or from oak apples soaked in a ferrous sulfate solution.

In order to analyze a text, the paleographer must know the different handwriting styles and the times and places of their use. The Greek capital (majuscule) letters that were used for inscribing stone and for writing on papyrus gradually became more rounded and elegant in the hands of the literary circles of Alexandria, Egypt, where many Greeks settled. A cursive script, used for everyday affairs, was widely adopted, and so much of it is preserved that it gives a day-by-day account of the lives of the ancient Greeks.

The capital letters of the Latin alphabet were used when writing on stone, but rarely on parchment. A more flowing script called rustic, applied with brush or thick pen, was used to paint notices on walls in the 1st century AD. By the 4th century another script, called uncial, existed. As in Greek writing, in Latin, too, a cursive script developed for everyday use. Other Latin alphabet scripts were devised in other parts of the West, most notably in Ireland, where the lovely insular script was used in monasteries. In England insular script and uncial script came together with the arrival of missionaries from Rome after 597. The emperor Charlemagne was instrumental in the development of Caroline miniscule (small) script that is very similar to modern typefaces. Its rounded style was made more angular by 12-century Gothic scribes; but by the 15th century the style had returned to the original form and was adopted by Italian printers.

Ancient abbreviation plagues paleographers. Ends of words were omitted (suspension) or letters in the middle of the word were deleted (contraction), and the change was marked by a symbol (similar to our modern apostrophe). More than 13,000 signs and devices that mark such changes were in use in the Middle Ages. However, the knowledge of these abbreviations helps date documents. The style of handwriting and the content of the document (when a historical event is relayed) are also used to ascertain date of composition.

Paleographers learn to identify different scribes by their characteristic handwriting and from this identify the periods in which they wrote. Not all scribes, however, are reliable. Some were actually illiterate, employed to copy documents because they could write—not read—a fine hand. An error made by one copyist was reproduced and added to by others who used his text as a model. Gothic scripts with many vertical strokes might be rendered gibberish by a scribe who had no knowledge of the language. This "minimum corruption" of vertical strokes is a problem common in paleography.

One aspect of this science needs no expertise to be enjoyed, that of book decoration. Painstaking artistic practice coupled with a highly individual artistic freedom produced books with elaborately adorned capital letters and delicate scripts complemented by finely executed miniature paintings that served as illustrations of the text. These illuminated manuscripts, most notably those from 7th-century Irish monasteries, are among the great art treasures of the world.

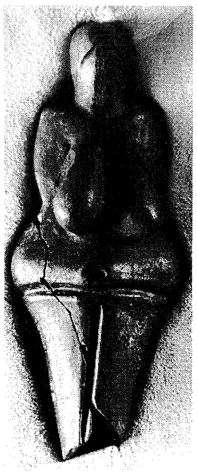
As in all art, the possibility of forgery exists and, in the Middle Ages, was proved in cases in which monasteries forged deeds to lands that were threatened by an unsympathetic monarchy. Today, forgeries are attempted because of the high prices paid for ancient documents, but modern detection devices like ultraviolet light quickly reveal the counterfeit.

paleohydrology, also spelled PALAEOHYDROLOGY, science concerned with hydrologic systems as they existed during previous periods of Earth history. Changing hydrologic conditions are inferred from the evidence of the alteration, deposition, and erosion in rocks from these periods. Paleohydrology also deals with the changes in the floral and faunal assemblages through geologic time that have been greatly influenced by hydrologic change.

Paleolithic Period, also spelled PALAEOLITHIC PERIOD, also called OLD STONE AGE, ancient cultural stage, or level, of human development, characterized by the use of rudimentary chipped stone tools.

At sites dating from the Lower Paleolithic Period (about 2,500,000 to 200,000 years ago), simple pebble tools have been found in association with the remains of what may have been the earliest human ancestors. A somewhat more sophisticated Lower Paleolithic tradition, known as the Chopper chopping-tool industry (*q.v.*), is widely distributed in the Eastern hemisphere. This tradition is thought to have been the work of the hominid species named *Homo erectus*. Although no such fossil tools have yet been found, it is believed that *H. erectus* probably made tools of wood and bone as well as stone.

Around 700,000 years ago, a new Lower Paleolithic tool, the hand ax, appeared. The earliest European hand axes are assigned to the Abbevillian industry (*q.v.*), which developed in northern France in the valley of the Somme; a later, more refined, hand ax tradition is seen in the Acheulian industry (*q.v.*), evidence of which has been found in Europe, Africa, the Middle East, and Asia. Some of the earliest known hand axes were found at Olduvai Gorge (Tanzania) in association with remains of *H. erectus*. Alongside the hand ax tradition there developed a distinct and very different stone tool industry, based on flakes of stone: special tools were made from worked (carefully shaped) flakes of flint. In Europe, the Clactonian industry (*q.v.*) is one example of a flake tradition. The early flake industries probably contributed to the development of the Middle Paleolithic flake tools of the Mousterian industry (*q.v.*), which is associated with the remains of Neanderthal man.



"Venus of Věstonice," Upper Paleolithic period clay statuette from Dolni Věstonice, Mikulov, Czechoslovakia, Aurignacian culture; in the Moravian Museum, Brno, Czech.
Werner Forman Archive

The Upper Paleolithic Period (beginning about 40,000 years ago) was characterized by the emergence of regional stone tool industries, such as the Perigordian, Aurignacian, Solutrean, and Magdalenian of Europe, as well as other localized industries of the Old World and the oldest known cultures of the New World. Principally associated with the fossil remains of anatomically modern humans (Cro-Magnon man), Upper Paleolithic industries are characterized by the greater complexity, specialization, and variety of tool types and by the emergence of distinctive regional artistic traditions.

Two forms of Paleolithic art are known to modern scholars: small sculptures, and monumental paintings, incised designs, and reliefs on the walls of caves. Such works were produced throughout the Mediterranean region and other scattered parts of Eurasia and Africa but survived in quantity only in eastern Europe and parts of Spain and France.

Small sculptured pieces evidently dominated the Upper Paleolithic artistic traditions of eastern Europe; typical were small, portable clay figurines and bone and ivory carvings. The works from this area include simple but realistic stone and clay animal figurines, as well as carved stone statuettes of women, referred to by scholars as Venus figures. These small, stylized figures are characteristically rotund, emphasizing parts of the female body associated with sexuality and fertility; many are so abstract that only protuberant breasts and exaggerated hips are clearly distinguishable.

Monumental arts flourished in western Europe, the province of the so-called Franco-Cantabrian school (*q.v.*), where limestone caves provided a sheltered surface for painting, incised designs, and relief carvings. These caves have preserved much small carving of fine quality and an abundant and varied sample of prehistoric graphic art, ranging from simple finger tracings in clay to sophisticated polychrome paintings, generally depicting animals, of dynamic naturalism and exquisite design. The function or purpose of art in Paleolithic life remains a subject of debate. Some scholars see the human and animal representations as evidence of the use of magical rites to ensure success in hunting or to guarantee fertility. Others have suggested that Paleolithic artists' accurate representations of animals' coats may be an early attempt to produce a seasonal notation system. Another viewpoint, disregarding utility altogether, sees the art of Paleolithic peoples solely as an outgrowth of a basic human need to creatively record and reproduce aspects of the world around us.

Paléologue, Maurice-Georges (b. Jan. 13, 1859, Paris—d. November 1944, Paris?), French diplomat and writer who encouraged the Franco-Russian alliance before and during World War I.

Paléologue entered the diplomatic service at an early age and went successively to Tangier, Rome, Germany, the East, Korea, and Bulgaria. He became in 1909 deputy director and in 1911 director of affairs in the foreign office. Shortly before the outbreak of World War I, Paléologue was appointed ambassador to St. Petersburg (Leningrad), and he retained this post until the Bolshevik Revolution in 1917. During the war he consolidated the Franco-Russian alliance and helped to ensure effective military action on the part of Russia. In 1920 he was secretary general of the ministry of foreign affairs.

Paléologue published in 1921–22, under the title of *La Russie des Tsars pendant la grande guerre* ("Tsarist Russia During the Great War"), records of his diplomatic experiences in St. Petersburg. He also wrote critical works on Vauvenargues and Alfred de Vigny (1890) and several novels. He was admitted to the French Academy in 1928.

paleomagnetism: *see* remanent magnetism.

paleontology, also spelled PALAEONTOLOGY, scientific study of life of the geologic past that involves the analysis of plant and animal fossils, including those of microscopic size, preserved in rocks. It is concerned with all aspects of the biology of ancient life forms: their shape and structure, evolutionary patterns, taxonomic relationships with each other and with modern living species, geographical distribution, and interrelationships with the environment. Paleontology is mutually interdependent with stratigraphy and historical geology because fossils constitute a major means by which sedimentary strata are identified and correlated with one another. Its methods of investigation include that of biometry (statistical analysis applied to biology), which is designed to provide a description of the forms of organisms statistically and the expression of taxonomic relationships quantitatively.

Paleontology has played a key role in reconstructing the Earth's history and has provided much evidence to support the theory of evolution. Data from paleontological studies, moreover, have aided petroleum geologists to locate deposits of oil and natural gas. The occurrence of such fossil fuels is frequently associated with the presence of the remains of certain ancient life-forms.

Paleontological research dates back to the early 1800s. In 1815 the English geologist William Smith demonstrated the value of using fossils for the study of strata. About the same time the French zoologist Georges Cuvier initiated comparative studies of the structure of living animals with fossil remains.

Paleosiberian, also spelled PALAEOSIBERIAN, member of the peoples of northeastern Siberia who are believed to be remnants of earlier and more extensive populations pushed into this area by later Neosiberians. The Paleosiberians include the Chukchi (*q.v.*), Koryak, Kamchadal, Yukaghir (*q.v.*), and Ket (*q.v.*). The Chukchi and Koryak are traditional reindeer breeders and hunters; maritime groups are sea-mammal hunters and fishers. The Kamchadal are sedentary fishers, and the Yukaghir were formerly hunters.

Paleosiberian languages, also called PALEO-ASIATIC, or HYPERBOREAN, languages spoken in northern Asia (Siberia) that belong to four genetically unrelated groups—Yeniseian, Luorawetlan, Yukaghir, and Gilyak. The Yeniseian group contains at least four languages—Ket, Kott, Arin (Arrin), and Assan—of which only Ket (about 1,000 speakers) is still in use. The Luorawetlan family is usually divided into five languages: Chukchi (about 13,000 speakers), Koryak (about 8,000 speakers), Kamchadal, Aliutor, and Kerek. Kamchadal, Aliutor, and Kerek each has fewer than 350 speakers. With about 450 speakers, the only living language of the Yukaghir group is Yukaghir proper (or Odul), although the extinct Omok and Chuvan languages also belonged to this group. Gilyak (about 4,000 speakers) is an individual language unrelated to any of the other Paleosiberian groups.

A brief treatment of the Paleosiberian languages follows. For full treatment, *see* MACROPAEDIA: Languages of the World.

The Paleosiberian languages are spoken by a small number of people scattered over a wide area. Speakers of Luorawetlan languages, for example, live in the extreme northeast corner of Siberia and extend south into the Kamchatka Peninsula. Gilyak is spoken on and near the island of Sakhalin, just north of Japan. Far to the west, 2,400 miles (3,900 km) from Kamchatka, live speakers of the Yeniseian group. Yukaghir is found in only a few settlements, widely removed from one another. In the vast territories between all these groups, and among the groups themselves, live speakers of non-Paleosiberian language families like Uralic, Tungus, and Turkic.

The Paleosiberian languages, although unrelated, have been classed together since the middle of the 19th century. They were thought to have been the remnants of a greater language family that had once extended over a broader expanse of Asia, a hypothesis first proposed by Leopold von Schrenck. Yeniseian, Luorawetlan, and Yukaghir languages were in fact once spoken over a larger territory than they are today, and Gilyak probably extended further to the west. However, this does not imply that these languages had a common ancestor. There may have been an even greater diversity of language families in prehistoric Siberia before the advancement of Uralic, Tungus, and Turkic peoples.

Ket, Yukaghir, and Gilyak have not been shown to be genetically related to other language families like Sino-Tibetan, Caucasian, or Uralic, although many theories have been offered proposing such connections. In particular, a Yukaghir-Uralic hypothesis based on structural similarities between the two groups has been much discussed, but this remains to be conclusively demonstrated.

The Paleosiberian languages today are written in a Cyrillic-based script. The Yukaghir, and to some extent the Koryak as well, previously used a pictographic writing, cutting figures into birch bark. A literary language has now been established for each Paleosiberian language. Increasing bilingualism (with Russian) and continued education have helped shape emerging modern native literatures drawn on Russian models.

The numerous loanwords in the Paleosiberian languages can be traced to various sources. A large portion of borrowed vocabulary, especially technical terms, is from Russian. Most loanwords, however, come from Tungus (a branch of Altaic) and from Turkic languages like Yakut. Ket has some words from Selkup (a Uralic language), and Chukchi has a vocabulary from Eskimo. The reindeer terminology of Gilyak is borrowed from a Tungus language with which it is no longer in contact. Gilyak also has some words from Ainu, a language of northern Japan.

The four Paleosiberian groups share some linguistic features. They all make extensive use of compounding. Postvelar consonants (*i.e.,* sounds formed further back in the mouth than the sound of the letter *k*) are common. Another characteristic is that of vowel harmony. The Paleosiberian languages also show consonant alternations and, except in Yukaghir, rich consonant clusters.

Beyond this, the Paleosiberian languages have few similarities, and individual languages may resemble languages of other families more than they do each other. Gilyak, for example, shares certain grammatical categories with Japanese. Yukaghir shares some grammatical categories with Uralic, in particular a special conjugation for verbs with objects and another conjugation for negative verbs. Luorawetlan shows a tendency toward complex compounding and ergative constructions (where the agent is not expressed as subject). Ket is distinguished by its succinct verbal complexity.

Paleozoic Era, also spelled PALAEOZOIC, major interval of geologic time extending from 570 to 245 million years ago. It is the first era of the Phanerozoic Eon.

A brief treatment of the Paleozoic Era follows. For full treatment, *see* MACROPAEDIA: Geochronology.

Eras have traditionally been named to reflect major changes in the development of life on Earth. The Paleozoic, from the Greek for "ancient life," is followed by the Mesozoic ("intermediate life") and Cenozoic ("recent life"). The Paleozoic is divided into six periods: the Cambrian, Ordovician, Silurian, Devonian, Carboniferous, and Permian (*qq.v.*).

The early Paleozoic (roughly the first 160 million years) was characterized by widespread uplifts and downwarps of the Earth's crust, which resulted in mountain building and geosynclines (downward flexing) in parts of North America, Europe, and Asia. Great seas were formed in the southern areas of the emergent landmasses. Much of North America was covered by a warm shallow sea with many coral reefs. In the later Cambrian and subsequent periods, episodes of mountain building followed. There is no evidence of a cold climate during this time; glaciations once thought to belong to the Cambrian Period are now known to have taken place in Precambrian time.

Fossils from the early Paleozoic include such invertebrates as worms and primitive invertebrate shells like *Volborthella, Hyolithes,* and others. Indeed, it was during the Cambrian Period that many of today's invertebrate groups first came into being. In the Cambrian Period the trilobites, marine arthropods whose skeletons are divided into three longitudinal lobes, were the most abundant faunal group and are among the most frequently found fossil forms today. By the end of the Late Cambrian several marine life-forms were abundant: graptolites, cephalopods, brachiopods, and trilobites were the four dominant groups that gave rise to a flourishing fauna of bryozoans (marine colonial animals), mollusks such as the earliest gastropods (snails and slugs), ostracods (small bivalved crustaceans), eurypterids (large arthropods, now extinct), and others. Primitive fish also appeared during the early Paleozoic. The plants of this time were predominantly algae, with some mosses and ferns.

The late Paleozoic, which extended from about 410 to 245 million years ago, saw tremendous changes wrought in the Earth. Both plant and animal life flourished in the great, warm, shallow seas, and the various convolutions of the Earth laid down extensive mineral deposits. Much of the copper, gold, lead, zinc, and other minerals mined today derive from Devonian times in the late Paleozoic; and the mining activities in modern times have greatly expanded geologic knowledge about this time interval. Huge swampy forest regions covered much of the northern continents, and these were repeatedly and suddenly invaded by the seas, which buried the vegetation, then covered it with silt. When the sea subsequently withdrew, the forests revived and were again buried in rhythmic cycles that are now evident in deposits called cyclothems. Heat and pressure transformed the buried vegetation into the oil and coal so important to the modern world.

During the Devonian Period animal life emerged from the ocean, and various species adapted themselves to breathing air and moving about on land. This happened by way of the amphibians, which evolved with considerable diversity in the Carboniferous and Permian periods, ranging in length from several centimetres to 3 m (a few inches to 10 feet). When desert conditions began to prevail again in the Permian, the amphibians were succeeded by a new form, the reptiles, who could lay eggs in the desert that would hatch and bring forth young quite independent of water. The reptiles then developed rapidly into a number of diversely adapted species.

The late Paleozoic also saw the beginning of insect life. More than 500 species are known from fossils found in Carboniferous coal deposits, including dragonflies over 60 cm (2 feet) across and winged cockroaches measuring up to 30 cm (1 foot). Thus the first steps were taken for life-forms to invade the air, but it would be some time yet before the reptiles grew wings, which led eventually to that dominant aerial form, the birds.

Fishes underwent rapid development in the late Paleozoic. Sharks and sharklike forms were common; the largest, *Dinichthys* (now extinct), was more than 6.8 m (22 feet) long, with massive bony armour plates protecting its head and hinged to body armour around the neck region. The Sarcopterygii, the fleshy-finned bony fishes, developed the ability to breathe air, which enabled them to survive in deserts in times of drought: five genera of these Dipnoi still survive. The crossopterygian fishes gave rise to amphibians.

Late Paleozoic flora saw a profusion of land plants. Ferns grew to tree size in the Carboniferous forests. The cordaiteans, the precursors of the conifers, first appeared in the Lower Carboniferous.

Another development of the late Paleozoic was the occurrence of several major glaciations. South America, Africa, Antarctica, and Australia show early glacial deposits; such conditions threatened much warmwater life with extinction. A second and a third glaciation followed, and then, at the end of the Paleozoic Era, came one of the greatest crises in the history of life. The climate warmed, and there was no further glaciation for many millions of years. Of the life-forms adapted to cold water, most were nearly halved, both in variety and in numbers. On land, as well, some 75 percent of the amphibian families and more than 80 percent of the reptiles were extinct by the end of the Permian.

Palermo, ancient (Latin) PANORMUS, capital of the autonomous *regione* of Sicily in the Italian Republic and an important port since antiquity.

The city was founded by Phoenician traders in the 8th century BC. It later became a Carthaginian settlement until its capture by the Romans in 254 BC. The city decayed under Roman rule but prospered after AD 535, when the Byzantine general Belisarius recovered it from the Ostrogoths. The Arabs conquered Palermo in 831, and the city flourished as a centre of rich trade with North Africa. Palermo's golden age, however, came during the Norman era (1072–1194), when it was the capital of the Kingdom of Sicily.

A distinctive Arab-Norman architecture is represented by the cathedral, founded in 1185. From the same period date the Royal Palace, the churches of Santo Giovanni degli Eremiti (1132) and the Martorana (1143), and several country palaces around the city, such as the Cuba and the Zisa.

Norman rule in Sicily was replaced in 1194 by that of the German Hohenstaufen dynasty. The Hohenstaufen Holy Roman emperor Frederick II shifted the centre of imperial politics to southern Italy and Sicily, and the cultural brilliance of his court at Palermo was renowned throughout western Europe. The city declined under succeeding Hohenstaufen rulers. It was conquered by the French Charles of Anjou in 1266, but Angevin oppression was ended in 1281 by a popular uprising called the Sicilian Vespers. Palermo then came under Aragonese rule.

After 1412 the crown of Sicily was united with that of Aragon (and later Spain), and Palermo took on a new aspect of prosperity. In the 16th and 17th centuries Spanish viceroys fostered the reconstruction of the city, but the city experienced repeated risings of the urban poor.

In the wake of the War of the Spanish Succession (1701–14), Palermo passed for a short time under the rule of Victor Amadeus II of Savoy and, after 1718, of the Austrian Habsburgs. In the resettlement of Europe after the Napoleonic Wars, Sicily-Naples was given to the Spanish Bourbons. Revolts against Bourbon rule erupted in Naples in 1820 and 1848, and in 1860 Garibaldi liberated the city.

The Cathedral of Palermo, Italy
Alinari—Art Resource/EB Inc.

Palermo was attached to the newly reformed Kingdom of Italy and recovered its prosperity.

The city was severely bombarded in July 1943, when it was taken by Allied troops. In 1948 regional autonomy was granted to Sicily within the Italian Republic, and Palermo was restored as the leading city on the island. New industries developed in manufacturing, chemicals, and printing, but the problems of endemic poverty in parts of the city remain. The port operates both merchant and passenger lines to Tunisia and Naples and handles foreign trade. Citrus fruits, cereals, fresh fish, and chemicals are among Palermo's principal exports. Pop. (1989 est.) mun., 731,483.

Palermo Stone, one of the basic sources of information about the chronology and cultural history of Egypt during the first five dynasties (*c.* 2925–*c.* 2325 BC). Named for the Sicilian city where it has been preserved since 1877, the black basalt stone is one of six existing fragments, all similar in scale and arrangement, that probably originally stood in Egyptian temples or other important buildings. It is inscribed on both sides with horizontal lines of hieroglyphic text, the top row listing the names of predynastic rulers. The following rows, each headed by the name of a different king, are divided into compartments, each compartment signifying one year. Within the compartments the hieroglyphs always list one or more memorable events of that year. Thus the original monument was apparently a year-by-year record of all the kings from the 1st through the 5th dynasty, although the last name preserved on the stone is that of Neferirkare, the third of the nine kings of the 5th dynasty. The stone was probably copied under Shabaka, of the 25th dynasty, from an original on more perishable material.

The Palermo Stone, first side
By courtesy of the Regional Museum of Archaeology, Palermo

Palés Matos, Luis (b. March 20, 1898, Guayama, P.R.—d. Feb. 23, 1959, San Juan), poet, considered by many to be Puerto Rico's most distinguished lyric poet, who enriched the vocabulary of Spanish poetry with words, themes, symbols, images, and rhythms of African and Afro-American folklore and dance.

Palés Matos wrote his first poetry, which was collected in *Azaleas* (1915), in imitation of the fashionable modernist trends, but he soon found his own direction in his personal interpretation (as a white man) of black culture. His poems on black themes, published in periodicals, firmly established his literary reputation and gave impetus to the developing concern of Spanish-Americans with their African heritage.

Palés Matos, unlike some of his contemporaries and disciples in what became known as the Negro poetry movement, did not strive for authenticity. He preferred to evoke a culture as a poet rather than as a sociologist. For this freely inventive approach to black themes, he was sometimes criticized by those more concerned with accuracy than with poetic merit; his ironic, often skeptical note has been interpreted by some as condescension. His mastery of poetic form and language is acknowledged, however, even by those who find his approach offensive. Although he was best known and most influential for his "Negro poetry," his reflective and introspective personality found expression in poetry of many other moods and themes. *Poesía, 1915–56* (1957), a collection of much of his poetry, reveals his more personal side as a lyric poet and as a melancholy man, ill at ease in the modern world.

Palestine, region of the eastern Mediterranean, comprising parts of modern Israel and Jordan. The area referred to as Palestine today generally extends from the Mediterranean Sea on the west to the Jordan River on the east and from the international boundary of Israel and Lebanon in the north to Gaza in the south. In the 20th century the region has been the object of conflicting claims between Jewish and Arab national movements.

The territory was occupied in biblical times by the kingdoms of Israel and Judah. Also called the Holy Land, it is sacred in varying degrees to Judaism, Christianity, and Islām. For Judaism, Palestine, called Eretz Yisra'el ("Land of Israel"), has traditionally been the land promised by God, a uniquely sacred place, and the seat of national independence. For Christianity, it is the scene of the life and ministry of Jesus and the Apostles, with especially revered places. For Islām, certain sites associated with the Prophet Muḥammad are holy places. A local Palestinian Arab nationalism developed during the period of the Zionist settlement (from the early 1920s) and especially since the establishment of the State of Israel (1948); it claims Palestine as the homeland and domain of the Arab peoples who have inhabited it since the Muslim conquest in the 7th century.

A brief treatment of Palestine follows. For full treatment, *see* MACROPAEDIA: Palestine.

The name Palestine is derived from the Greek Palaistina, which comes from the Hebrew Pleshet ("Land of the Philistines"), referring to a small coastal area northeast of Egypt, also called Philistia. The Romans used the term Syria Palaestina in the 2nd century BC for the southern third of the province of Syria, including the former Judaea. The name Palestine was revived as an official title for a portion (all of the territory from the Jordan River westward to the Mediterranean coast) of a mandate given to the British after World War I.

Palestine's frontiers have fluctuated widely throughout history, but it has usually embraced the territory from the Mediterranean and the coastal plain in the west, through the transitional zone of Ha-Shefela, to the hill country of Judaea and Samaria, heartland of the ancient Hebrew kingdoms. The Wilderness of Judaea (Midbar Yehuda) slopes down eastward to the Jordan River valley, the northern section of the East African Rift system. In the south is the Negev, a dry, rugged area ending at the Gulf of Aqaba. In the north the broad, fertile Plain of Esdraelon divides Samaria (south) from the hill country of Galilee, the highest and best-watered part of Palestine as described here. In the east of Galilee lie the Sea of Galilee and the now-drained Ḥula Valley. Kings David and Solomon, however, ruled (*c.* 1000) over a kingdom that included much of modern Lebanon and Syria.

Palestine is a land of sharp contrasts; only 14 miles (23 km) separate an elevation of 2,694 feet (821 m) above sea level north of Jerusalem from the shores of the Dead Sea, approximately 1,312 feet (400 m) below sea level (lowest point on the Earth's land surface). The country has a moderate Mediterranean winter-rainfall climate, with average annual precipitation decreasing farther inland—*i.e.,* to the east.


The Wilderness of Judaea west of the Dead Sea (foreground), and the mountains of Moab (background), in Palestine
By courtesy of the Ministry of Culture and Information, Jordan

Settled since early prehistoric times, Palestine has been held by virtually every power of the Middle East, among them Egypt, Assyria, Babylonia, Persia, Alexander the Great's empire and those of his successors (the Ptolemies and Seleucids), the Romans, Byzantines, Umayyads, ʿAbbāsids, Fāṭimids, crusaders, Ayyūbids, Mamlūks, and Ottoman Turks. After World War I Palestine was administered by Great Britain under a mandate of the League of Nations; the mandate incorporated the Balfour Declaration of 1917, which stated that British policy favoured the establishment of a national home for the Jewish people in Palestine. Britain governed Palestine until 1948; its administration, however, satisfied neither the majority Arabs nor the growing Jewish population. After World War II Britain's continued rule of Palestine became untenable, and the problem was turned over to the United Nations General Assembly, which recommended (Nov. 29, 1947) the establishment of separate Arab and Jewish states in Palestine. The State of Israel was proclaimed on May 14, 1948, and the last British officials left Palestine. The regular armies of the surrounding Arab states, which did not recognize Israel's claim, entered Palestine. From the ensuing war, Israel emerged with about 50 percent more land than it had been allotted under the UN plan, including all of Galilee, the coast, a reduced Gaza Strip (occupied by Egypt), all of the Negev, and northwestern Jerusalem. About 720,000 Palestinian Arabs fled Israel and became refugees in surrounding Arab countries. In 1950 the Kingdom of Jordan formally annexed some 2,000 square miles (5,180 square km) on the west bank of the Jordan River (known since as the West Bank), which had been envisaged as part of an Arab state in the UN plan. (Jordan's action was not generally recognized.) The West Bank was seized and occupied by Israel in 1967, together with the Gaza Strip, the Sinai Peninsula, the Golan Heights, and East Jerusalem. Under the terms of the Camp David accords (1979), Israel returned the Sinai Peninsula to Egypt in 1979–82, but the West Bank, the Gaza Strip, the Golan Heights, and East Jerusalem remained in Israeli hands.

The Arab League at a summit meeting in Rabat (Morocco) in October 1974 recognized the Palestine Liberation Organization (PLO) as the sole spokesman for the Palestine Arabs. As enunciated in its 1969 charter, the PLO long claimed as its goal the elimination of Israel and the conversion of the territory encompassed by the Palestine mandate into an independent country of Muslims, Christians, and Jews. In 1988, however, the PLO for the first time expressed its support for a two-state solution to the Palestine problem—*i.e.,* the creation of a Palestinian state that would coexist with neighbouring Israel. (*See also* Arab-Israeli wars; Palestine Liberation Organization.)

Palestine Liberation Organization (PLO), Arabic MUNAẒẒAMAT AT-TAḤRĪR FILASṬĪNIYAH, umbrella political organization claiming to represent the world's estimated 4,450,000 Palestinians—those Arabs who lived in mandated Palestine before the creation there of the state of Israel in 1948, as well as their descendants. It was formed in 1964 to centralize the leadership of various Palestinian groups that previously had operated as clandestine resistance movements, but it came into prominence only after the Arab-Israeli war of June 1967. The movement is dedicated to the creation of a "democratic and secular" Palestinian state.

In the Palestine war of 1948 and in the subsequent hostilities, the Arab states took the lead in the fight against Israel, while their Palestinian fellow Arabs played a more or less passive role. After the defeat of the Arab states by Israel in the Six-Day War of 1967, the PLO came to be recognized as the spokesman of the Palestinians and the promoter of a distinctively Palestinian ideology.

Major factions within or associated with the PLO include Fatah (*q.v.*), the Popular Front for the Liberation of Palestine (*q.v.;* PLFP), and the Popular Democratic Front for the Liberation of Palestine (*q.v.;* PDFLP). Terrorist organizations connected with the PLO have included the Black September group of Fatah and the PLFP-General Command.

Membership within the PLO has varied with the reorganizations and internal disagreements of its constituent bodies. Moderate factions within the PLO are inclined to accept a negotiated settlement with Israel that would yield a Palestinian state. Other, more radical factions are steadfast in their goals of the destruction of Israel and its replacement with a secular state in which Muslims, Jews, and Christians would participate as equals. Funding for the PLO has been received from sympathetic nations and from taxes levied on the salaries of Palestinian workers.

In 1969 Yasir Arafat, leader of Fatah, the largest Palestinian group, was named chairman of the PLO. From the late 1960s, the PLO organized and launched military operations against Israel from its bases in Jordan. The PLO came into growing conflict with the government of King Hussein of Jordan in 1970, however, and in 1971 was forcibly expelled from Jordan by the Jordanian army. It shifted its bases to Lebanon.

From 1974 Arafat advocated the PLO's withdrawal from international terrorism outside of Israel and the world community's acceptance of the PLO as the legitimate representative of the Palestinian people. In 1974 the Arab heads of state recognized the PLO as the sole legitimate representative of all Palestinians. The PLO was admitted to full membership in the Arab League in 1976. The PLO was excluded from the negotiations between Egypt and Israel that resulted in 1979 in a peace treaty; the treaty returned the Israeli-occupied Sinai Peninsula to Egypt, but the negotiations failed to win Israel's agreement to the establishment of a Palestinian state in the West Bank and Gaza Strip. Continuing PLO attacks on Israeli territory from Syrian-occupied Lebanon led Israel to invade Lebanon on June 6, 1982, in an effort to neutralize Palestinian and Syrian troops based there. After several weeks of fighting, Israeli troops surrounded Beirut, which for several years had been the PLO's headquarters. As a result of negotiations, most Palestinians evacuated the Lebanese capital of Beirut for transportation to sympathetic Arab nations.

Increasing dissatisfaction with Arafat's leadership arose in the PLO after his withdrawal from Beirut to Tunis, Tun., and in 1983 Syrian-backed PLO rebels supported by Syrian troops forced Arafat's remaining troops out of Lebanon. Arafat retained the support of some Arab leaders and eventually was able to reassert his leadership of the PLO.

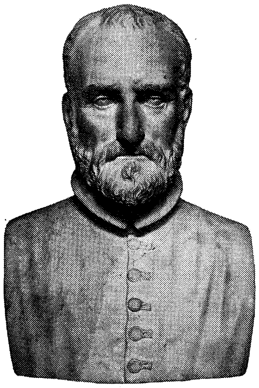
On Nov. 15, 1988, the PLO proclaimed the "State of Palestine," a kind of government-in-exile; and on April 2, 1989, the PLO's governing body, the Palestine National Council, elected Arafat president of the new quasi-state. The PLO during this period also recognized Israel's right to exist, thus appearing to drop its goal of eliminating Israel in favour of a policy accepting separate Israeli and Palestinian states, with the latter occupying the West Bank and the Gaza Strip. Negotiations between Israelis and Palestinians were inhibited, however, by many suspicions and barriers, including (1) Israel's statute of 1986 outlawing Israeli contacts with the PLO and (2) the persistence of militant PLO factions willing to pursue terrorist actions against Israel.

Palestinian Talmud, also called TALMUD YERUSHALMI, one of two compilations of Jewish religious teachings and commentary that was transmitted orally for centuries prior to its compilation by Jewish scholars in Palestine. The other such compilation, produced in Babylon, is called the Babylonian Talmud, or *Talmud Bavli. See* Talmud.

Palestrina (Italy): *see* Praeneste.

Palestrina, Giovanni Pierluigi da (b. *c.* 1525, Palestrina, near Rome—d. Feb. 2, 1594, Rome), Italian Renaissance composer of more than 105 masses and 250 motets, a master of contrapuntal composition.

Palestrina lived during the period of the Catholic Counter-Reformation and was a primary representative of the 16th-century conservative approach to church music.



Palestrina, portrait bust; in the Vatican Museums
By courtesy of the Vatican Museums

Life. Palestrina was born in a small town where his ancestors are thought to have lived for generations, but as a child he was taken to nearby Rome. In 1537 he was one of the choirboys at the basilica of Sta. Maria Maggiore, where he also studied music between 1537 and 1539. In 1544 Palestrina was engaged as organist and singer in the cathedral of his native town. His duties included playing the organ, helping with the choir, and teaching music. His pay was that of a canon and would have been received in money and kind. His prowess at the church there attracted the attention of the bishop, Giovanni Maria Ciocchi del Monte, who later became Pope Julius III.

In 1547 Palestrina married Lucrezia Gori. Three sons were born to them: Rodolfo, Angelo, and Iginio. Only the last outlived his father. In 1551 Palestrina returned to Rome, where he assumed the first of his papal appointments, as musical director of the Julian Chapel choir, and thus was responsible for the music in St. Peter's. Before he was 30 he published his first book of masses (1554), dedicated to Julius III, and the following year he was promoted to singer in the Pontifical Choir. About this time he became composer to the papal chapel. Palestrina repaid the Pope's patronage by composing a mass in his honour. Yet he did not neglect the secular side of his art, for his first book of madrigals (secular and spiritual part-songs) appeared in 1555, unfortunately at a time when the lenient regime of Julius III had given way to the sterner discipline of Paul IV. A decree of the new pope forbade married men to serve in the papal choir, and Palestrina, together with two of his colleagues, received a small pension by way of compensation for their dismissal.

For the next five years Palestrina directed the choir of St. John Lateran, but his efforts were continually thwarted by singers whose quality was almost as limited as their number, which was restricted because very little money was available for music. Nevertheless, he gained admission for his eldest son, Rodolfo, then about 13, as a chorister. Eventually he broke away from this uncongenial milieu. The chapter archives of St. John Lateran record that in July 1560 he and his son suddenly departed.

A year passed before Palestrina found employment. In March 1561 he accepted a new post at Sta. Maria Maggiore. This post was more congenial to him and he remained at it for about seven years. At the invitation of Cardinal Ippolito d'Este he then took charge of the music at the Villa d'Este in Tivoli, a popular summer resort near Rome. He was in the Cardinal's service for four years, at which time he also worked as music master for a newly formed Seminarium Romanum (Roman Seminary), where his sons Rodolfo and Angelo became students.

Palestrina received an offer in 1568 to become musical director at the court of the emperor Maximilian II in Vienna. He refused the position because of the low salary and a disinclination to leave Rome. Palestrina's terms were also too high when he was invited to the court at Mantua in 1583. The composer and the duke of Mantua, Guglielmo Gonzaga, an amateur musician of some pretensions, did become friends, however, and Palestrina was commissioned to write special compositions for the ducal chapel of Sta. Barbara.

With the death in 1571 of the composer Giovanni Animuccia, musical director at the Vatican since 1555, there was a chance for Palestrina to return to his old post as musical director of the Julian choir. The chapter, eager to have him back, increased the salary, and he forthwith returned to St. Peter's. When his growing fame as a composer prompted Sta. Maria Maggiore to rehire him, St. Peter's again raised his salary. In acknowledgment of his position as the most celebrated Roman musician, he was given in 1578 the title of master of music at the Vatican Basilica.

The series of epidemics that swept through central Italy in the late 1570s carried off his wife and his two elder sons, both of whom showed great musical promise. He himself fell seriously ill. Grieving over his wife's death, he announced his intention of becoming a priest, to the delight of the pope, Gregory XIII. After having been made a canon, however, he renounced his vows in order to marry (1581) Virginia Dormoli, widow of a wealthy merchant. Although he spent considerable time administering her fortune, he retained his position at St. Peter's and continued to compose.

Although an attempt in 1585 to make Palestrina musical director of the Pontifical Choir proved abortive, he was considered by all the popes under whom he served as the official composer for the choir, and it is recorded that he marched at the head of the pontifical singers on the occasion of erecting the great Egyptian obelisk in the piazza of St. Peter's.

Pope Gregory XIII had commissioned Palestrina and Annibale Zoilo to restore the plainchant, or plainsong (a traditional liturgical chant sung in unison), then in use to a more authentic form. The task proved too great, and Palestrina's editorial work gave way to a flow of creative music. Much of it was published during the last 12 years of his life, including volumes of motets (choral compositions based on sacred texts), masses, and madrigals. He also helped to found an association of professional musicians called the Vertuosa Compagnia dei Musici.

Two years before Palestrina's death, the new pope, Clement VIII, increased his pension, and the same year, in a singular mark of respect and admiration, fellow composers paid their elderly senior the compliment of writing 16 settings of the Vesper Psalms to his praise. In return, Palestrina sent them a motet on the appropriate text: *Vos amici mei estis* "You are my friends, if you do what I teach, said the Lord."

Music. Palestrina's musical output, though vast, maintained a remarkably high standard in both sacred and secular works. His 105 masses embrace many different styles, and the number of voices used ranges from four to eight. The time-honoured technique of using a cantus firmus (preexistent melody used in one voice part) as the tenor is found in such masses as *Ecce sacerdos magnus; L'Homme armé; Ut, re, mi, fa, sol, la; Ave Maria; Tu es Petrus;* and *Veni Creator Spiritus.* These titles refer to the source of the particular cantus firmus. Palestrina's mastery of contrapuntal ingenuity may be appreciated to the fullest extent in some of his canonic masses (in which one or more voice parts are derived from another voice part). His ability to ornament and decorate a solemn plainchant, making it an integral part of the texture and sometimes almost indistinguishable from the other, freely composed parts, is evident from some of his masses based on hymn melodies.

By far the greatest number of masses employ what has come to be known as the parody technique, by which a composer made use either of his own music or that of others as a starting point for the new composition. Many other masses derive from musical ideas by Palestrina's predecessors or contemporaries. Yet another type of mass is demonstrated by the nine works written for Mantua; in these the Gloria and Credo sections are so arranged that plainsong and polyphony alternate throughout. Finally, there is a small but important group of masses that are in free style, the musical material being entirely original. Perhaps the best known example is the *Missa brevis* for four voices.

Palestrina's motets, of which more than 250 are extant, display almost as much variety of form and type as do his masses. Most of them are in some clearly defined form, occasionally reflecting the shape of the liturgical text, though comparatively few are based on plainsong. Many of them paraphrase the chant, however, with an artistry that is every bit as successful as that of the masses. On the same level as the canonic masses are such motets as *Cum ortus fuerit* and *Accepit Jesus calicem,* the latter apparently a favourite of the composer's—an assumption justified because he is depicted holding a copy of it in a portrait now in the Vatican.

His 29 motets based on texts from the Song of Solomon afford numerous examples of "madrigalisms": the use of suggestive musical phrases evoking picturesque features, apparent either to the ear or to the eye, sometimes to both. In the offertories, Palestrina completely abandons the old cantus firmus technique and writes music in free style, whereas in the hymns he paraphrases the traditional melody, usually in the highest voice. In the *Lamentations of Jeremiah* he brings effective contrast to bear on the sections with Hebrew and Latin text, the former being melismatic (floridly vocalized) in style and the latter simpler and more solemn. His Magnificats are mainly in four sets of eight, each set comprising a Magnificat on one of the eight "tones": *alternatim* structure is used here as in the Mantua masses.

Although Palestrina's madrigals are generally considered of less interest than his sacred music, they show as keen a sense for pictorial and pastoral elements as one finds in any of his contemporaries. Over and above this, he is to be remembered for his early exploitation of the narrative sonnet in madrigal form, notably in *Vestiva i colli,* which was frequently reprinted and imitated. His settings of Petrarch's poems also are of an exceptionally high order.

At the end of the 19th century the view that Palestrina represented the loftiest peak of Italian polyphony was in some ways detrimental to his reputation, for it cast his music into rigid preconceptions. Even more unfortunate was the insistence on "counterpoint in the style of Palestrina" in the examination requirements of academies and universities, for such requirements stultified a style that Palestrina had used with great flexibility. Generations of fledgling composers were taught to revere the music of Palestrina as a symbol of all that was pure in ecclesiastical counterpoint. Indeed, the greater part of his musical output, and in particular his masses (where his unerring sense of tonal architecture may be heard at its best), still remains worthy of admiration.

Palestrina, unlike Bach, did not have to be rediscovered in the 19th century, though the dissemination of his achievement was helped by the interest of Romantic composers. There always was a Palestrinian tradition, mainly because his music supplied the need for a well-regulated formal system to be used by the embryonic composer in presenting himself to the musical world. Strict counterpoint was associated with a technique acquired in this way. In his day, Palestrina was a senior figure who, utilizing the dominant style of his time, created works notable for their spiritual qualities and technical mastery.

(D.W.S.)

MAJOR WORKS. *Masses.* 105 masses, including *Ecce sacerdos magnus* (published 1554), *De Beata Virgine* (1567), *Papae Marcelli* (1567), *L'Homme armé* (1570), *Lauda Sion* (1582), *O magnum mysterium* (1582), *Aeterna Christi munera* (1590), *Jam Christus astra ascenderat* (1590), *Dum complerentur* (1599), *Tu es Petrus* (1601), *Veni Creator Spiritus* (1888).

Motets. More than 250, for 4, 5, 6, 7, 8, and 12 voices, including a set of 29 motets based on the Song of Solomon (1584); *Assumpta est Maria* (1572); three settings of *Alma Redemptoris Mater;* three settings of *Lauda Sion.*

Madrigals. Spiritual madrigals for three, four, and five voices; secular madrigals for various voices.

Other vocal music. Including 68 Offertories, 13 complete sets, Lamentations, 12 Litanies, 20 Psalms, 35 Magnificats (mainly in four sets of eight, each set comprising a work on one of the eight "tones").

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Paley, William (b. July 1743, Peterborough, Northamptonshire, Eng.—d. May 25, 1805, Lincoln, Lincolnshire), English Anglican priest, Utilitarian philosopher, and author of influential works on Christianity, ethics, and science, among them the standard exposition in English theology of the teleological argument for the existence of God.

His major works are *The Principles of Moral and Political Philosophy* (1785), the subject of lectures at the University of Cambridge; *A View of the Evidence of Christianity* (1794), which was required reading for entrance to Cambridge until the 20th century; and *Natural Theology* (1802), based on John Ray's *Wisdom of God Manifested in the Works of the Creation* (1691). In *Natural Theology*, Paley used the analogy of the watch: both the world and the watch presuppose a maker. The book strongly influenced Charles Darwin.

Paley, William S(amuel) (b. Sept. 28, 1901, Chicago), U.S. broadcaster, first president (1928–46) and chairman of the board (1946–82) of Columbia Broadcasting System (CBS).

Paley was the son of an immigrant Russian who conducted a thriving cigar business in Chicago. The family moved to Philadelphia when Paley was ready for college, and he entered the Wharton School of Finance at the University of Pennsylvania. There he earned a bachelor's degree and entered the new cigar business the family had set up in Philadelphia. He became vice president, and he signed an early radio advertising contract for the firm's products. He became convinced that radio advertising had an important future, and when the opportunity appeared he bought a small radio network, which in 1929 he renamed Columbia Broadcasting System. He promptly began to build it into one of the world's leading radio and television networks. Paley retained or hired such entertainment stars as Bing Crosby, Kate Smith, the Mills Brothers, Will Rogers, Eddie Cantor, and Bob Hope, luring some of them from rival networks.

During World War II Paley served the U.S. government as supervisor of the Office of War Information (OWI) in the Mediterranean, and later as chief of radio in the OWI's Psychological Warfare Division (1944–45), finally becoming deputy chief of the Psychological Warfare Division.

Back at CBS after the war Paley supported and encouraged Edward R. Murrow in building an outstanding news staff. In 1966 Paley waived the CBS mandatory retirement rule so that he could remain active as chairman of the board. He remained as chairman until 1983. He won many honours, including the U.S. Order of Merit, the French Croix de Guerre, and the Italian Order of the Crown.

Pālghāt, town, administrative headquarters of Pālghāt district, central Kerala state, southwestern India. The town lies on the Ponnāni River in a break in the Western Ghāts range known as the Pālghāt Gap. Its location has always given the town strategic and commercial importance. It is a marketplace for grain, tobacco, textiles, and timber; its industries include tobacco processing, rice milling, weaving, and light manufacturing. In Pālghāt are Government Victoria College (established 1888) and an engineering college. Across the river, to the north, is the rail junction of Olavakod. Pālghāt has an ancient fort, captured by the British temporarily in 1783 and permanently in 1790.

Pālghāt district, 1,699 sq mi (4,400 sq km) in area, mostly consists of a stretch of coastal plain between the Ghāts and the Arabian Sea; the hills of the Ghāts extend into the district's southeastern corner. Ponnāni, 50 mi (80 km) to the west, is its outport. Pop. (1981) town, 111,245; metropolitan area, 117,956; district, 2,044,399.

Pālghāt Gap, major break in the Western Ghāts mountain range, in southwestern India. Located between the Nīlgiri Hills (north) and the Anaimalai Hills (south), it is about 20 mi (32 km) wide and straddles the Kerala–Tamil Nādu border, serving as a major communication route between these two states. Highways and rail lines through the gap connect Pālghāt in Kerala with Coimbatore and Pollāchi in Tamil Nādu. Pālghāt Gap also influences southern India's climate; the southwest monsoons as well as storms from the Bay of Bengal cross the mountains through the opening.

Palgrave, Francis Turner (b. Sept. 28, 1824, Great Yarmouth, Norfolk, Eng.—d. Oct. 24, 1897, London), English critic and poet, editor of the influential anthology *The Golden Treasury.*

Palgrave spent many years in the education department of the civil service and from 1885 to 1895 was professor of poetry at Oxford. He was a friend of many notables of the time: the statesman William Gladstone (to whom in 1846 he was assistant private secretary) and the poets Robert Browning, Alfred Tennyson, and Matthew Arnold. Of his original verse, *Visions of England* (1880–81) is the best known. His greatest service to poetry, however, was his compilation of *The Golden Treasury of English Songs and Lyrics* (1861), a comprehensive,

Palgrave, chalk drawing by Samuel Lawrence, 1872; in the National Portrait Gallery, London
By courtesy of the National Portrait Gallery, London

well-chosen anthology, carefully arranged in its sequence. Palgrave's choice of poems was made in consultation with Tennyson. The *Anthology* had great influence on the poetic taste of several generations and was of particular value in popularizing Wordsworth. The original selections were modified in later editions.

Pāli, town, administrative headquarters of Pāli district, Rājasthān state, northwestern India, just north of the Bāndi River, a tributary of the Lūni. A trade centre in ancient times, Pāli is divided into an ancient and modern quarter; it has several historic temples. Now chiefly an agricultural market centre, it is connected by road and rail with Beāwar and Jodhpur. Industries include textile and oil mills, cotton printing and dyeing, copper working, and ivory and sandalwood handicrafts. Pāli has a hospital and also a college affiliated with the University of Rājasthān.

Pāli district (4,784 sq mi [12,391 sq km]), formerly a part of Jodhpur princely state, comprises a tract of plain bordered (east) by the Arāvalli Range and drained by the Lūni River and its tributaries. The district has oil and textile mills, metalworks, and cotton-ginning factories. The chief crops include wheat, jowar (sorghum), oilseeds, and cotton. Pop. (1981) town, 91,568; district, 1,274,504.

Pāli language, sacred language of the Theravāda Buddhist canon, a Middle Indo-Aryan language of north Indian origin. On the whole, Pāli seems closely related to the Old Indo-Aryan Vedic and Sanskrit dialects but is apparently not directly descended from either of these. Its use as a Buddhist canonical language came about because the Buddha opposed the use of Sanskrit, a learned language, as a vehicle for his teachings, and encouraged his followers to use vernacular dialects. In time, his orally transmitted sayings spread through India to Ceylon (*c.* 3rd century BC), where they were written down in Pāli (1st century BC), a literary language of rather mixed vernacular origins. Pāli eventually became a revered, standard, and international tongue. The language and the Theravāda canon known as *Tipiṭaka* (Sanskrit *Tripiṭaka*) were brought to Burma, Thailand, Cambodia, Laos, and Vietnam. Pāli died out as a literary language in mainland India in the 14th century but survived elsewhere until the 18th.

Pāli literature, body of canonical texts and commentaries in the sacred Pāli language of Theravāda Buddhism. *See* Tipiṭaka.

Palikao, Charles-Guillaume-Marie-Apollinaire-Antoine Cousin-Montauban, comte de (count of): *see* Cousin-Montauban, Charles-Guillaume-Marie-Apollinaire-Antoine.

Palimé, formerly KPALIMÉ, town, Kloto *préfecture,* in Plateaux economic *région,* southwestern Togo, western Africa, situated about 70 miles (110 km) northwest of Lomé, the national capital. The town lies in a mountainous area important for cultivation of coffee, cacao, and oil palms. A large portion of these crops is transported from Palimé by road and rail to Lomé. Palimé serves as a major centre for commercial trade in Togo. The Ewe people inhabit the town and surrounding area. Pop. (1981) 27,669.

palimpsest, manuscript in roll or codex form carrying a text erased, or partly erased, underneath an apparent additional text. The underlying text is said to be "in palimpsest," and, even though the parchment or other surface is much abraded, the older text is recoverable in the laboratory by such means as the use of ultraviolet light. The motive for making palimpsests usually seems to have been economic—reusing parchment was cheaper than preparing a new skin. Another motive may have been directed by Christian piety, as in the conversion of a pagan Greek manuscript to receive the text of a Father of the Church.

palindrome, word, number, sentence, or verse that reads the same backward or forward. The term derives from the Greek *palin dromo* ("running back again").

Examples of word palindromes include "civic," "madam," "radar," and "deified." Numerical palindromes include sequences that read the same in reverse order (*e.g.,* 1991), as well as those that can be read upside down and backward (*e.g.,* 1961). Examples of sentences include "Able was I ere I saw Elba" and "Lewd did I live & evil I did dwel." Examples of verse include (in Latin) "Roma tibi subito motibus ibit amor" and "Signa te, signa temere me tangis et angis." Some persons have refined upon the palindrome and composed verses each word of which is the same read backward as forward—for instance, that of William Camden:

> Odo tenet mulum, madidam mappam tenet Anna,
> Anna tenet mappam madidam, mulum tenet Odo.

The following is still more complicated, as it can be read in four ways—upward and downward as well as backward and forward:

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S A T O R
A R E P O
T E N E T
O P E R A
R O T A S
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This Latin palindromic square, which was found on a Roman wall in Cirencester, Eng., and in Pompeii, Italy, may be translated: "Arepo the sower holds the wheels with care." As late as the 19th century it was graven on amulets and charms and laid upon pregnant women to ensure safe delivery. Like the sign of the fish (an acrostic: Greek *ichthys,* "fish," happens to have the first letters of the Greek words for Jesus Christ, God's son, Saviour), the square may have been used to identify fellow Christians in the days of persecution, for its letters form a cross with the word *tenet* and can be arranged in the cross

```
        P
        A
        T
        E
        R
PATERNOSTER
        O
        S
        T
        E
        R
```

with four letters remaining: *A, O, A,* and *O.* These, placed at the extremities, can represent alpha and omega. Though some, because of the early date of the eruption that destroyed Pompeii (AD 79), suggest a Jewish origin, the threefold Christian symbols, cross, prayer, and quotation, seem to confute them; moreover, the letters of the square can be rearranged to spell *Oro Te, Pater; oro Te, Pater; sanas:* "I pray to thee, Father. Thou healest." Thus the palindrome, now merely a game, had a serious beginning.

Palio, The, Italian CORSO DEL PALIO ("Course of the Banner"), festival of medieval origin conducted annually in certain Italian cities and featuring bareback horse races. Best known to foreigners is the Palio of Siena. Horse racing in Siena dates from 1232. The Palio was first held in 1482 as a civic celebration. The current course was formally established in 1659 and has been held semiannually on July 2 and on August 16 since 1701, except during wartimes. Lasting about a minute, the race consists of three turns around the Piazza del Campo, the main city square.

Preceding the horse race, a splendid parade is staged by representatives of the 17 ward organizations of the city, called *contrade,* which now function as social clubs but which in the European Middle Ages were rival military companies. Ten *contrade* compete in each race, which is run with intense partisan spirit, rampant distrust, and occasional scuffles. It is widely acknowledged that the outcome is determined by bribery. Each *contrada* hires a professional jockey to dress in the 15th-century costume in its colours. Riding without saddle or stirrups, whipping their competitors' horses as they race for the Palio (Latin term for the silk standard painted in black and gold), the riders finish with cannon fire signaling the end of the race. Though the race is considered a secular event, each horse is blessed in the church of its *contrada* by the parish priest before the race begins. The festival is enhanced by drummers and flag throwers who demonstrate their arts using the colourful banners of their respective *contrade.*

Palisa, Johann (b. Dec. 6, 1848, Troppau, Silesia [now Opava, Czech.]—d. May 2, 1925, Vienna, Austria), Silesian astronomer best known for his discovery of 120 asteroids. He also prepared two catalogs containing the positions of almost 4,700 stars.

Palisa briefly was an assistant astronomer at the observatories in Vienna and Geneva before being appointed director (1872–80) of the Austro-Hungarian naval observatory at Pola (now Pula, Yugos.), a position that carried with it the rank of commander. From 1880 to 1919 he was a member of the staff at the Vienna Observatory. By 1891, when the photographic plate was first used in astronomy, he had found 83 of the 120 asteroids he eventually identified by visual observation alone. His star catalogs were published in 1899, 1902, and 1908.

Palisades, The, sandstone bluffs 200–540 feet (60–165 m) high along the west side of the Hudson River, southeastern New York and northeastern New Jersey. They are an extension of the Catskill Mountains. Rising vertically from near the water's edge, they are characterized by uplifts, faults, and columnar structure developed by slow cooling of molten material near the end of the Triassic period (245 to 208 million years ago). The Palisades Interstate Park Commission, established in 1900 and headquartered in Bear Mountain, N.Y., oversees 16 park units along the river, occupying a total area of 77,321 acres (31,292 hectares), mostly in New York but also including one park in New Jersey. Linking the various units is the 42-mile (68-kilometre) Palisades Interstate Parkway, extending northward from George Washington Bridge, Fort Lee, N.J., to Bear Mountain Bridge, N.Y. The largest unit is Harriman State Park (46,181 acres [18,689 hectares]). Facilities for hiking, swimming, fishing, boating, camping, picnicking, and skiing are available.

The term Palisades, now quasi-generic for a line of cliffs, was apparently first used in reference to these columnar formations along the Hudson.

Palissy, Bernard (b. 1509, St. Avit, near Lacapelle Biron, Fr.—d. 1590, Paris), French Huguenot potter and writer, particularly associated with decorated rustic ware, a type of earthenware covered with coloured lead glazes sometimes mistakenly called faience (tin-glazed earthenware).

Palissy began as a painter of glass, but, after journeys in the south and in the Ardennes brought him into contact with humanists, he settled as a surveyor and potter in Saintes, near La Rochelle. Persecuted as a Protestant, he was imprisoned until the constable of Montmorency employed him in the decoration of the Château d'Ecouen. His appointment, about 1565, as "inventor of rustic pottery to the king and the queen mother" enabled him to work in Paris. In 1570, helped by his sons, he built a pottery grotto for Catherine de Médicis in the garden of the Tuileries.

From 1575, in Paris, Palissy gave public lectures on natural history, which, published as *Discours admirables* (1580; Eng. trans. *Admirable Discourses*), became extremely popular, revealing him as a writer and scientist, a creator of modern agronomy, and a pioneer of the experimental method, with scientific views generally more advanced than those of his contemporaries. After seeing a white glazed cup, probably Chinese porcelain, he determined to discover the secrets of its manufacture. His early researches are described in *De l'art de la terre.*

As the struggle against Protestants grew, Palissy took refuge in the homes of the Princess of Sedan and Robert de la Marck in eastern France, returning to Paris in 1575. Imprisoned in the Conciergerie for religious reasons in 1588, he was transferred to the Bastille, where he died.

Palissy's pottery generally consists of oval or circular dishes, ewers, and sauceboats, decorated with plants and animals and allegorical and mythological scenes. Some of his pottery had marbled reverse surfaces, and some pieces were reproductions of objects by such leading French metalworkers of the 16th century as François Briot.

Palissy probably did not use the potter's wheel. His best-known pieces were apparently pressed into a mold and finished by modeling or the application of ornament molded in relief. His authentic productions bear no signature or mark. His molds were used later during the 17th century at Avon near Fontainebleau and at Manerbe, Calvados, where a few lead-glazed earthenware statuettes were made. Between 1840 and 1870 copies were executed by Jean-Charles Avisseau of Tours and by Georges Pull of Paris.

Consult the INDEX *first*

Palk Strait, inlet of the Bay of Bengal, between southeastern India and northern Sri Lanka and bounded on the south by Pāmban Island (India), Adam's (Rama's) Bridge (a chain of shoals), and Mannar Island (Sri Lanka). The strait is 40–85 miles (64–137 km) wide and 85 miles long. It receives several rivers, including the Vaigai (India), and it contains many islands of Sri Lanka. The port of Jaffna, the commercial centre for northern Sri Lanka, has trade with the state of Tamil Nādu, India. The southwestern portion of the strait is also called Palk Bay.

Pālkonda Hills, series of ranges in southern Andhra Pradesh state, southern India. The hills trend northwest to southeast and form the central part of the Eastern Ghāts. Geologically they are relics of ancient mountains formed during the Cambrian Period (500,000,000 to 570,000,000 years ago) that were subsequently eroded by the Penner River and its tributaries. The Punchu and Cheyyeru rivers join in a spectacular confluence in a gorge in the corridor between the Velikonda and the Pālkonda Hills. Formed of quartzites, slates, and lavas, the Pālkondas reach an elevation of 3,000 ft (900 m) in the south. The valleys between the mountains are drained by streams, many of which, having been dammed for storage tanks, provide irrigation for cultivation. The main crops are jowar (sorghum) and peanuts (groundnuts).

P'alkwanhoe (Korean: Assembly of P'alkwan), most important of Korea's ancient national festivals, a ritualistic celebration that was essentially Buddhist in form but tinged with elements of Taoism and indigenous folk beliefs. Some historians think P'alkwanhoe was originally a state-sponsored cultural festival that developed from the harvest festivals of earlier days. The festival, which seems to have been firmly established in AD 551 at a time when Buddhism was recognized as the state religion, was conducted by Buddhist priests and apparently included prayers for the welfare of the state. During the festival, lamps were lit, incense was burned, the royal palace was elaborately decorated, and there was joyous singing and dancing. The king participated by receiving congratulations from foreign merchants, provincial ministers, and ordinary citizens and by dispensing food and even wine, which was forbidden at other times. The royal P'alkwan treasury (P'alkwanbo) took care of all expenses but sometimes relied on contributions from the aristocracy.

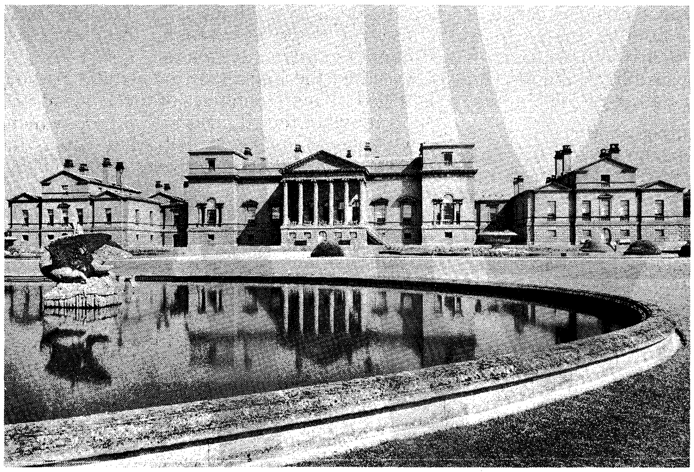
The festival still survives in certain rural areas of Korea and includes prayers to heaven, mountains, rivers, and the dragon.

pall (liturgical vestment): *see* pallium.

pall-mall, French PAILLE-MAILLE (from Italian *pallamaglio, palla,* "ball," and *maglio,* "mallet"), obsolete game of French origin, resembling croquet. An English traveller in France mentions it early in the 17th century, and it was introduced into England in the second quarter of that century. Thomas Blount's *Glossographia* (1656) described it as "a game wherein a round bowle is with a mallet struck through a high arch of iron (standing at either end of an alley) which he that can do at the fewest blows, or at the number agreed on, wins. This game was heretofore used in the long alley near St. James's and vulgarly called Pell-Mell." The pronunciation here described as vulgar afterward became classic, a famous London street having been named after a pall-mall alley. A mallet and balls used in the game were found in 1845 and are now in the British Museum: the mallet resembles that used in croquet, but its head is curved; the balls are of boxwood and about one foot in circumference. The 17th-century diarist Samuel Pepys described the alley as of hard sand "dressed with powdered cockle-shells." The length of the alley varies, the one at St. James being close to 800 yards long.

Palladian window, in architecture, three-part window composed of a large, arched central section flanked by two narrower, shorter sections having square tops. This type of window, popular in 17th- and 18th-century English versions of Italian designs, was inspired by the so-called Palladian motif, similar three-part openings having been featured in the work of the 16th-century Italian architect Andrea Palladio; his basilica at Vicenza, designed in 1546, was especially rich in these. Because the motif was first described in the work *L'architettura* (1537), by the Italian architect Sebastiano Serlio, it is also known as the Serlian motif, or Serliana, and the window derived from it may be called a Serlian window. It is also sometimes referred to as a Venetian window.

Palladianism, style of architecture based on the writings and buildings of the humanist and theorist from Vicenza, Andrea Palladio (1508–80), perhaps the greatest architect of the latter 16th century and certainly the most influential. Palladio felt that architecture should be governed by reason and by the principles of classical antiquity as it was known in surviving buildings and in the writings of the 1st-century-BC architect and theorist Vitruvius. Palladianism bespeaks rationality in its clarity, order, and symmetry, while it also pays homage to antiquity in its use of classical forms and decorative motifs. Few architects beyond Palladio's immediate disciple Vincenzo Scamozzi (1552–1616) were interested in pursuing the most erudite aspect of Palladio's work—his investigation of harmonic proportions—and in the hands of all too many followers of the next two centuries, Palladianism tended to become a sterile academic formula devoid of Palladio's own forcefulness and poetry. His true heirs have been those, from Gian Lorenzo Bernini (1598–1680) to the contemporary American architect John Hejduk, who have reinvestigated the basic principles of his architecture from other viewpoints.



Holkham Hall, by William Kent, Palladian style, begun 1734, Norfolk, Eng.
A.F. Kersting

Inigo Jones, who introduced Palladian architecture into England, might be said to be one of those, as his works were not copies of Palladio's buildings but, rather, re-creations in the same spirit. Upon his return from a trip to Italy (1613–14), Jones created a Palladian style in London; this style was based upon the knowledge he had acquired from his study of Palladio's writings and from his own first-hand examination of ancient and Renaissance architecture. Outstanding among the preserved examples are the Queen's House at Greenwich (completed 1635), the Banqueting House at Whitehall (1619–22), and the Queen's Chapel at St. James Palace (1623).

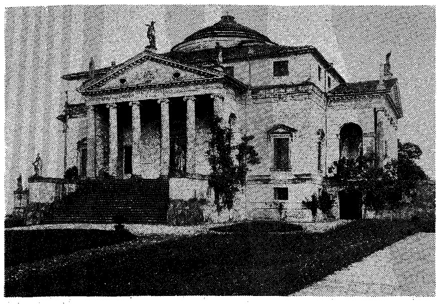
At the beginning of the Georgian period (1714–1830), a second and more consuming interest in Palladio developed. Partly as a reaction to the grandiose architecture of the later Stuarts, the newly powerful Whigs expressed a desire to return to a more rational and less complicated style. Their wish coincided with the publication of an English translation of Palladio's treatise *I quattro libri dell' architettura* (1570; *Four Books on Architecture,* 1715) and the first volume of Sir Colin Campbell's study of classical buildings in Great Britain, *Vitruvius Britannicus* (1715). Campbell, the first practitioner of the new and more literal English Palladianism, built Houghton Hall in Norfolk (begun 1722) and Mereworth Castle in Kent (*c.* 1722). The wealthy amateur architect Richard Boyle, 3rd earl of Burlington, and his protégé William Kent complete the triumvirate responsible for the second phase of the style. Burlington's home, Chiswick House (begun 1725), was designed by him as a reinterpretation of Palladio's Villa Rotonda. Holkham Hall, Norfolk (begun 1734), was built by Kent, who is also credited with having invented the English landscape garden.

In the 18th century a revival of Palladianism in England spread to Italy and thence throughout most of Europe and the American Colonies. Among the notable architects of this movement were Francesco Maria Preti in Italy, Thomas Jefferson in America, Georg Knobelsdorff in Germany, and Pieter Post and Jacob van Campen in the Netherlands. The style spread to Russia through the work of the Scottish-born Charles Cameron and the Italian Giacomo Quarenghi, and it was also important in Sweden and Poland. By shortly after 1800 the style had succumbed everywhere to a new taste for classicism derived directly from antiquity instead of seen through Palladio's Renaissance eyes.

Palladio, Andrea, original name ANDREA DI PIETRO DELLA GONDOLA (b. Nov. 30, 1508, Padua, Republic of Venice—d. August 1580, Vicenza), Italian architect, regarded as the greatest architect of 16th-century northern Italy. His designs for palaces (palazzi) and villas, notably the Villa Rotonda (1550–51) near Vicenza, and his treatise *I quattro libri dell'architettura* (1570; *The Four Books of Architecture,* 1716) made him one of the most influential figures in Western architecture.

Early life and works. Palladio was born in the northern Italian region of the Veneto, where, as a youth, he was apprenticed to a sculptor in Padua until, at the age of 16, he moved to nearby Vicenza and enrolled in the guild of the bricklayers and stonemasons. He was employed as a mason in workshops specializing in monuments and decorative sculpture in the style of the Mannerist architect Michele Sanmicheli of Verona.

Between 1530 and 1538 Count Gian Giorgio Trissino, a Humanist poet and scholar, was rebuilding his villa at Cricoli outside Vicenza in the ancient Roman, or classical, style. Palladio, working there as a mason, was noticed by Trissino, who undertook to expand his practical experience with a Humanist education. The Villa Trissino was rebuilt to a plan reminiscent of designs of Baldassarre Pe-



Villa Rotonda, near Vicenza, Italy, by Andrea Palladio, 1550–51
Osvaldo Bohm

ruzzi, an important High Renaissance architect. Planned to house a learned academy for Trissino's pupils, who lived a semimonastic life studying mathematics, music, philosophy, and classical authors, the villa represented Trissino's interpretation of the ancient Roman architect and theorist Vitruvius (active 46–30 BC), whom Palladio was later to describe as his master and guide. The name Palladio was given to Andrea, after a Humanist habit, as an allusion to the mythological figure Pallas Athena and to a character in Trissino's poem "Italia liberata dai goti." It indicates the hopes Trissino had for his protégé.

At the Villa Trissino, Palladio met the young aristocracy of Vicenza, some of whom were to become his patrons. By 1541 he had stylistically assimilated the Mannerist works of Michele Sanmicheli and the High Renaissance buildings of Jacopo Sansovino, whose library of St. Mark's in Venice had been begun in 1536. He had probably been introduced in Padua to Alvise Cornaro, whose designs were the first to import the Roman Renaissance style to northern Italy. Palladio may also have met a prominent Mannerist architect and theoretician, Sebastiano Serlio, who was in Venice at that time and whose third and fourth books on architecture (*L'architettura;* 1540 and 1537, respectively) were to be an inspiration to him.

In about 1540 Palladio designed his first villa, at Lonedo for Girolamo de' Godi, and his first palace, in Vicenza for Giovanni Civena. The Villa Godi has a plan clearly derived from the Villa Trissino but with similarities to traditional Venetian country houses. It contains all the elements of Palladio's future villa designs, including symmetrical flanking wings for stables and barns and a walled courtyard in front of the house. In elevation the Palazzo Civena is close to the High Renaissance palace type developed in the early 16th century in Rome. In plan it resembles Sanmicheli's Palazzo Canossa (*c.* 1535) in Verona. An innovative feature is the use of traditional arcaded pavement of northern Italy behind the main elevation, an idea that Palladio reinterpreted in imitation of an ancient Roman forum.

Visits to Rome and work in Vicenza. In 1541 and again in 1547 Palladio visited Rome with Trissino. These visits greatly affected his palace designs. On them, he saw the work of the greatest architects of the Roman High Renaissance style, Donato Bramante, Peruzzi, and Raphael, generally more remembered for his painting than for his architecture. He also measured ancient Roman antiquities, notably the baths. Palladio's principal ideas on palace design were formed between his first works of 1540 and his visit to Rome in 1554–56.

In 1546 Palladio prepared designs for the reconstruction of the 15th-century town hall in Vicenza, known since then as the Basilica, and in 1548 these plans were accepted, though much earlier designs, drawn in 1534 by the Mannerist architect and painter Giulio Romano and by several other distinguished architects, had been previously rejected. This was his first major public commission, and the work, which was not actually finished until 1617, involved recasing a vast hall with a two-story arcade of white stone to serve as a buttress to the old structure. Suited to both the Gothic style of the original structure and the dimensions of the classical orders, Palladio's arcade was of great proportional subtlety. The architectural motifs used were taken from Serlio and from Sansovino's library of St. Mark's in Venice. Up to 1556 Palladio produced three basic palace types. The first, in 1550, was the Palazzo Chiericati, in which he extended his Palazzo Civena forum idea of a block with its axis parallel to the pavement, which it envelops in a loggia, or roofed open gallery. The tripartite division of the colonnaded elevation, which gives the building a definite central focus, was an innovation. The second, in 1552, was seen in the Palazzo Iseppo Porto, Vicenza, in which he stated in its clearest form his reconstruction of a Roman house. The facade was closely based on the Roman Renaissance palace type, such as Bramante's House of Raphael (*c.* 1514), which Palladio had drawn in Rome. But it was planned in what Palladio believed to be the ancient Roman style. Two tetrastyle halls with four columns each were placed on opposite sides of a court surrounded by a giant colonnade of Corinthian columns. The third, in 1556, was in the Palazzo Antonini in Udine, which has a square plan with a central four-column tetrastyle hall and the service quarters asymmetrically to one side. The facade has six columns, which are attached to the wall rather than freestanding and which are centrally placed on each of the two floors, surmounted by a pediment or a low-pitched gable—a device normally used in his villas.

Palladio further developed the basic plan of his Palazzo Iseppo Porto in the Palazzo Thiene (*c.* 1545–50), Vicenza, the largest and most problematical of his palace designs, of which only the side and rear blocks were completed. Four wings, containing a combination of rectangular rooms and small octagons, similar to those of the Roman public baths, are symmetrically placed around a huge court. The elevations are of a grandeur unequalled in Palladio's other work. The design is the first in which Palladio was influenced deeply by the prevailing contemporary style of Mannerism and especially by Giulio Romano, who was in Vicenza when the project was begun.

During his stay in Rome, from 1554 to 1556, Palladio in 1554 published *Le antichità di Roma* ("The Antiquities of Rome"), which for 200 years remained the standard guidebook to Rome. In 1556 he collaborated with the classical scholar Daniele Barbaro in reconstructing Roman buildings for the plates of Vitruvius' influential architectural treatise (written after 26 BC) *De architectura* (*On Architecture*). The new edition was published in Venice in 1556.

Palladio's elevations have always a central emphasis that reflects the axial symmetry of the plan. This is developed in the Palazzo Valmarana, Vicenza, of 1565, along with an increasing use of stucco surface reliefs and giant orders, or columns, extending more than one story. The latter are both Mannerist elements, used particularly by Michelangelo. Giant orders were also used in the massive and unfinished Palazzo Porto-Breganze of *c.* 1570 and finally in the Loggia del Capitanio of 1571. The latter was built in emulation of many similar loggias, such as those of Florence and Venice. The lower floor was to be a raised platform open to the square and the upper a meeting hall. The original decoration was adapted to symbolize the contribution of Vicenza to the Venetian victory over the Turks at Lepanto in 1571, and a triumphal-arch motif was added to the side elevation. But the cost of the victory so impoverished the government that only three bays, or sections, were built of a possible five or seven intended.

Though Palladio absorbed contemporary Mannerist motifs, his plans and elevations always retained a repose and order not associated with Mannerist architecture, particularly that of Michelangelo and Giulio Romano. When the simplicity of his early designs was abandoned, it was largely to incorporate details warranted by the examination of buildings of the late Roman Empire, reflecting archaeological study common to his period.

Palladio's villas were less affected by his visits to Rome. For practical reasons these buildings were always of stuccoed brickwork with a minimum of carved-stone detail. His aim was to recreate the Roman villa as he had come to understand it from Latin descriptions in the writings of Pliny and Vitruvius. His villas were built for a capitalist gentry who, during the period of Palladio's maturity, gained in prosperity and found new economic outlets in agricultural improvement and land reclamation. He developed the prototype plan of Villa Trissino with many variations at Cricoli. The plan could change in scale and function to serve as a summer residence of an urban aristocrat or the estate headquarters of a gentleman farmer. Included in the former category are the least typical and most widely copied of Palladio's villa designs, the villa for Giulio Capra, called the Villa Rotonda, near Vicenza. This was a hilltop belvedere, or summer house, with a view, of completely symmetrical plan with hexastyle, or porticoes on each of four sides and central circular halls surmounted by domes. The Villa Trissino at Meledo, of the same type, was to have curved wings attached to the main portico. This was a device Palladio usually used when less consideration had to be given to farming and agricultural use of the land. Although the Villa Trissino was not built, it was a most influential design because it was illustrated in the *Quattro libri.*

Palladio adapted the classical temple front to the facades of his villas because it had the dignity suitable for an entrance. He reasoned that, since ancient temples such as the Pantheon in Rome had pedimented porticoes, houses, which preceded temples, would also have had them. Sometimes, as at the Villa Cornaro (*c.* 1560–65) at Piombino Dese and the Villa Pisani (*c.* 1553–55) at Montagnana, the portico is two-storied, with principal rooms on two floors. Normally (as at the Villa Foscari at Mira, called Malcontenta [1560]; the Villa Emo at Fanzolo [late 1550s]; and the Villa Badoer), the porch covers one major story and the attic, the entire structure being raised on a base that contains service areas and storage. In a third type the temple front covers the whole front of the house, as at the Villa Barbaro (*c.* 1555–59) at Maser, which Palladio designed for his friend the scholar Daniele Barbaro. This villa retains the contemporary fresco interiors painted by the Venetian master Paolo Veronese (*c.* 1528–88) and is one of the few interiors to survive from Palladio's day.

At the Villa Thiene (*c.* 1550) at Quinto, he started to build a grandiose house planned on the lines of his reconstruction of a Roman villa shown in the *Quattro libri,* but it was never finished. At the Villa Sarego (*c.* 1568–69) at Santa Sofia a similar inward-facing complex was also planned but not completed. This design differs from the normal villa in its two-story rusticated colonnade forming loggias to rooms arranged around three sides of a court. It is reminiscent of the court to the Pitti Palace in Florence, built in 1550 by the Mannerist architect and sculptor Bartolommeo Ammannati (1511–92).

Palladio's villas were planned as total complexes but could be built in part to satisfy the owner's immediate requirements. He attached great importance to the courts that flanked or stood in front of the house, since they extended its axial symmetry and proportion.

At the end of 20 years of intensive building, Palladio in 1570 published *I quattro libri dell'architettura.* This work was a summary of his studies of classical architecture. He used a number of his own designs to exemplify the principles of Roman design. The first book contains studies of materials, the classical orders, and decorative ornaments; the second, many of Palladio's designs for town and country houses, together with his classical reconstructions. His executed designs are frequently corrected, particularly in the case of early works like the Villa Godi. They are marked with dimensions according to a system of mathematical ratio. The ratios employed are based upon the musical intervals that were in use in Palladio's day, and it was believed that numerical equivalents would result in a beautiful building, since it would be designed within a universal mathematical order. The third book contains designs for bridges, ancient town planning, and basilicas, or ancient Roman oblong halls for public assembly, later adopted as a prototype for the Christian church. The fourth book has to do with the reconstruction of ancient Roman temples.

Venetian period. After 1570 Palladio's life was centred on the building of churches in Venice. In the Veneto, because of a war with the papacy, few churches had been built in the first half of the century, and there are no church designs in his early drawings. Palladio's first design was for the facade of San Pietro di Castello (1558) in Venice—a design that does not survive. In about the 1560s he was working on monastic commissions in Venice for Santa Maria della Carità and for the refectory and cloisters of San Giorgio Maggiore. In the early 1560s he designed the facade for San Francesco della Vigna, at Venice, which had been built according to Sansovino's designs of 1534 but was never finished. Palladio's facade became a design prototype for classical churches with a high nave, or central aisle, and lower aisles. He resolved this by intersecting classical temple fronts—one joining the side aisles and the other, grander front superimposed upon it and covering the higher elevation of the nave. This ingenious solution was refined and perfected in the facades of San Giorgio Maggiore (1566, completed in 1610) and Il Redentore (1576, completed in 1592). The liturgical revival of the Counter-Reformation opposed the centrally planned church, requiring separate functions for different parts of a Latin-cross church. Palladio's proposals for a circular church for Il Redentore, therefore, were rejected. In both churches the nave is a hall of gray stone columns, lit from windows at high level and covered with a plain stucco barrel vault. The interiors are a chaste white with no decoration. In Il Redentore the apse is lit from the dome above and from the choir, which stands behind a semicircular screen of columns.

At the end of his life, in 1579, Palladio designed a central-plan church as a chapel at Maser. It is a shallow Greek cross covered by a circular dome. Internally, the complex decoration of all surfaces relates it in style more closely to Palladio's late palace designs than to his churches. This was followed by a similar unexecuted project, San Nicola di Tolentino (1579) in Venice. These demonstrate Palladio's ideal church plan and follow his reconstruction of the Pantheon in the *Quattro libri* and paralleling designs by Giacomo da Vignola (1507–73), the leading architect in Rome after Michelangelo.

With the death of Sansovino in 1570, Palladio became the leading architect of the Veneto region. Until then he had failed to gain official state patronage, and his designs for palaces in Venice, known from the *Quattro libri* and from drawings, had never found patrons. His later civic work in Venice consisted of advice on fortifications, designs for decorations used on state occasions, and interiors for the Doges' Palace. In 1572 his two sons died, and afterward he lived a secluded life, publishing only an illustrated edition of Julius Caesar's *Commentaries* as a memorial.

Palladio's last commission came in 1579–80—to build a theatre in Vicenza for the Accademia Olimpica for the performance of classical dramas. The design of the Teatro Olimpico was in the nature of an academic exercise, being based on the reconstruction of the ancient Roman theatre at Orange, in France.

When Palladio died he left a considerable number of unfinished buildings, including the Basilica in Vicenza, the two Venetian churches, the Villa Rotonda, and the Teatro Olimpico. These were continued by his followers, notably Vincenzo Scamozzi (1552–1616) and O. Bertotti-Scamozzi (1719–90), but, because of the changing taste of the period, they were not strictly in accordance with Palladio's designs.

Assessment. Palladio is one of the most influential figures in the whole development of Western architecture. The qualities that made him influential were numerous and varied. His palaces and villas were imitated for 400 years all over the Western world; he was the first architect to systematize the plan of a house and consistently to use the ancient Greco-Roman temple front as a portico, or roofed porch supported by columns (this was probably his most imitated architectural feature), and finally, in his *I quattro libri dell'architettura,* he produced a treatise on architecture that, in popularizing classical decorative details, was possibly the most influential architectural pattern book ever printed.

The influence of Palladio's buildings and publications reached its climax in the architecture of the 18th century, particularly in England, Ireland, the United States, and Italy, creating a style known as Palladianism, which in turn spread to all quarters of the world.

(M.A.R.)

MAJOR WORKS. *Villas.* Villa Godi, Lonedo (*c.* 1540–42); Villa Marcello, Bertesina (*c.* 1540–44); Villa Poiana, Poiana Maggiore (*c.* 1545–50); Villa Thiene, Quinto (*c.* 1550); Villa Pisani, Bagnolo (1540s–60s); Villa Rotondo, Vicenza (1550–51); Villa Pisani, Montagnana (*c.* 1553–55); Villa Badoer, Fratta Polesine (1554–63); Villa Chiericati, Vancimuglio (1554–57); Villa Emo, Franzolo (late 1550s); Villa Barbaro, Maser (*c.* 1555–59); Villa Cornaro, Piombino Dese (*c.* 1560–65); Villa Valmarana, Lisiera (*c.* 1565–66).

Palaces and public buildings. Palazzo Civena, Vicenza (1540–46); Palazzo Thiene, Vicenza (*c.* 1545–50); Basilica, Vicenza (design accepted 1548, finished 1617); Palazzo Chiericati, Vicenza (1550); Palazzo Valmarana, Vicenza (1565–66); Teatro Olimpico, Vicenza (1579–80).

Churches. Giorgio Maggiore, Venice, refectory (1560–62), church (1566, completed 1610); S. Francesco della Vigna, Venice (*c.* 1565); Il Redentore, Venice (begun 1576); Tempietto, Maser (design 1579, begun 1580).

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Palladium, in Greek religion, image of the goddess Pallas (Athena), especially the archaic wooden statue of the goddess that was preserved in the citadel of Troy as a pledge of the safety of the city. As long as the statue was kept safe within Troy, the city could not be conquered. It was said that Zeus, the king of the gods, threw the statue down from heaven when the city of Ilium (Greek Troy) was founded and that the Greek warriors Odysseus and Diomedes carried it off from the temple of Athena in Troy, thus making the Greek capture of Troy possible. Many cities in Greece and Italy claimed to possess the genuine Trojan Palladium, but it was particularly identified with the statue brought to Italy by the hero Aeneas after Troy's destruction and preserved in the shrine of the goddess Vesta at Rome. The Palladium was a common subject in Greek art, as was its theft in literature. The story of its fall from heaven perhaps signifies that the Palladium was originally a baetyl, or sacred stone.

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palladium (Pd), chemical element, lightest and lowest-melting of the platinum metals of Group VIII of the periodic table, used especially as a catalyst (a substance that speeds up chemical reactions without changing their products) and in alloys. A precious, gray-white metal, palladium is extremely ductile and easily worked. Palladium is not tarnished by the atmosphere at ordinary temperatures. Thus, the metal and its alloys serve as substitutes for platinum in jewelry and in electrical contacts; the beaten leaf is used for decorative purposes. Relatively small amounts of palladium alloyed with gold yield the best white gold. Palladium is used also in dental alloys. The largest use of the pure metal is for electrical contacts in telephone equipment. Palladium coatings, electrodeposited or chemically plated, have been used in printed-circuit components.

Native palladium, though rare, occurs alloyed with a little platinum and iridium in Colombia (department of Chocó), in Brazil (Itabira, Minas Gerais), in the U.S.S.R. (Ural Mountains), and in South Africa (the Transvaal). Palladium occurs in the Earth's crust at an abundance of 0.015 parts per million. For the mineralogical properties of palladium, *see* native element (table). Palladium also occurs alloyed with native platinum. It was first isolated (1803) from crude platinum by the English chemist and physicist William Hyde Wollaston. He named the element in honour of the newly discovered asteroid Pallas. Palladium is also associated with a number of gold, silver, copper and nickel ores. It is generally produced commercially as a by-product in the refining of copper, and nickel ores. For specific information about the mining and recovery of palladium, *see* MACROPAEDIA: Industries, Extraction and Processing.

Surfaces of palladium are excellent catalysts for chemical reactions involving hydrogen and oxygen, such as the hydrogenation of unsaturated organic compounds. Under suitable conditions, palladium absorbs more than 900 times its own volume of hydrogen; it expands and becomes harder, stronger, and less ductile in the process. A metallic or alloylike hydride is formed from which the hydrogen can be removed by increased temperature and reduced pressure. Because hydrogen passes rapidly through the metal at high temperatures, heated palladium tubes impervious to other gases function as semipermeable membranes and are used to pass hydrogen in and out of closed gas systems or for hydrogen purification.

Palladium is attacked more readily by acids than any of the other platinum metals. It dissolves slowly in nitric acid to give palladium nitrate, $Pd(NO_3)_2$, and with concentrated sulfuric acid it yields palladium sulfate, $PdSO_4 \cdot 2H_2O$. A series of palladium compounds can be prepared with the +2 oxidation state; numerous compounds in the +4 state and a few in the 0 state are also known. Among the transition metals palladium has one of the strongest tendencies to form bonds with carbon. All palladium compounds are easily decomposed or reduced to the free metal. An aqueous solution of potassium tetrachloropalladate(II), K_2PdCl_4, serves as a sensitive detector for carbon monoxide or olefin gases because a black precipitate of the metal appears in the presence of exceedingly small amounts of those gases. Natural palladium consists of a mixture of six stable isotopes: palladium-102 (0.96 percent), palladium-104 (10.97 percent), palladium-105 (22.23 percent), palladium-106 (27.33 percent), palladium-108 (26.71 percent), and palladium-110 (11.81 percent).

atomic number	46
atomic weight	106.40
melting point	1,552° C (2,826° F)
boiling point	2,927° C (5,301° F)
specific gravity	11.97 (0° C)
valence	2, 4
electronic config.	2-8-18-18 or (Kr)$4d^{10}$

Palladius (b. *c.* 363, Galatia, Anatolia—d. before 431, Aspuna), Galatian monk, bishop, and chronicler whose *Lausiac History,* an account of early Egyptian and Middle Eastern Christian monasticism, provides the most valuable single source for the origins of Christian asceticism.

Palladius took up the ascetical life himself, first at the Mount of Olives, the scene of Christ's Passion outside Jerusalem, then in Egypt in the Nitrian desert, now Wādī an-Naṭrūn, to avail himself of the advice of the 4th-century pioneer monks Macarius and Evagrius Ponticus. Returning to Palestine *c.* 399 because of poor health, he was named bishop of Helenopolis, near modern Istanbul.

Soon after 400, Palladius began an extended defense of his articulate theological mentor St. John Chrysostom, patriarch of Constantinople, against charges of heresy. Enemies both at the rival theological school of Alexandria, Egypt, and at Constantinople's imperial court, embarrassed by Chrysostom's moral exhortations and envious of his office, accused him of doctrinal errors. For Palladius' support of Chrysostom at Byzantium and at Rome, the Eastern Roman emperor Arcadius exiled him for six years, during which time, *c.* 408, he wrote his *Dialogue on the Life of St. John Chrysostom.* Styled after the manner of Plato's *Phaedo,* it provides data with which to reconstruct the political–theological controversy.

In 413, after his banishment was lifted, Palladius became bishop of Aspuna in Galatia, and during 419–420 he composed his chronicles on "The Lives of the Friends of God," referring to the earliest Christian ascetics in the various wilderness areas of Egypt and Asia Minor. This *Lausiac History,* dedicated to Lausus, chamberlain of Emperor Theodosius II, is a fusion of personal experiences with secondary accounts of desert monasticism. Although sometimes credulous in repeating legendary narratives modeled after the classical Greek form of heroic epic, Palladius also exhibits a sober humanism that avoids pious ascetical theory, as in his reaction to monastic vanity: "To drink wine with reason is better than to drink water with pride." After previous doubts, 20th-century scholarship has verified the authenticity of the *Lausiac History* as well as part of a treatise on ascetical ideals of India.

Pallas, second largest known asteroid and the second such object to be discovered. It was detected in 1802 by the German astronomer and physician Wilhelm Olbers following the discovery of Ceres, the largest asteroid, the year before. It was named after Pallas Athena, the Greek goddess of wisdom.

Pallas measures 608 kilometres (377 miles) in diameter. Its orbital inclination to the plane of the ecliptic (*i.e.,* Earth's orbital plane) is rather large at nearly 35°, but its semimajor axis and period are typical for asteroids, at 2.77 astronomical units (414,390,000 km) and 4.61 years, respectively. This places Pallas within the asteroid belt between Mars and Jupiter. Pallas is thought to be spheroidal in shape, because it seems massive enough for gravity to have pulled its constituent material into that shape during formation. Based on studies of its reflecting spectrum, the surface of Pallas appears to be essentially that of the early forming, dark, carbon-rich stony asteroids (carbonaceous chondrites). Pallas differs, however, in having water locked into its surface material (*i.e.,* not in free ice or liquid form) and a higher proportion of magnesium in its stony inclusions. Pallas' albedo is 0.09, somewhat greater than typical carbonaceous chondrite asteroids.

Pallas, Peter Simon (b. Sept. 22, 1741, Berlin—d. Sept. 8, 1811, Berlin), German naturalist who advanced a theory of mountain formation and, by the age of 15, had outlined new classifications of certain animal groups.

In 1761 he went to England to study natural-history collections and to make geological observations. He was appointed professor of natural history at the Imperial Academy of Sciences, St. Petersburg (now Leningrad), in 1768. About the same time he joined a scientific expedition to Russia and Siberia. For the next six years he traveled across the length and breadth of the vast empire. He found a wide distribution of mammoth and rhinoceros fossils, including some with their hairy hides

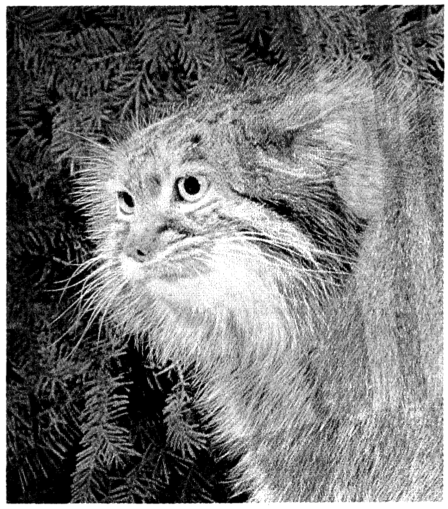
Pallas, engraved portrait

Bruckmann—Art Reference Bureau from Bildarchiv Preussischer Kulturbesitz BPK, West Berlin

preserved, in the Siberian ice. He returned to St. Petersburg in 1774 with a great amount of data and many fossil specimens, but he had ruined his health. He published his major findings from the expedition in three volumes, *Reise durch verschiedene Provinzen des russischen Reichs* (1771–76; "Journey Through Various Provinces of the Russian Empire"). His chief geological contribution, based largely on his study of the Ural and Altai mountain ranges of Siberia, was the recognition of a temporal sequence of rocks from the centre to the flanks of a range.

pallasite, any stony iron meteorite containing about 50 percent olivine as well as kamacite, plessite, taenite, and troilite. The olivine is present as single crystals larger than those in any other meteorite type and may form aggregates. The olivine is usually swathed by kamacite that does not show the Widmanstätten pattern (bands of kamacite with narrower bands of taenite, the meshes being a mixture of the two); kamacite forms a large part of the metal found in pallasites. The centres of large areas of metal, however, are able to develop Widmanstätten structure.

Pallas's cat, also called STEPPE CAT, or MANUL (*Felis manul*), small, long-haired cat (family Felidae) native to deserts and rocky, mountainous regions from Tibet to Siberia. It was named for the naturalist Peter Simon Pallas. The Pallas's cat is a soft-furred animal about the size of a house cat and is pale silvery gray or light brown in colour. The end of its



Pallas's cat (*Felis manul*)

Tierbilder Okapia—Frankfurt am Main

tail is ringed and tipped with black, and some individuals have vague, dark markings on the body. The fur of the underparts is about twice as long as that of the upperparts and possibly represents an adaptation to the cat's habitual lying and crouching on cold ground.

Head and body length ranges from 45 to 60 centimetres (18 to 24 inches) with an additional 23–30 cm for the tail; weight ranges from 2.5 to 3.5 kilograms (5.5 to 7.7 pounds). The Pallas's cat is distinguished by a broad head with high-set eyes and low-set ears. It has been suggested that the positioning of these features is an adaptation for peering over rocky ledges; the supposition is that the cat thus exposes only a small part of itself to its prey of small mammals (such as pikas and rodents) and birds.

Pallava DYNASTY, early 4th-century to late 9th-century southern Indian line of rulers whose members originated as indigenous subordinates of the Sātāvahanas in the Deccan, moved into Andhra, and then to Kāñcī (Kānchipuram in modern Tamil Nadu state, India), where they became rulers. Their genealogy and chronology are highly disputed. The first group of Pallavas was mentioned in Prākrit (a simple and popular form of Sanskrit) records, which tell of King Viṣṇugopa, who was defeated and then liberated by Samudra Gupta, the emperor of Magadha, in about the middle of the 4th century AD. A later Pallava king, Siṃhavarman, is mentioned in the Sanskrit *Lokavibhāga* as reigning from AD 436.

The Pallavas were the emperors of the Dravidian country and rapidly adopted Tamil ways. Their rule was marked by commercial enterprise and a limited amount of colonization in Southeast Asia, but they inherited rather than initiated Tamil interference with Ceylon.

The Pallavas supported Buddhism, Jainism, and the Brahminical faith and were patrons of music, painting, and literature. Their greatest monuments are architectural, in particular the Shore Temple, the various other temples carved from granite monoliths, and the

Varāha cave (7th century) at Mahābalipuram (Māmallapuram), once a flourishing port. The mother of the Pallava ruler Siṃhaviṣṇu (mid-6th century) may have been a Christian. Mahendravarman I wrote (*c.* 620) the *Mattavilasa-prahasana,* a farce in Sanskrit.

In general, the Pallava rulers were ineffective in withstanding military pressure from the Western Cālukya dynasty, and their capable feudatories, the Cōḷas, gradually ousted them from power. In about 880 the Pallava dominions passed to the Cōḷa kings.

Pallavicino, Oberto: *see* Pelavicino, Oberto.

Pallenberg, Max (b. Dec. 18, 1877, Vienna—d. June 26, 1934, Karlsbad, Austria), Italian-born actor, an exponent of the Austrian tradition of extempore farce, whose talents contributed to the evolution of German theatrical practice.

Pallenberg's career started in Vienna (1909) with appearances in popular revues and operettas, but soon he was at Berlin's Deutsches Theater working with Max Reinhardt. Pallenberg became known for his comic improvisational skills, a talent that created difficulties for the actors who worked with him but that gave his performances an immediacy and authenticity valued by critics and audiences alike. He continued to work with Reinhardt in farces that exploited his talent for improvisation but was soon given more conventionally structured roles as well.

Pallenberg was particularly well received in his portrayals of the Cashier in Georg Kaiser's *Morn to Midnight,* the Barker in Ferenc Molnar's *Liliom,* and Argon in Molière's *Imaginary Invalid.* Pallenberg's stellar role, however, came under the direction of Erwin Piscator in the latter's 1928 production of Bertolt Brecht's dramatic adaptation of Jaroslav Hašek's novel *The Good Soldier Schweik.* As the befuddled underdog Schweik, Pallenberg created the perfect foil for Piscator's multimedia "epic theatre" event, which used cutout cartoon characters, animated film, treadmills, signboards, and abstract lighting to condemn bureaucratic manipulation and callousness. He was forced to leave Germany in the early 1930s because his wife, the operetta star Fritzi Massary, was Jewish; Pallenberg was killed in an airplane crash on the way to a theatrical appearance.

pallium, also called PALL, liturgical vestment worn over the chasuble by the pope, archbishops, and some bishops in the Roman Catholic Church. It is bestowed by the pope on archbishops and bishops having metropolitan jurisdiction as a symbol of their participation in papal authority. It is made of a circular strip of white lamb's wool about two inches wide, is decorated with four black crosses, and is placed over the shoulders. Two vertical bands, each decorated with a cross, extending from the circular strip in the front and back, give the pallium a Y-shaped appearance.

The pallium probably developed from the ancient Greek himation, called pallium by the Romans, a common outer garment formed from a rectangular piece of cloth draped around the body as a mantle or folded and carried over the shoulder when not needed for warmth. Gradually, the pallium became narrower and resembled a long scarf. The Y-shaped pallium probably developed during the 7th century.

The use of the pallium by church officials developed from the secular tradition of emperors and other high officials wearing a special scarf as a badge of office. The pallium was worn by many bishops in the 4th and 5th centuries, and in the 6th century the pope was conferring it as a symbol of distinction. Since the 9th century, an archbishop cannot exercise his metropolitan jurisdiction until he

Emperor Henry II flanked by two bishops wearing palliums, 11th-century miniature; in the Staatsbibliothek Bamberg, Bamberg, Ger.
Hirmer Fotoarchiv, Munchen

has received the pallium from the pope. He can wear it only within his own province; only the pope can wear it anywhere.

The equivalent vestment in the Eastern churches is the omophorion, a long, white silk or velvet embroidered scarf, worn by bishops celebrating the holy liturgy.

pallium (biology): *see* mantle.

palm, order name ARECALES, any flowering plant of the order Arecales and of the single family in the order, Arecaceae (Palmae).

A brief treatment of palms follows. For full treatment, *see* MACROPAEDIA: Angiosperms.

Many of the approximately 2,600 known species of the order are economically important. Palms furnish food, shelter, clothing, timber, fuel, building materials, fibres, starch, oils, waxes, wines, and a host of minor products for indigenous populations in the tropics. Palms are chiefly tropical and subtropical trees, shrubs, and vines, usually having a tall, unbranched, columnar trunk. The trunk is crowned by a tuft of large, pleated, fan- or feather-shaped leaves with stout sheathing and often prickly petioles (stalks), the persistent bases of which frequently clothe the trunk. The small, usually unisexual flowers are produced in large clusters. The stem, or trunk, may vary from the length and width of a pencil to a height of about 60 metres (about 200 feet) and a diameter of about 1 m. The leaves may vary in length from several centimetres to more than 9 m. Seeds may be smaller than a match head or the size of a large melon. The great centres of palm distribution are tropical America (with more than 500 species concentrated in Brazil alone) and tropical Asia. Among the most important palms are:

Arenga pinnata (*saccharifera*), the sugar palm, occurs in Malaysia. It grows about 12 m tall and frequently has 20–28 feather-shaped leaves. Sugar, wine, and arrack, a distilled liquor, are processed from the sap. Sago, a starch, is made from the pith. The leaves yield a moisture-resistant fibre.

Attalea cohune (cohune palm), occurring in Central America, grows about 18 m tall and has erect, plume-shaped leaves. Oil from the seeds is used in soap. The related *A. funifera* of the Amazon region of South America yields a water-resistant fibre.

Borassus flabellifer (palmyra palm), occurring in tropical Asia, grows about 20 m tall and has fan-shaped leaves. Fibre from various parts of the plant are made into brooms, hats, and mats. The fruits and seeds are edible.

Chrysalidocarpus lutescens (areca palm), native to Madagascar, sometimes is grown indoors as an ornamental. It grows to about 10 m and has feather-shaped leaves about 60 centimetres (2 feet) long.

Coccothrinax argentea (*garberi*), biscayne, or silver, palm, is a stemless species native to the southeasternmost United States. The fan-shaped leaves are silvery beneath.

Cocos nucifera, coconut palm, originated in Malaysia but has been widely distributed in tropical coastal regions. The tree grows about 30 m tall and has feather-shaped leaves. The nuts—40 to 100 are produced each year—grow to about 25 cm in diameter. The fibre of the nut husk is called coir (*q.v.*). The white meat of the nut is eaten raw or shredded and dried for use in confections. When dried for industrial purposes, it is called copra (*q.v.*). Liquid in the core of the nut, known as coconut milk, is a tasty beverage. Palm wine, arrack, and vinegar are made from the flower buds. Baskets and mats are made from the leaves. The trunk yields a useful timber.

Copernicia cerifera (carnauba palm), occurring in tropical South America, grows to about 10 m tall and has fan-shaped leaves. The trunk is swollen near the base. Carnauba wax—used in polishes, varnishes, and candles—is obtained from the leaves.

Hyphaene thebaica (doum palm), an African species, is unusual because of its many-branched stem. It is known in some areas as Egyptian doom palm and gingerbread tree.

Lodoicea maldivica (*callipyge*), commonly called coco de mer (*q.v.*) or double coconut, occurs in the Seychelles Islands of the Indian Ocean. It grows about 30 m tall.

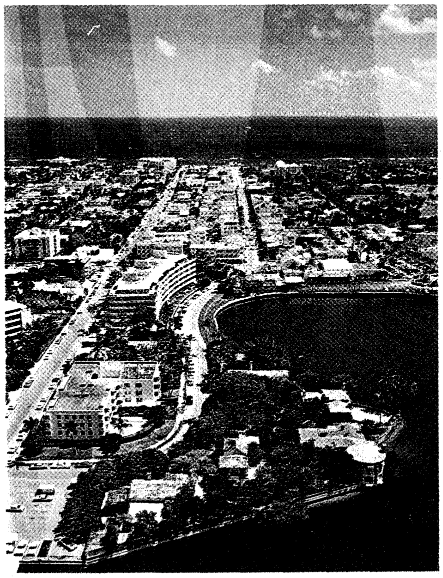
Phoenix dactylifera (date palm), native to the Middle East and cultivated for its fruit since about 6000 BC, grows 30 m tall and has feathery leaves. A tree may bear as much as 250 kilograms (550 pounds) of dates (*see* date palm) annually for 100 years or more.

Royal palm (*Roystonea regia*)
E.R. Degginger—EB Inc.

Roystonea regia (royal palm), an erect, beautiful species native to the southeastern United States, the West Indies, and tropical America, grows to about 30 m tall and has graceful feathery leaves and a smooth, pale gray trunk resembling concrete in colour and texture. It is often grown as an ornamental.

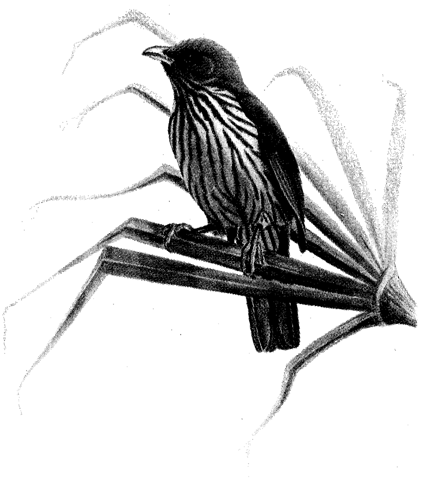
Sabal palmetto (cabbage palmetto), occurring in the southeastern United States and the West Indies, grows to about 24 m tall and has fan-shaped leaves. The water-resistant trunk is used as wharf piling; the trees are commonly grown for shade and as ornamentals along avenues. The buds are edible, mats and baskets are sometimes made from the leaves, and stiff brushes are made from the stems. *S. texana,* a similar species, occurs in the southwestern United States and in Mexico.

Palm Beach, town, Palm Beach county, southeastern Florida, U.S., on a narrow barrier beach between the Atlantic Ocean (east) and Lake Worth (west). The latter, actually a lagoon (part of the Atlantic Intracoastal Waterway), is bridged to West Palm Beach. In 1878 a shipwrecked cargo of coconuts was washed onto the barren, sandy beach and took root. Early settlers also gathered the nuts and planted them to create a palm-shaded haven, which was named Palm City in 1880. Renamed Palm Beach in 1887, it developed as a resort after Henry Flagler extended the Florida East Coast Railroad to West Palm Beach in 1894 and opened his Royal Poinciana Hotel. Palm Beach was frequented by wealthy and famous personages and remains one of the most luxurious winter resorts in the United States, with hotels, clubs, private estates, and yacht facilities. It is strictly zoned and has no manufacturing. Inc. 1911. Pop. (1988 est.) 11,670.



View of Palm Beach, Fla.
S. Aarons—Photo Researchers/EB Inc.

palm-chat (species *Dulus dominicus*), songbird of Hispaniola (Haiti and the Dominican Republic) and nearby Gonâve Island, which may belong in the waxwing family (Bombycillidae) but which is usually separated as the family Dulidae. This 19-centimetre (7.5-inch) bird has a stout bill, and its plumage is greenish brown above and whitish, with dark streaking, below (in both sexes). Palm-chats feed in flocks on berries and flowers. They build a large communal nest in a tree, with a private-entrance chamber for each of up to 30 pairs.



Palm-chat (*Dulus dominicus*)
Painting by H. Jon Janosik

palm chestnut, edible nut of the peach palm (*Bactris Gasipaes,* or in some classifications *Guilielma Gasipaes*), family Palmaceae, grown extensively from Central America as far south as Ecuador. The typical 18-metre (60-foot) mature peach palm bears up to five clusters of 50 to 80 orange-yellow fruits, each 5–7.5 cm (about 2–3 inches) in diameter. The fruit keeps well on the tree and after it is harvested. Its somewhat dry and mealy flesh, easily separated from the seed after boiling in salted water, is fermented into a beverage.

The 2-centimetre seed, or nut, is conical with a black, thin, hard shell. The flavour of the white inner kernel resembles that of the coconut. The plentiful oil from the seeds is used locally in cooking. The hard wood of the tree is used as a building material and in bow making.

Palm Springs, city, Riverside county, southern California, U.S., in the Coachella Valley, at the foot of Mount San Jacinto (10,804 feet [3,293 m]). Originally known as Agua Caliente ("Hot Water") for its hot springs, by 1872 it had become a stage stop between Prescott, Ariz., and Los Angeles. In 1884 Judge John Guthrie McCallum established the Palm Valley Colony on the site that later developed as a model desert resort. Incorporated as a city in 1938, it includes within its boundaries parts of the Agua Caliente Indian reservation. Palm Springs developed into a glamorous desert resort and residence, frequented by Hollywood film stars and other luminaries. It has luxurious hotels, fashionable restaurants and boutiques, and vast recreation areas for tennis, swimming, hiking, skiing, and especially golf (some 50 golf courses lie within a 20-mile radius). The Joshua Tree National Monument is nearby. Pop. (1988 est.) 31,280.

Palm Sunday, also called SECOND SUNDAY OF THE PASSION, in the Christian tradition, first day of Holy Week and the Sunday before Easter, commemorating Jesus Christ's triumphal entry into Jerusalem. It is associated in the Roman Catholic church (and others) with the blessing and procession of palms (leaves of the date palm or twigs from locally available trees). These special ceremonies were taking place toward the end of the 4th century in Jerusalem and are described in the travelogue *Peregrinatio Etheriae* (*The Pilgrimage of Etheria*). In the West the earliest evidence of the ceremonies is found in the Bobbio Sacramentary (8th century). During the European Middle Ages the ceremony for the blessing of the palms was elaborate: the procession began in one church, went to a church in which the palms were blessed and returned to the church in which the procession had originated for the singing of the liturgy. The principal feature of the liturgy that follows the procession is the chanting by three deacons of the account of the Passion of Christ (Matthew 26:36–27:54). Musical settings for the crowd parts are sometimes sung by the choir. After the reform of the Roman Catholic liturgy for Holy Week in 1955, the ceremonies were somewhat simplified. In Roman Catholicism the day is now called officially the Second Sunday of the Passion, or Palm Sunday.

In the Byzantine liturgy the Eucharist on Palm Sunday is followed by a procession in which the priest carries the icon representing the events being commemorated. In the Anglican churches some of the traditional ceremonies were revived in the 19th century, but in the majority of Protestant churches the day is celebrated without ritual ceremonies.

Palma and Palma Bay, with the cathedral in the background
Keystone

Palma, in full PALMA DE MALLORCA, capital of the Balearic Islands comprising Baleares *provincia* and *comunidad autónoma* ("autonomous community"), Spain, in the western Mediterranean Sea. The city lies on the southwestern coast of the Bay of Majorca in the centre of the island of Palma, which is 10 miles (16 km) wide. Little is known of Palma before 123 BC, when the Romans conquered Majorca, making the archipelago a Roman province. Attacked by the Vandals in the 5th century, it became part of the Byzantine Empire a century later. In the 8th century it fell to the Arabs, and in 1229 it was conquered by James I of Aragon. On his death it became independent but was again incorporated into Aragon by Peter IV in the 14th century. In 1469 it became part of the Spanish monarchy upon the marriage of Ferdinand II of Aragon and Isabella I of Castile.

The old quarters of Palma have many notable homes built in the 16th and 18th centuries. Historic buildings include the Gothic cathedral (1230–1601); Bellver Castle (14th century), on the hill of the same name; La Lonja (early 15th century), the former exchange, now a museum; Almudaina Palace (restored in the 12th and 16th centuries), former residence of the Arab dynasty, and now the captain general's headquarters; the Consulate of the Sea (Consulado del Mar; 17th century); the bishop's palace (17th century); and the town hall (16th century) housing the archives of the old kingdom of Majorca. The modern city, with its fine buildings, promenades, and gardens, stretches along the coast for 7 miles (11 km). Palma's cultural facilities include a section of the University of Barcelona and art museums and galleries.

The city's economy is varied, with tourism and the manufacture of furniture, footwear, and fabrics as the most important factors.

Palma's many craftsmen produce embroidery, pottery, artistic glasswork and ironwork, palmetto and raffia basketwork, and olive woodcarving. Palma is linked to the mainland by frequent air and steamer services. Pop. (1982 est.) 319,620.

Palma, Jacopo, original name JACOPO NEGRETI, also called PALMA VECCHIO (b. *c.* 1480, Serinalta, Republic of Venice—d. July 30, 1528, Venice), Venetian painter of the High Renaissance, noted for the craftsmanship of his religious and mythological works. He may have studied under Giovanni Bellini, the originator of the Venetian High Renaissance style.

"Three Sisters," oil on wood panel by Jacopo Palma, early 16th century; in the Staatliche Kunstsammlungen, Dresden

By courtesy of the Staatliche Kunstsammlungen, Dresden

Palma specialized in the type of contemplative religious picture known as the *sacra conversazione* (a group of historically unrelated sacred personages grouped together). To his late 15th-century subject matter he applied the idyllic vision of Giorgione in colour and fused soft-focus effects. Palma's particular refinement of the Giorgionesque technique was his use of transparent glazes, most of which later deteriorated. Monumental figures, loose technique, and blond tonality characterize his finest work, such as the "Sta. Barbara Altarpiece" (*c.* 1510; Sta. Maria Formosa, Venice). Palma developed an ideally feminine, blonde, pretty type, which may be seen in such works as the "Three Sisters" (Staatliche Kunstsammlungen, Dresden). This work, along with many of his later paintings, shows the influence of Lorenzo Lotto. Sixty-two of Palma's works remained unfinished at his death and were finished by his pupils. Presumably this accounts for the variable quality of his work.

Palma, Ricardo (b. Feb. 7, 1833, Lima—d. Oct. 6, 1919, Lima), Peruvian writer best known for his collected legends of colonial Peru, one of the most popular collections in Spanish-American literature.

At the age of 20 he joined the Peruvian Navy and in 1860 was forced by political exigencies to flee to Chile, where he devoted himself to journalism. Six years later he returned to Lima to join the revolutionary movement against Spain. He also took part in the War of the Pacific (1881) and during the Chilean occupation courageously protested against the wanton destruction of the famous National Library by Chilean troops. After the war Palma was commissioned to rebuild the National Library; he remained its curator until his death. In 1887 he founded the Peruvian Academy.

Palma's literary career began in his youth with light verses, romantic plays, and translations from Victor Hugo. His *Anales de la inquisición de Lima* (1863; "Annals of the Inquisition of Lima") was followed by several volumes of poems. His fame derives chiefly from his charmingly impudent *Tradiciones peruanas* (1872; "Peruvian Traditions")—short prose sketches that mingled fact and fancy about the pageantry and intrigue of colonial Peru. His sources were the folktales, legends, and racy gossip of his elders, in addition to historical bits gleaned from the National Library. The first six volumes of this series appeared between 1872 and 1883; they were followed by *Ropa vieja* (1889; "Old Clothes"), *Ropa apolillada* (1891; "Moth-Eaten Clothes"), *Mis últimas tradiciones* (1906; "My Last Traditions"), and *Apéndice a mis últimas tradiciones* (1910; "Appendix to My Last Traditions").

Palma Soriano, city, central Santiago de Cuba province, eastern Cuba. Lying on the Río Cauto, on the northern slopes of the Sierra Maestra, Palma Soriano is a commercial and manufacturing centre for the agricultural and pastoral hinterland, which yields sugarcane, cacao, coffee, corn (maize), fruits, and cattle. Coffee, soft drinks, and furniture are the main industrial products. Manganese is found in the vicinity. Palma Soriano is on the central highway and a major railroad and has an airfield. Pop. (1981) 56,389.

Palmares, Republic of, autonomous enclave in Alagoas state in northeastern Brazil during the period 1605–94; it was formed by the coalescence of as many as 10 separate communities (called *quilombos* or *mocambos*) of fugitive black slaves. The state owed its prosperity to abundant irrigated agricultural lands and to the abduction of slaves from Portuguese plantations. (In Palmares, captured slaves remained in bondage, but runaways became free citizens.)

By the 1690s Palmares numbered 20,000 inhabitants, ruled according to a melange of Central African norms by an elected chief called Ganga Zumba ("Great Lord") who allocated landholdings, appointed officials (usually his own relatives), and resided in a fortified royal enclave called Macoco. Between 1680 and 1686, six Portuguese expeditions attempted to conquer Palmares and failed. Finally the governor of Pernambuco engaged an army of *bandeirantes* under the command of Domingos Jorge Velho, who defeated a *palmarista* force led by a nephew of the last of Palmares' five rulers, on Feb. 6, 1694, putting an end to the republic.

Palme, (Sven) Olof (Joachim) (b. Jan. 30, 1927, Stockholm—d. Feb. 28, 1986, Stockholm), prime minister of Sweden (1969–76, 1982–86), prominent leader of the Swedish Social Democratic Workers' Party (Sveriges Socialdemokratiska Arbetar Partiet), Sweden's oldest continuing party. He became Sweden's best-known international politician.

Born into a wealthy Stockholm family, he studied at Kenyon College, Ohio, U.S. (B.A., 1948), and at the law faculty of Stockholm University, obtaining a law degree in 1951. An active member of the Social Democrats from the early 1950s, Palme became Prime Minister Tage Erlander's personal secretary in 1953 and entered the Swedish Parliament in 1958. Palme joined the Social Democratic government in 1963 as minister without portfolio. In 1965 he advanced to the post of minister of communication and in 1967 to the dual post of minister of education and ecclesiastical affairs. He succeeded Erlander as party secretary and as prime minister in 1968. Soon afterward his attacks on U.S. war policy in Vietnam and his acceptance of U.S. Army deserters who sought refuge in Sweden led to strained relations between his country and the United States. (He denied the deserters official political refugee status, however, saying that one could not be a refugee from a free country.)

The 1976 general election resulted in the defeat of the Social Democrats after 44 years in power. Between terms in office Palme continued to be active in his party and maintained his strong pacifist stance. He served as president of the Nordic Council from 1979 to 1980, chaired the Independent Commission on Disarmament and Security in Geneva, and acted as UN special envoy to mediate in the war between Iran and Iraq. After his 1982 election Palme tried to reinstate Socialist economic policies in Sweden, and he continued to be outspoken on matters of European security. He was assassinated by a gunman in 1986.

Palmela, Pedro de Sousa Holstein, duque de (duke of), also called (1812–23) CONDE (count) DE PALMELA, or (1823–33) MARQUÊS (marquess) DE PALMELA (b. May 8, 1781, Turin, Piedmont—d. Oct. 12, 1850, Lisbon), Portuguese liberal statesman and supporter of Queen Maria II.

He was born abroad during his father's tour of duty in the diplomatic corps. His family, and particularly his mother, had suffered from the Marquês de Pombal's despotism. Educated abroad and at Coimbra, Port., Palmela entered the army in 1796 and the foreign service in 1802. He was a friend of Madame de Staël and of Alexander von Humboldt and campaigned with Wellington in the Peninsular War. Palmela represented Portugal in Rome (1802), Spain (1810), and Great Britain (1812). With the title of count (from 1812), he also took part in the Congress of Vienna. In 1817 he was appointed Portuguese minister of foreign affairs, but it was only in 1820 that he arrived in Rio de Janeiro, where the court then was, so that he did not serve long. He returned to Portugal with King John VI in 1821 and was created a marquess in 1823. In later years he was for short periods minister of foreign affairs again (1835), president of the chamber of peers (1841), and prime minister (1842 and 1846).

A moderate liberal along British lines, he urged John VI to embrace constitutionalism. Having allied himself with the Liberals on John VI's death (1826), Palmela stalwartly identified himself with the movement that in 1834 put Maria II on the throne; and it was largely thanks to his subsequent efforts that she remained queen. Duke of Palmela from 1833, he was active in politics and diplomacy almost until his death.

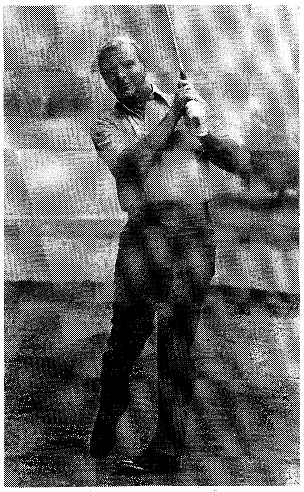
Palmer, city, southern Alaska, U.S., on the Matanuska River. Established *c.* 1916 as a station on the Matanuska branch of the Alaska Railroad, it was supposedly named for George Palmer, a late 19th-century trader. In the 1930s Palmer became the seat of the Alaska Rural Rehabilitation Corporation, a supply centre for farm families moving to Alaska from the Midwest. The city, 40 mi (64 km) northeast of Anchorage and on a railroad, grew as a market for agricultural products of the Matanuska Valley. It is the site of Matanuska-Susitna Community College. Inc. city, 1951. Pop. (1982 est.) 2,504.

Palmer, A(lexander) Mitchell (b. May 4, 1872, Moosehead, Pa., U.S.—d. May 11, 1936, Washington, D.C.), American lawyer, legislator, and U.S. attorney general (1919–21) whose highly publicized campaigns against suspected radicals touched off the so-called Red Scare of 1919–20.

A devoted Quaker from his youth, Palmer—later nicknamed the "Fighting Quaker"—was educated at Swarthmore College, Swarthmore, Pa. He was admitted to the Pennsylvania bar in 1893, practiced law at Stroudsburg, Pa., and became active in state Democratic Party affairs. He served in the U.S. House of Representatives (1909–15) and played a prominent role in securing the Democratic presidential nomination for Woodrow Wilson in 1912. He ran for the Senate in 1914 but was defeated. Upon U.S. entry into World War I, Palmer was appointed alien property custodian. In 1919 he was named U.S. attorney general by President Wilson. During his two years at that post, he used the Espionage Act of 1917 and the Sedition Act of 1918 as a basis for launching an unprecedented campaign against political radicals, suspected dissidents, left-wing organizations, and aliens. He deported the self-avowed anarchist Emma Goldman and others suspected of subversive activities. On Jan. 2, 1920, government agents in 33 cities rounded up thousands of persons, many of whom were detained without charge for long periods. The disregard of basic civil liberties during the "Palmer raids," as they came to be known, drew widespread protest and ultimately discredited Palmer, who nevertheless justified his program as the only practical means of combating what he believed was a Bolshevik conspiracy to overthrow the U.S. government. Although he lost the Democratic presidential nomination in 1920, Palmer remained active in the Democratic Party until his death, campaigning for, among others, presidential candidates Al Smith and Franklin D. Roosevelt.

Palmer, Arnold (Daniel) (b. Sept. 10, 1929, Youngstown, Pa., U.S.), professional American golfer, the first to win the Masters Tournament (Augusta, Ga.) four times and the first to earn $1,000,000 in tournament prize money. From 1954, when he became a professional, through 1975 he won 61 tournaments sanctioned by the Professional Golfers' Association of America (PGA). As the leading figure in world golf from the late 1950s through the middle 1960s, he attracted a vast following known as "Arnie's Army."

The son of a greenskeeper, Palmer attended Wake Forest (N.C.) University and served in the U.S. Coast Guard. He turned professional



Arnold Palmer, 1984
Arnold Palmer Enterprises

after winning the 1954 U.S. Amateur championship. In addition to his four victories in the Masters Tournament (1958, 1960, 1962, 1964), he won the U.S. Open (1960) and the British Open (1961–62). He won the PGA Senior Open in 1980 and 1981.

An astute businessman, he served as president of the highly successful Arnold Palmer Enterprises and was national spokesman for such companies as Hertz Rent-a-Car and Pennzoil. He also wrote a number of books, either autobiographical or concerned with the techniques of golf.

Palmer, Barbara, Countess of Castlemaine: *see* Cleveland, Barbara Villiers, duchess of.

Palmer, E(dward) H(enry) (b. Aug. 7, 1840, Cambridge, Cambridgeshire, Eng.—d. Aug. 11, 1882, Wādī Sidr, Egypt), English Orientalist, distinguished as a linguist and as a traveler, among whose many translations is a version of the Qur'ān—the sacred scripture of Islām—that, despite some inaccuracies, captures the spirit and poetry of the original.

As a student, Palmer showed remarkable linguistic ability; in 1867 he was elected a fellow in Oriental studies at the University of Cambridge. The following year he joined an ordnance survey expedition tracing the route taken by the Israelites from Egypt through the Sinai Desert to Jerusalem; in 1870 he accom-

E.H. Palmer, engraving by M. Klinkicht, 1883, after a portrait by J. Bell
By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

panied Charles Tyrwhitt Drake, an explorer, on a further desert exploration. Both journeys he described in *The Desert of the Exodus,* 2 vol. (1871). The same year he published *Jerusalem, the City of Herod and of Saladin,* a Muslim view of the history of the city. He was professor of Arabic at Cambridge during 1871–81. In 1882 he was asked by the British government to enlist the sheikhs' support for the proposed British occupation of Egypt and to take measures ensuring the safety of the Suez Canal. His first mission was successful, but he was ambushed and killed on a second.

Palmer's many publications include *Oriental Mysticism* (1867) and *The Song of the Reed and Other Pieces* (1877), which include translations from the Persian and Arabic as well as original poems.

Palmer, Geoffrey (Winston Russell) (b. April 21, 1942, Nelson, N.Z.), New Zealand Labour Party leader and prime minister of New Zealand for a year in 1989–90.

Palmer was educated at the Victoria University of Wellington (B.A., LL.B.) and at the University of Chicago (U.S.). He worked as a solicitor for a Wellington law firm (1964–66) before turning to teaching, becoming a lecturer in political science at Victoria University of Wellington (1968–69), professor of law at the universities of Iowa and of Virginia (1969–73), and professor of English and New Zealand law at Victoria again (1974–79). After joining the New Zealand Labour Party in 1975, he was elected to Parliament in a by-election in 1979. He became personal assistant to the prime minister Wallace Edward Rowling and soon was deputy leader of the party (1983–89) and deputy prime minister and minister of justice and attorney general (1984–89).

When Prime Minister David Russell Lange, suffering serious setbacks in party loyalties and public opinion, resigned in August 1989, he nominated Palmer as his successor, and party leaders confirmed the choice. One year later, in September 1990, Palmer resigned for virtually the same reasons.

Palmer, Nathaniel B(rown) (b. Aug. 8, 1799, Stonington, Conn., U.S.—d. June 21, 1877, San Francisco, Calif.), American sea captain and explorer after whom Palmer Land, a stretch of western Antarctic coast and islands, is named.

Palmer went to sea at the age of 14. He served first as a sailor on a blockade runner in the War of 1812. He later became a sealer, and his South Sea explorations were largely stimulated by the desire to locate new seal rookeries. Becoming captain of the schooner *Galina* in 1818, Palmer began explorations of the Cape Horn region and western Antarctic the following year. On these and subsequent voyages he discovered the Gerlache Strait and Orleans Channel in Antarctica as well as the South Orkney Islands.

From 1822 to 1826 he engaged in trade on the Spanish Main and helped to transport troops and supplies to Simón Bolívar during the war of South American independence. Throughout much of his career Palmer displayed a keen interest in shipbuilding and helped to design packets (passenger boats), pleasure yachts, and clipper ships.

Palmer, Potter (b. May 20, 1826, Albany county, N.Y., U.S.—d. May 4, 1902, Chicago, Ill.), American merchant and real-estate promoter who was responsible for the development of much of the downtown district and the Lake Shore Drive area of Chicago after Chicago's great fire of 1871.

Palmer started as a clerk in a general store in Durham, N.Y. He was store manager in two years and opened his own dry-goods store the following year (1847) in Oneida, N.Y. In 1852 his father helped supply the capital for Palmer to open a dry-goods store in Chicago. There Palmer developed practices new to retailing at the time, including allowing goods to be returned for either a full refund or an exchange, sending goods to customers on approval, and offering bargain sales. He also stressed advertising and attractive displays of merchandise. In 1867 he sold his share in the business to his partners, Marshall Field and Levi Z. Leiter.

With the money that he had made in retailing, he bought a 0.75-mile (1.2-kilometre) stretch of State Street, at that time an undeveloped lane on the outskirts of downtown, and transformed it into Chicago's major retail thoroughfare. In the great fire of 1871 most of his 32 buildings were destroyed. Borrowing $1,700,000, he built larger buildings than before, including the second Palmer House, a large hotel. Palmer also reclaimed the swampland north of Chicago's commercial district, developing it into the beautiful Lake Shore Drive area.

Palmer's wife, Bertha Palmer, *née* Honoré (b. May 22, 1849, Louisville, Ky., U.S.—d. May 5, 1918, Osprey, Fla.), whom he married in 1871, aided him in his financial dealings and became the social leader of Chicago and a noted philanthropist.

Palmer, Roundell: *see* Selborne, Roundell Palmer, 1st Earl of.

Palmer, Samuel (b. Jan. 27, 1805, London, Eng.—d. May 24, 1881, Redhill, Surrey), English painter and etcher of visionary landscapes who was a disciple of William Blake.

Palmer's father, a bookseller, encouraged him to become a painter. By 1819 he had already exhibited small landscape studies at the Royal Academy. The works that survive from 1819 to 1821 are able but conventional. In the following years, however, there are signs of a profound change in his thinking, perhaps connected with his conversion from the Baptist faith to a personal form of High Anglicanism and with his discovery of medieval art.

A sketchbook of 1824 (British Museum), rediscovered in 1956, already shows all the elements of his visionary style: a mystical but precise depiction of nature and an overflowing religious intensity, united by a vivid recreation of the pastoral conventions. In October 1824 the painter John Linnell took him to see William Blake, who encouraged Palmer in the mystical direction he was taking and provided examples of his own work for Palmer to follow. Blake's influence can be seen clearly in the "Repose of the Holy Family" (1824–25) and the series of sepia drawings of 1825.

In 1826 Palmer visited Shoreham in Kent, and the following year he settled there. His Shoreham paintings became more naturalistic but were still charged with visionary intensity. The years 1827–30 were his most productive, but after 1830 his work shows unmistakable signs of artistic decline. As his religious fervour faded, the precarious balance between realism and vision was lost. He left Shoreham for London in 1834, and expeditions to Wales and Italy confirmed the break with his own past.

Palmer's real forebears are writers rather than painters. He read with enthusiasm the writings of the German mystic Jakob Böhme, the pastoral poems of John Milton, and above all the works of John Bunyan, whose "Countrey of Beulah" is the nearest equivalent to Palmer's "Valley of Vision."

Palmer, (Edward) Vance (b. Aug. 28, 1885, Bundaberg, Queen., Australia—d. July 15, 1959, Melbourne, Vic.), Australian author of novels, short stories, and plays whose work is noted for disciplined diction and frequent understatement. He is considered one of the founders of Australian drama.

Born and educated in Queensland, Palmer published his first work in English magazines when he was only 17 years old. Two years later he went to London to become a writer, meeting with some success. He returned, however, by way of Finland, Russia, Siberia, and the East and spent several years working at a variety of jobs in the Australian outback. He next took up writing again, traveling to London and the United States, then serving with Australian forces during World War I. From 1922 to 1926 he and his wife, Nettie (*née* Janet Higgins, also a writer), helped organize the Pioneer Players, a theatrical company in Melbourne specializing in Australian drama.

Of his novels, *The Passage* (1930), set in the Caloundra area of Queensland, is considered the best. It describes the life of a family and the subtle links between its members and their environment. *Golconda* (1948) describes the conflict between miners and management in the Mount Isa area of Queensland; it is the first volume of a political trilogy that includes *Seedtime* (1957) and *The Big Fellow* (1959). He also wrote several plays on political themes. His short stories have been collected in four volumes: *Separate Lives* (1931); *Sea and Spinifex* (1934); *Let the Birds Fly* (1955); and *The Rainbow Bird* (1956). He also wrote two volumes of balladlike poetry, of which *The Forerunners* (1915) is considered the best, and several volumes of essays and literary criticism.

Palmer, William Henry (magician): *see* Heller, Robert.

Palmer, William Waldegrave: *see* Selborne, William Waldegrave Palmer, 2nd Earl of.

Palmer Archipelago, also called ANTARCTIC ARCHIPELAGO, island group off the northwestern coast of the Antarctic Peninsula, from which it is separated by Gerlache and Bismarck straits. The archipelago, which includes the islands of Anvers (46 miles [74 km] long by 35 miles [56 km] wide), Liège, Brabant, and Wiencke, was discovered in 1898 by the Belgian explorer Adrien de Gerlache. Argentina and the United Kingdom have operated research stations in the islands, which are claimed by both these countries and Chile.

Palmer Land, broad southern part of the Antarctic Peninsula, about 400 miles (640 km) east of Peter I Island (in the Bellingshausen Sea), claimed by Britain as part of the British Antarctic Territory. It is named after its discoverer, Nathaniel Palmer, captain of a U.S. sealing vessel, who led an expedition to Antarctica in 1820. Palmer Land is mountainous, attaining elevations varying between 6,600 and 13,800 feet (2,000 and 4,200 m), and covered by thick glaciers except for its most precipitous peaks and cliffs, some of which form stretches of the coastline along the Weddell Sea. A number of minerals have been identified in Palmer Land, including magnetite, hematite, limonite, chalcopyrite, pyrite, and azurite, and traces of gold and silver have been discovered. The Siple research station (U.S.) is located in Palmer Land.

Palmer Peninsula (Antarctica): *see* Antarctic Peninsula.

Palmerston (of Palmerston), Henry John Temple, 3rd Viscount, BARON TEMPLE OF MOUNT TEMPLE, byname PAM (b. Oct. 20, 1784, Broadlands, Hampshire, Eng.—d. Oct. 18, 1865, Brocket Hall, Hertfordshire), English Whig-Liberal statesman whose long career, including many years as British foreign secretary (1830–34, 1835–41, 1846–51) and prime minister (1855–58, 1859–65), made him a symbol of British nationalism.

Lord Palmerston, *c.* 1860
BBC Hulton Picture Library

Early life. The christening of Henry John Temple in the "House of Commons church" of St. Margaret, Westminster, was appropriate. His father, a cultured grand seigneur and dilettante politician, failed in his ambition to convert his Irish peerage into a United Kingdom peerage, which would have condemned his son (known as Harry) to a seat in the House of Lords. Instead, with a break of less than a year (in 1835), Harry Temple was to sit in the Commons from 1807 until he died as prime minister on the eve of his 81st birthday. After two years in Italy and Switzerland with his family, young Temple went to Harrow School in May 1795. Its classical curriculum was supplemented by French, Italian, and some German from a tutor brought home from Italy. In November 1800, Temple entered the University of Edinburgh.

In April 1802 Temple succeeded to his father's title and estates as 3rd Viscount Palmerston and to a burden of debt that conspired, along with a sense of public duty, to make him seek public office; the fact was, he could never afford to be out of office long. He soon began to extend and embellish the house and gardens of Broadlands in Hampshire and, from the mid-1820s, improved his Irish estates in County Sligo. Having survived a youth of ill health, he later displayed a rare stamina, cultivated by regular exercise. Entering St. John's College, Cambridge, in October 1803, Palmerston was still an undergraduate when he contested the vacancy in the university parliamentary representation resulting from the death of William Pitt in January 1806. He lost then and again in the general election of 1807, but he sat for the University of Cambridge from 1811 to 1831.

Political life, 1807–30. Only after being made a junior lord at the admiralty in the Tory government of 1807 did Palmerston become a member of Parliament by a transaction with the patron of the pocket borough of Newport, Isle of Wight. Studious at Cambridge, though no recluse, the young junior minister was thought a bit of a prig. As he passed into middle age 20 years later, he was thought of politically as a dull dog; for, after refusing the chancellorship of the Exchequer from the prime minister Spencer Perceval in 1809, he took the office of secretary at war. The office was humdrum, and its parliamentary duties were light. He rejected the post office in 1821 because it would have taken him to the House of Lords; and he resisted other offers because they would have taken him to Dublin, the Caribbean, or Calcutta. Palmerston would not forgo the delights of the London society centring on Almack's social club, the three principal hostesses of which—Lady Jersey, the Princess Lieven, and Lady Cowper (whom he married in 1839 after she was widowed)—were all probably his mistresses; he was known widely as "Lord Cupid." Because in 1827 the ultra-Tories refused to serve under Canning, Palmerston at last reached the Cabinet. But the offer of the Exchequer by Canning was withdrawn, and it was as secretary at war that Palmerston sat in the cabinets of George Canning, Viscount Goderich, and the Duke of Wellington.

Known initially as a Pittite and condemned by Radicals as a follower of Viscount Castlereagh, who was hostile to civil liberties, Palmerston acquiesced in the switch from unmoving resolution to "Liberal Toryism" over which Lord Liverpool presided in 1821–23. But Palmerston was not an intimate of Canning and his follower, the financier and statesman William Huskisson, nor of Sir Robert Peel. Only after Canning's death, when Palmerston applauded "the great strides which public opinion has made in the last few years," could he be considered a Canningite. As such, he resigned, reluctantly, when Wellington drove Huskisson out of office in mid-1828; but he never closed the door to overtures from Wellington. He had owed his return to the Cambridge seat in Parliament in 1826 to the Whigs—he was opposed by two ministerial colleagues hostile (as he was not) to Catholic Emancipation—and of the Whigs who sat with him in the cabinets of Canning and Goderich, he said that he liked them much better than the Tories and agreed with them much more. Palmerston, whose maiden speech in February 1808 had been a defense of a British attack on the Danish fleet to deny it to Napoleon, became in Cabinet entranced with foreign affairs and adopted a position on events in Greece and Portugal in advance of the other Canningites. This he made public in the House on June 1, 1829, when he complained that Wellington had made Britain the keystone of the arch of European absolutism. The circulation of his speech as a pamphlet indicates that Palmerston had decided to play for high political stakes. By interrogating the Tory government from a Whiggish point of view all through 1830 and by rejoicing at the Paris revolution of that year, he qualified himself to become foreign secretary when Wellington's resistance to all parliamentary reform led to the creation of a Whig-Canningite coalition under Earl Grey.

Views on liberalism and conservatism. The Reform Bills of 1831 and 1832 were more considerable than Palmerston liked, and he tried to modify them. Failing, he blamed "the stupid old Tory party" for making them necessary by refusing minor concessions, emphasized the "final" nature of the 1832 Act, and proclaimed his confidence that the landed interest would continue to prevail in politics as he thought it should. From 1849 to 1865 he came to personify the opposition of the landsmen and many of the middle classes to the enfranchisement of trade unionists and to resist fiscal and legislative assaults on landed property, opining (with regard to Ireland) that "tenant right was landlord's wrong." After one term (1832–35) as member for South Hampshire, he was defeated; and for the rest of his life he represented the Devon market town of Tiverton. A racehorse owner, he combined the conservatism of the countryman with a concern for the expansion of the manufacturer's foreign markets. His standard text was that reform in 1832 had prevented social revolution and that enlightened legislation thereafter was producing social peace. This made him proud of his country and more than ever inclined to exhort foreign autocrats and bureaucrats to behave like sensible Whigs and Canningites.

Palmerston believed that something like the British system of responsible government would be good for all European states and that it would become the norm (as by the first decade of the 20th century it had). No English ministry was doing its duty, he declared, if inattentive to the interests of constitutional states, which were Britain's natural allies. He persuaded himself that "the selfish interests and political influence of England were best promoted by the extension of liberty and civilisation," and even, against the evidence, that constitutional governments would be pro-British. Rebuked for "missionary diplomacy" not intended to lead to action but to inflame international relations, he retorted that ineffective protest was better than tacit acquiescence in wrong and that opinions were mightier than armies. He was charged with "disturbing the peace of Europe by giving encouragement to every revolutionary and anarchical set of men." Yet his opinions on foreign and domestic matters were all of a piece. He did not want democratic or republican, least of all "Red," regimes abroad any more than at home. But he regarded the mission of Lord Minto to the Italian courts, on the eve of the revolutions of 1848, as mediatorial, not inflammatory; its object was to show the rulers of Europe that they should have their minor revolutions, lest worse befall them.

Views on nationalism. Palmerston was a British nationalist; he said that the country had no permanent allies, only permanent interests. The idea that, because he applauded the cause of Liberalism in Europe, he wished to tear up the Treaty of Vienna is nonsense. It was true that he was instrumental in securing confirmation of the independence of Greece and Belgium; but for Polish, Magyar, and Romanian patriotic causes he lifted not a finger. Palmerston was a philhellene; but by the time he became foreign secretary the only question was whether Greece should be a viable size, wholly independent of Turkey and under the surveillance of Britain, France, and Russia. By 1832 he had achieved this objective.

The Belgian revolt of 1830 was a fait accompli, and it had become a British interest to secure Dutch recognition of it without allowing the French to profit by intervening. In this matter, as chairman of the London Conference, Palmerston first showed his diplomatic proficiency. The outcome was an independent constitutional Belgium, with its neutrality guaranteed by the Five Powers in a famous "scrap of paper."

If he wanted Italian federation or unification, it was from no addiction to the national principle in the abstract, and, if he wanted the Austrians out of Italy, it was not primarily because they were illiberal. His view was that Austria had been put into northern Italy in 1815 to provide a barrier against French aggression. Through mismanagement the Austrians had contrived to raise so much "national hatred" against themselves that their presence in Italy was a danger to the general peace, and it was weakening the Habsburg Empire as well. An able speech in Parliament on July 21, 1849, gave the coldest comfort to the Hungarians, against whose bid for independence Austria had to seek Russian aid. Palmerston said, wholly sincerely, that "the political independence and liberties of Europe are bound up . . . with the maintenance and integrity of Austria as a great European Power." Austria was, after all, Britain's natural ally in the Balkans.

Palmerston's fears of France and Russia. Of the great powers, Palmerston felt that only Russia and France might directly threaten British interests, which he interpreted widely and in which he certainly included all the routes to India and the Far East via the Mediterranean; from concern for India sprang Persian and Afghan wars as well as the Crimean War. It was Palmerston's objective never to find France and Russia arrayed together against Britain and to practice the technique of "restraint by cooperation." The France of Louis-Philippe acted for most of the 1830s as Britain's ally, and Palmerston's riposte to Metternich's coalition of the three emperors (of Austria, Prussia, and Russia) at Münchengrätz in 1833 was the 1834 Quadruple Alliance of Britain and France with the constitutional parties in Spain and Portugal. The French, however, became irked at the restraining element in British cooperation and did not see why they should not be as predominant in Spain as the British were in Portugal. Relations, therefore, deteriorated even before there was an open breach in 1839–40 on the Eastern Question (regarding the Ottoman Empire). Palmerston's mobilization of the powers to isolate France and confine Muḥammad ʿAlī Pasha to Egypt gave him (1840) a major diplomatic and parliamentary triumph, achieved amid the doubts, fears, and opposition of Cabinet colleagues.

Relations with France were unnecessarily bad when Palmerston left office in 1841. His condemnation of Lord Aberdeen for appeasing France and the United States also contributed to a feeling in the highest Whig circles that he ought not to return to the foreign office; and his refusal to take any other appointment was made the excuse for the prime minister, Lord John Russell, declining to form a government to repeal the Corn Laws in December 1845. In mid-1846, when Russell did form a government, Palmerston became foreign secretary again. After the revolution in 1848, as in 1830, Palmerston was concerned with both protecting the new French regime and deterring it from going to war. He and the Tsar, both standing for the Treaty of Vienna and the balance of power, saluted one another from the twin rocks that stood amid the revolutionary tide.

The popular hero. In 1848–49 Palmerston was more intent upon preserving the general peace than upon patronizing Liberalism. In 1849–51, however, he won Radical applause for his denunciations of the cruelty of counter-revolutionaries; for his release of British arms to Sicilian insurgents and his later endorsement of William Ewart Gladstone's exposure of King Ferdinand's treatment of political prisoners; by his evident approval of the hostile reception given to the Austrian general Julius, Freiherr von Haynau, when he visited Britain; by his pressure on the Turks; and by his acceptance, when the defeated Hungarian patriot Lajos Kossuth visited Britain, of addresses describing the rulers of Austria and Russia in Kossuthian terms.

This propagandist diplomacy infuriated Prince Albert and embarrassed Cabinet colleagues who, like Queen Victoria, were not kept fully informed. But Palmerston defeated Russell's intention of removing him from the foreign office by a famous dusk-to-dawn speech on July 8, 1850, in which he defended the British bombardment of Athens and the sabotaging of an agreement reached in London with France and Russia over British subjects' claims against Greece. His popularity as "the most English minister who ever governed England" was such that Russell did not dare dismiss him until December 1851, when Palmerston, to stand well with the ruler of France, approved the coup d'etat by which President Bonaparte overthrew the constitution of the Second Republic.

Palmerston at once brought about the fall of the Russell government and might have joined the minority Tory government if the prime minister, Lord Derby, had been willing to abandon his protectionist policies. He served as a reforming home secretary in a Peelite–Whig coalition under Aberdeen, which in 1854 took Britain into the Crimean War against Russia and allied with France in defense of Turkey. His resignation in December 1853, avowedly in opposition to Russell's reform bill, was ascribed to discontent with an infirm diplomacy. A switch to a more belligerent posture was regarded as the price of his immediate return.

Premierships. Under Aberdeen, Palmerston was a more loyal and reasonable colleague than was Russell. When Russell resigned as leader of the House of Commons because he would not oppose a motion for inquiry into the misconduct of the Crimean War, Palmerston succeeded him. With public opinion behind him, Palmerston became prime minister. His attempts to galvanize the war effort and remedy gross defects in many branches of the services were partly nullified by bad appointments at home and in the Crimea. He was pressured by the French to make peace (1856) on terms he thought inadequate but which forced Russia to give up its control of the mouth of the Danube. He submitted to restraints by colleagues in quarrels with the United States, but when the Tory opposition, with Peelites and Cobdenites (followers of the free-trade activist Richard Cobden), narrowly defeated him on the China War, Palmerston confidently appealed to the electors against "an insolent barbarian" at Canton violating British persons and property. The considerable majority achieved in the April 1857 election was a personal triumph, but it melted away when he did not make the lion's roar sufficiently loud in response to French attacks on Britain for harbouring refugees conspiring to murder Napoleon III; and Palmerston's government resigned after defeat in the House (February 1858).

After the election of 1859 denied the Tories a majority, Palmerston resumed the premiership with Russell and the Peelite Gladstone, all being pro-Italian against Austria. This triumvirate ruled until Palmerston died. Palmerston knew that he would be able to rely on the Tories for support if Gladstone resigned and linked himself with the Radical John Bright. Although his determination that Britain "should count for something in the transactions of the world" was successfully challenged by Bismarck in the Schleswig-Holstein affair, 1863–64, Palmerston retained great prestige at home; and on the eve of his death he greatly enlarged the Liberal majority in an election on the cry "Leave it to Pam." It was rightly said, after his death, that "the exceptional sway of Lord Palmerston could not be reproduced by any other statesman, or any combination" and that "the reign of *moderate* Liberalism" was over. He had been a conservative statesman using radical tools and keeping up a show of liberalism in his foreign policy; after him the defense of the Conservative cause would revert to the Conservative Party. (Do.S./Ed.)

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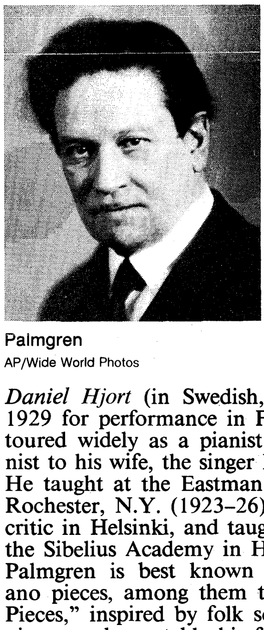
(ed.), *Gladstone and Palmerston* (1928, reprinted 1971); and Brian Connell (ed.), *Regina vs. Palmerston: The Correspondence Between Queen Victoria and Her Foreign and Prime Minister, 1837–1865* (1961). Guedalla's *Palmerston* (1926) is a piece of artistry, apt to mislead, unlike the less pretentious work of W. Baring Pemberton, *Lord Palmerston* (1954). See also Kenneth Bourne, *Palmerston: The Early Years, 1781 to 1841* (1982).

Palmerston North, city, southern North Island, New Zealand, overlooking the Manawatu River. The settlement, named after Lord Palmerston, prime minister of England, was founded in 1866 and declared successively a town (1868), a borough (1877), and a city (1930). Junction of road and rail lines to Wellington (87 mi [140 km] southwest) and Auckland (339 mi northwest), it is a communications, commercial, and service centre for the pastoral and mixed-farming Manawatu Plain and its bordering hills. Industries include food processing, printing, brewing; the manufacture of brick, tile, footwear, clothing, fertilizer, and pharmaceutical supplies; general and electrical-engineering works; and motor- and tractor-assembly plants. The Royal New Zealand Air Force jet-engine testing facility, workshops, and aircraft-assembly factory are there. The city has become a university and research centre with Massey University (founded 1926; university status 1963), the New Zealand Dairy Research Institute, and the Palmerston North Medical Research Foundation. Pop. (1983 est.) 61,400.

Palmgren, Selim (b. Feb. 16, 1878, Pori, Fin.—d. Dec. 13, 1951, Helsinki), Finnish pianist and composer who helped establish the nationalist movement in Finnish music.

He studied at the Helsinki Conservatory in 1895 and with Ferrucio Busoni in Germany (1899–1901). In 1909 he became conductor at Turku, Fin., where he produced his opera

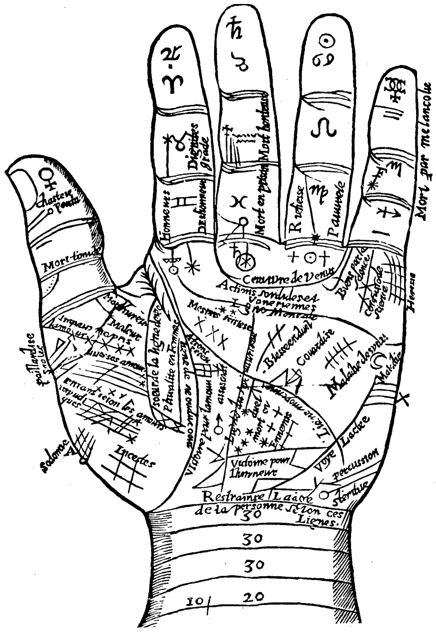


Palmgren
AP/Wide World Photos

Daniel Hjort (in Swedish, 1910; revised in 1929 for performance in Finnish). Palmgren toured widely as a pianist and as accompanist to his wife, the singer Maikki Pakarinen. He taught at the Eastman School of Music, Rochester, N.Y. (1923–26), became a music critic in Helsinki, and taught composition at the Sibelius Academy in Helsinki (1939–51). Palmgren is best known for his small piano pieces, among them the "Finnish Lyric Pieces," inspired by folk songs. In his larger piano works, notably his five piano concerti, he was influenced by Franz Liszt.

Palmira, city, Valle del Cauca department, southwestern Colombia, in the rich Cauca Valley, 3,284 ft (1,001 m) above sea level. Founded in 1688, the city has long been an important agricultural and livestock-raising centre. Now the second largest city in its department, Palmira is referred to as the "agricultural capital of Colombia"; tobacco, coffee, sugarcane, rice, and grain are grown in the area. The city houses an agricultural experiment station and a college of agronomy. Palmira is accessible by the Pan-American Highway and railroad from Cali, the departmental capital, and from other cities in the Cauca Valley. Pop. (1973) 143,092.

palmistry, also called CHIROMANCY, or CHIROSOPHY, reading of character and divination of the future by interpretation of lines and undulations on the palm of the hand. The origins of palmistry are uncertain. It may have begun in ancient India and spread from there. It was probably from their original Indian home that



The pattern of the future in the human hand, from Jean Belot's *Oeuvres*, 1649
The Mansell Collection

the traditional fortune-telling of the Gypsies was derived. The chiromantic art has been known in China, Tibet, Persia, Mesopotamia, and Egypt, and it underwent significant development in ancient Greece. Medieval palmistry was pressed into service by the witch-hunters, who interpreted pigmentation spots as signs of a pact with the Devil. After a period of disrepute, palmistry flourished again in the Renaissance. In the 17th century, attempts were made to develop empirical and rational foundations for its basic principles. After a second ebb, during the Enlightenment, it underwent a popular revival in the 19th century with the work of Casimir d'Arpentigny, Louis Harmon (byname Cheiro), and William Benham. In the 20th century, palmistry has received renewed attention and interpretation by, among others, followers of C.G. Jung.

Although there is no scientific support for the contention that the physical features observed in palmistry have psychic or occult predictive meaning, the human hand does show evidence of the person's health, cleanliness, and occupational and nervous habits (*e.g.*, as evidenced by calluses or nail-biting). Hands are routinely examined in medical diagnosis and provide clues with which the palmist may often astound the unsophisticated.

Palmyra, also called TADMUR, TADMOR, or TUDMUR, ancient Syrian city, now in Ḥimṣ *muḥāfaẓah* (governorate), Syria. The name Palmyra is the Greek and Latin form of Tadmur, Tadmor, or Tudmur, the pre-Semitic name of the site, still in use in modern times. Although Tadmur and its inhabitants are mentioned as early as the 19th century BC on a Cappadocian tablet, the city did not attain prominence until the 3rd century BC, when the Seleucids probably made the road through Palmyra one of the routes of east–west trade.

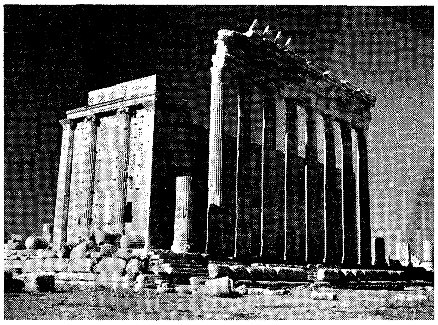
Although at first autonomous, Palmyra came under Roman control at least by the time of the emperor Tiberius (AD 14–37). The emperor Hadrian visited (*c.* AD 129) the city, which thereafter became a *civitas libera* (free city). Later it was granted by Caracalla the title of *colonia*, with exemption from taxes. The 3rd century AD was the great age of Palmyra.

When the Sāsānians supplanted the Parthians in Iran and southern Mesopotamia (AD 227), the road to the Persian Gulf was soon closed to Palmyrene trade. These difficulties plus the instability of the Roman Empire favoured the setting up of the personal rule of the family of Septimius Odaenathus. He was appointed governor of Syria Phoenice by the emperor Valerian, but it was apparently Gallienus (AD 253–268) who conferred on him the title of *corrector totius Orientis* ("governor of all the East"). Both Odaenathus and his eldest son, the heir apparent, were assassinated, however, reputedly at the command of Odaenathus' wife, Zenobia. She governed effectively, and in 270 the armies of Palmyra conquered most of Anatolia (Asia Minor) and Zenobia declared Palmyra's independence from Rome. The emperor Aurelian, however, regained Anatolia and Palmyra in AD 272.

The city remained the chief station on the *strata Diocletiana*, a paved road that linked Damascus to the Euphrates. But in 634 it was taken by Khālid ibn al-Walīd in the name of the first Muslim caliph, Abū Bakr (AD 632–634).

The language of Palmyra was Aramaean; it had two systems of writing: a monumental script and a Mesopotamian cursive—reflecting the city's position between East and West. The great bilingual inscription known as the Tariff of Palmyra and the inscriptions carved below the statues of the great caravan leaders are sources of knowledge of the organization and nature of Palmyra's trade. The Palmyrenes exchanged goods with India via the Persian Gulf route and also with such cities as Coptos on the Nile, Rome, and Doura-Europus in Syria.

The principal deity of the Aramaeans of Palmyra was Bol (probably Baal, Lord). Bol soon became Bel by assimilation to the Babylonian Bel-Marduk, both of whom presided over the movements of the stars: the Palmyrenes associated Bel with the sun and moon gods, Yarhibol and Aglibol. Another heavenly triad formed around the Phoenician god Baal Shamen, the "lord of heaven," more or less identical with Hadad. A monotheistic tendency emerged in the 2nd century AD with the cult of an Unnamed God, "he whose name is blessed forever, the merciful and good."



The Temple of Bel at Palmyra
H. Roger-Viollet

The ruins at Palmyra clearly reveal the network plan of the ancient city. Along the principal street, oriented east–west, a double portico is ornamented with three nymphaea. To the south are the agora, the Senate House, and the theatre. Other ruins include a vast complex called Diocletian's Camp and the chief Palmyrene sanctuary, dedicated to Bel, Yarhibol, and Aglibol. In architecture the Corinthian order marks almost all the monuments, but the influence of Mesopotamia and Iran is also clearly evident.

Modern Tadmur, at the site of ancient Palmyra, is situated on the Kirkuk (Iraq)–Tripoli (Lebanon) pipeline and at the junction of motor routes through the Syrian Desert. Pop. (1985 est.) 20,627.

Palmyra, town (township), Wayne county, western New York, U.S., on the New York State Barge Canal, 20 miles (32 km) east-southeast of Rochester. Founded in 1789 as a frontier town and named for the ancient Syrian city, the locale is associated with Joseph Smith, whose supposed visions there led to his founding the Church of Jesus Christ of Latter-day Saints (the Mormon Church) in 1830 at Fayette, 28 miles (45 km) southeast. Smith's boyhood Palmyra home (restored) is near Sacred Cove, where his first vision occurred in 1823. At nearby Hill Cumorah, as directed by the angel Moroni, he is said to have unearthed (1827) the Golden Plates from which he translated the *Book of Mormon.* A 40-foot (12-metre) monument to the angel crowns the hill, site of an annual Mormon pageant that takes place for seven nights beginning in late July. The village of Palmyra was separately incorporated in 1819. Dairy and vegetable farms are in the area, and feed, pickles, vinegar, and sauerkraut are processed; mechanical packings and paper boxes are manufactured. Pop. (1986 est.) 3,870.

Palmyra Atoll, formerly SAMARANG, coral atoll, unincorporated territory of the United States, in the Northern Line Islands in the west-central Pacific Ocean, 1,000 miles (1,600 km) southwest of Honolulu. It comprises 50 islets with a combined area of 4 square miles (10 square km) and an average height of only 6 feet (2 m) above sea level. Sighted in 1802 by the American ship *Palmyra,* the island was annexed by the Kingdom of Hawaii in 1862 and by Britain in 1889. By an act of the U.S. Congress in 1898, Palmyra was included with the Hawaiian Islands and was then annexed to them in 1912. During World War II the atoll's central lagoon and joined islets were used as landing strips. When Hawaii became a state in 1959, Palmyra was not included. The atoll, once a producer of copra, is now privately owned but is under the administration of the U.S. Department of the Interior. There are no permanent inhabitants.

Palmyrenian alphabet, Semitic script used in Palmyra, a city on the trade routes between Syria and Mesopotamia, from the 3rd to the 2nd century BC until shortly after the conquest of the city by the Romans in AD 272. Developed from the Aramaic alphabet, Palmyric had 22 letters and was written from right to left. It occurred in two forms: a rounded, cursive form derived from Aramaic about 250 BC and a decorative monumental script developed from the cursive form in the 1st century BC.

Palmyrenian inscriptions have been found in Palmyra, Palestine, and Egypt and elsewhere in North Africa and from as far afield as the Black Sea coast, Hungary, Italy, and England. The earliest surviving Palmyrenian inscription dates from 44 BC; the last dates from AD 274.

Palni Hills, range of hills, an eastward extension of the Western Ghāts, southwestern Tamil Nādu state, southern India. A continuation of the Anaimalai Hills in Kerala state, the Palnis are about 45 miles (70 km) wide and 15 miles (23 km) long. In the south the hills terminate abruptly in steep slopes.

The upper Palnis, in the west, consist of rolling hills covered with coarse grasses; dense forests grow in the valleys. Peaks include Vandaravu, 8,376 feet (2,553 m); Vembādi Shola, 8,221 feet (2,505 m); and Karunmakadu, 8,042 feet (2,451 m). The town of Kodaikānal is located in a high basin averaging 7,000 feet (2,150 m) above sea level. Hill villages cultivate vegetables and fruits such as potatoes, beans, root crops, pears, and peaches. There are also bauxite mines.

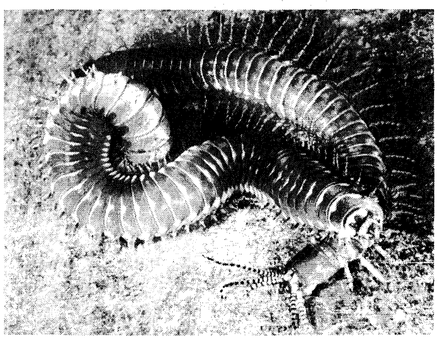
The lower Palnis, in the east, form a confused jumble of peaks averaging 3,000–5,000 feet (900–1,500 m) above sea level and separated by steep wooded valleys. Teak trees have been extensively planted. Important cash crops include coffee, bananas, cardamom, citrus fruit, and turmeric.

Palo Alto, city, Santa Clara county, California, U.S., on the western shore of San Francisco Bay. Gaspar de Portolá's 1769 expedition is said to have camped near El Palo Alto (referring to "the tall [redwood] tree"). The site was developed in 1891 as a "dry" village for Stanford University, and deeds still prohibit liquor sales. The city received its name from Senator Leland Stanford's "Palo Alto" farm. Stimulated by the university and by urban growth of the west bay shore area, Palo Alto developed research-oriented light industries including aerospace, communications, and electronics. Inc. 1939. Pop. (1988 est.) 57,517.

Palo Alto, Battle of (May 8, 1846), first clash in the Mexican War, fought at a small site in southeastern Texas about 9 miles (14.5 km) northeast of Matamoros, Mex. Mexican troops had crossed the Rio Grande to besiege Fort Brown and to threaten General Zachary Taylor's supply centre. General Taylor and his army met the invaders at Palo Alto with superior artillery. Despite the greater numbers and crack cavalry units of the Mexican army, commanded by General Mariano Arista, the Mexicans suffered heavier casualties. Disheartened by their lack of success, they retired the next day to a defensive position farther south.

palo verde (Spanish: "green wood"), any member of the genera *Cercidium* and *Parkinsonia,* of the pea family (Fabaceae), comprising a small group of trees and shrubs scattered through the arid regions of the southwestern United States, Mexico, Central America, and Venezuela. Three species of palo verde are native to the United States; two of them become treelike. Blue palo verde (*C. floridum*) is a bushy tree that grows up to 9 m (30 feet) high, found in desert areas of southern California, Arizona, and northwestern Mexico, including the Baja California peninsula. It is usually a short-trunked, intricately branched tree, with smooth, conspicuously green bark and minute leaves that fall after the rainy season. The bright-yellow flowers, borne in clusters, are followed by cylindrical, beanlike pods approximately 7.6 cm (3 inches) long. The blue palo verde is a characteristic woody plant along washes in the Colorado desert. Border palo verde (*C. macrum*), a Mexican tree, grows only as far north as southeastern Texas. It is readily distinguished from the blue palo verde by its flattened, podlike fruits. Mexican palo verde (*Parkinsonia aculeata*) occurs in southwestern Arizona and from Texas to Florida.

palolo worm, any of various segmented marine worms of the families Eunicidae and Nereidae (class Polychaeta, phylum Annelida). The palolo worm exhibits unique breeding behaviour: during the breeding season, always at the same time of year, the worms break in half; the tail section, bearing reproductive cells, separates and swims to the surface, where it releases eggs and sperm.



Palolo worm (*Eunice*)
Jacques Six

Adults of the family Eunicidae are about 40 cm (16 inches) long and are divided into ringlike segments, each with paddlelike appendages bearing gills. Several sensory tentacles grow from the head. A pharynx that may be thrust forward is armed with teeth. Males of this family are reddish brown; females are bluish green.

The palolo worm of the South Pacific (*Palolo siciliensis* [*P. viridis* or *Eunice viridis*]) inhabits crevices and cavities in coral reefs. As the breeding season approaches, the tail end of the body undergoes a radical change. The muscles and most of the organs degenerate, and the reproductive organs rapidly increase in size. The limbs on the posterior segment become more paddlelike. After the animal backs part way out of its tubelike burrow, the posterior section breaks free and swims to the surface as a separate animal, complete with eyes. The anterior end, still attached to its tube, regenerates a new posterior end.

The free-swimming section always makes its appearance in the early morning for two days during the last quarter of the Moon in October. Twenty-eight days later, it appears in even greater numbers in the final quarter of the November Moon. At the surface of the sea the sperm and eggs are discharged, and fertilization occurs. Palolo tails, considered a delicacy by the Polynesians, are gathered in vast numbers during swarming.

Widely distributed in the rock coral of the West Indies is the Atlantic palolo (*E. furcata,* or *E. schemocephala*), which swarms during the last quarter of the June–July Moon. The Japanese palolo (*Tylorrhynchus heterochaetus*), also considered a food delicacy, lives in the coastal waters of Japan.

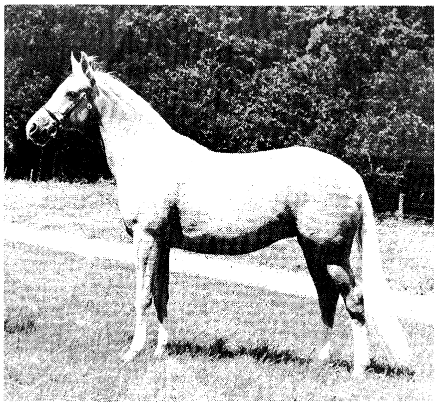
Palomar, Mount, peak (6,126 feet [1,867 m]) in the Cleveland National Forest, southern California, U.S., about 40 miles (65 km) north-northeast of San Diego. The Palomar Mountain State Park (1,887 acres [764 hectares]) extends up the mountain slope, and the Palomar Observatory, one of the Hale Observatories, occupies a 720-acre (290-hectare) plateau at the top and can be reached by the Highway to the Stars. The peak was once called Smith Mountain but reverted to its Mexican name, Palomar (meaning "place of the pigeons"), in 1901.

Palomar Observatory, astronomical observatory located on Mount Palomar, about 40 miles (65 km) north-northeast of San Diego, Calif. The observatory is the site of the famous Hale telescope, a reflector with a 5-metre (200-inch) aperture that has proved instrumental in cosmological research. Built in 1948 and named in honour of the American astronomer George Ellery Hale, this high-magnification telescope was the largest instrument of its kind until 1976. Other important instruments at Palomar include a wide-angle Schmidt telescope, which has a 0.9-metre (36-inch) aperture and 1.2-metre (48-inch) mirror. This instrument was used in the early 1950s to produce the monumental *National Geographic Society–Palomar Observatory Sky Survey,* a star atlas containing photographs of more stars and nebulae than had been cataloged in any previous collection. It was employed again during the mid-1980s for a photographic mapping of the entire sky.

The Palomar Observatory was founded in 1948 by the California Institute of Technology in Pasadena and was operated jointly with the

Mount Wilson Observatory as the Hale Observatories until 1980.

Palomino, colour type of horse distinguished by its cream, yellow, or gold coat and white or silver mane and tail. The colour does not breed true. Horses of proper colour, of proper saddle-horse type, and from at least one registered parent of several light breeds can be registered as Palominos. This colour is popular for pleasure and parade classes. Their type and use depend upon their breeding and training. They may conform to the breed types of several light breeds, such as Arabian or American Quarter horse. Two associations, the Palomino Horse Breeders of America, established in 1941, and the Palomino Horse Association, established in 1936, register Palominos.



Palomino
Sally Anne Thompson—EB Inc.

Palomino DE CASTRO Y VELASCO, in full ANTONIO ACISELO PALOMINO DE CASTRO Y VELASCO (b. 1655, Bujalance, Spain—d. August 1726, Madrid), Spanish painter, scholar, and author, the last court painter to King Charles II of Spain.

After study at the University of Córdoba, Palomino was a student of the painter Valdes Leal and later Alfaro. In 1688 Palomino was appointed court painter and continued to concentrate on easel work until 1699. Thereafter he assisted Luca Giordano in the fresco decoration of El Escorial and continued to execute numerous large frescoes in churches in Madrid, Salamanca, Córdoba, Granada, and El Paular. Influenced by both Juan Carreño de Mirauda and Claudio Coello, he specialized in elaborate allegorical paintings marked by effects of light and a dignified elegance, as in "St. Michael" (Kansas City, Mo.).

He is most remembered for his writings. *El museo pictórico y escala óptica* (1715–24; "The Pictorial Museum and Optical Scale") consists of two volumes, one on the theory and the other on the practice of painting, together with a collection of the lives of eminent Spanish painters and sculptors and of artists from other countries who worked in Spain. Modeled on Giorgio Vasari's biographies of Italian artists, it is the most valuable source for the history of Spanish painting in the 16th and 17th centuries.

palsy (disease): *see* paralysis.

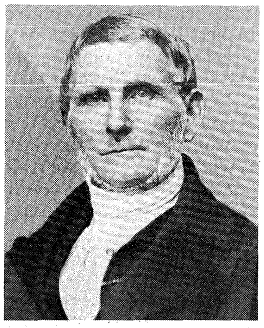
Palta, Ecuadorian Indian ethnolinguistic group that lived in the Andean highlands at the time of the Spanish conquest (16th century). Although the Ecuadorian highlands are still inhabited by persons of Indian descent, the languages, cultures, and tribal affiliations existing at the time of the conquest have disappeared and little is known of them. The Palta language probably belonged to the Arawakan language family. The Palta appear to have moved into the highlands from the tropical forests to the east not long before the conquest. They were mainly farmers who grew corn (maize), potatoes, beans, squash, avocados, and tropical fruits. Settlements were dispersed, each family living on its own farmland; houses were made of mud and thatch. Little is known about Palta crafts, religion, or social structure.

Palu, city, capital of Sulawesi Tengah *provinsi* ("province"), Celebes, Indonesia, located at the mouth of a small estuary on the Makassar Strait and surrounded by hills. It is connected by road with Toboli and Tomini on the eastern coast of the province and with Donggala, Mapida, and Mapaga on the western coast. The population consists mainly of Buginese and Makasarese; Islām is the dominant religion, although there are a few Christians. The majority of Palu's inhabitants are seafarers and traders. Much of the trade is by small craft and is localized along the western coast. Household industries include wood carving, sawmilling, plaiting, and basket and mat making. Small factories process food, and boats are built and repaired. Deep-sea fishing is also economically important. Copra and timber are exported. Pop. (1980) 298,584.

Paludan, (Stig Henning) Jacob (Puggaard) (b. Feb. 7, 1896, Copenhagen—d. Sept. 26, 1975, Birkerød, near Copenhagen), Danish novelist and conservative critic whose work expressed a mistrust—based on the fear of Americanization of European culture—of Danish society and of the generation that followed World War I.

Paludan traveled to Ecuador and the United States after World War I. He was the leading critic of the conservative Copenhagen newspaper *Dagens Nyheder* and was the editor of *Hasselbalchs Kulturbibliotek,* a book series that popularized arts and letters. He translated several books into Danish, most notably Sinclair Lewis' *Dodsworth.* His foremost contribution, however, is that of his novels. *Fugle omkring fyret* (1925; *Birds Around the Light*), *Markerne modnes* (1927; "The Ripening Fields"), and his monumental epic novel *Jørgen Stein,* 2 vol. (1932–33) were among his most widely known and translated works.

Paludan-Müller, Frederik (b. Feb. 7, 1809, Kerteminde, on the Island of Fyn, Den.—d. Dec. 28, 1876, Copenhagen), Danish poet who achieved early acclaim in the Danish Romantic movement for his Byronic epic *Danserinden* (1833; "The Danseuse").

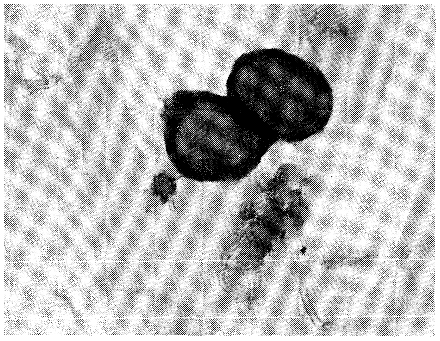


Paludan-Müller
By courtesy of the Royal Library, Copenhagen

The son of a bishop, he was educated at the University of Copenhagen. Later, after he was rescued from a mental and religious crisis by a happy marriage, he became a moralist and a critic of Romantic values. His *Adam Homo,* 3 vol. (1841, 1848), a lengthy satirical epic in three parts, is counted among the most important works of Danish literature. Its autobiographical hero, Adam Homo, is a worldly success who suffers the loss of his soul. He is saved only by the devotion of his jilted sweetheart Alma. Adam Homo is said to have been Ibsen's model for the character of Peer Gynt.

palygorskite, a fibrous magnesium aluminum silicate. The structure of palygorskite contains extended silicon-oxygen sheets, justifying the retention of the mineral in the layer silicate family, but the tetrahedral SiO_4 groups forming these sheets are oriented in such a manner as to develop extended lathlike features that give rise to the fibrous morphology. The mineral occurs in sediments from playa lakes and saline deposits, in desert soils, and in calcareous material. Attapulgite is a variety of palygorskite found in Attapulgus, Ga. For chemical formula and physical properties of attapulgite, *see* clay minerals (table).

palynology, scientific discipline concerned with the study of plant pollen and spores and certain microscopic planktonic organisms, in both living and fossil form. The field is associated with the plant sciences as well as with the geologic sciences, notably those aspects dealing with stratigraphy, historical geology, and paleontology. Accordingly, the scope of palynologic research is extremely broad, ranging from the analysis of pollen morphology with electron microscopes to the study of organic microfossils (palynomorphs) extracted from ancient coals.



Fossil pollen found in a 6,500-year-old peat bog, used for palynology research
Bruce Iverson

As pollen and spores are produced in large numbers and dispersed over large areas by wind and water, their fossils are recoverable in statistically significant assemblages in a wide variety of sedimentary rocks. Moreover, because pollen and spores are highly resistant to decay and physical alteration, they can be studied in much the same way as the components of living plants. Identification of pollen and spore microfossils has greatly aided delineation of the geographical distribution of many plant groups from early Cambrian time (590,000,000 years ago) to the present.

Important, too, is the fact that the evolutionary sequence of organisms based on the large fossil remains of plants in sedimentary rocks is recorded by the sequence of plant microfossils as well. Such microfossils are thus useful in determining geologic age and are especially important in sediments devoid of large fossils. Because of their abundance and minute size, microfossils can be extracted from small samples of rock secured in drilling operations. Palynological analysis therefore is of practical application to petroleum exploration and to other geologic research involving subsurface sediments and structures.

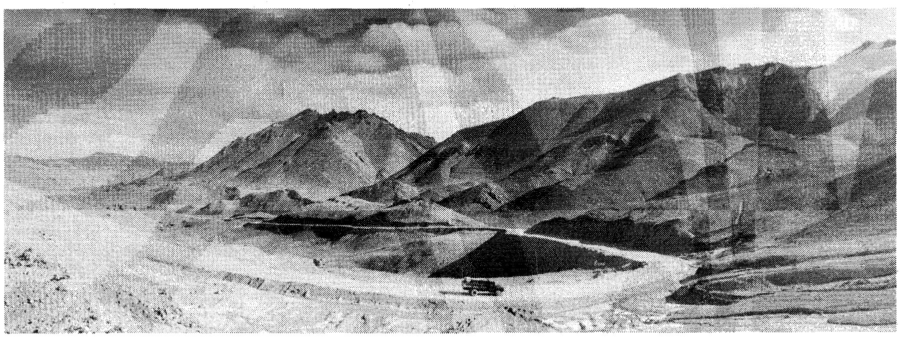
The phases of palynology that deal exclusively with fossils are outgrowths and extensions of techniques and principles developed in the study of peat deposits of northern Europe during the early 1900s. In such research the presence, absence, and relative abundance of the pollen of various species of trees from known depths in the bog were ascertained statistically. Inasmuch as forest composition determines the pollen types trapped on the surface of a bog at any given time, it follows that changes in the pollen content reflect regional changes in forest composition. It was established that alterations in forest makeup were induced by climatic change over the many thousands of years since glacial ice disappeared from northern Europe. A relationship was thus established between the pollen content of the peat, the age (*i.e.*, position in the bog), and climate. Application of such findings proved invaluable in subsequent studies of ancient climate, particularly the glacial and interglacial stages of the Pleistocene Epoch (about 2,000,000 to 10,000 years ago).

pamaquine, synthetic chemical drug introduced into medicine in 1926. It is related to both quinine and quinacrine and is used in treating malaria. It was the first of a series of important antimalarial drugs to be derived from 6-methoxyquinoline, a constituent of the naturally occurring drug quinine.

Pamaquine is a liquid; its solid salt, pamaquine pamoate, was used successfully in the treatment of malaria, although toxic reactions led to its displacement by related but less toxic drugs, such as chloroquine, primaquine, and amodiaquin. Toxic effects include blood diseases such as methemoglobinemia and leukopenia as well as toxic hepatitis.

Pamirs, also called PAMIR, highland region of central Asia, centred in the Gorno-Badakhshan autonomous *oblast* (province) of the Tadzhik Soviet Socialist Republic of the Soviet Union.

A brief treatment of the Pamirs follows. For full treatment, *see* MACROPAEDIA: Asia.



The Osh–Khorog highway through the Pamirs in Tadzhik S.S.R., U.S.S.R.
K. Garenskikh/TASS from Sovfoto

The Pamirs include a combination of east–west and north–south ranges, with the former predominating. The highland covers an area of approximately 3,250 square miles (8,400 square km), bounded on the north by the Trans-Alay Mountains; on the east by the Sarykol Range, which forms the border between China and the Soviet Union; on the south by Lake Zorkul, the Pamir River, and the source of the Pyandzh River bordering Afghanistan; and on the west by the north–south segment of the Pyandzh valley.

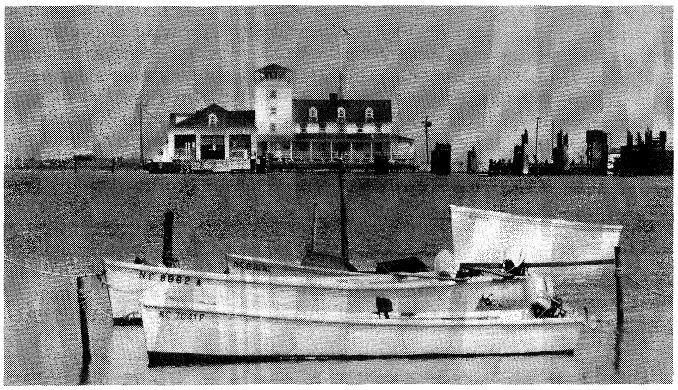
In the eastern Pamirs, rounded mountain ranges of medium relief rise from a high foundation and are separated by wide, flat-bottomed valleys. Peaks average 20,000 feet (6,100 m) or more above sea level, but their relative heights above their foundations do not generally exceed 3,300 to 5,900 feet (1,000 to 1,800 m). In the western Pamirs, however, the relief is extreme and sharply disjointed, alternating between low ranges and Alpine ridges capped by glaciers and cut by deep, narrow ravines with high, rapid rivers. Communism Peak in the Academy of Sciences Range rises to 24,590 feet (7,495 m) in the northwest, the highest point in the system and in the Soviet Union.

The majority of the region's rivers, most notably the Pyandzh and the Pamir, drain toward the basin of the Amu Darya (river), which flows into the Aral Sea; a few rivers contribute their waters to the Tarim Basin. The climate of the Pamirs is arid and continental, characterized by very low amounts of precipitation and snow coverage and great variations in temperature. These climatic features are more pronounced in the eastern ranges, and, as a result, only low-growing plants survive the severe conditions of the cold, high mountain desert. The vegetation of the western ranges is richer, especially along the river valleys at lower elevations, where dense willow, birch, and poplar forests grow. Among the sparse wildlife are the *arkhar* (a mountain sheep) and the *kiik* (a mountain goat).

In the sparsely populated Pamirs area, which has an average density of only a few persons per square mile, about nine-tenths of the inhabitants are Tadzhiks, who live in the western Pamirs; in the eastern Pamirs live the Kirgiz. Nearly all are peasants whose chief occupation is farming small fields and orchards and raising sheep and goats. There are a few automobile roads through the area, some of which follow ancient caravan routes through mountain passes to China and Afghanistan. However, many routes are accessible only to pedestrians and pack animals. Industry in the Pamirs includes several small hydroelectric power stations, a few small antimony, mercury, and silver mines in the west, and brown coal and salt mines in the east.

Pamlico, Algonkian-speaking Indians who lived along the Pamlico River in what is now Beaufort county, N.C., when first encountered by Europeans. These sedentary agriculturalists were almost destroyed by smallpox in 1696, and in 1710 the 75 survivors lived in a single village. They joined with part of the Tuscarora and other tribes in a war against white settlers (1711–13); at the close of the war those Tuscarora under treaty with the English agreed to exterminate the Pamlico. The surviving remnant were probably incorporated as slaves to the Tuscarora.

Pamlico Sound, shallow body of water along the eastern shore of North Carolina, U.S., separated from the Atlantic Ocean by narrow barrier beaches (the Outer Banks) of which Cape Hatteras is the easternmost. The sound extends 80 miles (130 km) south, then southeastward, from Roanoke Island, and is 8–30 miles (13–48 km) wide. It receives the Tar-Pamlico and Neuse-Trent rivers, while the main inlets from the ocean are Ocracoke and Hatteras. Numerous swans, geese, and ducks nest along the coastal waters, and there is some commercial fishing, especially for oysters. The name is derived from that of an extinct local Indian tribe.



U.S. Coast Guard station on Ocracoke Island in Pamlico Sound, North Carolina
Bill Barley/Shostal Associates

Pampa (fl. 940), South Indian poet and literary figure called *ādikavi* ("first poet") in the Kannada language, who created a style that served as the model for all future works in the Kannada language.

Although Pampa's family had been orthodox Hindus for generations, his father, Abhirāmadevarāya, together with his whole family, was converted to the Jaina faith. True to his rearing, Pampa cared little for material possessions and gave freely of what he had. He esteemed his guru, Devendramuni, and his royal patron, Arikēsarī, highly and lauded both in his writings.

Pampa's great work was the *Ādipurāṇa* ("First [or Original] Scriptures"), in which Jaina teaching and tenets are expounded. Another epic of his creation is the *Pampa-Bhārata* (*c.* 950; Bhārata is both the ancient name for India and the name of a famous king), in which Pampa likens his royal master to the mythical hero Arjuna in the *Mahābhārata* ("Great Bhārata").

Pampa, city, seat (1902) of Gray county, northern Texas, U.S., 55 miles (88 km) northeast of Amarillo. Located in the Texas Panhandle, the city serves as the centre of an oil-producing, wheat-growing, and cattle-raising area. Its economy is based mainly on petroleum, natural gas, chemicals, and related industries. It is headquarters for one of the world's largest producers of carbon black and oil-field equipment. Other economically important activities include meat-packing and clothing manufacturing. Founded in 1888 on the Santa Fe Railroad, it was named for the supposed resemblance of the surrounding prairie lands to the Argentine Pampas. Inc. city, 1912. Pop. (1986 est.) 23,241.

Consult the INDEX *first*

Pampanga River, Spanish RÍO GRANDE DE PAMPANGA, river in Luzon Island, Philippines, rising in several headstreams in the Caraballo Mountains and flowing south for about 120 miles (190 km) to empty into northern Manila Bay in a wide, swampy delta. The Candaba Swamp, covering more than 200 square miles (500 square km) when flooded, has been formed north of the delta where the Angat River joins the Pampanga. Other major tributaries are the Chico Pampanga and the Lubao. There are extensive fishponds and a large-scale irrigation project on the lower course of the Pampanga.

Pampangan, also called KAPAMPANGAN, cultural-linguistic group of the Philippines. The Pampangan, numbering about 1,970,000 in the late 20th century, live principally in the central plain of Luzon Island but also inhabit other portions of the island. Their region, extending north from Manila Bay, has a relatively high population density; there are many tenant farmers and landless workers. Their religion is Christian, predominantly Roman Catholic.

The Pampangan language is closely related to others of the central Philippines, all of which belong to the Austronesian (Malayo-Polynesian) family of languages.

Pampas, the, also called THE PAMPA, Spanish LA PAMPA, vast plain extending westward across central Argentina from the Atlantic coast to the Andean foothills, bounded by the Gran Chaco (north) and Patagonia (south). The name comes from a Quechua Indian word meaning "flat surface." It has a gradual slope from northwest to southeast, from about 1,640 feet (500 m) above sea level at Mendoza to 66 feet (106 m) at Buenos Aires. Apart from a few sierras in the northwest and south, most of the region appears perfectly flat. Several smaller plains in other parts of South America, such as the desert of northern Chile, are also referred to by the term Pampas.

The Argentine Pampas covers an area of approximately 295,000 square miles (760,000 square km) and is divided into two distinct zones. The dry Pampas in the west, which includes most of La Pampa province, is largely barren, with great saline areas, brackish streams, and sandy deserts. The humid Pampas in the east, a much smaller area that includes part of Buenos Aires province, is temperate and well-watered and is the economic heart of the nation and the country's most populated area. The soil consists chiefly of fine sand, clay, and silt washed down toward the Atlantic by the great rivers or blown in dust storms from the west. Cool winds from the south periodically meet warm air from the tropical north, creating violent gales accompanied by heavy rain in the neighbourhood of Buenos Aires. These storms are known as pamperos. Characteristic animals of the Pampas include foxes, skunks, small herds of guanaco, viscachas, bush dogs, and many bird species related to the sparrows, hawks, and waterfowl of the North American prairies.

The region has been transformed since the middle of the 19th century. The Spaniards had introduced cattle and horses but had made no attempt toward land development. The animals were rounded up by gauchos, who were celebrated for their horsemanship, hardiness, and lawlessness. After liberation from Spain (1816) and the pacification of the Indians who roamed the plains, landowners began to employ immigrants (chiefly Italians) to cultivate their estancias (ranches), sowing alfalfa for fodder, corn (maize), and finer pastures. They fenced their lands and imported pedigreed sheep and cattle from Great Britain. Railways were built across the Pampas, the gauchos gradually became peons (labourers), and horses were replaced by tractors. The southeastern area between Mar del Plata and Tandil, being relatively cool and containing much swampy land, was devoted to the breeding of high-grade sheep and cattle, while the western belt (from Bahía Blanca to Santa Fe) was cultivated principally for alfalfa and wheat. Around Rosario, corn (maize) and flax are the chief crops, and some livestock is raised. The vicinity of Buenos Aires has been developed to supply the capital with vegetables, fruit, and milk.

The Pampas served as background in Argentina's gauchoesque literature, including such notable works as José Hernández' *El gaucho Martín Fierro* (1872) and Ricardo Güiraldes' *Don Segundo Sombra* (1926), and also as the theme for a great deal of Argentina's musical folklore.

pampas cat (*Felis colocolo*), small cat, family Felidae, native to South America. It is about 60 cm (24 inches) long, including the 30-centimetre tail. The coat is long-haired and grayish with brown markings which in some individuals may be indistinct. Little is known about the habits of the pampas cat. It is reported to live in thick shrubbery and to hunt birds and small animals at night.

pampas grass (*Cortaderia selloana*), one of more than 20 species of tall, reedlike Central and South American and New Zealand grasses comprising the genus *Cortaderia* (family Poaceae). Female plants bear silvery, plumelike flower clusters about 30 to 90 cm (1 to 3 feet) tall. Pampas grass is cultivated as a lawn ornamental in warm parts of the world.

Pampas grass (*Cortaderia selloana*)
A.M. Wettach—Shostal/EB Inc.

Pamphili, Giovanni Battista (pope): *see* Innocent X.

pamphlet, brief booklet; in the UNESCO definition, it is an unbound publication that is not a periodical and contains no fewer than 5 and no more than 48 pages, exclusive of any cover.

After the invention of printing, short unbound or loosely bound booklets were called pamphlets. Since polemical and propagandist works on topical subjects were circulated in this form, the word came to be used to describe them. Librarians and bibliographers generally classify as a pamphlet any short work, unbound or bound in paper covers. Although the word tract is almost synonymous, it generally describes religious publications.

Pamphlets were among the first printed materials, and they were widely used in England, France, and Germany. The first great age of pamphleteering was inspired by the religious controversies of the early 16th century. In France so many pamphlets were issued in support of the Reformed religion that edicts prohibiting them were promulgated in 1523, 1553, and 1566. In Germany the pamphlet was first used by the leaders of the Protestant Reformation to inflame popular opinion against the pope and the Roman Catholic Church. Martin Luther was one of the earliest and most effective pamphleteers. The coarseness and violence of the pamphlets on both sides and the public disorder attributed to their distribution led to their prohibition by imperial edict in 1589.

The pamphlet was popular in the Elizabethan age, being used not only for religious controversy but also by such men as Thomas Dekker, Thomas Nashe, and Robert Greene for romantic fiction, autobiography, scurrilous personal abuse, and social and literary criticism.

In France didactic and abusive religious pamphleteering gave way to a more flippant and lively writing that satirized the morals of the court and the chief ministers. The pamphlets of Blaise Pascal, known as *Les Provinciales,* raised the form to the level of literature. In England pamphlets gained increasing propagandist influence during the political and religious controversies of the 17th century. They played an important role in the debates between Puritan and Anglican, and king and Parliament in the years before, during, and after the English Civil Wars. At the time of the Restoration in England in 1660, the flow of pamphlets was checked, their range restricted to some extent by newspapers and periodicals. During the Revolution of 1688, however, pamphlets increased in importance as political weapons. The development of party politics gave employment to pamphleteers, including such writers as Joseph Addison, Richard Steele, Matthew Prior, Francis Atterbury, and Jonathan Swift.

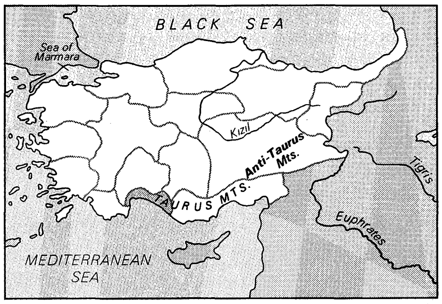
The pamphlet continued to have a powerful influence throughout the 18th century. In North America, pre-Revolutionary political agitation stimulated the beginning of extensive pamphleteering; foremost among the writers of political pamphlets was Thomas Paine, whose "Common Sense" appeared in January 1776. After the United States was founded, another wave of pamphleteering was caused by the proposal of a new constitution in 1787. From this material there emerged *The Federalist Papers,* contributions made to the discussion of government by the revolutionary pamphleteers Alexander Hamilton, John Jay, and James Madison. *The Federalist* may also be regarded as marking the end of the era of the political pamphlet; thereafter political dialogue was largely carried on in newspapers, periodicals, and bound books.

Noted pamphleteers of 18th-century France—Voltaire, Jean-Jacques Rousseau, Montesquieu, and Denis Diderot, among others—used pamphlets to express the philosophy of the Enlightenment. These pamphlets were reasoned discourses, though with the arrival of the French Revolution, they once again became powerful polemical weapons. The revolution itself produced many popular anonymous pamphlets, slandering the queen and the nobility and commenting on events. The most complete collection of Revolutionary pamphlets can be found in the Bibliothèque Nationale, Paris. The revolution also occasioned one of the most outstanding English pamphlets, Edmund Burke's *Reflections on the Revolution in France* (1790). It provoked many replies, the most famous of which is Thomas Paine's *Rights of Man* (1791–92).

In 19th-century France, Paul-Louis Courier wrote polemic masterpieces. In England the pamphlet played a part in all political movements of the 19th century. Most notable were pamphlets on Chartism, Irish Home Rule, and the Oxford Movement. At the turn of the century, Fabian Society members George Bernard Shaw, Beatrice Webb, and Graham Wallas propagated political doctrine in a series of pamphlets.

In the 20th century the pamphlet has more often been used for information than for controversy, chiefly by government departments and learned societies.

Pamphylia, ancient maritime district of southern Anatolia, originally a narrow strip of land that curved along the Mediterranean between Cilicia and Lycia, but that under Roman administration included large parts of Pisidia to the north. The Pamphylians, a mixture



Pamphylia

From W. Shepherd, *Historical Atlas*, Harper & Row, Publishers (Barnes & Noble Books), New York; revision copyright © 1964 by Barnes & Noble, Inc.

of aboriginal inhabitants, immigrant Cilicians, and Greeks, never acquired great political significance and ran the gauntlet of Anatolian conquerors: Phrygians, Lydians, Persians, Alexander the Great and his successors, and, finally, the Romans. In the 1st century BC they joined with Pisidians and Cilicians in piratical raids on Mediterranean shipping. The Pamphylians became largely Hellenized in Roman times and have left memorials of their civilization at Perga, Aspendus, and Side.

Where the same name may denote a person, place, or thing, the articles will be found in that order

Pamplona, city, Norte de Santander department, northeastern Colombia, in the Andean Cordillera (mountains) Oriental at an elevation of 7,503 ft (2,287 m), on the Río Pamplonita. Founded in 1548, it was famed during the colonial era for its mineral production. Though it has been damaged by earthquakes (most severely in 1644 and 1875), much colonial architecture survives. Particularly noteworthy are the cathedral and the former monasteries of San Francisco, Santo Domingo, and San Agustín. The city's industries include textile mills, breweries, and distilleries. Gold and coal are mined in the vicinity. The University of Pamplona was founded in 1960. Pamplona lies on the Pan-American Highway, 45 mi (72 km) southeast of Cúcuta, the departmental capital. Pop. (1973) 32,946.

Pamplona, capital of Navarra province and autonomous community (region), northeastern Spain, on the western bank of the Río Arga in the fertile La Cuenca region, just south of Bayonne, Fr. According to tradition, it was founded in 75 BC by Julius Caesar's rival Pompey (Gnaeus Pompeius Magnus) as a military settlement during his campaign against Quintus Sertorius, leader of a revolt against Rome. The city's first name was Pompeiopolis, or Pompaelo (corrupted by the Moors to Banbalūnah). It was almost derelict after Moorish and Frankish invasions and the final dismantling of its defenses by the Frankish king Charlemagne in 778. Pamplona was made capital of the kingdom of Navarre by Sancho III of Navarre (1000–35), his new foundation being known as the Ciudad de la Navarrería. In 1512 the armies of Ferdinand the Catholic entered Pamplona, and the portion of Navarre south of the Pyrenees was incorporated into Castile. The citadel built by Philip II of Spain in 1571 made Pamplona the most strongly fortified town of the north. After the First Carlist War (1833–39), Pamplona ceased (1841) to be the capital of the Navarre kingdom but became capital of the new Navarra province.

The medieval core of the town, La Navarrería, is dominated by the cathedral, mostly 14th- to 15th-century French Gothic but with Romanesque remnants and a Neoclassical facade. Notable, too, is the Gothic church (13th–14th century) in the old district of San Saturnino or Cernín (*i.e.,* San Saturninu, who traditionally evangelized the city). Other important buildings include the Cámara de Comptos (royal treasury, *c.* 1364); the Casa Consistorial (1741, with Baroque facade); and the Diputación Provincial (Neoclassical) with the Archivo General de Navarra adjoining. The centre of the city, linking old with new, is the porticoed Plaza del Castillo. Pamplona has various museums and institutions of higher education. The University of Navarra was established at Pamplona in 1952.

The city's chief tourist attraction is the Fiesta de San Fermín (honouring St. Fermin, its first bishop), described in Ernest Hemingway's novel *The Sun Also Rises* (1926). Starting on July 6, the eve of the saint's festival, the fiesta lasts until the 14th, with daily bullfights preceded each morning by the famous *encierro* ("enclosing") of the bulls, when they are driven through the streets behind crowds of skillfully dodging men and boys.

Situated in an irrigated cereal-producing area, Pamplona is a flourishing agricultural centre. The city's ancient crafts of wineskin, sandal, rope, and pottery making coexist with the manufacture of kitchenware, liquor, paper, and chemicals, and the milling of flour and sugar. Industrialization has produced a suburban belt of factories and workers' dwellings. Pamplona is important for communications between Spain and France. Pop. (1982 est.) 186,363.

Pamukkale (ancient Phrygian city): *see* Hierapolis.

Pan, in Greek mythology, a fertility deity, more or less bestial in form; he was associated by the Romans with Faunus (*q.v.*). Originally an Arcadian deity, his name is a Doric contraction of *paon* ("pasturer") but was com-

Pan, terra-cotta statuette from Eretria, *c.* 300 BC; in the Staatliche Museen zu Berlin, Germany

By courtesy of the Staatliche Museen zu Berlin, Germany

monly supposed in antiquity to be connected with *pan* ("all"). His father was generally said to be Hermes; his mother, however, was often named Penelope, probably not the wife of Odysseus but commonly identified with her, and consequently one or another of the characters in the *Odyssey* was sometimes called his father. Pan was generally represented as a vigorous and lustful figure having the horns, legs, and ears of a goat; in later art the human parts of his form were much more emphasized. He haunted the high hills and his chief concern was with flocks and herds, not with agriculture. Like a shepherd he was a piper, and he rested at noon. Pan was insignificant in literature, aside from Hellenistic bucolic, but he was a very common subject in ancient art. His rough figure was antithetical to, for example, that of Apollo, who represented culture and sophistication; hence the story of their musical contest.

Pan, also called PANGUINGUE, card game, expanded form of the game Cooncan, or Conquian, and one of the earliest of the Rummy games. Pan is popular in the western United States, where it is played as a gambling game in many clubs. Eight packs of 40 cards (the 8, 9, 10 not being used) are used, ranking K (high) to A (low). The game is best with 6 or 7 players, although as many as 15 may play. Each player is dealt 10 cards, 5 at a time. The rotation is to the right, as in Cooncan. The remainder of the pack is placed face down on the table to form the stock, and the top card is turned face up beside it to begin the discard pile.

The object of the game is to meld 11 cards. After the deal, players may decide whether to stay in the game or drop the hand; if they drop, they usually must pay a forfeit.

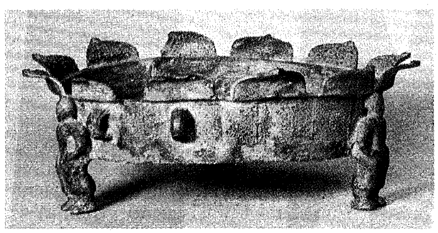
Melds, as in Rummy, are either sequences of three or more cards in the same suit or groups of three or more cards of the same rank. In Pan, groups of aces or kings (noncomoquers) are valid regardless of suits; groups of other ranks (comoquers) must be either all of one suit or all of different suits. Certain melds, called conditions, entitle the player to collect from all other players. Valles, or value cards, are 3s, 5s, and 7s. Conditions and their usual collections are a group of valles of one suit (2 units), a group of nonvalles of one suit (1), low sequence of 3–2–A (1), and high sequence of K–Q–J (1). In some games, conditions in spades collect double.

In play, each player in turn draws one card from the top of the stock or the discard pile. Some rules forbid drawing from the discard pile; others allow it only if the card drawn may be melded at once. After drawing, the player may meld or add (lay off) as many cards as he wishes to his previous melds. Then he must discard one card. When a player has melded all 10 cards of his original hand, he must continue to draw and discard until he can meld or lay off the card drawn.

Players may split or borrow cards from previous melds to form new ones, providing that they leave valid melds. Conditions formed by splitting or borrowing collect as if they were entirely new.

The first player to meld 11 cards wins the deal and collects a previously established sum from all players who did not drop. He also collects from them again for all of his conditions and takes the forfeits of players who did drop.

p'an, Pinyin PAN, type of Chinese bronze vessel produced during the Shang (18th–12th century BC) and, more commonly, during the Chou (1111–255 BC) dynasties. A low bowl



Bronze *p'an,* late Warring States, *c.* 3rd century BC; in the Asian Art Museum of San Francisco, The Avery Brundage Collection

By courtesy of the Asian Art Museum of San Francisco, The Center of Asian Art and Culture, The Avery Brundage Collection or pan used as a serving dish or for ceremonial washing, the *p'an* is generally circular and supported on a low ring base. Sometimes there are two vertical handles, and occasionally there are legs attached to the base.

The bronze *p'an* shape has a Neolithic (*c.* 3000–1500 BC) pottery predecessor. The base and the narrow exterior surfaces of the bowl support a limited series of decorative motifs; the broad, flat interior of the vessel is often used for a more elaborate design or for a long inscription.

Pan-African Congress (PAC), in full (since 1964) PAN-AFRICAN CONGRESS OF AZANIA, also called PAN-AFRICANIST CONGRESS, political organization of South African blacks who joined together to work for majority rule and equal rights. (Azania is an African name for South Africa.)

The PAC was formed in April 1959 as an offshoot of the more moderate and multiracial African National Congress (ANC). The founder and chairman of PAC was Robert Sobukwe, who claimed that the ANC was contaminated by non-African influences. The PAC originally advocated such methods of political pressure as strikes and boycotts. On March 21, 1960, a year after its formation, it sponsored a nationwide one-day protest against the laws requiring blacks to carry passes. Sobukwe and others were arrested.

During one such demonstration, at Sharpeville in the Transvaal, police fired into a crowd, killing 69 Africans and wounding 180. In further response to the demonstration, the government outlawed the PAC (as well as the ANC) as of April 8, 1960. Sobukwe remained in prison or under some form of restriction until his death in February 1978. Some members of the PAC went abroad, establishing centres in London and Dar es Salaam, Tanz. The PAC became involved in armed struggle about 1961, and a number of arrests related to both the armed struggle and the clandestine activities of the PAC and the ANC occurred throughout the late 1960s and the '70s. The PAC cultivated sympathy for the cause in the United Nations, the Organization of African Unity, and the World Council of Churches, while other members remained in South Africa as an underground movement. In 1985 the PAC reiterated its "Africans-only" policy but announced willingness to work with the ANC and other antiapartheid groups. The ban on the organization was lifted early in 1990.

Pan Am Corporation, holding company established in 1984, its chief subsidiary being Pan American World Airways, Inc. The airline was founded in 1927 (as Pan American Airways, a name retained until 1950) and, by the late 20th century, had service to cities in many countries in North and South America, the Caribbean Islands, Europe, Asia, Africa, and the Middle East. Headquarters are in the Pan Am Building in New York City.

The company was incorporated in 1927 by a former World War I naval aviator, Juan Terry Trippe, who secured a contract to fly mail between Key West, Fla., and Havana. The airline's first passenger service—between these cities—began the next year. (One of the employee pilots and a surveyor of new routes was Charles A. Lindbergh.) By the end of 1929 Pan Am had a 12,000-mile (19,000-kilometre) route linking the United States, Cuba, Haiti, Dominican Republic, Puerto Rico, Mexico, British Honduras, Panama, and Colombia. Pan Am inaugurated the first transpacific flights (from San Francisco to Manila) in 1936, with the famous *China Clipper;* the first transatlantic flights (from New York City to Lisbon) in 1939, with the *Yankee Clipper;* and the first round-the-world flights (from New York to New York eastbound) in 1947.

In the late 1970s Pan American competed with Eastern Airlines and Texas International Airlines for control of a major domestic carrier, National Airlines, Inc. In 1980 it won and completed the purchase, giving it an extensive network of routes along the eastern U.S. seaboard and points west. National was formed in 1929, when founder George Theodore Baker (1900–63) began the National Airlines Air Taxi System in Chicago. In 1934 he moved to Florida; in 1937 he reincorporated as National Airlines, Inc.; and in 1944 it became a major airline with the award of the lucrative tourist route between New York and Florida. In 1986 United Airlines, Inc., took over by purchase Pan American's routes to cities in Asia and the South Pacific. Pan American thus largely abandoned its Pacific routes to concentrate on its European, Middle Eastern, and South American traffic.

Pan American's system includes Pan Am Express, Inc., with connecting flights in Canada, the United States, and Europe, and Pan Am Shuttle, Inc., which serves the New York City–Boston and New York City–Washington markets.

Pan-American conferences, various meetings between representatives of some or all of the independent states of the Western Hemisphere (Canada usually excluded). Between 1826 and 1889, several meetings between American states were held to discuss problems of common defense and juridical matters. The First International Conference of American States (1889–90), held largely as the result of the efforts of the U.S. secretary of state James G. Blaine, established the International Union of American Republics (later called the Pan-American Union), with its headquarters in Washington, D.C. Subsequent conferences dealt with such matters of common concern as arbitration of financial and territorial claims, extradition of criminals, codification of international law, copyrights, patents and trademarks, and the status of aliens and diplomatic personnel. The Inter-American Conference for the Maintenance of Peace, held in 1936 at the request of President Franklin D. Roosevelt, at Buenos Aires, adopted a draft treaty for the peaceful resolution of conflicts between American states; conferences held in 1938 (at Lima), 1945 (at Chapultepec in Mexico City), and 1947 (at Quitandinha, near Petrópolis, Brazil) considered the problems of hemispheric defense, reciprocal assistance, and solidarity. The Ninth International Conference of American States, at Bogotá (1948), led by the United States, reconstituted the Pan-American organization as the Organization of American States (OAS). *See also* American States, Organization of.

Pan American Games, Spanish JUEGOS PANAMERICANOS, quadrennial sports event for the nations of the Western Hemisphere, patterned after the Olympic Games and sanctioned by the International Olympic Committee.

The Pan American Games had their inception at a meeting of the Pan American Congress at Buenos Aires in 1940, attended by representatives of the national Olympic committees of 16 countries. Because of World War II, the games scheduled to be held in 1942 were not held until 1951. The first games were held in Argentina. Some 2,000 athletes represented 20 Western Hemisphere nations in a program of 19 sports: athletics (track-and-field), baseball, basketball, boxing, cycling, equestrian events, fencing, gymnastics, pentathlon, polo, rowing, shooting, soccer, swimming and diving, tennis, water polo, weight lifting, wrestling, and yachting. Judo, synchronized swimming, and volleyball were added later.

Pan-American Highway, network of highways connecting North America and South America. Originally conceived in 1923 as a single route, the concept grew to include a great number of designated highways in participating countries. The Inter-American Highway, from Nuevo Laredo, Mex., to Panama City (3,350 miles [5,390 km]), is a part of it.

The Mexican section was built and financed entirely by Mexico, while the sections through the smaller Central American countries were built with U.S. assistance. The whole system, when completed through Chile, Argentina, and Brazil, will total nearly 16,000 miles (26,000 km). In the 1980s a portion about 240 miles (400 km) long, called the Darien Gap highway (located in Panama and Colombia), remained uncompleted.

Pan American World Airways, Inc., subsidiary of Pan Am Corporation (*q.v.*).

Pan Ch'ao, Pinyin BAN CHAO (b. AD 32, An-ling, Ku-fang [now Hsien-yang, Shensi province], China—d. 102, Lo-yang, Honan province, China), Chinese general and colonial administrator of the Han dynasty (206 BC–AD 220) who reestablished Chinese control over Central Asia. The brother of the historian Pan Ku (32?–92), Pan Ch'ao early tired of literary pursuits and turned to military affairs. In 73 he was dispatched with a small force on a mission to pacify the Hsiung-nu tribes who had been raiding China's northwestern borders. By playing on the internal dissensions among the tribes, he quickly succeeded. His efforts were frustrated, however, by his recall three years later.

Several years elapsed before Pan Ch'ao was permitted to resume his mission, but he soon had the entire Tarim Basin (in modern Sinkiang Uighur Autonomous Region) under his control. He was made *tu hu* (protector general) of the western regions in 91, and he expanded his conquests across the Pamirs to the shores of the Caspian Sea. Only Parthia (in modern Iran) separated him from the outer reaches of the Roman Empire, and he sent an envoy to contact Roman authorities. The man, however, turned back after reaching the Persian Gulf.

In 102 Pan Ch'ao's sister, Pan Chao, a well-known scholar, successfully petitioned the emperor to allow Pan Ch'ao to return home, where he died a month later. Two of his sons maintained Chinese control in Central Asia for a brief period.

Pan Chao, Pinyin BAN ZHAO (b. *c.* AD 45, An-ling, Ku-fang [now Hsien-yang, Shensi province], China—d. *c.* 115, China), renowned Chinese scholar and historian of the Eastern Han dynasty.

Daughter of a prominent family, she married at the age of 14, but her husband died while she was still young. She never remarried, devoting herself instead to literature and the education of her son. Her father, Pan Piao (AD 3–54), apparently had begun a history of the Former Han dynasty (206 BC–AD 8). After his death, Pan Chao's brother Pan Ku (AD 32?–92) was given a post by the emperor as official historian and was ordered to complete the work. The resulting *Han shu* ("Book of Han") is one of the best-known histories ever written and the model for all future dynastic histories in China. Pan Chao, who assisted her brother with the work during his lifetime, was commissioned by the emperor to complete it after Pan Ku's death.

Because of her reputation as a scholar and an exemplary widow, Pan Chao also was made a lady in waiting to the empress. In 101, while in the palace, she wrote a memorial to the throne that led to the recall of her other brother, the general Pan Ch'ao, to the capital after 30 years of extraordinary military and colonial service in Central Asia. Pan Chao wrote many beautiful poems and essays, the most famous of which is *Nü shih* (106; "Lessons for Women").

Pan-ch'iao, also spelled PAN KIAO, *shih* (municipality) and seat of T'ai-pei *hsien* (county), northern Taiwan, 4 mi (7 km) southwest of Taipei city, in the northern part of the western coastal plain. Situated on the eastern bank of Tan-shui Ho (Tamsui River), it flourished in the early 18th century and is the centre of the agricultural region producing tea, rice, sweet potatoes, and citrus fruits. Pan-ch'iao is on the West Line branch of the Taiwan Railway. Its chief industries are textile production and food canning; coal is mined and clay is extracted nearby. The oriental garden of the Lin-pen Yüan and T'zu Hu (Lake Mercy), about 13 mi southwest of Pan-ch'iao, are tourist attractions. Pop. (1979 est.) 377,523.

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Pan-Germanism, German PANGERMANISMUS, or ALLDEUTSCHTUM, movement whose goal has been the political unification of all people speaking German or a Germanic language. Some of its adherents favoured the unification of only the German-speaking people of central and eastern Europe and the Low Countries (Dutch and Flemish being regarded as Germanic dialects). The movement had its roots in the desire for German unification stimulated by the war of liberation (1813–15) against Napoleon I and fanned by such early German nationalists as Friedrich Ludwig Jahn and Ernst Moritz Arndt. Advocates of the Grossdeutschland solution wished also to include the Germans of the Austrian Empire in one German nation. Others wished also to include the Scandinavians. Writers such as Friedrich List, Paul Anton Lagarde, and Konstantin Franz argued for German hegemony in central and eastern Europe—where German domination in some areas had begun as early as the 9th century AD with the *Drang nach Osten* (expansion to the East)—to ensure European peace. The notion of the superiority of the "Aryan race" proposed by Joseph-Arthur, comte de Gobineau, in his *Essai sur l'inégalité des races humaines* (1853–55; *Essay on the Inequality of Human Races,* 1907), influenced many Germans to extol the Nordic, or German, "race."

The Pan-German Movement was organized in 1894, when Ernst Hasse, a professor at Leipzig and a member of the Reichstag (parliament), set up the Alldeutscher Verband (Pan-German League) on the basis of the loosely organized Allgemeiner Deutscher Verband (General German League) founded in 1891. Its purpose was to heighten German nationalist consciousness, especially among German-speaking people outside Germany. In his three-volume work, *Deutsche Politik* (1905–07), Hasse called for German imperialist expansion in Europe. Georg Ruter von Schönerer and Karl Hermann Wolf articulated Pan-Germanist sentiments in Austria-Hungary and also attacked Slavs, Jews, and capitalism. These ideas did much to mold the mind of Adolf Hitler. Under the Weimar Republic (1919–33), Pan-Germanists continued to press for expansion; the most articulate and active force toward that end was Hitler and the Nazi Party. Expansionist propaganda was buttressed by a theory called geopolitics, which made history subject to a kind of geographical determinism. The expansionism preached by Munich professor Karl Haushofer, together with Ewald Banse, author of *Raum und Volk im Weltkriege* (1932), and Hans Grimm, author of *Folk ohne Raum* (1926), was put into practice by Hitler in his annexation of Austria and the German-speaking area of Czechoslovakia and in the demands he made on Poland that led to the outbreak of World War II. Defeat in 1945 not only brought an end to the Third Reich and its European hegemony but also resulted in the expulsion of Germans from formerly German areas of eastern Europe, the loss of a large portion of territory on Germany's eastern frontier, and the division of the remaining German territory into two states. Since then Pan-Germanism has diminished in influence.

pan-hu, Pinyin BANHU, bowed-string instrument of China, especially popular in the northern regions. The bow is threaded between the two strings, which are stretched over a small bamboo bridge resting on a wooden soundboard. It is played in an upright position, and bowing is done close to the top of the resonator. A soprano version tuned a fifth apart and an alto version tuned a fourth apart are popular. The performance of the *pan-hu* is characterized by frequent use of rapid separate bowing and glissandos.

Pan Kiao (Taiwan): *see* Pan-ch'iao.

P'an Ku, Pinyin PAN GU, central figure in Chinese Taoist legends of creation. P'an Ku, the first man, is said to have come forth from chaos (an egg) with two horns, two tusks, and a hairy body. Some accounts credit him with the separation of heaven and earth, setting the sun, moon, stars, and planets in place, and dividing the four seas. He shaped the earth by chiselling out valleys and stacking up mountains. All this was accomplished from P'an Ku's knowledge of yin-yang, the inescapable principle of duality in all things.

P'an Ku holding the yin-yang symbol, 19th-century European print after a Chinese drawing; in the British Museum
By courtesy of the trustees of the British Museum

Another legend asserts that the universe derived from P'an Ku's gigantic corpse. His eyes became the sun and moon, his blood formed rivers, his hair grew into trees and plants, his sweat turned to rivers, and his body became soil. The human race, moreover, evolved from parasites that infested P'an Ku's body. These creation myths date from the 3rd to the 6th century. Artistic representations frequently depict P'an Ku as a dwarf clothed with leaves.

Pan Ku, Pinyin BAN GU (b. AD 32?, Ch'ang-an, China—d. AD 92), Chinese scholar-official of the Eastern, or Later, Han dynasty and one of China's most noteworthy historians. His *Han shu,* or *The History of the Former Han Dynasty,* became the model most frequently used by later Chinese historians.

Pan Ku was the son of Pan Piao (AD 3–54), an intellectual and antiquarian who was given a court appointment by the Emperor during the early years of the restoration of the Han dynasty. Disliking court life, Pan Piao pleaded poor health and retired, thereafter devoting himself to the independent study of history. He collected material for the continuation of Ssu-ma Ch'ien's great history of China, the *Shih-chi,* which had begun with the earliest dynasties and stopped midway through the Western, or Former, Han dynasty.

After his father's death, Pan Ku continued this historiographical undertaking. In the course of it, however, he was imprisoned for tampering with dynastic records. His twin brother, Pan Ch'ao, an outstanding general who extended China's western frontier to the Pamirs, interceded so successfully that Pan Ku was not only acquitted but was also appointed by the Emperor to the office of official historian.

With all obstacles now removed, he spent the next 16 years compiling and editing the vast *Han shu,* which became the prototype for the official histories of successive ruling houses in China, recording the administrations of their predecessors. Although modelled on the *Shih-chi,* the *Han shu* was not merely a supplement to that long-range work but was a new and comprehensive record of the Han Empire, from its beginning down to the regime of the reformer Wang Mang, who had proclaimed his own short-lived dynasty in AD 9.

Pan Ku went back to the beginning of the Han, duplicating almost verbatim most of the documents Ssu-ma Ch'ien had used for that part of the Han period he had treated, excising redundancies or simplifying the prose that seemed to him awkward or obscure. And, since Pan Ku's own age enjoyed widening education, bureaucratic proliferation, improved writing materials and techniques, and standardized orthography, he had an even larger body of recent records from which to select. Dealing with a period of roughly 200 years, the *Han shu* is much longer than the *Shih-chi,* which purports to cover 3,000 years.

Both Ssu-ma Ch'ien and Pan Ku were court officials, and they inevitably used the official record of the lives of the emperors and their close relatives (and of the often more decisive activities of their civil and military administrators) to form their main chronological narrative. This constitutes Pan's part 1, the basic annals. He adopted Ssu-ma Ch'ien's methods for other parts: part 2, charts and diagrams of events, genealogies, persons, etc.; part 3, treatises on a wide range of topics, such as court ceremony, music, money and taxes, and navigation; and part 4, single or grouped biographies of memorable persons other than emperors. To these subjects he added new ones on natural phenomena, on geography, and on bibliography, a descriptive account of the books preserved in the Imperial library—invaluable to later scholars trying to judge textual authenticity and family lineages after many works had vanished. Pan Ku eliminated Ssu-ma Chi'en's fifth category of "hereditary houses," since China was no longer a collection of competing states.

When the historian felt his task to be essentially completed, he apparently decided to participate more actively in the politics of his day. He had been at least on the periphery of intellectual controversy regarding the interpretation of the Confucian Classics—by no means a mere antiquarian pursuit but one fraught with political implications, as he remarked in one of his few personal observations in the *History.* Editorship of the *Pai-hu t'ung,* or "Symposium in the White Tiger Hall," which deals with this subject, is ascribed to him.

In his middle 40s, however, Pan Ku chose to undertake something more adventurous. Leaving the finishing touches on the *Han shu* to his sister Pan Chao, also an extraordinary scholar (not to be confused with his brother Pan Ch'ao), he joined the staff of the general Tou Hsien and accompanied him in successful campaigns against the northern Hsiung-nu tribes. The following victory inscription composed by Pan Ku was carved in stone 1,000 miles beyond the frontier:

> Our trained soldiery came hither on a campaign against barbarian hordes. We chastised Turkic insolence and restored our supremacy in this distant land. Across these vast plains they went back to their northern home, while our splendid troops set up this trophy that the achievements of our glorious Emperor should be heard of ten thousand generations hence.

The Emperor, however, who was 14 years old and Tou Hsien's nephew, became alarmed at the general's self-importance and, suspecting him of excessive ambitions, exiled him to his own lands. Pan Ku's fate was one common throughout Chinese history; his superior's fall implicated him, and he was incarcerated for interrogation. Falling ill in prison, he died there at the age of 60. His sister duly rounded out the vast *Han shu* manuscript and was officially sanctioned to instruct other scholars on its contents.

For centuries the Chinese have debated the relative merits of the history of the single, self-contained dynasty such as Pan Ku's, and the comparatively rare histories that span the rise and fall of successive hegemonies and systems, which are claimed to reflect more effectively the lessons of history. Obviously, the general historian must build on the work of those dealing with shorter periods, and the two kinds of enterprise cannot be compared qualitatively on the basis of scope. As a historian, Pan Ku must be evaluated on other grounds in relation to his predecessor and to the next great long-range narrator, Ssu-ma Kuang, who wrote more than 1,000 years later. Since both were more inclined to offer interpretations and personal comments, their commentaries appear to be more colourful and sometimes more interesting. Pan Ku, on the other hand, is admired for his thoroughness and his virtually complete objectivity.

Indeed, one might call Pan Ku a historiographer rather than a historian. He undertook simply to represent the Han dynasty and empire as factually as possible through an organized compendium of existing documents; hence the title *Han shu*—literally, "Han Documents."

Pan Ku's prose style, to which he more or less adjusted the documents he incorporated, was simple, lucid, uneccentric, and not especially vivid. It was terse but not lapidary; somewhat more carefully regulated than Ssu-ma Ch'ien's, it was still, probably, not altogether remote from the spoken Chinese of his own day and class. It was a model of what came to be known as the Han style, revived many centuries later in reaction to excessively elaborate prose.

When practicing the dominant literary form of his time, the *fu*, or rhymed prose, however, Pan Ku could be as extravagant, bizarre, and exhibitionistic as others displaying their talents in this fashionable genre. His two rhymed prose compositions on the merits of the successive Han capitals (the new one, of his present masters, of course, winning out) spawned many imitations, especially for their exhibition of unusual words. In a simpler vein he wrote some rather inconsequential verses modelled on the popular folk songs of his day. His name has been attached, spuriously, to a collection of anecdotes and hearsay about the reign of the Han emperor Wu Ti.

(G.W.Ba.)

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P'an-lung-ch'eng, Pinyin PANLONGCHENG, Chinese archaeological site from about the middle of the Shang dynasty period (18th–12th century BC). The site, located near the confluence of the Yangtze and Han-shui rivers in central Hupei, consists of five graves and two storage pits that were first excavated in 1963 and a town wall and palace foundations that were uncovered in 1974.

P'an-lung-ch'eng was an ancient walled town of *hang-tu* construction, covering an area of 850 by 950 feet (260 by 290 metres). Chinese archaeologists have reconstructed its probable layout. There was a large palace, which was a hall in four bays surrounded by a continuous corridor. This is apparently a typical Shang palace type. A wooden coffin found in one of the tombs was incised with an animal mask and designs of thunderclouds. These are the earliest wood carvings yet found in China. Among more than 60 objects also discovered were several bronze axes with cicada and dragon decorations. Buried together with the owner of these were three sacrificed slaves.

Pan Piao, Pinyin BAN BIAO (b. AD 3, Fu-feng, China—d. 54, China), eminent Chinese official of the Han dynasty (206 BC–AD 220) who is reported to have begun the famous *Han shu* ("Book of Han"), considered the Confucian historiographic model on which all later dynastic histories were patterned.

Pan Piao intended the work to supplement the *Shih-chi* ("Historical Records") of the famous historian Ssu-ma Ch'ien (*c.* 145–85 BC) and to cover the period from 104 BC, the last year covered by Ssu-ma. Pan died before the writing was completed, at which point it was taken over by his son Pan Ku. Pan Ku did not live to finish the work, ultimately completed by Pan Piao's daughter Pan Chao, China's most famous woman scholar.

Pan-p'o-ts'un, Pinyin BANPOCUN, one of the most important sites yielding remains of the Painted Pottery, or Yang-shao, culture of late Neolithic China. Located in the northwestern Chinese province of Shensi, Pan-p'o-ts'un was excavated by members of the Chinese Academy of Sciences in 1953 and 1955.

The large Neolithic settlement was situated on a low river terrace and contained multi-shaped clay huts, with floor levels often below the ground. Each hut had an earthen pillar in the middle to support a thatched roof, which was reinforced with clay. All dwellings contained several fireplaces and a number of storage areas. Several kilns were found on the site, as well as a number of fine specimens of coloured red and gray bowls and jars. Some coarse sandy ware decorated with black geometric figures has also been found.

Most of the Pan-p'o-ts'un people's tools were bone, though they also had some polished and chipped stone implements. They were agriculturalists whose primary grain was millet. Bones of pigs, dogs, and sheep have been found around the village, indicating the presence of domestic animals. Children were buried in small urns, adults in rectangular pits.

Pan-Scandinavianism, also called SCANDINAVIANISM, or SCANDINAVISM, an unsuccessful 19th-century movement for Scandinavian unity that enflamed passions during the Schleswig-Holstein crises. Like similar movements, Scandinavianism received its main impetus from philological and archaeological discoveries of the late 18th and the 19th century, which pointed to an early unity. It was also spurred by the rise of Pan-Germanism and by a general fear of Russian expansion. Generally a middle-class and student movement calling for varying forms of cultural and political unity, Scandinavianism was a significant force from 1845 to 1864. It clashed with Pan-Germanism over the Schleswig-Holstein question, and Swedish and Norwegian volunteers joined the Danes during the Schleswig War (1848–50). When Sweden-Norway refused to join Denmark after hostilities over the duchies again erupted in 1864, however, Scandinavianism became bankrupt. Thereafter it remained strong only among the Swedish minority in Finland. There has been a resurgence of Pan-Scandinavian sentiment in the latter part of the 20th century.

Pan-shan (Chinese writer and statesman): *see* Wang An-shih.

Pan-shan ware, Pinyin BANSHAN, type of Chinese Neolithic painted pottery. The name is that of the site in the Kansu Province of North China in which this pottery was found in a grave in 1923. As with all Neolithic ware, the dating is conjectural; but Pan-shan ware is generally considered to date from between 2500 and 2000 BC; some authorities extend the limits as far back as 3000 BC, while others believe them to be as late as the early Shang dynasty, *c.* 1500 BC. Most of the specimens are urns, some quite large; and a few deep bowls have been found. The body is a reddish brown; the decoration, mostly in black pigment probably applied with a brush, consists of geometric patterns or stylized figures of men, fish, and birds; and there is no glaze. Although coiling was common, some of the wares were probably shaped on a slow, or hand-turned, wheel. The handles are set low on the body of the urns, and the lower part of the body is left undecorated—as with most Greek Proto-Geometric funerary ware, to which there is a certain likeness. The paucity of Neolithic Chinese pottery at the time of the discovery gave the find an importance out of proportion to its size. Since the 1950s, however, the large amount of archaeological activity in China has placed Pan-shan in a larger framework of Neolithic Chinese ware.

Pan-Slavism, 19th-century movement that recognized a common ethnic background among the various Slav peoples of eastern and east central Europe and sought to unite those peoples for the achievement of common cultural and political goals. The Pan-Slav movement originally was formed in the first half of the 19th century by West and South Slav intellectuals, scholars, and poets, whose peoples were at that time also developing their sense of national identity. The Pan-Slavists engaged in studying folk songs, folklore, and peasant vernaculars of the Slav peoples, in demonstrating the similarities among them, and in trying to stimulate a sense of Slav unity. As such activities were conducted mainly in Prague, that city became the first Pan-Slav centre for studying Slav antiquities and philology.

The Pan-Slavism movement soon took on political overtones, and in June 1848, while the Austrian Empire was weakened by revolution, the Czech historian František Palacký convened a Slav congress in Prague. Consisting of representatives of all Slav nationalities ruled by the Austrians, the congress was intended to organize cooperative efforts among them for the purpose of compelling the Emperor to transform his monarchy into a federation of equal peoples under a democratic Habsburg rule.

Although the congress had little practical effect, the movement remained active, and by the 1860s it became particularly popular in Russia, to which many Pan-Slavs looked for leadership as well as for protection from Austro-Hungarian and Turkish rule. Russian Pan-Slavists, however, altered the theoretical bases of the movement. Adopting the Slavophile notion that western Europe was spiritually and culturally bankrupt and that it was Russia's historic mission to rejuvenate Europe by gaining political dominance over it, the Pan-Slavists added the concept that

Russia's mission could not be fulfilled without the support of other Slav peoples, who must be liberated from their Austrian and Turkish masters and united into a Russian-dominated Slav confederation.

Although the Russian government did not officially support this view, some important members of its foreign department, including its representatives at Constantinople and Belgrade, were ardent Pan-Slavists and succeeded in drawing both Serbia and Russia into wars against the Ottoman Empire in 1876–77.

When efforts were made in the early 20th century to call new Pan-Slav congresses and revive the movement, the nationalistic rivalries among the various Slav peoples prevented their effective collaboration.

p'an-t'ao, Pinyin PANTAO (Chinese: "flat peach"), in Chinese Taoist mythology, the peach of immortality that grew in the garden of Hsi wang mu ("Queen Mother of the West"). When the fruit ripened every 3,000 years, the event was celebrated by a sumptuous banquet attended by the Pa Hsien ("Eight Immortals").

Hsi wang mu presented the *p'an-t'ao* to favoured mortals such as the Chou-dynasty emperor Mu-wang (10th century BC) and the Han-dynasty emperor Wu-ti (141–87 BC). The first Ming-dynasty emperor (14th century AD) is said to have been presented with a *p'an-t'ao* stone identified, by 10 engraved characters, as formerly belonging to Wu-ti. Flat peaches from Chekiang province were sent each year to the imperial palace in Peking before the founding of the Chinese Republic (1912).

Pan-Turanianism, also called PAN-TURANISM, late 19th- and early 20th-century movement to unite politically and culturally all the Turkic, Tatar, and Uralic peoples living in Turkey and across Eurasia from Hungary to the Pacific. Its name is derived from *Tūrān,* the Persian word for Turkistan (*i.e.,* the land to the north of Iran). It was popular mainly among intellectuals and developed from a now largely discarded theory of the common origin of Turkish, Mongol, Tungus, Finnish, Hungarian, and other languages (the Ural-Altaic languages). In the half-century before World War I, some Hungarians sought to encourage Pan-Turanianism as a means of uniting Turks and Hungarians against the Slavs and Pan-Slavism. The movement was never more than a sidelight, however, to the more important Pan-Turkism.

Pan-Turkism, political movement of the late 19th and early 20th century, which had as its goal the political union of all Turkish-speaking peoples in the Ottoman Empire, Russia, China, Iran, and Afghanistan. The movement, which began among the Turks in the Crimea and on the Volga, initially sought to unite the Turks of the Ottoman and Russian empires against the growing Russian tsarist domination.

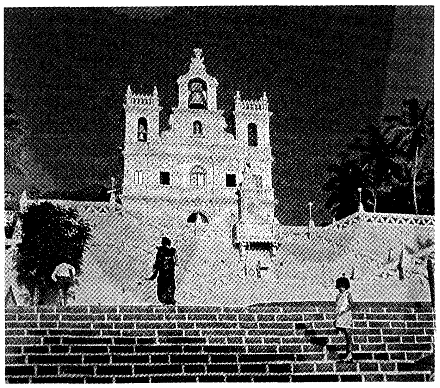
In 1883 İsmail Gasprinski, a Crimean Turk, proclaiming the "unity in language, thought and action" of all the Turkish-speaking peoples in the Russian and Ottoman empires, established the Turkish newspaper *Tercüman* in the Russian Crimea. In 1911 Yussuf Aktshura Oghlu founded in Constantinople (Istanbul) a similar paper, *Türk Yurdu* ("The Turkish Homeland"). At the same time, prominent Turkish writers such as Ziya Gökalp and Halide Edib Adıvar, author of the novel *Yeni Turan* (1912; "The New Turan"), glorified the common legendary past and the future of the Turkish race. Their symbol was a she-wolf (*Bozkurt*), regarded as the mother of the race and worshiped before the Turkish conversion to Islām.

During the years 1913–18, when Turkey was involved in a bitter struggle with Russia, Pan-Turkish propaganda was officially promoted by the Ottoman government. In the 1920s and '30s Kemal Atatürk deemphasized Pan-Turkism, instead encouraging Turkish nationalism within Turkey. During World War II, the revival of Pan-Slavism under Stalin and the Russian threat to Turkish autonomy, brought a renewed, though slight, interest in Pan-Turkism among some Turks. The demand for a federation of Turkish states continued after World War II among the Turkish-speaking Islāmic peoples in the Soviet Union.

Panaetius (b. Lindus, Rhodes; fl. *c.* 180–109 BC), the founder of Roman Stoic philosophy, and a friend of Scipio Aemilianus and of Polybius.

A pupil in Athens of Diogenes of Seleucia and of Antipater of Tarsus, Panaetius also studied the philosophies of Plato and of Aristotle. Many years resident in Rome, he was an influential member of the Scipionic circle and was invited to be Scipio's sole companion on an ambassadorial visit to the Orient in about 140 BC. Panaetius succeeded Antipater as head of the school and passed the last 20 years of his life in Athens. While adhering to fundamental Stoic teaching, Panaetius tempered the rigid austerity of the ancient Stoa and introduced a new humanist note. He appears to have written less voluminously than other leading Stoics, and none of the five treatises attributed to him is extant. His important ethical treatise *On the Appropriate* was Cicero's model for the first two books of the *De Officiis.* His chief disciple was Poseidonius of Apamea.

Panaji, also spelled PANJIM, town, capital of Goa state, western India, on the Mandāvi River. It was a tiny village until the mid-18th century, when repeated plagues forced the Portuguese to abandon their capital of Velha Goa (Old Goa, or Ela). Panaji became the capital in 1843. The town contains colonial houses and plazas, and by law all the houses must be whitewashed annually. Chiefly an administrative centre, in the 1970s Panaji also grew in commercial importance, and an



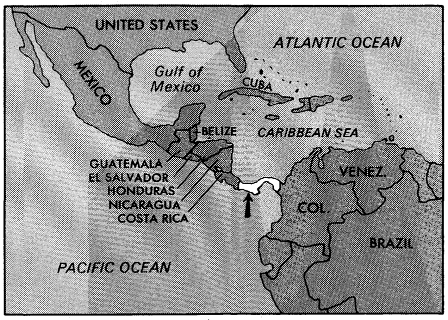
Church in Panaji, Goa state, India
Picturepoint, London

industrial estate was developed nearby. Numerous Portuguese and Marāṭhā ruins can be found in the environs. Pop. (1981) town, 43,-165; metropolitan area, 77,226.

Panama, officially REPUBLIC OF PANAMA, Spanish REPÚBLICA DE PANAMÁ, country of Central America occupying the southernmost extension of the isthmus connecting with the northwestern corner of South America, covering 29,762 square miles (77,082 square km). The capital is Panama City. It is a narrow, curved strip of land, bordered on the north (along a 720-mile [1,160-kilometre] coastline) by the Caribbean Sea, on the east by Colombia, on the south (along a rugged 1,050-mile [1,690-kilometre] coastline) by the Pacific Ocean, and on the west by Costa Rica. The population in 1990 was estimated to be 2,418,000.

A brief treatment of Panama follows. For full treatment, *see* MACROPAEDIA: Central America; Latin America, The History of. For current history and for statistics on society and economy, *see* BRITANNICA WORLD DATA ANNUAL.

The land. The Panamanian landscape consists of three distinct areas: the lowlands, or hot lands, lying at elevations below 2,300 feet



Panama

(700 m), which make up more than 85 percent of the country's territory; the temperate lands, situated at elevations of between 2,300 and 4,900 feet (1,500 m); and the highlands, or cold lands, lying more than 4,900 feet above sea level. The highlands include the inactive Barú Volcano (11,401 feet [3,475 m]), the country's highest peak, located in the central Tabasará Mountain Range; the northeastern mountain arc, including the San Blas and Darién mountains; the southeastern mountain arc; and the southern volcanic chains. The lowlands include the plains near the gulfs of Panamá and Chiriquí, the Bayano and Chucunaque river basins, and the plains of the Caribbean region. On Panama's continental shelf are more than 1,600 islands. Its coasts have many bays, gulfs, peninsulas, and capes.

Panama has approximately 500 rivers, most of which have their sources in the highlands. They include the Tuira, Bayano, Sixaola, Changuinola, Chiriquí Viejo, and Santa María.

Panama has mostly a tropical, rainy climate, with warm days and cool nights throughout the year. Only the savanna area situated on the Pacific coast experiences a marked dry season for part of the year. The annual average temperature on both coasts is about 80° F (27° C), and it ranges from 50° to 66° F (10° to 19° C) in the mountains. The period of heaviest rainfall is from May to December. Rainfall averages more than 117 inches (2,972 mm) a year on the Caribbean coast and 63 inches (1,600 mm) on the Pacific coast. More than one-half of Panama is forested, largely with tropical rain forest. Swamp woods, including mangrove trees, cativo, and orey, are abundant. On the wet Caribbean coast the forest is evergreen, while on the drier Pacific side the forest is partly deciduous. There are at least 2,000 different species of flowering plants, including the Holy Ghost orchid (the national flower). Among the animal life are the giant anteater, bush dog, ocelot, jaguar, Central American tapir, and American crocodile. Panama is generally poor in natural resources, but it has large reserves of copper ore.

The people. In the 16th century, when the Spaniards first colonized the isthmus, Panama was occupied by Cuna, Guaymí, Chocoe (Chocó), and other Indian groups. The mingling of Spaniards with the Indians gave rise to a mestizo population. With the introduction of black Africans, other mixed races developed. North Americans (mainly from the United States), French, and Chinese arrived to work on railroad projects in the 19th century. During the construction of the Panama Canal, more American nationals went to Panama, as did blacks from the Caribbean islands, Spaniards, Italians, and Greeks.

The most numerous of the Indian groups are the Guaymí, who live in the western part of the country. Their language is called *movere,* or the "language of the plains." Next in terms of numbers are the Cuna, who live in the San Blas Archipelago and on the coast nearby, as well as in other parts of the isthmus and along the shores of the Tuira River and its tributaries; they speak the Cuna language. The Chocoe groups live mainly in the eastern one-third of the country. Mestizos are the largest population group in the southwest and central parts of Panama. The Antillean blacks are a small minority who live primarily in Panama City. Spanish is the official language of Panama. Roman Catholicism is the religion of nearly nine-tenths of the population, but the constitution guarantees freedom of worship.

The birth rate is the lowest in Central America, while the death rate is also comparatively low. The annual rate of population growth has declined steadily since the early 1960s, influenced by a decrease in levels of immigration since World War II. Somewhat more than half the population is urban.

Economy. Panama has a market economy based on services, primarily transportation, communications, and storage connected with the Panama Canal, international banking, and tourism. The gross national product (GNP) is growing at about the same rate as the population. The GNP per capita is significantly higher than those found in the rest of Central America.

Agriculture accounts for about one-tenth of the GNP but employs nearly one-third of the labour force. The principal food crops are rice, corn (maize), sugarcane, beans, bananas, and plantains; the country is largely self-sufficient in foods, except for wheat. Bananas, sugar, coffee, and cacao are the principal cash crops and are among Panama's most important exports. Livestock raising is traditionally important. Fishing is a growing industry, with shrimp, lobster, prawns, and fishmeal being important exports.

The mineral industry is of only minor significance to the country's economy. Manufacturing, concentrated in and around Panama City, centres on food products, cement and building materials, petroleum products, clothing, paper products, and furniture. Several large projects, including the 86-mile (138-kilometre) trans-Panama oil pipeline, have stimulated growth in the construction industry. About three-fourths of Panama's electricity is generated from hydroelectric sources and the remainder from imported fuels.

The service sector accounts for about three-fourths of the GNP and employs more than half of the labour force. Since the late 1960s Panama has developed into a major international financial centre, capitalizing on favourable banking laws, good communication and transportation facilities, the absence of exchange controls, and the full transferability of the Panamanian currency, the balboa, with U.S. currency. Service receipts from the Panama Canal are a major contribution to the economy.

Panama's main trading partners, the United States, Mexico, Japan, Germany, and other Latin-American countries, supply fuels and lubricants, machinery and transportation equipment, basic manufactures, chemicals and chemical products, and food products. The Colón Free Zone (Zona Libre de Colón), established in 1953, has become one of the world's largest trading centres, providing warehousing, assembly, and transshipment services. Service exports are of greater importance to the economy than product exports; services to the Panama Canal and the free zone, international banking, and tourism receipts offset the traditionally large deficit in the trade (merchandise) balance.

Government and social conditions. Panama is a civilian republic. The constitution of 1972 originally granted legislative responsibility to a democratically elected National Assembly of community representatives, which met once a year for 30 days. When the assembly was not in session, legislative authority was assumed by a smaller National Legislative Council consisting of members both appointed by the assembly and elected by popular vote. Under a series of constitutional amendments approved in 1983, the National Assembly was abolished, while the National Legislative Council became the fully elected Legislative Assembly consisting of 67 members. The president, who is elected by popular vote and serves a five-year term, selects cabinet ministers and other key officials. The judiciary in Panama is headed by the Supreme Court of Justice. There are two major political parties in Panama—the Democratic Revolutionary Party (Partido Revolucionario Democrático), a left-of-centre, pro-government organization; and the National Opposition Front (Frente Nacional Opositora), a loose coalition of opposition parties.

The government's social-welfare system provides employed persons with sickness and maternity benefits and old-age, disability, and survivor's pensions.

Health conditions in Panama are adequate except in urban slum areas, where tuberculosis is still common. Most residents have access to medical care of some kind; the ratio of doctors to people is significantly higher than that found in the other Central American countries. Panama's infant mortality rate is one of the lowest in Latin America, and life expectancy is about 70 years for males and 74 years for females, which is high by Latin-American standards.

All children must either complete six grades of primary education or attend school through the age of 15. Nearly nine-tenths of primary-school-age children are enrolled in classes. Primary graduates may attend secondary schools, which are divided into two cycles of three years each. The upper cycle awards the *bachillerato,* a degree required for admission to Panama's schools of higher learning, which include the University of Panama (1935) and the University of Santa María la Antigua (1965).

Panamanian music and dance are among the most colourful to be found in the Americas. Panamanians still enjoy the *tamborito,* an African dance that is performed to the accompaniment of drums and handclapping. The nation's most popular folk song is the *mejorana,* which was brought from Spain during the 18th century. There are a number of established cultural institutions.

History. There may have been as many as 750,000 Indians in Panama when the Spanish arrived in 1501, but they were decimated by exploitation, disease, and murder. The first successful Spanish settlement was under the leadership of Vasco Núñez de Balboa (1510–14). He was replaced by Pedro Arias Dávila (Pedrarias) in 1514. In 1519 Pedrarias founded Panama City and moved the administration to the Pacific side of the isthmus. Panama developed into a transshipment centre for both Spanish and colonial goods. The trade fairs that were held at Portobelo until 1748 attracted British pirates who ravaged the Panamanian coast until 1688. In 1751 Panama became a dependency of Santa Fe de Bogotá in Colombia.

Panama proclaimed its independence from Spain in 1821 after Simón Bolívar cleared New Granada (present-day Ecuador, Colombia, Panama, and Venezuela) of Spanish and loyalist forces, but after a few months it voluntarily joined the Colombian union. Three attempts to secede from Colombia in the 1830s met with defeat.

The California gold rush of 1849 brought prosperity to Panama. Many prospectors chose the Panamanian route to California instead of the arduous overland U.S. trail. The U.S.-financed Panama Railway was opened in 1855 and led directly to the founding of the city of Colón. A French company, headed by Ferdinand de Lesseps, was given a concession to build a canal across the isthmus in 1879, but its work came to a halt in 1889.

Between 1850 and 1900 Panama had 40 administrations, 50 riots, 5 attempted secessions, and 13 U.S. interventions. American interest in a canal heightened in the early years of the 20th century, and, when the Colombian Senate put off ratifying a canal treaty, the United States lent its support to a Panamanian separatist movement, recognizing the Panamanian insurrection on Nov. 6, 1903, and concluding the Hay–Bunau-Varilla canal treaty on November 18. The treaty gave the United States control over the Panama Canal Zone in perpetuity, and the completed canal was opened in 1914.

The post-World War II situation was stormy in Panama. Riots were frequent and anti-U.S. sentiment widespread. In 1968 the National Guard staged a successful coup under Colonel Omar Torrijos Herrera, who negotiated the Panama Canal Treaty of 1977. Under the treaty Panama assumed jurisdiction over the former U.S. Canal Zone, but responsibility for operation of the canal itself remained with the United States through 1999.

The political upheaval that characterized much of the late 20th century in Panama reached a crisis point in December 1989 when U.S. troops invaded Panama and overthrew the country's de facto ruler, General Manuel Antonio Noriega, commander of the Panama Defense Forces.

Panama, Gulf of, Spanish GOLFO DE PANAMÁ, inlet of the Pacific Ocean, bordering the southern side of the Isthmus of Panama. It is 115 miles (185 km) across at its widest point and 100 miles (160 km) long. The gulf is relatively shallow and separates the

Stretch of beach on one of the Pearl Islands in the Gulf of Panama
B. Helms/Shostal Assoc.

mountain ranges of western Panama from the beginning of the Colombian Serranía de Baudó. Its western part is indented as Parita Gulf, its northern as the Bay of Panama, and its eastern as San Miguel Gulf. The Pearl Islands (*q.v.*), which have important fisheries, are in the gulf, and Panama City is the main urban centre on the gulf shore.

Panama, Isthmus of, Spanish ISTMO DE PANAMÁ, land link extending east–west about 400 mi (640 km) from the border of Costa Rica to that of Colombia. It connects North and South America and separates the Caribbean Sea (Atlantic Ocean) from the Gulf of Panama (Pacific Ocean). The narrowest part of the Americas (30–120 mi wide), it embraces the Republic of Panama; its narrowest sections are the isthmuses of Darién (east) and Chiriquí (west). The terrain alternates between mountains, tropical rain forests, and coastal plains.

The isthmus was first inhabited by Indians migrating from the Andes and the West Indies. The Spanish explorer Rodrigo de Galván Bastidas was the first European to visit the area (1501). The following year Christopher Columbus landed on the north coast and named Portobelo ("beautiful harbour"). During colonial times, the isthmus, crossed by the Cruces Mule Trail, was a source of friction between the Spanish and English. Despite constant attacks by English pirates, it remained in Spanish hands until independence early in the 19th century. Following the California Gold Rush of 1849, the Transisthmian Railway was constructed, and the towns of Portobelo and Colón experienced a tremendous economic boom. The opening of the Panama Canal in 1914 resulted in a heavy population migration to what was then the Canal Zone. The strategic importance of the isthmus accounts for much of Panama's turbulent history.

Panama Canal, canal of the lake-and-lock type connecting the Atlantic and Pacific oceans through the narrow Isthmus of Panama in Central America. Its length from deep water in the Atlantic to deep water in the Pacific is 50.7 mi (81.6 km). It is one of the two most strategic artificial waterways in the world, the other being the Suez Canal; ships sailing between the east and west coasts of the United States, for example, can shorten their voyage by about 8,000 nautical miles by using the Panama Canal instead of rounding Cape Horn.

A brief treatment of the Panama Canal follows. For full treatment, *see* MACROPAEDIA: North America: *Panama Canal.*

Although it remains one of the great engineering feats of the world, construction of the Panama Canal presented problems from the beginning. In 1879 Ferdinand de Lesseps, the French diplomat who had supervised excavation of the Suez Canal, formed the Compagnie Universelle du Canal Interocéanique and began work the following year on cutting a sea-level channel through the isthmus. Poor planning, disease, and accusations of fraud led to the collapse of the enterprise in 1889, and in 1894 the French company was reorganized as the Compagnie Nouvelle du Canal de Panama. In 1903 the Hay–Bunau-Varilla Treaty between Panama and the United States granted the United States canal-building rights and the sole right to operate and control the Canal Zone (*q.v.*). The Compagnie Nouvelle du Canal de Panama sold its holdings to the United States in 1904.

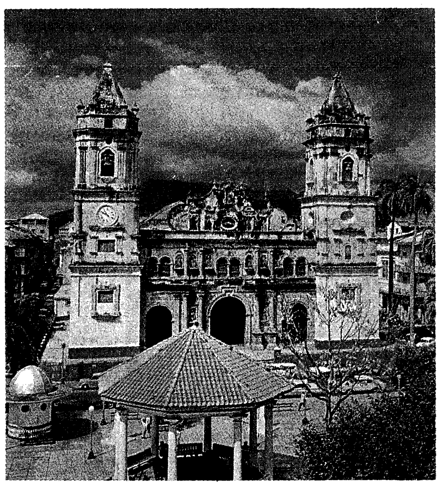
The principal decision facing American engineers was whether to build a sea-level or a high-level, lake-and-lock canal. In 1879 the French engineer Adolphe de Lépinay had proposed damming the torrential Chagres River on the Atlantic side of the isthmus and the Río Grande on the Pacific side, creating navigable lakes in their respective valleys that would be connected by a cut through the continental divide. Although rejected by the original French company and by early U.S. commissions that favoured a sea-level canal, Lépinay's proposal was the basis for the final plan drafted in 1906 by John F. Stevens, chief engineer of the U.S. Isthmian Canal Commission. Construction under U.S. supervision, which had begun in 1904, accelerated after Congress adopted Stevens' plan, and the Panama Canal opened to traffic on Aug. 15, 1914. Following numerous disputes between the United States and Panama over the sovereignty of the waterway, the Panama Canal Treaty of 1977 established that the Republic of Panama would take complete control of the canal in the year 2000.

The canal runs due south from its Atlantic entrance, a 7-mi dredged channel in Bahía Limón (Limón Bay), for a distance of 11.5 mi to the Gatún Locks, a series of three locks that raise ships 85 ft (26 m) to man-made Lago Gatún (Lake Gatún). It continues south and then southwest through a channel in Lago Gatún for nearly 24 mi to Gamboa, where the Gaillard (Culebra) Cut begins. The channel through the Gaillard Cut is 8 mi long and 500 ft wide, winding through the continental divide to the locks at Pedro Miguel. At the Pedro Miguel Locks, a single lock lowers ships 31 ft to a small lake, through which vessels pass one mile to the locks at Miraflores. The Miraflores Locks constitute a 54-ft, two-step drop down from the lake level to the sea-level dredged channel, 8 mi long, leading to the Pacific terminus in the Bahía de Panamá.

Except for small craft, no vessel can pass through the locks of the Panama Canal under its own power. Vessels are taken in tow by towing locomotives that operate on cog tracks on the lock walls at 2 mi per hour; six locomotives are usually used for each vessel. The locks are duplicate, so that ships may pass in opposite directions simultaneously. With waiting time, ships require about 24 to 30 hours to negotiate passage. Crude oil and petroleum products, grains, and coal and coke are the three principal commodity groups transported through the canal.

Panama Canal Zone: *see* Canal Zone.

Panama City, Spanish PANAMÁ, capital of the Republic of Panama and of Panamá province, located near the Pacific entrance of the Panama Canal, on the Bay of Panama. The site was originally an Indian fishing village; the name *Panamá* means "many fish." The old city (Panamá Viejo) was founded in 1519 by Gov. Pedro Arias Dávila and was



The cathedral in Panama City
Charles May—Shostal/EB Inc.

made the seat of both secular and ecclesiastical authority. From the Andean countries bullion was shipped northward by sea to Panama City and from there was carried across the isthmus by pack animals to Nombre de Dios or Portobelo on the Caribbean coast for shipment to Spain. The city prospered until the depredations of pirates and privateers curtailed trade. In 1595 Sir Francis Drake tried unsuccessfully to send a force across the isthmus to sack old Panama; in 1671, however, Henry (afterward Sir Henry) Morgan completely destroyed it. The new city (Panamá Nuevo) was rebuilt 5 mi (8 km) west of the old site in 1674 by Alonso Mercado de Villacorta, a Spanish conquistador. Political and economic decline followed, and in 1751 the city and area became part of New Granada and eventually part of Colombia. During the 19th century, Panama was the scene of much disorder. In 1903 independence from Colombia was declared there, and the city was made the national capital. In the Hay–Bunau-Varilla Treaty of 1903, the United States was given the right to keep order in the city and to maintain hygiene. Both rights were yielded in treaties of 1936 and 1959, respectively.

Following the opening of the canal (1914), Panama City developed rapidly. It became a polyglot modern city with cabarets, nightclubs, and squalid slums (later partially cleared). The title to the water and sewer systems, built by the United States, was turned over to the government of the republic in 1942, and in 1953 their management was also transferred. The city was the site of Latin-American congresses in 1826, 1939, and 1959.

The port facilities serving Panama City lie in adjacent Balboa, and many canal employees live in suburban Ancón. The city's economy is largely dependent on canal traffic and on providing services for canal personnel. Industries include breweries, oil refineries, steel-rolling mills, and clothing and wood factories. Panama City is linked with Colón by the canal, the Ferrocarril de Panama (Panama Railroad), and the Transisthmian Highway and with David and Chepo by the Carretera Interamericana (Pan-American Highway). It is served by an international airport at Tocumen, 17 mi (27 km) from the city.

The city retains many reminders of colonial times, including several plazas, the cathedral (begun 1673), which contains Bartolomé Murillo's painting of the Virgin of the Rosary, and the San Francisco church (now renovated). Modern buildings include the Palace of Justice, La Presidencia, the National Palace, and the hotel El Panamá. Panama City is the seat of the national university (founded 1935), the University of Santa María La Antigua (1965), and schools of dance, music, art, and theatre associated with the National Institute of Culture. There are a number of academies, libraries, museums, and research institutes. The Gorgas Memorial Laboratory of Tropical and Preventive Medicine was established there in 1928. Pop. (1984 est.) city, 424,204; metro. area, 1,116,823.

Panama City, seat (1913) of Bay County, northwestern Florida, U.S., port of entry on St. Andrew Bay (Gulf of Mexico), 98 mi (158 km) east of Pensacola. The first English settlement (*c.* 1765), known as Old Town, was a fishing village later called St. Andrew. In 1909 Panama City (then a village, named by developer George W. West for the Canal Zone city) merged with St. Andrew and Millville to form the present city. During the Revolution the area was settled by British Loyalists, who established indigo plantations and engaged in lumbering and naval stores industries. Saltworks on St. Andrew Bay, established to serve the Confederacy, were destroyed by Union raids from the sea in 1863. During World War II the city became a shipbuilding and war industrial centre, and the population grew rapidly. Its landlocked, deepwater harbour is on the Atlantic Intracoastal Waterway. The Naval Coastal Systems Center, a diving school, is in Panama City, and Tyndall Air Force Base is nearby. Fish, paper, chemicals, and tourism (especially sports fishing) are the chief economic factors. Panama City is the seat of Gulf Coast Community College (1957). Pop. (1982 est.) city, 34,565; (1984 est.) metropolitan area (MSA), 108,500.

Panama disease, also called BANANA WILT, a devastating disease caused by the soil-inhabiting fungus species *Fusarium oxysporum* variety *cubense,* which is widespread in Asia, Africa, Australia, Pacific Islands, the Caribbean, Central and South America, and wherever susceptible banana cultivars, such as 'Gros Michel,' are grown.

Banana trees afflicted with Panama disease
W.H. Hodge

The *Fusarium* fungus invades young roots or root bases, often through wounds. Some infections progress into the rhizome (rootlike stem) followed by rapid invasion of the rootstock and leaf bases. Spread occurs through vascular bundles, which become discoloured brown or dark red, and finally purplish or black. The outer edges of older leaves turn yellow. Within a month or two all but the youngest leaves turn yellow, wilt, collapse, and hang downward, covering the trunk (pseudostem) with dead brown leaves. All aboveground parts are eventually killed, although fresh suckers form at the base. These later wilt and the entire stool dies, usually within several years.

The best long-range control is to breed and grow highly resistant cultivars. *See also* Fusarium wilt.

Panasqueira, tungsten mine, Castelo Branco district, central Portugal. Located in the Serra (mountains) da Estrela, it is about 5 mi (8 km) northwest of the village of Silvares. The mine was the fifth leading producer of tungsten in the world in the early 1980s. During World War II, Portugal was both publicly criticized and privately admired for allowing this strategic mineral to be exported from Panasqueira to both Axis and Allied powers. Efficient mechanization of the mine has increased productivity. Small amounts of tin and copper are also extracted.

Panathenaea, in Greek religion, an annual Athenian festival of great antiquity and importance. It was eventually celebrated every fourth year with great splendour, probably in deliberate rivalry to the Olympic Games. The festival consisted solely of the sacrifices and rites proper to the season (mid-August) in the cult of Athena, the city protectress. At the Great Panathenaea, representatives of all the dependencies of Athens were present, bringing sacrificial animals. After the presentation of a new embroidered robe to Athena, the sacrifice of several animals was offered. The great procession, made up of the heroes of Marathon, is the subject of the frieze of the Parthenon. The Athenian statesman Pericles (*c.* 495–429 BC) introduced a regular musical contest in place of the recitation of rhapsodies (portions of epic poems), which were a long-standing accompaniment of the festival. The contest took place in the odeum, originally built for the purpose by Pericles himself.

In addition to major athletic contests, many of which were not included at Olympia, several minor contests also were held between the Athenian tribes.

Panay, island, westernmost of the Visaya group, central Philippines, surrounded by the Sibuyan, Visayan, and Sulu seas; the Guimaras Strait to the southeast separates it from Negros. Roughly triangular in shape, it has an area of 4,446 sq mi (11,515 sq km). A rugged, almost unpopulated mountain range parallels its western coastline. Between the range and a hilly eastern portion, a densely populated, intensely farmed (sugarcane, rice) fertile plain extends for about 95 mi (155 km) from the northern to the southern coasts. A wide lowland on the southeast is formed by the deltas of the Jalaud, Jaro, and Sibalom rivers.

There are large concentrations of fishponds in the north and east, and mineral deposits include coal and copper. The inhabitants are primarily of the Hiligaynon (Ilongo) ethnolinguistic group, and nomadic Negritos live in the mountainous areas. The island is divided into Aklan, Antique, Capiz, and Iloilo provinces (*qq.v.*). Its chartered cities are Roxas and Iloilo City. Pop. (1980) 2,595,314.

Panayan (people): *see* Hiligaynon.

Pañca-tantra, also spelled PANCHATANTRA (Sanskrit: "Five Chapters"), collection of Indian animal fables, which has had extensive circulation both in the country of its origin and throughout the world. In Europe the work was known under the name *The Fables of Bidpai* (after the narrator, an Indian sage, Bidpai, called in Sanskrit Vidyāpati), and one version reached there as early as the 11th century.

In theory, the *Pañca-tantra* is intended as a textbook of *artha* ("worldly wisdom"); the aphorisms tend to glorify shrewdness and cleverness more than the helping of others. The original text is a mixture of Sanskrit prose and stanzas of verse, with the stories contained within one of the five frame stories. The introduction, which acts as an enclosing frame for the entire work, attributes the stories to a learned Brahmin named Vishṇuśarman, who used the form of animal fables to instruct the three dull-witted sons of a king.

The original Sanskrit work, now lost, may have originated at any time between 100 BC and AD 500. It was translated into Pahlavi (Middle Persian) by the Persian royal physician Burzoe in the 6th century. Although this work also is lost, a Syriac translation of it has survived, together with the famous Arabic translation, by Ibn al-Muqaffaʿ (died AD 760), known as *Kalīlah wa Dimnah,* after the two jackals that figure in the first story. The *Kalīlah wa Dimnah* led to various other versions, including a second Syriac version and an 11th-century version in Greek, the *Stephanites kai Ichnelates,* from which translations were made into Latin and various Slavic languages. It was the 12th-century Hebrew version of Rabbi Joel, however, that became the source of most European versions.

The 17th-century Turkish translation, the *Hümayun-name,* was based on a 15th-century Persian version, the *Anwār-e Suhaylī.* The *Pañca-tantra* stories also traveled to Indonesia through Old Javanese written literature and possibly through oral versions. In India the *Hitopadeśa* ("Good Advice"), composed by Nārāyaṇa in the 12th century and circulated mostly in Bengal, appears to be an independent treatment of the *Pañca-tantra* material.

Pāñcarātra, early Hindu religious movement whose members worshipped the deified sage Nārāyaṇa (who came to be identified with Lord Vishnu) and that, in merger with the Bhāgavata (*q.v.*) sect, formed the earliest sectarian movement within Hinduism. The new group was a forerunner of modern Vaiṣṇavism, or the worship of Vishnu.

The Pāñcarātras originated in the Himalayan region perhaps in the 3rd century BC. The name of the cult is attributed to a sacrifice continuing for five days (*pañca-rātra*) performed by Nārāyaṇa by which he obtained superiority over all beings and became all beings.

The Pāñcarātra doctrine was first systematized by Śāṇḍilya (*c.* AD 100?), who composed several devotional verses about the deity Nārāyaṇa; that the Pāñcarātra system was also known in South India is evident from 2nd-century-AD inscriptions. By the 10th century the sect had acquired sufficient popularity to leave its influence on other groups, though criticized by Śaṅkara and other orthodox figures as nonmonastic and non-Vedic.

Pancasila, also spelled PANTJASILA, English FIVE PRINCIPLES, the Indonesian state philosophy, formulated by the Indonesian nationalist leader Sukarno. It was first articulated on June 1, 1945, in a speech delivered by Sukarno to the preparatory committee for Indonesia's independence, which was sponsored by the Japanese during their World War II occupation. Sukarno argued that the future Indonesian state should be based on the Five Principles: Indonesian nationalism; internationalism, or humanism; consent, or democracy; social prosperity; and belief in one God. The statement was not well received by the Japanese authorities, but independence preparations for Indonesia were continued. Before Indonesia's independence was declared, however, the Japanese had surrendered and Britain had taken control of the country.

The Five Principles have since become the blueprint of the Indonesian nation. In the constitution of the Republic of Indonesia promulgated in 1945, the Five Principles were listed in a slightly different order and in different words: the belief in one God, just and civilized humanity, Indonesian unity, democracy under the wise guidance of representative consultations, and social justice for all the peoples of Indonesia.

pañcāyat (caste government): *see* panchayat.

Pānch Mahāls, district, Gujarāt state, west central India, bounded by the states of Rājasthān (northeast) and Madhya Pradesh (east). Its 3,423-sq-mi (8,866-sq-km) area rises from lowlands into foothills of the Vindhya Range and is largely rough and wooded. The valleys produce bajra (pearl millet), corn (maize), cotton, and gram (chick-pea). Manganese is mined near Shivrājpur. Godhra, the district headquarters, Dohad, and other principal towns are served by a railway and highways. Pop. (1981) 2,321,689.

Panchatantra (Indian animal fables): *see* Pañca-tantra.

panchayat, also spelled PANCHAYET, or PUNCHAYET, Hindi PAÑCĀYAT, the most important adjudicating and licensing agency in the self-government of an Indian caste. There are two types: permanent and impermanent. Literally, a panchayat (from Sanskrit *pañca,* "five") consists of five members, but usually there are more; the panchayat has a policy committee, however, often numbering five.

The panchayat sits as a court of law. Cases are heard in open meetings in which all members of the caste group concerned are entitled to take part. Any evidence that has any conceivable bearing on the case is admissible; it can be produced by either party, by onlookers, or by members of the council. Types of offenses adjudicated in meetings of the panchayat are breaches of eating, drinking, or smoking restrictions; infractions of marriage rules; breaches of a caste's customs in feast; breaches of its trade rules; the killing of certain animals, notably cows; causing injury to a Brahman; and, less commonly, criminal and civil cases actionable before a court of law. Panchayats of Muslim castes try only a few of the offenses, as the rest fall under *fiqh,* or Islāmic law.

Penalties take the form of fines (paid by distributing sweets to a caste group or by contributing to a caste fund), the obligation to offer a feast to the *berādarī* (family brotherhood) or to Brahmans, and temporary or permanent excommunication. Pilgrimage and self-humiliation are sometimes levied, but physical punishment is now uncommon.

The passing of the Evidence Act by the British in 1872, with its strict rules of admissible evidence, led to a bypassing of the panchayat by some caste members who began to take their cases directly to the state court (*see* Indian Evidence Act). Some castes try cases that have come up before a state court or retry them after the verdict of the state court has been given. The Congress Party in India has made a point of creating village panchayats as local instruments of government, the so-called panchayat raj, or government by panchayats.

Paṇchen Lama, title of the line of reincarnated lamas in Tibet who head the influential Tashilhunpo monastery (near Zhikatse) and who until recent times were second only to the Dalai Lamas in spiritual authority within the dominant Dge-lugs-pa sect of Tibetan Buddhism.

The title Paṇchen (a short form of the Sanskrit-Tibetan Paṇḍita Chen-po, or "Great Scholar") was that traditionally given to head abbots of the Tashilhunpo monastery, who were chosen for their maturity and learning. In the 17th century the fifth Dalai Lama declared that his tutor, Blo-bzang chos-kyi-rgyal-mtshan (1570–1662), who was the current Paṇchen Lama, would be reincarnated in a child. He thus became the first of the line of reincarnated lamas, reappearing as Blo-bzang-ye-shes (1663–1737), Blo-bzang-dpal-ldan-ye-shes (1737–80), Blo-bzang-bstan-pa'i-nyi-ma (1781–1854), Bs-tan-pa'i-dbang-phyug (1854–82), and Chos-kyi Nyi-ma (1883–1937). They were each regarded as physical manifestations of the self-born Buddha, Amitābha. (Sometimes the three lamas who preceded Blo-bzang chos-kyi-rgyal-mtshan as abbots of Tashilhunpo are also included in the list of reincarnations.)

Disagreements between the government of the Dalai Lama and the Tashilhunpo administration over tax arrears led to the Paṇchen Lama's flight to China in 1923. A boy born of Tibetan parents in about 1938 in Tsinghai Province, China, Bskal-bzang Tshe-brtan, was recognized as his successor by the Chinese government but without having gone through the usual exacting tests that determine rebirth. He was brought to Tibet in 1952 under Communist military escort and enthroned as head abbot of Tashilhunpo. The Paṇchen Lama remained in Tibet in 1959 after the popular revolt and the Dalai Lama's flight into exile, but his refusal to denounce the Dalai Lama as a traitor brought him into disfavour with the Chinese government, which imprisoned him in Peking in 1964. He was released in the late 1970s and died in 1989.

Panchimalco, town, southern El Salvador. It lies in the Pacific coastal range, just south of San Salvador. The population is made up primarily of descendants of Pipil Indians, who are noted for their handwoven textiles and for their traditional (pre-Columbian) dress and customs. Pop. (1985 est.) 5,094.

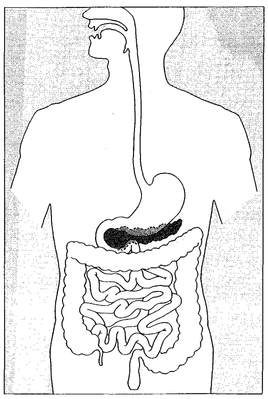
pancreas, compound gland common to all vertebrates; it functions both as an exocrine gland discharging digestive enzymes into the gut and as an endocrine gland secreting insulin and glucagon, vital in carbohydrate (sugar) metabolism, into the bloodstream. The term also designates a gland found in many invertebrates, the primary function of which is the secretion of digestive enzymes.

In humans, the pancreas is attached to the duodenum, the upper portion of the small intestine. A large main duct, the duct of Wirsung, collects pancreatic juice and empties into the duodenum. In many individuals a smaller duct (duct of Santorini) also empties into the duodenum. Enzymes active in the digestion of carbohydrate, fat, and protein flow from the pancreas through these ducts continuously and at an increased rate when food is present in the small intestine. Their flow is controlled by the vagus nerve and by the hormones secretin and pancreozymin, which are produced in the intestinal mucosa.

When food enters the duodenum, secretin and pancreozymin are released into the bloodstream by the duodenum's secretory cells. When these hormones reach the pancreas, its cells are stimulated to produce and release large amounts of water, bicarbonate, and digestive enzymes, which then flow into the intestine.

The cells in the pancreas that produce digestive enzymes are called acinar cells (Latin *acinus,* "grape"), so named because the cells aggregate to form bundles that resemble a cluster of grapes. Located between the clusters of acinar cells are scattered patches of another type of secretory tissue, collectively known as the islets (or islands) of Langerhans, named for the 17th-century German pathologist Paul Langerhans. The islets are responsible for the secretion of insulin and glucagon, which control the amount of sugar stored in the body. Insulin stimulates the body's cells to remove sugar from the bloodstream and utilize it. Glucagon has the opposite effect of insulin; it releases stored sugar and increases the blood-sugar level, acting as a control mechanism whenever the body produces too much insulin. The islets of Langerhans secrete insulin and glucagon directly into the bloodstream.

The pancreas may be the site of acute and chronic infections, tumours, and cysts. Should it be removed surgically, life can be sustained by the administration of insulin and of potent pancreatic extracts. Approximately 80 to 90 percent of the pancreas can be removed surgically without producing either endocrine (insulin and glucagon) or exocrine (water, bicarbonate, and enzymes) insufficiency.



Pancreas

For a depiction of the pancreas in human anatomy, shown in relation to other parts of the body, *see* the colour Trans-Vision in the PROPAEDIA: Part Four, Section 421.

pancreatitis, inflammation of the pancreas. Development of the disorder has been associated with intake of alcohol and with obstruction of pancreatic ducts. The process of inflammation starts with the escape of activated pancreatic enzymes into the tissues of the pancreas. These digestive juices cause chemical irritation, with edema (collection of fluid) and with congestion of the blood vessels. Often the inflammation then subsides, but occasionally there is bleeding, necrosis of pancreatic tissue, and formation of pus. Infection may set in. With recovery the necrotic areas are replaced with scar tissue.

The onset of pancreatitis may bring severe pain, most acute when the affected person is lying on his back. There may be slight fever, and the blood pressure may be somewhat higher than usual. If the attack is severe, the skin may be cold and moist, the pulse feeble and rapid, and the temperature below normal. Treatment of acute pancreatitis is directed toward control of pain, prevention or alleviation of shock, inhibition of the secretion of pancreatic juices, and avoidance of infection. Lost fluids and salts are replaced.

In chronic pancreatitis, with its repeated attacks, much of the pancreas may be destroyed, with resultant deficiency in the amounts of pancreatic juices secreted. Islet cells of the pancreas may also be destroyed, so that the secretion of insulin is depleted and diabetes mellitus develops. Management of this disorder includes a low-fat diet, abstinence from overeating and from intake of alcohol, the administration of pancreatic extracts, and control of diabetes, if it has developed.

pancreozymin (hormone): *see* cholecystokinin/pancreozymin.

panda, either of two species of East Asian mammals that are classed together because of shared characteristics of tooth structure, skull architecture, penis shape, and pattern of fur colour. The two species, the giant panda and the lesser panda, are classified by some authorities with the bears and the raccoons, respectively, but other authorities place them together within a separate family, the Ailuridae (order Carnivora).

The bearlike black-and-white panda popular in zoos is the giant panda (*Ailuropoda melanoleuca*). Armand David, a Jesuit missionary, discovered some panda furs in 1869, but no European observed a live giant panda in the wild until the Stötzner Expedition of 1913–15. The giant panda has been classified by some authorities as an aberrant bear (family Ursidae), but its skull and dental structure have no resemblance to those of bears. The giant panda once ranged over comparatively large tracts of China and Burma, but the destruction of its forest habitat has reduced the species to a handful of small, remote bamboo forests in mountainous areas of Szechwan province in west-central China. The panda is classified as an endangered species, and fewer than 1,000 specimens still exist in the wild, while another 100 or so are kept in zoos in China or other countries. The wild areas that pandas inhabit have been set aside by the Chinese government as nature preserves.

The giant panda grows to a length of 1.5 m (5 feet) and a weight of about 100 kg (220 pounds). It has a distinctive coloration consisting of a dense creamy white coat of fur marked with a broad black band across the shoulders and forelegs, black hind legs, and blobs of black colour on the ears and around the eyes. It feeds almost exclusively on bamboo and is able to grasp the young stems and leaves of this plant with the aid of a special thumblike structure on its front foot. The panda's broad, massive teeth are well-suited for chewing and grinding bamboo plant parts, but its digestive system is that of a carnivore, and so the animal is unable to digest cellulose, which is the main constituent of bamboo. Consequently, the panda must consume enormous quantities of bamboo in order to obtain from this plant the nourishment it needs; the average panda eats 30–60 pounds (14–27 kg) of bamboo leaves, stems, and shoots a day. Pandas must spend about 16 hours a day foraging and feeding. Pandas in captivity, by contrast, subsist happily on a diet of cereals, milk, and garden vegetables.

The giant panda has a lumbering gait on the ground but is an agile tree climber. It lives alone except when breeding. Mating usually takes place in March to May, and a litter

(Top) Giant panda (*Ailuropoda melanoleuca*) and (bottom) lesser panda (*Ailurus fulgens*)

(Top) Tom McHugh—Photo Researchers/EB Inc.; (bottom) San Diego Zoo

of one or two young is born in August or September. The newborn panda is a tiny, blind, hairless creature weighing only about 4 ounces (125 g), and the mother cares for the helpless and immobile infant by holding it to her chest with her large forepaws. The young panda opens its eyes at about 45 days of age and begins to crawl about at 75 days, at which time it begins to grow rapidly. It begins to eat bamboo at about five months of age and adopts a solitary lifestyle at 18 months of age. Pandas in the wild have a slow reproductive cycle, and pandas in captivity are bred only with the greatest difficulty. Thus the species may not be able to replace those members in the wild who are killed by poaching or who are menaced by loss of habitat.

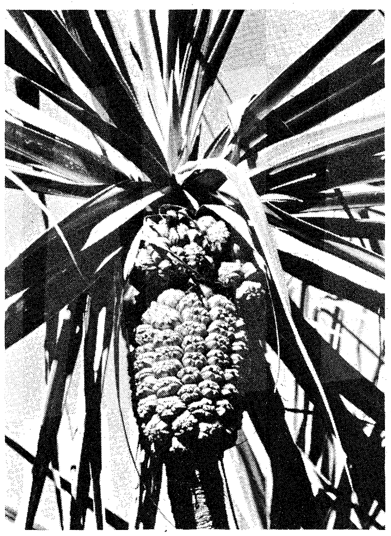
Giant pandas in captivity engage in clownish antics that are very appealing to human onlookers, but pandas are actually somewhat irascible, short-tempered animals. The Chinese government has made it a practice to give or lend giant pandas to other nations as a special mark of friendship. Su-Lin, the first of the giant pandas to be exhibited in the West, reached the United States as an infant in 1936 and was a popular attraction at the Brookfield Zoo, near Chicago, until his death in 1938. Two others, a male and a female (at the National Zoo in Washington, D.C.), were a gift of the Chinese government to the United States in 1972. Since then several other zoos have received pandas.

The lesser (red, or common) panda (*Ailurus fulgens*) has been classified with the raccoon family (Procyonidae) because of its resemblance to those animals. It ranges from the eastern Himalayas to western China. Sometimes called bear cat, or cat bear, it has soft, thick fur—rich reddish brown above and black underneath; the face is white, with a stripe of red-brown from each eye to the corners of the mouth, and the bushy tail is faintly ringed. The head and body length of the lesser panda is 50–65 cm (20–26 inches); the tail, 30–50 cm (12–20 inches) long; and the weight ranges from 3 to 4.5 kg (6.5 to 10 pounds). It lives high in the mountains among rocks and trees and climbs with agility. It is nocturnal and may live alone, in pairs, or in family groups. Its diet consists mainly of fruit and other plant material. The litters generally contain one or two young born in spring after a gestation period of about 130 days. The lesser panda is gentle and easily tamed but usually resents being handled.

Pandai (Indonesia): *see* Pantar Island.

Pandanales, the screw-pine order of monocotyledonous flowering plants, containing the screw-pine family, Pandanaceae, with three genera of trees, shrubs, and vines. Members of the genus *Pandanus* (more than 650 species) produce from their trunks and branches stiltlike aerial prop roots that support the plants and give them a distinctive appearance, the main root usually decomposing in time. The genus *Freycinetia* (65 species) consists of shrubby vines that climb by means of aerial roots like those of *Pandanus* but that are much more slender. The genus *Sararanga* (two species) consists of trees that lack both aerial roots and the spiral leaf arrangement found in the other plants of the order. In nearly all members of the order, numerous long, narrow, parallel-veined, palmlike leaves with spiny margins and midribs are produced in tufts at the branch tips in three or four close, twisted ranks around the stem, forming the screwlike helices of leaves that give the common name screw-pine to these plants. The plants grow along seacoasts and in marshy places and forests of tropical and subtropical regions, especially in Asia and Africa.

The flowers are simple, petalless, usually densely clustered, and either male or female, the sexes being produced on different plants.



Screw pine (*Pandanus tectorius*)

G.R. Roberts

The fruits of many are heavy ball-shaped or conelike aggregates produced by the coalescence of the developing ovaries of many adjacent flowers. Often there are hollow spaces inside the fruits that aid in distribution by floating. Fruit-eating birds are also thought to distribute the seeds of some.

Much use is made of the leaves for thatching, mats, hats, ropes, twine, sails for small boats, baskets, and fibre products, especially from the textile screw-pine, or pandanus palm (*Pandanus tectorius*). Fibres are also obtained from the aerial roots. The fruits and seeds of some species are edible (*e.g., P. utilis* and the Nicobar Islands breadfruit, *P. leram*). A few species are grown as greenhouse subjects (*e.g., P. pygmaeus, P. veitchi,* and *P. utilis*). The candelabrum, or chandelier, tree (*P. candelabrum*) is especially favoured as an outdoor ornamental in warm regions and as a conservatory plant and houseplant.

The order is considered to be related to the cattail order (Typhales) and the Panama hat palm order (Cyclanthales), but the relationships are not clear.

Pandarus, in Greek legend, son of Lycaon, a Lycian. In the *Iliad* he broke the truce between the Trojans and the Greeks by treacherously wounding Menelaus, the king of Sparta; he was finally slain by the warrior Diomedes. In the medieval tale of Troilus and Cressida, as well as in Shakespeare's play by the same name, Pandarus acted as the lovers' go-between; hence the word "pander."

Pāṇḍavas, in Hindu legend, the five sons of the dynastic hero Pāṇḍu who were victorious in the great epic war with their cousins, the Kauravas. *See* Mahābhārata.

Pandects, Latin PANDECTAE, also called DIGEST, collection of passages from the writings of Roman jurists, arranged in 50 books and subdivided into titles according to the subject matter. In AD 530 the Roman emperor Justinian entrusted its compilation to the jurist Tribonian with instructions to appoint a commission to help him. The Pandects were published in AD 533 and given statutory force (*see also* Justinian, Code of). Early in the 19th century the term Pandectists was applied to the historical school of Roman-law scholars in Germany who resumed the scientific study of the Pandects. The leader of the school was Friedrich Karl von Savigny.

Panderma (Turkey): *see* Bandırma.

pandermite (mineral): *see* priceite.

Pandharpur, town, southern Mahārāshtra state, western India. It lies along the Bhīma River, west of Sholāpur city. Easily reached by road and rail, it is a religious town visited throughout the year by thousands of Hindu pilgrims. Four major annual festivals are held in the town in honour of the deities Viṭhoba, an incarnation of Vishnu, and his consort, Rukmiṇī. The main temple was built in the 12th century by the Yādavas of Devagiri. The town is also associated with the Mahārāshtra poet-saints devoted to the Bhakti cult. Pop. (1981) 64,380.

Pandit, Vijaya Lakshmi, *née* SWARUP KUMARI NEHRU (b. Aug. 18, 1900, Allahābād, India), Indian political leader and diplomat, one of the world's leading women in public life in the 20th century.

She was the daughter of Motilal Nehru, a nationalist leader, and sister of Jawaharlal Nehru, the first prime minister of independent India. In 1921, after receiving a private education in India and abroad, she married Ranjit S. Pandit (d. 1944), a fellow Congress worker. In her family's tradition she became an active worker in the Indian nationalist movement and was imprisoned three times by the British authorities in India. She entered municipal government in Allahābād (western

Vijaya Pandit, 1955
Keystone

India) before entering the legislative assembly of the United Provinces (later Uttar Pradesh) and becoming minister for local self-government and public health (1937–39), the first Indian woman to hold a cabinet portfolio.

With the coming of Indian independence, Pandit entered on a distinguished diplomatic career, leading the Indian delegation to the United Nations (1946–48, 1952–53) and serving as India's ambassador to Moscow (1947–49) and to Washington and Mexico (1949–51). In 1953 Pandit became the first woman to be elected president of the UN General Assembly. From 1954 to 1961 she was Indian high commissioner (ambassador) in London and concurrently ambassador to Dublin. She served as governor of the state of Mahārāshtra from 1962 to 1964, and from 1964 to 1968 she was a member of the Indian Lok Sabha (Parliament), representing the constituency formerly represented by her brother, Jawaharlal Nehru.

In 1977 Pandit left the Congress Party to join the Congress for Democracy, which had merged with the Janata Party. A year later she was appointed the Indian representative to the UN Human Rights Commission, and in 1979 she published *The Scope of Happiness: A Personal Memoir.*

Pando, department, northern Bolivia, bounded north and east by Brazil and west by Peru. Created in 1938, the area of 24,644 sq mi (63,827 sq km) lies in the humid Amazon Basin. It is drained by many rivers, the largest of which is the Madre de Dios (*q.v.*). The main economic resources are forest products: rubber, Brazil nuts, and hardwoods. Cobija (*q.v.*), the capital, can be reached by air, but, otherwise, transportation is by river. Isolation, poor communications, and sparse population hinder development of the region. Pop. (1984 est.) 45,645.

Pandora (Greek: All-Giving), in Greek mythology, the first woman. After Prometheus, a fire god and divine trickster, had stolen fire from heaven and bestowed it upon mortals, Zeus, the king of the gods, determined to counteract this blessing. He accordingly commissioned Hephaestus (a god of fire and patron of craftsmen) to fashion a woman out of earth, upon whom the gods bestowed their choicest gifts. She had or found a jar—the so-called Pandora's box—containing all manner of misery and evil. Zeus sent her to Epimetheus, who forgot the warning of his brother Prometheus and made her his wife. Pandora afterward opened the jar, from which the evils flew out over the Earth. According to another version, Hope alone remained inside, the lid having been shut down before she could escape. In a later story the jar contained not evils but blessings, which would have been preserved for the human race had they not been lost through the opening of the jar out of curiosity by man himself.

Pandulph, also spelled PANDULF, Italian PANDOLPHO (b. Rome—d. Sept. 16, 1226, Rome), papal legate to England and bishop of Norwich who was deeply involved in English secular politics.

Pope Innocent III sent him to England in an effort to secure King John's acceptance of Stephen Langton as archbishop of Canterbury. When the negotiations failed, John was excommunicated, and England was placed under papal interdict. On May 15, 1213, however, Pandulph accepted John's personal submission and surrender of the country as a fief of the Pope, whose vassal the King became. John also permitted Langton to assume the see of Canterbury. Allying himself with John, Pandulph used ecclesiastical censures, including excommunication, to avert a threatened French invasion of England and suspended Archbishop Langton for refusing to excommunicate the barons and for extracting the Magna Carta (charter of liberties) from the King (June 19, 1215). For these services John rewarded Pandulph with the see of Norwich.

After John's death (Oct 18/19, 1216), Pandulph was prominent in the regency for the boy king Henry III until 1220 or 1221, when Langton induced Innocent's successor, Pope Honorius III, to recall him.

Panduranga, Ramchandra (Indian rebel leader): *see* Tantia Topi.

Panduro, Leif (b. April 18, 1923, Frederiksberg, Den.—d. Jan. 16, 1977, Asserbo), Danish novelist and dramatist a social critic who wrote in a satirical, humorous vein.

His first novel, *Av, min guldtand* (1957; "Off, My Gold Tooth"), is an ironic, at times hilarious description of small-town life, based to a large extent on Panduro's own experiences. The same is the case in his next novel, *Rend mig i traditionerne* (1958; "Kick me in the Traditions"), a study of a schoolboy and his puberty crisis reminiscent of J.D. Salinger's *The Catcher in the Rye* of 1951. *De uanstaendige* (1960; "The Indecent Ones") is a critical account of the Danish middle class during the German occupation. Panduro's most ambitious novel is *Øgledage* (1961; "Saurian Days"), which makes use of a sophisticated, modernistic narrative technique. The saurians of the title refer to those who protest against the deadening conventions of everyday life. The conflict between instinctive energies and the demands of conformity becomes the central theme in several of Panduro's novels from the 1960s—*Fern fra Danmark* (1963; "Far from Denmark"), *Fejltagelsen* (1964; "The Mistake"), and *Den gale mand* (1965; "The Crazy Man"). Panduro could see no easy resolution of this antagonism and the breakdowns of his main characters confirm the repressive nature of even a seemingly idyllic society like Denmark.

Panduro produced a number of scripts for radio, television, and film, becoming one of the most successful Scandinavian dramatists of the 1970s with such works as *Farvel, Thomas* (1968; "Goodbye, Thomas") and *I Adams verden* (1973; "In Adam's World").

Pāṇḍya DYNASTY, Tamil rulers in the extreme south of India of unknown antiquity (they are mentioned by Greek authors in the 4th century BC). The Roman emperor Julian received an embassy from a Pāṇḍya *c.* AD 361. The dynasty revived under Kaḍuṅgōn in the early 7th century AD and ruled from Madura or farther south until the 16th century. The small but important (9th–13th century) dynasty of Pāṇḍya of Ucchangi, a hill fort south of the Tuṅgabhadra River, may have originated from the Madura family.

The Pāṇḍya kings were called either Jatavarman or Māravarman. From being Jains they became Śaivas (worshippers of Śiva) and are celebrated in the earliest Tamil poetry. They ruled extensive territories, at times including the Cēra (or Kerala) country, the Cōḷa country, and Ceylon through collateral branches subject to Madura. The "Five Pāṇḍyas" flourished from the 12th to the 14th century and eventually assumed control of all the plains of the extreme south as far north as Nellore (1257). Family quarrels, however, and Muslim invasions, from 1311, culminating in the foundation of the Madura sultanate, weakened Pāṇḍya influence. By 1312 control over Kerala was lost, and by the mid-16th century all their territories had passed into other hands.

panegyric, eulogistic oration or laudatory discourse that originally was a speech delivered at an ancient Greek general assembly (*panēgyris*), such as the Olympic and Panathenaic festivals. Speakers often took advantage of these occasions, when Greeks of various cities were gathered together, to advocate Hellenic unity. With this end in view and also to gratify their audience, they tended to expatiate on the former glories of Greek cities; hence came the encomiastic associations that eventually clung to the term panegyric. The most famous ancient Greek panegyrics to survive intact are the *Panegyricus* (*c.* 380 BC) and the *Panathenaicus* (*c.* 340 BC), both by Isocrates.

Akin to panegyric was the *epitaphion*, or funeral oration, such as Pericles' funeral speech as recorded by Thucydides, a panegyric both on war heroes and on Athens itself.

In the 2nd century AD, Aelius Aristides, a Greek rhetorician, combined praise of famous cities with eulogy of the reigning Roman emperor. By his time panegyric had probably become specialized in the latter connection and was, therefore, related to the old Roman custom of celebrating at festivals the glories of famous men of the past and of pronouncing *laudationes funebres* at the funerals of eminent persons.

Another kind of Roman eulogistic speech was the *gratiarum actio* ("thanksgiving"), delivered by a successful candidate for public office. The *XII Panegyrici Latini*, an ancient collection of these speeches, includes the *gratiarum actio* delivered by Pliny the Younger when he was nominated consul by the emperor Trajan in AD 100. Late Roman writers of the 3rd to the 5th century indiscriminately praised and flattered the emperors in panegyrics that were sometimes written in verse.

Although primarily a literary form associated with classical antiquity, panegyric continued to be written on occasion in the Middle Ages, often by Christian mystics in praise of God, and in the Renaissance and Baroque periods, especially in Elizabethan England, in Spain during the Siglo de Oro (Golden Age), and in France under the reign of Louis XIV.

panēgyris (Greek: "gathering"), plural PANĒGYREIS, in Greek religion, an ancient assembly that met on certain fixed dates for the purpose of honouring a specific god. The gatherings varied in size from the inhabitants of a single town to great national meetings, such as the Olympic Games. The religious aspect of the meetings was by far the most important, and included prayers, feasts, and processions. The populace, however, was probably more attracted to the amusements, games, fairs, and festive orations (panegyrics) that occurred at the gatherings.

panel chair: *see* wainscot chair.

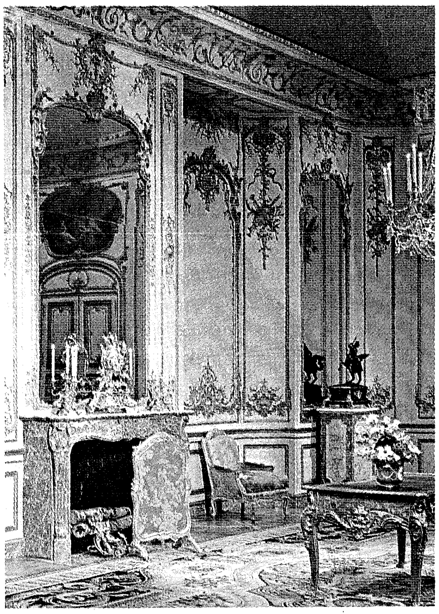
panel heating: *see* radiant heating.

panel painting, painting executed on a rigid support—ordinarily wood or metal—as distinct from painting done on canvas. Before canvas came into general use at the end of the 16th century, the panel was the support most often used for easel painting. A variety of woods has been used, including beech, cedar, chestnut, fir, larch, linden, white poplar, mahogany, olive, dark walnut, and teak. Wooden panels were usually boiled or steamed to remove gum and resin and thereby prevent splitting and then were coated with size (a glutinous material) to fill pores and with gesso (a mixture of glue and whiting), on which the painting was executed. Metals used for panel paintings include silver, tin, lead, and zinc. During the Middle Ages, especially in Russia, paintings were executed on panels over which leather had been stretched.

Presentation of Richard II of England to the Virgin and Child, front of the "Wilton Diptych," panel paintings in the International Gothic style; in the National Gallery, London

By courtesy of the trustees of the National Gallery, London

paneling, also spelled PANELLING, in architecture and design, decorative treatment of walls, ceilings, doors, and furniture consisting of a series of wide, thin sheets of wood, called panels, framed together by narrower, thicker strips of wood. The latter are called styles (the external vertical strips), muntins (the internal vertical strips), and rails (the horizontal strips).



Paneled room designed by Nicolas Pineau in the Louis XV style, 1735, from the Hôtel de Varengeville, Paris; in the Metropolitan Museum of Art, New York City

By courtesy of the Metropolitan Museum of Art, New York City, acquired with funds given by Mr. and Mrs. Charles B. Wrightsman

Simple paneling on doors was used in Classical architecture, both Greek and Roman, as it was in the transitional Italian Romanesque interiors. Its extensive use on walls and furnishings, however, began in the Gothic period. The richness and warmth of interior wood paneling is a highly characteristic aspect of the Tudor and Elizabethan styles of decoration in England. Early Tudor walls are profusely carved, often in fielded panels, in which the central area is raised above the framing. One particularly popular form of fielded panel was the linenfold, featuring stylized carvings that represent vertically folded linen; Hampton Court Palace near London contains many superb examples. In the English Renaissance, paneling became simpler; in the France of kings Louis XIV and XV, it was lavish and ornate; and in the Italian Renaissance, architects restricted its use to ceilings. In 17th-century New England, paneling was used but without decoration; in the 18th century it became more decorative, especially in the Southern colonies.

In all of these historical instances the paneling was almost always made of either oak or pine. In the 20th century an enormous variety of materials came into use: solid wood (walnut, mahogany, birch, redwood), plywood (a thin wood veneer on a plywood base), vinyl with surface imitating wood grain, hardboard (or pressed wood), pegboard, and even translucent materials such as lucite.

Paneth, Friedrich Adolf (b. Aug. 31, 1887, Vienna—d. Sept. 17, 1958, Vienna), Austrian chemist who with George Charles de Hevesy introduced radioactive tracer techniques (1912–13).

Paneth, the son of noted physiologist Joseph Paneth, studied at Munich, Glasgow, and Vienna, then held positions at the Radium Institute, Vienna, and at research facilities in Prague, Hamburg, Berlin, and Königsberg. Upon the rise of the Nazi movement, he went to England and took a position as guest lecturer at the Imperial College of Science and Technology, London (1933–38), and then became professor of chemistry at the University of Durham (1939). In 1953 he returned to West Germany as director of the Max Planck Institute at Mainz.

Between 1918 and 1922 Paneth prepared hydrides of bismuth, lead, and polonium with radioactive isotopes. Beginning in 1929 he furnished proof of the brief existence of the methyl and ethyl free radicals. His microanalytical work in rare gases led him to study the composition of the atmosphere and to conclude that the composition of air is constant at least to an altitude of approximately 61 km (38 miles). His measurement of helium from the radioactive decomposition of meteorites and terrestrial rocks led to methods for ascertaining their age.

Paneth cell, specialized type of epithelial cell found in the mucous-membrane lining of the small intestine and of the appendix, at the base of tubelike depressions known as Lieberkühn glands. Named for the 19th-century Austrian physiologist Joseph Paneth, the cell has one nucleus at its base and densely packed secretory granules throughout the rest of its body. Their function is not totally known, nor is their manner of discharging their granules. They are known to secrete large amounts of protein-rich material and are thought to secrete the enzyme peptidase, which breaks peptide molecules into amino acids suitable for assimilation by the body. In humans the granules are found to contain carbohydrates, proteins, and radioactive zinc. In mice a specific protein, lysozyme, known to destroy some bacteria, is believed to be present in the granules. This suggests that the Paneth cell might also have an antibacterial function.

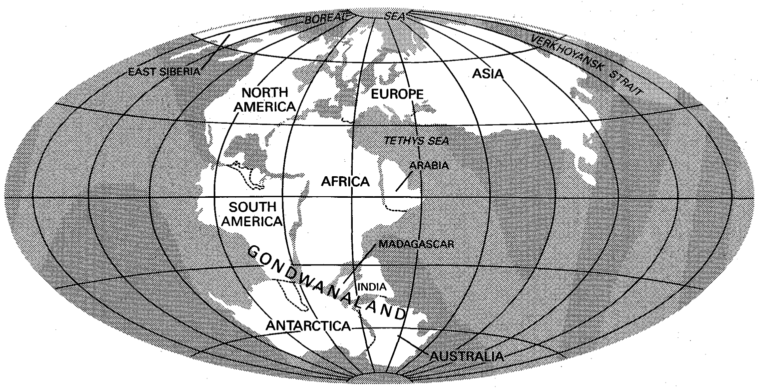
Panevėžys, city, north-central Lithuanian Soviet Socialist Republic, on the Nevėžis River. First mentioned in documents in 1503, it was chartered as a district town in 1842 and became a regional economic centre.

Agricultural trade is important; the leading industry is food processing (especially sugar refining). There are metalworks, glassworks, and a large flax-processing plant. The city has schools of technology, music, and medicine. The Panevėžys Drama Theatre, a celebrated Lithuanian national institution, was founded in 1940. Pop. (1986 est.) 119,000.

Pang-pu, Pinyin BANGBU, city in north-central Anhwei *sheng* (province), China. The name is mentioned in the early 1st millennium BC in connection with the myths surrounding the cultural hero Emperor Yü. Throughout most of Chinese history, however, it was only a small market town and port on the middle course of the Huai River. The city comprises two parts—greater Pang-pu, on the southern bank of the Huai, and little Pang-pu, on the northern bank.

Pang-pu's modern growth began with the construction in 1912 of the great trunk railway from Tientsin to P'u-k'ou, opposite Nanking, on the Yangtze River—a route that crossed the Huai. The river traffic on the Huai made Pang-pu the natural collecting centre for the agricultural produce, especially grain, cotton, peanuts (groundnuts), and soya beans, from much of northern Anhwei. Pang-pu's importance as a communication centre was further increased with the completion in 1944 of a railway linking it to Ho-fei and to the Huai-nan coalfield. In addition, it is also the centre of a road network, connecting it with K'ai-feng in Honan province to the northwest and with Ho-fei to the south. Since 1949, particularly since the improvement of the Huai River system and the restoration of the Grand Canal, Pang-pu's position as the chief commercial centre of the middle Huai Valley has been consolidated. Industrial growth, however, has been comparatively slow. There are coal mines at Huai-yüan, to the northwest, and copper mines have been reported opened in the vicinity. Pop. (1985 est.) 390,900.

Pangaea (from Greek *pangaia,* "all earth"), hypothetical protocontinent proposed by the German meteorologist Alfred Wegener in 1912 as a part of his theory of continental drift (*q.v.*). According to this theory, Pangaea was composed of continental sial (granitic rock), which was balanced isostatically in a layer of denser material (basalt), called sima, constituting the uppermost portion of the Earth's mantle. The protocontinent supposedly covered about half the Earth and was completely surrounded by a world ocean called Panthalassa. During the Jurassic Period (approximately 136,000,000 to 190,000,000 years ago), Pangaea began to break apart. Its segments Laurasia (composed of all the present-day northern continents) and Gondwanaland (all of the present southern continents) gradually receded, resulting in the formation of the Atlantic Ocean.



Pangaea
Adapted with permission of Irving Geis

The breakup of Pangaea is now explained in terms of plate tectonics (*q.v.*). This theory states that the Earth's outer shell, or lithosphere, consists of large, rigid plates, which move relative to each other and interact at their margins, where they diverge, converge, or slip past one another. Pangaea split apart at one of the divergent plate boundaries, and a rift developed beneath the continent. As the two segments of the continent pulled farther apart, molten rock material from the asthenosphere, the layer underlying the lithosphere, flowed upward to fill the void, creating the floor of the new Atlantic Ocean basin.

Pangaion, Mount, also spelled PANGEON, PANGAEUM, PANGAEOS, or PANGAIOS, Modern Greek PANGAÍON ÓROS, mountain, at the mouth of the Strymon river, northeastern Kavála *nomós* (department), Macedonia, Greece. Its highest point is 6,417 feet (1,956 m). The upper slopes are formed by fracturing of marble rock; gold and silver mineral deposits mined from ancient times are found at lower elevations. Mount Pangaion is rich in forest and streams and is surrounded by the fertile alluvial plain of the Strymon, on which crops such as tobacco, cotton, rice, and olives are cultivated intensively. In ancient times, the peak was the home of a cult of Dionysus. The ancient Thracians exploited its gold and silver, trading their metals for goods supplied by the Amphipolitans and Neapolitans. Its famed wealth led to constant strife in the region, however, until Philip II of Macedon gained control in the 4th century BC. Situated on the east side of the mountain are the monastery of Eikosiphoinissis, containing some ancient manuscripts, and the church of Zoodochos Pighi, founded in the 6th century AD. The usual base for the ascent of Mount Pangaion is either of the towns of Elevtheroupolis or Pravion.

Pangalos, Theodoros (b. Jan. 11, 1878, Salamís, Greece—d. Feb. 26, 1952, Athens), soldier and statesman who for eight months in 1926 was dictator of Greece.

After service in World War I and the unsuccessful Greek campaign in western Turkey (1921–22), Pangalos was appointed minister of war shortly after the abdication of King Constantine (1922). He directed the military court that condemned those responsible for the rout of Greek forces at Afyon, Tur., in August 1922 and the later massacre of Greeks in Smyrna (now İzmir, Tur.). In 1923 he was also commander in chief in Thrace. In June 1925 he staged a coup and had himself installed as prime minister, and on Jan. 3, 1926, he proclaimed himself dictator. In April he procured his own election as president but was deposed on Aug. 22, 1926, in a coup by his own Republican Guard. His arbitrary rule brought an eight-month suspension of Parliament, a deterioration in relations with Bulgaria (October 1925), and unsuccessful attempts to regulate public morality. After retiring from public life he was sentenced to two years' imprisonment in a building scandal (1930). In World War II he was accused of having collaborated with the Germans and Italians, but the charges remained unsubstantiated.

Pangani, historic town, northeastern Tanzania, eastern Africa, at the mouth of the Pangani River, on the Pemba Channel of the Indian Ocean. The town was formerly a slave-trading depot at the terminus of Arab caravan routes from the interior. Pangani is now an important commercial centre, producing sisal, corn (maize), bananas, and cassava. Pop. (1978 prelim.) 5,368.

Pangasinan, ninth largest cultural-linguistic group of the Philippines. Numbering about 1,263,000 in the late 20th century, the Pangasinan occupy the west-central area of the island of Luzon. They are predominantly Roman Catholic. There has been considerable intermarriage with the Ilocanos from northern Luzon, an adjacent cultural-linguistic group with whom they share many traditions. Their language belongs to the Austronesian (Malayo-Polynesian) family of languages. The area inhabited by the Pangasinan is one of the richest agricultural regions of the Philippines. The chief crop is rice, much of which goes by rail to the Manila markets. Minor crops are corn (maize), coconuts, mangoes and other tropical fruits, sugarcane, and tobacco.

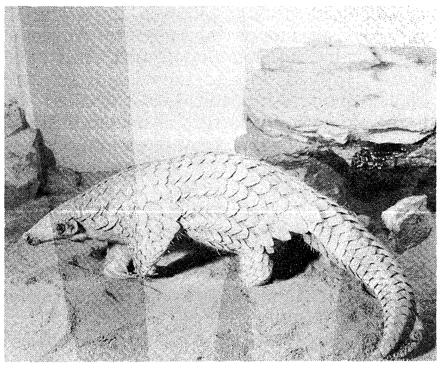
Pangkalpinang, city (*kotamadya*) and chief settlement of Bangka island, Sumatera Selatan *provinsi* ("province"), Indonesia, located in the east-central part of the island. It is a major port on the Java Sea and has an airport. The city's population consists mostly of Hakkas, originally from Kwangtung province, China. Locally they are called Perankan (Indonesian: "Children of the Indies"), and they speak a creolized Hakka dialect. Household industries include wood carving, metalwork, weaving, plaiting, and basket making. Coastal vessels are built and repaired there, and deep-sea fishing is important. The island of Bangka produces pepper, and tin from mines on the island is smelted at Pangkalpinang. The city exports tin, pepper, fish, and copra. It is connected by road to other municipalities and towns on the island. Pop. (1980) 90,096.

Pangkor Engagement (1874), treaty between the British government and Malay chiefs in Perak, the first step in the establishment of British dominion over the Malay states. In January 1874, Governor Andrew Clarke of the Straits Settlements, prompted by the local trading community, organized a meeting between British, Malay, and Chinese leaders to settle a Perak succession dispute and to stop warfare between Chinese secret societies. Named after Pangkor Island, off the Perak coast, the engagement adjudicated these issues. The complicated Perak succession controversy was settled in favour of Raja Abdullah, the candidate supported by Lower Perak chiefs, who had been passed over in the 1871 succession. Ismail, the Upper Perak contender, absent from the meeting, was pensioned off with an annual allowance and was granted the honorific title of *sultan muda.* In return for British backing, Abdullah agreed to accept a British resident (adviser) with broad powers at his court. The Chinese-secret-society issue was settled in the separate Chinese Engagement (*q.v.*). Similar agreements were later signed with other Malay states, achieving de facto British rule of the Malay Peninsula by 1914.

Pango-Pango (American Samoa): *see* Pago Pago.

pangolin, also called SCALY ANTEATER, any of the armoured placental mammals of the order Pholidota. Pangolin, from the Malayan meaning "rolling over," refers to this animal's habit of curling into a ball when threatened. About eight species of pangolins, usually considered to be of the genus *Manis,* family Manidae, are found in tropical Asia and Africa. Pangolins are 30 to 90 cm (1 to 3 feet) long exclusive of the tail and weigh from 5 to 27 kg (10 to 60 pounds). Except for the sides of the face and underside of the body, they are covered with overlapping brownish scales composed of cemented hairs. The head is short and conical, with small, thickly lidded eyes and a long, toothless muzzle; the tongue is wormlike and extensile, up to 25 cm (10 inches) in length. The legs are short, and the five-toed feet have sharp claws. The tail, about as long as the body, is prehensile, and, with the hind legs, it forms a tripod for support.

Some pangolins, such as the African black-bellied pangolin (*Manis longicaudata*) and the Chinese pangolin (*M. pentadactyla*), are almost entirely arboreal; others, such as the giant pangolin (*M. gigantea*) of Africa, are terrestrial. All are nocturnal and able to swim a little. Terrestrial forms live in burrows. Pangolins feed mainly on termites but also eat



Indian pangolin (*Manis crassicaudatus*)
By courtesy of the New York Zoological Society

ants and other insects. They locate prey by smell and use the forefeet to rip open nests.

Their means of defense are the emission of a odorous secretion from large anal glands and the ploy of rolling up, presenting erected scales to the enemy. Pangolins are timid and live alone or in pairs. Apparently usually one young is born at a time, soft-scaled at birth, and carried on the female's back for some time. Life span is about 12 years.

Pangolins were once grouped with the true anteaters, sloths, and armadillos in the order Edentata, mainly because of superficial likenesses to South American anteaters. Pangolins differ from edentates, however, in many fundamental anatomical characteristics.

The earliest fossil Pholidota are bones indistinguishable from those of the African giant pangolin, found in a cave in India and dating to the Pleistocene Epoch (about 10,000 to 2,500,000 years ago).

Panguingue (card game): *see* Pan.

Panguna, mining town and site of a large open-pit copper mine in the south-central interior of Bougainville Island, Papua New Guinea. Conzine Riotinto, an Australian mining company, began prospecting for copper in the Crown Prince Range at Panguna in the early 1960s. Subsequently, Bougainville Copper Ltd. was set up, and roads, a pipeline to convey the copper concentrate to the drying and loading installations at Loloho on Arawa Bay, and the nearby dormitory town of Arawa were built. The mine was brought into production in 1972 and has become one of the world's largest copper producers, with most of the concentrate exported to Japan and Germany. Gold is also extracted from the ore. Built in ribbon formation in the valleys of the Crown Prince Range, Panguna includes the company's administration offices, several housing areas, and canteens, all for the employees of the mining company and their dependents. Pop. (1981 prelim.) 3,487.

Panhard, René (b. 1841, Paris—d. 1908, La Bourbole, Fr.), French automobile engineer and manufacturer who, with Émile Levassor, produced the first vehicle with an internal-combustion engine mounted at the front of the chassis rather than under the driver's seat. Their vehicle became the prototype of the modern automobile. It had a sliding gear transmission and a differential gear with power transmitted to the rear axle by a chain drive.

Panhard, a graduate of the École Centrale des Arts et Manufactures, in 1886 joined Levassor, who had gained control of the French rights to the Daimler patents. In 1891–92 Panhard and Levassor built their vehicle with the front-mounted engine to Levassor's design. It was put on sale in 1892 and competed successfully in early races.

panic, in economics, acute financial disturbance, such as widespread bank failures, feverish stock speculation followed by a market crash, or a climate of fear caused by economic crisis or the anticipation of such crisis. The term is applied only to the violent stage of financial convulsion and does not extend to the whole period of a decline in the business cycle. *Compare* depression; recession.

Until the 19th century, economic fluctuations were largely connected with shortages of goods, market expansion, and speculation, as in the incident known as the South Sea Bubble (1720), when stock speculation reached panic proportions in both France and England. Panics in the industrialized societies of the 19th and 20th centuries, however, have reflected the increasing complexity of advanced economies and the changed character of their instability. A financial panic has quite often been a prelude to a crisis that extended beyond commercial activities into sectors of consumption and capital-goods industries. The Panic of 1857 in the United States, for example, was the outcome of a number of developments, including the railroads' defaulting on their bonds, the resultant decline in the value of rail securities, and the tying up of bank assets in nonliquid railroad investments. Its effects were also complex, including not only the closing of many banks but also a sharp increase in unemployment in the United States and a money-market panic on the European continent. The Panic of 1873, which began with financial crises in Vienna in June and in New York City in September, marked the end of the long-term expansion in the world economy that had begun in the late 1840s. The greatest panic, however, was the crisis in 1929, which rocked the U.S. economy, shattered world economic relations, and brought about the Great Depression.

panicum, any of nearly 600 species of forage and cereal grasses in the genus *Panicum* (family Poaceae), distributed throughout tropical and warm temperate regions. These plants are annuals and perennials; many are tufted or have underground stems.

Many species of *Panicum,* known as millet (*q.v.*), are cultivated in Europe and Asia as crop plants and in the United States for forage, hog feed, and birdseed. Guinea grass (*P. maximum*), a tall African plant, also is cultivated for forage, especially in tropical America and southern North America. Switch grass (*P. virgatum*) is an erect, tough perennial, 1 to 2 m (about 3 to $6\frac{1}{2}$ feet) tall, that grows in clumps; its spikelets may be reddish. It is a major constituent of tall grass prairie in North America and is a valuable forage grass. It is sometimes used for erosion control because its thick underground stems send up new plants.

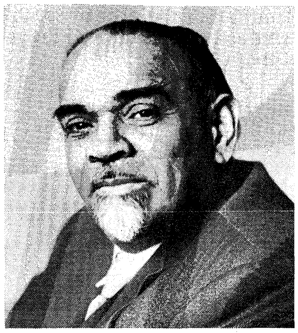
Panicum
Syndication International—Photo Trends

Witchgrass (*P. capillare*), a tufted annual, is a common weed in fields and disturbed areas. Its large, purplish flower clusters break off and are blown by the wind. Vine mesquite grass (*P. obtusum*) is planted for erosion control in the southwestern United States.

Pānihāti, town, south-central West Bengal state, northeastern India, just east of the Hooghly River, part of the Calcutta urban agglomeration. Connected by road and rail with Calcutta, it is a rice trade centre; its major industries include cotton milling, tanneries, and the manufacture of chemicals, pottery, cement, glass, paint, and rubber goods. With the southern suburb of Āgarpārā, it was constituted a municipality in 1900, when it was separated from Barrackpore (*q.v.*) municipality. Pop. (1981) 205,518.

Panikkar, Kavalam Madhava (b. June 3, 1895, Travancore, India—d. Dec. 10, 1963, Mysore), Indian statesman, diplomat, and scholar.

Educated at the University of Oxford, Panikkar read for the bar at the Middle Temple, London, before returning to India, where he then taught at Alīgarh and Calcutta universities. He turned to journalism in 1925 as editor of the *Hindustan Times.* He entered political life in the service of the Indian princes, becoming secretary to the chancellor of the Chamber of Princes (organization of rulers of the princely states). He also served as the foreign minister of the state of Patiala and as foreign minister and later as chief minister of the state of Bīkaner (1944–47). After India gained its independence, he was entrusted with greater responsibilities as ambassador to China (1948–52), Egypt (1952–53), and France (1956–59). Late in life, he



Panikkar
Camera Press

returned to academia and was vice-chancellor of the University of Mysore at his death.

Panikkar's interest in European influence on Asia was reflected in his studies of the Portuguese and the Dutch in Malabar (in South India) and especially in his *Asia and Western Dominance* (1953). *In Two Chinas* (1955) revealed his sympathy with Communist China. He also wrote plays and novels.

Panin, Nikita Ivanovich, Graf (Count) (b. Sept. 29 [Sept. 18, Old Style], 1718, Gdańsk, Pol.—d. April 11 [March 31], 1783, St. Petersburg [now Leningrad]), statesman who served as a chief diplomatic adviser to Catherine II the Great of Russia (reigned 1762–96).

Son of the Russian commandant at Pärnu (Pernau), Estonia, Panin entered the Russian army in 1740, was appointed Russia's minister to Denmark in 1747, and was then transferred to Sweden, where he served from 1748 to 1760, officially acting as a major opponent of the pro-French party in Sweden and personally developing liberal political views and an appreciation of constitutional forms of government.

When Russia reversed its foreign policy in 1756 and entered the Seven Years' War as an ally of France and Austria, his position grew more difficult; he was about to retire in 1760 when Empress Elizabeth (reigned 1741–62), finding him one of the most learned and accomplished gentlemen of Russia, recalled him to St. Petersburg to supervise the education of the grand duke Paul, son of her heir, the future Peter III (reigned 1762), and his wife, the future Catherine II (reigned 1762–96).

Though Panin urged that Paul be named emperor and Catherine act only as regent when Peter was overthrown in 1762, he became a trusted adviser to Catherine, particularly in foreign affairs, and was given the formal position of head of the foreign college (department of foreign affairs) in 1763. As such, he developed the concept of the "Northern Accord," an alliance system involving Russia, Prussia, Poland, Sweden, and, perhaps, Great Britain aimed against the Franco-Austrian bloc, and tried to direct Russia's foreign policy toward forming that alliance system.

In conjunction with that concept, however, Panin advocated the development of Poland

Panin, detail of a portrait by A. Roslin, 1777
Novosti Press Agency

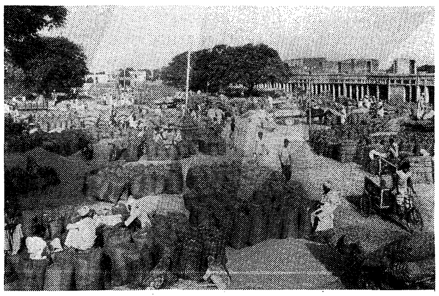
into a strong, independent state that would maintain friendly relations with Russia. This position brought him into conflict with Frederick II of Prussia, with whom Panin had cultivated close relations, as well as with Catherine, both of whom preferred that Poland remain weak and subservient. Upon Catherine's insistence, Panin first implemented her plan to place her former lover Stanisław Poniatowski on the Polish throne and effectively subordinate Poland to Russia (1764), then participated in the negotiations with Prussia and Austria (1770–71) that culminated in the first partition of Poland (1772).

Despite the failure of his grand scheme, Panin continued to urge close Russo-Prussian relations. But Catherine preferred to improve Russia's relations with Austria and, as she succeeded, Panin's position of influence declined. She finally dismissed him in May 1781 after they quarrelled over her plan (1780) to organize the protection of neutral shipping against British interference during the American Revolution.

Panin and members of the Vorontsov family were the leaders of a movement to redefine the position of the Russian gentry. Inspired by the concept of the nobility in England and Sweden, the program called for recognizing the gentry's intangible rights and privileges and for securing it from arbitrariness by the government. Only the upper stratum of the nobility was enlisted in support of this movement. It failed because after Peter III's overthrow Catherine, backed by her high-ranking nobles, refused to establish the privy council that Panin proposed.

Panini, Giovanni Paolo (Roman painter): *see* Pannini, Giovanni Paolo.

Pānīpat, city, Karnāl district, Haryāna state, northwestern India, connected by road and rail with Delhi (south) and Ambāla (north). The plain of Pānīpat was the site of three decisive battles in Indian history in the 16th and 18th centuries. Wool and cotton milling, saltpetre refining, and the manufacture of



The wheat market at Pānīpat, Haryāna, India
Baldev—Shostal Assoc. /EB Inc.

glass, electrical appliances, and bricks are the chief industries. Constituted a municipality in 1867, Pānīpat has three colleges affiliated with Kurukshetra University. Pop. (1981) 137,927.

Pānīpat, Battles of (1526, 1556, 1761), three military engagements, important in North Indian history, fought at Pānīpat, a level plain suitable for cavalry movements, about 50 miles (80 kilometres) north of Delhi. The first battle (April 21, 1526) was between the Mughal chief Bābur, then ruler of Kābul, and Sultan Ibrāhīm Lodī of Delhi. Although the Sultan's army outnumbered the Mughals', it was unused to the wheeling tactics of the cavalry and suffered from deep divisions. Ibrāhīm was killed, and his army was defeated. This marked the beginning of the Mughal Empire in India.

The second battle (Nov. 5, 1556) ended in a victory for Bayram Khān, the guardian of the young Mughal emperor Akbar, over Hemū, the Hindu general of an Afghan claimant who had proclaimed himself independent. It marked the restoration of Mughal power after the expulsion of the emperor Humāyūn by Shēr Shāh the Afghan in 1540.

The third battle (Jan. 14, 1761) ended the Marāthā attempt to succeed the Mughals as rulers of India and marked the virtual end of the Mughal Empire. The Marāthā army, under the Bhāo Sahib, uncle of the Peshwa (chief minister), was trapped and destroyed by the Afghan chief Aḥmad Shāh Durrānī. This began 40 years of anarchy in northwestern India and cleared the way for later British supremacy.

Panizzi, Sir Anthony, original name ANTONIO GENESIO MARIA PANIZZI (b. Sept. 16, 1797, Brescello, Italy—d. April 8, 1879, London), Italian patriot and man of letters who became famous as a librarian at the British Museum and played a part in the unification of Italy.

Panizzi, detail of an oil painting by G.F. Watts; in the National Portrait Gallery, London
By courtesy of the National Portrait Gallery, London

In 1822 Panizzi was forced into exile to avoid arrest as a revolutionary. He arrived in England in 1823 and, after teaching Italian at Liverpool, became professor of Italian at University College, London (1828–37). In 1831 he was named assistant librarian at the British Museum and became principal librarian in 1856. As a librarian and administrator, Panizzi was responsible for the reorganization and the new spirit of energy and concern for scholarship that made the museum one of the world's great centres of culture. He planned and began work on the general catalog; secured strict enforcement of the 1842 Copyright Act; drew up a report on the library's deficiencies that led to an increased grant for book purchases in 1845; improved staff conditions by insisting on the museum's recognition as a branch of the civil service; and was responsible, through his friendship with Thomas Grenville, for the bequest of the Grenville library in 1846. He is best remembered, however, for designing and supervising the building of the Reading Room, opened in May 1857.

Although he became a British citizen in 1832, Panizzi continued to further the cause of Italian liberty through his friendship with influential Liberal statesmen in England, with Thiers in France, and with the Italian leaders. After the unification of Italy, he declined invitations from Garibaldi and Cavour to return as senator or as a member of the Council of Public Instruction, preferring to continue to serve as "unofficial ambassador" in London.

Panizzi's literary works include editions of Boiardo's *Orlando innamorato* and Ariosto's *Orlando furioso* (1830–34) and of Boiardo's minor poems (1835). In his later years he was a close friend of Prosper Mérimée. He retired in 1866 and was knighted in 1869.

Panj, Āb-e (Afghanistan and U.S.S.R.): *see* Pyandzh River.

Pañjāb (India): *see* Punjab.

Panjabi language: *see* Punjabi language.

Panjgūr, town, administrative headquarters of Panjgūr district, Makrān division, Baluchistan province, Pakistan. Situated on the south bank of the Rakhshān River in the Siāhān Range, the town is a market centre and in summer is the temporary seat of most of Makrān's division offices. It has an overhead water storage tank and is connected by road to Turbat and Pasni to the southwest.

Panjgūr district, which had been part of the former Makrān district, consists mostly of mountains intersected by the Rakhshān and Gwārkoh (Gwārgō) river valleys and is semi-arid. It is inhabited mainly by Baluchi who are pastoral sheep-breeders. Dates, wheat, barley, *jowār* (sorghum), and rice are raised. Pop. (1981 prelim.) town, 10,000; district, 161,000.

Panjim (India): *see* Panaji.

Panjnad River, river in Punjab Province, Pakistan, formed just below Uch by successive junctions of the Sutlej, Beās, Rāvi, Jhelum, and Chenāb rivers. The Panjnad (literally Five Rivers) flows 44 mi (71 km) southwest to its junction with the Indus near Mithankot, forming in its course part of the boundary between Muzaffargarh, Bahāwalpur, and Rahīmyār Khān districts. A barrage located just after its junction with the Chenāb is part of the Sutlej Valley irrigation project.

Pankhurst, Dame Christabel Harriette (b. Sept. 22, 1880, Manchester—d. Feb. 13, 1958, Los Angeles, Calif., U.S.), suffragette leader credited with organizing the tactics of the militant British suffrage movement.

A daughter of suffrage activist Emmeline Pankhurst and a sister of Sylvia Pankhurst, Christabel Pankhurst advocated the use of militant tactics to win the vote for women in England. With her mother she founded the Women's Social and Political Union in 1903. Reflecting the Union's slogan, "Deeds not Words," Pankhurst, with Annie Kenney, fired the opening salvo in the militant suffrage campaign by disrupting a Liberal Party meeting in Manchester in 1905. Her action (she unfurled a banner reading "Votes for Women") received worldwide attention after she was sent to jail.

Pankhurst subsequently directed a campaign that included direct physical action, hunger strikes, and huge open-air rallies. During World War I, she declared a suffrage truce and helped to lead the war effort in England; in 1928 women became enfranchised in that country. In later life Pankhurst became a religious evangelist.

In 1936 she was created a Dame Commander of the Order of the British Empire.

Pankhurst, Emmeline, *née* GOULDEN (b. July 14, 1858, Manchester—d. June 14, 1928, London), militant champion of woman suf-

Emmeline Pankhurst in prison clothes, 1908
BBC Hulton Picture Library

frage whose 40-year campaign achieved complete success in the year of her death, when British women obtained full equality in the voting franchise. Her daughter Christabel Harriette (afterward Dame Christabel) Pankhurst (1880–1958) also was prominent in the woman suffrage movement.

In 1879 Emmeline Goulden married Richard Marsden Pankhurst, lawyer, friend of John Stuart Mill, and author of the first woman suffrage bill in Great Britain (late 1860s) and of the Married Women's Property acts (1870, 1882). Ten years later she founded the Women's Franchise League, which secured (1894) for married women the right to vote in elections to local offices (not to the House of Commons). From 1895 she held a succession of municipal offices in Manchester, but her energies were increasingly in demand by the Women's Social and Political Union (WSPU), which she founded in 1903 in Manchester. The union first attracted wide attention on Oct. 13, 1905, when two of its members, Christabel Pankhurst and Annie Kenney, thrown out of a Liberal Party meeting for demanding a statement about votes for women, were arrested in the street for a technical assault on the police and, after having refused to pay fines, were sent to prison.

From 1906 Emmeline Pankhurst directed WSPU activities from London. Regarding the Liberal government as the main obstacle to woman suffrage, she campaigned against the party's candidates at elections, and her followers interrupted meetings of Cabinet ministers. In 1908–09 Pankhurst was jailed three times, once for issuing a leaflet calling on the people to "rush the House of Commons." A truce that she declared in 1910 was broken when the government blocked a "conciliation" bill on woman suffrage. From July 1912 the WSPU turned to extreme militancy, mainly in the form of arson directed by Christabel from Paris, where she had gone to avoid arrest for conspiracy. Pankhurst herself was imprisoned, and, under the Prisoners (Temporary Discharge for Ill-Health) Act of 1913 (the "Cat and Mouse Act"), by which hunger-striking prisoners could be freed for a time and then reincarcerated upon regaining their health to some extent, she was released and rearrested 12 times within a year, serving a total of about 30 days. With the outbreak of World War I in 1914, she and Christabel called off the suffrage campaign, and the government released all suffragist prisoners.

During the war Pankhurst, who previously had made three tours of the United States to lecture on woman suffrage, visited the United States, Canada, and Russia to encourage the industrial mobilization of women. She lived in the United States, Canada, and Bermuda for several years after the war. In 1926, upon returning to England, she was chosen Conservative candidate for an east London constituency, but her health failed before she could be elected. The Representation of the People Act of 1928, establishing voting equality for men and women, was passed a few weeks before her death. Pankhurst's autobiography, *My Own Story,* appeared in 1914.

BIBLIOGRAPHY. *The Life of Emmeline Pankhurst* (1935, reissued 1969) was written by her second daughter, E. Sylvia Pankhurst.

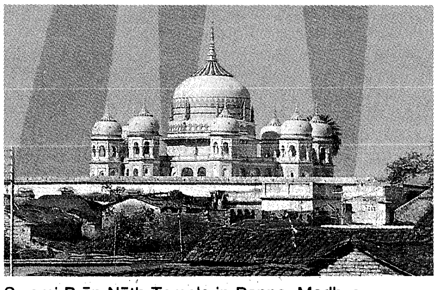
panleucopenia, also spelled PANLEUKOPENIA (disease of cats): *see* feline distemper.

Panlongcheng (archaeological site): *see* P'an-lung-ch'eng.

P'anmunjŏm, village, central Korea, in the demilitarized zone established after the Korean War, 5 miles (8 km) east of Kaesŏng and 3 miles (5 km) south of the 38th parallel, on the Kyŏngŭi high road (from Seoul to Sinŭiju). It was the location of the truce conference that was held for two years (1951–53) between representatives of the United Nations forces and the opposing North Korean and Chinese armies during the war. After the armistice, signed there July 27, 1953, both the liaison officers and the guards of the four countries forming the Neutral Nations Supervisory Commission (Sweden, Switzerland, Poland, and Czechoslovakia) were located there. In 1968 the U.S. intelligence ship *Pueblo* was seized off the North Korean coast by North Korean patrol boats, and its officers and crew were incarcerated and charged with espionage. P'anmunjŏm was then used as the negotiation site between the United States and North Korea, and the crew were released through the village. Subsequently, it has served as a meeting place for conferences between North and South Korea, including Red Cross conferences to establish means of communication and contact between people on either side of the truce line.

Panmure, Fox Maule, 2nd Baron: *see* Dalhousie, Fox Maule Ramsay, 11th Earl of.

Panna, town, northern Madhya Pradesh state, central India. The town grew in importance when Chhatrasal, ruler of Bundelkhand, made it his capital in 1675. It is a trade centre for agricultural products, timber, and cloth fabrics; handloom weaving is the major industry. Buildings of historical importance include the marble-domed Swami Prān Nāth Temple (1795) and Shri Baldeoji Temple. Constituted a municipality in 1921, Panna has colleges affiliated with Awadesh Pratap Singh University.



Swami Prān Nāth Temple in Panna, Madhya Pradesh, India
Baldev—Shostal Assoc./EB Inc.

The surrounding region comprises much of the former princely states of Panna and Ajaigarh. It consists of a hilly region known as the Panna Range, a branch of the Vindhya Range. There are important diamond mines located in Panna, which have been worked since the 17th century and are India's only producing diamond mines. Rice, wheat, sorghum, and oilseeds are the chief crops; there are several fisheries. Pop. (1981) town, 30,389; metropolitan area, 33,674.

paññatti (in Buddhist philosophy): *see* prajñapti.

Panneton, Philippe, pseudonym RINGUET (b. April 30, 1895, Trois-Rivières, Que., Can.—d. Dec. 29, 1960, Lisbon, Port.), French-Canadian novelist whose best-known works present the individual caught in the transition from primitive rural to modern urban life.

Panneton practiced medicine in Montreal and taught medicine at the University of Montreal. He was a cofounder of the French-Canadian Academy. From 1956 until his death, Panneton served as Canadian ambassador to Portugal. *Trente arpents* (1938; *Thirty Acres*), Panneton's major work, deals with the plight of the small French-Canadian farmer forced by the economic and social upheavals of the late 19th and early 20th centuries into migration to the city. In other novels, such as

Panneton
Andre Larose

Fausse monnaie (1947; "False Money") and *Le Poids du jour* (1948; "The Heaviness of the Day"), he continued his examination of the lives of displaced peasants. He also published a volume of short stories and two historical sketches.

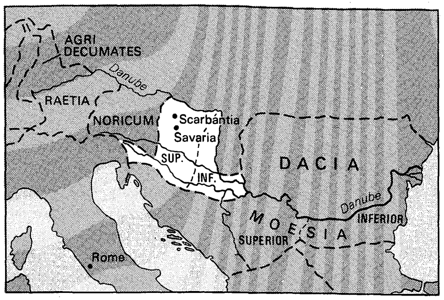
Pannini, Giovanni Paolo, Pannini also spelled PANINI (b. 1691, Piacenza, Duchy of Parma and Piacenza [now in Italy]—d. 1765, Rome), the foremost painter of Roman topography in the 18th century. His real and imaginary views of the ruins of ancient Rome embody precise observation and tender nostalgia, combining elements of late classical Baroque art with those of incipient Romanticism.

His early education included instruction in the art of perspective, and he may have studied *quadratura* (scenic perspective or design) with Ferdinando Galli Bibiena. He probably began painting in Piacenza, but his early activity remains entirely conjectural. Pannini settled in Rome in 1711 and shortly thereafter entered the studio of Benedetto Luti.

In 1718–19 Pannini was admitted into the Academy of St. Luke. His reception piece, "Alexander Visiting the Tomb of Achilles" (1719), is typical of his earlier easel paintings, having small figures dwarfed by an elaborate architectural construction derived from Bolognese theatrical scenography. Many of his canvases prior to 1730 feature explicit historical or religious subjects. His frescoes at the Villa Patrizi (1718–25, later destroyed) established Pannini's fame in this field. Later decorations include those at the Palazzo Alberoni (*c.* 1725; now Senato Palazzo), displaying his talent as a quadraturist, and at Santa Croce in Gerusalemme (*c.* 1725–28).

Toward 1730 Pannini began to specialize in the depiction of Roman topography. To satisfy tourists' demands for his paintings, Pannini frequently repeated subjects yet always retained his spontaneity by varying composition and details. Pannini's oeuvre included interiors of Roman buildings, old and new; most famous are the many versions depicting the Pantheon and St. Peter's. He was admitted into the French Academy in 1732 and subsequently became its professor of perspective. His greatest pupil was Hubert Robert. In 1754 Pannini became principal of the Academy of St. Luke. He painted little after 1760.

Pannonia, province of the Roman Empire, corresponding to present western Hungary and parts of eastern Austria and northern Yugoslavia. The Pannonians were mainly of Illyrians, but there were some Celts in the western part of the province. The Roman conquest of the area began in 35 BC under Octavian (later the emperor Augustus) and was completed in 14 BC with the capture of Sirmium (Sremska Mitrovica, Yugos.), the key town of the Sava Valley. The Pannonian tribes, joined by the Dalmatians, revolted in AD 6, posing the gravest threat to Italy since Hannibal's invasion. After the revolt was put down, Pannonia was organized as a separate province and garrisoned with three legions. The emperor Tra-



Pannonia in the time of Augustus

Adapted from R. Treharne and H. Fullard (eds.), *Muir's Historical Atlas: Ancient, Medieval and Modern,* 9th ed. (1965); George Philip & Son Ltd., London

jan divided the province in about AD 106. The western and northern districts comprised Pannonia Superior, which was the focal point of the Roman wars with the Marcomanni in the reign of Marcus Aurelius (161–180), who died at Vindobona (Vienna). The southern and eastern districts were organized as Pannonia Inferior under Diocletian (reigned 284–305). Pannonia Superior was divided into Pannonia Prima and Pannonia Ripariensis or Savia, and Pannonia Inferior was divided into Valeria and Pannonia Secunda.

The inhabitants of Pannonia retained their own culture into the 2nd century AD, but Romanization did proceed rapidly, especially in the west. In the 1st century AD, Emona (Ljubljana, Yugos.) and Savaria (Szombathely, Hung.) were made Roman colonies; and Scarbantia (Sopron, Hung.) and other cities were made municipia (self-governing communities). Pannonia was the birthplace of several Roman emperors of the 3rd century, and the province provided large numbers of troops for the Roman army. The grave barbarian threat in the 4th century AD forced the Romans to withdraw after 395. From that time, Pannonia ceased to exist as a separate unit.

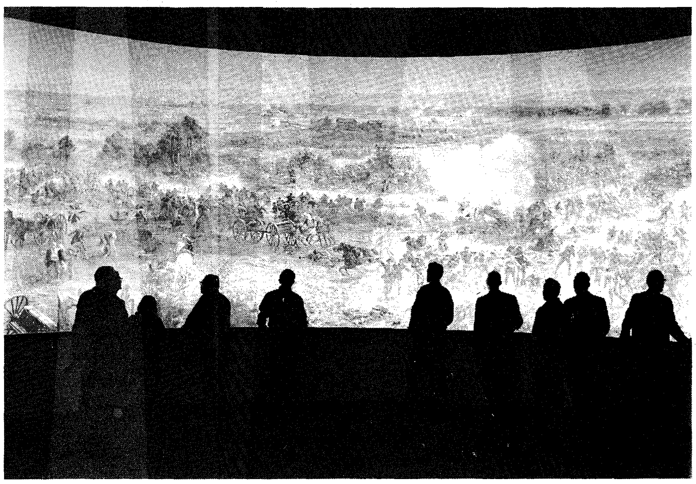
Panofsky, Erwin (b. March 30, 1892, Hannover, Ger.—d. March 14, 1968, Princeton, N.J., U.S.), U.S. art historian whose writings are distinguished for their variety of subject, critical penetration, erudition, and rich allusiveness to literature, philosophy, and history.

Panofsky was educated at the University of Freiburg in Breisgau and was professor at the University of Hamburg from 1926 to 1933. He first went to the United States in 1931 as visiting professor at New York University, New York, and in 1935 became professor of art history at The Institute for Advanced Study, Princeton, N.J.

Among Panofsky's major works in English are *Studies in Iconology: Humanistic Themes in the Art of the Renaissance* (1939); *The Codex Huygens and Leonardo da Vinci's Art Theory* (1940); *Albrecht Dürer* (2 vol.; 1943, 3d ed., 1948), also republished, with full text and illustrations but without the handlist of Dürer's works, as *The Life and Art of Albrecht Dürer* (1955); (ed. and trans.) *Abbot Suger on the Abbey Church of St. Denis and Its Art Treasures* (1946); *Gothic Architecture and Scholasticism* (1951); *Early Netherlandish Painting, Its Origin and Character* (2 vol.; 1953); *Meaning in the Visual Arts* (1955), a collection of nine of Panofsky's most important articles and essays on a wide variety of subjects; with Dora Panofsky, *Pandora's Box: the Changing Aspects of a Mythical Symbol* (1956); *Renaissance and Renascences in Western Art* (1960); *The Iconography of Correggio's Camera di San Paolo* (1961); and *Tomb Sculpture* (1964).

panopticon, architectural form for a prison designed by Jeremy Bentham in the late 18th century. It consisted of a circular, glass-roofed, tanklike structure with cells along the external wall facing toward a central rotunda; guards stationed in the rotunda could keep all the inmates in the surrounding cells under constant surveillance. Although Bentham's novel idea was not incorporated in the plans for penal institutions built at that time, its design had some influence on future construction. For example, a prison incorporating the essential features of the panopticon was erected in the United States at Stateville, near Joliet, Ill., in the early 20th century.

panorama, in the visual arts, continuous narrative scene or landscape painted to conform to a flat or curved background, which surrounds the viewer or is unrolled before him. Panoramas are usually painted in a broad and direct manner, akin to scene, or theatrical, painting. Popular in the late 18th and 19th centuries, the panorama was essentially the



Panorama of the Battle of Gettysburg, painting by Paul Philippoteaux, 1883; at Gettysburg National Military Park, Pennsylvania

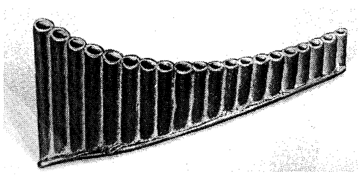
Lane Studio—Walter B. Lane

antecedent of the stereopticon and of motion pictures, especially animations and the process called Cinerama. The true panorama is exhibited on the walls of a large cylinder, the earliest version about 60 feet (18 metres) in diameter and later ones as large as 130 feet (40 metres) in diameter. The viewer, who stands on a platform in the cylinder centre, turns around and successively sees all points of the horizon. The effect of being surrounded by a landscape or event may be heightened in various ways: filling the space between the viewer and the cylinder walls with three-dimensional objects that gradually blend into the picture or the use of indirect lighting to give the illusion that light is emanating from the painting itself.

The first panorama was executed by the Scottish painter Robert Barker, who exhibited in Edinburgh in 1788 a view of that city, followed by panoramas of London and battle scenes from the Napoleonic Wars. Another early panorama painter, the American John Vanderlyn (1775–1852), painted in 1816–19 "The Palace and Gardens of Versailles" (preserved in the Metropolitan Museum of Art, New York City), exhibiting it until 1829 in a rotunda he built on a leased corner of City Hall Park in New York City. By the mid-19th century panoramas became a widespread, popular form of entertainment. Among the major works of this period was Henri Philippoteaux's "Siege of Paris," depicting an event in the Franco-Prussian War. His son Paul painted the panorama "The Battle of Gettysburg" (1883), exhibiting it in several American cities before its permanent installation in Gettysburg, Pa. At mid-century the rolled panorama, a kind of portable mural, became a popular amusement and educational device. Accompanied by a lecture and often music, the painting, on canvas and wound between two poles, would slowly be unrolled behind a frame or revealed in sections. Sometimes theatrical realism was utilized in the form of real steam, smoke, and sound effects. Among the longest and most ambitious of these rolled panoramas was one 1,200 feet (370 metres) long (deceptively advertised as three miles [nearly five kilometres] in length), depicting the landscape along the entire course of the Mississippi River, by the American John Banvard.

A higher form of panoramic art is the Chinese and Japanese traditional hand scroll painting on paper or silk.

panpipe, also spelled SYRINX, wind instrument consisting of cane pipes of different lengths tied in a row or held together by wax (metal, clay, or wood instruments are also made) and generally closed at the bottom. They are blown across the top, each providing a different note. The panpipe was widespread



Romanian panpipe; in the Horniman Museum, London

By courtesy of the Horniman Museum, London

in Neolithic and later cultures, especially in Melanesia and Aboriginal South America.

In the Greek legend of Pan the invention of the instrument is ascribed to the nymph Syrinx. In Europe it has been mainly a shepherd's instrument and has so endured in the Pyrenees. In Romania, however, it is played among professional *lăutari* (fiddlers); their panpipe, the *nai,* has from 19 to 22 pipes tuned diatonically (*i.e.,* to a seven-note scale), semitones being made by tilting the pipes toward the lips. The panpipe also has a long tradition in the Far East.

panpsychism (from Greek *pan,* "all"; *psychē,* "soul"), a philosophical theory asserting that a plurality of separate and distinct psychic beings or minds constitute reality. Panpsychism is distinguished from hylozoism (all matter is living) and pantheism (everything is God). For Gottfried Wilhelm Leibniz, the 17th-century German philosopher and a typical panpsychist, the world is composed of atoms of energy that are psychic. These monads have different levels of consciousness: in inorganic reality they are sleeping, in animals they are dreaming, in man they are waking; God is the fully conscious monad.

In 19th-century Germany, Arthur Schopenhauer asserted that the inner nature of all things is will—a panpsychistic thesis; and Gustav Theodor Fechner, founder of experimental psychology and ardent defender of panpsychism, contended that even trees are sentient and conscious. In the United States, Josiah Royce, an absolute Idealist, not only followed Fechner in affirming that heavenly bodies have souls but also adopted a unique theory that each species of animal is a single conscious individual—incorporating into itself the individual souls of each of its members.

Among other 20th-century philosophers, Alfred North Whitehead may fittingly be called a panpsychist inasmuch as in his philosophy each actual entity is capable of prehensions that involve feelings, emotions, consciousness, and so on.

pansy, any of several popular violets (*Viola* species), of the family Violaceae. Native to Europe, the wild, or field, pansy (*Viola tricolor*) is ancestor to one of the oldest cultivated flowering plants. It is an annual or a short-lived perennial and grows about 15 to

Pansy (*Viola tricolor*)
Kitty Kohout—Root Resources

30 centimetres (6 to 12 inches) tall. It has heart-shaped or rounded leaves at the base and oblong or oval leaves growing from the stems. The velvety flowers, usually in combinations of blue, yellow, and white, are about 2.5 to 5 cm across and have five petals. Four petals are in pairs; the fifth has a short spur. The plant grows best in rich soil in a damp, cool climate.

The cultivated, or garden, pansy (*V. wittrockiana*) is a hybrid of *V. tricolor* with such species as *V. cornuta,* the tufted pansy or horned viola, *V. lutea,* and *V. altaica.* The wild pansy (*V. tricolor*), also known as johnny-jump-up, heartsease, and love-in-idleness, has been widely naturalized in North America. The flowers of this form are mostly purple and less than 2 cm across.

Pant, Dhondu (Indian leader): *see* Nana Sahib.

Pantágoro (people): *see* Patángoro.

Pantagruel (Rabelais): *see* Gargantua and Pantagruel.

Pantaléon, Jacques (pope): *see* Urban IV.

Pantaloon, Italian PANTALONE, stock character of the 16th-century Italian commedia dell'arte; he was a cunning and rapacious yet often deceived Venetian merchant. The name is thought to be derived from the phrase *pianta leone* (Italian: "plant the lion") referring to the Lion of St. Mark, the emblem of the Venetian flag.

Pantaloon dressed in a tight-fitting red vest,

Pantaloon, Nymphenburg porcelain figurine, *c.* 1760; in the Bayerisches Nationalmuseum, Munich
By courtesy of the Bayerisches Nationalmuseum, Munich

red breeches and stockings, a pleated black cassock, slippers, and a soft brimless hat. Later versions of the character sometimes wore long trousers (pantaloons). His mask was gaunt and swarthy with a large hooked nose, and he had a disorderly gray goatee.

The humour of the role stemmed from Pantaloon's avarice and his amorous entanglements. An abject slave to money, he would starve his servant until he barely cast a shadow. If he discharged him, he made certain to do so before dinner. If married, he was a foil for his wife, who was young, pretty, disrespectful, and completely untrustworthy, and for the intrigues and deceits of his daughters and servant girls. Although anxious about his reputation, he engaged in flirtations with young girls who openly mocked him.

In the Italian commedia, Pantaloon was frequently paired with Dottore (*q.v.*) as a parent or guardian of one of the lovers. The French variant evolved from Pantalone when the commedia dell'arte companies played in France. In Elizabethan England, Pantaloon came to mean simply an old man. In 18th-century London, Pantaloon, minus his long coat, was one of the characters of the harlequinade (*q.v.*), the English pantomime version of the commedia dell'arte.

Pantanal, floodplain, northwestern Mato Grosso do Sul and southern Mato Grosso states, southwestern Brazil, extending about 100 mi (160 km) along the eastern bank of the upper Paraguay River. The swampy, marshland region is traversed by several tributaries of the Paraguay, including the São Lourenço and the Taquari. The Pantanal is frequently flooded, but its rich grazing lands support cattle raising.

Pantar Island, Bahasa Indonesia PULAU PANTAR, also called PANDAI, island in the Alor group, Nusa Tenggara Timur *propinsi* (East Nusa Tenggara province), Indonesia. Pantar lies about 45 mi (72 km) north of Timor, across the Selat (strait) Ombai. It is 30 mi long north–south, 7 to 18 mi wide east–west, and has an area of 281 sq mi (728 sq km). Most of the island is flat except for a hilly area in the northeast that rises to a height of about 3,000 ft (914 m). Rainfall is heavy but intermittent, and there is a dry season. Most of the population is engaged in agriculture, producing rice, corn (maize), and cotton. There are coconut plantations along the coast. Livestock is raised on the grasslands that cover much of the island, and there is considerable deep-sea fishing. Industry includes batik printing, wood carving, and the making of musical instruments. Transport is mostly by boat to other islands in the Alor group and to Timor Timur province. The population is mostly Muslim, together with a few Christians. The chief towns are Kabir and Kayan.

Pantelleria Island, Italian ISOLA DI PANTELLERIA, Latin COSSYRA, Italian island in the Mediterranean Sea between Sicily and Tunisia; it forms part of Trapani province, Sicily. Of volcanic origin, it rises to 2,743 ft (836 m) at the extinct crater of Magna Grande and has an area of 32 sq mi (83 sq km). The last eruption (underwater to the west of the island) took place in 1891, but hot mineral springs and fumaroles testify to continued volcanic activity. The island is fertile but lacks fresh water. A fortified Neolithic village (*c.* 3000 BC) has been excavated on the west coast, with remains of huts, pottery, and obsidian tools. To the southeast are tombs, known as *sesi,* similar to the *nuraghi* of Sardinia, comprising rough lava towers with sepulchral chambers in them. After a considerable interval, during which the island probably remained uninhabited, the Phoenicians established a trading station there in the 7th century BC. Later controlled by the Carthaginians, it was occupied by the Romans in 217 BC. Under the Roman Empire it served as a place of banishment. About AD 700 the Christian population was annihilated by the Arabs, from whom the island was taken by the Norman Roger II of Sicily in 1123. The Spanish Requesens family were princes of Pantelleria from 1311 until the town of Pantelleria was sacked by the Turks in 1553. The island's strategic situation in the narrow passage separating the eastern and western Mediterranean induced the Italian government of Benito Mussolini to fortify it as a base, from which Allied convoys were attacked in World War II. The installations and the town of Pantelleria were destroyed by intensive Allied air assault in 1943.

The main occupations are fishing and farming, and sweet wine and raisins are exported. The chief town, Pantelleria, is on the northwest, on the sole harbour; there is also a penal colony located there. Pop. (1981 prelim.) mun., 7,860.

Panter, Peter: *see* Tucholsky, Kurt.

Panthay (people): *see* Hui.

pantheism, the doctrine that the universe conceived of as a whole is God and, conversely, that there is no God but the combined substance, forces, and laws that are manifested in the existing universe. The cognate doctrine of panentheism asserts that God includes the universe as a part though not the whole of his being.

A brief treatment of pantheism and panentheism follows. For full treatment, *see* MACROPAEDIA: Religious and Spiritual Belief, Systems of.

The adjective pantheist was coined by the Rationalist freethinker John Toland in his book *Socinianism Truly Stated* (1705). The noun pantheism was first used a few years later by one of Toland's opponents. K.C.F.

Krause introduced the term panentheism in 1828 as a designation for his own philosophy. Both of these terms have been applied retrospectively to aspects of numerous philosophical traditions, both Eastern and Western.

There are several discernible types of pantheism, ranging from those that attribute consciousness to nature as a whole (panpsychism) to those that interpret the world as merely an appearance and ultimately unreal (acosmic pantheism), and from the rational Neoplatonic or emanationistic strain to the intuitive, mystical strain. A mingling of these types characterizes Hindu and Buddhist doctrines; pantheism of one form or another is deeply rooted in the *Vedas*, the *Upaniṣads*, and the *Bhagavadgītā*. Numerous Greek philosophers, notably Xenophanes, Heracleitus, Anaxagoras, Plato, Plotinus, and the proponents of Stoicism, contributed to the foundations of Western pantheism. Through Neoplatonism and Judeo-Christian mysticism, the tradition was continued in the medieval and Renaissance periods by John Scotus Erigena, Meister Eckehart, Nicholas of Cusa, Giordano Bruno, and Jakob Böhme.

It was at the advent of the modern era in Western philosophy that the Jewish rationalist Benedict Spinoza (1632–77) formulated the most thoroughly pantheistic system. Spinoza insisted that there could be by definition only one unlimited substance possessing an infinitude of attributes. Therefore, God and Nature are but two names for one identical reality; otherwise, God-and-world would be a greater totality than God alone. The necessity of God thus implies the necessity of the world and precludes any possibility of freedom.

Pantheism has traditionally been rejected by orthodox Christian theologians because it is interpreted to obliterate the distinction between the creator and creation, to make God impersonal, to imply a purely immanent rather than transcendent deity, and to exclude human and divine freedom. In the words of Samuel Johnson, the doctrine "confounds God with the universe."

Panentheism constitutes a middle way between the denial of individual freedom and creativity, characterizing many of the varieties of pantheism, and the remoteness of the divine, characterizing classical theism. Although elements of quasi-panentheism reach as far back as Plato's *Laws*, it is in 19th-century German Idealism (Johann Gottlieb Fichte, Friedrich Wilhelm Joseph von Schelling, Georg Wilhelm Friedrich Hegel) and 20th-century process philosophy (Alfred North Whitehead) that the doctrine receives systematic elaboration. Charles Hartshorne, a follower of Whitehead, provided the definitive theological analysis of panentheism, based upon the analogy of an organism (God) comprising individual, semiautonomous cells (all known and unknown constituents of reality).

Pantheon, in Rome, building begun in 27 BC by the statesman Marcus Vipsanius Agrippa, probably as a building of the ordinary classical temple type—rectangular with a gabled roof supported by a colonnade on all sides. It was completely rebuilt by the emperor Hadrian sometime between AD 118 and 128, with some alterations made in the early 3rd century by the emperors Lucius Septimius Severus and Caracalla. It is a circular building of concrete faced with brick, with a great concrete dome rising from the walls and a front porch, probably reassembled from Agrippa's building by Severus or Caracalla, of Corinthian columns supporting a gabled roof with triangular pediment. Beneath the porch are huge bronze double doors, 24 feet (7 m) high, the earliest-known large examples of this type.

Pantheon, Rome, begun by Agrippa in 27 BC, completely rebuilt by Hadrian *c.* AD 118–*c.* 128
Frederico Arborio Mella

The Pantheon is remarkable for its size, its construction, and its design. The dome was the largest built until modern times, measuring about 142 feet (43 m) in diameter and rising to a height of 71 feet (22 m) above its base. There is no external evidence of brick arch support inside the dome, except in the lowest part, and the exact method of construction has never been determined. Two factors, however, are known to have contributed to its success: the excellent quality of the mortar used in the concrete and the careful selection and grading of the aggregate material, which ranges from heavy basalt in the foundations of the building and the lower part of the walls, through brick and tufa (a stone formed from volcanic dust), to the lightest of pumice toward the centre of the vault. In addition, the uppermost third of the drum of the walls, seen from the outside, coincides with the lower part of the dome, seen from the inside, and helps contain the thrust with internal brick arches. The drum itself is strengthened by huge brick arches and piers set above one another inside the walls, which are 20 feet (6 m) thick.

The porch is conventional in design, but the body of the building, an immense circular space lit solely by the light that floods through the 27-foot (8-metre) "eye," or oculus, opening at the centre of the dome, was revolutionary; possibly this was the first of several great buildings of antiquity that were designed to favour the interior rather than the exterior. In contrast with the plain appearance of the outside, the interior of the building is lined with coloured marble; the walls are marked by seven deep recesses, screened by pairs of columns whose modest size gives scale to the immensity of the rotunda. Rectangular coffers, or indentations, were cut in the ceiling probably under Severus and decorated with bronze rosettes and molding.

The Pantheon was dedicated in AD 609 as the Church of the Santa Maria Rotonda, or ad Martyres, which it remains today. The bronze rosettes and moldings of the ceiling and other bronze embellishments have disappeared in the course of time, and a frieze of stucco decoration was applied to the interior directly beneath the dome in the late Renaissance. Otherwise, the building exists entirely in its original form.

Panthéon, in Paris, building begun about 1757 by architect Jacques-Germain Soufflot as the Church of Sainte-Geneviève to replace a much older church of that name on the same site. It was secularized during the French Revolution and dedicated to the memory of great Frenchmen, receiving the name Panthéon. Its design exemplified a general movement (Neoclassicism) to return to a strictly logical use of classical architectural elements. The Panthéon is a cruciform building with a high dome over the crossing and lower saucer-shaped domes (covered by a sloping roof) over the four arms. The facade, like that of the Roman Pantheon, is formed by a porch of Corinthian columns and triangular pediment attached to the ends of the eastern arm.

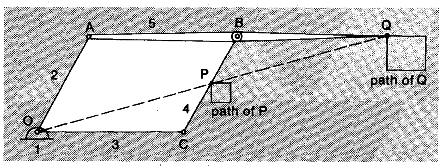
The interior is decorated with mosaics and paintings of scenes from French history, some of which were executed by Puvis de Chavannes. The pediment has sculptures by Pierre-Jean David d'Angers of post-Revolutionary patriots. The Panthéon was reconsecrated and resecularized several times during the 19th century, serving as a church in 1828–30 and in 1851–70. Today it is a civic building.

panther, either of two mammals of the cat family (Felidae), the leopard or the puma (*qq.v.*).

panting, a method of cooling, used by many mammals, most birds, and some reptiles, accomplished by means of the evaporation of water from internal body surfaces. As the animal's body temperature rises, its respiration rate increases sharply; cooling results from the evaporation of water in the nasal passages, mouth, lungs, and (in birds) air sacs. Like other forms of evaporative cooling (*e.g.,* perspiration), panting expends large amounts of water, which must be replaced if the animal is to maintain effective heat regulation.

Pantjasila (Indonesian history): *see* Pancasila.

pantograph, instrument for duplicating a motion or copying a geometric shape to a reduced or enlarged scale. It consists of an assemblage of rigid bars adjustably joined by pin joints; as the point of one bar is moved over the outline to be duplicated, the motion is translated to a point on another bar, which makes the desired copy according to the predetermined scale. In the Figure the links 2, 3, 4, and 5 are connected by pin joints at O, A, B, and C. Joint O is fixed to a support, while joints A, B, and C are free to move. Link 5 is a solid bar continuing on to Q. Point P is the guided point and is usually fixed on link



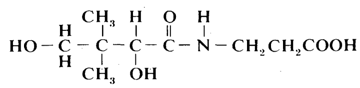
Pantograph

4. As P is guided on a specific path, such as the square in the Figure, point Q will follow a similar path on an enlarged scale. Conversely, if point Q is guided, point P will follow a similar path on a reduced scale.

The links in a pantograph may be arranged in other ways, but they all contain a parallelogram. Pantographs are used for reducing or enlarging engineering drawings and maps and for guiding cutting tools over complex paths. Artists specializing in miniatures use pantographs to achieve greater detail in their finished works.

pantomime: *see* mime and pantomime.

pantothenic acid, a water-soluble vitamin essential in animal metabolism. Pantothenic acid, a growth-promoting substance for yeast and certain bacteria, appears to be synthesized by intestinal flora in the higher animals. The vitamin, although widespread in nature—especially in yeasts, liver, kidney, and eggs—does not occur in a free form in animal tissues. The nature of the bound form was clarified through the discovery and synthesis (1947–50) of the compound pantetheine, which contains pantothenic acid combined with the compound thioethanolamine. Pantetheine is part of two larger compounds (coenzyme A and acyl-carrier protein) that promote a large



number of metabolic reactions essential for the growth and well-being of animals. In the absence of pantothenic acid (or its dietary equivalents: pantetheine, coenzyme A, or acyl-carrier protein), experimental animals fail to grow, develop skin lesions, and frequently show a graying of the hair. A dietary deficiency severe enough to lead to clear-cut disease has not been described in humans.

Pánuco River, Spanish RÍO PÁNUCO, river in Veracruz *estado* ("state"), east-central Mexico. Formed by the junction of the Moctezuma and Tamuín rivers on the San Luis Potosí–Veracruz state line, the Pánuco meanders generally east-northeastward past the town of Pánuco to the Gulf of Mexico about 6 miles (10 km) below Tampico. Just upstream from Tampico and Ciudad Madero, the Pánuco is joined by the Tamesí, which forms the Veracruz–Tamaulipas border. Principal headstreams of the Pánuco include the Santa María, which arises in the inland plateau near San Luis Potosí and becomes the Tamuín as it descends from the Sierra Madre Oriental, and the Moctezuma, which flows through the mountains from southern Querétaro state. The river system (316 miles [508 km] long including the Santa María) has considerable economic importance. It has served to drain Texcoco (*q.v.*) and other interior lakes via a system of tunnels and channels; its waters are used to irrigate the fertile La Huasteca lowlands, and its lower course is navigable (ocean vessels can be accommodated at Tampico).

Panuridae, family of songbirds, order Passeriformes, consisting of the parrotbills and bearded tits, about 19 species of small titmouselike birds found in the thickets of temperate Eurasia.

Members range in size from 10 to 17.5 cm (4 to 7 inches) long. They are distinguished (except for the bearded tit) from all other songbirds by having a sideways flattened bill, like that of a parrot. They are active in flocks, as they wander through brush and thickets, hunting seeds, berries, and small insects.

Formerly considered a subfamily (Paradoxornithinae) of the babbler family (Timaliidae) or a subfamily (Panurinae) of the Old World flycatcher family (Muscicapidae), they have also been raised to the family Paradoxornithidae. Their true status is still problematic.

The Panuridae belongs to the songbird suborder (Passeres).

Panyassis (fl. 5th century BC, Ionia), epic poet from Halicarnassus, on the coast of Asia Minor. The Roman rhetorician Quintilian stated that some later critics regarded Panyassis' work as being second only to Homer. His chief poems, extant only in fragments, were the *Heracleia,* describing the mythical adventures of the hero Heracles (Hercules), and the *Ionica,* relating the founding of Ionic Greek colonies in Asia Minor.

Panza, Sancho, Don Quixote's squire in the novel *Don Quixote* by Cervantes, a short, potbellied peasant whose gross appetite, common sense, and vulgar wit serve as a foil to the mad idealism of his master. He is famous for his many pertinent proverbs. Cervantes used the psychological differences between the two characters to explore the conflict between the ideal and the real and based much of his novel's narrative development on their personal relationship.

panzer division, German PANZERDIVISION ("armoured division"), a self-contained, combined-arms military unit of the German army, built around and deriving its mission largely from the capabilities of armoured fighting vehicles. A panzer division in World War II consisted of a tank brigade with four battalions; a motorized infantry brigade with four rifle battalions; an artillery regiment; and reconnaissance, antitank, and engineer battalions and service units. Early in the war the panzer divisions used mostly light tanks, and later mostly medium tanks.

The first three panzer divisions were created in October 1935, and by the outbreak of war in 1939 there were six. Panzer divisions formed the decisive striking force of the German army in the campaigns against Poland in 1939, The Netherlands, Belgium, Luxembourg, and France in 1940, and the Balkans and the Soviet Union in 1941. In the campaign against France, there were 10 panzer divisions incorporating all the German tanks in that campaign—2,574 out of the 3,400 tanks that Germany possessed. After the French campaign the number of panzer divisions was doubled, and in 1941 17 of them, grouped in four panzer armies, spearheaded the German invasion of the Soviet Union.

Since World War II, despite the acquisition of more advanced weapons and changes in ratios among constituent elements, the panzer division's mission has not undergone significant change. It remains the principal offensive element of the German army.

p'ao, wide-sleeved robe of a style worn by Chinese men and women from the Han dynasty (206 BC–AD 220) to the end of the Ming dynasty (1644). The *p'ao* was girdled about the waist and fell in voluminous folds around the feet. From the T'ang period (618–907), certain designs, colours, and accessories were used to distinguish rank; the emperor, for example, wore a dark-coloured *p'ao* on which the 12 imperial symbols were displayed, and the *p'ao* worn by officials was red with large squares containing symbolic birds or animals ("mandarin squares") on the breast.

P'ao on the poet T'ao Yüan-ming (365–427), ink drawing on paper by Wang Chung-yu, 14th century; in the Imperial Museum, Peking
Editions Cercle d'art, Paris

When the Manchus overthrew the Ming, it was decreed that a new style of dress should replace the *p'ao*. The *p'ao* style, which had been adopted by the Japanese court in the 8th century, has been basically retained in the Japanese kimono.

Pao-chi, Pinyin BAOJI, city in western Shensi *sheng* (province), China. Situated on the north bank of the Wei River, it has been a strategic and transportation centre since early times, controlling the northern end of a pass across the Tsinling Mountains, the only practicable route from the Wei valley into Szechwan province and the upper valley of the Han River. It is also at the western end of the intensively cultivated Wei valley and is at the centre of a network of routes into Kansu province and the Ningsia Hui autonomous region.

Surrounded by mountains to the south, north, and west, it was the major western defensive outpost of the metropolitan district around Sian (Ch'ang-an) in early times. Under the T'ang dynasty (618–907) in the 7th century, it was first given the name Pao-chi, which it has retained ever since; at the same time, the county seat was moved to its present site from its former position some 8 miles (13 km) to the northeast.

Pao-chi's modern importance has resulted from its improved communications. The Lunghai Railway was extended from Sian to Pao-chi on the eve of the war in 1937 and was subsequently extended westward to T'ien-shui by 1947. Since 1949 this railway has been extended to Lan-chou, where it links with the trunk line into central Asia and with the northern line to Pao-t'ou (Inner Mongolia) and Peking. In 1958 a further rail link (later electrified) was completed from Pao-chi southwest to Ch'eng-tu in Szechwan, where it links with the various new railways of the southwest. China's first electrified rail line was completed between Pao-t'ou and Ch'eng-tu in the late 1960s.

Pao-chi is an important commercial centre, collecting goods from a wide area, and has some industry, in particular, cotton textiles, metallurgy, machinery, electronics, and chemicals. Pop. (1988 est.) 301,000.

pao-chia, Pinyin BAOJIA, traditional Chinese system of collective neighbourhood organization, by means of which the government was able to maintain order and control through all levels of society, while employing relatively few officials.

A collective neighbourhood guarantee system was first instituted during the Warring States Period, when groups of 5 households formed a *wu.* This method of organization was revived in a different form during the Northern Wei dynasty (AD 386–534/535) but did not take on the name by which it is now known until the Sung dynasty (960–1279), when a *pao-chia* system was instituted by the great reformer Wang An-shih as a military measure. Under Wang's scheme, 10 households formed a *pao,* and 5 *pao* a *ta-pao.* Each *pao-chia* was made responsible for supplying the government with a certain number of trained and armed militiamen.

During the Ming dynasty (1368–1644), the *pao-chia* system often coincided with the *li-chia* (*lijia*) system, which had been established for the collection of land and labour taxes. But it also began to assume the separate function of overseeing the moral conduct of members of the community. The Ch'ing dynasty (1644–1911) perfected the system. Under the Ch'ing, a *pao-chia* unit ideally consisted of 10 families formed into a *chia* and 10 *chia*s formed into a *pao,* all under the supervision of an elected chief. The chief of each unit was responsible for preserving the public order; he also maintained the local census records and acted as an intelligence agent for the central government. *Pao-chia* organization began to deteriorate about the middle of the 19th century, when central control over local government began to erode.

From November 1934 until 1949, when the People's Republic was established, the *pao-chia* system was practiced throughout China.

Pao-ch'ing (China): *see* Shao-yang.

Pao Hsi (in Chinese mythology): *see* Fu Hsi.

Pao-p'u-tzu (alchemist): *see* Ko Hung.

Pao-ting, Pinyin BAODING, city, Hopeh *sheng* (province), China. It is situated on the edge of the North China Plain at the foot of the Wu-hui Mountains, a section of the T'ai-hang Mountains, and stands on the Tang River, a tributary of the Ta-ch'ing River. Situated on the main road from Peking through western Hopeh, it is southwest of the capital, roughly midway between Peking and Shih-chia-chuang. To the west, a route leads into northern Shansi *sheng* via the Lung-ch'üan Pass.

Pao-ting is in an area of old-established settlement. Before the Ch'in dynasty (221–206 BC) it was part of the state of Chao. During the period to AD 581, counties of various names were established in the district and formed parts of a variety of higher administrations. In 581 the Sui dynasty (581–618) changed the county's name to Ch'ing-yüan, which it retained until 1958. The area was of major strategic importance from early times. During the T'ang dynasty (618–907) it was the headquarters of one of the armies guarding the northeastern frontier against the Khitan, a Ural-Altaic people, and it later became a key garrison for government forces defending access to Shansi against the autonomous provinces of Hopeh. During the Five Dynasties (907–960) and the early years of the Sung dynasty (960–1126) it was a military prefecture on the contested border between the Sung and the Liao in the north. Under the Yüan (Mongol) dynasty (1279–1368) the area it administered became Pao-ting Circuit (*lu*). The transfer of the capital to Peking in Yüan and Ming (1279–1644) times meant a reversal of its strategic role so that it became the chief defensive bastion protecting Peking against attack from the south or incursions over the passes of the T'ai-hang Shan. Under the Ming it was the administrative centre of the Pao-ting Prefecture (*fu*), and under the Ch'ing dynasty (1644–1911) it became even more important. It was both the seat of the provincial government of Chihli and also the alternative seat, with Tientsin, of the military governor of Chihli. The city was heavily fortified, with walls more than 5 mi (8 km) in circumference, enclosing the government offices of the province, the military governor's offices, extensive barracks, and a military academy.

Although Pao-ting was primarily an administrative city, with extensive service industries, it was also a notable centre of learning. Under the Ming and Ch'ing it had many well-known schools, and in the reign of the emperor Yung-cheng (1723–35) a famous library, the Lien-ch'ien Shu-yüan, was founded there, which later became the Hopeh Library.

As a communication centre, it also had commercial importance. It was the centre of a rather dense road network and in 1905 was joined to Peking and Tientsin, and later to Han-k'ou, by the Peking to Wu-han railway. It was also a commercial centre, collecting grain, wool, cloth, cotton, cottonseed oil, and various agricultural products.

The city maintained its administrative importance both under the Japanese occupation before and during World War II and under the Communist government that came to power in 1949. Until 1958 it remained the provincial capital and the seat of the Hopeh People's Assembly. In that year the provincial administration was transferred to Shih-chia-chuang, and the name of the city was formally changed from Ch'ing-yüan to Pao-ting. The city has continued to grow, however. There are a number of light industrial plants, mostly small scale, as well as a medium-sized thermal generating plant. In the drive for fertilizer production in the mid-1960s, an ammonium carbonate plant was built there. Pop. (1953) 197,000; (1958 est.) 250,000; (1980 UN est.) 621,000.

Pao-t'ou, Pinyin BAOTOU, city in the Inner Mongolian Autonomous Region of China. A prefecture-level municipality, Pao-t'ou is situated on the north bank of the Huang Ho (Yellow River) on its great northern bend. The river and its upper tributaries are navigable westward as far as Hsi-ning in Tsinghai Province and Lan-chou in Kansu Province, but southward the main stream is impeded by rapids.

Pao-t'ou is of comparatively recent origin. Although the region was colonized and garrisoned during the T'ang dynasty (618–907), it was afterward occupied by Mongol tribes, and as late as the 1730s Pao-t'ou was merely a hamlet. As the Ch'ing dynasty (1644–1911) strengthened its grip on the Mongol border regions, Pao-t'ou gradually developed into a market town. It was walled in 1871 and eventually given the status of an administrative county in 1925.

Its modern growth began with the construction of a railway link with Peking, completed in 1922. It then grew rapidly into a major commercial centre for trade with Mongolia and with Northwest China, controlling a marketing area including most of what is now Ningsia Hui Autonomous Region, Kansu, Tsinghai, and parts of the Mongolian People's Republic. Exports were mostly hides, wool, and felt; chief imports were cloth, grain, drugs, and tea. The wool and hides collected by local merchant firms and by traders from Peking and Tientsin were transported to Tientsin for export. The area along the northern loop of the Huang Ho had been colonized by Chinese settlers from the 1880s onward, and Pao-t'ou became the major commercial centre for this Chinese community. The city grew rapidly, and during the Japanese occupation (1937–45) Pao-t'ou was a centre of the autonomous government of Meng-chiang. The Japanese began the development of light industry there and also discovered rich coal and mineral deposits nearby.

After 1949 Pao-t'ou was completely transformed. Its rail link with Peking, destroyed during the Chinese Communist Revolution in 1949, was restored in 1953 and double-tracked in the late 1950s. In 1955 construction was begun of a line following the Huang Ho to Lan-chou, where it now connects with other rail links to Szechwan Province, to central China, and to Wu-lu-mu-ch'i in the Sinkiang Uigur Autonomous Region. Under the First Five-Year Plan (1953–57), Pao-t'ou was the site of a major integrated iron and steel complex, based on the rich iron-ore deposits at Pai-yün-o-po to the north, with which it has been linked by rail; on coking coal from Shih-kuai-kou in the Ta-ch'ing Shan; and on local limestone. The complex was part of the move to relocate heavy industry centres away from the coastal zone. The completion of the industrial installation was announced in 1961, but full operation was not achieved until the late 1960s, allegedly because of the withdrawal of Soviet advisers and non-delivery of Soviet equipment.

An aluminum industry based on the use of large thermal generating plants and a local sugar-refining industry have also been developed. Pao-t'ou has become one of China's chief industrial centres and constitutes a major industrial base not merely for Inner Mongolia and the Northwest but also for China as a whole. Although its growth has been phenomenal, some of it is due to the expansion of the municipal area to include the coal mines to the east and the iron and steel complex to the west. Pop. (1983 est.) 1,042,000.

Pao-t'ou carpet, floor covering handwoven in Pao-t'ou, in the Inner Mongolian Autonomous Region of China, noted for its high-quality of workmanship and materials. The designs usually consist of landscapes or religious symbols, although horse, stag, lion, and dragon motifs are also used.

Pao-t'ous are executed in fine wool dyed blue, brown, red, and beige. The foundation weave is of cotton.

Paola, also spelled PAWLA, or PAULA, town, eastern Malta, just south of Valletta and adjacent to Tarxien to the southeast. Founded in 1626 by the Grand Master of the Hospitallers (Knights of St. John of Jerusalem), Antoine de Paule, it remained a small village until the late 19th century, when it grew rapidly as a residential district for workers from the adjacent Grand Harbour dockyards. It has a well-preserved Neolithic temple and the Hal Saflieni Hypogeum (catacombs), discovered in 1902. Pop. (1983 est.) 12,362.

Paoli, Pasquale (b. April 26, 1725, Stretta di Morosaglia, Corsica—d. Feb. 5, 1807, London), Corsican statesman and patriot who was responsible for ending Genoese rule of Corsica and for establishing enlightened rule and reforms.

The son of Giacinto Paoli, who led the Corsicans against Genoa from 1735, Pasquale followed his father into exile at Naples in 1739,

Paoli, detail of a portrait by Henry Bembridge, 1768
The Mansell Collection

studying at the military academy there and preparing to continue the fight for Corsican independence. In 1755 he returned to Corsica and, after overcoming the Genoese faction, was elected to executive power under a constitution more democratic than any other in Europe. For the next nine years, under the principles of enlightened despotism, he transformed Corsica, first by suppressing the system of vendetta and substituting order and justice, then by encouraging mining, building up a naval fleet, and instituting national schools and a university. At the same time he continued the war, first against Genoa and after 1764 against Genoa's ally, France. France bought Corsica in 1768 and invaded the island and defeated the nationalists in 1769. Paoli fled to England, received a pension from George III, and lived in London for the next 20 years.

Appointed lieutenant general and military commandant during the French Revolution, Paoli returned to Corsica in July 1790. Breaking with France in 1793, he once more led the fight for independence and, with British naval support, expelled the French in 1794. He then offered the sovereignty of Corsica to George III, who accepted and sent Sir Gilbert Elliot as viceroy. Elliot in turn chose not Paoli but Pozzo di Borgo as his chief adviser. Disappointed and not wishing to cause internal strife, Paoli retired to England in 1795, where he received a British government pension.

Paolo (Italian personal name): *see under* Paul, except as below.

Paolo UCCELLO, original name PAOLO DI DONO (painter): *see* Uccello, Paolo.

Paolo, Veneziano, also called MASTER PAOLO (b. *c.* 1300?, Venice—d. Sept. 1362, Venice), a principal Venetian painter of the Byzantine style in 14th-century Venice. Paolo and his son Giovanni signed a "Coronation of the Virgin" (Frick Collection, New York City) in 1358 that is the last known work by him. A second "Coronation of the Virgin" (National Gallery, Washington, D.C.), which is dated 1324, is also attributed to Paolo. Other known works of Paolo's are dated 1333, 1347, and 1353.

Paolo's style exhibits the conventional

gold-threaded draperies, flat space, and static compositions of the Byzantine style, but in some of his works an Italian-inspired fluidity is evident.

Paolozzi, Eduardo (Luigi) (b. March 7, 1924, Leith, near Edinburgh), British sculptor, considered one of the most radical artists of his period in Great Britain.

Born of Italian parents, Paolozzi attended Edinburgh College of Art (1943) and the Slade School of Art in London (1944–47). Paolozzi avoided the dominant influence of Henry Moore and, while working in Paris in the late 1940s, was most strongly affected by Giacometti and Klee, as well as Dadaism and Surrealism. His early sculptures juxtaposed insect and marine images in cement relief.

His mature work, usually of bronze, steel, or other alloys, fuses engineering concepts with a traditional idea of the human figure. The semiabstract totemic sculptures suggest robots with stylized anatomical features—*e.g.*, "Japanese War God" (1958) and "Medea" (1964).

In addition to doing sculpture, Paolozzi makes prints and textile designs, and in 1983 he completed a series of mosaic panels that were highly praised by the London Arts Council. He was elected to the Royal Academy of Arts in 1979.

Pap smear (medicine): *see* Papanicolaou's stain.

papacy, the system of central government of the Roman Catholic Church, the largest of the three major branches of Christianity, presided over by the pope, the bishop of Rome.

A brief treatment of the papacy follows. For full treatment, *see* MACROPAEDIA: Roman Catholicism.

The papal system, which has not gone undisputed, developed over the centuries since the early church until 1870 when the first Vatican Council officially defined as a matter of faith the absolute primacy of the pope and his infallibility when pronouncing on "matters of faith and morals." According to this definition, the pope exercises judicial, legislative, and executive authority over the church as the direct successor of St. Peter, who is thought to have been the head of the apostles and the first bishop of Rome. His authority rested on the words of Jesus quoted in Matthew 16:18–19 and elsewhere which have been interpreted as giving him authority in Heaven and on Earth in the place of Jesus. The early history of the papacy can be told as the history of the development of this Petrine theory, and the later history as the development of the claim to both spiritual and temporal authority over Christian society.

Though it is probable that St. Paul was martyred in Rome, there is no historical evidence that St. Peter was the first leader of the church of Rome nor that he was martyred there during a persecution of the Christians (*c.* AD 67). By the end of the 1st century, however, the see of Rome seems to have been accorded a place of honour among the bishoprics claiming apostolic foundation, perhaps because of Rome's claim to the graves of both Peter and Paul, its many martyrs and defense of what has triumphed as orthodoxy, and its status as the capital of the Roman Empire.

In the middle of the 3rd century, Pope Stephen I (reigned 254–257) and St. Cyprian, bishop of Carthage, clashed over Stephen's claim to exercise doctrinal authority over the universal church. In the 4th and 5th centuries, the growing power of the see of Constantinople as the capital of the Eastern Empire challenged that of Rome. Over Pope Leo I's objections, the Council of Chalcedon, called by the Eastern emperor in 451 and largely directed by him, accorded the patriarch of Constantinople the same primacy in the East as Rome held in the West. This was the first decisive demonstration of the Eastern Church's historic rejection of Rome's claim to hegemony based on the Petrine theory, which culminated in the final schism between the two churches in 1054.

During the next centuries of increasing political chaos, popes were often forced to trade their spiritual power for imperial protection. After the demise of effective Roman or Byzantine imperial control over Italy, the Roman pope became the representative of Roman imperial glory to the new Frankish and other German kingdoms. Stephen II (reigned 752–757) and other popes, in linking the fate of the Roman primacy to the support of Charlemagne and his house, gained a powerful protector and, through the Donation of Constantine forgeries, temporal power in Italy. However, they did not gain the freedom to exercise the spiritual power over the universal church for which they had hoped, since Charlemagne and his successors ignored the pope's claim to the right to crown the emperor and instead followed in the footsteps of their Byzantine and Roman predecessors by asserting a large measure of control over the Frankish church and the papacy itself.

During the late 9th and 10th centuries, the decadence of the papal court and political conditions in Italy led to the virtual takeover of the papacy by the German emperors. By 1049 the papacy's desperate need for reform was met in the person of Pope Leo IX, a reformer whose attitudes had been shaped in Burgundian and Lorraine monastic reform movements. A significant point in the so-called Gregorian reform begun by Leo, and in the history of the papacy itself, was the Investiture Conflict, which was precipitated by Gregory VII (Hildebrand) in 1075 when he threatened to excommunicate any civil ruler who attempted to invest the holder of an ecclesiastical office with the symbols of power, a practice which emphasized the control the lay ruler had over the selection and operation of bishops and local clergy. In this assertion the papacy committed itself to a course which it would be unable to maintain.

Continuing the legacy of Gregory VII, later popes seriously meddled in political issues in an attempt to prove the validity of papal monarchy, rather than mere papal leadership, of Christian society. Thirteenth-century centralization of administrative as well as jurisdictional power in the Curia (the body of officials surrounding the pope) led to increasing financial difficulties and eventually to the practice of "selling" benefices and other church services. This and other corruptions of the papal court, as well as the "Babylonian Captivity" of the papacy at Avignon, France (1309–77), led to both the conciliar movement, an attempt by bishops to regain control over the church, and loud calls for sacramental and organizational reform.

The Renaissance popes, most of whom were too involved in political and financial alliances to do more for the church than patronize the arts, were unable to deal with or to understand the significance of the Protestant Reformation of the 16th century. In the aftermath of the schism, the papacy finally acceded to demands for reform by calling the Council of Trent (1545), which instituted what has been called the Counter-Reformation. The theological and ecclesiastical decisions of this council largely determined the shape of the Catholic Church until the second half of the 20th century.

The alignment of the papacy with conservative political forces during the 19th century resulted in the loss of liberal and modernizing influences within the church and the loss of the Papal States to the new Kingdom of Italy. Divested of its temporal power, the papacy increasingly turned to its spiritual or teaching authority to retain control over Catholics, proclaiming infallibility and espousing the Ultramontane position (the idea that the pope is the absolute ruler of the church). A generally unfavourable view toward liberal ideas and modern culture persisted until the time of the second Vatican Council, called by Pope John XXIII in 1962. The theological and organizational changes made at Vatican II significantly revitalized the church and opened it to new reform, ecumenical dialogue, and the increased participation of bishops, clergy, and laity. Toward the end of the century, however, the papacy met with increasing controversy in regard to what were seen by many as uniquely modern moral, ethical, and political issues.

Papadiamantópoulos, Yánnis: *see* Moréas, Jean.

Papadopoulos, Dimitrios (Orthodox patriarch): *see* Dimitrios.

Papago, North American Indians who traditionally inhabited the desert regions of Arizona and northern Sonora, south of the Pima Indians (*see* Pima). The Papago speak a Uto-Aztecan language, a dialectal variant of Piman, and culturally they are similar to the Pima (*see also* Uto-Aztecan languages). There are, however, certain dissimilarities. The drier, harsher habitat of the Papago made intensive farming difficult and increased their reliance on wild foods. The lack of water necessitated a sort of seasonal nomadism, whereby the Papago spent the summer in "field villages" and the winter in "well villages."

The Papago did not have irrigated fields like those of the Pima but practiced flash-flood farming. After the first rains, seeds were planted in the alluvial fans at the mouths of washes that marked the maximum reach of the water after flash floods. Because the floods could be heavy while they lasted, it was necessary for the seeds to be planted deeply, four to six inches usually. Reservoirs, to impound runoff waters along the flood channels, and some ditches and dikes were constructed by Papago men. Women were responsible for gathering wild foods.

The shifting residential pattern and the wide dispersal of the Papago fields made large villages and tribal political organization impossible. The largest organizational unit appears to have been a group of related villages. Villages tended to be composed of several families related through the male line. The Papago have had much less contact with whites than the Pima, and they have retained some elements of aboriginal culture. In the late 20th century they numbered about 8,300 located on three reservations in southern Arizona (the Papago, Gila Bend, and San Xavier reservations) and a few hundred more in scattered villages in northwestern Sonora.

Papagos, Alexandros (b. Dec. 9, 1883, Athens—d. Oct. 4, 1955, Athens), Greek sol-

Papagos
Dimitri Papadimos

Popes and antipopes*
(antipopes in italics)

Peter	?–*c.* 64
Linus	*c.* 67–76/79
Anacletus	76–88 or 79–91
Clement I	88–97 or 92–101
Evaristus	*c.* 97–*c.* 107
Alexander I	105–115 or 109–119
Sixtus I	*c.* 115–*c.* 125
Telesphorus	*c.* 125–*c.* 136
Hyginus	*c.* 136–*c.* 140
Pius I	*c.* 140–155
Anicetus	*c.* 155–*c.* 166
Soter	*c.* 166–*c.* 175
Eleutherius	*c.* 175–189
Victor I	*c.* 189–199
Zephyrinus	*c.* 199–217
Calixtus I (Callistus)	217?–222
Hippolytus	*217, 218–235*
Urban I	222–230
Pontian	230–235
Anterus	235–236
Fabian	236–250
Cornelius	251–253
Novatian	*251*
Lucius I	253–254
Stephen I	254–257
Sixtus II	257–258
Dionysius	259–268
Felix I	269–274
Eutychian	275–283
Gaius	283–296
Marcellinus	291/296–304
Marcellus I	308–309
Eusebius	309/310
Miltiades (Melchiades)	311–314
Sylvester I	314–335
Mark	336
Julius I	337–352
Liberius	352–366
Felix (II)	*355–358*
Damasus I	366–384
Ursinus	*366–367*
Siricius	384–399
Anastasius I	399–401
Innocent I	401–417
Zosimus	417–418
Boniface I	418–422
Eulalius	*418–419*
Celestine I	422–432
Sixtus III	432–440
Leo I	440–461
Hilary	461–468
Simplicius	468–483
Felix III (or II)†	483–492
Gelasius I	492–496
Anastasius II	496–498
Symmachus	498–514
Laurentius	*498, 501–c. 505/507*
Hormisdas	514–523
John I	523–526
Felix IV (or III)†	526–530
Dioscorus	*530*
Boniface II	530–532
John II	533–535
Agapetus I	535–536
Silverius	536–537
Vigilius	537–555
Pelagius I	556–561
John III	561–574
Benedict I	575–579
Pelagius II	579–590
Gregory I	590–604
Sabinian	604–606
Boniface III	604
Boniface IV	608–615
Deusdedit (also called Adeodatus I)	615–618
Boniface V	619–625
Honorius I	625–638
Severinus	640
John IV	640–642
Theodore I	642–649
Martin I	649–655
Eugenius I	654–657
Vitalian	657–672
Adeodatus II	672–676
Donus	676–678
Agatho	678–681
Leo II	682–683
Benedict II	684–685
John V	685–686
Conon	686–687
Sergius I	687–701
Theodore	*687*
Paschal	*687*
John VI	701–705
John VII	705–707
Sisinnius	708
Constantine	708–715
Gregory II	715–731
Gregory III	731–741
Zacharias (Zachary)	741–752
Stephen (II)‡	752
Stephen II (or III)‡	752–757
Paul I	757–767
Constantine (II)	*767–768*
Philip	*768*
Stephen III (or IV)‡	768–772
Adrian I	772–795
Leo III	795–816
Stephen IV (or V)‡	816–817
Paschal I	817–824
Eugenius II	824–827
Valentine	827
Gregory IV	827–844
John	*844*
Sergius II	844–847
Leo IV	847–855
Benedict III	855–858
Anastasius (Anastasius the Librarian)	*855*
Nicholas I	858–867
Adrian II	867–872
John VIII	872–882
Marinus I	882–884
Adrian III	884–885
Stephen V (or VI)‡	885–891
Formosus	891–896
Boniface VI	896
Stephen VI (or VII)‡	896
Romanus	897
Theodore II	897
John IX	898–900
Benedict IV	900
Leo V	903
Christopher	*903–904*
Sergius III	904–911
Anastasius III	911–913
Lando	913–914
John X	914–928
Leo VI	928
Stephen VII (or VIII)‡	929–931
John XI	931–935
Leo VII	936–939
Stephen VIII (or IX)‡	939–942
Marinus II	942–946
Agapetus II	946–955
John XII	955–964
Leo VIII§	963–965
Benedict V§	964–966?
John XIII	965–972
Benedict VI	973–974
Boniface VII (1st time)	*974*
Benedict VII	974–983
John XIV	983–984
Boniface VII (2nd time)	*984–985*
John XV (or XVI) ‖	985–996
Gregory V	996–999
John XVI (or XVII) ‖	*997–998*
Sylvester II	999–1003
John XVII (or XVIII) ‖	1003
John XVIII (or XIX) ‖	1004–09
Sergius IV	1009–12
Gregory (VI)	*1012*
Benedict VIII	1012–24
John XIX (or XX) ‖	1024–32
Benedict IX (*1st time*)	1032–44
Sylvester III	1045
Benedict IX (*2nd time*)	1045
Gregory VI	1045–46
Clement II	1046–47
Benedict IX (*3rd time*)	1047–48
Damasus II	1048
Leo IX	1049–54
Victor II	1055–57
Stephen IX (or X)‡	1057–58
Benedict X	*1058–59*
Nicholas II	1059–61
Alexander II	1061–73
Honorius (II)	*1061–72*
Gregory VII	1073–85
Clement (III)	*1080–1100*
Victor III	1086–87
Urban II	1088–99
Paschal II	1099–1118
Theodoric	*1100–02*
Albert (also called Aleric)	*1102*
Sylvester (IV)	*1105–11*
Gelasius II	1118–19
Gregory (VIII)	*1118–21*
Calixtus II (Callistus)	1119–24
Honorius II	1124–30
Celestine (II)	*1124*
Innocent II	1130–43
Anacletus (II)	*1130–38*
Victor (IV)	*1138*
Celestine II	1143–44
Lucius II	1144–45
Eugenius III	1145–53
Anastasius IV	1153–54
Adrian IV	1154–59
Alexander III	1159–81
Victor (IV)	*1159–64*
Paschal (III)	*1164–68*
Calixtus (III)	*1168–78*
Innocent (III)	*1179–80*
Lucius III	1181–85
Urban III	1185–87
Gregory VIII	1187
Clement III	1187–91
Celestine III	1191–98
Innocent III	1198–1216
Honorius III	1216–27
Gregory IX	1227–41
Celestine IV	1241
Innocent IV	1243–54
Alexander IV	1254–61
Urban IV	1261–64
Clement IV	1265–68
Gregory X	1271–76
Innocent V	1276
Adrian V	1276
John XXI ‖	1276–77
Nicholas III	1277–80
Martin IV¶	1281–85
Honorius IV	1285–87
Nicholas IV	1288–92
Celestine V	1294
Boniface VIII	1294–1303
Benedict XI	1303–04
Clement V (at Avignon, from 1309)	1305–14
John XXII ‖ (at Avignon)	1316–34
Nicholas (V) (at Rome)	*1328–30*
Benedict XII (at Avignon)	1334–42
Clement VI (at Avignon)	1342–52
Innocent VI (at Avignon)	1352–62
Urban V (at Avignon)	1362–70
Gregory XI (at Avignon, then Rome from 1377)	1370–78
Urban VI	1378–89
Clement (VII) (at Avignon)	*1378–94*
Boniface IX	1389–1404
Benedict (XIII) (at Avignon)	*1394–1423*
Innocent VII	1404–06
Gregory XII	1406–15
Alexander (V) (at Bologna)	*1409–10*
John (XXIII) (at Bologna)	*1410–15*
Martin V¶	1417–31
Clement (VIII)	*1423–29*
Eugenius IV	1431–47
Felix (V) (also called Amadeus VIII of Savoy)	*1439–49*
Nicholas V	1447–55
Calixtus III (Callistus)	1455–58
Pius II	1458–64
Paul II	1464–71
Sixtus IV	1471–84
Innocent VIII	1484–92
Alexander VI	1492–1503
Pius III	1503
Julius II	1503–13
Leo X	1513–21
Adrian VI	1522–23
Clement VII	1523–34
Paul III	1534–49
Julius III	1550–55
Marcellus II	1555
Paul IV	1555–59
Pius IV	1559–65
Pius V	1566–72
Gregory XIII	1572–85
Sixtus V	1585–90
Urban VII	1590
Gregory XIV	1590–91
Innocent IX	1591
Clement VIII	1592–1605
Leo XI	1605
Paul V	1605–21
Gregory XV	1621–23
Urban VIII	1623–44
Innocent X	1644–55
Alexander VII	1655–67
Clement IX	1667–69
Clement X	1670–76
Innocent XI	1676–89
Alexander VIII	1689–91
Innocent XII	1691–1700
Clement XI	1700–21
Innocent XIII	1721–24
Benedict XIII	1724–30
Clement XII	1730–40
Benedict XIV	1740–58
Clement XIII	1758–69
Clement XIV	1769–74
Pius VI	1775–99
Pius VII	1800–23
Leo XII	1823–29
Pius VIII	1829–30
Gregory XVI	1831–46
Pius IX	1846–78
Leo XIII	1878–1903
Pius X	1903–14
Benedict XV	1914–22
Pius XI	1922–39
Pius XII	1939–58
John XXIII	1958–63
Paul VI	1963–78
John Paul I	1978
John Paul II	1978–

*Until the 4th century the popes were usually known only as bishops of Rome. †The higher number is used if Felix (II), who reigned from 355 to 358 and is ordinarily classed as an antipope, is counted as a pope. ‡Though elected on March 23, 752, Stephen (II) died two days later before he could be consecrated and thus is ordinarily not counted. The issue has made the numbering of subsequent Stephens somewhat irregular. §Either Leo VIII or Benedict V may be considered an antipope. ‖ A confusion in the numbering of popes named John after John XIV (reigned 983–984) resulted because some 11th-century historians mistakenly believed that there had been a pope named John between antipope Boniface VII and the true John XV (reigned 985–986). Therefore they mistakenly numbered the real popes John XV to XIX as John XVI to XX. These popes have since customarily been renumbered XV to XIX, but John XXI and John XXII continue to bear numbers that they themselves formally adopted on the assumption that there had indeed been 20 Johns before them. In current numbering there thus exists no pope by the name of John XX. ¶In the 13th century the papal chancery misread the names of the two popes Marinus as Martin, and as a result of this error Simon de Brie in 1281 assumed the name of Pope Martin IV instead of Martin II. The enumeration has not been corrected, and thus there exist no Martin II and Martin III.

dier and statesman who late in life organized a political party and became premier (1952–55) of Greece.

Papagos, commissioned in 1906, saw his first service in the Balkan Wars (1912–13). He took part in the Greek invasion of Turkey (1919–22), won promotion to the rank of major general (1927), and became corps commander and minister of war (1935); the following year he was named chief of staff. Although at the time of the Italian attack on Greece (October 1940) he conducted, as commander in chief, a passive, basically defensive campaign, he nonetheless succeeded in driving the Italians back into Albania. His defenses soon crumbled, however, against the later German onslaught (April 1941), and he was taken to Germany as a hostage. Liberated in 1945, he directed postwar operations in Greece against communist guerrillas and was appointed field marshal in 1949.

In May 1951 Papagos resigned as military commander in chief to form a new political party, the Greek Rally, which soon became the strongest political force in Greece. Enjoying wide popularity and modeling himself after Charles de Gaulle, Papagos led his party to a decisive victory in the elections of November 1952 and became premier. He died in office.

papain, a protein-digesting enzyme present in the milky juice of the papaya. Its action resembles that of protein-digesting enzymes found in animals. Papain is used in biochemical research involving the analysis of proteins, in preparations of various remedies for indigestion, in tenderizing meat, and in enzyme-action cleansing agents for soft contact lenses. A related enzyme from the same source is chymopapain, which has different characteristics of mobility and solubility. It is used to shrink or dissolve ruptured disks in certain kinds of lumbar spine injuries, and otherwise as a digestant of protein.

papal infallibility, in Roman Catholic theology, the doctrine that the pope, acting as supreme teacher and under certain conditions, cannot err when he teaches in matters of faith or morals. As an element of the broader understanding of the infallibility of the church, this doctrine is based on the belief that the church has been entrusted with the teaching mission of Jesus Christ and that, in view of its mandate from Christ, it will remain faithful to that teaching through the assistance of the Holy Spirit. As such, the doctrine is related to, but distinguishable from, the concept of indefectibility, or the doctrine that the grace promised to the church assures its perseverance until the end of time.

The term infallibility was rarely mentioned in the early and medieval church. Critics of the doctrine have pointed to various occasions in the history of the church when popes are said to have taught heretical doctrines, the most notable case being that of Honorius I (625–638), who was condemned by the third Council of Constantinople (680–681, the sixth ecumenical council).

The definition of the first Vatican Council (1869–70), established amid considerable controversy, states the conditions under which a pope may be said to have spoken infallibly, or ex cathedra ("from his chair" as supreme teacher). It is prerequisite that the pope intend to demand irrevocable assent from the entire church in some aspect of faith or morals. Despite the rarity of recourse to this claim, and despite the emphasis given to the authority of the bishops in the second Vatican Council (1962–65), the doctrine remained a major obstacle to ecumenical endeavours in the late 20th century and was the subject of controversial discussion even among Roman Catholic theologians.

Papal States, also called CHURCH STATES, Italian STATI PONTIFICI, or STATI DELLA CHIESA, territories of central Italy over which the pope had sovereignty from 756 to 1870. Included were the modern Italian provinces of Lazio, Umbria, Marche, and part of Emilia-

The Papal States in 1815

From W. Shepherd, *Historical Atlas*, Harper & Row, Publishers (Barnes & Noble Books), New York; revision Copyright © 1964 by Barnes & Noble, Inc.

Romagna, although the extent of the territory, along with the degree of papal control, varied over the centuries.

As early as the 4th century, the popes had acquired considerable property around Rome (called the Patrimony of St. Peter). From the 5th century, with the breakdown of Roman imperial authority in the West, the popes' influence in central Italy increased as the people of the area relied on them for protection against the barbarian invasions. When the Lombards threatened to take over the whole peninsula in the 750s, Pope Stephen II (III) appealed for aid to the Frankish ruler Pepin III the Short. On intervening, Pepin "restored" the lands of central Italy to the Roman see, ignoring the claim of the Byzantine (East Roman) Empire to sovereignty there. This Donation of Pepin (754) provided the basis for the papal claim to temporal power, while by the Treaty of Pavia (756) the Lombard king Aistulf ceded territory in northern and central Italy. The pope consequently became ruler of the area around Ravenna, the Pentapolis (along the Adriatic from Rimini to Ancona), and the Roman region. By alliance with the Normans in the late 11th century, the duchy of Benevento was acquired in 1077.

Through the European Middle Ages the popes were able to maintain their sovereignty over this territory despite the rise of local feudal lords in the 9th and 10th centuries and, more importantly, despite a clash with the German Holy Roman emperors that lasted from the Investiture Controversy of the mid-11th century until the 14th century. Relations with the emperors were exacerbated by controversy over the allodial lands of the countess Matilda of Tuscany, donated (1102) to the papacy but finally left (1111) to the emperor Henry V. But papal sovereignty was more nominal than real. The rise of commune governments, especially in the Romagna, weakened the popes' authority. With the transfer of the papal residence from Rome to Avignon (1309–77), local independence prevailed in the Papal States, a situation that continued through the end of the Great Schism in 1417. Many towns nominally held as vicariates granted by the pope were in fact ruled by local families.

From the mid-15th century the Renaissance popes sought to reestablish papal authority in central Italy. Under Julius II (pope from 1503 to 1513), the States reached their definitive boundaries, stretching from Parma and Bologna in the north, along the Adriatic coast, through Umbria, to the Campagna, south of Rome. These popes, however, failed in their attempt to make the papacy a force in international politics, and, by the end of the 16th century, the papal territory was merely one of a number of petty Italian states.

In the 17th and 18th centuries the trend toward centralization at the expense of local independence, begun by the Renaissance popes, continued, although the clerical-run government made little progress in improving the backward economic condition of the Papal States.

When the French, under Napoleon, secured domination of the Italian peninsula in the late 1790s, the States were taken from the pope in 1798–99 (to be included in the Cisalpine and Roman republics) and again in 1808–09 (to be included in the Italian kingdom and the French empire). Liberal ideas introduced into the Papal States during the French Revolution continued to play a role there after the restoration of the States to the pope by the Congress of Vienna (1815). In opposition to unenlightened clerical rule, revolts occurred in the States in 1830–31 and again in 1849, when another short-lived Roman Republic was established.

Through the Risorgimento (movement for Italian unification during the 19th century), the existence of the Papal States proved an obstacle to national union both because they divided Italy in two and because foreign powers intervened to protect papal independence. Annexation of the Papal States to the new Italian nation, however, was eventually achieved. After Austria's defeat in 1859, the papal territories of Romagna, Umbria, and Marche voted to join the Italian kingdom. With the withdrawal of French troops from Rome in 1870, the remaining papal territory—the area around Rome—was taken by Italian forces, and Rome was made capital of Italy. The popes refused to recognize the loss of their temporal power and remained "prisoners in the Vatican." The question of the pope's relation to the Italian state was unsettled until the Lateran Treaty of 1929 set up an independent Vatican City state.

Papaloapan River, Spanish RÍO PAPALOAPAN, river in Veracruz state, southeastern Mexico. It is formed by the junction of several rivers near the Veracruz–Oaxaca border and meanders generally northeastward for 76 miles (122 km) to Alvarado Lagoon, 10 miles (16 km) south-southeast of Alvarado. The chief headstreams include the Santo Domingo, Chichicatiapa, and San Cristóbal, which rise in the Sierra Madre Oriental. Since 1947 the Papaloapan River basin has been developed and colonized by the government. Swampy lowlands have been drained and reclaimed, dams for flood control and hydroelectric power built, farmlands apportioned, and settlers moved in from elsewhere in Mexico. The project's success has led to similar schemes in other parts of the gulf lowlands. The Papaloapan system is navigable for 150 miles (240 km) upstream from Alvarado Lagoon.

Papandreou, Andreas (Georgios) (b. Feb. 5, 1919, Chios, Greece), premier of Greece (1981–89).

Son of Georgios Papandreou, he attended the American College in Athens and studied law at the University of Athens. A Trotskyite, he was imprisoned briefly by the dictator Ionnis Metaxas and, when freed, fled to the United States, where he received a Ph.D. (1943) from Harvard University and obtained U.S. citizenship (1944). After serving in the U.S. Navy, he taught at Harvard, the University of Minnesota, and the University of California, Berkeley (1955–63). When his father became prime minister of Greece in 1963, Andreas gave up his U.S. citizenship and returned to his native country, winning election to the Greek Parliament. His close association with the left wing of his father's party, the Centre Union, and his rapid rise in the government and the party hierarchy created controversies that contributed to the fall of his father's government in 1965.

Papandreou was jailed for eight months after the military coup of 1967 and was then released. He again went into exile, teaching in Stockholm and Toronto and leading the democratic resistance to the junta from overseas. After the collapse of the Greek military dictatorship in 1974, he returned home and formed the left-wing Panhellenic Socialist Movement (PASOK). His new party won a steadily increasing share of the popular vote in the elections of 1974 and 1977, and in 1981 PASOK won a sweeping victory, capturing 172 of the 300 seats in Parliament.

As a candidate, Papandreou had advocated quasi-socialist domestic reforms while also calling for the removal of U.S. military bases from Greece. He also advocated Greece's withdrawal from NATO. But once in power, he pursued more moderate policies. The marriage and religious laws were liberalized, and some government functions were decentralized; but the United States' leases on its military bases in Greece were renewed, and Greece remained in NATO. The government did take a hard stance on the continued Turkish occupation of part of Cyprus, however.

Papandreou's combination of pragmatic policies with a strident anti-American rhetoric proved popular. His party won a decisive victory in the general elections of 1985, and he continued as prime minister. Late in Papandreou's second term, his government was weakened by a grave financial scandal that forced the dismissal or resignation of three Cabinet ministers. Papandreou's popularity was further diminished by his highly publicized relationship with a much younger woman while he was still married to his second wife. In the elections of June 18, 1989, PASOK lost its majority in Parliament, and Papandreou resigned from office on June 19.

Papandreou, Georgios (b. Feb. 13, 1888, Kaléntzi, Greece—d. Nov. 1, 1968, Athens), Greek liberal politician who was three times prime minister of his country.

Papandreou studied at Athens University (L.L.D., 1911) and in Germany. He began his political career in 1915, served as governor of the Aegean Islands (1917–20), and was minister of education (1929–33) in the liberal antimonarchist government of Eleuthérios Venizélos. He broke away from the left wing of the Liberal Party and in 1935 founded the Democratic Socialist Party. During the dictatorship of Ioannis Metaxas, he was in exile, and he was imprisoned by the Germans in 1942–44 during World War II. Managing to escape, he then headed the Greek coalition government (initially a government-in-exile) from April 1944 until after the German army withdrew from Greece in October 1944, but he resigned in December of that year as the country slipped into civil war. From 1946 to 1952 he held ministerial posts in several governments. During a subsequent period in opposition, he merged his Democratic Socialist Party with the Liberal Party and in 1961 organized a new centre-left coalition, the Centre Union.

In 1963 the Centre Union won a bare electoral majority, and Papandreou became prime minister; but he resigned shortly afterward to seek an absolute majority, which he obtained in new elections in 1964. As prime minister Papandreou introduced a program of social reforms more far-reaching than those sought by previous governments, and he also criticized what he viewed as the excessive influence of the United States in his country. A crisis developed in 1965 over Papandreou's insistence on giving ministerial posts to his son Andreas, and he also clashed with the Greek king, Constantine, over the control of conservative officers in the army. In July 1965 the king dismissed Papandreou from the prime ministry, after which a period of political instability ensued in Greece. In 1967, when it became clear that Papandreou's party was again headed for victory in upcoming general elections, a military junta seized power in Greece and arrested Papandreou and his son. They were later released, but the elder Papandreou died soon afterward.

Papanicolaou's stain, also called PAP SMEAR, laboratory method of staining smears of various body secretions from the respiratory, digestive, or genitourinary tract, for the examination of cast-off body cells, to detect the presence of cancer. The Pap smear is notably reliable in detecting the early stages of cancer in the uterine cervix. For such a Pap smear, two specimens are usually taken for laboratory staining and examination, one consisting of vaginal secretions obtained by suction (aspiration) or with a spatula, and the other of scrapings of the surface of the cervix, at the site where cancerous growth frequently originates. While the cervical scrapings provide material for highly accurate interpretations, the vaginal smear gives reliable results as well and may reveal malignant cells not only from the cervix but also from the endometrium (the mucous coat of the uterus) and the ovaries.

Papaveraceae, poppy family of the order Papaverales, comprising approximately 26 genera of mostly herbaceous plants but including some woody, small trees and shrubs. The family is outstanding for its many garden ornamentals and pharmaceutically important plants. Most species are found in the Northern Hemisphere.

All species have bisexual, regular, cup-shaped flowers with one superior pistil (female structure) and many stamens (male parts). They have 2 or 3 conspicuous, separate sepals and 4 to 12 or more separate petals. The fruit is a capsule, the leaves are usually deeply cut or divided into leaflets, and the sap is coloured.

Opium, from which morphine, heroin, and codeine are derived, is from the opium poppy (*Papaver somniferum*), which is native to Asia Minor. Numerous other members of the family are valuable ornamental plants, including about 50 species of the genus *Papaver* (poppy). Other genera of the Papaveraceae distinguished for their ornamental species include: *Meconopsis, Eschscholzia* (California poppy), *Hunnemannia, Dendromecon* (bush poppy), *Stylophorum, Chelidonium* (celandine), *Sanguinaria* (bloodroot), *Platystemon* (creamcups), *Romneya, Macleaya, Stylomecon, Bocconia,* and *Eomecon.* The genera *Argemone* (prickly poppy), *Glaucium* (horned poppy), and *Papaver* contain weedy species.

Papaverales, the poppy order of flowering plants, belonging to the class known as dicotyledon (characterized by the presence of two seed leaves). The order is composed of 45 genera and 640 species in three families. Its most familiar flowers are the poppy (*q.v.*) of the Papaveraceae and the bleeding heart (*q.v.*) of the Fumariaceae. This order mostly is herbaceous (nonwoody) and is distributed worldwide, primarily in temperate regions.

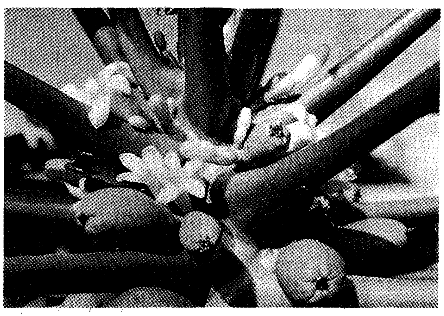
A brief treatment of Papaverales follows. For full treatment, *see* MACROPAEDIA: Angiosperms.

Features that characterize the Papaveraceae family are regular (radially symmetrical) flowers, bud-enclosing sepals, and regularly inserted stamens. Although some are treelike, the majority of Papaveraceae are annual or perennial herbs. Members of the *Papaver* genus include *P. somniferum,* which yields opium—a complex of 20 alkaloids (and other compounds) including morphine, heroin, and codeine. Members of the Fumariaceae family develop irregular (bilaterally symmetrical) flowers, with small sepals and six stamens in two groups. The family is valued for the beauty of its cultivated and wildflower members. Hypecoaceae, a family of herbs with one genus and 15 species, is native to regions that extend from the Mediterranean area to China. Its floral features, including free petals and four free stamens, place it between the Papaveraceae and the Fumariaceae.

In several species of Papaverales, rhizomes (horizontal stems), taproots, bulblets, and tubers give rise to colonies of plants. The major method of reproduction, however, is by sexual means. Flowers in the poppy family develop in four or more whorls, with two sepals, 4 to 6 (or 8 to 12) petals, numerous stamens, and a pistil composed of many joined carpels. Green sepals shed as the flower opens. Ovules arise along ridges on the inside of the one-chambered, superior ovary, and seeds are many. Some flowers are self-pollinated in the closed condition, but insects, especially bees, facilitate cross-pollination in all other species. After fertilization, the ovary becomes the fruit.

papaya, also called PAPAW, or PAWPAW, succulent fruit of a large plant (*Carica papaya*) of the family Caricaceae, considered a tree, though its palmlike trunk, up to 8 m (26 feet) tall, is not as woody as the designation generally implies. The plant bears no lateral branches but is crowned by deeply lobed leaves, sometimes 60 cm (2 feet) across, borne on hollow petioles 60 cm long. Normally, the species is dioecious, male and female flowers being produced on separate plants; but hermaphroditic forms are known, and numerous irregularities in the distribution of the sexes are common. Male flowers are borne in clusters on stalks 90 cm (3 feet) long; the flowers are funnel-shaped, about 2.5 mm (0.1 inch) long, and whitish, and the corolla is five-lobed, with 10 stamens in the throat. The female flowers are considerably larger, on very short stalks, and often solitary in the leaf axils; they have five fleshy petals that are united toward the base and a large cylindrical or globose superior ovary that is crowned by five fan-shaped sessile stigmas.

The fruit is commonly spherical to cylindrical in form, is 75–500 mm (3–20 inches) or even more in length, and sometimes weighs as much as 9 to 11.5 kg (20 to 25.5 pounds). In general character it strongly resembles a muskmelon. The very juicy flesh is deep yellow or orange to salmon-coloured and about 25 mm (1 inch) thick. Along the walls of the large central cavity are attached the numerous round, wrinkled, black seeds, the size of peas.



Female flowers and immature fruit of papaya (*Carica papaya*)
G.R. Roberts

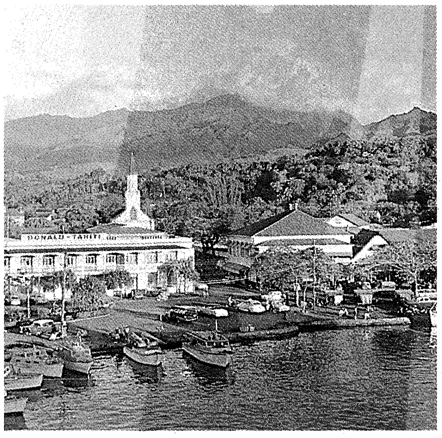
Though its origin is rather obscure, the papaya may represent the fusion of two or more species of *Carica* native to Mexico and Central America. Today it is cultivated throughout the tropical world and into the warmest parts of the subtropics.

The papaya fruit is slightly sweet, with an agreeable musky tang, which is more pronounced in some varieties and in some climates than in others. It is a popular breakfast fruit in many countries and is also used in salads, pies, sherbets, juices, and confections. The unripe fruit can be cooked like squash.

The unripe fruit contains a milky juice in which is present a protein-digesting enzyme known as papain, which greatly resembles the animal enzyme pepsin in its digestive action. This juice is used in the preparation of various remedies for indigestion and in the manufacture of meat tenderizers.

Papayas are usually grown from seed. Their development is rapid, fruit being produced before the end of the first year. Under favourable conditions, a plant may live five years or more.

Papeete, commune, capital of French Polynesia, lying on the northwest coast of Tahiti. A gracious tropical city with tall palms and abundant flowers, Papeete is one of the largest urban centres in the South Pacific. Its excellent harbour made it, by 1829, a place of



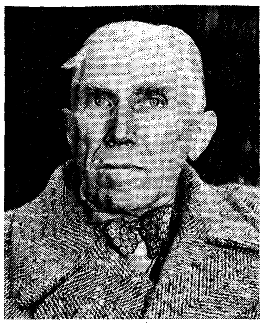
Quayside near the main street of Papeete, Tahiti, French Polynesia
Charles R. Meyer—Photo Researchers

trade and a favourite port of call for whalers. After annexation by the French (1880), it was made the seat of the governor, and in 1890 it became a commune.

Papeete is now a major stop for transpacific ships and airlines, with modern harbour facilities and, at nearby Faaa, a jet airport. Copra, sugarcane, mother-of-pearl, vanilla, and coffee are exported. It is a major tourist base serving both Tahiti and the other French Polynesian islands. A power plant supplies electricity for the island. The suburbs of Papeete grew rapidly in the early and mid-1970s, with an influx of people from other parts of French Polynesia. The population also includes Chinese and Europeans. Pop. (1983) 23,496.

Papen, Franz von (b. Oct. 29, 1879, Werl, Ger.—d. May 2, 1969, Obersasbach, W.Ger.), German statesman and diplomat who played a leading role in dissolving the Weimar Republic and in helping Adolf Hitler to become German chancellor in 1933.

The scion of a wealthy Catholic landowning family, Papen began his career as a professional soldier. At the beginning of World War I, he was military attaché in Washington, but after being implicated in cases of espionage and sabotage, he was recalled in 1915 at the request of the U.S. government. Until the end of the war he served as chief of staff of the 4th Turkish Army in Palestine. Returning after the war to Germany, Papen, a monarchist,



Papen
Camera Press

decided to enter politics. From 1921 to 1932, he was a deputy in the Reichstag (federal lower house) and belonged to the ultraright wing of the Catholic Centre Party. Though he had certain links with German monarchists, former aristocrats, big business circles, and the German Army, Papen himself had no political following. His elevation to the chancellorship (June 1, 1932), engineered by Pres. Paul von Hindenburg's adviser Gen. Kurt von Schleicher, came as a complete surprise to the public.

Papen established a rightist, authoritarian government without a political base or voting majority in the Reichstag. In an effort to appease the Nazis, who formed the second largest party in Parliament, he lifted the ban on the Nazis' paramilitary Sturmabteilung (SA) on June 15 and deposed the Social Democratic government of Prussia on July 20. In foreign affairs, he achieved the virtual cancellation of Germany's reparations obligations under the Treaty of Versailles. Hitler, however, who wanted to rule Germany himself, remained in opposition. Papen's reactionary policies and his efforts to replace Germany's Weimar constitution with authoritarian rule alienated Schleicher, who wished to establish a broad national front that would have a real popular mandate. Accordingly, Schleicher induced a number of Cabinet ministers to reject Papen's policies; Papen thereupon resigned and was, on December 4, succeeded as chancellor by Schleicher.

Incensed at his ouster and determined to gain revenge on Schleicher, Papen came to terms with Hitler (Jan. 4, 1933) and persuaded Hindenburg to appoint the Nazi leader to the chancellorship. As vice chancellor, Papen, whose fellow non-Nazi nationalists received a majority of the ministerial posts, naively thought he could restrain the Nazis. Though he soon realized how mistaken he had been, he continued to serve Hitler. Papen narrowly escaped with his life during Hitler's purge of the SA on June 30, 1934, and he resigned the vice chancellorship three days later. He was then sent as ambassador to Austria (1934–38), for whose annexation to Germany he worked. He eventually became ambassador to Turkey (1939–44), where he attempted to keep that country out of an alliance with the Allies.

Papen was arrested by the Allies in April 1945 and placed on trial as a war criminal. Found not guilty by the Nürnberg tribunal of conspiracy to prepare aggressive war, he was sentenced to eight years' imprisonment by a German court as a major Nazi, but in 1949, on his appeal, was released and fined. Papen's memoirs, *Der Wahrheit eine Gasse* (*Memoirs*), appeared in 1952.

paper, matted or felted sheet, usually made of cellulose fibres, formed on a wire screen from water suspension.

A brief treatment of paper follows. For full treatment, *see* MACROPAEDIA: Industries, Chemical Process.

Paper has been traced to China in about AD 105. It reached Central Asia by 751 and Baghdad by 793, and by the 14th century there were paper mills in several parts of Europe. The invention of the printing press in about 1450 greatly increased the demand for paper, and at the beginning of the 19th century wood and other vegetable pulps began to replace rags as the principal source of fibre for papermaking.

Before 1798, Nicholas-Louis Robert constructed the first paper-making machine. Using a moving screen belt, paper was made one sheet at a time by dipping a frame or mold with a screen bottom into a vat of pulp. A few years later the brothers Henry and Sealy Fourdrinier improved Robert's machine, and in 1809 John Dickinson invented the first cylinder machine.

Although almost all steps in papermaking have become highly mechanized, the basic process has remained essentially unchanged. First, the fibres are separated and wetted to produce the paper pulp, or stock. The pulp is then filtered on a woven screen to form a sheet of fibre, which is pressed and compacted to squeeze out most of the water. The remaining water is removed by evaporation, and the dry sheet is further compressed and, depending upon the intended use, coated or impregnated with other substances.

Differences among the grades and types of paper are determined by several factors: the type of fibre used; the preparation of the pulp, either by mechanical (groundwood) or chemical (primarily sulfite, soda, or sulfate) methods, or by a combination of the two; by the addition of other materials to the pulp, among the most common being bleach or colouring and sizing, the latter to retard penetration by ink; by conditions under which the sheet is formed, including its weight; and by the physical or chemical treatments applied to the finished sheet.

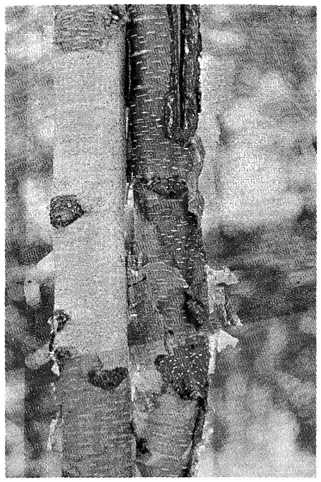
Although wood has become the major source of fibre for papermaking, rag fibres are still used for paper of maximum strength, durability, and permanence. Recycled wastepaper (including newsprint) and paperboard are also important sources. Other fibres used include straw, bagasse (residue from crushed sugarcane), esparto, bamboo, flax, hemp, jute, and kenaf. Some paper, particularly specialty items, is made from synthetic fibres.

Weight or substance per unit area, called basis weight, is measured in reams (now commonly 500 sheets). Paper is also measured by caliper (thickness) and density. The strength and durability of paper is determined by factors such as the strength and length of the fibres, as well as their bonding ability, and the formation and structure of the sheet. The optical properties of paper include its brightness, colour, opacity, and gloss. Among the most important paper grades are bond, book, bristol, groundwood and newsprint, kraft, paperboard, and sanitary.

paper birch (*Betula papyrifera*), also called CANOE BIRCH, SILVER BIRCH, or WHITE BIRCH, ornamental, shade, and timber tree of the family Betulaceae, native to northern and central North America.

Usually about 18 metres (60 feet) tall but occasionally reaching 40 m, the tree has ovate, dark-green, sharp-pointed leaves about 10 centimetres long. The bark, brown at first, whitens and peels into paper-thin layers, marked by narrow horizontal pores, or lenticels. On the copper-coloured inner bark, the pores are bright orange. Short, pendulous branches and their numerous flexible twigs create a lacy silhouette in winter.

The western paper birch (*B. papyrifera* variety *commutata*) of Canada and the western U.S. is about 30 m tall, with orange-brown to nearly white bark; the smaller northwestern paper birch of western North America (variety *subcordata*) is 18 m high and has orange-brown to silver-gray bark, purplish, red-brown twigs, and small, heart-shaped leaves, about six cen-



Paper birch (*Betula papyrifera*)
E.H. Ketchledge

timetres long; the mountain paper birch (variety *cordifolia*), with white bark, is a small, sometimes shrubby tree of Canada and the eastern and midwestern U.S. In the Alaska paper birch (variety *humilis*) the nearly triangular leaves are about four centimetres long, the bark white to red brown; the Kenai birch (variety *kenaica*), found in Alaska from sea level to altitudes of 665 m, is rarely 12 m tall and has white bark, tinged orange or brown.

Paper birch is fast growing but short-lived and susceptible to borers when cultivated south of its natural range. The close-grained, almost white wood is used for turned articles, woodenware, pulp, and fuel. North American Indians used the thin, water-impervious bark for roofing and canoes.

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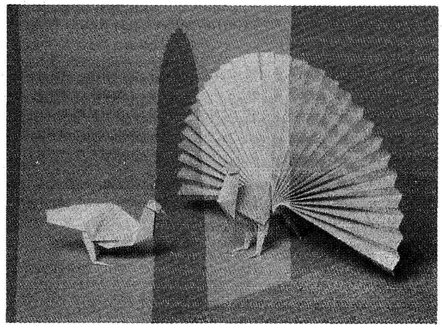
paper chromatography, in analytical chemistry, technique for separating dissolved chemical substances by taking advantage of their different rates of migration across sheets of paper. It is an inexpensive but powerful analytical tool that requires very small quantities of material.

The method consists of applying the test solution or sample as a spot near one corner of a sheet of filter paper. The paper is initially impregnated with some suitable solvent to create a stationary liquid phase. An edge of the paper close to the spot is then immersed in another solvent in which the components of the mixture are soluble in varying degrees. The solvent penetrates the paper by capillary action and, in passing over the sample spot, carries along with it the various components of the sample. The components move with the flowing solvent at velocities that are dependent on their solubilities in the stationary and flowing solvents. Separation of the components is brought about if there are differences in their relative solubilities in the two solvents. Before the flowing solvent reaches the farther edge of the paper, both solvents are evaporated, and the location of the separated components is identified, usually by application of reagents that form coloured compounds with the separated substances. The separated components appear as individual spots on the path of the solvent. If the solvent flowing in one direction is not able to separate all the components satisfactorily, the paper may be turned 90° and the process repeated using another solvent. Paper chromatography has become standard practice for the separation of complex mixtures of amino acids, peptides, carbohydrates, steroids, purines, and a long list of simple organic compounds. Inorganic ions can also readily be separated on paper. *Compare* thin-layer chromatography.

paper folding, Japanese ORIGAMI, art of folding objects out of paper without cutting, pasting, or decorating. Its early history is not known, though it seems to have developed from the older art of folding cloth.

In Japan, origami has reached its greatest development, with hundreds of traditional folds and an extensive literature dealing with the art. Japanese folds divide roughly into two categories: figures used in ceremonial etiquette (such as *noshi,* folded decorations attached to gifts); and birds, animals, fish, insects, flowers, human figures, furniture, and other objects. Some of the animals have amusing action features; best known are the bird that flaps its wings when its tail is pulled and the frog that hops when its back is tapped. Yoshizawa Akira of Tokyo is considered the greatest of modern paper folders. He wrote several books on origami and created a large number of new, often fantastically complex, figures possessing great realism and delicate beauty.



"Peafowl," origami by Yoshizawa Akira, 1942; in the artist's collection, Tokyo
Photograph, Nobuyuki Masaki

Paper folding also has flourished in Spain and South America. Miguel de Unamuno, Spanish writer and philosopher, made a hobby of paper folding. He invented many new animal constructions and wrote *Amor y pedagogía* (1902), a humorous essay on the art. In South America, Vicente Solórzano Sagredo of Argentina was the leading expert on paper folding and the author of the most comprehensive manuals on the art in Spanish. George Rhoads of Evanston, Ill., and Giuseppe Baggi of New York also achieved distinction in this art.

Apart from the Oriental tradition, the folding of coloured papers into ornamental designs was introduced by Friedrich Froebel into the kindergarten movement that he initiated in Germany in the 19th century. Later, the Bauhaus, a famous German school of design, stressed the folding of paper as a method of training students for commercial design. The use of folded paper in mathematical recreations is similarly independent of origami. Particularly intriguing are A.H. Stone's flexagons (1939), a variety of paper structures that alter their faces in curious ways when properly flexed.

paper pulp, raw material for paper manufacture that contains vegetable, mineral, or man-made fibres. It forms a matted or felted sheet on a screen when moisture is removed.

Rags and other fibres, such as straw, grasses, and bark of the mitsumata and paper mulberry (kozo), have been used as paper pulp. Except for certain special papers (*e.g.,* asbestos paper), nearly all papers are made of cellulosic (vegetable) fibres. The most abundant source of cellulose is the forest, though trees differ in the value of their fibre for making paper. The fibre of flax, cotton, jute, sisal, manila hemp, and the like usually comes to the paper industry as a secondary product, after serving other uses. Agricultural wastes—straw, corn stalks, bagasse (sugarcane waste), bamboo, and some other grasses—are used for making certain grades. Finally, one of the most important sources of pulp is the fibre recovered from old papers, rags, and cardboard boxes.

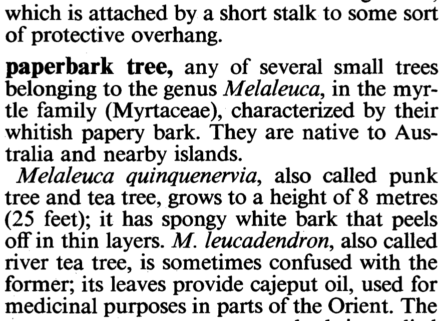
Wood pulps may be classified into two general groups, mechanical and chemical. Mechanical pulp, generally called groundwood, is usually produced by a mechanical grinding process and is not further classified except as fine, coarse, or bleached. Chemical pulps are classed as unbleached sulfite (strong and news grade), bleached sulfite (dissolving and paper grade), bleached and unbleached sulfate (kraft), and soda. "Semichemical" is a term applied to a process of cooking followed by mechanical treatment. Spruce, balsam fir, and hemlock are considered the best woods for sulfite and mechanical pulping; several varieties of pine are used for sulfate (kraft) pulping; hardwoods are pulped by all of the pulping processes. The chief European pulpwoods are Norway spruce, Scotch pine, and various hardwoods. *See also* kraft process; sulfite process.

paper wasp (*Polistes*), any of a worldwide genus of insects of the family Vespidae (order Hymenoptera). A striking-looking wasp, about 16 millimetres long, it has orange antennae, wings, and tarsi; the body is jet black with narrow yellow bands and paired segmental spots. The sting is painful but less toxic to humans than that of the more familiar species of wasps and hornets (*Vespa, Vespula*). The nest is made of a paperlike material, fashioned from wood which the females have chewed and mixed with saliva to form a paste. There are about 100 cells for larvae in a single nest, which is attached by a short stalk to some sort of protective overhang.

paperbark tree, any of several small trees belonging to the genus *Melaleuca,* in the myrtle family (Myrtaceae), characterized by their whitish papery bark. They are native to Australia and nearby islands.

Melaleuca quinquenervia, also called punk tree and tea tree, grows to a height of 8 metres (25 feet); it has spongy white bark that peels off in thin layers. *M. leucadendron,* also called river tea tree, is sometimes confused with the former; its leaves provide cajeput oil, used for medicinal purposes in parts of the Orient. The common name swamps paperbark is applied to *M. ericifolia,* which often grows in clumps, and to *M. rhaphiophylla.* These shrubs and small trees are sometimes cultivated in warm areas for their whitish to yellowish terminal flower clusters.

Paphlagonia, ancient district of Anatolia adjoining the Black Sea, bounded by Bithynia in the west, Pontus in the east, and Galatia in the south. The Paphlagonians were one of the most ancient peoples of Anatolia. Passing under the rule of Lydia and Persia, they submitted to Alexander the Great (333 BC), after which they enjoyed a measure of independence. In the 3rd and 2nd centuries BC Paphlagonia was gradually absorbed by the



Paphlagonia
From W. Shepherd, *Historical Atlas,* Harper & Row, Publishers (Barnes & Noble Books), New York; revision copyright © 1964 by Barnes & Noble, Inc.

expanding Pontic kingdom on its eastern border. When the Pontic kingdom under Mithradates VI was destroyed by Pompey in 65 BC, the coastal districts of Paphlagonia (including its capital at Sinope) were attached to Roman Bithynia while the interior regions were left under native rulers. Upon the extinction of the native dynasty (*c.* 6 BC), the remainder of the territory was incorporated into the Roman province of Galatia. Upon the division of the empire in the 4th century AD, Paphlagonia became a separate Roman province.

Paphos, Greek PÁFOS, modern town and administrative district and name of two ancient cities on the west coast of the Republic of Cyprus. The older ancient city (Greek Palaipaphos) was located at modern Pírgos (Kouklia); New Paphos, which had already superseded Old Paphos in Roman times, was 10 mi (16 km) farther west. New Paphos and Ktima together form modern Paphos.

Paphos, settled by Greek colonists in the Mycenaean period, contained a famous temple of Aphrodite and was the legendary site where Aphrodite was born from the sea foam. In Hellenic times Paphos was second only to Salamis in extent and influence among the states of Cyprus. The Cinyrad dynasty ruled Paphos until its final conquest by Ptolemy I of Egypt (294 BC). Old Paphos dwindled in influence after the fall of the Cinyradae, the foundation of New Paphos, and the Roman conquest of Cyprus (58 BC). It was finally deserted after the 4th century AD.

New Paphos, the port town of Old Paphos, became the administrative capital of the whole island in Ptolemaic and Roman times and head of one of the four Roman districts. The city was attacked and destroyed by Muslim raiders in AD 960. The modern town began to grow only after the British occupation in 1878. The harbour, centre of the city's life, was improved in 1908 and 1959, but remains too small to handle large commercial traffic, and thus serves only an active local fishing fleet, which lost local fishing grounds and some 200 vessels after the Turkish occupation of 1974, though fish landings recovered by the late 1970s. Despite economic difficulties arising from the settlement there of some 5,000 Greek Cypriot refugees after 1974, by the end of the decade the city had become the focus of strong economic development, including an industrial estate, and tourist hotels. Manufacturing consists of small enterprises producing clothing, footwear, canned meat, beverages, and vegetable oils. Local points of interest include Orthodox churches, the Djami Kebir Mosque, Paphos Castle, and Frankish baths.

Paphos district is bounded by the districts of Limassol and Nicosia on the east, and is bordered by the Mediterranean Sea (including Khrysokhou Bay on the northeast) on the south, west, and north. It covers an area of 538 sq mi (1,373 sq km). The Troödos Mountains, reaching an elevation of 4,468 ft (1,362 m) at Mt. Tripylos on the border with Nicosia district, dominate the landscape except for coastal lowlands with indented and rocky shores. In the southwestern part of the district, the mountains descend in a series of stepped foothills to the coastal plain. A network of rivers including the Khrysokhou and Dhiarrisos rises in the Troödos Mountains and flows radially to drain into the Mediterranean Sea. In the 6th century BC the region was probably part of the petty Kingdom of Paphos. Under the Romans it was one of the four districts into which Cyprus was divided. The Turks occupied the region in 1570. It became part of the Republic of Cyprus in 1960.

The economy of the district is predominantly agricultural and cereals, legumes, vegetables, and citrus fruits are grown. A large-scale irrigation project provides water for a major citrus growing area in the district. Olives, carob, apples, pears, and cherries are grown on hillsides and mountain slopes. Deep-sea fishing is also practiced. Industries produce beverages, shoes, plastics, bricks, canned fruit and vegetables, and vegetable oils. Copper is mined. Paphos, the administrative headquarters of the district, is linked by roads to Ktima, Kouklia, and Peyia. Pop. (1982 est.) town, 13,100; (1973) district, 57,100.

Papiamento, also spelled PAPIAMENTU, creole language based on Spanish, spoken on the islands of Curaçao, Aruba, and Bonaire, in the Caribbean Sea. Papiamento is apparently based on a Spanish pidgin or creole language, with early influences from Portuguese and, more recently, strong Dutch influences (Dutch is the official language of Curaçao). Twenty-five percent of the vocabulary of Papiamento is of Dutch origin; the remainder is primarily from Spanish or Portuguese. Although Papiamento has no official status, it is widely used on Curaçao and is more often recognized as a "real" language than formerly. As is usual with pidgins and creoles, Papiamento's grammar and syntax have become changed and simplified from those of Spanish, the parent language. An example of a sentence in Papiamento is: *E mâma ta'a mand' e jú bái bende piská,* Spanish *La mamá mandaba al hijo que vaya a vender pescado,* "The mother sent the boy to go and sell fish."

Papias (fl. early 2nd century), bishop of Hierapolis, Phrygia, whose work "Explanation of the Sayings of the Lord," although extant only in fragments, provides important apostolic oral source accounts of the history of primitive Christianity and of the origins of the Gospels.

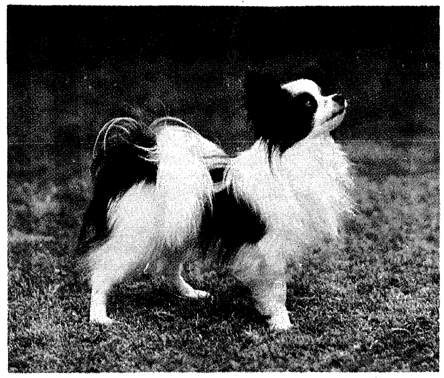
According to the 2nd-century theologian Irenaeus, Papias had known the Apostle John. The 4th-century church historian Eusebius of Caesarea (*q.v.*) critically records that Papias derived his material not only from John the Evangelist but also from John the Presbyter, through whose influence he had infected early patristic theologians with a false Judeo-Greek millenarianism, the apocalyptic teaching that Christ would reappear to transform the world into a 1,000-year era of universal peace, and had implicated Christ in fantastic parables. Eusebius' antipathy to Papias consequently led him to edit severely the latter's text and preserve only short excerpts.

Papias' interpretation of the Gospels was used by Eastern and Western Christian theologians down to the early 4th century.

papier-mâché, repulped paper that has been mixed with glue or paste so that it can be molded. The art of making articles of papier-mâché, beautifully decorated in Oriental motifs and handsomely lacquered, was known in the East centuries before its introduction in Europe. Molded paper products were first made in France in the early part of the 18th century and, later, in Germany and England. Different processes were used; for instance, several sheets of paper glued together could be pressure molded into such articles as trays and furniture panels. Although production has declined since the 19th century, papier-mâché is still used for toys, masks, model scenic materials, and the like.

Papillon (French criminal): *see* Charrière, Henri.

papillon, breed of toy dog known from the 16th century, when it was called a dwarf spaniel. A fashionable dog, it was favoured by Madame de Pompadour and Marie Antoinette, and it appeared in paintings by some of the Old Masters. The name papillon (French: "butterfly") was given to the breed in the late 19th century, when a variety with large, flaring ears resembling the wings of a butterfly came into vogue. There is another variety of papillon, with drooping ears. A slender, graceful dog with a plumed tail, the papillon stands 11 inches (28 centimetres) or less and weighs up to 11 pounds (5 kilograms). The coat is soft, full, and usually white with patches of black or of pale tan to dark reddish brown.



Papillon
Sally Anne Thompson—EB Inc.

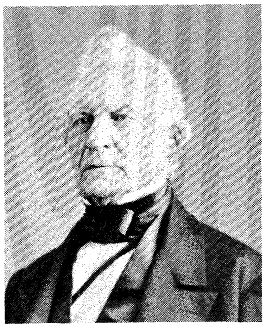
Papin, Denis (b. Aug. 22, 1647, Blois, Fr.—d. *c.* 1712, London), French-born British physicist who invented the pressure cooker and suggested the first cylinder and piston steam engine. Though his design was not practical, it was improved by others and led to the development of the steam engine, a major contribution to the Industrial Revolution. Papin assisted the Dutch physicist Christiaan Huygens with his air-pump experiments and went to London in 1675 to work with the English physicist Robert Boyle.

In 1679 Papin invented his steam digester (pressure cooker), a closed vessel with a tightly fitting lid that confines the steam until a high pressure is generated, raising the boiling point of the water considerably. A safety valve of his own invention prevented explosions. Observing that the enclosed steam in his cooker tended to raise the lid, Papin conceived of the use of steam to drive a piston in a cylinder, the basic design for early steam engines; he never built an engine of his own, however.

Papin, detail of an engraving, *c.* 1689
H. Roger-Viollet

In 1705 the German physicist and philosopher Gottfried Wilhelm Leibniz sent Papin a sketch of the first practical steam engine, built by Thomas Savery of England. That sketch stimulated Papin to further work, culminating in his *Ars Nova ad Aquam Ignis Adminiculo Efficacissime Elevandam* (1707; "The New Art of Pumping Water by Using Steam"). In 1709 he built a man-powered paddle-wheel boat that successfully demonstrated the practicability of using the paddle wheel in place of oars on steam-driven ships. Later that same year Papin returned to London, where he lived in obscurity until his death.

Papineau, Louis Joseph (b. Oct. 7, 1786, Montreal—d. Sept. 23, 1871, Montebello, Que., Can.), politician who was the leader of the French-Canadians in Lower Canada (now



Papineau
By courtesy of the Public Archives of Canada

in Quebec) in the period preceding an unsuccessful revolt against the British government in 1837.

Papineau was elected a member of the House of Assembly of Lower Canada in 1808. During the War of 1812 against the United States, he served as an officer in the Canadian militia. He became speaker of the house in 1815 and was already recognized as leader of the French-Canadian Party in its struggle against the English-dominated government of Lower Canada. In 1820 he was appointed a member of the executive council by the governor, Lord Dalhousie, but he resigned three years later, realizing that he had no real influence. Papineau went to England in 1822 to speak out in behalf of the French-Canadians, and he thereafter remained bitterly opposed to British government in Canada. Lord Dalhousie refused to confirm Papineau's speakership in 1827 and resigned when the House supported Papineau.

To achieve reforms for French-Canadians, Papineau began to work with William Lyon Mackenzie, leader of the Reform Party in Upper Canada (now in Ontario). In 1834 Papineau inspired the 92 Resolutions, a statement of French-Canadian demands and grievances, which was passed by the assembly. Lord Gosford, the governor, was authorized in 1837 to reject the demands and to appropriate provincial revenues without the assembly's consent. Papineau protested with inflammatory speeches. Hostilities broke out that November, and Papineau was forced to escape to the United States. He went to Paris in 1839 and remained there until 1844, when a general amnesty was granted.

During his absence, the British Parliament had united Upper and Lower Canada, as Canada West and Canada East (Act of Union, 1840). Papineau sat in the House of Commons in 1848–54, but he never regained his former dominance or his leadership of the French-Canadians. He agitated for the redivision of Canada and for independence from Great Britain, then retired to private life in 1854.

Papini, Giovanni (b. Jan. 9, 1881, Florence—d. July 8, 1956, Florence), journalist, critic, poet, and novelist, one of the most outspoken and controversial Italian literary figures of the early and mid-20th century. He was influential first as a fiercely iconoclastic editor and writer, then as a leader of Italian Futurism, and finally, after his reconversion in 1920 to Roman Catholicism, as a prolific (though sometimes unorthodox) spokesman for religious belief.

Educated at the University of Florence, Papini soon became a literary leader in Florence. He was a founder of an influential Florentine literary magazine, *Leonardo* (1903). During this period he wrote several violently anti-traditionalist works, such as *Il crepuscolo dei filosofi* (1906; "The Twilight of the Philosophies"), in which he expressed disenchantment with traditional philosophies. *Leonardo* was discontinued in 1907, and Papini moved on to the staffs of *L'Anima* and *La Voce.* Then he wrote one of his best known and most frequently translated books, the autobiographical novel *Un uomo finito* (1912; *A Man—Finished;* U.S. title, *The Failure,* both 1924), a candid account of his early years in Florence and his desires for ideological certainty and personal achievement.

Papini had already become an enthusiastic adherent of Futurism (*q.v.*), and he founded another Florentine periodical, *Lacerba* (1913), to further its aims. The magazine lasted two years and he later lost interest in the Futurist movement.

In 1920 Papini was reconverted to the Roman Catholicism in which he had been reared. A number of religious works followed, notably *Storia di Cristo* (1921; *The Story of Christ,* 1923), a vivid and realistic re-creation of the life of Jesus; *Pane e vino* (1926; *Bread and Wine,* 1923), a volume of religious poetry; and *Sant'Agostino* (1929; *St. Augustine,* 1930). Some of his later works were not uncritical of the church, however; for example, *Lettere agli uomini di papa Celestino VI* (1946; *Letters of Pope Celestine VI to All Mankind,* 1948) and *Il diavolo* (1953; *The Devil,* 1954), both of which contained unorthodox views.

Among Papini's many other books (he wrote more than 60) are three early collections of literary essays, the best known of which is *Ventiquattro cervelli* (1912; *Four and Twenty Minds,* 1970), a discussion of major European literary giants including, rather characteristically, an essay on Papini himself. He also published some early poetry and short stories; a biography of Dante, *Dante vivo* (1933; *Dante Living,* 1935), an opinionated but often insightful work that won the Mussolini Prize (Papini had become a fervent Fascist); a *Storia della letteratura italiana* (1937; "History of Italian Literature"); and also a biography (1949) of Michelangelo.

Papinian, Latin in full AEMILIUS PAPINIANUS (b. *c.* AD 140, probably at Emesa, Syria—d. 212), Roman jurist who posthumously became the definitive authority on Roman law, possibly because his moral highmindedness was congenial to the world view of the Christian rulers of the postclassical empire. The most important of his works are two collections of cases: *Quaestiones* (37 books) and *Responsa* (19 books). In the postclassical law schools the third-year students, who were called Papinianistae, used the *Responsa* as the basis of the curriculum. The Law of Citations (AD 426) of the emperor Theodosius II made Papinian predominant among five classical jurists whose works were to be authoritative in legal proceedings. His books were written in precise and elegant Latin.

Papinian held high public office under the emperor Lucius Septimius Severus (reigned AD 193–211). He was killed at the order of Severus' son and successor, Caracalla, perhaps for refusing to supply a legal excuse for the new emperor's murder of his brother and political rival, Geta.

Papinius Statius, Publius: *see* Statius.

papovavirus, any of a group of viruses constituting the family Papovaviridae, responsible for a variety of abnormal growths in animals: warts (papillomas) in humans, dogs, and other animals; tumours (polyomas) in mice; and vacuoles (open areas) in cells of monkeys. The virus particle lacks an outer membrane; is spheroidal, about 45 nanometres (nm; 1 nm $= 10^{-9}$ metre) across; is covered with 42 subunits called capsomeres; and contains deoxyribonucleic acid (DNA). Papovaviruses develop in the nuclei of cells, in which they can be seen in apparent crystalline arrangements.

Papp, Joseph, original name JOSEPH PAPIROFSKY (b. June 22, 1921, Brooklyn, N.Y., U.S.), U.S. theatrical producer and director, founder of the New York Shakespeare Festival and the Public Theatre. He was considered a major innovative force in U.S. theatre in the second half of the 20th century.

Papp studied acting and directing at the Actor's Laboratory Theatre in Hollywood from 1946 to 1948, when he became its managing director. In 1950 he took a position as assistant stage manager of the national touring company of Arthur Miller's *Death of a Salesman.* In 1954, after two years as a stage manager for the CBS television network in New York City, Papp founded the Shakespeare Workshop, which in 1960 became the New York Shakespeare Festival, a unique institution in the New York theatrical milieu. The festival gave free dramatic performances in various locations around the city, including outdoor productions in Central Park. (In 1962 the company received a newly built, permanent home in the park, the Delacorte Theatre.) Papp worked with little or no pay for several years to establish the festival, soliciting foundation grants and municipal support and producing and directing the majority of the plays himself.

In 1967 he founded the Public Theatre, which concentrated on contemporary and experimental dramas. Several of its productions eventually travelled to Broadway, including *Sticks and Bones* (1971), *That Championship Season* (1972), and *A Chorus Line* (1975). (The old Astor Library in Lower Manhattan was "recycled" into a seven-theatre complex to serve as the Public's physical plant.) Papp also served on various public committees concerned with theatre and was an adjunct professor of directing at Yale and Columbia universities.

pappataci fever, also called PHLEBOTOMUS FEVER, THREE-DAY FEVER, or SAND FLY FEVER, acute, infectious, febrile disease caused by a virus and producing temporary incapacitation. It is transmitted by the bloodsucking female sand fly, *Phlebotomus papatasii,* and is prevalent in the moist subtropical countries of the Eastern Hemisphere lying between latitude 20° and 45° N, particularly around the Mediterranean Sea, in the Middle East, and in parts of India. It breaks out in epidemic form during the summer season following the breeding of this species of fly, but the reservoir for the virus between epidemics is unknown. The sand fly becomes infected as a result of biting an infected person when the virus is circulating in the patient's blood; *i.e.,* from 48 hours before until 24 hours after the onset of fever. The virus then requires seven to ten days to incubate, after which the sand fly remains infected for life.

Man becomes infected from the bites of infected female sand flies. The virus multiplies and becomes widely disseminated throughout the body; and within two and one-half to five days after exposure there is suddenly a feeling of lassitude, abdominal distress, and dizziness, followed within one day by a chilly sensation and a rapid rise in temperature during the next day or two to 102°–104.5° F (38.8°–40.3° C). As in dengue, there are severe frontal headache and postorbital pain, intense muscular and joint pains, and a flushed appearance of the face but no true rash or subsequent scaling. During the first day of fever there is an accelerated pulse. Usually after two days the temperature slowly returns to normal; only rarely is there a second episode of fever. Following the febrile period there is great fatigue and weakness, accompanied by slow pulse and frequently subnormal blood pressure. Convalescence may require a few days or several weeks, but the prognosis is always favourable. Treatment is entirely symptomatic.

Sand flies breed in vegetation within a few hundred feet of human habitations. However, these breeding places are difficult to discover, rendering larvicidal control impractical. The bloodsucking females feed only from sunset to sunrise and only at ground level, so that sleeping above the ground floor provides moderately good protection. Ordinary mosquito netting and screening are useless, because unfed female flies can pass through their 18-mesh squares. Insect repellents, such as dimethyl phthalate, when applied to exposed skin, will keep sand flies away for a few hours, but the use of insecticide sprays on verandas, on screens, around doors and windows, and within habitations will readily kill all adult sand flies that alight on the sprayed surfaces.

Pappenheim, Gottfried Heinrich, Graf zu (count of) (b. May 29, 1594, Treuchtlingen, Bavaria [Germany]—d. Nov. 17, 1632, Leipzig), German cavalry commander conspicuous early in the Thirty Years' War.

Pappenheim served with the Catholic League, headed by the elector Maximilian I of Bavaria and commanded by Johann Tserclaes, Graf von Tilly. Idolized by his regiment of cuirassiers, the Pappenheimers, he proved a tempestuous cavalry officer, always charging ahead of his men, frequently wounded, and ruthless. He fought in the Bohemian War of 1620 and for the next two years campaigned in the Rhine against Ernst von Mansfeld, the feared mercenary serving Protestant Bohemia. He then served with the Spaniards in Lombardy and with the Grisons (1623–26). Recalled by Maximilian, he quelled a rebellion of Upper Austrian peasants in 1626 and conquered Wolfenbüttel (1627) in the Danish War. In the Swedish War he showed great courage in storming Magdeburg (1631), skillfully covered Tilly's retreat, and executed independent actions against the Swedes in northwestern Germany. In November 1632 Pappenheim, by this time an imperial field marshal, was mortally wounded while reinforcing Albrecht von Wallenstein's imperial army against the Swedish king at the Battle of Lützen.

Pappus OF ALEXANDRIA (fl. *c.* AD 320), the last great Greek geometer, whose *Synagoge* (*c.* AD 340; "Collection") incorporates a wealth of mathematical writings, many of them no longer available in any other form, but whose efforts to arrest the general decay of mathematics were unsuccessful. The *Synagoge* was made up of eight books, of which the first and part of the second are lost. His other works include commentaries on the *Analemma* (on an astronomical instrument) of Diodorus; on Ptolemy's *Almagest* (the classical astronomical work of his day), *Planisphaerium,* and *Harmonica;* and on Euclid's *Elements.* One of Pappus' own theorems is still cited as the basis of modern projective geometry.

The *Synagoge* contains a systematic account of the most important works in ancient Greek mathematics, with historical annotations, improvements and alterations of existing theorems and propositions, and original material. This work was intended as a guide to be used with the original works. Included are systematic introductions to each book, setting forth clearly the contents and general scope of the topics to be treated.

Book 1 covered arithmetic; the existing fragment of Book 2 sets forth a system of continued multiplication coupled with the expression of large numbers in terms of tetrads (powers of 10,000). Book 3 contains problems in plane and solid geometry, including that of finding two mean proportionals between two given lines. Pappus gave several solutions to this problem, one of them his own, and included a method of approximating continually to a solution, the significance of which he apparently failed to appreciate. The study of the arithmetic, geometric, and harmonic means and the problem of representing all three in one geometric figure served as an introduction to a general theory of means. He distinguished among 10 kinds of means with examples. Book 3 also reveals how each of the five regular polyhedra may be inscribed in a sphere.

Included in Book 4 are various theorems on the circle that circumscribes three given circles tangent to one another. Also considered are certain properties of various curves, including the Spiral of Archimedes, the conchoid of Nicomedes (fl. *c.* 240 BC), and the quadratrix of Hippias of Elis (fl. *c.* 430 BC). Proposition 30 describes the construction of a curve of double curvature called by Pappus the helix on a sphere. The area of the surface included between this curve and its base is found by the classical method of exhaustion equivalent to integration. The rest of the book concerns the trisection of any angle and the solution of problems by means of special curves.

Book 5 concerns the areas of different plane figures and the volumes of different solids; the 13 semiregular polyhedra discovered by Archimedes; and the surface and volume of a sphere.

Book 6 comments on problems of geometry and astronomy treated by Theodosius of Bithynia, Autolycus of Pitane, Aristarchus, and Euclid.

Book 7 explains the terms analysis and synthesis and the distinction between theorem and problem. Also the works of Euclid, Apollonius of Perga, Aristaeus, and Eratosthenes of Cyrene, 33 in all, are enumerated, as well as the famous problem of Pappus, which inspired René Descartes and the theorems rediscovered by and named after Paul Guldin (1577–1643) of Switzerland.

Book 8 deals principally with mechanics; interspersed are some questions on pure geometry.

Pappus' commentary on Euclid's theory of irrational numbers is extant in an Arabic translation and traces the historical development of the theory of irrationals.

paprika, spice made from the pods of *Capsicum annuum,* an annual shrub belonging to the nightshade family, Solanaceae, and native to tropical areas of the Western Hemisphere, including Mexico, Central America, South America, and the West Indies.

C. annuum is cultivated throughout most of the world for its pods, often called chili peppers, or chilies. The species includes most of the sweet peppers and many of the pungent, strong-flavoured types. Depending on the variety, the pods may be 0.5 inch to 1 foot (12.5 mm to 0.3 m) in length, with a long, round, or conical shape, and yellow, brown, purple, or red colour. A spongy central column bears the flat, kidney-shaped seeds.

Crops are planted in early spring and harvested in the summer and fall, when the pods are glossy and ripe. The pods are then dried and ground to produce paprika. When mild paprikas are made, the central core is first removed.

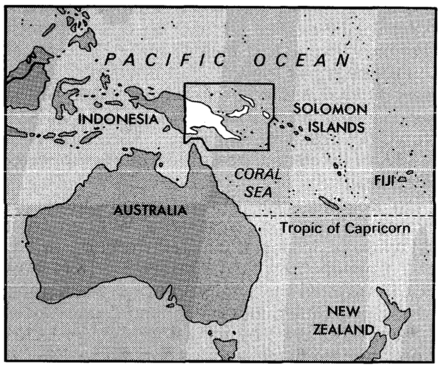
Paprika has some sugar content, varying with the variety, and is richer in vitamin C than the citrus fruits. Pungency is imparted by the nitrogen compound capsaicin, which is usually lower in *C. annuum* than in other plants of the same genus. A colouring agent, oleoresin of paprika, is extracted from the ground pods and used to impart bright red colour to meat and sausage products and to other processed foods.

The rose paprika of Hungary is generally considered the finest variety. It is made from choice dark red pods that have a sweet flavour and aroma. A sharper Hungarian variety, *Koenigspaprika,* or king's paprika, is made from the whole pepper.

Paprika is a popular seasoning in many cuisines. Its bright colour makes it an excellent garnish for nonsweet, light-coloured foods. It is frequently used in the cooking of Spain, Mexico, and the countries of the Balkan Peninsula. It is especially associated with Hungarian cuisine and is essential for such hot, spicy, Hungarian stew dishes as *gulyás* (called goulash in the United States), *pörkölt, paprikás,* and *tokány.*

Papua, Gulf of, inlet of the Coral Sea (southwestern Pacific) indenting the southeast coast of the island of New Guinea. About 225 miles (360 km) wide, it extends 95 miles (150 km) into south-central New Guinea. From west to east it is entered by the Fly, Bamu, Turama, Kikori, Purari, Lakekamu, and Vanapa rivers. Offshore natural gas deposits have been found in the Gulf of Papua.

Papua New Guinea, island country in the southwest Pacific Ocean, encompassing the eastern half of the island of New Guinea and a chain of tropical islands (including the Bismarck Archipelago and Bougainville), covering an area of 178,704 square miles (462,840 square km). The capital is Port Moresby. Papua New Guinea is bounded on the west by Indonesia's half of the island (Irian Jaya) and on the north by the Pacific Ocean, on the east by the Pacific and the Solomon Sea, and on the south by the Coral Sea and Torres



Papua New Guinea

Strait, which separates the island from Australia. The population in 1990 was estimated to be 3,671,000.

A brief treatment of Papua New Guinea follows. For information on regional aspects of Papua New Guinea, *see* MACROPAEDIA: Pacific Islands.

For current history and for statistics on Papua New Guinea's society and economy, *see* BRITANNICA WORLD DATA ANNUAL.

The land. About 85 percent of Papua New Guinea's total land area lies on the island of New Guinea. The terrain ranges from extensive swampy lowland plains in the south and north to high central mountains, the Highlands, which extend from the eastern reaches of the island to Indonesia on the west, rising to 14,793 feet (4,509 m) in Mount Wilhelm. Broad, fertile upland basins lie in the Highlands at elevations of 4,500 feet (1,400 m) or higher. The larger outlying islands, such as Bougainville, New Ireland, and New Britain are predominantly high volcanic types fringed by low-lying coral formations. The lowlands north of the central Highlands are drained by the Sepik River, which flows generally eastward into the Bismarck Sea. The southern marshes and plains are drained eastward into the Gulf of Papua (Coral Sea) by the Fly River. Papua New Guinea lies wholly within the tropics, and its climate is monsoonal. Temperatures are high in most of New Guinea's lowland areas and along the coast, averaging about 81° F (27° C), and much cooler in the Highlands, at about 68° F (20° C). The northwest monsoon season is from December to March; the southeast monsoon season is from May to October. Rainfall usually exceeds 60 inches (1,500 mm) everywhere except in the portion of the south coast in the Port Moresby area. On the southward-facing slopes of the Highlands rainfall frequently exceeds 300 inches (7,600 mm) annually.

More than 70 percent of Papua New Guinea is covered with dense tropical rain forest. The country's soils are generally thin, washed-out, and of low fertility, but some good volcanic and alluvial soils are found in the lowlands and outlying islands. Lowland rain forest is the dominant vegetation cover. The animal life is closely related to that of Australia and includes such marsupials as wallabies and several species of the phalanger family, as well as many tropical birds. There are also many species of nonpoisonous snakes.

Yimas village, East Sepik province, Papua New Guinea

Only about 1 percent of the country's land area is arable, with about half devoted to root crops. Papua New Guinea's extensive mineral resources include copper, gold, silver, and chromite. There are also reserves of petroleum and natural gas.

The people. Papua New Guinea's ethnic composition is extremely complex. There are more than 700 ethnic entities, which can be divided into two large groups: Papuan, comprising more than four-fifths of the total population, and Melanesian, less than one-sixth; the rest are Polynesian, Chinese, and European. Ethnic Papuans live in the interior and southern sections, and Melanesian peoples live in the north and east and in the outlying islands. More than 700 languages, mostly Papuan, are found within the country. English is the official language, although it is spoken by only a small percentage of the population. About half of the populace speak Tok Pisin, a Melanesian pidgin, and a small minority speak Hiri, or Police, Motu; both languages are used as a lingua franca. The majority of the population live in simple villages and practice subsistence agriculture. Although almost three-fifths of the populace are Protestants (the largest portion of which are Lutherans) and nearly a third are Roman Catholics, traditional religious beliefs and rituals are still widely practiced.

More than two-fifths of the population of Papua New Guinea is under 15 years of age. The population density is low, particularly in the vast marshy basins of the Fly and Sepik rivers. A majority of the populace is rural, and the growing urban population amounts to less than one-seventh of the total, about two-thirds of it concentrated in five major cities: Port Moresby, Lae, Madang, Wewak, and Goroka. Birth and death rates are high; infant mortality, though very high, has declined, owing to the expansion of preventive-medical services and malaria-eradication programs, the introduction of maternal and child health services, and general improvements in diet and hygiene. Life expectancy is about 54 years for both sexes.

Economy. Papua New Guinea possesses a developing mixed economy based to a large extent on the export of mineral and agricultural products. The gross national product (GNP) is growing almost as rapidly as the population.

Agriculture accounts for one-third of the GNP and employs about four-fifths of the work force. Most of the population exists primarily in a subsistence, nonmonetarized but largely self-sufficient economy. Yams, taro, sago, and bananas are lowland staples, while the sweet potato is the main highland food. Cash crops grown on plantations and smallholder farms include coffee, cacao, copra, palm oil, tea, and rubber.

Mining, accounting for about one-eighth of the GNP and employing less than 1 percent of the work force, is dominated by gold and copper production, although silver is also mined.

The manufacturing sector accounts for one-tenth of the GNP and is limited by an extremely small internal market and an inadequate infrastructure. Beverages, processed foods, wood products, textiles, metal goods, concrete, and twist tobacco are produced on a small scale. Machinery, transport equipment, food, mineral fuels, and manufactured goods are imported. Electricity is largely generated from imported petroleum. Services, including trade and finance, account for more than one-third of the GNP and employ about one-sixth of the work force. Papua New Guinea offers tax incentives to foreign investors and receives economic aid from Australia. Principal trading partners include Australia, Japan, Germany, and the United States.

Government and social conditions. The 1975 constitution of Papua New Guinea vests executive power in the National Executive Council headed by the prime minister. The prime minister is the leader of the majority party in the single-chamber National Parliament. The British monarch continues to be the nominal head of state and is represented by a governor-general who is a citizen of Papua New Guinea. The Supreme Court is the highest court of appeal.

Hospitals are located in all provinces, and church-related health agencies operate in many rural areas. Major diseases include respiratory infections, gastroenteritis, malaria, and malnutrition. Education in Papua New Guinea is controlled by the government with missions and churches playing an important role. Fees are charged for primary and secondary education. There are teacher-training and vocational schools, as well as technical and secretarial colleges. The country has two universities—the University of Papua New Guinea and the University of Technology, both founded in 1965.

The government encourages revival of traditional dancing styles, craft work, cooking techniques, and folklore. The Papua New Guinea National Museum and Art Gallery has more than 20,000 ethnographic items exhibited.

History. It has been speculated that migrations from Southeast Asia via Indonesia to New Guinea occurred about 50,000 years ago. The earliest people on the island were hunters; agriculture was introduced through later migratory movements. New Guinea, especially the western half, Irian Jaya, was known to Indonesian and Asian seafarers centuries before it was known to Europeans. In 1512 the Portuguese sighted the New Guinea coast but made no landing until 1527. Inigo Ortiz de Retes claimed the island for Spain in 1545, but the first European attempt at colonization was made in 1793 by Lieutenant John Hayes, a British naval officer, near Manokwari, now in Irian Jaya. The Dutch, however, claimed this western half of the island as part of the Dutch East Indies in 1828. John Moresby of Great Britain surveyed the southern coast of the eastern half in the 1870s and by 1884 annexed New Guinea's southeastern quadrant for Britain. In the same year, the German New Guinea Company took over the northeastern quadrant.

In 1906 British New Guinea was passed to Australia, and its name was changed to the Territory of Papua. When World War I broke out in 1914, Australian armed forces occupied German New Guinea, and it was under their administration for the next seven years. In 1921 the League of Nations gave Australia a mandate to govern German New Guinea (except for Nauru and Micronesia). The Japanese invaded New Guinea and part of Papua in 1942; by 1945 the territory had been recovered by Australia. The administration of Papua and the New Guinea mandate was then combined into the Territory of Papua and New Guinea. Dutch New Guinea was annexed to Indonesia in 1969 as the province of Irian Jaya. In December 1973 Papua New Guinea became self-governing; it achieved complete independence from Britain in September 1975, becoming, at that time, a full member of the Commonwealth. Papua New Guinea also maintains observer status in the Association of Southeast Asian Nations. In 1989 secessionist rebels on Bougainville Island closed the island's copper mine, a major source of revenue for the country.

Papuan languages, a group of some 700 languages spoken in an area centred on New Guinea. Some of these languages (350–450 of them) have been shown to be related and are known as the Central New Guinea macrophylum; the remaining 250–350 languages are of doubtful or unknown affiliation.

A brief treatment of the Papuan languages follows. For full treatment, *see* MACROPAEDIA: Languages of the World.

The Papuan languages are spoken in an area centred on New Guinea and extending from the islands of Alor, Halmahera, and Timor in the west to the Santa Cruz Archipelago in the east. The term Papuan was originally used merely to set these languages apart from the Austronesian and Australian languages; they were thought to be unrelated to one another. Since the late 1950s linguistic research has shown that about 350–450 of the Papuan languages constitute the Central New Guinea macrophylum (a macrophylum being a group of languages related less closely than those of a language family or stock). The number of speakers of each language varies from a few hundred to a few thousand, although Enga, numerically the largest language, has more than 160,000 speakers. Even related languages generally show considerable diversity, especially in vocabulary. A few basic grammatical characteristics, however, are shared by many languages. In many instances it is difficult to determine the borderline between languages and dialects, despite the presence of marked differences between two forms of speech. Recent research has resulted in the preliminary classification of most of the Papuan languages. Grammatical and lexical studies have been prepared, and folklore has been collected.

Most Papuan languages show extreme grammatical complexity. Their verbs reflect a wide range of numbers and other features of the subject as well as of the direct and indirect objects and the beneficiary. Verbs also indicate tense, aspect, mood, and the direction and circumstances in which the action that they designate is performed. There are, basically, two major types of verb forms in many Papuan languages. The normal type occurs in sentences in which only one action is referred to; the second, which may be called the special verb form, occurs in sentences which mention more than one action. Many of the languages have gender and noun class systems, some with up to 10 or more classes. Complex variations of adjectives, numerals, demonstratives, and subject and object markers often result, as these words have special forms for each of the various classes of nouns. Tonal systems, in which changes of pitch in words and syllables affect meaning, interact in intricate fashion with patterns of stress and syllable length.

Groups of languages that are more distantly related than those of a family or stock but more closely related than those of a macrophylum are divided into phyla. Apart from the isolates, there are 21 known Papuan phyla. Eight of these are small, with two to six languages each; six constitute the Central New Guinea macrophylum; and three more can tentatively be included in it. The Central New Guinea macrophylum comprises (1) the East New Guinea Highlands phylum, (2) the Finisterre–Huon phylum, (3) the Central and South New Guinea phylum, (4) the West New Guinea Highlands phylum, (5) the South-East New Guinea phylum, and (6) the Madang phylum. The tentative member phyla are (1) the Adelbert Range phylum, (2) the Middle Sepik–Upper Sepik–Sepik Hill phylum, and (3) the Anga stock. Some Papuan languages are difficult to classify because of strong Austronesian influence upon them. Most Papuan languages are of only regional importance, but a few have achieved some cultural significance because of their use as missionary languages.

papyrology, the care, reading, and interpretation of ancient documents written on papyrus, which is of prime importance in Egyptian, Middle Eastern, and Classical archaeology.

Most papyrus documents have been found in Egypt, where the papyrus plant was cultivated for the manufacture of writing material and the dry climate favoured preservation. Papyrus documents have been found dating from as early as about 2600 BC (a blank roll of papyrus, *c.* 3000 BC, was excavated in a 1st-dynasty tomb), and there are important documents from the Hyksos period to the end of the New Kingdom (*c.* 1630–1075 BC)—*e.g.,* the Rhind (mathematical) Papyrus, the Edwin Smith Surgical Papyrus, and the Turin Papyrus (*q.v.*), as well as literary compositions—but the majority of them date from Hellenistic and Roman times (4th century BC–6th century AD) and are written either in Egyptian demotic script, Greek, or Latin. Since they began to be collected in the late 18th and early 19th centuries, they have become an important source of information about the ancient Mediterranean world and an invaluable aid to the study of Classical literature and ancient religions. More than 2,500 papyrus copies of Greek and Roman literary works have been discovered; many of these works were previously unknown, and some were known only from references in ancient authors. One of the most spectacular of these discoveries was a manuscript of Aristotle's *Constitution of Athens,* found by an American missionary in Egypt in 1890. New biblical manuscripts have also come to light, and the papyrus scrolls found in the Dead Sea area since the late 1940s have been an outstanding aid to the study of ancient Judaism and early Christianity.

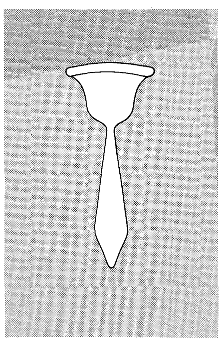
papyrus, writing material of ancient times and also the plant from which it was derived, *Cyperus papyrus* (family Cyperaceae), also called paper plant. The papyrus plant was long-cultivated in the Nile delta region in Egypt and was collected for its stalk or stem, whose central pith was cut into thin strips, pressed together, and dried to form a smooth, thin writing surface.

Paypyrus is a grasslike acquatic plant that has woody, bluntly triangular stems and grows up to 4.6 m (about 15 feet) high in quietly flowing water up to 90 cm (3 feet) deep. The triangular stem can grow to a width of as much as 6 cm (2.5 inches). The papyrus plant is now often used as a pool ornamental in warm areas or in conservatories. The dwarf papyrus (*C. isocladus,* also given as *C. papyrus* 'Nanus'), up to 60 cm (2 feet) tall, is sometimes potted and grown indoors.

The ancient Egyptians used the stem of the papyrus plant to make sails, cloth, mats, cords, and, above all, paper. Paper made from papyrus was the chief writing material in ancient Egypt, was adopted by the Greeks, and was extensively used in the Roman Empire. It was used not only for the production of books (in roll or scroll form) but also for correspondence and legal documents. Pliny the Elder gave an account of the manufacture of paper from papyrus. The fibrous layers within the stem of the plant were removed, and a number of these longitudinal strips were placed side by side and then crossed at right angles with another set of strips. The two layers formed a sheet, which was then dampened and pressed. Upon drying, the gluelike sap of the plant acted as an adhesive and cemented the layers together. The sheet was finally hammered and dried in the sun. The paper thus formed was pure white in colour and, if well-made, was free of spots, stains, or other defects. A number of these sheets were then joined together with paste to form a roll, with usually not more than 20 sheets to a roll.

Papyrus was cultivated and used for writing material by the Arabs of Egypt down to the time when the growing manufacture of paper from other plant fibres in the 8th and 9th centuries AD rendered papyrus unnecessary. By the 3rd century AD, papyrus had already begun to be replaced in Europe by the less-expensive vellum, or parchment, but the use of papyrus for books and documents persisted sporadically until about the 12th century.

papyrus column, in Egyptian religion, amulet that conveyed freshness, youth, vigour, and the continuance of life to its wearer. The amulet, made of glazed ware or various types of stone, was shaped like a papyrus stem and bud. Its significance was perhaps derived from its ideographic value (Egyptian *wadj,* "green, fresh, vigorous"); for, just as the plant itself was vigorous and growing, so also would the wearer of the papyrus column amulet possess these qualities.



Papyrus column

Pará, *estado* ("state") of northern Brazil through which the Lower Amazon River flows to the sea. It is bounded on the north by Guyana, Suriname, and the Brazilian territory of Amapá, on the northeast by the Atlantic Ocean, on the east by the Brazilian states of Maranhão and Tocantins, on the south by Mato Grosso, and on the west by Amazonas. It is the second largest state in Brazil and has an area of 481,871 square miles (1,248,-042 square km). The capital and chief city is Belém.

Belém was founded by the Portuguese in 1615, chiefly to keep other European nations from settling there. Spanish Jesuit missions were the first settlements upstream, including Santarém in 1661; they were finally expelled by the Portuguese in 1710. Pará was made a captaincy in 1652, reunited with Maranhão in 1654, and re-established in 1772. It did not acknowledge the Brazilian Empire established in 1822 but yielded to force in 1823. It became a state when the new Brazilian republic was founded in 1889. Between 1850 and 1910 there was a period of feverish economic activity in the state as workers went out into the forests to tap the rubber trees. Rubber in large quantities was shipped out through Belém, and the city grew rapidly in size and importance. Production dropped quickly after 1910, however.

The dominant physical feature of Pará is the outlet of the Amazon River, which crosses the state for about 500 miles (800 km) from west to east before entering the Atlantic Ocean. The lower Amazon River valley is comparatively narrow, the territory on both sides rising in steep bluffs about 150 to 200 feet (50 to 60 m) above the river to the level of the ancient plateau that once covered this part of the continent. The chief towns in the state are located on the bluffs. To the north rise the Guiana Highlands, and on the south the country rises in forested terraces and is broken by escarpments caused by the erosion of the northern slope of the great central plateau of Brazil.

The state is crossed by the equator, and the climate is equatorial. The average annual temperature is 78° F (26° C), with a range between the coldest and warmest months of between 2° and 3° F (1.1° and 1.7° C). Rainfall, which occurs throughout the year, and humidity are high. Average annual rainfall is more than 59 inches (1,500 mm).

An enormous amount of water pours into the ocean through the state of Pará. The Amazon itself winds about on its floodplain, leaving a maze of abandoned channels in the form of oxbow lakes and an intricate crescentic pattern of levees and swamps. At Óbidos the Amazon's floodplain is scarcely a mile in width, but it opens out again downstream. The Amazon receives the water of several great tributaries, including, from west to east on the southern side, the Tapajóz, the Xingu, and the Tocantins. At the mouth of the Amazon is Marajó Island, as well as several other large islands. Marajó Island is 183 miles (295 km) long and 124 miles (200 km) wide, with an area of 18,519 square miles (47,964 square km). Except for a few patches of savanna, most of the state is covered with dense, tropical rain forest, or selva, with thousands of species of broadleaf evergreen trees. The soil under the selva, where little light reaches the ground, is deeply leached and, when the forest is cleared, quickly loses its capacity to produce crops. The largest land animal of the selva is the tapir; there are many smaller animals, including several species of cat.

Pará's population density is higher than that of the other states (Acre, Amazonas, and Rondônia) and territories (Roraima and Amapá) that make up the northern region of Brazil. The state's population is concentrated in the few cities and towns; the largest is Belém on the Pará River, and others include Santarém on the Tapajóz and Maraba on the Tocantins. There are a few small settlements and trading posts on the principal rivers and tributaries, and there are also plantations and small, scattered groups of Indians. Some groups of Indians are so remote and isolated that well into the second half of the 20th century they still had no contact with modern civilization.

Ethnically the population is composed of people of European, Indian, and mixed European and Indian ancestry. Since the 1930s, Japanese have settled in northern Pará. In Pará, health, education, and welfare programs in the cities are limited; outside the cities they are almost nonexistent.

Belém is the leading educational and cultural centre of northern Brazil. It has a university (founded 1957), a normal school to train teachers, an institute for research on tropical diseases, and an institute specializing in tropical agriculture.

The economy of Pará (*i.e.,* Belém and its environs) is based primarily on the collection and export of forest products, chiefly Brazil nuts, *malvas* (a palm-shaped herb), medicinal herbs, organic oils and insecticides, tropical fruits, and fibres. Since World War II some plantation products have been introduced with considerable success by Japanese colonists, including jute along the Amazon River and black pepper just to the south of Belém and near Santarém in the north. And with the opening and development of the Amazon region, some large foreign companies have located their plants in Pará.

Transportation within the state and externally is almost entirely by water, road, or air. The main port for Amazon River craft as well as for international and coastal shipping is Belém, and the Belém Airport is the principal air facility in northern Brazil.

The construction of the Belém do Pará-Brasília Highway, the Transamazônica Highway running west from Belém to the Peruvian border, and the Cuiaba–Santarém Highway, all of which were built during the 1970s, have led to a new tide of pioneer settlement and resource development in the hitherto most isolated parts of the Amazon Basin. Pop. (1988 est.) 4,617,000.

Pará (city, Brazil): *see* Belém.

para adumma (Judaism): *see* red heifer.

para-aminobenzoic acid (PABA), also called AMINOBENZOIC ACID, a vitamin-like substance and a growth factor required by several types of microorganisms. In bacteria, PABA is used in the synthesis of the vitamin folic acid. The drug sulfanilamide is effective in treating some bacterial diseases because it prevents the bacterial utilization of PABA in the synthesis of folic acid.

PABA is not an essential nutrient for vertebrates, since they do not synthesize their own folic acid. PABA is present in high concentrations in brewer's yeast, and it is perhaps best-known as an ultraviolet screen and as an active ingredient of some sun lotions.

para-aminosalicylic acid (PAS), also called AMINOSALICYLIC ACID, chemotherapeutic drug used in combination with isoniazid or the antibiotic streptomycin to treat tuberculosis. *Para*-aminosalicylic acid (PAS), which is administered orally, is only slightly antituberculotic when used alone. It was introduced in the treatment of tuberculosis in 1946. The use of *para*-aminosalicylic acid in combination with isoniazid or streptomycin helps reduce or delay the development of resistant strains of the tubercle bacillus.

para nut: *see* Brazil nut.

Pará River, Portuguese RIO PARÁ, channel of the Amazon delta that passes to the south and east of Marajó Island, in northeastern Pará state, northern Brazil. It carries a small part of the discharge of the Amazon River eastward and northward to the Atlantic Ocean, off Cape Maguarinho. Its width varies from 5 to 40 miles (8 to 65 km), and its entire 200-mile (320-kilometre) length is navigable. Because it receives the Tocantins River from the south, the Pará is often called an estuary of that river. Belém, the capital of Pará state, lies on the Pará River's right (south) bank, near the mouths of the Guamá and Guajará rivers. The tidal bore of the Amazon is strong on the Pará, reaching 12 feet (4 m) in height.

parable (from Greek *parabolē,* "comparison," or "similitude"), short fictitious narrative by which moral or spiritual relations are set forth. The term originally referred to a Greek rhetorical figure, a kind of extended simile, involving the use of a literary illustration. The parable differs from the fable in the inherent plausibility of its story and in the exclusion of anthropomorphic animals or inanimate creatures, but it resembles it in the essential qualities of brevity and simplicity. The storytelling aspect of a parable is usually subordinated to the analogy it draws between a particular instance of human behaviour and human behaviour at large. The simple narratives of parables give them a mysterious, suggestive tone and make them especially useful for the teaching of moral and spiritual truths. Parables can often be fully understood only by an informed elite, who can discern the meaning within their brief, enigmatic structures.

The most famous parables are in the New Testament; in them, Jesus uses the form to illustrate his message to his followers by telling a fictitious story that is nevetheless true-to-life. There are also parables in the Old Testament (II Samuel 12:1–9; II Samuel 14:1–13), but they have suffered in popularity by comparison with the New Testament ones.

Throughout Christian history, the pious tale or parable has been a popular preaching device. The more paradoxical aspects of the parable were revived in the 19th century through treatises on Christian faith and practice written by the Danish philosopher Søren Kierkegaard. His use of the form influenced the enigmatic works of Franz Kafka and the writings of Albert Camus.

parabola, open curve, a conic section produced by the intersection of a right circular cone and a plane parallel to an element of the cone. As a plane curve, it may be defined as the path (locus) of a point moving so that its distance from a fixed line (the directrix) is equal to its distance from a fixed point (the focus).

The vertex of the parabola is the point on the curve that is closest to the directrix; it is equidistant from the directrix and the focus. The vertex and the focus determine a line, perpendicular to the directrix, that is the axis of the parabola. The line through the focus parallel to the directrix is the latus rectum (straight side). The parabola is symmetric about its axis, moving farther from the axis as the curve recedes in the direction away from its vertex. Rotation of a parabola about its axis forms a paraboloid (*q.v.*).

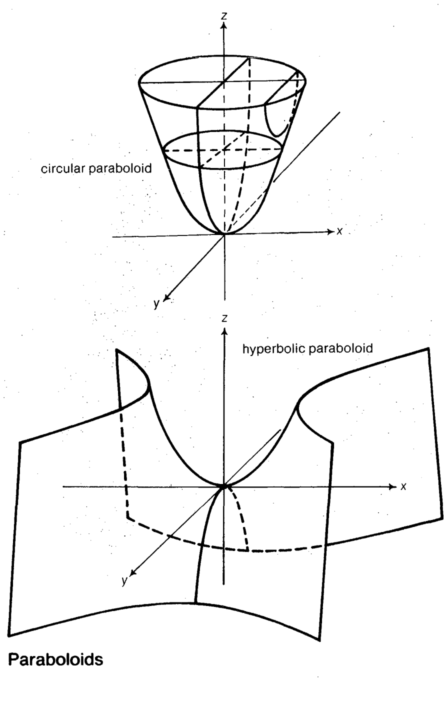
The parabola is the path, neglecting air resistance and rotational effects, of a projectile thrown outward into the air. The parabolic shape also is seen in certain bridges, forming arches.

For a parabola the axis of which is the x axis and with vertex at the origin, the equation is $y^2 = 2px$, in which p is the distance between the directrix and the focus.

parabolic equation, any of a class of partial-differential equations arising in the mathematical analysis of diffusion phenomena, as in the heating of a slab. The simplest such equation in one dimension, $u_{xx} = u_t$, governs the temperature distribution at the various points along a thin rod from moment to moment. The solutions to even this simple problem are complicated, but they are constructed largely from a function called the fundamental solution of the equation, given by an exponential function, $\exp[(-x^2/4t)/t^{1/2}]$. To determine the complete solution to this type of problem, the initial temperature distribution along the rod and the manner in which the temperature at the ends of the rod is changing must also be known. These additional conditions are called initial values and boundary values, respectively, and together are sometimes called auxiliary conditions.

In the analogous two- and three-dimensional problems, the initial temperature distribution throughout the region must be known, as well as the temperature distribution along the boundary from moment to moment. The differential equation in two dimensions is, in the simplest case, $u_{xx} + u_{yy} = u_t$, with an additional u_{zz} term added for the three-dimensional case. These equations are appropriate only if the medium is of uniform composition throughout, while, for problems of nonuniform composition or for some other diffusion-type problems, more complicated equations may arise. These equations are also called parabolic in the given region if they can be written in the simpler form described above by using a different coordinate system. An equation in one dimension the higher-order terms of which are $au_{xx} + bu_{xt} + cu_{tt}$ can be so transformed if $b^2 - 4ac = 0$. If the coefficients a, b, c depend on the values of x, the equation will be parabolic in a region if $b^2 - 4ac = 0$ at each point of the region.

paraboloid, an open surface generated by rotating a parabola (*q.v.*) about its axis. If the axis of the surface is the z axis and the vertex is at the origin, the intersections of the surface with planes parallel to the xz and yz planes are parabolas (*see* Figure, top). The intersections of the surface with planes parallel to and above the xy plane are circles. The general equation for this type of paraboloid is $x^2/a^2 + y^2/b^2 = z$.



Paraboloids

If $a = b$, intersections of the surface with planes parallel to and above the xy plane produce circles, and the figure generated is the paraboloid of revolution. If a is not equal to b, intersections with planes parallel to the xy plane are ellipses, and the surface is an elliptical paraboloid.

If the surface of the paraboloid is defined by the equation $x^2/a^2 - y^2/b^2 = z$, cuts parallel to the xz and yz planes produce parabolas of intersection, and cutting planes parallel to xy produce hyperbolas. Such a surface is a hyperbolic paraboloid (*see* Figure, bottom).

A circular or elliptical paraboloid surface may be used as a parabolic reflector. Applications of this property are used in automobile headlights, solar furnaces, radar, and radio relay stations.

Articles are alphabetized word by word, not letter by letter

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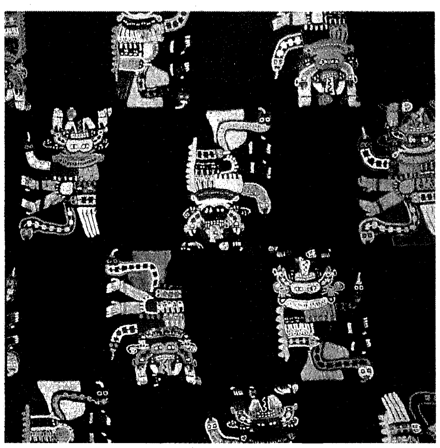
paracanthopterygian, any member of the superorder Paracanthopterygii, a group of bony fishes comprising six orders and containing about 1,160 species. Well-known forms include the anglerfish and the commercially valuable cod, but the toadfish, clingfish, and beardfish also belong to this group.

A brief treatment of the paracanthopterygians follows. For full treatment, *see* MACROPAEDIA: Fishes.

Most paracanthopterygians are found worldwide in oceans; only the trout perch of North America lives solely in freshwater. The codfish, which grows up to 2 m (about 7 feet) long, is the largest species; they may weigh as much as 90 kg (200 pounds). Some goosefish may also reach about two metres in length, with a body weight of 35 kg (75 pounds).

The distinguishing features of paracanthopterygians are a distinctive jaw musculature, the structure of the caudal (tail) vertebrae, and the placement of the pelvic fins in the middle of the body or toward the head. Fossil forms have been found that date from the Cretaceous period (144 million to 66.4 million years ago).

Paracas, culture centred on the peninsula of the same name, located in present-day southern Peru in the vicinity of Ica, during the Early Horizon and the Early Intermediate periods (*c.* 900 BC–AD 400). The Paracas culture's earlier phase, called Paracas Cavernas, is related to the Chavín culture (*c.* 1000–400 BC). The pottery of the period is not well-fired and was sometimes painted after firing. The Paracas cultures of the middle Early Intermediate Period (*c.* AD 1–400) are referred to as the Paracas Pinilla and the Paracas Necrópolis phases. These periods show an improvement in pottery making. The Paracas Necrópolis people were named for and described by the study of cemeteries discovered at Cerro Colorado. The people wrapped the mummified corpses of their deceased, along with funeral offerings, in embroidered cloaks, which are among the finest examples of the art of textile making. The multicoloured designs on these textiles bear a definite relationship to those of painted pottery of the contemporaneous and later Nazca culture. These people also engaged in artificial deformation of the skull by binding the skull in infancy.



Embroidered cloak used to bury the dead, Paracas Necrópolis culture *c.* 200 BC–AD 200; in the Linden-Museum, Stuttgart, Ger.

Ferdinand Anton

Paracel Islands, Wade-Giles romanization HSI-SHA CH'ÜN-TAO, Pinyin XISHA QUNDAO, Vietnamese QUAN DAO HOANG SA, group of about 130 small coral islands and reefs in the South China Sea. They lie about 250 miles (400 km) east of central Vietnam and about 220 miles (350 km) southeast of Hainan Island, China. Apart from a few isolated, outlying islands (Triton in the south, Lincoln in the east), they are divided into the Amphitrite group in the northeast and the Crescent group in the west. The low, barren islands, none of which exceeds 1 square mile (2.5 square km), lack fresh water. Turtles live on the islands, and seabirds have left nests and guano deposits, but there are no permanent human residents.

China, Taiwan, and Vietnam all claim the archipelago. In 1932 French Indochina announced the annexation of the Paracels and established a weather station there. Japan occupied some of the islands during World War II (1939–45) but later withdrew and, in 1951, renounced its claims there. By 1947 Chinese troops occupied Woody Island, the main island of the Amphitrite group. On Prattle Island, the largest of the Crescent group, the original weather station continued to be operated by French Indochina and its successor, Vietnam. With the political separation of the two Chinas and Vietnams, the number of claimants doubled: while the People's Republic of China and South Vietnam actually occupied the islands, Taiwan and North Vietnam declared themselves the heirs of legitimate Chinese and Vietnamese claims. The discovery of oil deposits under the South China Sea led to a crisis early in 1974 when, in reaction to Vietnamese contracts with foreign oil companies, China attacked the islands from sea and air, captured the weather station crew, and assumed control of the entire archipelago. In the 1980s the Paracels, still occupied by China, remained a subject of contention.

Paracelsus, byname of PHILIPPUS AUREOLUS THEOPHRASTUS BOMBASTUS VON HOHENHEIM (b. Nov. 11 or Dec. 17, 1493, Einsiedeln, Switz.—d. Sept. 24, 1541, Salzburg, Archbishopric of Salzburg [now in Austria]), German-Swiss physician and alchemist who established the role of chemistry in medicine. He published *Die grosse Wundartzney* ("Great Surgery Book") in 1536 and a clinical description of syphilis in 1530.

Early life. Paracelsus was the only son of a somewhat impoverished German doctor and chemist. Theophrastus, as he was first called, was a small boy when his mother died; his father then moved to Villach in southern Austria. There the boy attended the Bergschule, founded by the wealthy Fugger family of merchant bankers of Augsburg, where his father taught chemical theory and practice. Youngsters were trained at the Bergschule as overseers and analysts for mining operations in gold, tin, and mercury, as well as iron, alum, and copper-sulfate ores.

The young Paracelsus learned from miners' talk of metals that "grow" in the earth, watched the seething transformations in the smelting vats, and perhaps wondered if he would one day discover how to transmute lead into gold, as the alchemists sought. Thus Paracelsus early gained insight into metallurgy and chemistry that, doubtless, laid the foundations of his later remarkable discoveries in the field of chemotherapy.

Paracelsus, engraving, *c.* 1600

By courtesy of the Musee National Suisse, Zurich, Switz.

In 1507, at the age of 14, he joined the many vagrant youths who swarmed across Europe in the late Middle Ages, seeking famous teachers at one university after another. During the next five years Paracelsus is said to have attended the universities of Basel, Tübingen, Vienna, Wittenberg, Leipzig, Heidelberg, and Cologne but was disappointed with them all. He wrote later that he wondered how "the high colleges managed to produce so many high asses," a typical Paracelsian jibe.

Rejection of traditional education and medicine. His attitude upset the schoolmen. "The universities do not teach all things," he wrote, "so a doctor must seek out old wives, gipsies, sorcerers, wandering tribes, old robbers, and such outlaws and take lessons from them. A doctor must be a traveller, . . . Knowledge is experience." Paracelsus held that the rough-and-ready language of the innkeeper, barber, and teamster had more real dignity and common sense than the dry-as-dust scholasticism of Aristotle, Galen, and Avicenna, the recognized Greek and Arab medical authorities of his day.

Paracelsus is said to have graduated from the University of Vienna with the baccalaureate in medicine in 1510, when he was 17. He was, however, delighted to find the medicine of Galen and the medieval Arab teachers criticized in the University of Ferrara, where, he always insisted, he received his doctoral degree in 1516 (university records are missing for that year). At Ferrara he was free to express his rejection of the prevailing view that the stars and planets controlled all the parts of the human body. He is thought to have begun using the name "para-Celsus" (above or beyond Celsus) at about that time, for he regarded himself as even greater than Celsus, the renowned 1st-century Roman physician.

Clearly a man of this type could never settle for long in any seat of learning, and so, soon after taking his degree, he set out upon many years of wandering through almost every country in Europe, including England, Ireland, and Scotland. He then took part in the "Netherlandish wars" as an army surgeon, at that time a lowly occupation. Later he went to Russia, was held captive by the Tatars, escaped into Lithuania, went south into Hungary, and again served as an army surgeon in Italy in 1521.

Ultimately his wanderings brought him to Egypt, Arabia, the Holy Land, and, finally, Constantinople. Everywhere he sought out the most learned exponents of practical alchemy, not only to discover the most effective means of medical treatment but also—and even more important—to discover "the latent forces of Nature," and how to use them. He wrote:

> He who is born in imagination discovers the latent forces of Nature.... Besides the stars that are established, there is yet another—*Imagination*—that begets a new star and a new heaven.

Height of his career. After about 10 years of wandering, he returned home in 1524 to Villach to find that his fame for many miraculous cures had preceded him. When it became known that the Great Paracelsus, then aged 33, had been appointed town physician and lecturer in medicine at the University of Basel, students from all parts of Europe began to flock into the city. Pinning a program of his forthcoming lectures to the notice board of the university on June 5, 1527, he invited not only students but anyone and everyone. The authorities were scandalized and incensed by his open invitation. Ten years earlier Luther had nailed his Theses on Indulgences to the doors of the Wittenberg Schlosskirche. Later, Paracelsus wrote:

> Why do you call me a Medical Luther? . . . I leave it to Luther to defend what he says, and I will be responsible for what I say. That which you wish to Luther, you wish also to me: you wish us both in the fire.

Three weeks later, on June 24, 1527, surrounded by a crowd of cheering students, he burned the books of Avicenna, the Arab "Prince of Physicians," and those of the Greek physician Galen, in front of the university. No doubt his enemies recalled how Luther, just six and a half years before at the Elster Gate of Wittenberg on Dec. 10, 1520, had burned a papal bull that threatened excommunication. Paracelsus seemingly remained a Catholic to his death, although it has been said that his books were placed on the *Index Expurgatorius.* Like Luther, he also lectured and wrote in German rather than Latin, for he loved the common tongue.

Despite his bombastic blunders, he reached the peak of his tempestuous career at Basel. His name and fame spread throughout the known world, and his lecture hall was crowded to overflowing. He stressed the healing power of nature and raged against those methods of treating wounds, such as padding with moss or dried dung, that prevented natural draining. The wounds must drain, he insisted, for "If you prevent infection, Nature will heal the wound all by herself." He attacked venomously many other medical malpractices of his time and jeered mercilessly at worthless pills, salves, infusions, balsams, electuaries, fumigants, and drenches, much to the delight of his student-disciples.

Paracelsus' triumph at Basel lasted less than a year, however, for he had made too many enemies. By the spring of 1528, he was at loggerheads with doctors, apothecaries, and magistrates. Finally, and suddenly, he had to flee for his life in the dead of night. Alone and penniless he wandered toward Colmar in Upper Alsace, about 50 miles north of Basel. He stayed at various places with friends. Such leisurely travel for the next eight years allowed him to revise old manuscripts and to write new treatises. With the publication of *Die grosse Wundartzney* in 1536 he made an astounding comeback; this book restored, and even extended, the almost fabulous reputation he had earned at Basel in his heyday. He became wealthy and was sought by royalty.

In May 1538, at the zenith of this second period of notoriety, he returned to Villach again to see his old father, only to find that he had died four years previously. In 1541 Paracelsus himself died in mysterious circumstances at the age of 48 at the White Horse Inn, Salzburg, where he had taken up an appointment under the prince-archbishop, Duke Ernst of Bavaria.

Assessment. His medical achievements were outstanding. In 1530 he angered the city council of Nürnberg by writing the best clinical description of syphilis up to that time, maintaining that it could be successfully treated by carefully measured doses of mercury compounds taken internally, thus foreshadowing the Salvarsan treatment of 1909. He stated that the "miners' disease" (silicosis) resulted from inhaling metal vapours and was not a punishment for sin administered by mountain spirits. He was the first to declare that, if given in small doses, "what makes a man ill also cures him," an anticipation of the modern practice of homeopathy. Paracelsus is said to have cured many persons in the plague-stricken town of Stertzing in the summer of 1534 by administering orally a pill made of bread containing a minute amount of the patient's excreta he had removed on a needle point.

He was the first to connect goitre with minerals, especially lead, in drinking water. He prepared and used new chemical remedies, including those containing mercury, sulfur, iron, and copper sulfate, thus first uniting medicine with chemistry, as the first *London Pharmacopoeia,* in 1618, indicates. Paracelsus, in fact, contributed substantially to the rise of modern medicine, including psychiatric treatment. Carl Gustaf Jung, the psychiatrist, wrote of him that "We see in Paracelsus not only a pioneer in the domains of chemical medicine, but also in those of an empirical psychological healing science." (J.G.H.)

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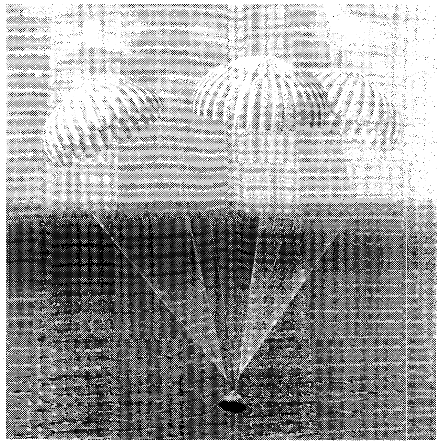
paracetaldehyde (drug): *see* paraldehyde.

parachute, umbrella-like device for slowing the descent of a body falling through the atmosphere. Originally conceived for human use either as a sport or to provide a safe escape from a disabled aircraft, parachutes have found wide employment in war and peace for safely dropping supplies and equipment as well as personnel, and for slowing a returning space capsule after re-entry into the Earth's atmosphere.

The parachute was invented at virtually the same time as the balloon but independently of it. The principle had been recognized by several writers, including Leonardo da Vinci; the first man to demonstrate it in action was Louis-Sébastien Lenormand of France in 1783. Lenormand jumped from a tree with two parasols; a few years later, other French aeronauts jumped from balloons; André-Jacques Garnerin was the first to use a parachute regularly, making a number of exhibition jumps, including one of about 8,000 feet (2,400 metres) in England in 1802.

Early parachutes were made of canvas; later, silk was employed. The first successful descent from an airplane was by Capt. Albert Berry of the U.S. Army in 1912. But in World War I, although parachutes were used with great frequency by observers escaping



Parachutes supporting the Apollo 14 spacecraft as it approached touchdown in the South Pacific Ocean, Feb. 9, 1971

By courtesy of the National Aeronautics and Space Administration

from captive balloons, they were considered impractical for airplanes, and only in the last stage of the war were they finally introduced. In World War II, however, parachutes were extensively employed for a variety of purposes by the Germans, including landing special troops for combat, supplying isolated or inaccessible troops, infiltrating agents into enemy territory, and stabilizing and retarding airborne weapons. With the increased speed of aircraft the ejection seat was developed, which shot the pilot free of the disabled aircraft and automatically opened his chute after he had cleared it.

Modern man-carrying parachutes are made of nylon and assembled in a pack containing the parachute canopy, a small pilot parachute that assists in opening the canopy, and suspension lines, attached to a harness worn by the user. The canopy is given extraordinary strength by fabrication from up to 28 separate panels, or gores, each made of smaller sections, sewn together in such a way that a tear will usually be confined to the section in which it originates. The direction of the weave in each section adds further strength. The pack is fitted to the parachutist's back or front and opened by a ripcord that can be activated manually, by an automatic timing device, or by a line fastened to the aircraft. The harness is so constructed that deceleration, gravity, and wind forces are transmitted to the wearer's body with maximum safety and minimum discomfort.

Several forms of parachute have been developed for special purposes. The ring or ribbon parachute, invented in Germany during World War II, is composed of a number of concentric rings of radiating ribbons of fabric with openings between them that permit some airflow; such a chute has high aerodynamic stability and performs heavy-duty functions well, as in dropping heavy cargo loads or braking aircraft in short landing runs. Gliding parachutes have been designed to take advantage of the natural glide potential of chutes in general through manipulation of the suspension lines.

Parachutes designed for opening at supersonic speeds have radically different contours from conventional canopy chutes; they are made in the form of a cone, with air allowed to escape either through pores of the material or through a large circular opening running around the cone. Still another type, the bal-lute, is closed and becomes inflated by air taken in by special openings in the sides.

To permit escape from an aircraft flying at supersonic speeds, the parachute is designed as part of an assembly that includes the ejection seat. A small rocket charge ejects pilot, seat, and parachute; when the pilot is clear of the seat, the parachute opens automatically.

Sport parachuting, or sky diving, became an international athletic event in the 1950s. A new component, the sleeve, has made sport parachutes, or parafoils, exceptionally safe by drawing the parachutist upright and by making entanglement in the chute impossible. A sport parachute has an airfoil section and can be controlled very accurately.

parachuting: *see* skydiving.

paraclete (religion): *see* Holy Spirit.

parade, a type of pageant (*q.v.*) whose main feature is a public procession.

Parādip, town and major port of east-central Orissa state, eastern India, on the Bay of Bengal. It is situated on the delta of the Mahānadi River at the mouth of one of its branches. The development of Parādip was begun after 1958. In the 1970s it was enlarged and has since become Orissa state's principal port. Pop. (1981) 33,042.

Paradisaeidae (bird family): *see* bird-of-paradise.

paradise, in religion, a place of exceptional happiness and delight. The term paradise is often used as a synonym for the Garden of Eden before the expulsion of Adam and Eve. An earthly paradise is often conceived of as existing in a time when heaven and earth were very close together or actually touching, and when humans and gods had free and happy association. Many religions also include the notion of a fuller life beyond the grave, a land in which there will be an absence of suffering and a complete satisfaction of bodily desires. Accounts of a primordial earthly paradise in the higher religions range from that of a garden of life (Judaism, Christianity, Islām) to that of a golden age of human society at the beginning of each cycle of human existence (Buddhism, Hinduism). A final state of bliss is variously conceived of as a heavenly afterlife (Islām, Christianity), union with the divine (Hinduism), or an eternal condition of peace and changelessness (Buddhism).

In Christianity, paradise is pictured as a place of rest and refreshment in which the righteous dead enjoy the glorious presence of God. In its view of the heavenly afterlife, Islām views paradise as a pleasure garden in which the blessed experience the greatest sensual and spiritual happiness.

paradise, bird of: *see* bird-of-paradise.

paradox, apparently self-contradictory statement, the underlying meaning of which is revealed only by careful scrutiny. The purpose of a paradox is to arrest attention and provoke fresh thought. The statement "Less is more" is an example. Francis Bacon's saying, "The most corrected copies are commonly the least correct," is an earlier literary example. In George Orwell's anti-utopian satire *Animal Farm* (1945), the first commandment of the animals' commune is revised into a witty paradox: "All animals are equal, but some animals are more equal than others." Paradox has a function in poetry, however, that goes beyond mere wit or attention-getting. Modern critics view it as a device, integral to poetic language, encompassing the tensions of error and truth simultaneously, not necessarily by startling juxtapositions but by subtle and continuous qualifications of the ordinary meaning of words.

When a paradox is compressed into two words as in "loud silence," "lonely crowd," or "living death," it is called an oxymoron.

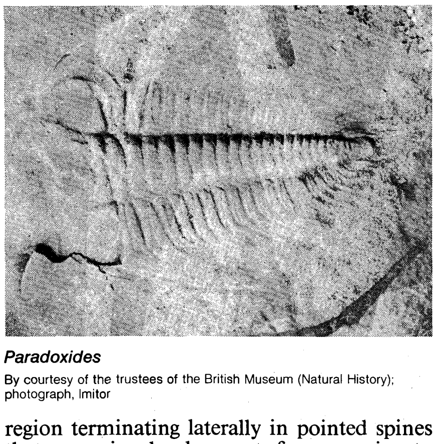
paradoxes of Zeno, statements made by the Greek philosopher Zeno of Elea, a 5th-century-BC disciple of Parmenides, a fellow Eleatic, designed to show that any assertion opposite to the monistic teaching of Parmenides leads to contradiction and absurdity. Parmenides had argued from reason alone that the assertion that only Being *is* leads to the conclusions that Being (or all that there is) is (1) one and (2) motionless. The opposite assertions, then, would be that instead of only the One Being, many real entities in fact are, and that they are in motion (or could be). Zeno thus wished to reduce to absurdity the two claims, (1) that the many are and (2) that motion is.

Plato's dialogue, the *Parmenides,* is the best source for Zeno's general intention, and Plato's account is confirmed by other ancient authors. Plato referred only to the problem of the many, and he did not provide details. Aristotle, on the other hand, gave capsule statements of Zeno's arguments on motion; and these, the famous and controversial paradoxes, generally go by names extracted from Aristotle's account: the Achilles (or Achilles and the tortoise), the dichotomy, the arrow, and the stadium.

The Achilles paradox (*q.v.*) is designed to prove that the slower mover will never be passed by the swifter in a race. The dichotomy paradox is designed to prove that an object never reaches the end. Any moving object must reach halfway on a course before it reaches the end; and because there are an infinite number of halfway points, a moving object never reaches the end in a finite time. The arrow paradox endeavours to prove that a moving object is actually at rest. The stadium paradox tries to prove that, of two sets of objects traveling at the same velocity, one will travel twice as far as the other in the same time.

If, in each case, the conclusion seems necessary but absurd, it serves to bring the premise (that motion exists or is real) into disrepute, and it suggests that the contradictory premise, that motion does not exist, is true; and indeed, the reality of motion is precisely what Parmenides denied.

Paradoxides, genus of trilobites (an extinct group of arthropods) found as fossils in Middle Cambrian rocks of North America and western Europe (the Cambrian Period began 570,000,000 years ago and lasted 70,000,000 years). *Paradoxides* has a well-developed head



Paradoxides

By courtesy of the trustees of the British Museum (Natural History); photograph, Imitor

region terminating laterally in pointed spines that vary in development from species to species; the tail region is poorly developed. The body is well-segmented, and the axial lobe tapers to the minuscule pygidium (tail). Some species of *Paradoxides* attained large size (45 cm, or 18 inches). *Paradoxides* is useful in correlating Middle Cambrian rocks and time.

Paradoxides Series, rocks deposited during the Middle Cambrian Period in western Europe and Scandinavia and in eastern North America (the Cambrian Period lasted from 570 million to 500 million years ago). The Paradoxides Series is characterized by the fossil occurrence of trilobites of the family Paradoxididae and other trilobites, such as the genera *Agnostus* and *Eodiscus.*

paraffin hydrocarbon, also called ALKANE, any of the saturated hydrocarbons having the general formula C_nH_{2n+2}, C being a carbon atom, H a hydrogen atom, and *n* an integer. The paraffins are major constituents of natural gas and petroleum. Paraffins containing fewer than 5 carbon atoms per molecule are usually gaseous at room temperature, those having 5 to 15 carbon atoms are usually liquids, and the straight-chain paraffins having more than 15 carbon atoms per molecule are solids. Branched-chain paraffins have a much higher octane number rating than straight-chain paraffins and, therefore, are the more desirable constituents of gasoline. The hydrocarbons are immiscible with water but are soluble in absolute alcohol, ether, and acetone. All paraffins are colourless.

paraffin oil: *see* kerosine.

paraffin wax, colourless or white, somewhat translucent, hard wax consisting of a mixture of solid straight-chain hydrocarbons ranging in melting point from about 48° to 66° C (120° to 150° F). Paraffin wax is obtained from petroleum by dewaxing light lubricating oil stocks. It is used in candles, wax paper, polishes, cosmetics, and electrical insulators. It assists in extracting perfumes from flowers, forms a base for medical ointments, and supplies a waterproof coating for wood. In wood and paper matches, it helps to ignite the matchstick by supplying an easily vaporized hydrocarbon fuel.

Paraffin wax was first produced commercially in 1867, less than 10 years after the first petroleum well was drilled. Paraffin wax precipitates readily from petroleum on chilling. Technical progress has served only to make the separations and filtration more efficient and economical. Purification methods consist of chemical treatment, decolorization by adsorbents, and fractionation of the separated waxes into grades by distillation, recrystallization, or both. Crude oils differ widely in wax content.

Synthetic paraffin wax was introduced commercially after World War II as one of the products obtained in the Fischer–Tropsch reaction, which converts coal gas to hydrocarbons. Snow-white and harder than petroleum paraffin wax, the synthetic product has a unique character and high purity that make it a suitable replacement for certain vegetable waxes and as a modifier for petroleum waxes and for some plastics, such as polyethylene. Synthetic paraffin waxes may be oxidized to yield pale-yellow, hard waxes of high molecular weight that can be saponified with aqueous solutions of organic or inorganic alkalies, such as borax, sodium hydroxide, triethanolamine, and morpholine. These wax dispersions serve as heavy-duty floor wax, as waterproofing for textiles and paper, as tanning agents for leather, as metal-drawing lubricants, as rust preventives, and for masonry and concrete treatment.

Parafusulina, genus of extinct fusulinid foraminiferans (single-celled animals with a hard, complexly constructed shell) found as fossils in Permian marine rocks (the Permian Period began 286 million years ago and ended 245 million years ago). *Parafusulina* is more specifically restricted to the Leonardian and Guadalupian stages, smaller divisions of Permian rocks and time, and is thus an excellent index, or guide, fossil. The shell is characterized by distinct flutings, and the details of internal structure are best studied in thin section.

paragenesis, the sequence in which the minerals are formed in an ore deposit. Variations in the pressure and temperature and in the chemical constituents of a hydrothermal solution will result in the precipitation of various minerals at different times within the same ore deposit. The general sequence of deposition is gangue minerals (silicates and carbonates) first; oxide minerals next, with the sulfides and arsenides of iron, nickel, cobalt, and molybdenum contemporaneous with or closely following the oxides, and the lead and zinc sulfides following them; and lastly the native metals and tellurides followed by the antimony and mercury sulfides. The paragenesis at any particular location may be complicated if the ore deposit has been formed by more than one period of hydrothermal activity.

paragonimiasis, infection caused by *Paragonimus westermani*, or lung fluke, a parasitic worm some 8 to 12 millimetres (0.31 to 0.47 inch) long. It is common in Japan, Korea, China, the Philippines, and Indonesia and has also been reported in parts of Africa and South America. The worm lives in the lungs of the infected individual, where it produces small cysts with fibrous walls. When a cyst in the lung ruptures, the eggs of the worm are coughed up in the sputum, some of which is swallowed so that the eggs are passed in the feces. Finding their way to water, the eggs hatch into larvae, which then infect water snails. When the larvae emerge from the snails, they enter and infect freshwater crabs and crayfish. Man acquires the infection by eating undercooked crab or crayfish harbouring the fluke larvae. The pulmonary lesions and symptoms resemble those of tuberculosis in many respects. Definitive diagnosis is obtained by finding the fluke eggs in the sputum, which may be bloodstained and purulent. In heavy infestations, lesions may also be found in the liver, skeletal muscle, and brain. Bithionol is an effective drug against the fluke. In the absence of reinfection, gradual recovery takes place after the worms die. Prevention consists of the thorough cooking of shellfish; salting, pickling, or soaking in rice wine is usually not effective in killing the infective larvae.

paragonite, mica mineral similar to muscovite, a basic silicate of sodium and aluminum; a member of the common mica group. It was thought to be an uncommon mineral, but experiment and investigation have shown that it is widespread in metamorphic schists and phyllites, in gneisses, in quartz veins, and in fine-grained sediments. It seems probable that much paragonite has been mistaken for muscovite. Fine-grained paragonite, like muscovite, is called sericite or white mica. For chemical formula and detailed physical properties, *see* mica (table).

Paraguaçu River, Portuguese RIO PARAGUAÇU, river, in central and eastern Bahia state, eastern Brazil, rising in the Chapada Diamantina and flowing northward and then eastward for approximately 300 mi (500 km). It empties into Baía de Todos os Santos (All Saints Bay), just below Maragogipe. The river is navigable from its mouth for only about 25 mi as far as Cachoeira. The region around its upper course yields black industrial diamonds. Principal river towns, apart from Cachoeira, are Andaraí and Itaetê. In the late 1970s the Brazilian government began projects for irrigation, cattle raising, fruit cultivation, and electrification of sites in the Paraguaçu River Valley.

Paraguaná Peninsula, Spanish PENÍNSULA DE PARAGUANÁ, Falcón state, northwestern Venezuela, between the Caribbean Sea on the east and the Golfo de Venezuela on the west. Of low elevation, the peninsula has infertile soil and is sparsely populated, but the development of the petroleum industry, especially in the 1950s and 1960s, has given Paraguaná great economic importance. Pipelines lead from the oil fields at Lake Maracaibo to the large oil refineries at Amuay and Punta Cardón on the western side of the peninsula, where coastal indentations permit easy access by deep-draft tankers. In the 1960s Punto Fijo emerged as the peninsula's major urban centre. Coro (*q.v.*), the state capital, lies at the base of the isthmus linking the peninsula to the mainland and is connected by highways with the oil-refining centres of the peninsula and with Venezuela's principal highland cities.

Paraguarí, department, southern Paraguay, bounded south by Misiones department, and west by Ñeembucú department. The territory, 3,361 sq mi (8,705 sq km) in area, is drained by the Río Tebicuary, a tributary of the Paraguay River, and by Laguna Verá, the nation's largest lake, on the department's western border. Northern Paraguarí contains part of the forested extension of the Brazilian Highlands that reach westward to Asunción, including the Cordillera (mountains) de los Altos, of which Cordillera Ybycurí is the third largest peak in Paraguay at 2,065 ft (630 m) above sea level. Southern Paraguarí consists of rich agricultural lowlands producing tropical subsistence and cash crops. Population is well distributed, and there are many processing and marketing centres. In 1936, 100 Japanese families invited to immigrate by the Paraguay government settled in La Colmena. Near Caapucú, the principal centre of southern Paraguarí, are important iron-ore reserves. The department is served by the main Asunción–Villarrica railway, which passes through Paraguarí (*q.v.*), the departmental capital, and by the Asunción–Encarnación highway. Pop. (1982 prelim.) 205,160.

Paraguarí, capital, Paraguarí department, southern Paraguay. It lies on the southern slopes of the forested extension of the Brazilian Highlands, including la Cordillera (mountains) de los Altos, that reach westward to Asunción. Originally a Jesuit mission, the city was formally organized in 1775. In 1811, when Paraguay stood aside from the Argentine colonies in their revolt against Spain, Paraguarí was the scene of an important battle in which the Argentines were repulsed and Paraguay's independence was secured. Paraguarí is now the commercial and manufacturing centre of a fertile and active agricultural hinterland. Cotton, tobacco, sugarcane, oranges, rice, corn (maize), hides, and petitgrain (a base for perfume made from bitter orange leaves) are among its products. Ceramic works, tanneries, and food-processing plants are located in the area. The city is also the headquarters of Paraguay's artillery regiment and school. Santo Tomás grottoes, on a nearby hill, are noted for their hieroglyphic inscriptions, presumably the work of early indigenous peoples; one long cavern is a centre of Good Friday pilgrimage. Paraguarí is accessible by railway or highway from Asunción, Villarrica, and Encarnación. Pop. (1982 prelim.) 2,724.

Paraguay, officially REPUBLIC OF PARAGUAY, Spanish REPÚBLICA DEL PARAGUAY, landlocked country of south central South America, covering an area of 157,048 sq mi (406,752 sq km). The capital is Asunción. The country lies between latitudes 19° and 28° S (about 616 mi [992 km] from northwest to southeast) and longitudes 54° and 63° W (about 425 mi at its widest from east to west). Paraguay is bordered on the east by Brazil; on the southeast, south, and southwest by Argentina; and on the north and northwest by Bolivia. The population in 1984 was estimated at 3,445,000.

The article that follows is a summary of significant detail about Paraguay. Fuller treatment is provided in the following MACROPAEDIA articles. For geography and history, *see*

Paraguay

Paraguay; for information about the country in its regional setting, *see* South America; for information about regional aspects of Paraguay's history, *see* Latin America, The History of; and about Paraguay's peoples and their traditional cultures, *see* American Indians.

For current history and for statistics on Paraguay's society and economy *see* the article "World Affairs" and BRITANNICA WORLD DATA, respectively, in the *Britannica Book of the Year*.

The land. The Paraguay River, flowing from north to south, divides Paraguay into two distinct geographical regions: the Región Oriental (Eastern Region) and the Región Occidental (Western Region). The Región Oriental, with about 40 percent of the country's land area, is an extension of the Brazilian Plateau; it varies in elevation from about 165 ft (50 m) above sea level at the southwestern corner of the country to a few scattered hills that rise to about 2,500 ft. About 80 percent of the entire country is lower than 1,000 ft in elevation. The Cordillera de Amambay (Amambay Mountains) runs approximately north to south along part of the eastern border with Brazil; it then runs eastward as the Cordillera de Mbaracayú. To the west of these mountains lies the broad valley of the Paraguay River. The Región Occidental (also called Chaco Boreal [Northern Chaco]), which covers about three-fifths of the country, forms the northern part of the hot and semiarid plains of the Gran Chaco, a flat and largely featureless region that also extends into Bolivia and Argentina. Three navigable rivers, the Paraguay in the north, the Alto Paraná in the east and south, and the Pilcomayo in the southwest trace four-fifths of the country's perimeter. These major rivers, providing the country with access to the distant Atlantic Ocean and with sites for hydroelectric power, are of vital importance to the nation's economic life.

Paraguay's climate is subtropical; temperatures range between 77° F (25° C) and 104° F (40° C) in the summer (October–March), and between 50° F (10° C) and 68° F (20° C) in the winter (April–September). The annual average rainfall varies from 67 in. (1,702 mm) in the southeast, to 55 in. along the Paraguay River, and 23 in. in the west. The entire country is subject to periodic floods and droughts, which cause severe agricultural losses.

About two-fifths of the Eastern Region and more than one-half of the Chaco are forested. More than 500 species of hardwood have been identified, including urunday, lapacho, and quebracho. Much of the Chaco is covered by cacti and thorny scrubs. Animals found in

Paraguay include deer, wild pig, jaguar, wolf, fox, armadillo, and anteater.

Although the mineral resources of Paraguay are scarce, the country has great hydroelectric potential. It is estimated that upon completion of hydroelectric projects at Itaipú, Yacyretá-Apipé, and Corpus on the Alto Paraná River, Paraguay will become the largest exporter of electric power in the world.

The people. Paraguay's population had a growth rate of 3.2 percent annually during the 1970s. The general population density is low, although it is distributed unevenly; more than 95 percent of the population lives in the eastern region on less than 40 percent of national territory. The young and dependent age groups are large, with approximately 45 percent of the population under 15 years of age. Ninety-five percent of the population is mestizo (mixed Spanish and Guaraní Indian). There are much smaller groups of Indians, blacks, Caucasians, and Asians living in the Chaco and the forests of eastern Paraguay. Most of the population speaks Spanish and about half of the population is bilingual. Roman Catholics comprise 95 percent of the population; other religious groups include Mennonites and adherents of Eastern religions.

Population growth is encouraged and a relatively high birth rate of close to 37 births per 1,000 population has been achieved. Child abandonment and high maternal mortality, however, are serious and persisting problems. The infant mortality rate is exhorbitant, at 48.6 infant deaths per 1,000 live births. The nation's death rate is approximately 7 deaths per 1,000 population, and life expectancy is approximately 60 years for males and 64 for females. Poor sanitation and malnutrition persist in rural areas and urban slums.

Approximately two-fifths of the population resides in urban areas. Asunción, the capital, has 434,928 inhabitants (1978 est.). Construction of the Itaipú dam has provided impetus for the growth of several new urban settlements. Emigration has slowed since the early 1970s because of an improved economy.

The economy. Paraguay has a developing market economy that is based largely on agriculture, trade and services, and light industries. The dam construction on the Paraná River has stimulated economic growth, and the gross national product (GNP) grew at an annual rate of more than 10 percent between 1976 and 1980. The GNP totalled U.S. $4,110,000,000 in 1980; the GNP per capita, which has grown more rapidly than the population, was $1,340.

Agriculture accounts for nearly one-third of the GNP and employs approximately one-half of the work force. Pastures occupy two-fifths of the land and support more than 5,000,000 cattle and other livestock. The European Economic Community has restricted imports of meat from Paraguay since 1974, with the result that the cultivation and export of cotton and soybeans have expanded rapidly. More than 1,800,000 tons of soybeans are harvested annually. Sugarcane, cassava, and corn (maize) are also important crops. The production of maté (Paraguayan tea) is declining.

Forests cover one-half of the land, and forestry has expanded to meet the growing demand of domestic construction. Sawmills and woodworking industries have benefitted from government restrictions on the export of logs.

The country's limited mining industry accounts for less than 1 percent of the GNP. There are significant deposits of limestone, salt, kaolin, and apatite. Fuels must be imported, and the government is developing a plant to produce alcohol to be mixed with gasoline.

Manufacturing accounts for approximately one-fifth of the GNP and employs some 15 percent of the work force. Manufactures are in large part based on domestic raw materials and include cement, leather, textiles, refined sugar, and lumber. Foreign investment in industry is encouraged by various tax incentives, and tariffs are lowered on imports of certain raw materials and capital goods.

Paraguay has been self-sufficient in electric power since 1976 and exports electricity to Brazil and Argentina. Production of electricity totalled 810,000,000 kW-hr in 1980 and was almost entirely generated from hydroelectric plants.

Paraguay has access to Atlantic shipping via the Paraná River; large vessels navigate the Paraguay River between Asunción and Concepción. All but one-tenth of the country's roads are unpaved.

National revenues ordinarily exceed or equal expenditures, and the government has attempted to minimize expansionary pressures on the money supply resulting from a massive influx of foreign exchange. Revenues are largely derived from various domestic taxes and tariffs; expenditures are chiefly allocated to defense, education, and public works. External public debt has increased more than sixfold since 1970.

Administrative and social conditions. Paraguay is a constitutional republic. The government is highly centralized, with a powerful executive branch. Its constitution, adopted in 1967 and amended in 1977, concentrates executive power in the president, who is directly elected to a five-year term. The president governs with the assistance of the appointed Council of State, an advisory body composed of his own appointed Council of Ministers and representatives of various sectors of society. The president has broad authority, including the power to legislate by decree when Congress is recessed. Regular legislative power is vested in the bicameral Congress consisting of a 60-member Chamber of Deputies and a 30-member Senate. Members are elected concurrently with the president to a five-year term. The party that wins the largest number of votes in the election receives two-thirds of the seats in each chamber. The remaining seats are apportioned among the minority parties on the basis of votes received

Political parties are legally free to organize, but they must be recognized by the executive branch in order to participate in elections, and they are closely regulated. The dominant party is the Colorado Party. The judicial system is headed by the Supreme Court, consisting of five justices appointed by the president. The armed forces total 16,000 men, more than three-quarters of them in the army.

Paraguay's social welfare system provides cash and medical care for sickness, maternity, and work injury; and pensions for old age, invalidism, disability, and loss of support. Although health facilities are improving in number, they remain largely concentrated in urban areas. In the nation at large there are about 14 hospital beds per 1,000 inhabitants, but in rural areas there can be as few as 2 beds per 1,000. Physicians number about 1,300, or 3.6 per 1,000 inhabitants, a ratio that compares unfavourably with most South American countries. Endemic diseases include hepatitis, typhoid, and diptheria. Inadequate shelter during the winter months is the chief cause of persisting influenza, pneumonia, and tuberculosis. Shanty towns have grown up on the outskirts of Asunción to accommodate the growing population of urban migrants.

The literacy rate is a relatively high 90 percent for men and 82 percent for women. Elementary education is free and compulsory between the ages of 7 and 14, however schools are not available in some remote areas. Enrollment of school-aged children in elementary schools is 85 percent, while in secondary schools it is only 20 percent. There are technical and scientific institutes as well as two universities. The National University of Asunción provides free higher education.

Although freedom of the press is guaranteed in the constitution, in practice the press has found it prudent to exercise self-restraint in criticism of the government. The Paraguayan press is relatively young; the oldest existing daily, *La Tribuna*, was founded in 1925. Radio and television, supervised by the state's National Telecommunications Administration, are almost entirely privately owned and commercially operated.

The main characteristic of Paraguayan culture is its fusion of both the Guaraní and Spanish traditions. Folklore, the arts, and literature reflect this dual origin. The country's outstanding handicraft is the production of ñandutí lace, which is thought to represent a combination of 16th-century needlepoint lace-making techniques from Europe with Guaraní traditions.

Paraguay's principal cultural institutions are located in Asunción. There are learned societies concerned with Paraguayan and Guaraní history and culture, as well as various other societies and research institutes. The Normal School of Music, the Conservatory of Music, the National Academy of Fine Arts, and the Asunción Symphony Orchestra are located there. Paraguay has museums of ethnography, natural history, and military history, as well as museums with collections of the work of Paraguayan artists.

History. Indian tribes speaking the Guaraní language occupied the region between the Paraguay and Paraná rivers long before the arrival of Europeans. They were seminomadic peoples practicing agriculture, hunting, and fishing in a land rich in natural resources.

Alejo García, making his way from the Brazilian coast in 1524, and Sebastian Cabot, sailing up the Paraná in 1526, were the earliest European explorers in the area. Domingo Martínez Irala established the first colonial settlement in Asunción in 1537. From this date until the establishment of the viceroyalty of Río de la Plata (1776), Asunción was the centre of Spanish power in southeastern South America. Prior to 1776 the colony was known as a large Jesuit settlement, with more than 30 *reducciones* (Indian missions). Between 1721 and 1735 many landowners waged a struggle to overthrow the Jesuits' monopoly of trade with the Indians. This led to the eventual ouster of the Jesuits in 1767.

The local metropolis of Buenos Aires was made capital of the viceroyalty of Río de la Plata in 1776, and in 1810 the city cast off Spanish rule and attempted to reconstitute the viceroyalty under its own rule. Paraguayans refused to accept rule from Buenos Aires, and sought help from the Portuguese to repulse attacks from the city's junta. The Paraguayan people then disposed of their Spanish governor and declared their independence in 1811.

After a short period of anarchy, José Gaspar Rodríguez Francia, called by the Indians "El Supremo," set up a dictatorship that lasted until 1840. Francia adopted a policy of isolationism in an effort to preserve the homogeneous character of Paraguay and strengthen the nation's spirit of self-reliance. In the two dictatorships that followed, Carlos Antonio López (1840–62) and his son Francisco Solano López (1862–70) abandoned Francia's isolationism, extended education, and opened the country up for trade and development.

Paraguayans feared the aspirations of Brazil and Argentina, and the increasing domination of Uruguay by Brazil eventually sparked a war in 1865. Paraguay attacked Brazil and in doing so violated Argentine territory. The Triple Alliance of Argentina, Brazil, and Uruguay invaded Paraguay. Paraguayan soldiers and citizens fought a tenacious defensive war until 1870. Paraguay was devastated and foreign troops occupied the country for six years.

Political clashes, coups d'etat, and civil wars succeeded one another during the remainder of the century. During World War I Paraguay was neutral, and some economic expansion took place. Tensions over Paraguay's western boundary with Bolivia increased rapidly during the early 20th century. Both countries constructed forts along the border, and sporadic skirmishes over many years led to the Chaco War (1932–35). The peace of 1938 gave Paraguay most of the disputed territory, but Bolivia acquired an outlet to the Paraná River.

Colonel Rafael Franco, leader of the Febristas, seized power in 1936. The government soon fell, however, and General José Félix Estigarribia, hero of the Chaco War, was elected president (1939). Estigarribia died unexpectedly in 1940, and Paraguay was ruled by various dictators until 1954, when General Alfredo Stroessner seized power. Stroessner remained in power until he was overthrown in a military coup in 1989. His eight successive terms as president marked the longest period of unbroken rule by one individual in a Latin-American country in the 20th century. During his rule Paraguay made significant economic progress; inflation was kept low, and health and educational services and the road network were improved. Stroessner's regime, however, engaged in the systematic repression of political opposition.

Consult the INDEX *first*

Paraguay River, Portuguese RIO PARAGUAI, Spanish RÍO PARAGUAY, river, the fifth largest in South America and the principal tributary of the Paraná River. Rising in the Mato Grosso region of Brazil at 980 feet (300 m) above sea level, it crosses Paraguay to empty into the Paraná near the Argentine border; it is 1,584 miles (2,550 km) long.

A brief treatment of the Paraguay River follows. For full treatment, *see* MACROPAEDIA: South America.

The source and upper course of the Paraguay are in Brazil, where it demarcates part of the frontier with Paraguay before entering Paraguay itself, which it traverses from north to south. It then forms the frontier between Paraguay and Argentina for the last 150 miles (240 km) of its course before joining the Paraná River, which then flows into Argentina.

Inaccessible to oceangoing ships, the river is used only for local traffic; steamers from Buenos Aires, capital of Argentina, ply upstream as far as Asunción, the capital of Paraguay. Often flowing through country rife with malaria and other tropical diseases and subject for much of its length to seasonal flooding, the Paraguay River constitutes more of an obstacle than an aid to the development of its basin.

The Paraguay has varying rates of flow between its source and mouth. Above Corumbá (Brazil), the highest rate of flow occurs in February and the lowest rate occurs from July to August. Downstream from Corumbá the highest rate of flow occurs in July and the lowest from December to January. The upper Paraguay (down to Concepción, Paraguay) floods from December to March, while the middle Paraguay (from Concepción to Asunción) floods from May to June. Flooding on the lower Paraguay takes place in February, and the river's flood area exceeds 30,000 square miles (78,000 square km). The predominant climate of the Paraguay drainage basin, which has an area of 380,000 square miles (980,000 square km), is of the hot and humid savanna type, characterized by dry winters and heavy rains in the summer. Forest and grassland are found along the banks of the Paraguay. In the lowlands of eastern Paraguay, forest cover and savanna grasslands alternate. The river's fish population includes the dorado (a fish resembling salmon), the piranha, and the pacu (which resembles bass). The basin is sparsely populated and largely economically underdeveloped. Livestock raising and subsistence agriculture are the principal modes of livelihood. The river has a mean annual discharge of 68,000 cubic feet per second (1,900 cubic m/sec).

Paraguay tea: *see* maté.

Paraguayan War, also called WAR OF THE TRIPLE ALLIANCE (1864–70), the bloodiest conflict in Latin-American history, fought between Paraguay and the allied countries of Argentina, Brazil, and Uruguay.

Paraguay had been involved in boundary and tariff disputes with its more powerful neighbours, Argentina and Brazil, for years. The Uruguayans had also struggled to achieve and maintain their independence from those same powers, especially from Argentina.

In 1864 Brazil helped the leader of Uruguay's Colorado Party to oust his Blanco Party opponent, whereupon the dictator of Paraguay, Francisco Solano López, believing that the regional balance of power was threatened, went to war with Brazil. Bartolomé Mitre, president of Argentina, then organized an alliance with Brazil and Colorado-controlled Uruguay (the Triple Alliance), and together they declared war on Paraguay on May 1, 1865.

López' action, following his buildup of a 50,000-man army, then the strongest in Latin America, was viewed by many as aggression for self- and national aggrandizement; but, as the war wore on, many Argentines and others saw the conflict as Mitre's war of conquest.

At the opening of the war, in 1865, Paraguayan forces advanced through Argentina northward into the Brazilian province of Mato Grosso and southward into the province of Rio Grande do Sul. Logistical problems and the buildup of the allied troop strength, which soon outnumbered Paraguay's by 10 to 1, then forced the Paraguayans to withdraw behind their frontiers. In June 1865, Brazilian naval forces defeated a Paraguayan flotilla on the Paraná River at Riachuelo, near the Argentine city of Corrientes; by January 1866 the allies had blockaded the rivers leading to Paraguay. In April, Mitre led an allied invading force into southwestern Paraguay but was prevented from advancing for two years. Fierce battles were fought; the most notable, won by the Paraguayans at Curupayty in September 1866, inhibited any allied offensive for nearly a year. Both sides suffered heavy losses in the campaign.

In January 1868 Mitre was replaced as commander in chief by the Brazilian marquess (later duke) de Caxias. In February Brazilian armoured vessels broke through Paraguayan defenses at the river fortress of Humaitá, near the confluence of the Paraná and Paraguay rivers, and pressed on to bombard Asunción, the capital. In the Campaign of Lomas Valentinas in December, the Paraguayan army was annihilated. López fled northward and carried on a guerrilla war until he was killed on March 1, 1870.

The Paraguayan people had been fanatically committed to López and the war effort, and as a result they fought almost literally to the last man. The war left Paraguay utterly prostrate; its prewar population of approximately 525,000 was reduced to about 221,000 in 1871, of which only about 28,000 were men. During the war the Paraguayans suffered not only from the enemy but also from malnutrition, disease, and the domination of López, who tortured and killed countless numbers. Argentina and Brazil annexed about 55,000 square miles (140,000 square km) of Paraguayan territory: Argentina took much of the Misiones region and part of the Chaco between the Bermejo and Pilcomayo rivers; Brazil enlarged its Mato Grosso province from annexed territory. They both demanded a large indemnity (which was never paid) and occupied Paraguay until 1876. Meanwhile, the Colorados had gained control of Uruguay, and they retained that control until 1958.

Paraíba, also called PARAHYBA, or PARAHYBA DO NORTE, *estado* ("state") of northeastern Brazil. Primarily an agricultural state, Paraíba is bounded by the states of Rio Grande do Norte on the north, Ceará on the west, and Pernambuco on the south and by the Atlantic Ocean on the east. Its area is 21,765 square miles (56,372 square km). Its chief river, the Paraíba, rises on the Pernambuco border and enters the Atlantic Ocean near the state capital, João Pessoa. The only other large city is Campina Grande, a cotton-shipping centre farther inland.

Paraíba is a name of Tupí Indian origin formed from the words *para* and *hiba,* meaning "arm of the river." The name of the capital was itself formerly Paraíba, but it was changed to honour the memory of a former governor, João Pessoa, a reformist and national vice-presidential candidate whose assassination in 1930 helped spark the revolution that brought Getúlio Vargas to national power in Brazil.

Northeastern Brazil was the first part of the country to become wealthy when, in the 16th century, the Portuguese established the world's first large-scale sugarcane plantations there with African slave labour. Founded on Aug. 5, 1585, as the captaincy of Itamaracá (a captaincy being a kind of fiefdom granted by the Portuguese crown), Paraíba shared in the sugarcane riches of the period; and, because sugar required large investments and cheap labour, economic and political power fell into the hands of a few wealthy landowning families. In the 18th century, cotton, Paraíba's chief product today, was first produced and became a significant export.

Physiographically, Paraíba in the east has a narrow coastland of sandy beaches and dunes off which deep-sea fishermen, or raftsmen, ride the surf on tree-trunk rafts. There is no coastal plain; from this seaboard the land rises abruptly to coastal mesas, which, together with a few inland river valleys, provide the principal wealth of the state—cotton, sugar, and sisal, together with tobacco, corn (maize), cassava, cacao, banana, pineapple, oiticica oil, livestock, and hides. These coastal areas, enjoying dependable rainfall, were once covered by dense tropical forests, but from the early period of plantations on they were cleared for crops and pastures. To the west, behind the zone of coastal mesas, a hilly upland known as the Bordorema Plateau occupies most of the central part of the state. Columbium, tantalum, and a variety of minerals are mined on the plateau, though their economic importance is less than that of agriculture. The plateau is a semi-arid region once covered by deciduous, thorny scrub woodland called caatinga. In the caatinga there are only small areas of forest on the tops of the higher mountains. Generally, though, the area is dry not so much because of a lack of measurable rain as because of the unevenness of the rainfall and the poor drainage. Rain falls in summer and autumn and evaporates quickly or, partly because of man's excessive clearing of the land, runs off the impermeable ground, leaving sandy gullies and pebble-strewn stretches of dry earth. Life in the caatinga country thus depends on irrigation; the federal government has built a number of reservoirs; however, the nature of the hilly land permits irrigated crops to be raised only around the margins of the lakes behind the dams. Finally, Paraíba's farthest western section consists of broad plains—peneplains, or semi-arid flatlands, developed by erosion, with only a few tablelands called *chapadas* remaining from an earlier era.

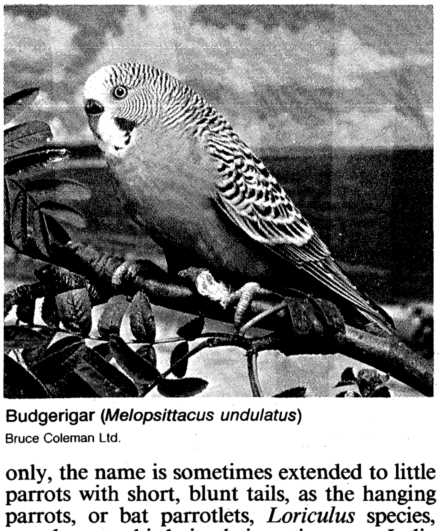
Since the 1960s Paraíba has been developing industrially; two industrial parks in João Pessoa and Campina Grande house a wide range of industries, including clothing, agricultural machinery, cellulose, plastics, soaps, synthetic fibres, stoves, and rubber shoes. The Transamazonica Highway links Cruzeiro do Sul in Acre near the Peruvian border with João Pessoa, passing through Patos and Campina Grande. Other highways crosscut the state to connect it with the rest of Brazil; in the early 1970s power lines brought electrical energy from Pernambuco and distributed it among all the towns of Paraíba.

A university, the Universidade Federal da Paraíba, founded in 1955, has campuses in João Pessoa, Campina Grande, Areia, Bananeiras, Cajazeiras, Sousa, and Patos. Pop. (1984 est.) 2,971,000.

Paraíba do Sul River, Portuguese RIO PARAÍBA DO SUL, river, in eastern Brazil, formed by the junction of the Paraibuna and Paraitinga rivers, east of São Paulo, between Mogi das Cruzes and Jacareí. It flows east-northeastward, receiving tributaries from the Serra da Mantiqueira and the Serra do Mar and forming part of the border between Minas Gerais and Rio de Janeiro states. From its initial elevation of 5,000 ft (1,500 m), the river descends gradually until it reaches São Fidélis, where it emerges through a series of falls to the coastal plain and enters the Atlantic Ocean near São João da Barra after a course of 700 mi (1,100 km).

The Paraíba do Sul has long played a vital role in the social and economic life of Brazil, for its lower course is navigable, and several large cities, including Volta Redonda, are located on its banks. Some of its tributaries, notably the Piraí, have been used for power and irrigation.

parakeet, also spelled PARRAKEET, any of numerous seed-eating parrots of small size, slender build, and long, tapering tail. In this sense the name is given to some 115 species in 30 genera of the subfamily Psittacinae (family Psittacidae) and has influenced another parrot name, lorikeet (*see* parrot). To indicate size



Budgerigar (*Melopsittacus undulatus*)
Bruce Coleman Ltd.

only, the name is sometimes extended to little parrots with short, blunt tails, as the hanging parrots, or bat parrotlets, *Loriculus* species, popular cage birds in their native area, India to Malaya and the Philippines.

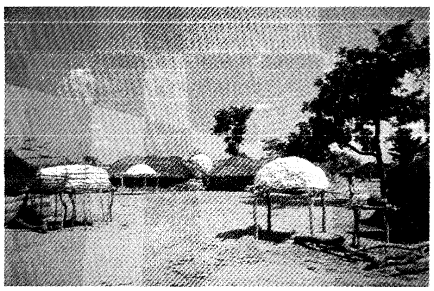
Parakeets occur worldwide in warm regions; they are abundant from India and Sri Lanka to Australia and the Pacific Islands, throughout Southeast Asia, and in tropical America. Typically they form large flocks and may be serious pests in grainfields. Most species lay four to eight eggs in a tree hole. Dozens of colourful kinds are kept as pets. All are highly active and need much room; most are pugnacious—notably when paired—toward other birds; and a few become good, though small-voiced, mimics. Many colour varieties and intergeneric hybrids are known in the wild as well as in aviaries.

The most popular caged parakeet is the budgerigar, or shell parakeet (*Melopsittacus undulatus*). Mistakenly called lovebird, this 19-centimetre (7½-inch) parakeet has hundreds of colour mutations from the green and yellow basic stock; but cheek spots and close barring on the upper parts usually persist. Sexes look alike but may differ seasonally in colour of the cere, the bare skin at the base of the bill. Budgerigars are seed eaters; in the wild, they form large flocks in Australia's grasslands. They breed colonially, in tree holes, laying six to eight eggs twice a year. Most budgerigars are hardy, surviving for 5 to 10 years.

The Australian parakeets, or rosellas, *Platycercus* species, have scalloped backs and underparts, black shoulders, distinctive cheek and throat markings, and long, broad tails that are centrally greenish or bluish with a blue and white margin. The seven species, averaging 26–36 cm (10–14 in.) in length, are also called harrakeets.

The smaller broad-tailed parrots are the five species of *Psephotus,* which have no specific group name. Female rosellas are duller than males. Popular caged birds, rosellas are hardy and prolific but notoriously quarrelsome with other species.

Parakou, town and administrative capital of Borgou province, central Benin (formerly Da-



Cotton harvest near Parakou, Benin
EB Inc.

homey), West Africa. It is the terminus of the so-called Benin–Niger Railway, which was originally planned to extend to the Niger River. The railway runs northward from Cotonou, Benin's major port and commercial centre on the Gulf of Guinea, to Parakou, whence goods must be transported by road to the navigable Niger River and into landlocked Niger. Pop. (1982 est.) 65,945.

Parākramabāhu I, also called PARĀKRAMABĀHU THE GREAT (b. *c.* 1123, Punkhagama, Ceylon—d. 1186, Polonnaruwa), Sinhalese king of Ceylon (1153–86) who united the island under one rule, reformed Buddhist practices, and sent successful expeditionary forces to India and Burma.

The son of Manabharana (one of Ceylon's four regional lords), who controlled the south and who died while Parākrama was still a boy, Parākrama succeeded his father's successor, Siri Megha, the de facto ruler of Ceylon. He won and maintained control only after several battles and counterrevolutions.

Parākramabāhu designed a government of 12 provincial governors, princes, army generals, and leading merchants. He reformed the Buddhist establishment by expelling lax monks and by building new temples. He allowed Hindus freedom of worship.

paraldehyde, also called PARACETALDEHYDE, colourless liquid of disagreeable taste and pungent odour used in medicine as a sedative–hypnotic drug and in chemistry in the manufacture of organic chemicals. When administered as a medicine, it is largely excreted by the lungs and gives an unpleasant odour to the breath. It is most useful for recalcitrant cases and is an older drug for treatment of acute alcoholic dementia.

Paraldehyde is produced for commerce by polymerizing acetaldehyde with a trace of sulfuric acid; the resulting liquid is then neutralized with calcium carbonate and purified by fractional distillation. Paraldehyde boils at 124° C (255° F) and melts at a temperature of 12.5° C (54.5° F).

parallax, in astronomy, the difference in direction of a celestial object as seen by an observer from two widely separated points. The measurement of parallax is used directly to find the distance of the body from the Earth (geocentric parallax) and from the Sun (heliocentric parallax). The two positions of the observer and the position of the object form a triangle; if the base line between the two observing points is known and the direction of the object as seen from each has been measured, the apex angle (the parallax) and the distance of the object from the observer can be found simply.

In the determination of a celestial distance by parallax measurement, the base line is taken as long as possible in order to obtain the greatest precision of measurement. For the Sun and Moon, the base line used is the distance between two widely separated points on the Earth; for all bodies outside the solar system, the base line is the axis of the Earth's orbit. The largest measured stellar parallax is 0.76″, for the nearest star, Alpha Centauri; the smallest that can be directly measured is about 25 times smaller, but indirect methods discussed below permit calculation of the parallax, inversely proportional to the distance, for more and more distant objects but also with more and more uncertainty.

The parallax of the Sun or Moon is defined as the difference in direction as seen from the observer and from the Earth's centre. In Figure 1, let O be the observer on the surface of the Earth, E the centre of the Earth, and M the position of the Moon; then the angle OME is the parallax. This varies with the altitude of the Moon. If the Moon is directly overhead, the parallax is zero, and parallax is greatest when the body is on the horizon. At an angular distance z from the zenith, Z, we find from the triangle OME that $\sin p = a/r \sin z$. When $z = 90°$, $\sin p = a/r$ and this value is called the horizontal parallax or, briefly, the parallax. For all bodies except the Moon, p is so small that it does not differ appreciably from $\sin p$, and it is usually expressed in an-

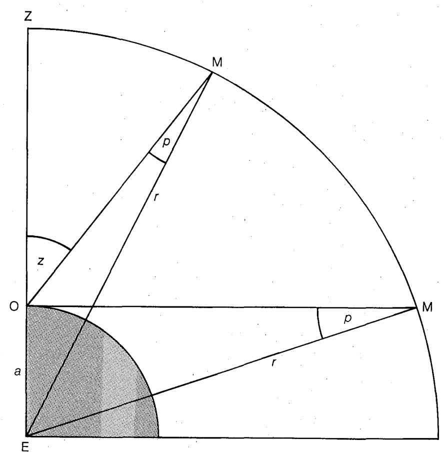


Figure 1: Change of parallactic angle with altitude

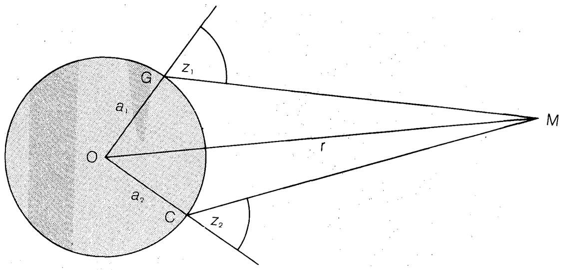


Figure 2: Measurement of parallax by observations from a northern and a southern observatory

gular measure. The definitions of lunar and solar parallax must be further refined because of the spheroidal figure of the Earth. The numerical values generally given are those of the equatorial horizontal parallax. The solar parallax is usually derived from measurements of the positions of other bodies of the solar system.

Lunar parallax. The first parallax determination was for the Moon, by far the nearest celestial body. Hipparchus (150 BC) determined the Moon's parallax to be 58′ for a distance of approximately 59 times the Earth's equatorial radius as compared with the modern value of 57′02.6″; that is, a mean value of 60.2 times. Lunar parallax is directly determined from observations (*see* Figure 2) made at two places, such as G, Greenwich, Eng., and C, the Cape of Good Hope, that are nearly on the same meridian. Angles z_1 and z_2 are observed, and other data are obtained from the latitudes of the observatories and the known size and shape of the Earth. In practice, stars near the Moon are observed also to eliminate errors of refraction and instruments.

Another method rests on a comparison of the force of gravity at the Earth's surface with its value at the Moon. If M and m are the masses of the Earth and Moon, r the mean distance, P the sidereal period of revolution of the Moon about the Earth and k the constant of gravitation, $k(\mathrm{M}+m)=4\pi^2r^3/\mathrm{P}^2$ where $\pi=3.14$. Also, g, the value of gravity at the Earth's surface, determined from pendulum observations, is equal to $k\mathrm{M}/a^2$. Hence

$$\left(\frac{a}{r}\right)^3 = 4\pi^2\frac{\mathrm{M}}{\mathrm{M}+m}\cdot\frac{a}{g\mathrm{P}^2} \qquad (1)$$

As the quantities on the right-hand side are known with great accuracy, a/r is accurately determined as 57′2.7″.

Radar measures of the distance from the Earth to the Moon have provided a recent value of the lunar parallax. Radar ranges have the advantage of being a direct distance measure, although the ranges are affected by variations in the surface topography of the Moon and require assumptions about the lunar radius and the centre of mass.

The International Astronomical Union in 1964 adopted a value of 57′02.608″ for the lunar parallax corresponding to a mean distance of 384,400 kilometres.

Solar parallax. The basic method used for determining solar parallax is the determination of trigonometric parallax. In accordance with the law of gravitation, the relative distances of the planets from the Sun are known, and the distance of the Sun from the Earth can be taken as the unit of length. The measurement of the distance or parallax of any planet will determine the value of this unit. The smaller the distance of the planet from the Earth, the larger will be the parallactic displacements to be measured, with a corresponding increase in accuracy of the determined parallax. The most favourable conditions are therefore provided by the observation, near the time of opposition, of planets approaching close to the Earth. The determination can be based either on simultaneous or nearly simultaneous observations from two different places on the Earth's surface, or on observations made after sunset and before sunrise at the same place, when the displacement of the place of observation produced by the rotation of the Earth provides the base line for the measurements.

The first reasonably accurate determination of the Sun's parallax was made in 1672 from observations of Mars at Cayenne, French Guiana, and Paris, from which a value of 9.5″ was obtained.

Methods depending on velocity of light are also employed to ascertain solar parallax. The value of the velocity of light has been determined with very high precision and may be utilized in several different ways. A direct method is the converse of the procedure of Ole Rømer in the discovery of the velocity of light; *i.e.,* to use the light equation, or time taken by the light to reach us at the varying distances of Jupiter, but great accuracy is hardly obtainable in this way. A second method is by means of the constant of aberration, which gives the ratio of the velocity of the Earth in its orbit to the velocity of light. As aberration produces an annual term of amplitude 20.496″ in the positions of all stars, its amount has been determined in numerous ways. Observations made at Greenwich in the years 1911 to 1936 gave the value 20.489″ ± 0.003″ leading to the value 8.797″ ± 0.013″ for solar parallax.

This method is not free from the suspicion of systematic error.

The velocities of stars toward or away from the Earth are determined from spectroscopic observations. By choosing times when the orbital motion of the Earth is carrying it toward or from a star, astronomers are able to determine mathematically the velocity of the Earth in its orbit. In this way the solar parallax was found from observations at the Cape of Good Hope to be 8.802″ ± 0.004″.

Radar measures of the distance from the Earth to Venus have provided the best determination of the solar parallax. By measuring the flight time of a radar pulse to Venus, the distance between the two planets can be obtained, allowing the determination of the unit distance between the Earth and the Sun.

The present value for the radar astronomical unit is 149,598,000 km ± 200 km, corresponding to a solar parallax of 8.79414″ ± 0.00004″. The principal limitations of the method are its dependence on knowledge of the planetary orbits, the uncertainty in the value of the velocity of light, and the possibility of electromagnetic effects in the Earth–Venus plasma delaying the radar pulse.

Gravitational methods are still another means of determining solar parallax. In lunar theory there is a term of period one month known as the parallactic inequality. The coefficient of the term contains the ratio of the parallaxes of the Sun and Moon as a factor. The coefficient's large size makes it of value.

The ratio of the combined mass of the Earth and the Moon to that of the Sun may be determined from the disturbing action of the Earth and Moon on the elliptic motion of the planets. The ratio of the Moon's mass to that of the Earth is 1/81.30, and thus the ratio of the Earth's mass to that of the Sun is found. In a manner similar to that described above for the Moon's parallax, the solar parallax is then derived.

At the General Assembly of the International Astronomical Union in 1964 the value 8.79405″ (8.794″) for the solar parallax was adopted, corresponding to an astronomical unit of 149,600,000 km.

Stellar parallax. The stars are too distant for any difference of position to be perceptible from two places on the Earth's surface; but, as the Earth revolves at 149,600,000 km from the Sun, stars are seen from widely different viewpoints during the year. The effect on their positions is called annual parallax, defined as the difference in position of a star as seen from the Earth and Sun. Its amount and direction vary with the time of year, and its maximum is a/r, where a is the radius of the Earth's orbit and r the distance of the star (Figure 3). The quantity is very small and never reaches 1/206,265 in radians, or 1″ in sexagesimal measure.

Direct measurement. The introduction of the photographic method by F. Schlesinger in 1903 considerably improved the accuracy of stellar parallaxes. In practice a few photographs are taken when the star is on the meridian shortly after sunset at one period (epoch) of the year and shortly before sunrise six months later. Since the star's positions also change because of its motion across the sky (proper motion), a minimum of three such sets of observations is necessary for obtaining the parallax. From approximately 25 photographs taken over five epochs, the parallax of a star usually is determined with an accuracy of about ± 0.010″ (probable error), even though the diameter of the photographic disk of the star is rarely less than 2.0″.

The unit in which stellar distances are expressed by astronomers, the parsec, is the distance of a star whose parallax is 1″. This is equal to 206,265 times the Earth's distance from the Sun, or approximately 30,000,000,000,000 km. When p is measured in seconds of arc and the distance d in parsecs, the simple relation $d = 1/p$ holds. One parsec is equal to 3.26 light years.

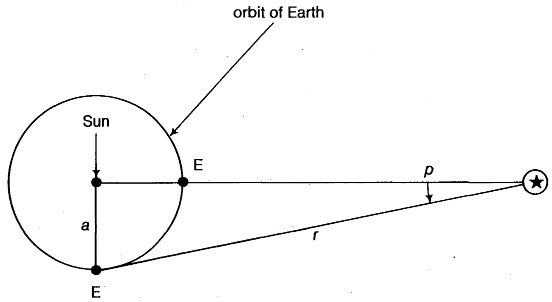


Figure 3: Stellar parallax

The star with the largest known parallax, 0.76″, is Alpha Centauri. Fifty-eight separate stars are known within a distance of five parsecs from the Sun. These stars include the bright stars Alpha Centauri, Sirius, Procyon, and Altair, but the majority are faint telescopic objects.

Indirect measurement. For stars beyond a distance of 30 parsecs (parallactic angle 0.03″), the trigonometric method is in general not sufficiently accurate, and other methods must be used to determine their distances.

The parallax can be derived from the apparent magnitude of the star if there are any means of knowing the absolute magnitude of the star—*i.e.,* the magnitude the star would have at the standard distance of 10 parsecs. For many stars a reasonable estimate can be made from their spectral types or their proper motions. The formula connecting the absolute magnitude, M, and the apparent magnitude, m, with parallax, p, is

$$M = m + 5 + 5 \log p \qquad (2)$$

expressing the condition that the light received from a star varies inversely as the square of the distance.

Some groups of stars, such as the Hyades cluster in Taurus and the Ursa Major cluster, have proper motions converging toward a definite point on the celestial sphere and are called moving clusters. The apparent convergence is due to the effect of perspective on parallel motions. Once the direction toward the convergent point is known, and the proper and radial motion of a member star is known, the parallax can be determined from the geometry.

One method of indirect measurement involves the determination of mean, or average, stellar parallaxes. The solar system is moving through space with a velocity of 19.5 km per second, carrying it four times the Earth's distance from the Sun in one year. This produces a general drift in the angular movement of the stars away from the apex, or point in the sky to which the movement is directed. Were the stars at rest, this would give a ready means of determining their individual distances. As the stars are all moving, the method gives the average distance of a group of stars examined, on the assumption that their peculiar motions are eliminated. In this way the mean parallaxes of stars of successive apparent magnitudes, of different galactic latitudes, and of different spectral types are obtained. Thus the mean parallax of fifth magnitude stars (*i.e.,* of stars just visible to the naked eye) is 0.018″, and of the 10th magnitude stars (*i.e.,* of stars each giving about 1/100 of the light of a star of the fifth magnitude) is 0.0027″.

Stellar parallaxes are also deduced from spectroscopic observations. The spectra of nearly all stars can be grouped into a small number of classes, which form a continuous sequence depending on the effective (surface) temperatures of the stars. The Henry Draper (HD) classification, which is of this kind, uses the letters O–B–A–F–G–K–M to denote classes with temperatures descending from about 30,000 K for class O to about 2,500 K for class M. The HD system has been generally adopted, usually in combination with a decimal subdivision for refined work.

Empirical studies show that the spectra of the stars also include important clues to their true luminosities. In 1914 Walter Adams and Arnold Kohlschütter established the spectroscopic differences between giant and dwarf stars of the same spectral type and laid the foundation for the determination of spectroscopic parallaxes. These differences, depending upon the intrinsic brightness of the star, allow an estimate of its absolute magnitude, and the parallax can then be deduced by means of the equation (2) given above. This method has been applied to most of the brighter stars in the Northern Hemisphere, using stars of known parallax as standards.

A two-dimensional classification system of stellar spectra, which has been universally adopted, has greatly improved the accuracy of spectroscopic parallaxes. The system, called the MK system, assigns a precise system of Draper classes and five luminosity classes, using the Roman numerals I to V. The system divides the majority of stars into supergiants, bright giants, subgiants, and main sequence (dwarf) stars, depending upon their intrinsic brightness, as determined from the spectral lines most sensitive to this property. The luminosity classes are then calibrated in terms of absolute magnitude.

The colours of the stars can also be used as indicators of their absolute magnitude, as first shown by Ejnar Hertzsprung in 1905 and 1907. A measure of the colour of a star is the difference in brightness, measured in magnitudes, in two selected wavelength bands of its spectrum. Initially the difference between the visual and the photographic magnitude of a star was defined as the colour of its light and called its colour index. A comparison between the colour index and the spectral classification of a star has made it possible to develop a quantitative method of measuring a star's absolute magnitude. Several photometric systems have been developed. The most widely used system is the two-dimensional quantitative classification method based upon photoelectric measurements in three wavelength bands in the ultraviolet, blue, and yellow (or visual) regions of the spectrum, hence called the *UBV* system. The system of the two colour indices *U-B* and *B-V* is calibrated in terms of spectral class and luminosity class on the MK system, based upon a set of standard stars. The relationship between the two indices in the *UBV* system and the absolute magnitudes for the main-sequence stars is of particular interest. By means of this relationship and the inverse square law, it is possible to determine the distances to galactic clusters from photoelectric observations of main-sequence stars in these clusters. In other words, such photometric parallaxes are obtained from a comparison of the observed apparent magnitudes of the stars and the absolute magnitudes inferred from their spectral types.

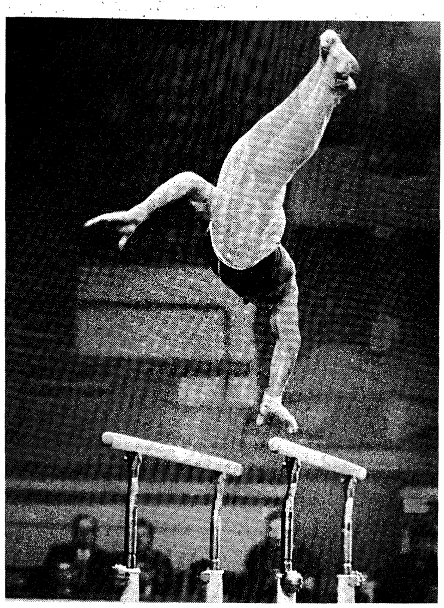
If the relative orbit of a visual binary system is known, the following relation connects the combined mass, M, of the two stars, expressed in the Sun's mass as unit; the orbital period, P, expressed in years, the semimajor axis of the relative orbit; a, expressed in seconds of arc; and the parallax p: $p = a/\sqrt[3]{MP^2}$. Both a and P are known, but not M; it will be noted that an error in the value of M gives rise to a much smaller error in p. Thus, for instance, increasing M by a factor of 8 only halves the value of p. The value of p obtained by assuming the combined mass to be equal to the mass of the Sun is called the hypothetical parallax.

In many visual pairs the complete orbit has not been observed. If s denotes the apparent distance in seconds of arc and ω the relative motion in seconds of arc per year, a hypothetical parallax can be derived from the formula $p = 0.418\sqrt[3]{s\omega^2}$. By use of the relationship between mass and luminosity of a star, it is possible, knowing the spectral type of the star, to derive a correcting factor that will give a more accurate value of the parallax. Parallaxes so determined are called dynamical parallaxes.

(K.A.S./Ed.)

parallel, imaginary line extending around the Earth parallel to the equator; it is used to indicate latitude. The 38th parallel, for example, has a latitude of 38° N or 38° S. *See* latitude and longitude.

parallel bars, gymnastic apparatus invented in the early 19th century by the German Friedrich Jahn, usually considered the father of gymnastics. It is especially useful in improving upper-body strength. The two bars, made of wood, are 0.05 m (2 inches) oval in cross section, 3.5 m (11.5 feet) long, 1.7 m (5 feet 5 inches) high, and 42 to 48 cm (16.5 to 19 inches) apart. Height and width of the bars are usually adjustable. In competitive performances, for men only, movements combine swings, vaults, strength, and balance, although swings and vaults must predominate. Movements below the bars and the release and regrasping of the bars are also required. *See also* uneven parallel bars.



Parallel bars
Stewart Fraser—Colorsport

For winners, *see* Sporting Record: *Gymnastics;* Olympic Games.

parallelism, in rhetoric, component of literary style in both prose and poetry, in which coordinate ideas are arranged in phrases, sentences, and paragraphs that balance one element with another of equal importance and similar wording. The repetition of sounds, meanings, and structures serves to order, emphasize, and point out relations. In its simplest form parallelism consists of single words that have a slight variation in meaning: "ordain and establish" or "overtake and surpass." Sometimes three or more units are parallel; for example, "Reading maketh a full man, conference a ready man, and writing an exact man" (Francis Bacon, "Of Studies"). Parallelism may be inverted for stronger emphasis; *e.g.,* "I have changed in many things: in this I have not" (John Henry Newman, *Apologia pro Vita Sua,* 1864). Parallelism lends wit and authority to the antithetical aphorism; *e.g.,* "We always love those who admire us, but we do not always love those whom we admire" (La Rochefoucauld, *Maximes,* 1665).

Parallelism is a prominent figure in Hebrew poetry as well as in most literatures of the ancient Middle East. The Old Testament and New Testament, reflecting the influence of Hebrew poetry, contain many striking examples of parallelism, as in the following lines from the Psalms: "but they flattered him with their mouths; they lied to him with their tongues" (Psalms 78:36); "we will not hide them from their children, but tell to the coming generation the glorious deeds of the Lord" (78:4).

paralysis, also called PALSY, loss or impairment of voluntary muscular power. For paralysis from psychiatric causes, *see* hysteria.

Most of the commonly encountered diseases that produce paralysis can be divided into two main groups depending on whether they entail structural alterations in nervous or muscular tissue, or lead to metabolic disturbances in neuromuscular function.

Some act in a systematic way and affect one of the three elements in the motor system (upper and lower neuron and muscle) more or less extensively and exclusively. More often, however, one element or neighbouring portions of two of the three elements are involved over a limited extent by a single focal lesion.

The most common cause of hemiplegia (paralysis of the muscles of the lower face, arm, and leg on the side opposite the main lesion) is damage to the corticospinal (pyramidal) tracts and associated motor tracts in one hemisphere of the brain from obstruction (blood clot, or thrombosis) or rupture (cerebral hemorrhage) of a major cerebral artery. Brain tumour is another but less common cause of hemiplegia and develops and increases in severity gradually over a period of weeks or months. When the lesion is in the left hemisphere in a right-handed person, the resulting right hemiplegia is often associated with one of the various forms of aphasia, such as inability to sound words, to write, or to read.

Bilateral hemiplegia with pseudobulbar palsy results from diffuse, bilateral brain disease such as occurs in severe cerebral arteriosclerosis or cerebral vascular syphilis. The terms cerebral palsy and spastic diplegia refer to bilateral hemiplegia resulting from prenatal developmental brain defects or from injury to the brain at birth.

The spinal cord is rarely the site of vascular obstruction or hemorrhage. The more common causes of damage to the pyramidal tracts in the cord include deformities of the spinal column from bone and joint disease and from injury to the spine with fracture and dislocation, spinal cord tumours, and a number of inflammatory and degenerative diseases and changes associated with pernicious anemia. One of the most common causes of progressive spastic paraplegia in persons past middle age is spinal degenerative arthritis, with protrusion of an intervertebral disk cartilage into the lower cervical portion of the spinal canal.

Of the diseases that attack lower motor neurons and result in flaccid paralysis with muscular wasting, the most common are poliomyelitis and polyneuritis, the former affecting the cell bodies of bulbar and spinal motor neurons and the latter affecting their peripheral processes. Bell's palsy is a peripheral neuritis of unknown cause affecting a single nerve trunk—the facial nerve—and resulting in paralysis of all the muscles of one side of the face. In the majority of cases, recovery eventually occurs.

Diseases that result in paralysis through primary changes in muscle tissue are fewer than the above. Of the conditions belonging in this category, progressive muscular dystrophy is the only one apparently confined to the muscles. This is a familial, hereditary disease characterized by progressive, symmetrical muscular weakness and wasting. One rare variety has its onset before puberty, is more common in boys, and usually progresses to severe disability within a few years. It is known as pseudohypertrophic muscular dystrophy. The other types of dystrophy, in general, begin in adolescence or young adult life, and the two sexes are about equally affected. The progress of these other forms is slow; and life expectancy is not necessarily shortened, nor is severe disability inevitable.

Muscular weakness without structural alteration in nerve or muscle tissue may be a symptom of disturbances in metabolism arising from a wide variety of causes. Among such conditions are diseases of the endocrine glands, certain intoxications, and several metabolic defects.

The most common example of a metabolic disorder in neuromuscular function of unknown cause is myasthenia gravis. In this condition there is muscular weakness, without atrophy, which may be mild or severe and either generalized or restricted to a few muscle groups. Some of the muscles innervated by cranial nerves are affected in almost every case. The weakness of myasthenia gravis results from a localized defect in the chemical processes involved in the transmission of impulses from motor nerve endings to muscle fibres. Although the cause of this defect and its precise nature are unknown, several drugs facilitate the transmission of impulses from nerve to muscle. One of these, neostigmine, has proved to benefit most patients but does not correct the basic, unknown defect.

paralysis, infantile: *see* poliomyelitis.

paralysis agitans: *see* Parkinson's disease.

paramagnetism, kind of magnetism characteristic of materials weakly attracted by a strong magnet, named and extensively investigated by the British scientist Michael Faraday beginning in 1845. Most elements and some compounds are paramagnetic. Strong paramagnetism (not to be confused with the ferromagnetism of the elements iron, cobalt, nickel, and other alloys) is exhibited by compounds containing iron, palladium, platinum, and the rare-earth elements. In such compounds atoms of these elements have some inner electron shells that are incomplete, causing their unpaired electrons to spin like tops and orbit like satellites, thus making the atoms a permanent magnet tending to align with and hence strengthen an applied magnetic field.

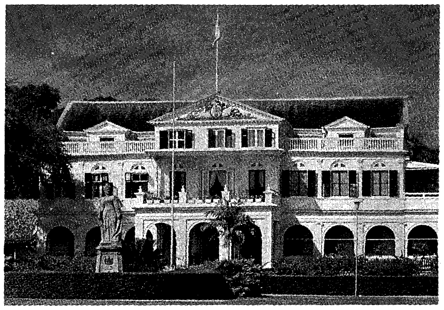
Strong paramagnetism decreases with rising temperature because of the de-alignment produced by the greater random motion of the atomic magnets. Weak paramagnetism, independent of temperature, is found in many metallic elements in the solid state, such as sodium and the other alkali metals, because an applied magnetic field affects the spin of some of the loosely bound conduction electrons. The value of susceptibility (a measure of the relative amount of induced magnetism) for paramagnetic materials is always positive and at room temperature is typically about 1/100,000 to 1/10,000 for weakly paramagnetic substances and about 1/10,000 to 1/100 for strongly paramagnetic substances.

Paramanuchit, also called PARAMANUJITA JINORASA (b. 1791—d. Dec. 9, 1852), prince-patriarch of the Siamese Buddhist church who was a prolific writer on patriotic and moralistic themes in verse and prose. He became abbot of Watphra Jetubon and was later created *krom somdec-phra Paramanujit,* prince-patriarch of the church.

Paramanuchit's masterpiece is the *Taleng Phai* ("The Defeat of the Mons"), the heroic epic of the struggle of King Naresvara of Ayutthaya to liberate his country from Myanmar (Burmese) rule and of his famous single combat with the crown prince of Myanmar in 1590. His concluding section of the *Samuddhaghosa,* a folktale adapted from a collection called the *Paññāsajātaka,* which had been left unfinished since the 18th century, is distinguished for the beauty of its descriptive passages. His prose is equally valued for its eloquence and descriptive power. He also contributed to the collection of literary inscriptions on stone at Watphra Jetubon under the patronage of King Rama III, by writing classic models of Siamese poetry that still remain.

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

Paramaribo, largest town, capital, and chief port of Suriname (formerly Dutch, or Netherlands, Guiana). It lies 9 miles (15 km) from the Atlantic Ocean on the Suriname River. It originated as an Indian village that became a French settlement (*c.* 1640) and was later the site of an English colony planted in 1651 by Lord Willoughby of Parham. In 1667 Paramaribo was one of the settlements ceded to the Dutch under the Treaty of Breda, commencing the period of Dutch colonial rule that was interrupted only by brief periods of British control (1799–1802 and 1804–15). Since World War II the town has grown considerably because of tourism and industries, including paint, margarine, and cement factories and a brewery that makes beer from rice.



Government House, Paramaribo, Suriname
EB Inc.

Paramaribo is built on a shingle reef that stands 16 feet (5 m) above the river at low tide. Access from the sea is limited by a sandbar that allows a depth of about 20 feet (6 m). Much of the distinctive Dutch colonial architecture, as well as a canal system, remains. Paramaribo has the Suriname Museum and an extensive library, as well as the botanic gardens and Government House. Schools include the Anton de Kom University of Suriname (1968), Suriname Agricultural Research Center (1965), and Suriname College of Medicine (1969). The 17th-century Fort Zeelandia is nearby. An international airport, 25 miles (40 km) south, highways, and a railroad serve the town. Pop. (1986 est.) 77,558.

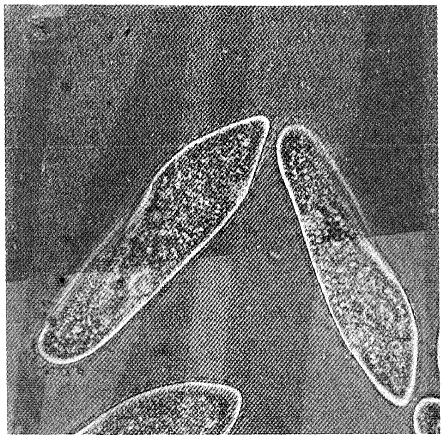
Paramecium, genus of free-living protozoans of the holotrichous order Hymenostomatida. There are at least eight well-defined species; all can be cultivated easily in the laboratory. Although they vary in size, most *Paramecium* species are about the size of the period at the end of this sentence. The basic shape varies, depending on the species: *P. caudatum* is elongated and gracefully streamlined and *P. bursaria* resembles a footprint. The term paramecium is also used to refer to individual organisms in a *Paramecium* species.

These microscopic single-celled organisms are completely covered with fine hairlike filaments (cilia) that beat rhythmically to propel them and to direct bacteria and other food particles into their mouths. On the ventral surface an oral groove runs diagonally posterior to the mouth and gullet. Within the gullet, food particles are transformed into food vacuoles, and digestion takes place within each food vacuole; waste material is excreted through the anus.

A thin layer of clear, firm cytoplasm (ectoplasm) lies directly beneath the flexible body membrane (pellicle) and encloses the inner, more fluid portion of the cytoplasm (endoplasm), which contains granules, food vacuoles, and crystals of different sizes. Embedded in the ectoplasm are spindle-shaped bodies (trichocysts) that may be released by chemical, electrical, or mechanical means. Originally believed to be a defense reaction, they appear to be extruded as a reaction to injury or for use as an anchoring device.

A paramecium has two, occasionally three, contractile vacuoles located close to the surface near the ends of the cell. They function in regulating the water content within the cell and may also be considered excretory structures since the expelled water contains metabolic wastes.

Paramecia have two kinds of nuclei: a large ellipsoidal nucleus called a macronucleus and



Paramecium caudatum (highly magnified)
John J. Lee

at least one small nucleus called a micronucleus. The organism cannot survive without the macronucleus; it cannot reproduce without the micronucleus. The macronucleus is the centre of all metabolic activities and, like the micronucleus, contains genes that bear hereditary information. The micronucleus is necessary for conjugation.

Strictly speaking, the only type of reproduction in *Paramecium* is asexual binary fission in which a fully grown organism divides into two daughter cells. *Paramecium* also exhibits several types of sexual processes. Conjugation (cross-fertilization) consists of the temporary union of two organisms and the exchange of micronuclear elements. Without the rejuvenating effects of conjugation, a paramecium ages and dies. Only mating types, or genetically compatible organisms, can unite in conjugation. *P. aurelia* has 34 hereditary mating types that form 16 distinct mating groups, or syngens (now considered separate species by many authorities). Autogamy (self-fertilization) is a similar process that occurs in one animal. In cytogamy, another type of self-fertilization, two animals join together but do not undergo nuclear exchange.

paramedical personnel, also called PARAMEDICS, health-care workers who provide clinical services to patients under the supervision of a physician. The term generally encompasses nurses, therapists, technicians, and other ancillary personnel involved in medical care but is frequently applied specifically to highly trained persons who share with physicians the direct responsibility for patient care. This category includes nurse practitioners, physician's assistants, and emergency medical technicians. These paramedical workers perform routine diagnostic procedures, such as the taking of blood samples, and therapeutic procedures, such as administering injections or suturing wounds; they also relieve physicians of making routine health assessments and taking medical histories. Paramedical training generally prepares individuals to fill specific health-care roles and is considerably less comprehensive than the education required of physicians.

Paramesvara (Cambodian ruler): *see* Jayavarman II.

parameters, variation of, general method for finding a particular solution of a differential equation by replacing the constants in the solution of a related (homogeneous) equation by functions and determining these functions so that the original differential equation will be satisfied.

To illustrate the method, suppose it is desired to find a particular solution of the equation $y'' + p(x)y' + q(x)y = g(x)$. To use this method, it is necessary first to know the general solution of the corresponding homogeneous equation—*i.e.,* the related equation in which the right-hand side is zero. If $y_1(x)$ and $y_2(x)$ are two distinct solutions of the equation, then any combination $ay_1(x) + by_2(x)$ will also be a solution, called the general solution, for any constants a and b.

The variation of parameters consists of replacing the constants a and b by functions $u_1(x)$ and $u_2(x)$ and determining what these functions must be to satisfy the original nonhomogeneous equation. After some manipulations, it can be shown that if the functions $u_1(x)$ and $u_2(x)$ satisfy the equations $u'_1y_1 + u'_2y_2 = 0$ and $u_1'y_1' + u_2'y_2' = g$, then $u_1y_1 + u_2y_2$ will satisfy the original differential equation. These last two equations can be solved to give $u_1' = -y_2g/(y_1y_2' - y_1'y_2)$ and $u_2' = y_1g/(y_1y_2' - y_1'y_2)$. These last equations either will determine u_1 and u_2 or else will serve as a starting point for finding an approximate solution.

pāramitā, in Mahāyāna ("Greater Vehicle") Buddhism, any of the perfections, or transcendental virtues, practiced by bodhisattvas ("Buddhas-to-be") in advanced stages of their path toward enlightenment. The six virtues are generosity (*dāna-pāramitā*); morality (*śīla-pāramitā*); perseverance (*kṣānti-pāramitā*); vigour (*vīrya-pāramitā*); meditation, or concentration (*dhyāna-pāramitā*); and wisdom (*prajñā-pāramitā*). Some lists expand the virtues to 10 by adding skill in the means of helping others (*upāya* [*kauśalya*]-*pāramitās*), profound resolution to produce enlightenment (*praṇidhāna-pāramitā*), perfection of the 10 powers (*bala-pāramitā*), and practice of transcendent knowledge (*jñāna-pāramitā*).

Paramount Communications Inc., formerly (1958–60) GULF & WESTERN CORPORATION, (1960–86) GULF + WESTERN INDUSTRIES, INC., and (1986–89) GULF + WESTERN INC., one of the largest and foremost communications and media conglomerates in the United States. The present form of the corporation is the result of a transformation from one of the most diverse American corporations into one focusing on the entertainment and publishing fields. Headquarters are in New York City.

Gulf + Western was founded by Charles Bluhdorn, an Austrian immigrant, in 1958. Bluhdorn combined the Michigan Bumper Corporation, founded in 1934, with a Houston automotive-parts manufacturer to form Gulf + Western, intending to make automotive replacement parts on the Gulf Coast and then to ship them west. Bluhdorn began accumulating other companies at a rapid rate, and Gulf + Western developed into a patchwork of mostly unrelated and successful companies.

In addition to motion-picture and television production and distribution, educational and consumer publishing, cable television networks, professional sports teams, and sports facilities, Gulf + Western's other major operating areas included auto-parts supplying, cigar and apparel manufacturing, natural-resource development, paper and building products, and financial services. Gulf + Western also had foreign agricultural and mining interests.

In the early 1980s Gulf + Western began to expand its holdings in the media and communications fields and to sell its unrelated businesses. In 1989 its name was changed to Paramount Communications Inc., reflecting the new concentration on entertainment and publishing. Among the major businesses owned by Paramount Communications are Paramount Pictures Corporation, Madison Square Garden, and Simon and Schuster, Inc.

Paramount Pictures Corporation, one of the first and most successful of the Hollywood motion-picture studios.

Established in 1914 when W.W. Hodkinson's film-distributing firm offered Adolph Zukor's Famous Players Film Company, the Jesse L. Lasky Feature Play Company, and other producers an outlet for their movies, it quickly rose to prominence by featuring such popular stars as Mary Pickford, "Fatty" Arbuckle, and, later, Rudolph Valentino; by introducing the first "big western," *The Covered Wagon* (1923); and by opening branches in Great Britain and France. *The Ten Commandments* (1923; 1956) and *The King of Kings* (1927), biblical epics directed by Cecil B. deMille, were produced under Paramount's auspices. Paramount was declared bankrupt in 1933 but was reorganized two years later. The studio built up a reputation for producing light entertainment with such films as *Going My Way* (1944) and the "road" comedies of Bob Hope, Bing Crosby, and Dorothy Lamour—*e.g., Road to Zanzibar* (1941) and *Road to Rio* (1947).

In the 1950s Paramount introduced VistaVision, a wide-screen process that retained the colour and image clarity of the smaller screen. The company merged with Joseph E. Levine, Inc., in the 1960s. In 1966 Gulf + Western Industries took over control of the corporation. Paramount Pictures became a key element in the restructuring of Gulf + Western from a diverse conglomerate into one focusing on media and communications—a transformation reflected when Gulf + Western changed its name to Paramount Communications Inc. in 1989.

Paraná, city, capital of Entre Ríos *provincia,* eastern Argentina, near the Paraná River, opposite Sante Fe. Founded as a parish in 1730

The Cathedral of Paraná, Arg.
Art Resource—EB Inc.

and formerly called Bajada de Santa Fe, the city had little importance until 1853, when it was made capital of the Argentine Confederation. Until 1862, while Buenos Aires was separated from the confederation, Paraná was the residence of the federal authorities, which boosted its economic, cultural, and population growth. Development was sustained after it was made the provincial capital in 1882.

Because of flood dangers, Paraná (Guaraní Indian for "father of the rivers") stands on high ground 2 miles (3 km) from the riverbank and is linked by rail and road to its port, Bajada Grande. The city has two national historic monuments—the Cathedral of Paraná (1883), which houses the image of Our Lady of the Rosary, and the building of the Senate of the Argentine Confederation (1858). Other notable buildings include the home of General Justo José de Urquiza (Argentina's first president), the Bishop's Palace, and the Museum of Entre Ríos. A base of the Argentine Air Force is located there. Pop. (1980) 161,638.

Paraná, *estado* ("state") of southern Brazil, bounded to the east by the Atlantic Ocean, on the south by the state of Santa Catarina, on the southwest by Argentina, on the west by Paraguay, on the northwest by the state of Mato Grosso do Sul, and on the north and northeast by São Paulo state. Its area is 77,048 square miles (199,554 square km). Paraná, named for the Paraná River (Rio Paraná), which forms its west and northwestern border, has its capital, Curitiba, in the eastern part of the state.

After a century of gradual penetration by bands of Spanish explorers from São Paulo and by Jesuit missionaries, the territory of the present state was occupied, to a large extent, by the forces of a Portuguese emissary, Gabriel de Lara, in the 1640s. Gold was discovered at several locations in the 17th century and attracted settlers. Eventually recognized as belonging to Portugal's sphere of influence, rather than Spain's, the territory was attached at first to the captaincy of São Paulo and subsequently to the province of the same name. Paraná became a separate province of the Brazilian Empire in 1853 and later a state of the Brazilian Republic in 1891.

Paraná can be divided into five topographic zones, each running approximately northeast to southwest. Proceeding westward there is the coastal region, fringed with dunes and mangrove swamps and backed by the high mountain ranges of the Serra do Mar to the west. The Serro do Mar, rising to the peak of Serra da Graciosa (6,193 feet [1,888 m]), forms a watershed between the coastal region and the first of the three successive plateaus farther westward, each lower than the one before. The first plateau, which lies at a height of between 2,700 and 3,000 feet (800 and 900 m) above sea level, is formed mainly of crystalline rock. On the western side of the first plateau, a cuesta (an escarpment with a steep slope on one side and a gentle slope on the other) rising to heights of from 3,500 to 3,800 feet (1,050 to 1,150 m) marks the beginning of the second plateau. A basaltic scarp with a maximum elevation of 3,800 feet rises at the western border of the second plateau, forming the eastern edge of the third plateau, which slopes westward and downward until it reaches the fringes of the Paraná River.

Three major rivers cross the second and third plateaus. Two of them, the Iguaçu and the Ivaí rivers, flow westward and are immediate tributaries of the Paraná River. The third major river is the Tibagi, which flows northward to join the Paranapanema River tributary of the Paraná. The Paraná River borderland (comprising the fifth topographic zone) has low elevations and steep gullies and is dominated by rain forest.

Paraná state, the northern region of which crosses the Tropic of Capricorn, has a moderately warm climate. Winters are dry in the northwest, while other parts receive adequate precipitation throughout the year. Summers are hot in the lower elevations and cooler—below 72° F (22° C)—at the higher elevations. On the coast the annual mean temperature is 70° F (21° C) at Paranaguá, and the rainfall reaches 81 inches (2,057 mm) annually, with the largest amounts falling in January and February.

Dense tropical rain forest extends along certain tracts of the Atlantic coast and over the uplands into the Paraná River borderland. Some areas of the state consist of treeless savanna, and there are localized bushlands.

The people of the state are largely of Portuguese-Brazilian descent. After the Portuguese, waves of other immigrants began to arrive as labourers and businessmen; these included Poles, Ukrainians, Italians, Germans, Arabs, Dutch, and Japanese. The common language is Portuguese, and the principal religion is Roman Catholicism.

The state is responsible for primary and secondary education. Among the institutions of higher learning are the Federal University of Paraná and the Catholic University of Paraná, both located in Curitiba.

Paraná is one of the richer states of Brazil. Intensively developed plantations have made Paraná one of Brazil's chief producers of coffee, the most important centres for this crop being Umuarama, Rondon, and Londrina. Other important crops are Indian or Paraguay tea (maté), cotton, peanuts (groundnuts), and ramie (a strong, lustrous fibre capable of being spun or woven). Lumbering is also economically important.

Corn (maize) is grown for the most part around Ivaiporã, Rondon, and Toledo; rice, cassava, potatoes, beans, oats, rye, barley, and wheat are cultivated quite widely, as are garlic, onions, tomatoes, and soybeans. Sugarcane is grown mainly around Porecatu. Fruit production includes oranges, bananas, grapes, and pineapples.

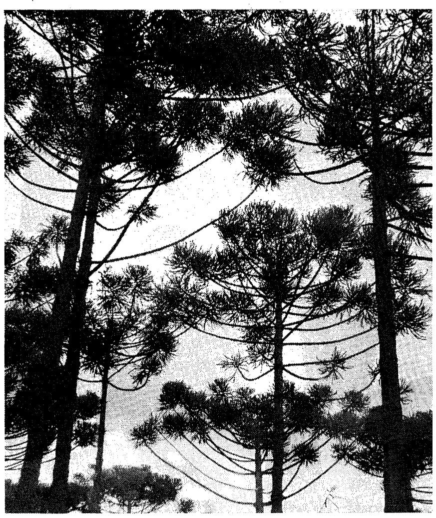
Paraná's livestock herds have been much enlarged and improved with help from government agencies. Pigs, sheep, cattle, and horses are raised. Dairy products and wool are marketed from the northern and eastern parts of the state.

In addition to a regular output of dolomite (a type of limestone or marble), lead, iron, talc, and lime, Paraná produces coal from Venceslau Brás and cement from Rio Branco do Sul.

The main railroad in Brazil from São Paulo to the south traverses the eastern half of Paraná state; an important branch line from Ponta Grossa serves Curitiba and the Atlantic ports. Highways link the state with São Paulo to the north and Santa Catarina to the south. The rivers are generally navigable only for limited distances. Paranaguá and Antonina are the chief seaports, and Curitiba and Londrina the chief airports.

Several towns have public libraries, the most notable at Curitiba. The theatre at Guaíra, the best known in the state, is widely known in South America; its architecture is in the modern style. Pop. (1988 est.) 8,308,000.

Paraná pine, also called BRAZILIAN PINE, or CANDELABRA TREE (*Araucaria angustifolia*), an important evergreen timber conifer of the family Araucariaceae, native to the mountains of southern Brazil. The Paraná pine grows to 30 m (100 feet) high and bears branches in a circle about the stems. As the tree matures,



Paraná pine (*Araucaria angustifolia*)
E. Aubert de la Rue

the lower branches drop off, leaving a long, bare trunk with a crown of upturned branches tufted at the ends.

Paraná Plateau, lava plateau, one of the world's largest, lying mostly in Rio Grande do Sul and São Paulo states, southern Brazil. Its formations of solidified sheets of lava rock (diabase) also appear in Uruguay, Argentina, and Paraguay. Where the diabase is exposed at the surface, it weathers into a well-drained, dark purple soil known as *terra roxa,* famous as a producer of coffee. Other crops grown there include *feijão* (beans), corn (maize), rice, cotton, and potatoes. The plateau is dissected by rivers, between which the surface is flat-topped.

Paraná River, Portuguese RIO PARANÁ, Spanish RÍO PARANÁ, river of South America, the second longest after the Amazon, rising on the plateau of southeast-central Brazil and flowing generally south to the point where, after a course of 3,032 miles (4,880 km), it joins the Uruguay River to form the extensive Río de la Plata estuary of the Atlantic.

A brief treatment of the Paraná River follows. For full treatment, *see* MACROPAEDIA: South America.

The Paraná River's drainage basin, with an area of about 1,081,000 square miles (2,800,000 square km), includes the greater part of southeastern Brazil, Paraguay, eastern Bolivia, and northern Argentina. From its origin at the confluence of the Grande and Paranaíba rivers to its junction with the Paraguay, the river is known as the Alto (Upper) Paraná. This upper course has three important tributaries, namely the Tietê, the Paranapanema, and the Iguaçu, all three having their sources near the Atlantic coast in southeastern Brazil. The Alto Paraná's passage through the mountains was formerly marked by the Guaíra Falls; this series of massive waterfalls was completely submerged in the early 1980s by the reservoir of the newly built Itaipú dam complex, which spans the Paraná River.

From its confluence with the Iguaçu River to its junction with the Paraguay River, the Alto Paraná continues as the frontier between Paraguay and Argentina. When it is joined by the Paraguay, it becomes the lower Paraná and commences to flow through only Argentine territory. Near Santa Fé, the lower Paraná receives its last considerable tributary, the Salado River. Between Santa Fé and Rosario the delta of the Paraná begins to form, being 11 miles (18 km) wide at its upper end and 40 miles (65 km) wide at its lower end. Within the delta the river divides again and again into distributary branches, the most important being the last two channels formed, the Paraná Guazú and the Paraná de las Palmas.

The volume of the lower Paraná River is dependent on the amount of water it receives from the Paraguay River, which provides about 25 percent of the total; the Paraná's annual average discharge is 610,740 cubic feet per second (17,290 cubic metres per second). The basin of the Alto Paraná has a hot and humid climate all the year round. The winters are dry and summers are rainy. The middle and lower basins have a subtropical climate of temperate humidity, with less plentiful rainfall but without seasonal differences. The Alto Paraná has two zones of vegetation, forests to the east and savanna to the west. Forests continue along the Paraná downstream to Corrientes, where the savanna begins to dominate both banks. The Paraná River has a rich and varied animal life that includes many species of edible fish. Much of the Paraná basin is economically unexploited. The main dam of the huge Itaipú project on the Paraná River was completed in 1982 and had a power generating capacity of 12,600 megawatts. The lower river is a transport route for agricultural products, manufactured goods, and petroleum products, and its waters are used for irrigation of the adjacent farmlands.

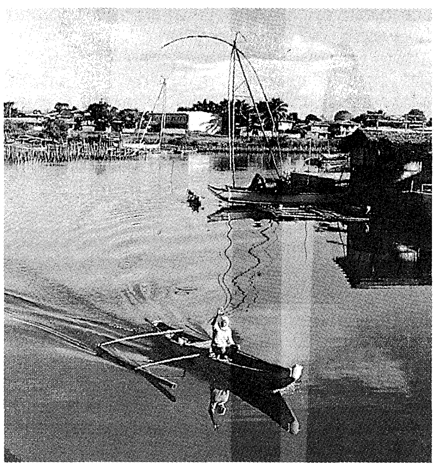
Paranaguá, port, southeastern Paraná *estado* ("state"), Brazil, on Paranaguá Bay, at the foot of the coastal Serra do Mar, 18 mi (29 km) from the open Atlantic. It was founded in 1585 by Portuguese explorers. Surviving colonial landmarks include the fort of Nossa Senhora dos Prazeres (1767), the Baroque Museum of Archaeology and Popular Art (formerly the Colegio dos Jesuitas), the São Benedictus church, and a 17th-century fountain.

By the mid-20th century Paranaguá had become Brazil's largest coffee-exporting port as well as the chief port (hides, paper, maté [tea], *feijão* [beans], cotton, plywood, bananas, sugar) of Paraná state. An oil terminal was built there in the late 1970s. Paranaguá is linked to Curitiba, the state capital (65 mi inland), by rail and highway and serves as a free port for Paraguay. Pop. (1980 prelim.) 68,366.

Paranaíba River, Portuguese RIO PARANAÍBA, south central Brazil, rising on the western slopes of the Serra da Mata da Corda and flowing west-southwestward for about 600 mi (1,000 km); it collects eight sizable tributaries along its course to join the Grande River and form the Paraná River. The river constitutes the border between Minas Gerais and Goiás states and briefly separates Minas Gerais from Mato Grosso do Sul state. Diamond washings are along its course. In the late 1970s, the Brazilian government began irrigation projects in the Paranaíba River Valley for cattle raising and cultivation of sugarcane, rice, corn (maize), cassava (for alcohol production), vegetables, *feijão* (beans), peanuts (groundnuts), bananas, and cotton. A hydroelectric plant was built at São Simão, about 60 mi north of the junction of the Paranaíba and Araguaia rivers.

Paranapanema River, Portuguese RIO PARANAPANEMA, river, rising south of São Paulo in the Serra do Paranapiacaba, southeastern Brazil, and flowing in a west-northwesterly direction for 560 mi (900 km) before entering the Paraná River at Pôrto São José. After receiving the Itararé, it forms part of the São Paulo–Paraná state border. There are numerous rapids along its course, which is navigable only for the last 50 mi. Dam-flood control projects are near Piraju and Jacarèzinho. Coffee and cotton are grown in the river basin, which occupies part of the fertile Paraná Plateau. Tributaries include the Rio das Cinzas and Rio Tibagi, the latter having an important hydroelectric station near Monte Alegre.

Parañaque, town, Rizal province, central Luzon, Philippines, on the southeastern shore of Manila Bay. Its site was occupied by small vegetable farms until the mid-20th century, when expanding urbanization transformed the town into a southern suburb of Manila. The Manila International Airport to the east occupies Nichols Field, a former U.S. air base. Parañaque has long been noted for intricate hand embroidery, which has continued as a household industry. Fishing from rafts mounted with *salambaos* (large nets) is an important activity. The Manila Bay Beach Resort, a national park, is located there. Pop. (1980) mun., 208,552.



Fishing settlement at Parañaque, Luzon, Philippines
Morton Beebe—Photo Researchers

Parandowski, Jan (b. May 11, 1895, Lemberg, Austria-Hungary—d. Sept. 26, 1978, Warsaw), Polish writer, essayist, and translator.

He graduated from the classical *gimnazjum* of Lwów and, together with the entire Polish elite, was transported to Russia when the tsarist army occupied eastern Galicia at the beginning of World War I. Returning home after the Russian Revolution, he completed his education in 1923 at the University of Lwów, where he read classical philology and archaeology. Shortly afterwards he visited France, Italy, and Greece. He published a dozen books, ranging from historical novels to travelogues, that had Greek or Italian themes or subject matter. One notable exception was a novel, *Niebo w płomieniach* (1936; "Heaven in Flames"), detailing the experiences of a young man who undergoes a religious crisis. From 1933 Parandowski was chairman of the Polish PEN writers' organization and vice president of the International PEN (from 1962).

Parangaba, city, northern Ceará state, northeastern Brazil, immediately southwest of Fortaleza, the state capital, and part of its metropolitan area. Until the 1940s it was a small cotton-producing centre on the site of an old Indian village, Parangaba (formerly Porangaba), but has since experienced phenomenal suburban growth. Cashew nuts and carnauba wax are produced in the region. Pop. (1980 prelim.) 226,749.

paranoia, the central theme of a group of psychotic disorders characterized by systematic delusions. The word paranoia was used by the ancient Greeks, apparently in much the same sense as the modern popular term insanity. Since then it has had a variety of meanings. Toward the end of the 19th century it came to mean a delusional psychosis, in which the delusions develop slowly into a complex, intricate, and logically elaborated system, without hallucination and without general personality disorganization. In contemporary psychiatric practice, the term paranoia is generally reserved for all rare, extreme cases of chronic, fixed, and highly systematized delusions. All the rest are called paranoid disorders. Some psychiatrists, however, have come to doubt the validity of paranoia as a diagnostic category, claiming that what has in the past been considered paranoia is actually a variety of schizophrenia (*q.v.*).

One of the most common delusions in paranoid disorders is that of persecution. A chief contributing factor is an exaggerated tendency to self-reference; *i.e.*, to systematically misinterpret remarks, gestures, and acts of others as intentional slights or as signs of derision and contempt directed at him. Self-reference becomes paranoid delusion when a person persists in believing that he is the target of hostile actions or insinuations, aimed at him by some enemy or band of enemies, when this is actually not the case. The identifying marks of delusional conviction are (1) readiness to accept the flimsiest evidence in support of the belief and (2) inability to entertain seriously any evidence that contradicts it.

In addition to the common persecutory type of paranoid reaction, a number of others have been described, most notably paranoid grandiosity, or delusions of grandeur (also known as megalomania), characterized by the false belief that one is a superlative person.

Paranthropus, fossil hominid genus initially assigned by Robert Broom to a robust form of australopithecine found at Kromdraai and Swartkrans, S.Af. The remains are known as *Australopithecus robustus* to scholars who do not consider it a separate genus from other australopithecines.

paraphrase, in music, the recomposition of a phrase, melody, section, or entire piece for use in another, favoured especially during the Renaissance for masses and motets, but also for keyboard works, where the melody is frequently broken up, with new notes interpolated occasionally, and condensed. A paraphrased melody may appear in one voice part of the new composition, as in the motet *Alma redemptoris mater* (*Beloved Mother of the Redeemer*) by Guillaume Dufay, or in all voice parts through the technique of melodic imitation, as in the *Missa pange lingua* (mass on the plainsong hymn "Pange lingua" ["Sing, My Tongue"]) by Josquin des Prez.

In 19th-century music, the term acquired slightly different connotations, when piano and other virtuosos engaged in elaborate paraphrases of operas as well as of each other's works.

Parapinaces (Byzantine emperor): *see* Michael VII Ducas.

paraplegia, paralysis of the legs and lower part of the body. Often it involves loss of sensation (of pain, temperature, vibration, and position) as well as loss of motion. It may also include paralysis of the bladder and bowels. Paraplegia may be caused by injury to or disease in the lower spinal cord or peripheral nerves or by such brain disorders as cerebral palsy. Some paraplegics are able to walk with the aid of braces and crutches. Quadriplegia involves paralysis of both arms and both legs. *See also* paralysis.

parapsychological phenomenon, also called PSI PHENOMENON, any of several types of events that cannot be accounted for by natural law or knowledge apparently acquired by other than usual sensory abilities. The discipline concerned with investigating such phenomena is called parapsychology.

Parapsychological phenomena of two types have been described. They may be cognitive, as in the case of clairvoyance, telepathy, or precognition (*qq.v.*); here one person is believed to have acquired knowledge of facts, of other people's thoughts, or of future events, without the use of the ordinary sensory channels—hence the term extrasensory perception (*q.v.*; ESP), often used to designate these phenomena. Alternatively, parapsychological phenomena may be physical in character: the fall of dice or the dealing of cards is thought to be influenced by a person's "willing" them to fall in a certain way; or objects are moved, often in a violent fashion, by poltergeists (*see* poltergeist). The term psychokinesis (*q.v.*) is often used in this connection. The general term psi has become established to denote all kinds of parapsychological phenomena.

Scientific interest in the subject is of relatively recent origin, but belief in the reality of such phenomena has been widespread since the earliest recorded times. Before the rise of modern science the causation of all complex physical phenomena was very poorly understood, and hence appeals to nonmaterial agencies (ghosts, sorcerers, demons, mythological beings) took the place of a causal, scientific explanation. Even so, there were widespread debates about the reality of phenomena that obviously transcended the bounds of everyday happenings, such as veridical prophecies, as by the oracle of Delphi, or the revival of the dead.

The existence of parapsychological phenomena continues to be a subject of dispute, although societies for the study of psychic phenomena, made up of eminent scientists and laymen, have been in existence for over a century. In 1882 the Society for Psychical Research was founded in London, followed six years later by the founding of a similar society in the United States, partly through the efforts of psychologist William James. Such societies were founded later in most European countries, and active work is carried on, particularly in The Netherlands, France, Italy, the Soviet Union, and Japan. Universities have been slower to recognize psychical research as a serious subject for study. The activities of the parapsychological laboratory at Duke University, Durham, N.C., under the American parapsychologist J.B. Rhine from the 1930s to the 1960s attracted considerable interest. A department of psychical research later was opened at the University of Utrecht under W.H.C. Tenhaeff.

One of the reasons for interest in psychical research in the last half of the 19th century was the rise of the spiritualist movement that grew out of the acceptance of spirit communication as real and the use of this as the basis of a new religion. Some of the early psychical researchers were also spiritualists, as, for example, British spiritualist F.W.H. Myers and the British physicist Sir Oliver Lodge. Other psychical researchers (such as the French physiologist Charles Richet) accepted paranormal activity as real but rejected the spiritualist explanation, while others were not committed to either view.

Discussion about parapsychological phenomena has sometimes assumed emotional overtones, unsuitable to scientific discipline, and outspoken but contradictory opinions are still frequently voiced. Believers and nonbelievers in psi may base their belief or disbelief on what they consider to be the scientific evidence, on their personal experiences, or on some larger system of attitudes and values into which ESP does or does not fit. When such extreme and contradictory views are widely held, it is almost certain that the evidence is not conclusive either way and that confident conclusions are unlikely to be supported by a survey of all the known facts.

Paraschwagerina, genus of extinct fusulinid foraminiferans (protozoans with a relatively large shell readily preservable in the fossil record), the fossils of which are restricted to marine rocks; the animal probably lived in clear water, far from the shoreline. The various species are excellent index, or guide, fossils for the Early Permian (which occurred from 286 to 258 million years ago) and allow the correlation of sometimes widely separated rock units.

parasitism, relationship between two species of plants or animals in which one benefits at the expense of the other, without killing it. Parasitism is differentiated from parasitoidism, a relationship in which the host is killed by the parasite; parasitoidism occurs in some Hymenoptera (ants, wasps, and bees), Diptera (flies), and a few Lepidoptera (butterflies and moths): the female lays her eggs in or on the host, upon which the larvae feed on hatching.

Parasites may be characterized as ectoparasites—including ticks, fleas, leeches, and lice—which live on the body surface of the host and do not themselves commonly cause disease in the host; or endoparasites, which may be either intercellular (inhabiting spaces in the host's body) or intracellular (inhabiting cells in the host's body). Intracellular parasites—such as bacteria or viruses—often rely on a third organism, known as the carrier, or vector, to transmit them to the host. Malaria, which is caused by a protozoan of the genus *Plasmodium* transmitted to humans by the bite of an anopheline mosquito, is an example of this type of interaction. The plant disease known as Dutch elm disease (caused by the fungus *Ceratocystis ulmi*) can be spread by the European elm bark beetle.

A form of parasitism called brood parasitism is practiced by the cuckoo and the cowbird, which do not build nests of their own but deposit their eggs in the nests of other species and abandon them there. Though the cowbird's parasitism does not necessarily harm its host's brood, the cuckoo may remove one or more host eggs to avoid detection, and the young cuckoo may heave the host's eggs and nestlings from the nest.

Another form of parasitism, such as that practiced by some ants on ants of other species, is known as social parasitism. Parasites may also become parasitized; such a relationship, known as hyperparasitism, may be exemplified by a protozoan (the hyperparasite) living in the digestive tract of a flea living on a dog.

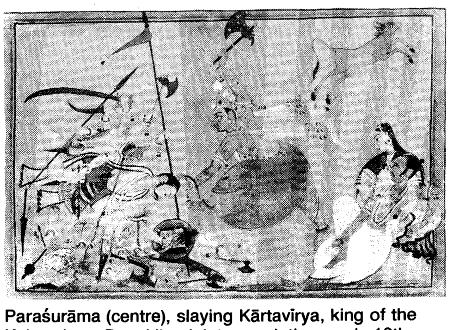
parasitology, the study of animal and plant parasitism as a biological phenomenon. Parasites occur in virtually all major animal groups and in many plant groups, with hosts as varied as the parasites themselves. Many parasitologists are concerned primarily with particular taxonomic groups and should perhaps be considered students of those groups, rather than parasitologists per se; others are interested in parasitism as an evolutionary phenomenon and work with a number of taxonomic groups. The science has a number of branches (*e.g.,* veterinary, medical, or agricultural parasitology).

The history of parasitology is scattered among a number of other disciplines, especially zoology. Many highly evolved parasites remained essentially unknown or misunderstood until the advent of the microscope in the mid-17th century. A pioneer in the field of intestinal parasitology was the mid-19th century Belgian biologist P.J. van Beneden, who unraveled the life history of tapeworms and many other groups.

Paráskhos, Akhilléfs (b. March 6, 1838, Návplion, Greece—d. Jan. 26, 1895, Athens), Greek poet who was the central figure of the Greek Romantic school of poetry in its second and last period (*c.* 1850–80). His models were Alfred de Musset, Victor Hugo, and Lord Byron, but he fell short of their achievement.

Paráskhos' unrestrained manner and grandiloquent language owed much to the Phanariote poets, whose tradition he continued. He touched on all the usual Romantic subjects, but love and patriotism were his favourites. In his numerous lyrics he made use of both "refined" Greek, inherited from the Byzantine scholars, and the spoken language, but his vocabulary remained as limited as his ideas. Perhaps no other modern Greek poet was more admired by his contemporaries. His poems were published in Greek in two volumes (1881, 1904).

Paraśurāma (Sanskrit: "Rāma with the Ax"), sixth of the 10 *avatāra*s (incarnations) of the Hindu god Vishnu. The *Mahābhārata* ("Great Epic of the Bharata Dynasty") and the *Purāṇas* ("Ancient Lore") record that Paraśurāma was born to the Brahman sage Jamadagni in order to deliver the world from the arrogant oppression of the baron or warrior caste, the Kshattriyas. He killed all the male Kshattriyas on earth 21 successive times (each time their wives survived and gave birth to new generations) and filled five lakes with blood. Scholars view the legend as reflecting strife between the two classes of society in pre-Buddhist India. Paraśurāma is the traditional founder of Malabar and is said to have bestowed land there on members of the priestly caste whom he brought down from the north in order to expiate his slaughter of the Kshattriyas. He is sometimes said to have lived on earth during the lifetime of the seventh *avatāra,* Rāma, and to have expressed some jealousy of the younger incarnation.



Paraśurāma (centre), slaying Kārtavīrya, king of the Kshattriyas, Basohli, miniature painting, early 18th century; in a private collection
Pramod Chandra

parasympathomimetic drug, any drug that mimics the action of the neurotransmitter acetylcholine. *See* cholinergic drug.

parathion, an organic phosphorus compound well known as an insecticide that is extremely toxic to humans. The compound acts in mammals, as in insects, as a cholinesterase inhibitor (cholinesterase being the enzyme that controls the normal functioning of the nervous system), causing death by inducing respiratory failure. The specific antidote for poisoning by parathion and other organophosphorus insecticides is atropine. Parathion and similar insecticides must be handled with great care because the substance is toxic if swallowed, inhaled, or absorbed through the skin. Parathion may be rendered nontoxic by application of an alkaline solution.

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parathyroid adenoma, also called OSTEITIS FIBROSA CYSTICA, or VON RECKLINGHAUSEN'S DISEASE OF BONE, uncommon disorder characterized by loss of mineral materials from the skeleton, the development of brown cystic bone tumours and of kidney stones, and progressive kidney insufficiency. Increase in the number (hyperplasia) of secretory cells of one or more of the parathyroid glands results in an excess of parathormone in the circulation. The action of parathormone removes calcium from the bones; the calcium may then be deposited elsewhere, as in kidney stones.

Symptoms include chronic tiredness and sleepiness, weakness, loss of appetite, constipation, nausea, thirst, and sometimes personality changes. Pain accompanies weakening of bones, and in 25 percent of cases so-called brown tumours develop in the ends of long bones; pathological fractures are not uncommon. The teeth become loose in their sockets, and the lamina dura, or compact bone lining of the sockets, disappears. The disease is twice as frequent in women as in men and usually begins in middle age. Persons with preexisting peptic ulcers are more likely to develop hyperparathyroidism. Treatment usually includes surgical excision of the hyperplastic parathyroid.

parathyroid gland, endocrine gland occurring in all vertebrate species from amphibia upward, usually located close to and behind the thyroid gland and secreting parathormone, a hormone that regulates and maintains a normal calcium level in the blood serum. Human parathyroid tissue is brownish red, and the tiny glands may number as few as two and as many as eight on each side of the thyroid. Microscopically, they are made up of closely packed epithelial cells separated by thin fibrous bands; occasionally the cells are arranged in circles with an open centre (alveolar arrangement), which may contain a colloid material.

The exact action of the internal secretion of these glands is not clear. It is believed that the parathyroid hormone plays an important role in stabilizing the calcium concentration of the body fluids—a very important function, since a lowering of the calcium ion concentration results in a condition of increased excitability of nerves and muscles known as tetany, which results in muscular spasms, convulsions, and sometimes dementia. Under normal conditions a small drop in the calcium concentration of the body fluids results in increased activity of the parathyroid glands, which raises the calcium concentration by mobilizing some of the skeletal calcium. On the other hand, a rise in body fluid calcium concentration above the normal is counteracted by a reduction or cessation of secretion of parathyroid hormone.

The internal secretion of the parathyroids also affects the metabolism of phosphorus, an excess of the hormone resulting in a lowering of inorganic phosphate concentration in the blood serum and an increased excretion of phosphate in the urine. Reduced parathyroid function is accompanied by a rise in the inorganic phosphate of the serum and a lessened urinary output of phosphate.

Parathyroid hormone appears to play a role in the regulation of magnesium metabolism as well, possibly increasing the excretion of that electrolyte.

paratuberculosis: *see* Johne's disease.

paratyphoid fever, infectious disease similar to typhoid, though usually milder, caused by any of several organisms: *Salmonella paratyphi* (paratyphoid A), *S. schottmulleri* (paratyphoid B), or *S. hirschfeldii* (paratyphoid C). The means of infection, spread, clinical course, pathology, diagnosis, prevention, and treatment are similar to those for typhoid.

Whereas typhoid and paratyphoid A are strictly human diseases, the paratyphoid B organism has been found in other animals and fowl, and accordingly these represent additional means of contamination of food and water. *See also* typhoid.

parauque (bird): *see* pauraque.

Parbate (people): *see* Pahāṛī.

Parbhani, town, east-central Mahārāshtra state, western India, on the Manmād-Hyderābād railway, about 10 miles (16 km) south of the Dudna River. Its name refers to the Prabhāvatī Temple, which was forcibly converted to a mosque during the Mughal period. Now a commercial centre, the town has little industry. The economy of the surrounding region is almost wholly agricultural; the chief crops are jowar (sorghum), bajra (pearl millet), and cotton. Pop. (1981) 109,364.

Parc National Suisse (Switzerland): *see* Swiss National Park.

Parc Zoologique de Clères: *see* Clères Zoological Park.

Parcheesi (board game): *see* Pachisi.

parchment, the processed skins of certain animals—chiefly sheep, goats, and calves—that have been prepared for the purpose of writing on them. The name apparently derives from the ancient Greek city of Pergamum (modern Bergama, Tur.), where parchment is said to have been invented in the 2nd century BC. Skins had been used for writing material even earlier, but a new, more thorough method of cleaning, stretching, and scraping made possible the use of both sides of a manuscript leaf, leading to the supplanting of the rolled manuscript by the bound book (codex).

Parchment made from the more delicate skins of calf or kid or from stillborn or newly born calf or lamb came to be called vellum, a term that was broadened in its usage to include any especially fine parchment. The vellum of most early manuscripts, through the 6th century AD, is of good quality. After this, as demand increased, a great amount of inferior material came on the market, but by the 12th century, when large numbers of manuscripts were being produced in western Europe, a soft, pliant vellum was in vogue. In Constantinople, a sumptuous form was produced at an early date by dyeing the material a rich purple and lettering it in silver and gold, a practice condemned as a useless luxury in a well-known passage of St. Jerome. The purple dye was subsequently abandoned, but the practice of "illuminating" parchment manuscripts in gold, silver, and other tints flourished throughout the European Middle Ages.

In modern usage, the terms parchment and vellum may be applied to a type of paper of high quality made chiefly from wood pulp and rags and frequently having a special finish.

parchment worm (genus *Chaetopterus*), any of several species of segmented worms of the class Polychaeta (phylum Annelida), especially *C. variopedatus* of the Atlantic and Pacific oceans. They live on the sea bottom in U-shaped tubes that are lined with parchment-like material. Parchment worms grow to a length of about 25 cm (10 inches).

Parco Nazionale Svizzero (Switzerland): *see* Swiss National Park.

pard: *see* leopard.

pardalote (bird): *see* diamondbird.

Pardo Bazán, Emilia, condesa de (countess of) (b. Sept. 16, 1852, La Coruña, Spain—d. May 12, 1921, Madrid), Spanish author of novels, short stories, and literary criticism.

Pardo Bazán attained early eminence with her polemical essay *La cuestión palpitante* (1883; "The Critical Issue"). It discussed Émile Zola and Naturalism, made French and Russian literary movements known in Spain, and started an important literary controversy in which she championed a brand of Naturalism that affirmed the free will of the individual. Her finest and most representative novels are *Los Pazos de Ulloa* (1886; *The Son of a Bondwoman*) and its sequel, *La madre naturaleza* (1887; "Mother Nature")—studies of physical and moral ruin among the Galician squirearchy, set against a beautiful, natural background and a moral background of corrupting power. *Insolación* ("Sunstroke") and *Morriña* ("The Blues"; both 1889) are excellent psychological studies. Her husband separated from her because her literary reputation scandalized him. Pardo Bazán was professor of Romance literature at the University of Madrid. In 1916 she was accorded the distinction—unusual for a woman in those days—of a chair of literature.

pardon, in law, release from guilt or remission of punishment. In criminal law the power of pardon is generally exercised by the chief executive officer of the state. Pardons may also be granted by a legislative body, often through an act of indemnity, anticipatory or retrospective, for things done in the public interest that are illegal.

A pardon may be full or conditional. It is conditional when its effectiveness depends on fulfillment of a condition by the offender, usually a lesser punishment, as in the commutation of the death sentence.

The effect of a full pardon is unclear in some jurisdictions. In England it is said that a full pardon clears the person from all infamy, removing all disqualifications and other obloquy, so that a pardoned person may take action for defamation against anyone who thereafter refers to him as a convict. In the United States the matter is much less clear, although the Supreme Court has held that a pardon blots out guilt and makes the offender "as innocent as if he had never committed the offense." Some states in the United States have held that a pardon does not remove the disqualification from holding public office and that a pardoned offender may still be refused a license to engage in a business or profession. The difficulty stems from lack of differentiation between pardons granted for reasons of clemency and those granted from a belief in the accused's innocence. Continental European and Latin-American countries generally have detailed statutory provisions governing the law of pardon.

Pardubice, German PARDUBITZ, city, Východočeský *kraj* (region), Czechoslovakia, at the confluence of the Labe and Chrudimka rivers, east of Prague. Originating in the 13th century as a trade mart, it received civil rights in 1340 and by 1490 had become a possession of the Czech Pernštejn family, who renovated it in Renaissance style during the 16th century. The town was razed by Swedish troops in 1645. Its square is an architectural showplace, with a row of outstanding patrician houses, a 16th-century Gothic castle, and the Green Gate (Zelená brána, 1507). Kunětická hora, 4 miles (6 km) northeast, is a cone-shaped basaltic hill (1,006 feet [305 m]), site of a prehistoric burial ground and topped by a 15th-century castle ruin.

Pardubice is known for horse racing, particularly its Grand Pardubice Steeplechase, and for motorcycle track meets. It has a regional museum for Eastern Bohemia and a College of Chemical Technology (1950). Industries include engineering, sugar refining, brewing, and, since World War II, oil refining. The town is an important road and rail junction and a cultural and administrative centre. Pop. (1988 est.) 95,540.

Paré, Ambroise (b. 1510, Bourg-Hersent, Fr.—d. Dec. 20, 1590, Paris), French physician, one of the most notable surgeons of the European Renaissance, regarded by some medical historians as the father of modern surgery.

About 1533 Paré went to Paris, where he soon became a barber-surgeon apprentice at the Hôtel-Dieu. He was taught anatomy and surgery and in 1537 was employed as an army surgeon. By 1552 he had gained such popularity that he became surgeon to the king; he served four French monarchs: Henry II, Francis II, Charles IX, and Henry III.

At the time Paré entered the army, surgeons treated gunshot wounds with boiling oil since such wounds were believed to be poisonous. On one occasion, when Paré's supply of oil ran out, he treated the wounds with a mixture of egg yolk, rose oil, and turpentine. He found that the wounds he had treated with this mixture were healing better than those treated with the boiling oil. Sometime later he reported his findings in *La Méthod de traicter les playes faites par les arquebuses et*

Paré, detail of an engraving, 1582
H. Roger-Viollet

aultres bastons à feu (1545; "The Method of Treating Wounds Made by Harquebuses and Other Guns"), which was ridiculed because it was written in French rather than in Latin. Another of Paré's innovations that did not win immediate medical acceptance was his reintroduction of the tying of large arteries to replace the method of searing vessels with hot irons to check hemorrhaging during amputation.

Unlike most surgeons of his time, Paré resorted to surgery only when he found it absolutely necessary. He was one of the first surgeons to discard the practice of castrating patients who required surgery for a hernia. He introduced the implantation of teeth, artificial limbs, and artificial eyes made of gold and silver. He invented many scientific instruments, popularized the use of the truss for hernia, and was the first to suggest syphilis as a cause of aneurysm (swelling of blood vessels).

Parecis Mountains, Portuguese SERRA DOS PARECIS, mountains, Rondônia and Mato Grosso *estados* ("states"), west-central Brazil. Rising out of the tropical rain forests of Rondônia, near the Bolivian border, the range extends southeastward for 500 miles (800 km) to the vicinity of Diamantino in Mato Grosso. Its northwestern section consists of rolling plateaus, which rise to more than 2,300 feet (700 m) above sea level in the southeast. On its northern and western slopes rise the Juruena and Guaporé rivers, both tributaries of the Amazon; from the range's southern flanks come headwaters of the Paraguay River.

paregoric, also called CAMPHORATED OPIUM TINCTURE, narcotic preparation principally used as an antiperistaltic for the treatment of diarrhea. In early medical writings the term paregoric sometimes was used in reference to soothing medicaments in general.

The preparation is made from opium tincture (laudanum) or from powdered opium and includes anisi oil, camphor, benzoic acid, glycerin, and diluted alcohol. The usual adult dose is 5–10 millilitres, which corresponds to 2–4 milligrams of anhydrous morphine.

Pareja, Juan de, byname EL ESCLAVO (Spanish: "The Slave") (b. *c.* 1610, Seville—d. 1670, Madrid), Spanish painter and student of Diego Velázquez.

A mulatto, Pareja was Velázquez' slave and accompanied him on his second visit to Italy (1649–51), where Velázquez painted his portrait. The portrait was purchased at auction by the Metropolitan Museum in 1970 for nearly $5.5 million, a record at the time. According to early writers, Pareja painted in the manner of Velázquez, but his only known portrait is a crude reflection of Velázquez' style. While in Rome, Pareja was granted his freedom (1650) by Velázquez.

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

parenchyma, in plants, tissue typically composed of living cells that are thin-walled, unspecialized in structure, and therefore adaptable, with differentiation, to various functions. Parenchyma may be compact or have extensive spaces between the cells. It is often called ground, or fundamental, tissue and makes up the mesophyll (internal layers) of leaves and the cortex (outer layers) and pith (innermost layers) of stems and roots; it also forms the soft tissues of fruits. Cells of this type are also contained in xylem (wood) and phloem (bast, or food-conducting, cells) as transfer cells (*see* phloem) and, with both xylem and phloem as bundle sheaths, the cells that surround the vascular strands.

parent, one who has begotten offspring, or one who occupies the role of mother or father. In Western societies, parenthood, with its several obligations, rests strongly on biological relatedness. This is not the case in all societies: in some, a distinction is made between a biological parent and social parent, with the former producing the child and latter raising the child and acting as a mother or father in as affective or legal a sense as biological parents are expected to do in Western society. This distinction is particularly common in the case of fathers, and to accommodate it anthropologists have developed separate kinship terms: a "genitor" is a biological father, and a "pater" is a social one.

Parent-Teacher Association: *see* National Congress of Parents and Teachers.

Parentalia, Roman religious festival held in honour of the dead. The festival, which began at noon on February 13 and culminated on February 21, was essentially a private celebration of the rites of deceased family members. It was gradually extended, however, to incorporate the dead in general. During the days of the festival, all temples were closed and no weddings could be performed. On the last day a public ceremony, the Feralia, was held, during which offerings and gifts were placed at the graves and the anniversary of the funeral feast was celebrated.

Parentucelli, Tommaso: *see* Nicholas V *under* Nicholas (Papacy).

paresis, also called BRAIN SYPHILIS, SYPHILITIC MENINGOENCEPHALITIS, GENERAL PARALYSIS OF THE INSANE, or DEMENTIA PARALYTICA, psychosis caused by widespread destruction of brain tissue occurring in some cases of late syphilis. Mental changes include gradual deterioration of personality, impaired concentration and judgment, delusions, loss of memory, disorientation, and apathy or violent rages. Convulsions are not uncommon, and while temporary remissions sometimes occur, untreated paresis is eventually fatal.

Paresis occurs most frequently in men between 35 and 50 years of age. The malarial treatment of paresis, effective because the malarial fever destroys the syphilitic microorganisms, was initiated in 1917 by the Austrian physician Julius Wagner von Jauregg; it has been supplanted by the use of antibiotics. *See also* syphilis.

Pareto, Vilfredo (b. July 15, 1848, Paris—d. Aug. 20, 1923, Geneva), Italian economist and sociologist, known for his theory on mass and elite interaction as well as for his application of mathematics to economic analysis.

After his graduation from the University of Turin (1869), where he had studied mathematics and physics, Pareto became an engineer and later a director of an Italian railway and was also employed by a large ironworks. Residing in Florence, he studied philosophy and politics and wrote many periodical articles in which he first analyzed economic problems with mathematical tools. In 1893 he was chosen to succeed Léon Walras in the chair of political economy at the University of Lausanne, Switz.

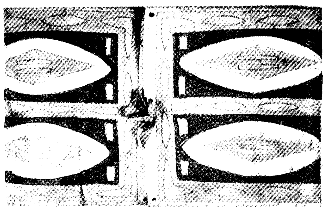
Pareto's first work, *Cours d'Économie Politique* (1896–97), included his famous but much-criticized law of income distribution, a complicated mathematical formulation in which Pareto attempted to prove that the distribution of incomes and wealth in society is not random and that a consistent pattern appears throughout history, in all parts of the world and in all societies.

In his *Manuale d'economia politica* (1906), his most influential work, he further developed his theory of pure economics and his analysis of ophelimity (power to give satisfaction). He laid the foundation of modern welfare economics with his concept of the so-called Pareto optimum, stating that the optimum allocation of the resources of a society is not attained so long as it is possible to make at least one individual better off in his own estimation while keeping others as well off as before in their own estimation. He also introduced "curves of indifference," analytical instruments that did not become popular until the 1930s.

Believing that there were problems that economics could not solve, Pareto turned to sociology, writing what he considered his greatest work, *Trattato di sociologia generale* (1916; *Mind and Society*), in which he inquired into the nature and bases of individual and social action. Persons of superior ability, he argued, actively seek to confirm and aggrandize their social position. Thus social classes are formed. In an effort to rise into the elite of the upper strata, privileged members of the lower-class groups continually strive to use their abilities and thus improve them; the opposite tendency obtains among the elite. As a result, the best-equipped persons from the lower class rise to challenge the position of the upper-class elite. There thus occurs a "circulation of elites." Because of his theory of the superiority of the elite, Pareto sometimes has been associated with fascism.

pareve, also spelled PARVE, or PARVEH (Yiddish: "neutral"), in the observance of Jewish dietary laws (*kashrut*), those foods that may be eaten indiscriminately, with either meat dishes or dairy products—two general classes of food that may not be consumed at the same meal. Fruits and vegetables are classified as pareve unless cooking or processing alters their status. In modern times, cakes and similar foods are classed as pareve, provided they are made with vegetable oil (rather than butter) and with "neutral" liquids substituted for milk.

parfleche, tough, folded rawhide carrying bag made by the Plains Indians of North America; more loosely applied, the term also refers to many specialized rawhide articles. The Plains Indians had an abundant source of hides in the buffalo they hunted, but, as they were nomadic, they had little opportunity to tan the skins. Parfleche, or rawhide, was prepared by



Painted Arapaho parfleche, 1860–75; in the Museum of the American Indian, Heye Foundation, New York City

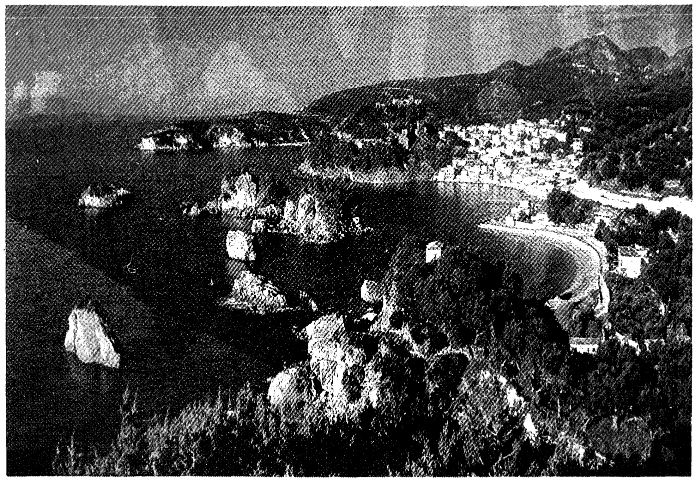
Museum of the American Indian, Heye Foundation, New York City

cleaning and dehairing the skin and then by stretching it and allowing it to dry in the sun. This process created a stiff but durable leather that was used for many items, including bags, thongs, and war shields.

The parfleche bag, or trunk (valise), was assembled by folding the two ends of a long, rectangular piece of rawhide over to meet and form a kind of envelope. The two flaps were thonged together, and the whole was used in tandem with another, similar parfleche, one strapped to each side of a horse. The maximum dimensions of the parfleche were generally 2 feet (60 cm) by 3 feet (90 cm). The large flat surface of the parfleche bag was invariably painted with colourful, basically geometric, abstract designs; a sharpened porous buffalo bone served as an effective paint brush. Sometimes the rawhide was incised to highlight a design.

Párga, port of the *nomós* (department) of Préveza, on the Ionian Sea opposite the island of Paxos (Paxoí), Greece. In 1401 it welcomed the Venetians, who built (1572) the mole that forms the present harbour, over which stands a Venetian fortress. For three centuries quasi-independent under Venice, it went to France in 1797 and two years later came under Russian protection after capture by a Russian fleet. It was part of the independent Ionian Republic until 1807 when, under the Treaty of Tilsit, it was returned to France. In 1814, however, the city accepted British protection.

In 1819 England invoked the Russo-Turkish Convention of 1800, by terms of which Párga reverted to Turkey, provided that no mosque be built or Muslim settle there. Rather than submit to Turkish rule, about 4,000 Pargiotes elected in 1819 to migrate to the Ionian Islands, and the Turkish government was constrained to pay them compensation. A few families returned in 1822. Párga was taken by the Greeks in the Balkan Wars (1912–13) and annexed to Greece in 1913. Pop. (1981) 1,892.



The harbour, at Párga, Greece
R.G. Everts—Rapho/Photo Researchers

Parhae, Chinese P'O-HAI, state established in the 8th century among the Tungus tribes of northern Manchuria (Northeast Provinces) and northern Korea by a former Korean general, Tae Cho-yang. The ruling class consisted largely of the former aristocrats of Koguryŏ, which had occupied most of northern Korea and Manchuria before it was conquered by the state of Silla in 668. Parhae was considered the successor state to Koguryŏ.

Parhae, like Silla, became a tributary state of the Chinese T'ang dynasty (618–907) and was prevented by the T'ang from developing friendly relations with Silla. Its trade and cultural relations were largely with the nomadic tribes of the north and with Japan and China. Parhae appears to have enjoyed high prosperity; indeed, in its heyday it was referred to in Korea as *Haedong-songguk,* "the prosperous country of the East." The territory at this time extended from the Sungari and Amur rivers in northern Manchuria down to the northern half of Korea.

Parhae bore a strong cultural resemblance to Koguryŏ. The surviving Buddhist images and stone lanterns suggest that Buddhism played a predominant role in the life of the Parhae people. The government administration was modelled after the T'ang bureaucracy.

Parhae's rule was brought to an end in 927, when it was conquered by the Khitan tribes of Central Asia, who were soon to form the Liao dynasty (947–1125) on China's northern borders.

parhelion, also called MOCK SUN, or SUN DOG, atmospheric optical phenomenon appearing as luminous spots 22° on each side of the Sun and at the same elevation as the Sun. Usually, the edges closest to the Sun will appear reddish. Other colours are occasionally visible, but more often the outer portions of each spot appear whitish.

Parhelia occur when the Sun or Moon shines through a thin cloud composed of hexagonal ice crystals falling with their principal axes vertical, as opposed to the halo phenomenon that occurs when the principal axes are randomly arranged in a plane perpendicular to the Sun's or Moon's rays. The red end of the spectrum, being bent the least, appears on the inside, with the blue, when visible, appearing on the outside. *See also* halo.

pari-mutuel (French *pari,* "bet"; *mutuel,* "mutual"), plural PARI-MUTUELS, or PARIS-MUTUELS, method of wagering introduced in France in about 1870 by Parisian businessman Pierre Oller. Subsequently it became one of the world's most popular methods of betting on horse races. Most systems are operated by the racetrack, although in France a national pari-mutuel system with offtrack branches was established in 1891. In pari-mutuel betting, the player buys a ticket on the horse he wishes to back. The payoff to winners is made from the pool of all bets on the various entries in a race, after deduction of an operator's commission and tax. The system has the advantages of always giving the operator a profit and allowing any number of bettors to win.

An important innovation in pari-mutuel betting came in the 1920s with the development of the totalizator, a mechanical device for issuing and recording betting tickets. Modern totalizators, usually computers, calculate betting pools and current odds on each horse and flash these figures to the public at regular intervals. They may also display race results, payoff amounts, running times, and other information. Increasingly sophisticated equipment has encouraged introduction of a variety of combination bets, such as the daily double (picking winners in two specified races, usually the first two), exacta or perfecta (picking the first two finishers in a race in precise order), quinella (picking the first two finishers in a race regardless of order), pick six (picking the winners in six consecutive races, usually the second through the seventh), and many others.

Pari-mutuel betting is still most practiced in horse racing but has an important place in other sports as well, most notably dog racing and jai alai.

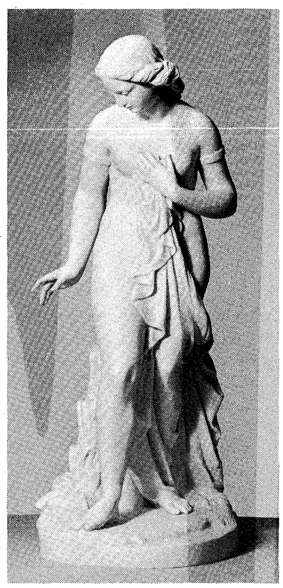
Paria, Gulf of, inlet of the Caribbean Sea, lying between the Venezuelan coast (including the mountainous Paria Peninsula) and Trinidad. Extending about 100 mi (160 km) east–west and 40 mi north–south, it is linked with the Caribbean to the north by the islands of Dragon's Mouth and with the Atlantic to the south by the Serpents Mouth (both 10 mi wide). It receives the San Juan River and several arms of the Orinoco River Delta, including the Caño Mánamo. Gulf ports, including San Fernando and Port of Spain (Trinidad) and Güiria, Irapa, and Pedernales (Venezuela), handle shipments of petroleum, iron ore, bauxite, lumber, and agricultural products. Columbus, while on his third voyage (1498), probably first sighted South America when he sailed into the Gulf of Paria.

pariah, member of a low-caste group of Hindu India, formerly known as "untouchables" but renamed by the Indian social reformer Mahatma Gandhi as Harijans (children of the god Hari Viṣṇu, or, simply, children of God). The word pariah—originally derived from Tamil *paṛaiyar,* "drummer"—once referred to the Paraiyan, a Tamil caste group of labourers and village servants of low status, but the meaning was extended to embrace many groups outside the so-called clean caste groups, with widely varying degrees of status. *See also* untouchable.

Parian Chronicle, also called MARMOR PARIUM (Latin: Parian Marble), document inscribed on marble in the Attic Greek dialect containing an outline of Greek history from the reign of Cecrops, legendary king of Athens, down to the archonship of Diognetus at Athens (264/263 BC). The years are reckoned backward from the archonship of Diognetus and further specified by the reigns of kings or the archons of Athens. The author gave little attention to constitutional history or battles but recorded the dates of the establishment of festivals, of the introduction of various kinds of poetry, of the births and deaths of the poets, and of their victories in contests of poetic skill.

One large fragment, bought at Smyrna in the early 17th century, is at the Ashmolean Museum, Oxford. Another, found on Paros in 1897, is now in the Paros Museum.

Parian ware, porcelain introduced in about 1840 by the English firm of Copeland & Gar-

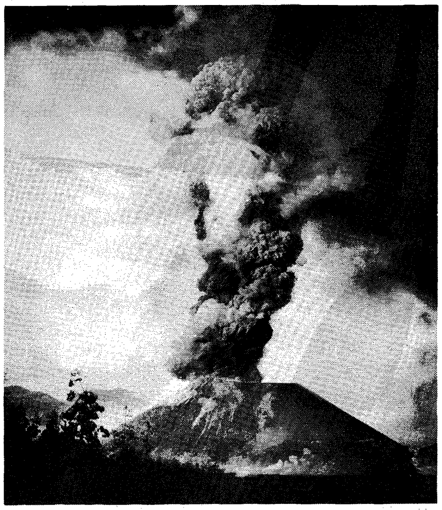


Parian ware figure of Musidora, Staffordshire, Eng., 1857; in the Victoria and Albert Museum, London
By courtesy of the Victoria and Albert Museum, London, and Spode Limited

rett, in imitation of Sèvres biscuit (fired but unglazed porcelain). Its name is derived from its resemblance to Parian marble.

A great many figures, some extremely large, were made in this medium. Most of them consist of either sentimental subjects or quasi-erotic nudes, which were popular in Victorian art. In the United States, Parian ware was manufactured by Norton and Fenton.

Parícutin, volcano, western Michoacán state, west-central Mexico, just north of the volcano Tancítaro Peak and 20 miles (32 km) west-northwest of Uruapan. It is one of the youngest volcanoes on Earth.



Parícutin volcano in eruption, western Michoacán state, Mexico
Ewing Galloway

On Feb. 20, 1943, it began to erupt in an open field. The fire, lava, and ashes destroyed and buried two villages and hundreds of homes. A partially buried church at the edge of the lava flows is a local tourist attraction. In the first year, the volcano's cone had risen 1,475 feet (450 m) from the base (at 7,480 feet [2,280 m] above sea level) and had buried the village of Parícutin. Its peak reached an elevation of 9,210 feet (2,808 m) in 1952, when the eruption finally ended.

Paridae, songbird family, order Passeriformes, consisting of the titmice and chickadees, about 64 species of small, gregarious birds, primarily of the Northern Hemisphere and Africa.

Members range in size from 7.5 to 20 cm (3 to 8 inches) long. They have short, stout, pointed bills, nostrils concealed by thick feathers, strong feet, and rounded wings. These active, curious birds are similar to crows in trainability. They feed chiefly on insects but eat fruit also. A popular American species is the black-capped chickadee (*Parus atricapillus*); in Europe there is the similar willow tit (*P. montanus*), immortalized by Gilbert and Sullivan.

The long-tailed tits (*Aegithalos* and other genera) are sometimes given family rank as the Aegithalidae; and the penduline tits (*Remiz* and other genera) are sometimes similarly ranked as the Remizidae. They appear to be related to the crow-jay complex (family Corvidae). The Paridae belongs to the songbird suborder (Passeres).

parietal bone, cranial bone forming part of the side and top of the head. In front each parietal bone adjoins the frontal bone; in back, the occipital bone; and below, the temporal and sphenoid bones. The parietal bones are marked internally by meningeal blood vessels and externally by the temporal muscles. They meet at the top of the head (sagittal suture) and form a roof for the cranium. The parietal bone forms in membrane (*i.e.,* without a cartilaginous precursor); the sagittal suture closes between ages 22 and 31. In primates that have large jaws and well-developed chewing muscles (*e.g.,* gorillas and baboons), the parietal bones may be continued upward at the midline to form a sagittal crest. Among early hominids, *Paranthropus* (also called *Australopithecus robustus*) sometimes exhibited a sagittal crest.

For a depiction of the parietal in human anatomy, shown in relation to other parts of the body, *see* the colour Trans-Vision in the PROPAEDIA: Part Four, Section 421.

parietal cell, also called OXYNTIC CELL, or DELOMORPHOUS CELL, in biology, one of the cells that are the source of the hydrochloric acid and most of the water in the stomach juices. The cells are located in glands in the lining of the fundus, the part of the stomach that bulges above the entrance from the esophagus, and in the body, or principal part, of the stomach.

Parilia, ancient Roman festival celebrated annually on April 21 in honour of the god and goddess Pales, the protectors of flocks and herds. The festival, basically a purification rite for herdsmen, beasts, and stalls, was at first celebrated by the early kings of Rome, later by the *pontifex maximus,* or chief priest. The Vestal Virgins opened the festival by distributing straw and the ashes and blood of sacrificial animals. Ritual cleaning, anointment, and adornment of herds and stalls followed, together with offerings of simple foods. The celebrants jumped over a bonfire three times to complete the purification, and an open-air feast ended the festival.

According to later tradition, April 21 was the day on which Romulus began building the city of Rome and was thus celebrated as the *dies notalis* of the city.

Parima Mountains, Spanish SIERRA PARIMA, Portuguese SERRA PARIMA, range in northern Brazil and southern Venezuela. It is an outlying range of the Guiana Highlands and extends south-southeastward for about 200 miles (320 km), separating Venezuela from Roraima territory, Brazil. Its peaks, largely unexplored, reach an elevation of 5,000 feet (1,500 m) above sea level.

Headstreams of the Orinoco River rise on the western flanks, and headstreams of the Branco River descend from the eastern slopes. The range connects with Pacaraima Mountains in the northeast.

Parini, Giuseppe (b. May 22/23, 1729, Bosisio, near Milan [Italy]—d. Aug. 15, 1799, Milan), Italian prose writer and poet remembered for a series of beautifully written Horatian odes and particularly for *Il giorno,* a satiric poem on the selfishness and superficiality of the Milanese aristocracy.

Of humble origins, Parini was educated by the Barnabites in Milan. A volume of Arcadian verse, *Alcune poesie di Ripano Eupilino* (1752), brought him into literary circles; the following year he joined the prestigious Milanese Accademia dei Trasformati ("Academy of the Transformed").

In 1754 Parini was ordained priest and entered the household of Duke Gabrio Serbelloni as tutor to the duke's oldest son. He remained there until 1762, unhappy and badly treated; but he won ample revenge, first in *Dialogo sopra la nobiltà* (1757), a discussion between the corpse of a nobleman and the corpse of a poet about the true nature of nobility, and next through his masterpiece, the satiric poem *Il giorno* (4 books, 1763–1801; *The Day*).

The first two parts of *Il giorno* brought Parini literary renown; he became editor of the *Gazzeta di Milano* and then a humanities professor in the Palatine and Brera schools. In Milan he met the young W.A. Mozart, who composed an operatic score for his play *Ascanio in Alba* (opera performed 1771). When the French took Milan in 1796, Parini, rather uncomfortably, held a government post for three years.

The most important of Parini's other works are his odes (*Odi,* published 1795), composed over a period of about 20 years. Parini also wrote several literary tracts and an aesthetic treatise, *Dei principi generali e particolari delle belle lettere* (1801).

Paris, also called ALEXANDROS (Greek: "Defender"), in Greek legend, son of King Priam of Troy and his wife, Hecuba. A dream regarding his birth was interpreted as an evil portent, and he was consequently expelled from his family as an infant. Left for dead, he was either nursed by a bear or found by shepherds. He was raised as a shepherd, unknown to his parents. As a young man he entered a boxing contest at a Trojan festival, in which he defeated Priam's other sons. After his identity was revealed, he was received home again by Priam.

The "judgment of Paris" was and continues to be a popular theme in art. According to legend, Paris was chosen by Zeus to determine which of three goddesses was the most beautiful. Rejecting bribes of kingly power from Hera and military might from Athena, he chose Aphrodite and accepted her bribe to help him win the most beautiful woman alive. His seduction of Helen (the wife of Menelaus, king of Sparta) and refusal to return her was the cause of the Trojan War. During the war Paris seems to have had a secondary role: a good warrior but inferior to his brother Hector and to the Greek leaders whom he faced. Menelaus would have defeated Paris in single combat, but Aphrodite rescued him, and the war continued.

The Judgment of Paris, Hermes leading Athena, Hera, and Aphrodite to Paris, detail of a red-figure kylix by Hieron, 6th century BC; in the Staatliche Museen Antikenabteilung, Berlin
By courtesy of Staatliche Museen Antikenabteilung, Berlin

Near the end of the war, Paris shot the arrow that, by Apollo's help, caused the death of the hero Achilles. Paris himself, soon after, received a fatal wound from an arrow shot by the archer Philoctetes.

Paris, city and capital of France, located in the north-central part of France on both sides of the Seine River, 233 miles (375 km) upstream from the English Channel. Its ideal crossroads location has enabled Paris to thrive for more than 2,000 years as the country's leading centre of population, culture, and economic activity.

A brief treatment of Paris follows. For full treatment, *see* MACROPAEDIA: Paris.

The Seine follows a curved course through the city and forms two islands: the Île de la Cité and Île Saint-Louis. The city occupies a central position in the rich agricultural region known as the Paris Basin. The region has a temperate maritime climate with warm summers and fairly mild winters. The mean temperature is about 50° F (10° C); January averages about 38° F (3° C) and July about 65° F (18° C). Rainfall is fairly evenly distributed, though somewhat heavier in the summer and autumn; average annual precipitation is about 24 inches (619 mm).

Paris is the leading industrial city of France. Manufacturing industries predominate in the northern suburbs, and among the most developed are the automobile and aeronautics industries, electronics industries, chemical and pharmaceutical industries, and food industries. A second major type of industry is the manufacture of luxury articles, including precious metalware, leather crafts, china, and haute couture (fashion design). These occupations are mostly concentrated within the central *arrondissements*. The outlying *arrondissements* specialize in such trades as furniture making, shoemaking, precision-tool production, and the manufacture of optical instruments. Printing and publishing are found in the Quartier Latin (Latin Quarter) and the rue (street) Réamur at the centre of the city. The Greater Paris area also produces three-quarters of French motion pictures, and tourism is an important industry. Many banks and businesses have their headquarters in Paris, including the Banque de France, which has the French national gold reserve in vaults underneath its building. Near the bank is the Bourse (Stock Exchange). The city's central market, the Halles, was closed in 1969, and new markets were installed at Rungis, near Orly.

The city of Paris had its beginnings on the Île de la Cité, where the splendid 12th-century cathedral of Notre Dame is located. Connected by bridge to the Île de la Cité is Île Saint-Louis, where old houses and narrow streets date back to the 17th century. On the Right Bank of the Seine, east of Île Saint-Louis, is the Place de la Bastille, where the July 14, 1789, capture of the Bastille prison helped launch the French Revolution. Between Île Saint-Louis and the Place de la République is the Hôtel de Ville (City Hall). Stretching along the river, the palace of the Louvre, one of the world's most celebrated museums, houses an art collection that ranks among the largest and finest in existence. Other notable museums include the Orsay Museum of 19th-century art and civilization and the National Museum of Modern Art in Pompidou Centre. Northward of the Louvre lies the Place de l'Opéra, the location of the Paris Opera House and National Academy of Music. In the Place de la Concorde, just northwest of the Louvre, stood the guillotine where, during the French Revolution, Louis XVI and Marie-Antoinette were executed in 1793. From the Place de la Concorde, the tree-lined Champs-Élysées leads up a gentle rise to the Arc de Triomphe, commissioned by Napoleon in 1806. Also on the Right Bank of the Seine is the district of Montmartre, dominated by the Sacred Heart Basilica (Basilique du Sacré Coeur). With its cafes and bistros, it is a centre of nightlife and a renowned haunt of poets and painters. On the Left Bank of the Seine are the Champ-de-Mars and the Eiffel Tower, a visual symbol of Paris. The oldest part of the Left Bank is the Latin Quarter, in which stands the Sorbonne (founded about 1257, now part of the University of Paris). Many other educational institutions are clustered near the Sorbonne. Nearby are the Cluny Museum, with a rich collection of medieval art, and the Panthéon, where many of France's notables are buried. Transportation in Paris and its inner suburbs is organized by the RATP (Régie Autonome des Transports Parisiens) through the double network of the Métro (underground railway) and buses. The Réseau Express Régional (RER), a network of express rail lines, runs to the outer suburbs. France's roads and railways have been designed to converge on the capital from all directions. Paris is the largest inland port in France and is served by an excellent system of waterways. The city has two major airports, the Orly and the Charles de Gaulle, serving national and international flights. Area city, 41 square miles (105 square km); metropolitan region, 805 square miles (2,118 square km). Pop. (1982) city, 2,165,-892; metropolitan area, 10,210,059.

Consult the INDEX *first*

Paris, city, seat of Bourbon county, north-central Kentucky, U.S., on the South Fork of Licking River, in the Bluegrass region. First settled about 1775, it was founded as Hopewell (1789) and was called Bourbontown before it was renamed Paris (1790) in appreciation of French aid during the Revolutionary War. Bourbon whiskey was first distilled there in 1790. Duncan Tavern Historic Shrine (1788), once the rendezvous of frontiersmen such as Daniel Boone, has been restored. A few miles east is Old Cane Ridge Meeting House (1791), where in 1804 Barton W. Stone started a movement called the New Lights, which merged in 1832 with the "Campbellites" to become the Disciples of Christ, or Christian Church. The basic farm economy (livestock, thoroughbred horses, seed processing) is supplemented by the manufacture of textiles and mining machinery. Inc. city, 1862. Pop. (1984 est.) 7,893.

Paris, city, seat (1844) of Lamar county, northeastern Texas, U.S., on a ridge between the Red and Sulphur rivers, 106 miles (171 km) northeast of Dallas. Laid out in 1845 and named for Paris, Fr., it developed after the arrival of the railroad in 1876. The city was replanned after a disastrous fire in 1916. A shipping point for cotton, grain, and livestock of the Blacklands Belt, it also has some light manufacturing. Paris Junior College was established in 1924. The Gambill Wildlife Refuge on Lake Gibbons and the Flying Tigers Air Museum are nearby. Inc. town, 1874; city, 1905. Pop. (1986 est.) 27,311.

Paris, Banque Nationale de, nationalized French commercial-banking company. It has branches and representatives in more than 75 countries. Headquarters are in Paris.

The bank was created in 1966 when French Finance Minister Michel Debré combined two existing banks to make the largest bank on the European continent. The two merged banks were Banque Nationale pour le Commerce et l'Industrie (established in 1932) and Comptoir National d'Escompte de Paris (established in 1848), both nationalized in 1945.

Banque Nationale provides domestic-banking services for individuals and corporations, investment banking, advisory services, and foreign and international banking services. The bank acts as a managing underwriter for most debt securities of the French government, underwrites corporate securities, and provides markets for Eurocurrency securities in Paris. It also provides financing for French export companies and credit lines for foreign companies buying French exports. Many of the international-banking services are provided through foreign banks, subsidiaries, and associated banks.

Paris, Commune of (1871), also called PARIS COMMUNE, insurrection of Paris against the French government from March 18 to May 28, 1871. It occurred in the wake of France's defeat in the Franco-German War and the collapse of Napoleon III's Second Empire (1852–70).

The National Assembly, which was elected in February 1871 to conclude a peace with Germany, had a royalist majority, reflecting the conservative attitude of the provinces. The republican Parisians feared that the National Assembly meeting in Versailles would restore the monarchy.

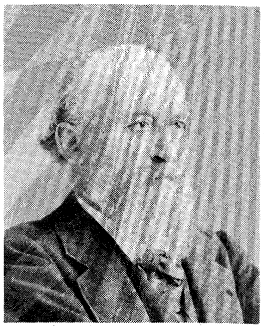
To ensure order in Paris, Adolphe Thiers, executive head of the provisional national government, decided to disarm the National Guard (composed largely of workers who fought during the siege of Paris). On March 18 resistance broke out in Paris in response to an attempt to remove the cannons of the guard overlooking the city. Then, on March 26, municipal elections, organized by the central committee of the guard, resulted in victory for the revolutionaries, who formed the Commune government. Among those in the new government were the so-called Jacobins, who followed in the French Revolutionary tradition of 1793 and wanted the Paris Commune to control the Revolution; the Proudhonists, socialists who supported a federation of communes throughout the country; and the Blanquistes, socialists who demanded violent action. The program that the Commune adopted, despite its internal divisions, called for measures reminiscent of 1793 (end of support for religion, use of the Revolutionary calendar) and a limited number of social measures (10-hour workday, end of work at night for bakers).

With the quick suppression of communes that arose at Lyon, Saint-Étienne, Marseille, and Toulouse, the Commune of Paris alone faced the opposition of the Versailles government. But the Fédérés, as the insurgents were called, were unable to organize themselves militarily and take the offensive, and, on May 21, government troops entered an undefended section of Paris. During *la semaine sanglante,* or "bloody week," that followed, the regular troops crushed the opposition of the Communards, who in their defense set up barricades in the streets and burned public buildings (among them the Tuileries Palace and the City Hall [Hôtel de Ville]). About 20,000 insurrectionists were killed, along with about 750 government troops. In the aftermath of the Commune, the government took harsh repressive action: about 38,000 were arrested and more than 7,000 were deported.

Paris, (Bruno-Paulin-)Gaston (b. Aug. 9, 1839, Avenay, Fr.—d. March 6, 1903, Cannes), greatest French philologist of his age.

After a thorough education in German universities and at the École des Chartes in Paris, he succeeded his father as professor of French medieval literature at the Collège de France. He was one of the founders and directors of *Revue critique* and of *Romania,* the leading journal devoted to French philology.

A scholar of enormous erudition and exemplary thoroughness, Paris is also remarkable for his efforts to present the findings of research in a form suitable for the general reading public. He became a member of the



Gaston Paris
H. Roger-Viollet

Académie des Inscriptions in 1876 and of the Académie Française in 1896.

Paris, Matthew (d. 1259), English Benedictine monk and chronicler, known only through his voluminous and detailed writings, which constitute one of the most important sources of knowledge of events in Europe between 1235 and 1259.

Paris was admitted a monk at the Abbey of St. Albans in England in 1217, and in 1248 he was sent to Norway to reform the Benedictine Monastery of St. Benet Holm on the island of Nidarholm. Apart from this mission and occasional visits to the royal court at Westminster, Winchester, and elsewhere, he remained at St. Albans, assiduously recording contemporary events. His *Chronica majora* incorporates Roger Wendover's *Flores historiarum* and continues it from 1235 to 1259. His other chronicles—the *Historia Anglorum,* the *Flores historiarum,* and the *Abbreviatio chronicorum*—are all abridged from his *Chronica majora* but contain some additional matter. Matthew also wrote a history of his own house, the *Gesta abbatum monasterii Sancti Albani.* Autograph manuscripts of all these works survive. He wrote biographies of Saint Alban, Edward the Confessor, Thomas Becket, and Edmund Rich, in Anglo-Norman verse, and of Stephen Langton and Edmund Rich, in Latin prose.

As a chronicler, Matthew is noteworthy for his detailed knowledge of events all over Europe; for his use of information obtained from the leading figures of his day, such as Henry III and Richard, Earl of Cornwall, both of whom he knew well; for the large number of documents that he included either in his chronicle or in an appendix to it; and for the outspoken expression of his prejudices against, in particular, the king, the foreign favourites at court, and the papacy.

Paris, Pact of: *see* Kellogg–Briand Pact.

Paris, (Louis-) Philippe (-Albert) d'Orléans, comte de (count of) (b. Aug. 24, 1838, Paris, Fr.—d. Sept. 8, 1894, Stow House, Twickenham, Middlesex, Eng.), pretender to the French throne after the death of Louis-Philippe (1850). The death of his father, Ferdinand, Duke d'Orléans, son and heir of Louis-Philippe, in 1842 made the young Philippe heir to the throne and the candidate of the Orleanists; the title of Count de Paris was created for him.

During the Revolution of 1848 he was taken into exile in England. He and his brother Robert, Duke de Chartres, served as volunteers under the Federal general George B. McClellan in the American Civil War in 1861–62. Back in England, the count married his cousin, Isabelle d'Orléans-Montpensier, in 1864.

After the downfall of Napoleon III (1870), he returned to France as a private person. At Frohsdorf, in Austria, he recognized the right of Henri d'Artois, Count de Chambord, to the French crown (August 1873); but this Legitimist–Orleanist entente broke down in 1875. When the Count de Chambord died (1883), most French Legitimists acknowledged the Count de Paris as the heir to the throne; but the success of his Paris reception celebrating his daughter Marie-Amélie's marriage in Lisbon to the future Carlos I of Portugal provoked the French republican government to pass the law of June 1886 expelling the heads of all formerly sovereign houses from France. The count retired to England, and, when General Georges Boulanger failed in his machinations, all hopes of an early restoration of the French monarchy were extinguished.

paris, plaster of, quick-setting gypsum plaster consisting of a fine, white powder, calcium sulfate hemihydrate (*see* calcium), which hardens when moistened and allowed to dry. Plaster of paris is prepared by heating calcium sulfate dihydrate, or gypsum, to 120°–180° C (248°–356° F). With an additive to retard the set, it is called wall, or hard wall, plaster.

Used since ancient times, plaster of paris is so called because gypsum was early used near Paris to make plaster and cement. Plaster of paris is also used to precast and hold parts of ornamental plasterwork placed on ceilings and cornices and is used in medicine to make plaster casts to protect broken arm, leg, or other bones while they heal. Some modern sculptors work directly in plaster of paris. The speed at which the plaster sets gives the work a sense of immediacy and enables the sculptor to achieve his original idea quickly.

Paris, Treaties of (1814–15), two treaties signed at Paris respectively in 1814 and 1815 that ended the Napoleonic Wars. The treaty signed on May 30, 1814, was between France on the one side and the Allies (Austria, Great Britain, Prussia, Russia, Sweden, and Portugal) on the other. (Spain made the same treaty with France in July.) Napoleon had abdicated as France's emperor in April, and the victorious Allies, even after nearly a quarter century of war, gave generous terms to France under the restored Bourbon dynasty. France was allowed to retain its boundaries of Jan. 1, 1792, keeping possession of the enclaves annexed in the early years of the French Revolution. France was restored most of its foreign colonies, but Tobago and Saint Lucia in the West Indies and the Ile-de-France (now Mauritius) in the Indian Ocean were ceded to Great Britain. The treaty dealt only in general terms with the disposal of the European territories taken from the French empire and ended with the provision that all of the powers engaged on either side in the war should send plenipotentiaries to the Congress of Vienna to complete those arrangements.

The second treaty between France and the Allies, of Nov. 20, 1815, was signed in an altogether different spirit from the first. Napoleon had escaped from Elba and been welcomed by the French, and, consequently, war between France and the Allies had resumed and continued until Napoleon was defeated at the Battle of Waterloo. The second treaty abandoned the lenient spirit of the first and exacted indemnities from France, partly in the form of territory and partly in money. The French frontier was changed from that of 1792 to that of Jan. 1, 1790, thus stripping France of the Saar and Savoy. France had to pay an indemnity of 700,000,000 francs and to support an army of occupation of 150,000 men on its soil for three to five years.

Paris, Treaty of (1856), treaty signed on March 30, 1856, in Paris that ended the Crimean War. The treaty was signed between Russia on one side and France, Great Britain, Sardinia-Piedmont, and Turkey on the other. Since the western European powers had fought the war to protect Ottoman Turkey from Russia, the treaty gave special attention to this problem. The signatories guaranteed the independence and territorial integrity of Turkey. Russia was obliged to surrender Bessarabia (situated at the mouth of the Danube) to Moldavia, which along with Walachia were reorganized as autonomous states under Ottoman suzerainty. (These two principalities later joined to form Romania.) The Black Sea was neutralized (*i.e.,* its waters were closed to all warships), and the Danube River was opened to the shipping of all nations.

Paris I–XIII, Universities of, French UNIVERSITÉS DE PARIS I À XIII, universities founded in 1970 under France's 1968 Orientation Act reforming higher education. They replaced the former University of Paris, one of the archetypal European universities, founded about 1170.

The medieval University of Paris grew out of the cathedral schools of Notre-Dame and, like most other medieval universities, was a kind of corporate company that included both professors and students. With papal support, Paris soon became the great transalpine centre of Christian orthodox theological teaching. At the end of the 13th and during the 14th centuries, it was the most celebrated teaching centre of all Christendom. Its famous professors included Alexander of Hales, St. Bonaventure, Albertus Magnus, and Thomas Aquinas.

The university was originally divided into four faculties: three "superior," theology, canon law, and medicine; and one "inferior," arts. In the faculty of arts, the trivium (grammar, rhetoric, and dialectic) and the quadrivium (arithmetic, geometry, astronomy, and music) were taught together with general scientific, literary, and general culture. Aristotelian philosophy was an especially important field of study in the arts faculty. Each faculty was headed by a dean, and the dean of the faculty of arts had by the 14th century become the head of the collective university under the title of rector.

Many colleges were built to accommodate the students. The most celebrated college of Paris was the Sorbonne, founded by the theologian Robert de Sorbon about 1257. Because its halls were the scene of numerous theological disputations, the name Sorbonne became a popular term for the theological faculty of Paris.

The University of Paris remained a spokesman for Roman Catholic orthodoxy, and its educational program, which was founded on Scholastic dialectics, became rigidly fixed. As a result, the university made little contribution to the humanistic studies of the Renaissance, and the university subsequently declined under the impact of the Reformation and the ensuing Counter-Reformation. With the French Revolution (1789–99) and Napoleon's subsequent reorganization of many of France's institutions, the University of Paris became one of the academies of the newly created University of France. Among its several faculties were some that were later abandoned (*e.g.,* theology in 1886), and others, such as science and pharmacy, that were new. Teaching at the university had by then become secular—that is, independent of political or religious doctrine.

At mid-20th century (when the University of France, as a central organizing body, had given place to the Ministry of Public Instruction), the University of Paris had again become a preeminent scientific and intellectual centre. The most distinguished professors lectured there, and there were more than 600 professorial chairs. In May 1968 a protest initiated by students at the Sorbonne grew into a serious national crisis. This led to a major educational reform that decentralized schools and gave students greater participation in university administration.

Paris Basin, geographic region of France, constituting the lowland area around Paris.

Geologically it is the centre of a structural depression that extends between the ancient Armorican Massif (west), the Massif Central (south), and the Vosges, Ardennes, and Rhineland (east). The area, which forms the heartland of France, is drained largely by the Seine River and its major tributaries converging on Paris. The natural vegetation of the basin has been almost entirely lost to the works of man, except for a few relict forests.

Paris Codex, Latin CODEX PERESIANUS, along with the Madrid and Dresden codices, one of the three richly illustrated glyphic texts of the pre-Conquest Mayan period known to have survived the book burnings by the Spanish clergy during the 16th century. Its Latin name comes from the name Perez, which was written on the torn wrappings of the manuscript when it was discovered in 1859 in an obscure corner of the Bibliothèque Nationale in Paris.

The Paris Codex is devoted almost entirely to Mayan ritual and ceremony, such as the ceremony held to celebrate the end of a 20-year period. The codex is fragmentary and in poorer condition than either of the other known codices. It is composed of paper made from tree bark and is fashioned in a long strip and folded like a screen. The eleven individual leaves provide 22 pages of columns of glyphs and pictures of the gods. The set of year-bearers appearing in the codex offers a clue to the date of its production, placing it midway between the Classic and Conquest periods of Mayan history.

Paris-Match, weekly pictorial magazine published in France since 1949 as successor to *L'Illustration* (1843–1944), which was discredited during World War II. A popular pictorial-news and current-events magazine aimed at the lower-middle class, it features picture stories on public affairs, profiles of government officials and assorted celebrities, and stories on consumer products. Its format resembles that of the American magazine *Life,* and it is similarly noted for its topicality and outstanding photography.

Paris-Match was acquired by Jean Prouvost, publisher of the daily *Le Figaro,* who led *Paris-Match* to attain high prestige and financial success. It appeals to a broad spectrum of the French middle class and is one of the most widely circulated magazines in France.

Paris Observatory, French OBSERVATOIRE DE PARIS, national astronomical observatory of France, under the direction of the Academy of Sciences. It was founded by Louis XIV at the instigation of J.-B. Colbert, and construction at the site in Paris began in 1667. Gian Domenico Cassini was the first of four generations of his family to hold the post of director of the observatory.

The observatory was enlarged in 1730, 1810, 1834, 1850, and 1951. The Paris building now houses the headquarters of the International Time Bureau, which standardizes the time determinations of the world's observatories. In 1926 the solar observatory at Meudon, on the outskirts of Paris, was taken over by the Paris Observatory. A radio astronomy station is maintained at Nançay, about 160 km (100 miles) south of Paris.

Paris Opéra, formally ACADÉMIE NATIONALE DE MUSIQUE, opera company in Paris that for more than two centuries was the chief performer of serious operas and musical dramas in the French language. It is one of the most venerable operatic institutions in the world. It was established as the Royal Academy of Music (Académie Royale de Musique) under a patent granted by Louis XIV in 1669. The company's first performance was *Pomone* (1671), a pastoral by the composer Robert Cambert and the poet Pierre Perrin. In 1672 the Royal Academy of Dance was amalgamated with the Royal Academy of Music.

In the 17th and 18th centuries the Paris Opéra's productions were dominated by a series of operatic giants. Jean-Baptiste Lully, who profoundly influenced the development of French opera, ruled the Opéra from 1672 until his death in 1687. In 1733 Jean-Philippe Rameau, Lully's equal in the history of French opera, began his 30 years as the leading operatic figure in France, with *Hippolyte et Aricie.* Christoph Gluck, the leader of the movement for operatic reform, was associated with the Opéra from 1773 to 1779.

The French Revolution of 1789 prompted the Paris Opéra to produce a series of operas on revolutionary subjects. In the middle and late 19th century, grand opera, exemplified in the works of Giacomo Meyerbeer, flourished in the company's repertory. The Opéra underwent a decline in the 20th century, and attempts to rejuvenate it began at mid-century. Its administration was joined with that of the Opéra-Comique, which traditionally stages works with spoken dialogue. From 1875 to 1990 the Paris Opéra was housed in the Théâtre Nationale de l'Opéra, an architectural landmark that is better known simply as the Opéra. In the latter year the company occupied its new home in the Opéra de la Bastille building.

Paris Opéra Ballet, ballet company established in France in 1661 by Louis XIV as the Royal Academy of Dance (Académie Royale de Danse) and amalgamated with the Royal Academy of Music in 1672. As part of the Théâtre National de l'Opéra, the company dominated European theatrical dance of the 18th and early 19th centuries. Its artists developed the basic techniques of classical ballet: Pierre Beauchamp, the company's first director, codified the five basic ballet positions, and the virtuosos Jean Balon, Louis Duport, Marie Camargo, and Gaetano and Auguste Vestris extended the range of dance steps, especially the jumps and leaps.

In 1832 the company opened the era of Romantic ballet by presenting Filippo Taglioni's *La Sylphide.* The company's dancers of this period included Jules Perrot, Arthur Saint-Léon, Fanny Elssler, and Carlotta Grisi, who created the title role in *Giselle* at the Paris Opéra in 1841.

The company's decline at the end of the 19th century was arrested by Jacques Rouché, director of the Paris Opéra and the Opéra-Comique from 1914 to 1944. After the successful avant-garde productions of Sergey Diaghilev's Ballets Russes at the Opéra, Rouché engaged the Russian guest artists Michel Fokine, Anna Pavlova, and Bronisława Nijinska and in 1930 appointed Serge Lifar director of the company. Principal performers under Lifar included Yvette Chauviré, Solange Schwarz, Marjorie Tallchief, Michel Renault, and George Skibine. In 1976 dancer Violette Verdy became the first female director of the company.

Paris Peace Conference (1919–20), the meeting that inaugurated the international settlement after World War I.

Although hostilities had been brought formally to an end by a series of armistices between the Allies and their adversaries—that of Salonika (Thessaloníka) with Bulgaria on Sept. 29, 1918, that of Mudros with Turkey on October 30, that of Villa Giusti with Austria-Hungary on November 3, and that of Rethondes with Germany on November 11—the conference did not open until Jan. 18, 1919. This delay was attributable chiefly to the British prime minister, David Lloyd George, who chose to have his mandate confirmed by a general election before entering into negotiations.

Lloyd George's arrival in Paris was followed on Jan. 12, 1919, by a preliminary meeting of the French, British, U.S., and Italian heads of government and foreign ministers—respectively Georges Clemenceau and Stephen Pichon; Lloyd George and Arthur James Balfour; Woodrow Wilson and Robert Lansing; and Vittorio Emanuele Orlando and Sidney Sonnino—at which it was decided that they themselves, with the Japanese plenipotentiaries, would constitute a Supreme Council, or Council of Ten, to monopolize all the major decision making. In March, however, the Supreme Council was, for reasons of convenience, reduced to a Council of Four, numbering only the Western heads of government, as the chief Japanese plenipotentiary, Prince Saionji Kimmocho, abstained from concerning himself with matters of no interest to Japan. The foreign ministers continued to meet as a Council of Five dealing with secondary matters.

The five Great Powers likewise controlled the Supreme Economic Council, created in February 1919 to advise the conference on economic measures to be taken pending the negotiation of peace. Specialized commissions were appointed to study particular problems: the organization of a League of Nations and the drafting of its Covenant; the determination of responsibility for the war and guarantees against a renewal of it; reparations; international labour legislation; international ports, waterways, and railroads; financial questions; economic questions of a permanent sort; aviation; naval and military matters; and territorial questions.

Major products of the conference were (1) the Covenant of the League of Nations, which was submitted in a first draft on Feb. 14, 1919, and finally approved, in a revised version, on April 28, (2) the Treaty of Versailles, presented at last to a German delegation on May 7, 1919, and signed, after their remonstrances, on June 28, (3) the Treaty of Saint-Germain, presented to an Austrian delegation in a rough draft on June 2, 1919, and in a fuller version on July 20 and signed on September 10, and (4) the Treaty of Neuilly, presented to a Bulgarian delegation on Sept. 19, 1919, and signed on November 27. There had been wrangling among the Allies over both the treaties with Germany and those with Austria. Concerning the former, the Americans and the British resisted French demands affecting Germany's western frontier and the Polish demand, supported by France, for Danzig (Gdańsk), while the Americans also objected to Japanese claims to Germany's special privileges in Shantung, China. Concerning the latter treaty, the Italians and the Yugoslavs quarreled over the partition of Austria's former possessions on the Adriatic.

The formal inauguration of the League of Nations on Jan. 16, 1920, brought the Paris conference to an end, before the conclusion of treaties with Turkey (1920, 1923) or with Hungary (1920).

Paris Zoo, zoological park comprising the Menagerie of the Botanical Garden (Ménagerie du Jardin des Plantes) and the Zoological Park of Paris (Parc Zoologique de Paris), both services of the French National Museum of Natural History. In 1793 the Jardin des Plantes, which was originally a botanical garden, also became the first public zoo in France. The compact 6.5-hectare (16-acre) area, with formal 18th-century landscaping, was retained when the Jardin was renovated between 1918 and 1939. It holds more than 930 specimens of about 275 animal species, including the rare Przewalski's horse and the onager; it has had excellent success breeding these species, as well as gorals, chamois, and European bison.

In 1934 the Parc Zoologique, a modern 17-ha (42-ac) zoo with spacious natural-habitat surroundings, was opened in a wooded area, the Bois de Vincennes. Its landmark is the Grand Rocher, a 71-m- (236-ft-) high artificial mountain with winding paths for wild sheep. The zoo has more than 950 specimens of nearly 225 species. It has had notable success in breeding the okapi and giraffe, and houses more than 40 species of antelope and many deer, including the rare Eld's deer for which the zoo maintains the international studbook.

parish, in some Christian church polities, geographical unit served by a pastor; it is a subdivision of a diocese. In the New Testament, the Greek word *paroikia* means sojourning, or temporary, residence. In the very early church, the parish was the entire body of Christians in a city under the bishop, who stood in the same relationship to the Christians of the entire city as does the parish priest to the parish in modern times. In the 4th century, when Christianity in western Europe spread to the countryside, Christians in an important village were organized into a unit with their own priest under the jurisdiction of the bishop of the nearest city. The unit was called a parish.

In Anglo-Saxon England the first parish churches were founded in important administrative centres. They were called minsters, and subsequently old minsters, to distinguish them from the later village churches. When the Church of England became independent of Rome during the 16th century, it retained the parish as the basic unit of the church.

The parish system in Europe was essentially created between the 8th and 12th centuries. The Council of Trent (1545–63) reorganized and reformed the parish system of the Roman Catholic Church to make it more responsive to the needs of the people.

In civil government the parish is the lowest unit of government in England. In the United States, Louisiana is divided into parishes, the equivalent of counties in other states.

Parisien Libéré, Le (French: "The Free Parisian"), morning daily newspaper published in Paris, one of the largest and most influential in France. It was established in Paris in 1944 as an organ of the French underground during the latter part of the German occupation in World War II. The paper used a sensational makeup style with numerous headlines and photos on its front page and with the text of news articles often confined to inside pages.

After the war *Le Parisien Libéré* successfully competed with the welter of new dailies and by the 1960s, it had the second largest circulation in France. Faced with union difficulties and mounting costs, the paper's owner, Emilien Amaury, in 1975 moved the printing operations of *Le Parisien Libéré* to Saint-Ouen and Chartres. The union problems were settled in 1977, but the readership of *Le Parisien Libéré* had dropped somewhat. By the mid-1980s it had recovered.

Parisiensus, Johannes: *see* Perréal, Jean.

parity, in economics, equality in price, rate of exchange, purchasing power, and wages.

In international exchange, parity refers to the exchange rate between the currencies of two countries making the purchasing power of both currencies substantially equal. Theoretically, exchange rates of currencies can be set at a parity or par level and adjusted to maintain parity as economic conditions change. The adjustments can be made in the marketplace, by price changes, as conditions of supply and demand change. These kinds of adjustment occur naturally if the exchange rates are allowed to fluctuate freely or within wide ranges. If, however, the exchange rates are stabilized or set arbitrarily (as by the Bretton Woods Conference of 1944) or are set within a narrow range, the par rates can be maintained by intervention of national governments or international agencies (*e.g.*, the International Monetary Fund).

In U.S. agricultural economics, the term parity is used for a system of regulating the prices of farm commodities, usually by government price supports and production quotas, in order to provide farmers with the same purchasing power that they had in a selected base period. For most farm commodities the base period has been 1910–14. For example, the average price received per bushel of wheat during 1910–14 was 88 cents; if the prices paid by farmers for other goods quadrupled, the parity price for wheat would be $3.52 per bushel.

Parity is also used in personnel administration in establishing equitable wage schedules between certain classes of employees. A parity ratio may be set, for instance, between the salaries of policemen and the salaries of firemen.

parity, in physics, property important in the quantum-mechanical description of a physical system. In most cases, it relates to the symmetry of the wave function representing a system of fundamental particles. A parity transformation replaces such a system with its mirror image. Stated mathematically, the spatial coordinates describing the system are inverted through the point at the origin; that is, the coordinates x, y, and z are replaced with $-x$, $-y$, and $-z$. In general, if a system is identical to the original system after a parity transformation, the system is said to have even parity. If the final formulation is the negative of the original, its parity is odd. For either parity the physical observables, which depend on the square of the wave function, are unchanged. A complex system has an overall parity that is the product of the parities of its components.

Until 1956 it was assumed that, when an isolated system of fundamental particles interacts, the overall parity remained the same, or was conserved. This conservation of parity implied that, for fundamental physical interactions, it is impossible to distinguish right from left and clockwise from counterclockwise. The laws of physics, it was thought, are indifferent to mirror reflection and could never predict a change in parity of a system. This law of the conservation of parity was explicitly formulated in the early 1930s by the Hungarian-born physicist Eugene P. Wigner and became an intrinsic part of quantum mechanics.

In 1956 the Chinese-born physicists Tsung-Dao Lee and Chen Ning Yang proposed that parity is not always conserved. For subatomic particles, three basic interactions are important: electromagnetic, strong, and weak. Lee and Yang showed that the evidence for parity conservation applies only to the first two interactions and not to the weak interaction. The fundamental laws governing weak interactions should not be indifferent to mirror reflection, and, therefore, weak interactions should show some measure of built-in right- or left-handedness that might be experimentally detectable. The following year (1957) it was conclusively proven that the electrons ejected along with antineutrinos from certain unstable cobalt nuclei in the process of beta decay, a weak interaction, are predominantly left-handed. The spin vector of these electrons is opposite to their direction of travel; that is, their spin rotation is that of a left-handed screw. Nevertheless, it is believed, because of strong theoretical grounds (*i.e.*, the CPT theorem), that, when the operation of parity reversal P is joined with two others, called charge conjugation C and time reversal T, the combined operation does leave the fundamental laws unchanged.

park, large area of ground set aside for recreation. The earliest parks were those of the Persian kings who dedicated many square miles to the sport of hunting; by natural progression such reserves became artificially shaped by the creation of riding paths and shelters until the decorative possibilities became an inherent part of their character. A second type of park derived from such open-air public meeting places as that in ancient Athens, where the functions of an exercising ground, a social concourse, and an athletes' training ground were combined with elements of a sculpture gallery and religious centre.

In the parks of post-Renaissance times there were extensive woods, rectilinear *allées* stretching between one vantage point and another, raised galleries, and, in many cases, elaborate aviaries and cages for wild beasts, attesting to the hunting proclivities of the lords. Later the concept of the public park was somewhat domesticated. An area devoted simply to green landscape, a salubrious and healthful breathing space as a relief from the densely populated and industrialized city of the mid-19th century, became of vital importance. Examples of this type park are Birkenhead park in England (1844) by Sir Joseph Paxton; Jean Charles Alphand's Bois de Boulogne, outside Paris; Central Park in New York City by F.L. Olmsted and C. Vaux; Friedrich-Wilhelms-garten in Germany; the Botanic Gardens in Melbourne, Australia; and Akashi Park in Kōbe, Japan. The design was generally romantic in character. The primary purpose was to provide for passive recreation—walking and taking the air in agreeable and natural surroundings reminiscent of the unspoiled country.

What primarily differentiates modern parks is their accommondation for active recreation. Park areas differ greatly from country to country, and their designs reflect differences in climate, cultural attitudes, social habits, and pastimes. In the gardens of the Generalife, a Spanish family may enjoy its holiday outing in a shaded *bosque* near a cool fountain. On an evening in Venice a procession with banners and torches may sweep into one of the little piazzas. In the Buttes-Chaumont in Paris children reach out from wooden horses on the merry-go-round to spear a brass ring. During the bright summer weekends in Stockholm, residents cultivate vegetables in allotment gardens leased to them by the park department. In Israel, Iran, and Pakistan, basketball, soccer, and kabadei (a game like rugby) are played in parks; in Japan, volleyball, tennis, and sumō (wrestling) may be seen. Almost universally, there is recognition of the creative possibilities of leisure and of community responsibility to provide space and facilities for recreation.

The facilities include outdoor theatres, zoos, concert shells, historical exhibits, concessions for dining and dancing, amusement areas, boating, and areas for sports of all kinds, such as fly-casting pools and skating rinks. There is always the danger that the original reason for creating the park—*i.e.,* to bring a part of nature within reach of the city dweller—will be sacrificed to its specific recreational functions. It is difficult to keep the balance, as the tempo of urban life is mounting and with it the requirements for intensive use.

Another danger to the public park is the automobile. With the tremendous growth in automobile traffic and, consequently, increasing pressure from traffic authorities for more land, there has been hardly a major city that has not lost sections of its parks to highways. There has been a growing awareness, particularly in Europe, that large-scale urban planning should be carried out in such a way that traffic functions are clearly separate and do not encroach on other spheres. In the United States, there have been victories for the park user against the automobile; in San Francisco, the state freeway was halted at the city limits, and in New York City, Washington Square was closed to traffic.

It is unfortunate that the word park has come to connote almost exclusively the "romantic" style park or English garden of the 19th century. In truth, there are other traditions whose influence has been equally vital. How different from the Parisian Buttes-Chaumont, for instance, are the Tuileries across the river. These were laid out under the supervision of Marie de Médicis in the style of the Boboli Gardens in Florence. Versailles, the Belvedere Park in Vienna, the Vatican Gardens in Rome, Hellbrun in Salzburg, Blenheim in England, Drottningsholm in Sweden, and Peterhof in the U.S.S.R. are all parks that were planned in the Italian Baroque tradition. They were not intended to be a foil or escape from the oppressive city but rather to be its central dramatic focus—a display for the opulence of rulers, a piazza for the moving of great crowds, from the tournament and guild ceremonies of Florence in the 17th century to the formal pageantry of the court. It was in the Baroque park that the handling, control, and stimulation of crowds in the open air developed as one of the great arts of the urban designer.

Another park tradition that has had worldwide influence is that of Islām. In Teheran, Marrakech, Seville, Lahore, and Delhi, this tradition is the dominant one and, as with all parks developed according to the climate, social custom, and religious ethos. The original Muslim idea was to think of the garden as a paradise, a symbol of the afterlife as an oasis of beauty blooming in the earthly desert. Water and the cypress are the two main elements. Within the park, then, is water, the symbol of purity, in the four-way river of paradise, and trees (above all the cypress, symbolizing life), surrounded by high walls to keep out the dry wind. Everywhere, in keeping with Muslim belief, the design pattern is abstract rather than figurative. The fundamental idea creates its own specific technical skills; nowhere is there more artful use of irrigation for plants, of jets of water to cool the air, of orchards for shade, of colour to break up the sun's glare, or of the use of masonry patterns than in these Islāmic gardens.

The Taj Mahal in India dates from the 17th century, when by the testament of Shah Jahan this area of 20 acres was to be maintained as a public grounds in perpetuity, where the poor could walk and pick fruit. In China and Japan a similar opening of the royal precinct for public enjoyment, as with the Winter Palace or the Katsura Imperial Villa Gardens in Kyōto, has been a more recent development. The great religious shrines, however, have always resembled Western parks. The Horimonji temple in Tokyo, the Mimeguri shrine, the great Buddhist temple at Ise, and the Inner (Shintō) shrine, at Mieshima are examples of an age-old garden tradition in which man is but "one of a thousand things" and where nature is presented in an idealized and symbolic way as an object for contemplation and spiritual enjoyment. In their techniques of horticulture and in their use of stones, water, and surface textures, the gardens of the Far East are of a high level. This Eastern tradition had its effect on European park design in the 18th century and again in the 20th century, as in the grounds for the UNESCO building in Paris, designed by Isamu Noguchi. (R.B.Ni.)

Park, Mungo (b. Sept. 10, 1771, Fowlshiels, Selkirk, Scot.—d. *c.* January 1806, near Bussa on the Niger River), Scottish explorer of the Niger.

Educated as a surgeon at the University of Edinburgh, Park was appointed a medical officer in 1792 on a vessel engaged in the East Indies trade. His subsequent studies of the plant and animal life of Sumatra won for him the backing of the African Association to explore the true course of the Niger. Beginning his exploration at the mouth of the Gambia River on June 21, 1795, Park ascended that river for 200 miles to Pisania (now Karantaba, The Gambia), a British trading station. Hampered by fever and formidable hardships, he crossed the unknown territory of the upper Sénégal Basin. He was imprisoned by an Arab chief for four months but escaped on July 1, 1796, to continue his journey with little more than a horse and a compass. On July 20 he reached Ségou (now in Mali) on the Niger, which he followed downstream for 80 miles to Silla. Finally forced to turn back for lack of supplies, Park, travelling on foot, took a more southerly route on his return. After traversing mountainous country, he arrived at Kamalia in Mandingo country, where he lay dangerously ill with fever for seven months. With the assistance of a slave trader, he reached Pisania on June 10, 1797. He returned to Britain to write an account of his adventures, *Travels in the Interior Districts of Africa* (1797), which became a popular success and made him famous.

Two years later Park married and practiced medicine in Peebles, Peeblesshire, until asked by the government to head a second expedition to the Niger. Commissioned a captain, he led a party of 40 Europeans to Pisania and, on Aug. 19, 1805, with only 11 survivors, reached Bamako (now in Mali) on the Niger. Resuming the journey by canoe, he and his companions reached Ségou, where the local ruler gave him permission to continue his voyage down the unexplored river. Hoping to reach the coast at the end of January 1806, he set sail with eight companions from Sansanding, a little below Ségou, on Nov. 19, 1805. Reports that the expedition had met with disaster soon reached the settlements on the

Mungo Park, miniature after Henry Edrige; in the National Portrait Gallery, London
By courtesy of the National Portrait Gallery, London

Gambia. In 1812 it was learned that when the explorers reached the rapids at Bussa, about 1,000 miles below Sansanding, they were attacked by natives, and Park was drowned.

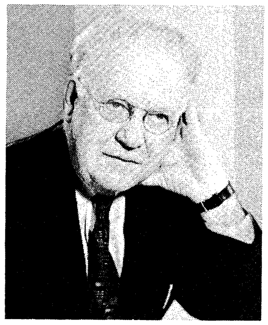
Park, Orlando (b. Oct. 13, 1901, Elizabethtown, Ky., U.S.—d. Sept. 23, 1969, Evanston, Ill.), U.S. entomologist known chiefly for his work on the biology and taxonomy of insects comprising the family Pselaphidae, a group of small, short-winged, mold beetles that commonly live in ant nests.

Several years after acquiring his Ph.D. at the University of Chicago, Park joined the faculty of Northwestern University, Evanston, Ill., from which he ultimately retired (1968) as chairman of the biology department. During his years in Evanston, Park also served as a research associate at the Chicago Natural History Museum (1955–69), where developed one of the world's finest collections of pselapid beetles.

Prior to his entomological investigations, Park had devoted much effort to animal ecology, the study of the interrelationships of organisms with their environment and the interactions between individuals within a population and between individuals of different populations. His books *A Laboratory Introduction to Animal Ecology and Taxonomy* (1939) and *Principles of Animal Ecology* (1949) helped to establish some of the basic principles and methods of this field of biology.

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

Park, Robert E(zra) (b. Feb. 14, 1864, Harveyville, Pa., U.S.—d. Feb. 7, 1944, Nashville, Tenn.), sociologist noted for his work on ethnic minority groups, particularly the U.S. black population, and on human ecology, a term he is sometimes credited with having



Robert E. Park
By courtesy of Fisk University News Bureau

coined. He was one of the leading figures in what came to be known as the "Chicago school" of sociology.

Park studied under the philosophers John Dewey (at the University of Michigan), William James and Josiah Royce (both at Harvard), and the sociologist Georg Simmel (in Germany). All his graduate work was done after 11 years' experience as a newspaper reporter in various large cities, where his interest in social problems was stimulated. He taught at Harvard (1904–05), the University of Chicago (1914–33), and Fisk University, Nashville, Tenn. (1936–43).

In 1906 Park wrote two magazine articles about the oppression of the Congolese by Belgian colonial administrators. Turning to the study of the black population in his own country, he became secretary to Booker T. Washington and is said to have written most of Washington's book *The Man Farthest Down* (1912). He believed that a caste system produced by sharp ethnic differences tends, because of the division of labour among the castes, to change into a structure of economic classes.

With Ernest W. Burgess, Park wrote a standard text, *Introduction to the Science of Sociology* (1921). In *The Immigrant Press and Its Control* (1922), Park argued that foreign-language newspapers in the long run would promote assimilation of immigrants. Three volumes of his *Collected Papers*, edited by Everett C. Hughes and others, were published between 1950 and 1955. The second volume deals with the city and also with human ecology, which was the title of a course taught by Park at the University of Chicago in 1926.

Park, Thomas (b. Nov. 17, 1908, Danville, Ill., U.S.), U.S. animal ecologist known for his experiments with beetles in analyzing population dynamics.

After earning a Ph.D. from the University of Chicago in 1932, Park taught at Johns Hopkins University, Baltimore, and at the University of Chicago. He wrote, with others, *Principles of Animal Ecology* (1949), which applied principles first formulated in studies of plant ecology to animal relationships in an evolutionary perspective. He was president of the American Association for the Advancement of Science in 1961, and he received the

Eminent Ecologist Citation from the Ecological Society of America in 1971.

Using two species of flour beetles, *Tribolium confusum* and *T. castaneum,* Park studied the efforts of competition caused by overcrowding. By analyzing birth and death rates, he found that in any mixed population one of the species always declined in numbers and became extinct, while the other increased in numbers in a characteristic percentage of tests. Overcrowding always led to a decrease in the a birth rate of the less fit species with an increase in disease, malformations, and death rate. Some scientists think that the implications of Park's experiments on insects may be applied to human populations as well.

Park Chung Hee (b. Sept. 30, or Nov. 14, 1917, region of Taegu, Korea—d. Oct. 26, 1979, Seoul), South Korean general and politician, president of the Republic of Korea (South Korea) from 1963 to his death, whose 18-year rule brought about enormous economic expansion at the cost of civil liberties and political freedom.

Born into an impoverished rural family, Park graduated (1937) with top honours from Taegu Normal School, after which he taught primary school. After attending a Japanese military academy, Park served as a second lieutenant in the Japanese army during World War II and became an officer in the Korean army when Korea was freed from Japanese rule after the war. In 1948 Park was sentenced to death for taking part in a revolt of junior officers who did not want to see Korea arbitrarily divided by the Allies. After turning prosecution witness and implicating the other officers as communists, Park was pardoned and restored to rank.

He was made a brigadier general (1953) during the Korean War and was promoted to general in 1961. In the same year, he led a bloodless coup (May 16) that overthrew the Second Republic. He remained the leader of the junta until two years later, when he won the first of his three terms as president of the Third Republic.

At home Park maintained a policy of guided democracy; in foreign affairs he continued his predecessors' close relations with the United States. Park was responsible in large part for South Korea's economic miracle; the programs he initiated gave his country one of the fastest-growing economies in the world, showing the best growth of any developing nation. His regime achieved a remarkable economic growth (more than 10 percent per year), transforming an impoverished, largely rural society into an industrial nation with exports of naval vessels, textiles, automobiles, and television sets. He brought electricity and piped water throughout South Korea.

Democracy, however, was curtailed, with restrictions on personal freedoms, suppression of the press and opposition parties, and control over the judicial system and the universities. He organized and expanded the dreaded Korean Central Intelligence Agency (KCIA), claiming that all his measures were necessary to fight communism. The last free election was in 1971, when Park narrowly beat his opponent, Kim Dae Jung. On Oct. 17, 1972, Park declared martial law, and one month later a new constitution was approved that gave him sweeping powers, including the right to appoint one-third of the members of the National Assembly. He grew increasingly harsh toward political dissidents. After Park's dismissal (1979) of a popular opposition leader from the National Assembly, Korea erupted with the worst riots and demonstrations since 1964, when Park established diplomatic relations with Japan. Park was assassinated—after two earlier, unsuccessful attempts, including one (1974) in which his wife was killed—by his life-long friend Kim Jae Kyu, the head of the KCIA.

Park Forest, village, Cook county, northeastern Illinois, U.S., southern residential suburb of Chicago. Developed after World War II, it attracted widespread interest because its planners assumed responsibility for all phases of community development. It was designed by Elbert Peets for American Community Builders, Inc., primarily for middle-income families, to include rental and privately owned dwellings as well as schools, churches, shopping centres, municipal services, and an industrial park. Park Forest was incorporated in 1949 and received national attention when William H. Whyte, Jr., wrote a series of articles (published 1956 as *The Organization Man*) about the manners, morals, and home life of young executives, based on research done in that community. Governor's State University was established (1969) in adjacent Park Forest South. Pop. (1988 est.) 25,832.

Park Range, segment of the Rocky Mountains, extending south-southeastward for about 200 miles (320 km) from Carbon county, Wyo., to northwestern Park county, Colo., U.S. The range lies largely within Medicine Bow, Pike, Arapaho, Routt, and White River national forests and includes the Mosquito (Colorado), Gore (Colorado), and Sierra Madre (Wyoming) subranges. Many peaks surpass 14,000 feet (4,300 m), with Mount Lincoln (14,286 feet [4,354 m]) the highest point. Major highways cut through Vail (10,603 feet [3,232 m]) and Rabbit Ears (9,426 feet [2,873 m]) passes, leading to popular winter-sports areas. The headstreams of the North and South Platte rivers rise in the range.

Park Ridge, city, Cook county, northeastern Illinois, U.S., northwestern suburb of Chicago. Founded in 1856 as Pennyville (later called Brickton), it developed as a residential community after the arrival of the Chicago and North Western Railway (1856). It was renamed (1873) in the belief that it included the highest ridge in the county. Park Ridge is known for its special educational facilities, including Park Ridge Youth Campus (1877; originally Park Ridge School for Girls, established for unwed pregnant girls). O'Hare International Airport is nearby. Inc. village, 1873; city, 1910. Pop. (1988 est.) 37,229.

Parker, Alton B(rooks) (b. May 14, 1852, Cortland, N.Y., U.S.—d. May 10, 1926, New York City), American jurist and Democratic presidential nominee in 1904, defeated by the incumbent, Theodore Roosevelt.

Having practiced law in Kingston, N.Y., Parker was elected surrogate of Ulster county in 1877 and reelected six years later. He also was active in state Democratic Party affairs. He was appointed to the New York Supreme Court in 1885, the state Appeals Court in 1889, and the appellate division of the state Supreme Court in 1896. From 1898 to 1904 Parker was chief justice of the New York Court of Appeals. On the bench, he was noted for upholding the rights of labour. Nominated on the first ballot at the Democratic convention in 1904, Parker, representing the Eastern, pro-gold-standard wing of the party, differed little from his opponent, President Theodore Roosevelt. Parker was soundly defeated, taking only 38 percent of the popular vote and winning 140 electoral votes to Roosevelt's 336. Thereafter he practiced law.

Parker, Bonnie: *see* Barrow, Clyde; and Parker, Bonnie.

Parker, Charlie, byname of CHARLES CHRISTOPHER PARKER, JR., also called BIRD, or YARDBIRD (b. Aug. 29, 1920, Kansas City, Kan., U.S.—d. March 12, 1955, New York City), American alto saxophonist, composer, and bandleader who is considered by many to have been the greatest improviser in jazz history and the father of the modern jazz style known as bebop. His first recordings with trumpeter Dizzy Gillespie during the mid-1940s set the pace for the jazz of the next two decades.

Parker's style began with the advanced swing-era approaches of Buster Smith and Lester Young, heard by him during the 1930s in Kansas City, Mo. In 1939 Parker moved to New York City, playing at Monroe's Uptown House on 52nd Street. After playing in the Earl Hines and Billy Eckstine bands with Dizzy Gillespie, Parker and Gillespie left to front their own quintet in 1945. The Dial and Savoy recordings of the late 1940s contain the definitive examples of Parker's playing, including such tunes as "Now's the Time," "Billie's Bounce," and "KoKo."

Charlie Parker, 1949
AP/Wide World Photos

Parker absorbed a wide range of musical influences, including Afro-American folk forms as well as 20th-century concert music. His favourite musical phrases became the vocabulary of, and eventually provided the melodic clichés for, modern jazz improvisers. More than 20 years after his death, new recordings of such tunes of his as "Confirmation," "Donna Lee," "Scrapple from the Apple," and "Ornithology" were still being made. His music became the subject of scholarly treatises and was taught within the college jazz curriculum much as the work of J.S. Bach is taught to conservatory students. Most influential innovators who followed him had at least some of their roots in his style; saxophonists Sonny Rollins, John Coltrane, and Ornette Coleman all showed some Parker influence in their earliest recordings.

Parker made common the use of quick tempos and the practice of adding and implying extra chords within existing chord progressions. His phrasings employed unique hesitations and abrupt endings. Though many of his followers insisted on double-timing their solos as he had, none showed his exuberance or the imagination that moved the spontaneous embellishments with which he decorated his own lines, nor did they show Parker's technical mastery of his instrument.

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Parker, Dorothy (b. Aug. 22, 1893, West End, N.J., U.S.—d. June 7, 1967, New York City), American short-story writer and poet chiefly known for her witty remarks.

Dorothy Parker, 1939
Culver Pictures

Parker grew up in New York City, where—after graduation from Miss Dana's School in Morristown, N.J.—she became drama critic for the magazine *Vanity Fair.* She and two other writers for the magazine—Robert Benchley, the humorist, and Robert Sherwood, then a drama critic and later to become a playwright—formed the nucleus of the Algonquin Round Table, an informal luncheon club held at New York's Algonquin Hotel.

Discharged from *Vanity Fair* in 1920 for the acerbity of her drama reviews (she wrote, for example, of the young Katherine Hepburn that she "ran the gamut of emotions from A to B"), she became a free-lance writer. She initiated a personal kind of book reviewing in *The New Yorker* magazine as "Constant Reader." Starting in 1927 and appearing intermittently until 1933, some of these reviews have been collected in *A Month of Saturdays* (1971). Her first volume of verse, *Enough Rope*, was a best-seller when it appeared in 1926. Two other books of verse, *Sunset Gun* (1928) and *Death and Taxes* (1931), were collected with it in *Collected Poems: Not So Deep as a Well* (1936).

In 1929 she won the O. Henry Award for the best short story of the year with "Big Blonde," a compassionate account of an aging party girl. *Laments for the Living* (1930) and *After Such Pleasures* (1933) were collections of her short stories, combined and augmented in 1939 as *Here Lies.* Characteristic of both the stories and verses is a view of the human situation as simultaneously tragic and funny.

In 1933 she and her second husband, Alan Campbell, went to Hollywood to collaborate as film writers, receiving screen credits for more than 15 films, including *A Star Is Born,* nominated for an Academy Award. She became active in left-wing politics, disdained her former role as a smart woman about town, reported from the Spanish Civil War, and discovered that her beliefs counted against her employment by the studios in the fervour of anticommunism that seized Hollywood after World War II. She wrote book reviews for *Esquire* magazine and collaborated on two plays: *The Coast of Illyria* (first performance 1949), about the English essayist Charles Lamb, performed briefly in Dallas, Texas, and London; and *The Ladies of the Corridor* (1953), about lonely widows in side-street New York hotels, which had a short run on Broadway. An earlier play, *Close Harmony,* written with Elmer Rice, also had a short New York run in 1924.

Parker's witty remarks remain popular. When told of former U.S. president Calvin Coolidge's death, she is said to have asked, "How can they tell?" She also is responsible for the couplet "Men seldom make passes / at girls who wear glasses."

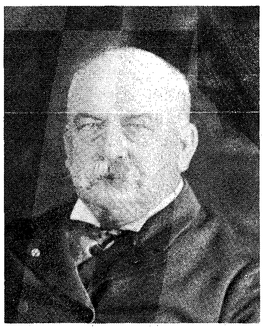
BIBLIOGRAPHY. Arthur F. Kinney, *Dorothy Parker* (1978); and Marion Meade, *Dorothy Parker* (1987), are solidly researched biographies.

Parker, Francis (Wayland) (b. Oct. 9, 1837, Bedford, N.H., U.S.—d. March 2, 1902, Chicago), a founder of progressive elementary education in the United States and organizer of the first parent-teacher group at Chicago.

At age 16 he began to teach and five years later became school principal at Carrollton, Ill. (1858). He was commissioned a lieutenant in the Union Army (1861) and rose to the rank of lieutenant colonel. Teaching in various places after the American Civil War, Parker experimented with teaching methods in an attempt to change the rigid formalism prevalent in American schools. In 1872 he went to Germany to study educational methods pioneered by Johann F. Herbart and others.

Returning to the United States (1875), he became school superintendent for Quincy, Mass. He brought science, arts, and crafts into the curriculum and advocated pupil self-expression, socialized activity, and a humanized, informal instruction stressing children's individuality. Children learned the alphabet by reading simple words, rather than by memorization; arithmetic by manipulating objects, rather than by dealing with abstractions; and geography by taking field trips.

After serving as supervisor of the Boston school system (1880–83), Parker was appointed principal of the Cook County Normal School at Chicago, which became noted for its liberalizing influence on American education. In 1899 an endowment made it pos-



Francis Parker
By courtesy of the Chicago Historical Society

sible for him to establish a private normal school, the Chicago Institute, which two years later became associated with the University of Chicago on his becoming the first director of the University's School of Education.

BIBLIOGRAPHY. Jack K. Campbell, *Colonel Francis W. Parker, the Children's Crusader* (1967), contains an extensive bibliography.

Parker, Sir (Horatio) Gilbert, BARONET (b. Nov. 23, 1862, Camden East, Ont., Can.—d. Sept. 6, 1932, London), British novelist of popular adventure and historical romances whose most widely known work was *The Seats of the Mighty* (1896), a novel of the 17th-century conquest of Quebec.

From 1885 to 1889 Parker traveled widely in Australia and the South Seas, after which he settled in London and began writing his spirited stories and novels, in which he skillfully combined energetic action, vivid characterizations, and rich local colour with accuracy of historical detail. In politics Parker became a prominent imperialist and was a member of Parliament from 1900 to 1918. He was knighted in 1902, made a baronet in 1915, and a privy councillor in 1916. (His marriage resulted in no issue, and the baronetcy became extinct upon his death.)

Parker, Horatio (William) (b. Sept. 15, 1863, Auburndale, Mass., U.S.—d. Dec. 18, 1919, Cedarhurst, N.Y.), composer, conductor, and teacher, prominent member of the turn-of-the-century Boston school of U.S. composers. Parker studied in Boston and Munich. Returning to New York, he taught at the National Conservatory of Music, then directed by Antonin Dvořák. In 1894 he became professor of music at Yale, where he was active in choral conducting. He also founded the New Haven Symphony Orchestra.

Horatio Parker
By courtesy of the Yale University Archives, Yale University Library

Parker's principal compositions are his choral works, which include his masterpiece, the oratorio *Hora Novissima* (1893); the ode *Hymnos Andron;* and the morality *The Dream of Mary.* He also wrote two operas, *Mona* (1912) and *The Fairyland* (1915), as well as organ works, piano pieces, chamber music, orchestral works, and a book, *Music and Public Entertainment* (1911).

Parker, Matthew (b. Aug. 6, 1504, Norwich, Norfolk, Eng.—d. May 17, 1575, Lambeth, London), Anglican archbishop of Canterbury (consecrated 1559) and moderate Reformer under Queen Elizabeth I, who carried out a religious settlement in which the Church of England maintained a distinct identity apart from Roman Catholicism and Protestantism, thus alienating the Puritans, who sought complete integration with the Protestant Reformation. Parker supervised the formulation of the Thirty-nine Articles (the Anglican summation of doctrine), initiated liturgical reforms, and wrote several scholarly treatises on English church history.

Parker, Quanah (b. 1845?, near Wichita Falls, Texas, U.S.—d. Feb. 23, 1911, near Fort Sill, Okla.), aggressive Comanche leader who mounted an unsuccessful war against white invaders in southeast Texas (1874–75); he later became the main spokesman and peacetime leader of the Indians in that area, a role he performed for 30 years.

Quanah was the son of Chief Peta Nocone and Cynthia Ann Parker, a white woman captured by the Comanches as a child. Quanah added his mother's surname to his own. He was a member of the fierce Kwahadi band—particularly bitter enemies of the buffalo hunters who had appropriated their best land on the Texas frontier. In order to stem the onslaught of Comanche attacks on settlers and travelers, the U.S. government assigned the Indians to reservations in 1867. Parker and his band, however, refused to cooperate and continued their raids. In June 1874 Parker gathered some 700 warriors from among the Comanche, Cheyenne, and Kiowa and attacked about 30 white buffalo hunters quartered at Adobe Walls, Texas. The U.S. military retaliated in force, but Parker's group held out on the Staked Plains for almost a year before he finally surrendered at Fort Sill.

Eventually agreeing to settle on the reservation in southwestern Oklahoma, Parker persuaded other Comanche bands to conform. During the next three decades he was the main interpreter of white civilization to his people, encouraging education and agriculture and becoming a successful businessman while maintaining his own Indian culture.

Parker, Robert LeRoy: *see* Cassidy, Butch.

Parker, Theodore (b. Aug. 24, 1810, Lexington, Mass., U.S.—d. May 10, 1860, Florence), U.S. Unitarian theologian, pastor, scholar, and social reformer active in the anti-slavery movement. Theologically, he repudiated much traditional Christian dogma, putting in its place an intuitive knowledge of God derived from man's experience of nature and insight into his own mind. He resembled Ralph Waldo Emerson and other New England Transcendentalists in his emphasis on intuition but differed in the way he tempered his romanticism with rationalist and scientific interest.

Although Parker passed the entrance examination for Harvard College in 1830, he had no funds to attend. He was allowed, however, to take the examinations for his course of study without enrolling and was granted an honorary degree. He then attended Harvard Divinity School, from which he graduated in 1836. The next year he was ordained pastor of the Unitarian Church in West Roxbury, Mass.

By 1841 he had formulated his liberal religious views and had incorporated them in the sermon "The Transient and Permanent in Christianity." The transient, to him, was Christianity's theological and scriptural dogma, and the permanent was its moral truths. He elaborated his views in lectures published as *A Discourse of Matters Pertaining to Religion.* Opposition to his liberalism increased, and he soon resigned his pastorate. His supporters founded the 28th Congregational Society of Boston and installed him as minister.

Believing that the moral truths of Christianity had application to contemporary social problems, Parker worked for prison reform, temperance, women's education, and other such causes. He made impassioned speeches against slavery, helped fugitive slaves to escape, and wrote an Abolitionist tract, *A Letter to the People of the United States Touching the Matter of Slavery* (1848). He also served on the secret committee that aided the Abolitionist John Brown.

Parkersburg, city, seat (1801) of Wood County, western West Virginia, U.S., at the confluence of the Ohio (there bridged to Belpre, Ohio) and Little Kanawha rivers. Settled *c.* 1785 as Neal's Station on a land tract originally purchased by Alexander Parker of Pittsburgh, it was first chartered by Virginia in 1820 and rechartered by West Virginia in 1863. The discovery in the 1890s of the nearby Burning Springs oil field stimulated industrial growth. Manufactures are well diversified and include oil-well equipment, glass and porcelain products, rayon, shovels, steel castings, and chemicals. The city is also an agricultural-marketing centre. Mountain State (Business) College (1868), Ohio Valley College (1960), and Parkersburg Community College (1971) are in the city. Blennerhassett Island in the Ohio River, 2 mi (3 km) south, was the home of Harman Blennerhassett, a wealthy Irishman who supposedly plotted with Aaron Burr to seize the Southwest and set up an empire; their plot was discovered in 1806, but both were acquitted of treason. Inc. city, 1911. Pop. (1950) 29,684; (1970) 44,208; (1980) 39,967.

Parkes, town, east central New South Wales, Australia, in the Lachlan River Valley. Originally known as Bushman's, it was founded in 1862 as a reef- and alluvial-gold centre, and it was renamed after Sir Henry Parkes, a state premier, in 1873. Proclaimed a municipality in 1883, it is a commercial centre for a sheep-, grain-, fruit-, pig-, and poultry-farming area of the Western Slopes region, it is a rail junction on the Newell Highway, with air connections to Sydney (185 mi [298 km] southeast). Industries include iron foundries, steel fabrication works, sawmills, joineries, rail workshops, and agricultural machinery plants. One of the world's largest (210 ft [64 m]) bowl-shaped radio telescopes, operated by the Commonwealth Scientific and Industrial Research Organization, is at Alectown (15 mi north). Pop. (1981) 9,047.

Parkes, Alexander (b. Dec. 29, 1813, Birmingham, Warwickshire, Eng.—d. June 29, 1890, West Dulwich, near London), British chemist and inventor noted for his development of various industrial processes and materials. Much of Parkes's work was related to metallurgy. He was one of the first to propose introducing small amounts of phosphorous into metal alloys to enhance their strength. One of his most significant inventions was a method of extracting silver from lead (1850). This procedure, commonly called the Parkes process, involves adding zinc to lead and melting the two together. When stirred, the molten zinc reacts and forms compounds with silver as well as with any gold, copper, and nickel present in the lead. These zinc compounds are lighter than the lead and, on cooling, form a crust that can be readily removed.

Another of Parkes's important contributions was the discovery of the cold vulcanization process (1841), a method of waterproofing fabrics by means of a solution of rubber and carbon disulfide. Parkes also produced a flexible, durable material called Parkesine (*c.* 1855) from a mixture of chloroform and castor oil that led to the development of the first plastic, celluloid (*q.v.*).

Parkes, Frank Kobina, in full FRANCIS ERNEST KOBINA PARKES (b. 1932, Korle Bu, Gold Coast), journalist, broadcaster, and widely anthologized poet whose style and great confidence in the future of Africa owe much to the Senegalese poet David Diop.

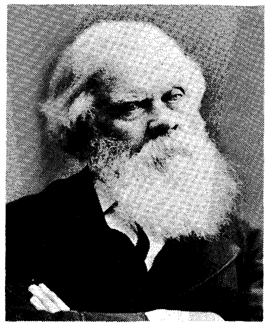
Parkes was educated in Accra, Ghana, and Freetown, Sierra Leone. He worked briefly as a newspaper reporter and editor and in 1955 joined the staff of Radio Ghana as a broadcaster. He was president of the Ghana Society of Writers and published a volume of poems, *Songs from the Wilderness* (1965).

His poetry, a rhythmic free verse with much repetition of words and phrases, tends to romanticize and glorify all that is African, from the blackness of African skin to indigenous music, dancing, and ritual. He recalls his continent's past sufferings, exhorts the reader to do something about oppression of blacks that still exists (in South Africa, for example), and criticizes world powers for their concern with atomic weapons and the Moon landings rather than with human needs. He admonishes colonial administrators of the past for the legacy they have left behind them. A great faith, similar to Diop's, in the ability of Africans to bring about a glorious future through their own efforts is revealed.

From the early 1970s Parkes worked for the Ministry of Information in Acara. Although a number of his poems have been collected in anthologies of African and Ghanian poetry—most notably *Messages* (1971) and *Katchikali* (1971)—*Songs from the Wilderness* is Parkes's only published volume of poetry.

Parkes, Sir Henry (b. May 27, 1815, Stoneleigh, Warwickshire, Eng.—d. April 27, 1896, Sydney), a dominant political figure in Australia during the second half of the 19th century, often called the father of Australian federation. He served five terms as premier of New South Wales between 1872 and 1891.

Parkes became politically prominent in 1849 as a spokesman for ending transportation of convicts to Australia from England. The following year he launched the *Empire,* a newspaper he ran until 1858 and through which he campaigned for fully representative government. He first held public office in 1854 and served almost without interruption as a representative and often as a minister or premier until 1894.



Sir Henry Parkes, 1888
Collection of the National Library of Australia

Parkes's educational work resulted in the Public Schools Act of 1866 and the Public Instruction Act of 1880, which introduced compulsory free education and severed connections between the church and the public schools. In his ministries between 1872 and 1887 he established New South Wales as a free-trade colony. He was knighted in 1877. In his fourth administration (1887–89) he carried through measures to improve railways and public works and to limit Chinese immigration.

Parkes first spoke for federation in 1867 and later presided over the National Australasian Convention in 1891. He withdrew support from the resulting Commonwealth of Australia Bill, however, and federation was postponed until 1901. After the elections of 1891 Parkes lost his position of political leadership. His autobiography, *Fifty Years in the Making of Australian History,* appeared in 1892. *Henry Parkes: A Biography* by A. W. Martin was published in 1980.

Parkhurst, Helen (b. March 7, 1887, Durand, Wis., U.S.—d. June 1, 1973, New Milford, Conn.), U.S. educator, author and lecturer who devised the Dalton Laboratory Plan and founded the Dalton School.

Parkhurst was teaching in a one-room Wisconsin school at the age of 16, and she was graduated four years later from Wisconsin State Teachers College. After doing graduate work at Columbia University, she studied at the universities of Rome and Munich and with Maria Montessori. Much later (1943), she earned a master's degree in education at Yale.

She taught again briefly in Wisconsin, then moved to Tacoma, Wash. (1910–11), where she conceived what came to be the Dalton Plan. She returned to teach at Wisconsin Central State Teachers College (1912–14) and, after further work with Montessori, set up her own school in New York City in 1916.

She had developed an experimental plan for the high school in Dalton, Mass., and drew on it for her New York school, which she conducted on a contractual basis with her students. Pupils worked in "laboratory brigades" on specific assignments for which they contracted. There were no tests or examinations, and external discipline was minimal. As they worked on assignments, students submitted progress reports to teachers.

Parkhurst remained headmistress of New York's Dalton School until her retirement in 1942. Over the final three decades of her life she lectured throughout the world, wrote books, and produced radio and television shows for and about young people ("Child's World," "Know Your Child," "Children Should Be Heard," and "It's a Problem"). Her books included *Education on the Dalton Plan* (1922), *Work Rhythms in Education* (1935), *They Found Johnny* (1947), *Exploring the Child's World* (1951), and *Undertow* (1959).

Parkinson, C(yril) Northcote (b. July 30, 1909, Barnard Castle, Durham, Eng.), British historian, author, and formulator of "Parkinson's Law," the satirical dictum that "Work expands to fill the time available for its completion." A relatively obscure academic prior to the enunciation of his "law," which first appeared in an essay in the London *Economist* in 1955, Parkinson later devised a second law, "Expenditure rises to meet income," detailed in *The Law and the Profits* (1960).

After receiving a B.A. and M.A. from Cambridge University and a Ph.D. in history from Kings College, London, in 1935, Parkinson taught at various schools in England and, from 1950 to 1958, in Malaya. He based his comments regarding the nature of bureaucracy on his experiences as a British army staff officer during World War II. Administrators make work for each other, he said, so that they can multiply the number of their subordinates and enhance their prestige. His second law was intended as a jibe at government functionaries, who he thought were inclined to expand their own ranks indefinitely, so long as taxes could be raised. Written in a deadpan but mercilessly funny style, Parkinson's *Economist* essays were issued in book form in *Parkinson's Law, or The Pursuit of Progress* (1958).

Apart from the books that made him famous, Parkinson wrote numerous historical works, including the critically acclaimed *The Evolution of Political Thought* (1958). Interested in naval history since childhood, he also wrote several novels with maritime themes.

Parkinson's disease, also called SHAKING PALSY, PARALYSIS AGITANS, PARKINSON'S SYNDROME, or PARKINSONISM, a relatively common chronic movement disorder of the central nervous system that is marked by tremor and weakness of resting muscles, stooped posture, slow and shuffling gait accompanied by a sense of propulsion, and muscular rigidity of the trunk and limbs, with a notable fixity of facial expression. A distinction should be made between Parkinson's disease—a chronic disease of unknown origin, treatable but incurable—and forms of parkinsonism caused by other diseases or by drugs and which may be completely reversible.

The onset of Parkinson's disease usually occurs in late adult life, but it may begin as early as the third decade. The course is slowly progressive over 10 to 20 or more years. The first symptom may be the scuffing of one foot in walking, a sense of heaviness of a limb, or a gentle tremor of one hand; the other symptoms follow in slow procession. The handwriting becomes small, and this and other manual skills are gradually lost. Speech is poorly articulated, and swallowing and chewing are laborious. Locomotion becomes increasingly difficult, and ultimately the patient finds it an effort even to rise from bed or a chair or to walk; and there is a tendency to lose balance and to fall. In the advanced stages, the patient is greatly handicapped in all voluntary movements but usually is not paralyzed. An unexpected call for action may momentarily excite the patient to perform some movement with surprising facility. The senses and the intellect are not damaged, except with the usual aging process. There is a slight tendency for more than one member of a family to be affected, but a genetic link is not commonly accepted.

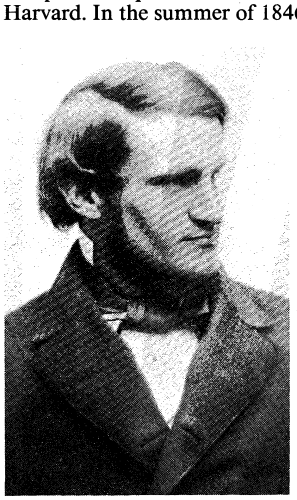
Parkinsonism is at least partially the result of the destruction of dopamine-producing cells in the substantia nigra in the midbrain. (Dopamine is a significant neurotransmitter.) Symptoms of the disease are alleviated by administration of L-dopa, the metabolic precursor of dopamine, although this treatment is not without undesirable side effects, such as vomiting, cardiac arrhythmias, and tics. One experimental treatment that reportedly produced striking results involved transplantation of tissue from the adrenal gland into the area of the brain that controls movement.

Parkman, Francis (b. Sept. 16, 1823, Boston—d. Nov. 8, 1893, Jamaica Plain, Mass., U.S.), American historian noted for his classic seven-volume history of *England and France in North America,* covering the colonial period from the beginnings to 1763.

Early years. Parkman was the son of Francis Parkman, a leading Unitarian minister of Boston. As a boy, he met many of his father's literary friends and read widely in the family library. He spent many summers at his grandparents' farm in nearby Medford, while during the rest of the year he was drilled in Greek, Latin, and mathematics at the Chauncy Place School, in Boston, in preparation for Harvard.

At college Parkman, a talented linguist, read almost as many books in foreign languages as in English, including the original texts of great historians of antiquity and Italian writers such as Niccolò Machiavelli. He also devoured the major works of French literature and history. In serious archival studies he was encouraged by his Harvard teacher, the renowned historian Jared Sparks. Sparks, a man drawn to adventure and exploration, exerted an enormous influence on an impressionable undergraduate such as Parkman.

Though teachers and books helped to shape Parkman's thinking in his formative years, he gathered data, as indicated by his letters and journals, through direct observation. During his college years he exhausted friends who struggled to keep pace with him on woodland expeditions through New England and southeastern Canada. Yet he did not neglect to participate in whiskey punch and Indian war cries that sometimes followed dormitory suppers. Pretty girls and horses, he concluded, were "the 'first-ratest' things in nature." After a breakdown in health during his last year in college, he made a grand tour of Europe in 1844. His particular interest in the Roman Catholic Church prompted him to observe it at close range, even to the extent of living for a short time in a monastery in Rome. In the following year, he toured historic sites in the northwest of America and, to please his father, completed requirements for a law degree at Harvard. In the summer of 1846 he embarked on a journey to the Great Plains in which he traveled a portion of the Oregon Trail to Fort Laramie.



Parkman

By courtesy of the Metropolitan Museum of Art, gift of I.N. Phelps Stokes, Edward S. Hawes, Alice Mary Hawes, Marian Augusta Hawes, 1937

Literary career. Parkman's literary career had its real beginning after he returned from the West. Despite temporary illness and partial loss of sight, he managed to write a series of Oregon Trail recollections for the *Knickerbocker Magazine.* Published in 1849 as *The California and Oregon Trail,* the book's title was misleading because Parkman had ventured nowhere near California. He keenly regretted the "publisher's trick" of the mention of California as a stimulus to better sales. The book, in later editions called *The Oregon Trail; Sketches of Prairie and Rocky-Mountain Life,* became one of the best-selling personal narratives of the 19th century.

The Oregon Trail served notice that a new writer, at home on the frontier as well as in staid, provincial Boston, had appeared. *History of the Conspiracy of Pontiac,* completed just before his marriage to Catherine Scollay Bigelow in 1851, was his first historical work, a comprehensive survey of Anglo-French history and Indian affairs in North America, culminating in the great Ottawa chief's "conspiracy" and Indian war of 1763. In the "dark years" of illness following the death of his young son (1857) and his wife (1858), Parkman entered a period of depression and semi-infirmity. His complaints of heart trouble, insomnia, painful headaches, semiblindness, water on the knee, and finally arthritis and rheumatism, which fill his correspondence, were probably the result of an underlying neurosis. By personalizing his illness and calling it the "enemy," Parkman seems to have forced himself to play the role of a man of action at the cost of great tension. His struggle against the "enemy" enabled him to maintain his self-respect and appears to be at least partly responsible for the powerful drive and creative force behind his writings.

By the time the American Civil War ended, Parkman had at least partly overcome his personal "enemy" of illness to complete his *Pioneers of France in the New World,* a vivid account of French penetration of the North American wilderness that created a setting for his later volumes. In the 27 years following the Civil War, Parkman (who had to content himself with writing militant, patriotic letters to the press during the conflict) completed his elaborate series by writing six more historical works in addition to the *Pioneers. The Jesuits in North America in the Seventeenth Century* (1867) is a powerful narrative of the tragedy of the Jesuit missionaries whose missions among the Hurons were destroyed by persistent Iroquois attacks, and his *La Salle and the Discovery of the Great West,* first published in 1869 as *The Discovery of the Great West* but later revised after French documents were made available, is in many respects one of the best one-volume biographies in the English language. La Salle, a hardy, gallant figure who overcame almost every obstacle in his path, was a heroic figure almost made for Parkman's pen. *Count Frontenac and New France Under Louis XIV* (1877) tells the story of New France, the early French settlement in Canada, under its most formidable governor, a man of vanity, courage, and audacity. Yet it was in *Montcalm and Wolfe* (1884)—a true biography of the French general Marquis de Montcalm and the English general James Wolfe, both of whom died at the Battle of Quebec in 1759—that Parkman not only reached his highest achievement in character portrayal but also showed how great biography can be used to penetrate the spirit of an age. By contrast, Parkman's *The Old Régime in Canada,* published in 1874, provides a sweeping panorama of New France in her infancy and youth, a pioneer work in social history that holds the interest of the reader no less than his narrative volumes. Parkman's literary artistry is perhaps best studied in his *Half-Century of Conflict,* completed shortly before his death. This final link in his history *England and France in North America* is a fascinating but complex account of events leading up to the French and Indian War.

Assessment. Parkman portrayed the Anglo-French and Indian wars as part of a struggle between contesting civilizations, in which the interior wilderness acted as a modifying force on rival colonial cultures. Perhaps Parkman's greatest achievement was his skill in recognizing the dramatic potentials in the raw materials of history, so that he could create a narrative both historically accurate and, as he said, "consistent with just historic proportion." When he wrote that his aim was "to get at the truth," he explained the lifelong search for factual data that underlies his entire work. Not all of his interpretations have been accepted unquestioningly, but Parkman's genius with the pen was such that his main figures—Frontenac, Montcalm, Wolfe, La Salle, and Pontiac—are not so much remembered today because of what they did but because Parkman made them the heroes of his history of Anglo-French rivalry in North America.

(W.R.J.)

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parkway: *see* expressway.

Parlement, the supreme court under the ancien régime in France. It developed out of the *curia regis* ("king's court") in which the early Capetian kings periodically convened their principal vassals and prelates to deliberate with them on feudal and political matters. It also dealt with the few legal cases submitted to the king as sovereign judge.

Throughout the 12th century and in the first decades of the 13th, the *curia regis* grew in importance, and professional advisers, *consiliarii,* were added to its membership. Meanwhile, by a slow process, the judicial sessions came to be differentiated from its meetings for other business; by the middle of Louis IX's reign (1226–70) these judicial sessions were being described as *curia regis in parlemento* ("speaking"), or Parlement. A system of appeal also grew up, with the Parlement hearing appeals against the judgments of *baillis* (representatives of the royal administration in the provinces); and cases concerning the royal towns were likewise decided by the Parlement. Furthermore, the expansion of the royal domain enlarged the competence of the *curia in parlemento,* which moreover could serve politically to strengthen the royal power by means of its *arrêts* (final decisions), since these expressed the king's law with incontestable authority.

Louis IX had his *curia in parlemento* installed in a special Chambre aux Plaids, or pleading chamber, on what is now the site of the modern Palais de Justice in Paris. The Grand Chambre, as the Chambre aux Plaids grew to be called, remained the core of Parlement, although other *chambres* grew up alongside it. Other *chambres* were the Chambre des Enquêtes (*q.v.;* inquiry) and the Chambre des Requêtes (*q.v.;* petitions), both instituted in the 14th century; the Chambre de la Tournelle (the criminal chamber), formally instituted in the 16th century, but in existence much earlier; and the Chambre de l'Édit (set up in the 16th century to deal with Huguenot affairs, but finally abolished in 1669).

Vacant seats in the Parlement in the later Middle Ages were supposed to be filled by election or co-optation; but from the 14th century members had resigned in favour of their sons or of someone willing to pay a specified price. In 1552 venality was formally recognized by the crown. Attempts to abolish it later in the century came to nothing; and in 1604 the "annual right," or *paulette* (devised by financier Charles Paulet), was established, enabling officeholders to ensure the hereditability of their offices by paying one-sixtieth of its purchase price every year. The office of premier president, heading Parlement, however, could be acquired only by a nominee of the crown.

Originally there was only one Parlement, that of Paris. Later others were created for the provinces, but the Parlement of Paris retained jurisdiction over nearly half of the kingdom.

The political pretensions of the Parlements were based on their registration of the king's edicts and letters patent. Before registering a measure, the Parlements examined it to see whether it conformed with the principles of law and justice and with the interests of the king and realm; if it did not, they withheld registration and addressed remonstrances to the king. If the king wished to force registration, he had to either send a *lettre de jussion,* ordering it, or come in person, to hold a *lit de justice,* at which his actual presence suspended any delegation of authority to his magistrates; but the right of remonstrance remained a counterbalancing influence in relation to the royal power.

During the 16th and early 17th centuries the Parlements took up a course of systematic opposition. Although this was restricted under Louis XIV, it was resumed in the 18th century. By that time opposition of the members was motivated, to a large extent, by anxiety to maintain their own privileges; but it served to focus more general feelings of political and social discontent. At the same time the Parlements were looked upon as a source of privilege and reaction and were swept away early in the French Revolution (1789).

Parléř, Petr (b. 1330, Swäbisch Gmünd, Württemberg—d. July 13, 1399, Prague), best known member of a famous German family of masons, his works exemplify the tendency toward profuse ornamentation and technical ostentation that are characteristic of late Gothic architecture.

At the age of 23 Parléř was called by King Charles IV of Bohemia to Prague to continue the cathedral church of St. Vitus. Seemingly influenced by English late Gothic style, he built complicated vaults with hanging bosses and ribs rising free through space; these vaults were the first real net vaults on the Continent. Parléř was also the first to use an even number of sides for the polygon of a choir (at Kuttenberg, Czech., in 1360). His sculptural work and vault innovations greatly influenced subsequent architecture.

Parley, Peter: *see* Goodrich, Samuel Griswold.

Parliament (from Old French *parlement,* Latin *parliamentum*), the original legislative assembly of England, Scotland, or Ireland and successively of Great Britain and the United Kingdom; the national and provincial legislatures in some countries that were once British colonies are also known as Parliaments. The British Parliament consists of the sovereign, the House of Lords, and the House of Commons (*see* Lords, House of; Commons, House of).

Modern Parliaments have developed from the fusion, during the reign (1272–1307) of Edward I, of two English governmental institutions. One of these, sometimes described as a *colloquium,* was a meeting of the Magnum Concilium, or Great Council, comprising the lay and ecclesiastical magnates, summoned to treat with the king on the affairs of the realm. Often, in practice, they were asked to agree to the levying of specific taxes. The Norman Magnum Concilium, in feudal terms a gathering of the king's tenants in chief, was not greatly dissimilar from the old Anglo-Saxon Witan, a meeting of the king's wise men. The second, and newer, institution was the Curia Regis, the King's Court, or Council, a much smaller body of semiprofessional advisers; at those of its meetings that came to be called *concilium regis in parliamento* ("the king's council in parliament"), judicial problems might be settled that had proved beyond the scope of the ordinary law courts dating from the 12th century. Joint meetings of the two bodies were held at the king's discretion and were attended by those explicitly summoned.

Early in the 14th century the practice developed of conducting debates between the lords spiritual and temporal in one chamber, or "house," and between the knights and burgesses in another. Strictly speaking, there were, and still are, three houses: the king and his council, the lords spiritual and temporal, and the commons. But the Lancastrian kings were usually forced to take all their councillors from among the lords, and under the Tudors it became the practice to find seats among the Commons for privy councillors who were not lords. Meanwhile, the greater cohesion of the Privy Council achieved in the 14th century separated it in practice from Parliament; and the decline of Parliament's judicial function led to an increase in its legislative activity, originating now not only from royal initiative but by petitions, or "bills," framed by groups within Parliament itself. Bills, if assented to by the king, became acts of Parliament; eventually, under Henry VI, the assent of the Lords and Commons also became necessary. Under the Tudors, though it was still possible to make law by royal proclamation, the monarchs rarely resorted to such an unpopular measure, and all major political changes were effected by acts of Parliament.

To these developments was added that of keeping a Parliament in being for several sessions, and there thus grew up a class of almost professional parliamentarians, some of whom were used by the king to secure assent to his measures and others who would disagree with some of those measures and encourage the Commons to reject them, though the firm idea of a formed "opposition" did not develop until much later.

In the 17th century the Parliament became a revolutionary body and was the centre of resistance to the king during the English Civil War (1642–51). The Restoration period (1660–88) saw the development of the Whig and Tory factions, ancestors of the later political parties. After the Glorious Revolution of 1688, William III chose his council, or officers of state, from among these party members in Parliament—at first from both parties and then, finding this unworkable, from the party commanding a majority in the Commons. Under Queen Anne this council, or Cabinet, as it came to be known, became a distinct policy-making body, usually meeting alone without the Queen. Subsequently, under the first two Georges, who were politically ineffectual, Robert Walpole, as leader of the Whigs, of the Commons, and of the Cabinet, became the real head of government, the "prime" minister (*see* prime minister); he set the principle that the Cabinet must act as a unit. Later, particularly after 1830, the party system became entrenched, and all members of Parliament began using a party label. Effective power was passing from the monarch, and the power of the House of Lords, too, would be diminished in the late 19th and early 20th centuries.

Parliament, Admonition to, Puritan manifesto, published in 1572 and written by the London clergymen John Field and Thomas Wilcox, that demanded that Queen Elizabeth I restore the "purity" of New Testament worship in the Church of England and eliminate the remaining Roman Catholic elements and practices from the Church of England. Reflecting wide Presbyterian influence among Puritans, the admonition advocated greater direct reliance on the authority of the Scriptures and also church government by ministers and elders rather than by a higher order of clergy (bishops). The Queen, however, resisted this document. The authors were imprisoned and the leader of the Presbyterians, Thomas Cartwright, was forced to flee England after publishing "A Second Admonition to Parliament" in support of the first. The clergy who refused to conform to the compulsory form of worship that had been promulgated by Elizabeth in 1559 (as the Act of Uniformity) lost their pulpits or were imprisoned.

Parliament, Houses of, also called WESTMINSTER PALACE, in the London borough of Westminster, the seat of the legislative body of the United Kingdom of Great Britain and Northern Ireland. A royal palace said to have existed at Westminster under Canute originally occupied the site of the present Houses of Parliament. The building, however, spoken of by William Fitzstephen as an "incomparable structure," was built by Edward the Confessor (died 1066) and enlarged by William I the Conqueror. In 1512 the palace suffered greatly from fire and thereafter ceased to be used as a royal residence. St. Stephen's Chapel, traditionally founded by King Stephen, was used from 1547 for the meetings of the House of Commons, held previously in the chapter house of Westminster Abbey; the Lords used another apartment of the palace. A fire in 1834 destroyed the whole palace except the historic Westminster Hall and St. Stephen's Chapel.

Sir Charles Barry, assisted by A.W.N. Pugin, designed the present buildings in the Gothic Revival style. Construction was begun in 1840 and finished in 1867. The Commons Chamber was burned out in an air raid during World War II but was restored and reopened in 1950. The House of Lords is an ornate chamber 97 feet (29.5 metres) in length; that of the Commons is 70 ft long. The southwestern Victoria Tower is 336 ft high. The Clock Tower, 329 ft in height, contains the clock famous for its 13-ton bell, Big Ben (*q.v.*), upon which the hours are struck. The bell is named after Sir Benjamin Hall, first commissioner of works.

Parliament Act of 1911, act passed Aug. 10, 1911, in the British Parliament which deprived the House of Lords of its absolute power of veto on legislation. The act was proposed by a Liberal majority in the House of Commons.

Chancellor of the Exchequer David Lloyd George, in his 1909 "People's Budget," had included a tax on the "unearned increment" of land enhanced in value by industrial or other developments nearby. (The budget also included higher death duties and a higher income tax.) The Lords rejected the land tax on the grounds that such a tax involved a land-valuation plan and did not belong in a finance bill. Their veto held up the national finances and caused a struggle between the two houses. To solve the crisis, two general elections were called in 1910. The second gave authority to carry a Parliament Bill that would end such struggles. The bill was endangered by the House of Lords' veto power; so the Liberal government threatened a mass creation of Liberal peers, if the Lords failed to pass it.

Under the act, any bill passed by the House of Commons in three separate sessions without being altered could be presented for the royal assent without the consent of the Lords, providing that two years had elapsed since the bill had been introduced. (The royal assent is required for an act of Parliament to become law.) Financial measures could now be presented one month after they passed the House of Commons. The maximum period that the House of Commons could remain in session was reduced from seven years to five.

In subordinating the House of Lords to the House of Commons, the 1911 Act was regarded as another step in the gradual democratization of the British Constitution.

parliamentary procedure, also called RULES OF ORDER, the generally accepted rules, precedents, and practices commonly employed in the government of deliberative assemblies. Such rules are intended to maintain decorum, to ascertain the will of the majority, to preserve the rights of the minority, and to facilitate the orderly transaction of the business of an assembly.

Rules of order had their origin in the early British Parliaments. Sir Thomas Smyth wrote (1562–66) an early formal statement of procedures in the House of Commons, *De Republica Anglorum* (published 1583). *Lex Parliamentaria* (1689) was a pocket manual for members of Parliament; it includes many precedents that are now familiar. It drew from the *Journal* of the House of Commons points such as the following: one subject should be discussed at a time (adopted 1581); the chair must always call for the negative vote (1604); personal attacks and indecorous behaviour are to be avoided in debate (1604)—"He that digresseth from the Matter to fall upon the Person ought to be suppressed by the Speaker.... No reviling or nipping words must be used"; and debate must be limited to the merits of the question (1610)—"A member speaking, and his speech, seeming impertinent, and there being much hissing and spitting, it was conceived for a Rule, that Mr. Speaker may stay impertinent speeches."

In British America, colonists depended heavily on procedures developed in Parliament and, under written charters and grants, gained experience in governing under written documents. That experience later led to the framing of state constitutions and the U.S. Constitution. Thomas Jefferson's *Manual of Parliamentary Practice* (1801) was the first to interpret and define parliamentary principles for the new U.S. democracy.

The modern system of general parliamentary law and practice is, in many respects, at wide variance with the current systems of procedure of both Parliament and the U.S. Congress. Rules designed for legislatures that are often bicameral with paid memberships, that meet in continuous session, that require a majority for a quorum, and that delegate their duties largely to committees address special legislative requirements. They are as a whole unsuited to the needs of an ordinary assembly. Writing for a previous edition of *Encyclopædia Britannica,* Clarence Cannon, who was U.S. congressman from Missouri, 1923–64, observed:

> ...there has been simultaneously developed through years of experiment and practice a simpler system of procedure adapted to the needs of deliberative assemblies generally and which, though variously interpreted in minor detail by different writers, is now in the main standardized and authoritatively established.

An early U.S. attempt to serve "assemblies of every description... especially... those not legislative in their character" was *Cushing's Manual* (1845), prepared by Luther S. Cushing (1803–56), a jurist and clerk of the House of Representatives of Massachusetts. Of lasting service has been *Robert's Rules of Order,* codified by a U.S. Army officer, Henry M. Robert (1837–1923) (*q.v.*). Published initially in 1876, it went through various editions and reprintings and continues to be published in periodic editions.

A "deliberative assembly," to which parliamentary law is ordinarily applied, has the following characteristics, according to *Robert's Rules of Order Newly Revised* (7th ed., 1970; Chapter 1, section 1): it is an independent or autonomous group convened to determine in free discussion "courses of action to be taken in the name of the entire group"; the "group is of such size—usually any number of persons more than about a dozen—that a degree of formality is necessary in its proceeding"; members are free to act; each member's vote has equal weight; "failure to concur... does not constitute withdrawal from the body"; and members present act for the entire membership "subject only to such limitations as may be established by the body's governing rules." The will of such a deliberative assembly is expressed by its action on proposals submitted for consideration in the form of motions or resolutions offered by members. In order to make a motion, a member ordinarily must rise and address the chair and secure recognition. If the motion is in order and is seconded by another member, it is "stated" by the presiding officer. Then it is subject to the action of the assembly.

Motions may be classified as main motions that introduce a proposition and as secondary motions, designed to affect the main motion or its consideration. A main motion is in order only when there is no other business before an assembly. It yields in precedence to all other questions.

Secondary motions may be subdivided into (1) subsidiary, (2) incidental, and (3) privileged. Subsidiary motions are applicable to other motions for the purpose of modifying the main question or affecting its consideration and disposition. They have precedence of the motion to which applied but yield to privileged and incidental motions. The subsidiary motion to lay on the table is, in U.S. usage, a motion to suspend consideration of the question until such time as the assembly may determine to take it from the table for further consideration. The motion is not debatable and may not be amended, postponed, committed, divided, or reconsidered. The purpose of the motion for the previous question is to close debate peremptorily and bring the assembly to an immediate vote on the pending question. It precludes both debate and amendment and requires a two-thirds vote for passage under general parliamentary procedure. It yields to the motion to table, to the question of consideration, and to privileged and incidental motions and may be reconsidered, but takes precedence of motions to postpone, amend, and commit. The motion to close or extend debate is in order under general parliamentary law and is subject to the rules governing the previous question. The motions to commit, recommit, and refer are practically equivalent and provide for reference of the pending proposition to a committee. The motion to recommit may be amended as by adding instructions to the committee as to time and manner of report. Debate on the motion is limited to the question of reference and instructions. It takes precedence of motions to amend and indefinitely postpone but yields to other subsidiary motions and to all incidental and privileged motions.

Motions to amend—calling for changes in the text or terms of the proposition—require a second and must be reduced to writing if requested by the chair. There is no limit to the number of amendments that may be proposed and new amendments may be offered as rapidly as the pending amendment is disposed of. Amendments in the second degree—that is, amendments to amendments—are admissible but amendments in the third degree—that is, amendments to amendments to amendments—are not in order. Only four amendments in the first and second degrees may be pending simultaneously, as follows: amendment; amendment to the amendment; substitute for the amendment (*i.e.,* when it is desired to replace the entire pending amendment); and amendment to the substitute. The amendment must, of course, be offered first and the substitute before the amendment to the substitute, but otherwise there is no rule governing the order in which the four amendments may be presented. They must, however, be voted on in the following order: first, amendments to the amendment; second, amendments to the substitute; third, the substitute; and last, the amendment. Motions to amend will not be entertained unless germane or relevant to the main question. This motion yields to all privileged, incidental, and subsidiary motions except indefinite postponement. It is subject to amendment, to the operation of the previous question, and to reconsideration, and when laid on the table carries with it the proposition proposed to be amended. Likewise, when the main question is laid on the table, postponed or recommitted, all pending amendments accompany it. (British usage differs: a proposal laid on the table of a British deliberative or legislative assembly has been put forth for consideration.)

Incidental motions include questions arising incidentally in the consideration of other questions and decided before disposition of the one to which they are incident. They have no relative rank and merely take precedence of the pending question in the consideration of which they have arisen. All are undebatable with the exception of appeal. They comprise motions to suspend the rules, withdraw motions, read papers, raise the question of consideration, raise questions of order and appeal, reconsider, take up out of order, determine method of procedure, divide pending questions, and raise questions relating to nominations. The motion temporarily to suspend the rules may not be debated or reconsidered and is not subject to the application of any subsidiary motion. The vote required to pass the motion is ordinarily fixed by the rules of the assembly and in the absence of such provision is two-thirds of those present and voting. The question of whether the assembly desires to take up a proposition regularly presented for its consideration may be tested by raising the question of consideration, which may be moved at any time before actual consideration commences and does not require a second. The assembly may by a two-thirds adverse vote decline to take up any business it prefers not to consider.

Privileged motions relate to matters of such urgent importance that they supersede temporarily pending business. They take precedence of all other motions and may be offered while other questions are pending. In this class of motions is the motion to fix the time at which to adjourn, to adjourn, to take a recess, and to raise questions of privilege, all of which are undebatable.

Points of order may be made while another has the floor and when the question concerns the use of unparliamentary language. The question must be raised at the time the proceeding giving rise to the objection occurs. Debate on questions of order may be closed by the presiding officer at any time.

The motion to reconsider must be made by one who voted with the prevailing side but may be seconded by any member. The motion is of the highest privilege. If agreed to, the motion reopens the entire question for further action.

Unclassified here are motions to take from the table, to discharge a committee, to accept the report of a committee, to rescind, to repeal, to annul, to expunge, and to permit a member to resume the floor after having been called to order for words spoken in debate.

To debate a question, a member must be recognized by the presiding officer for that purpose. The presiding officer should first recognize the mover of a proposition or the member of a committee presenting a report and should endeavour to alternate recognitions between those favouring and those opposing a question. Under general parliamentary procedure, a member securing the floor may speak without limit. In conventions, it is customary to adopt a rule at the opening session limiting debate to a specified number of minutes. In debate a member must confine remarks to the question under consideration, must avoid personalities, and must not arraign motives. A presiding officer who is a member of the assembly has the right to debate and to participate in the proceedings but should call another to the chair before taking the floor and should not resume it again until the pending question has been decided.

Voting may be by ballot, by division (that is, a rising, or standing, vote), viva voce (the presiding officer deciding by the volume of voices), by show of hands, by tellers who may take the count in various ways, and by yeas and nays (the clerk calling the roll and recording each vote as given). If there is doubt as to the result of a voice vote, any member may request a division; the presiding officer thereupon proceeds to take a rising vote. Only members in attendance may vote unless provision has been made for proxy votes. A tie vote defeats an affirmative motion. The presiding officer, if a member of the assembly, may vote to break a tie or to make one.

The committee of the whole consists of the entire assembly acting as a general committee. It affords greater freedom of consideration, but in bodies other than legislative assemblies it is rarely used.

Parma, city, capital of Parma province, in the Emilia-Romagna region of northern Italy, on the Parma River, northwest of Bologna. Founded by the Romans along the Via Aemilia in 183 BC, Parma was important as a road junction; its trade flourished, and it obtained Roman citizenship. It became an episcopal see in the 4th century and was later destroyed by the Ostrogoth king Theodoric. The city was rebuilt in the Middle Ages and was ruled by its bishops from the 9th century. Parma enjoyed communal liberty in the late 12th and 13th centuries, until its involvement in the struggles between the Holy Roman Empire and the papacy in the early 14th century led to its subjugation by a series of lordships. Made part of the Duchy of Parma and Piacenza by Pope Paul III in 1545, it was held by the Farnese dukes and later passed to the Austrians, from whom it was taken by Napoleon, who in 1815 gave it to his second consort, Marie Louise of Austria. In 1831 and 1848 it took part in the risings for independence and in 1861 became part of united Italy (*see also* Parma and Piacenza, Duchy of). During World War II the city was extensively damaged by Allied bombardment.

Famous natives of Parma include the music conductor Arturo Toscanini, the architect and sculptor Benedetto Antelami, and the painters Correggio (Antonio Allegri) and Parmigianino (Francesco Mazzola). The printer and typeface designer Giambattista Bodoni worked and died there.

The city's imposing Romanesque cathedral, rebuilt after an earthquake in the 12th century, contains magnificent works by Antelami and Correggio, and there are sculptures by Antelami and others of his school in the nearby baptistery (1196–1260). The church of S. Giovanni Evangelista (1494–1510) has frescoes by Correggio and arabesques by Michelangelo Anselmi. The church of Sta. Maria della Steccata (1521–39), the burial place of the Farnese family, is in the form of a Greek cross with a cupola displaying frescoes by Parmigianino. The 16th-century abbey of S. Paolo, with the Camera della Badessa (Room of the Abbess), has been splendidly decorated by Correggio. Notable secular landmarks include the Palazzo della Pilotta (begun 1583), residence of the Farnese dukes, containing the picture gallery, the Biblioteca Palatina (Palatine Library), and the National Museum of Antiquities; the partly ruined Palazzo Ducale (1564); and the Farnese Theatre (1618), all of which were restored after World War II. The university was founded in the 11th century and reorganized in 1601 by Ranuccio I Farnese.

Parma is an important rail and road junction on the main routes from Milan to Bologna. Its economy is mainly agricultural. Parmesan cheese is world famous. Machinery, pharmaceuticals, fertilizer, shoes, and alcohol are also made. Pop. (1983 est.) mun., 178,310.

Parma, city, Cuyahoga County, northeastern Ohio, U.S., a southern suburb of Cleveland. Settled by New Englanders in 1816, it was known as Greenbriar until 1826, when it became the township of Parma, named for the Italian city. A small section seceded to form Parma Heights in 1912, and in 1924 the remainder of the township became the village of Parma. After a 1931 proposal for annexation to Cleveland was defeated, Parma was organized (1932) as a city. Manufactures include automotive parts, tools, and dies and metal stampings. Pop. (1980) 92,548.

Parma, Alessandro Farnese, duque de (duke of): *see* Farnese, Alessandro.

Parma and Piacenza, Duchy of, the northern Italian cities of Parma and Piacenza, with their dependent territories, detached from the Papal States by Pope Paul III in 1545 and made a hereditary duchy for his son, Pier Luigi Farnese (died 1547). It was retained by the Farnese family until the family's extinction in 1731, when it passed to the Spanish Bourbons in the person of Don Carlos (the future Charles III of Spain). Except for one brief interruption, the Spanish Bourbons controlled the duchy until 1808, when it was formally annexed to France as the *département* of Taro.

In 1814 the Congress of Vienna gave the duchy to Napoleon's consort, Marie-Louise. With her death, in 1847, Parma and Piacenza were restored to the Bourbons, whose reign was periodically troubled by revolution and assassination. Louise of Bourbon-Berry, regent for her infant son Robert, transferred her powers to a provisional government on June 9, 1859, which paved the way for the annexation of Parma and Piacenza to Piedmont-Sardinia in March 1860. Piedmont-Sardinia became part of the Kingdom of Italy in 1861.

Parma e Piacenza, Alessandro Farnese, duca di (duke of): *see* Farnese, Alessandro.

Parme, Jean-Jacques-Régis de Cambacérès, duc de (duke of): *see* Cambacérès, Jean-Jacques-Régis de.

Parmelia, largest genus of foliose (leafy) lichens, which includes among its members the species commonly known as crottle and skull lichen. Crottle, the largest foliose lichen, resembles crumpled leather and sometimes grows 90 to 120 centimetres in diameter. It is characterized by a black underside. The central portion may die out, leaving a toad-stool-like "fairy ring." It is used as a reddish-brown cloth dye and was once considered a cure for epilepsy and the plague.

The so-called skull lichen (*P. saxatilis*) is a common variety that grows in flat gray-brown rosettes (5 to 10 centimetres across). According to folk superstition, it was believed to be an effective treatment for epilepsy if found growing on an old skull, especially that of an executed criminal.

Parmenides (b. *c.* 515 BC), Greek philosopher of Elea in southern Italy who founded Eleaticism, one of the leading pre-Socratic schools of Greek thought. His general teaching has been diligently reconstructed from the few surviving fragments of his principal work, a lengthy three-part verse composition titled *On Nature.*

Parmenides held that the multiplicity of existing things, their changing forms and motion, are but an appearance of a single eternal reality ("Being"), thus giving rise to the Parmenidean principle that "all is one." From this concept of Being, he went on to say that all claims of change or of non-Being are illogical. Because he introduced the method of basing claims about appearances on a logical concept of Being, he is considered one of the founders of metaphysics.

Plato's dialogue the *Parmenides* deals with his thought. An English translation of his work was edited by L. Tarán (1965).

Parmenio (b. *c.* 400 BC—d. 330, Ecbatana, Media), Macedonian general usually considered the best officer in the service of Philip II and his son Alexander the Great.

During the reign of Philip, Parmenio won a great victory over the Illyrians (356). In 336 he was sent with Amyntas and Attalus, his son-in-law, to Asia Minor to make preparations for the conquest of Asia. In the confusion that followed Philip's murder, he declared for Alexander and assisted in the murder of members of the faction opposed to Alexander. Parmenio became Alexander's second in command throughout the conquest of Persia and commanded the left wing of the army at the battles of Granicus, Issus, and Gaugamela. When Alexander continued eastward after the conquest of the Persian Empire, he left Parmenio in Media to guard his communications. During the campaign, Philotas, Parmenio's son, was charged with conspiring to murder Alexander, tried, and put to death. Though it is likely that Philotas was innocent, Alexander had Parmenio murdered.

Parmentier, André, English ANDREW PARMENTIER (b. July 3, 1780, Enghien, Austrian Netherlands—d. Nov. 26, 1830), Belgian-born American horticulturist, responsible for exhibiting many plant species in America.

Parmentier was the son of a linen merchant and was educated at the University of Louvain. His brothers were all horticulturists, the eldest being director of the Duc d'Arenberg's park at Enghien. In 1824 André lost his capital in speculation and immigrated to New York, where he established a commercial nursery and botanical garden. He imported plants and contributed to horticultural journals. Although he designed and laid out grounds, it is as a plantsman that he is remembered.

Parmesan, Italian PARMIGIANO-REGGIANO, hard, sharp cow's-milk cheese used primarily in grated form. The original Parmigiano-Reggiano is produced within a strictly delineated region in Italy that includes the towns of Parma, Modena, and Mantua and part of Bologna. The official name, along with the year the cheese was made, is stenciled on the rind of the approximately 75-pound (34-kilogram) cylinders. The tough, brownish-gold oily rind encases a gold interior of granular texture that gets quite brittle when aged. Parmesan is made only from April to November and must be aged at least two years. At this age it has a rich, savoury flavour and is consumed as a snack or after meals, as well as in cooking. Freshly grated Parmesan has considerably more flavour than ungrated. The widely, and often poorly, imitated original is considered one of the world's great cheeses.

Parmigianino, also called PARMIGIANO, byname of GIROLAMO FRANCESCO MARIA MAZZOLA, or MAZZUOLI (b. Jan. 11, 1503, Parma, Duchy of Milan—d. Aug. 24, 1540, Casalmaggiore, Cremona), painter who was one of the first artists to develop the elegant and sophisticated version of Mannerist style that became a formative influence on the post-High Renaissance generation.

Parmigianino, self-portrait from a convex mirror, oil on convex panel, 1524; in the Kunsthistorisches Museum, Vienna

By courtesy of the Kunsthistorisches Museum, Vienna

There is no doubt that Correggio was the strongest single influence on Parmigianino's early development, but he probably was never a pupil of that master. The influence is apparent in Parmigianino's first important work, the "Mystic Marriage of St. Catherine" (*c.* 1521). About 1522–23 he executed two series of frescoes: one series in two side chapels of S. Giovanni Evangelista, in Parma, executed contemporaneously with Correggio's great murals on the dome and pendentives of that church, and the other, representing the "Legend of Diana and Actaeon," on the ceiling of a room in the castle of Fontanellato just outside Parma. The scheme of the latter decoration recalls Correggio's work in the Camera di San Paolo in Parma.

In 1524 Parmigianino moved to Rome, taking with him three specimens of his work to impress the pope, including the famous self-portrait that he had painted on a convex panel from his reflection in a convex mirror. His chief painting done in Rome is the large "Vision of St. Jerome" (1527). Although this work shows the influence of Michelangelo, it was Raphael's ideal beauty of form and feature that influenced his entire oeuvre. While at work on the "Vision of St. Jerome" in 1527 he was interrupted by soldiers of the imperial army taking part in the sack of Rome, and he left for Bologna. There he painted one of his masterpieces, the "Madonna with St. Margaret and Other Saints." In 1531 he returned to Parma, where he remained for the rest of his life, the principal works of this last period being the "Madonna dal Collo Lungo" (1534; "Madonna of the Long Neck") and the frescoes on the vault preceding the apse of Sta. Maria della Steccata. The latter were to have been only part of a much larger scheme of decoration in the church, but Parmigianino was extremely dilatory over their execution, and he was eventually imprisoned for breaking his contract.

Parmigianino was one of the most remarkable portrait painters of the century outside Venice. Some of his best portraits are in Naples, in the Museo e Gallerie Nazionali di Capodimonte, including the "Gian Galeazzo Sanvitale" (1524) and the portrait of a young woman called "Antea" (*c.* 1535–37).

The style that he developed was, in its suave attenuations and technical virtuosity, one of the most brilliant and influential manifestations of Mannerism. It was an extreme development of Raphael's late manner and weakened the naturalistic basis inherent in High Renaissance art.

Parmigianino's works are distinguished by ambiguity of spatial composition, by distortion and elongation of the human figure, and by the pursuit of what the art historian Vasari called "grace"; that is to say, a rhythmical, sensuous beauty beyond the beauty of nature. This last quality of attenuated elegance is evident not only in Parmigianino's paintings but also in his numerous and sensitive drawings. One of the first Italian artists to practice etching, Parmigianino used the etching needle with the freedom of a pen, usually to reproduce his own drawings, which were in great demand.

Parnaíba, port city, northwestern Piauí state, northeastern Brazil, on the Rio Igaraçu, an outlet of the Rio Parnaíba, 9 mi (14 km) upstream from the Atlantic Ocean. Founded in 1761 and given city status in 1884, Parnaíba is the most important trade and distributing centre of the river valley. The chief products shipped from Parnaíba and its outport, Luís Correia (just to the northeast), are carnauba wax, cotton, babassu palm oil, sugar, cattle, chemicals, and hides. The city is also accessible by road and air. Pop. (1980) 102,181.

Where the same name may denote a person, place, or thing, the articles will be found in that order

Parnaíba River, Portuguese RIO PARNAÍBA, river, northeastern Brazil, rising in the Serra da Tabatinga and flowing north-northeastward for 1,056 mi (1,700 km) to empty into the Atlantic Ocean, forming a delta at its mouth. In addition to marking the border between the states of Maranhão and Piauí, the Parnaíba has great economic importance. Although its middle and upper reaches are interrupted by waterfalls, it is navigable by shallow-draft vessels from its mouth at least as far south as the junction of the Rio Canindé. Important river ports include Piauí's three major cities, Teresina (the state capital), Floriano, and Parnaíba.

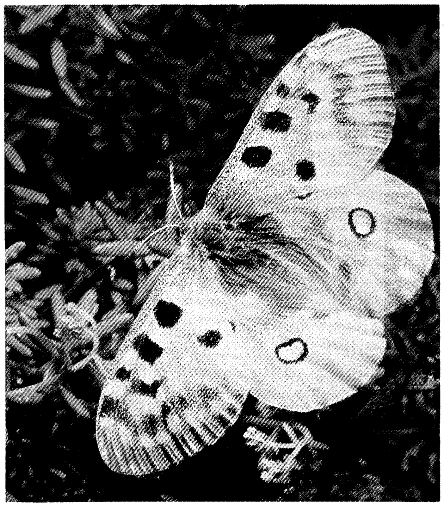
Parnassia, genus of North American perennial herbs more commonly known as grass of Parnassus (*q.v.*).

Parnassian, French PARNASSIEN, member of a group of 19th-century French poets headed by Leconte de Lisle, who stressed restraint, objectivity, technical perfection, and precise description as a reaction against the emotionalism and verbal imprecision of the Romantics. The poetic movement led by the Parnassians that resulted in experimentation with metres and verse forms and the revival of the sonnet paralleled the trend toward Realism in drama and the novel that became evident in the late 19th century. Initially taking their themes from contemporary society, the Parnassians later turned to the mythology, epics, and sagas of exotic lands and past civilizations, notably India and ancient Greece, for inspiration. The Parnassians derived their name from the anthology to which they contributed: *Le Parnasse Contemporain* (3 vol., 1866, 1871, 1876), edited by Louis-Xavier de Ricard and Catulle Mendès and published by Alphonse Lemerre. Their principles, though, had been formulated earlier in Théophile

Gautier's preface to *Mademoiselle de Maupin* (1835), which expounded the theory of art for art's sake, in Leconte de Lisle's preface to his *Poèmes antiques* (1852), and in *La Revue Fantaisiste* (1860), founded by Mendès. Gautier's *Émaux et camées* (1852), a collection of carefully worked, formally perfect poems, pointed to a new conception of poetry and influenced the works of major Parnassians such as Albert Glatigny, Théodore de Banville, François Coppée, Léon Dierx, and José Maria de Heredia. Heredia, the most representative of the group, looked for precise details, double rhymes, sonorous words, and exotic names, and concentrated on making the 14th line of his sonnets the most striking.

The influence of the Parnassians was felt throughout Europe and was particularly evident in the Modernist movement of Spain and Portugal and in the Jeune Belgique (Young Belgium) movement. In the late 19th century a new generation of poets, the Symbolists, followers of Stéphane Mallarmé and Paul Verlaine, themselves Parnassians in their youth, broke away from precise description in search of an art of nuance and musical suggestion.

parnassian butterfly, any member of the insect subfamily Parnassiinae of the cosmopolitan family Papilionidae (order Lepidoptera). The parnassian (*Parnassius*), also known as apollo, found in mountainous alpine regions



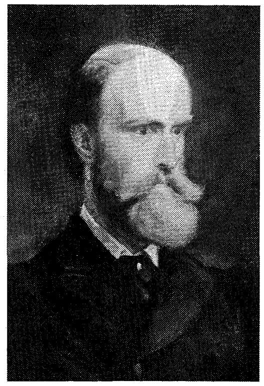
Parnassian butterfly (*Parnassius apollo*)
W. Zept from the Natural History Photographic Agency—EB Inc.

in Asia, Europe, and North America, is a medium-sized butterfly, generally with translucent white, yellow, or gray wings with dark markings and usually a red or orange spot on the hindwing.

Unlike most butterflies, parnassians pupate inside cocoon-like webs, usually constructed among leaves or in rubbish piles. They are prized among butterfly collectors because of their coloration. Parnassians are sometimes separated into their own family, Parnassiidae.

Parnassus, Mount, Modern Greek óros parnassós, mountain barren limestone spur of the Pindus Mountains, central Greece, running northwest–southeast on the borders of the *nomoí* (departments) of Phocis, Fthiótis, and Boeotia. Rising to a maximum elevation of 8,061 ft (2,457 m) in Mt. Parnassus, within sight of Delphi, it extends to Cape Opus on the Gulf of Corinth. In ancient times Parnassus was sacred to the Dorians and in mythology to Apollo and the Corycian nymphs. On a plateau between the summit and Delphi was the Corycian stalactite cave sacred to the nymphs and Pan. For the Roman poets, Parnassus' Castalian spring was a source of inspiration; they favoured Parnassus over Mt. Helicon as the home of the Muses. Parnassus is rich in bauxite, which is mined and converted into alumina and aluminum at nearby factories. A ski centre was opened above Arachova in 1977.

Parnell, Charles Stewart (b. June 27, 1846, Avondale, County Wicklow, Ire.—d. Oct. 6, 1891, Brighton, Sussex, Eng.), Irish nationalist, member of the British Parliament (1875–91), and the leader of the struggle for Irish Home Rule in the late 19th century. In 1889–90 he was ruined by proof of his adultery with Katherine O'Shea, whom he subsequently married.



Charles Parnell, detail of a painting by Sydney Prior Hall, 1892; in the National Gallery of Ireland, Dublin
By courtesy of the National Gallery of Ireland, Dublin

Early life. During Parnell's youth, the anti-British traditions and atmosphere of his home were significantly different from those of the majority of the Anglo-Irish Protestant landowning class to which he belonged. They did not, however, prevent his parents from giving him an education normal for his class. He went to three English boarding schools, where he seems to have been unhappy, and to Cambridge, where in 1869, after an undistinguished career, he was suspended for a relatively minor breach of discipline and decided not to return.

The Home Rule League and the Land League. The Ireland to which Parnell returned was in ferment. The government's oppressive measures against the revolutionary Irish Republican Brotherhood (the Fenians) aroused intense national feelings among even the moderate Irish. In 1870 a new political group, the Home Rule League, was set up to press for Irish autonomy in local government; in 1874 it returned 56 candidates to Parliament, where they formed a party under the nominal leadership of Isaac Butt. Though socially conservative and deferential to the opinions of the Roman Catholic hierarchy, all appealed in some degree to the national sentiments of the electorate. Parnell, an eminently suitable Home Rule candidate, was elected to Parliament for Meath in April 1875. Within two years he distinguished himself by his indifference to the opinion of the House of Commons and his sensitivity to Irish nationalist opinion. He embraced the policy of obstructing English legislation to draw attention to Ireland's needs, and his handsome presence and commanding personality gave him a powerful appeal. In September 1877 the Home Rule Confederation of Great Britain elected Parnell its president; he had become, at the age of 31, the most conspicuous figure in Irish politics.

In 1878 an agricultural crisis in Ireland seemed to threaten a repetition of the terrible famine and mass evictions of tenant farmers of the 1840s. To resist eviction and make Irish landlordism unworkable, the Irish Land League was founded in 1879 by a Fenian, Michael Davitt. Many moderates condemned the league, but Parnell identified himself with it and became its first president, thus becoming the centre of the great "new departure" national movement in which revolutionary devotion was combined with agrarian agitation and was supported by the obstructionist tactics of the "active section" in Parliament. Soon after the general election of 1880, Parnell was elected chairman of the Home Rule group in the new Parliament. After the rejection by the House of Lords of a moderate measure for Irish land reform, Parnell organized a massive land agitation, for which he then won the support of the clergy and of "moderate" opinion. It was combined with parliamentary obstruction on so large a scale that ultimately 36 Irish members were suspended. At this time Parnell rejected a policy of secession from Parliament, put forward by the Land League.

The passage in 1881 of Gladstone's Land Act, which conceded the principle that fair rents could be judicially determined, presented Parnell with a serious test of statesmanship. Its passage was unquestionably a great achievement for the Land League, but the most active Land Leaguers were not content, and a split in the movement seemed likely. This Parnell avoided by pursuing a policy moderate in substance—testing the act by bringing selected cases before the land commission—but making speeches couched in violent language. As a result, probably in accordance with his wish, he was, on Oct. 13, 1881, lodged in Kilmainham jail, Dublin. This assured his continued popularity and absolved him of responsibility for subsequent events.

Parnell's arrest was followed by the suppression of the Land League and a winter of sporadic local terror. It became clear to the government that only Parnell could restore order. In the spring of 1882 Parnell began negotiations for his release, conducted in the main through Capt. William O'Shea, a "moderate" Home Rule member, whose wife had been Parnell's mistress since 1880. A settlement was reached, the so-called Kilmainham Treaty, whereby tenants were to obtain substantial concessions and Parnell was to use all his influence to decrease further agitation.

The murders by nationalists in Phoenix Park, Dublin, of the chief secretary and the permanent undersecretary, which occurred within a few days of Parnell's release (May 2, 1882), caused a general revulsion against terrorism, and Parnell had little difficulty in bringing the nationalist movement again under firm discipline, subordinating the Irish National League (the successor to the Land League) to the Home Rule Party in Parliament.

Parliamentary manoeuvres. The Kilmainham Treaty ended the revolutionary phase of the "new departure." The results of by-elections showed that Parnell's leadership was unquestioned, except in eastern Ulster, and, after the Reform Bill of 1884 extended the franchise to agrarian workers, it became apparent that Parnell was likely in the next Parliament to lead a party of between 80 and 90 members. With this potential strength Parnell became a force to be reckoned with. He contemptuously refused overtures made for his support by the radical wing of the Liberal Party led by Joseph Chamberlain and Charles Wentworth Dilke.

The Tory advances to him led very quickly to a combination in which Tories and Irish voted together to defeat the Liberal government (June 1885), and in the election campaign that followed (November–December 1885), Parnell, having failed to get a satisfactory Home Rule statement from Gladstone, issued the "vote-Tory manifesto." Although the Irish could put the Liberals out, they could not keep the Tories in. In these circumstances, the Tories immediately broke with them and announced the intention of reintroducing coercion in Ireland. Parnellites and Liberals voted together to bring down the government, and Gladstone took office in February 1886. For his continuation in office he depended on Irish support.

There followed the curious and ominous episode of the Galway election. Parnell, under pressure from the O'Sheas and Joseph Chamberlain, put forward Captain O'Shea as Home Rule candidate, although he had refused to take the pledge "to sit and vote with the party." The evidence suggests that Chamberlain was attempting to undermine Parnell's authority and split his party. If so, he failed. A mutiny of a small faction was quelled and O'Shea was elected.

Although Gladstone's Home Rule proposals—involving a wide measure of autonomy—fell short of nationalist aspirations, Parnell accepted them as a basis of settlement and enlisted public opinion in their support. The introduction of the bill, though it was later rejected by the Commons on the second reading (June 1886), was regarded as his personal triumph. When the Conservative Lord Salisbury succeeded Gladstone as prime minister, Parnell withdrew to some extent from active political life. This was partly due to ill health but also to political reasons. With the Irish party firmly allied to the opposition, there was now no room for parliamentary obstruction. Parnell would neither challenge Gladstone's leadership nor appear as his henchman. He also held aloof in Ireland from the ingenious rent-withholding combination known as the plan of campaign, devised by William O'-Brien.

Despite his relative inactivity Parnell was kept before the public through the efforts of his enemies. On April 18, 1887, *The Times* published a facsimile of a letter purporting to be written by Parnell condoning the Phoenix Park murders of May 1882. Parnell immediately denounced it as a forgery. Nearly two years later the forger, a journalist named Richard Pigott, collapsed under cross-examination before an investigating commission. Parnell, after Pigott's suicide in Madrid soon afterward, was transformed in the eyes of the English liberals from a dubious ally into a hero and martyr. This brief period was the peak of Parnell's career.

Parnell's fall. On Dec. 24, 1889, Captain O'Shea filed a petition for divorce, naming Parnell as corespondent. Although Parnell's liaison had been known to some members of the Irish party, nationalist Ireland in general took it that the proceedings represented another attempt to wreck Home Rule. This was given colour by the fact that O'Shea was a follower of Joseph Chamberlain. The theory that there were political motives behind the divorce proceedings is not necessarily false. The suit being undefended, the court returned a verdict against Parnell and Katherine O'-Shea on Nov. 17, 1890.

The initial reaction of the Irish public was to uphold Parnell. In Britain, however, Nonconformist opinion was so hostile that the Irish parliamentary party found itself in an agonizing dilemma. Parnell was determined to hold the leadership and defy Gladstone. If the party upheld Parnell they would be destroying the Liberal alliance, and with it the hopes of Home Rule in their generation. If they rejected Parnell, they would be turning against him at the bidding of an Englishman. After a long and emotional debate, the majority rejected his leadership; a sizable minority remained with him.

There followed a series of bitter electoral campaigns. The Roman Catholic hierarchy, although slow to pronounce, now declared Parnell morally unfit for leadership. His marriage to Katherine O'Shea in June 1891 exacerbated Catholic opposition. He himself displayed feverish energy and increasing recklessness, directing his appeal more and more to the revolutionary elements. This appeal left a deep impression on the young but was rejected by the majority of the nation. When his principal ally, the nationalist *Freeman's Journal,* fell to his enemies shortly after his marriage, his cause was clearly lost. He died at his wife's home in Brighton in October 1891 and was buried in Glasnevin Cemetery, Dublin. The city, Parnellite to the end, gave him a magnificent funeral. (C.C.O'B.)

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Parnell, Thomas (b. 1679, Dublin—d. 1718, Chester, Eng.), Irish poet, essayist, and friend

Thomas Parnell, detail of an engraving
BBC Hulton Picture Library

of Alexander Pope, who relied on Parnell's scholarship in his translation of the *Iliad.* Parnell's poetry, written in heroic couplets, was esteemed by Pope for its lyric quality and stylistic ease. Among his best poems are "An Elegy to an Old Beauty" and "Night Piece on Death," said to have influenced Thomas Gray's "An Elegy Written in a Country Church Yard."

Parnell contributed to *The Spectator* and the *Guardian* and was a member, with Swift and Gay, of the literary Scriblerus Club. After Parnell's death, Pope collected his poetry and published it in a volume called *Poems on Several Occasions* (1722). The work was republished in 1770 with additional poems and a life of Parnell by Oliver Goldsmith.

Articles are alphabetized word by word, not letter by letter

Parni, also called APARNI, one of three nomadic or seminomadic tribes in the confederacy of the Dahae living east of the Caspian Sea; its members founded the Parthian empire. After the death of Alexander the Great (323 BC) the Parni apparently moved southward into the region of Parthia and perhaps eastward into Bactria. They seem to have adopted the speech of the native Parthians and been absorbed into the settled population. According to tradition Arsaces I (reigned *c.* 250 BC–*c.* 211 BC) was the first ruler of the Parthians and founder of the Parthian empire; a governor under Diodotus, king of the Bactrian Greeks, he revolted and fled westward to establish his own rule. The ruling family of the Parni in Parthia became known as the Arsacid dynasty, and Parthian kings were called Arsaces.

Pärnu, Russian PYARNU, formerly (until 1918) PERNOV, city, Estonian S.S.R., at the mouth of the Pärnu River on Pärnu Bay of the Gulf of Riga. First mentioned in 1251 as a member of the Hanseatic League, Pärnu was successively controlled by the Teutonic Knights, the Poles, the Swedes, and finally the Russians. It is now significant as a port, holiday resort, and centre of light industry, including food, wood, and leather processing. Pop. (1987 est.) 53,000.

Paro, town, western Bhutan, in the Himalayas on the Paro River. Centred on Fort Paro, a large rectangular building with a seven-story tower, it was the main cultural, commercial, and political centre of the country until the national capital was settled at Thimphu in 1962; Paro remains the summer capital. It is connected by the Indo-Bhutan National Highway to Phuntsholing on the Indian border, and it has an air landing strip. The Paro River valley, with temperatures ranging from an average of 40° F (4° C) in January to 75° F in July and annual rainfall averaging 30–35 inches (760–890 mm), is intensively cultivated; it is one of the most densely settled regions of Bhutan. Pop. (latest est.) 10,000.

parochial education, education offered institutionally by a religious group. In the United States, parochial education refers to the schooling obtained in elementary and secondary schools that are maintained by Roman Catholic parishes, Protestant churches, or Jewish organizations; that are separate from the public school systems; and that provide instruction based on sectarian principles.

Roman Catholic parochial schools in the United States are organized on a diocesan basis and are supported principally by voluntary offerings from the parishioners and by tuition. The administration of the schools of a diocese is the direct responsibility of the bishop. This work is usually delegated to a priest appointed by the bishop, who is given the title of superintendent of schools or secretary for education. Most dioceses have a school board made up of members appointed by the bishop. Usually this board has no administrative power but acts in an advisory capacity to the bishop and his chief school officer.

The Roman Catholic schools teach the same subjects as the public schools, but two important differences should be noted. In the Roman Catholic curriculum, a course in Christian doctrine is included that presents the matters of faith and morals that are the teachings of the Roman Catholic church. Other courses, particularly in such areas as the social studies and humanities, are often given a Roman Catholic orientation.

Diocesan systems are often organized on a statewide or regional basis in order to share certain educational advantages and to exchange ideas and programs for the betterment of their teachers and schools. All diocesan systems are members of the National Catholic Educational Association.

Among Protestant groups that maintain parochial school systems in the United States, the Lutheran bodies are by far the most active, with around 190,000 children in Lutheran schools. Smaller school systems are sponsored by the Seventh-day Adventists, the National Union of the Christian Schools, the Protestant Episcopal Church, the National Association of Christian Schools (evangelical), and the Quakers, Mennonites, Baptists, Methodists, and Presbyterians.

The administration of most Protestant schools is in the hands of a board of education elected by the sponsoring group—either individual congregation, association of congregations, or association of individuals. This board selects a principal and in cooperation with him develops the policies that control the school program.

The teachers in Protestant schools are drawn from denominational teachers colleges and liberal arts colleges. Special training in Bible and doctrine is required, in addition to the general requirements set for teachers at the elementary and secondary levels. While the course of study for each grade in Protestant schools is substantially the same as that offered in the public schools, Christianity is made a unifying and integrating factor in the educational program.

The Jewish day school or "complete" school (*i.e.*, the Jewish parochial school) in the United States is an educational institution in which a combined program of Jewish and general studies is offered. There are four types of institutions that provide intensive Jewish religious education as well as a complete course of study in general subject matter. The Talmudic day school makes provision for the study of the Hebrew texts of the Pentateuch and major portions of the Prophets and Scriptures, including the Masoretic commentaries, and places great stress on teaching of the Talmud. The secular studies meet the requirements of the city and state authorities. The modern day school stresses the study of Hebrew language, the Bible, Jewish history, prayers, and selected portions from the Talmud. All instruction is in the Hebrew language, with the secular subjects generally being given equal attention and equal time. The integrated day school aims to achieve a blending of instruction in Judaism and secular subjects, while the Hebrew-English private school emphasizes the study of general subjects and provides opportunities for Jewish learning for only five hours a week.

The majority of day schools (85 percent) are sponsored by Orthodox groups. Some that fall in the category of modern day schools are conducted by Conservative and other groups. Day schools operated by Yiddish culture groups include Yiddish language and literature among the basic subjects of instruction.

The two principal national organizations for the support of Jewish education are Torah Umesorah (National Society for Hebrew Day Schools) and the National Council for Torah Education.

parody (Greek *parodeia,* "a song sung alongside another"), in literature, a form of satirical criticism or comic mockery that imitates the style and manner of a particular writer or school of writers so as to emphasize the weakness of the writer or the overused conventions of the school. Differing from burlesque by the depth of its technical penetration and from travesty, which treats dignified subjects in a trivial manner, true parody mercilessly exposes the tricks of manner and thought of its victim yet cannot be written without a thorough appreciation of the work that it ridicules.

An anonymous poet of ancient Greece imitated the epic style of Homer in *Batrachomyomachia* (*The Battle of the Frogs and Mice*), one of the earliest examples of parody; Aristophanes parodied the dramatic styles of Aeschylus and Euripides in *The Frogs*; Chaucer parodied the chivalric romance in "The Tale of Sir Thopas" (*c.* 1375), as did Cervantes in *Don Quixote* (1605); Rabelais parodied the Scholastics in *Gargantua and Pantagruel* (1532–34); Shakespeare mimicked Christopher Marlowe's high dramatic style in the players' scene in *Hamlet* and was himself parodied by John Marston, who wrote a travesty of *Venus and Adonis* entitled *The Metamorphosis of Pigmalions Image* (1598). The 2nd Duke of Buckingham in *The Rehearsal* (1671) and Sheridan in *The Critic* (1779) both parodied the heroic drama, especially Dryden's *Conquest of Granada* (1670); John Phillips in *The Splendid Shilling* (1705) caught all the superficial epic mannerisms of Milton's *Paradise Lost* (1667); Racine parodied Corneille's lofty dramatic style in *Les Plaideurs* (1668, "The Litigants "); Fielding parodied Richardson's sentimental novel *Pamela* (1740–41) in *Shamela* (1741) and *Joseph Andrews* (1742) and mimicked the heroic play in *Tom Thumb* (1730).

In England the first collection of parodies to score a wide success was *Rejected Addresses* (1812) by Horace and James Smith, a series of dedicatory odes on the reopening of the Drury Lane Theatre in the manner of such contemporary poets as Scott, Byron, Southey, Wordsworth, and Coleridge. Unique among the Victorians is Lewis Carroll, whose parodies preserve verses that would otherwise not have survived—*e.g.,* Robert Southey's "Old Man's Comforts" (the basis for "You Are Old, Father William") and the verses of Isaac Watts that gave rise to "How Doth the Little Crocodile" and "The Voice of the Lobster."

In the United States the 19th-century poems of Poe, Whitman, Whittier, and Bret Harte were mimicked by their contemporaries, particularly by the poet and translator Bayard Taylor. Because of the variety of accents of 19th-century immigrants, U.S. parody often played on dialect—*e.g.,* Charles G. Leland's *Hans Breitmann's Ballads* first published under that title in 1884, a parody of the German poets Heine and Uhland in macaronic German American. Among more modern parodists, Samuel Hoffenstein is outstanding for his carefully damaging versions of A.E. Housman and the Georgian poets.

The art of parody has been encouraged in the 20th century by such periodicals as *Punch* and *The New Yorker.* The scope of parody has been widened to take in the far more difficult task of parodying prose. One of the most successful examples is Sir Max Beerbohm's *Christmas Garland* (1912), a series of Christmas stories in the style and spirit of various contemporary writers, most notably Henry James. Another innovation is double parody, invented by Sir John Squire in the period between World Wars I and II; it is the rendering of the sense of one poet in the style of another—*e.g.,* Squire's version of Thomas Gray's "Elegy Written in a Country Churchyard" written in the style of Edgar Lee Masters' *Spoon River Anthology* resulted in "If Gray Had Had to Write His Elegy in the Cemetery of Spoon River Instead of in That of Stoke Poges." Also outstanding among modern parodists have been Sir Arthur Quiller-Couch, Stephen Leacock, and E.B. White.

parody, in music, originally the creative reworking of several voice parts of a preexistent composition to form a new composition, frequently a mass; in modern musical usage, parody usually refers to the humorous imitation of a serious composition. The earliest known parody masses date from the late 14th century, and the procedure became common in the 15th and 16th centuries. The composer of a parody mass used as his model a vocal work such as a chanson, madrigal, or motet, freely reorganizing and expanding the original material, often inserting new sections between borrowed, modified passages. A parody mass is known by the name of its model; *e.g., Missa Malheur me bat* by Josquin des Prez, a reworking of Jean d'Okeghem's chanson "Malheur me bat" ("Misfortune Has Struck Me").

The process of parody also facilitated arrangements of vocal works for lute or keyboard, such as Peter Philips' arrangement for virginal (harpsichord) of the chanson "Bon jour, mon coeur" ("Good Day, My Heart") by Orlando di Lasso.

In more recent times the term musical parody came to signify the humorous application of new texts to preexistent vocal pieces, as well as both serious and ironic references to particular musical styles. Mozart's *Ein musikalischer Spass* (*A Musical Joke;* K. 522, 1787), deliberately violates any number of technical conventions, concluding with glaringly "wrong" notes; the endless, rapid repetitions of the word amen in Hector Berlioz' oratorio *L'Enfance du Christ* (*The Childhood of Christ;* Opus 25, 1854) clearly poke fun at the absurdities of much early 19th-century liturgical music.

Jacques Offenbach in his operettas (*e.g., Orpheus in the Netherworld*) frequently parodied serious opera. Similarly, Gustav Mahler, Arnold Schoenberg, and others have parodied the styles of predecessors and contemporaries as well as specific genres, including fashionable dances from the valse to the tango and the fox-trot. An American master of musical parody was Charles Ives (1874–1954).

parole, form of supervised conditional liberty from prison granted prior to the expiration of the sentence. As a form of correctional treatment, parole is designed to enhance the protection of the community through the supervision and rehabilitation of selected offenders following their release from prison. The modern use of parole as a correctional method stems from a change in penal philosophy to emphasize reform and rehabilitation rather than retribution and punishment.

Parole systems are usually administered by the ministry of justice, although in Mexico and South Africa the program is run by the ministry of welfare. In a few countries, parole is a function of the judiciary.

Eligibility for parole is governed by statutes that provide either definite or indeterminate sentences (*see* indeterminate sentence) and define offenses for which parole may be granted. In some jurisdictions, eligibility for parole is prohibited by statute for offenders convicted of such serious crimes as narcotics peddling, armed robbery, kidnapping, rape, or murder.

Parole supervision ranges from little more than a periodic police check to intensive supervision by trained personnel. Conditions of parole vary widely but usually define minimum standards of conduct, delimit freedom of movement, and require the parolee to report regularly to a parole officer. Violation of the conditions of parole may constitute grounds for parole revocation and reincarceration.

Páros, island, one of the Cyclades in the Aegean Sea, Greece, separated from Náxos on the east by a channel 4 mi (6 km) wide. With an area of 75 sq mi (194.5 sq km), it is formed by a single peak, Profítis Ilías (classical Marpessa), 2,530 ft (771 m) in height, which slopes evenly on all sides to a maritime plain that is broadest on the northeast and southwest sides. The island is mainly composed of marble. On a bay on the northwest lies the capital, Páros (or Paroikía,), occupying the site of the ancient and medieval capital. The small harbour is excelled by that of Náousa on the north side. White, semitransparent Parian marble (*Paria Marmara*), used for sculpture and quarried from subterranean pits on the north side of Mt. Marpessa, was the chief source of wealth for ancient Páros. Several of the marble tunnels have survived.

Páros shared the early Bronze Age culture of the Cyclades. Traditionally it was first colonized by Arcadians and then by Ionians. In the 7th century BC Parian colonies were sent to Thasos and to Parium on the Sea of Marmara and in 385 to the island of Pharos (Hvar, Yugoslavia) in the Adriatic. In 490 Páros joined the Persians and sent a ship to Marathon; in retaliation, its capital was attacked by an Athenian fleet under Miltiades. Páros also sided with Persia's king, Xerxes I, but after the Battle of Artemisium (480) its contingent remained in Kíthnos. After 480 a member of the Delian League, it joined the Second Athenian League in 378. On its political decline it passed to the Ptolemies of Egypt and thence to Roman rule. Following the brief Latin conquest of Constantinople (AD 1204), Páros was subject to Venice, becoming in 1389 an independent duchy. In 1537 it was taken by the Turks and was annexed to Greece in 1830 after the War of Greek Independence.

It is an important archaeological site. The Parian Chronicle, found in about 1627, is a marble inscription giving an account of artistic milestones in early and classical Greece. North of the capital is a sanctuary of Delian Apollo and Artemis. The present economy depends largely on locally grown cereals, grapes, figs, olives, and tobacco. Separated from Páros on the southwest by a channel 1.4 mile (2.2 km) wide is the once-attached island of Andíparos (Antiparos), the ancient Oliarus, whose limestone cavern is a tourist attraction. Pop. (1981) capital, 2,716; island, 7,881.

Parousia (religion): *see* Second Coming.

Parque de Madrid (Spain): *see* Retiro Park.

Parr, Catherine: *see* Catherine Parr.

Parr, William: *see* Northampton, William Parr, Marquess of.

Parra, Nicanor (b. Sept. 5, 1914, San Fabian, Chile), one of the most important Spanish-American poets of his time, the originator of so-called antipoetry.

Parra studied mathematics and physics at the University of Chile in Santiago and pursued advanced studies at Brown University, Providence, R.I., U.S. (1943–45), and at the University of Oxford. From 1952 he taught theoretical physics at the University of Chile.

His first book of poetry, *Cancionero sin nombre* (1937; "Songbook Without Name") received mixed reviews. Later, Parra renounced these poems, but the use of colloquial, often irreverent language, the light treatment of classical forms, and the humorous tone of the poems presage his later antipoetry.

With *Poemas y antipoemas* (1954; *Poems and Antipoems*), Parra's attempts at liberating poetry to make it more accessible to the masses gained him national and international fame. These poems treat common, everyday problems of a grotesque and often absurd world in clear, direct language and with black humour and ironic vision.

After experimenting with the local speech and humour of the Chilean lower classes in *La cueca larga* (1958; "The Long Cueca [Dance]"), Parra published *Versos de salón* (1962; "Verses of the Salon"), which continued the antipoetic techniques of his earlier works. *Obra gruesa* (1969; "Big Work") is a collection of Parra's poems except for his first book. The book is marked by a tone of dissatisfaction intensified by the use of prosaic language, cliché, and ironic wordplay.

In 1967 Parra began to write experimental short poems which he later published as a collection of postcards entitled *Artefactos* (1972; "Artifacts"). In these he attempted to reduce language to its simplest form without losing its social and philosophical impact.

parrakeet: *see* parakeet.

Parral (Mexico): *see* Hidalgo del Parral.

Parramatta, city within the Sydney metropolitan area, New South Wales, Australia. It lies along the 15-mile- (24-kilometre-) long Parramatta River (which enters Port Jackson harbour). Founded in 1788 by Governor Arthur Phillip as a western agricultural outlying farm colony of Sydney and called Rose Hill, it was renamed Parramatta, an Aboriginal word meaning "plenty of eels" and "head of river," the year after it was proclaimed a town in 1790. In its early years it was larger and of greater importance than Sydney. Incorporated as a municipality in 1861, it became a city in 1938 and was expanded in 1948, 1959, and 1972 by the inclusion of surrounding centres. It serves a region with plant nurseries and mixed vegetable farms and is industrialized to include motor-vehicle-body assembly, flour milling, and textile, paint, tile, tire, and asbestos manufacture. Parramatta, the second oldest European settlement in Australia (after Sydney), has many historic buildings, including Elizabeth Farm House (1793; the nation's oldest home still standing), Experiment Farm Cottage (1798), and the Kings School (1832). Pop. (1981) 130,943.

Parrhasius (fl. 5th century BC, Athens), one of the greatest painters of ancient Greece.

Parrhasius was born in Ephesus, Ionia (now part of Turkey), and later settled in Athens. He was praised by ancient critics as a master of outline drawing, and he apparently relied on subtle contours rather than the new technique of chiaroscuro to suggest the mass of the human body. He also tried to portray various psychological states and emotions in his depictions of the face. Many of his drawings on wood and parchment were preserved and highly valued by later painters for purposes of study. His picture of Theseus adorned the Capitol in Rome; other works were chiefly mythological groups. His picture of the Demos, the personified people of Athens, was particularly famous. None of his works or copies thereof survive.

Parrington, Vernon L(ouis) (b. Aug. 3, 1871, Aurora, Ill., U.S.—d. June 16, 1929, Winchcombe, Gloucestershire, Eng.), American literary historian and teacher who influenced American historical and literary thought.

Parrington grew up in Emporia, Kan., and was educated at the College of Emporia and Harvard University. He taught English and modern languages at the College of Emporia (1893–97), at the University of Oklahoma, Norman (1897–1908), and at the University of Washington, Seattle (1908–29). Parrington reappraised American literary history in his major work, *Main Currents in American Thought*, 2 vol. (1927), which won a Pulitzer Prize in 1928. A third volume with the subtitle *The Beginnings of Critical Realism in America*, incomplete at his death, was edited by E.H. Eby and was published in 1930. Parrington, a Jeffersonian liberal, interpreted the history of American literature in light of the concept of democratic idealism, which he saw as a characteristic American idea. He also wrote *The Connecticut Wits* (1926) and *Sinclair Lewis, Our Own Diogenes* (1927).

Parris, Alexander (b. Nov. 24, 1780, Hebron, District of Maine, Mass., U.S.—d. June 16, 1852, Pembroke, Mass.), American architect, a principal exponent of the Greek Revival style in early 19th-century Massachusetts.

Parris was apprenticed to a carpenter as a boy and subsequently studied design in Portland, Maine. His houses in that city include the Hunnewell-Shepley House (1805) and the Preble house (1807–08). In the War of 1812 Parris commanded a company of engineers and after the war moved to Boston.

An early Boston project was the David Sears House (1816) on Beacon Street, now the Somerset Club. He was also responsible for numerous other private homes in Boston. One of Parris' best-known designs is his St. Paul's Church (1819), which, with its graceful Ionic portico fronting a Greek-temple-type structure, marked the beginning of the Greek Revival style in America.

During the second half of the 20th century, the renovation of Boston's Faneuil Hall district brought attention to Parris' Quincy Market (1825), which was reopened as a farmers' market. The structure is notable for its monumentally simplified geometric forms and its system of post-and-lintel supports built of granite.

Among Parris' works outside Boston is the Unitarian Church at Quincy, called the Stone Temple (1828), a severe and impressive building that shelters the burial vaults of presidents John Adams and John Quincy Adams.

Parris Island, one of the Sea Islands in Port Royal Sound, just south of Port Royal, in Beaufort county, southern South Carolina, U.S. Spanish Franciscans and Jesuits came there in the 1520s and attempted to establish missions among the Indians. It became the site of Santa Elena, the capital of Spanish Florida. There are remains of the more recent of two forts called San Felipe, the oldest European military structure found in the United States, and of Fort San Marcos; the original site of Fort San Felipe (1566) has not been located. The 5.5-mile- (14-kilometre-) long island was used as a coaling station by Union forces during the Civil War. In 1876 it was made a naval station and named for Colonel Alexander Parris, public treasurer of South Carolina in the early 18th century. Since 1915 it has been a U.S. Marine Corps Recruit Depot, where thousands of marines are now trained annually. Pop. (1980) 2,296.

Parrish, (Frederick) Maxfield (b. July 25, 1870, Philadelphia—d. March 10, 1966, Plainfield, N.H.), American illustrator and painter who was perhaps the most popular commercial artist in the United States in the first half of the 20th century.

The son of an artist, Parrish was educated at Haverford College, Pa., and studied art at the Pennsylvania Academy of Fine Arts (1891–94) and the Drexel Institute of Art in Philadelphia. He did many posters, magazine covers, and book and advertising illustrations in the following years, and he also painted murals. By the 1920s he was the highest-paid commercial artist in the nation. His popularity began to decline in the late 1930s, but his illustrations never lost favour with some segments of the American public, and there was a renewed appreciation of his work in the 1960s and '70s. Parrish is best known for his depictions of fantasy landscapes populated by attractive young women. He used meticulously defined outlines and intricately detailed natural backgrounds, and his unusual colours give his pictures a dreamlike and idyllic atmosphere.

parrot, any of several hundred species of the bird family Psittacidae, order Psittaciformes. (*See* psittaciform.)

The classification of psittaciform birds is problematic; the entire group is under frequent taxonomic review. The nomenclature is vexed by the inaccurate use of scientific names by aviculturists and dealers and by the vague application of traditional popular group names. There are about 300 species of parrots distributed in approximately 75 to 80 genera and 6 subfamilies, as follows:

Strigopinae, comprising the owl parrot, also known as the kakapo (*Strigops habroptilus*), a rare New Zealand bird once thought extinct, survives as a scant population on South Island.

The Nestorinae comprise two species in the genus *Nestor*. The kea, *N. notabilis,* occasionally attacks sheep to get at the fat around the kidneys. The kaka, *N. meridionalis,* a gentler forest bird, is often kept as a pet. Both are from New Zealand. A related species, the Norfolk Island parakeet (genus Cyanomorphus), is endangered and may actually be extinct.

The Loriinae comprise about 60 species in 15 genera and are found in Australia, New Guinea, and many Pacific islands. These are the lories (with short tails) and lorikeets (with longer, pointed tails). All have a slender, wavy-edged beak and a brush-tipped tongue for extracting nectar from flowers and juices from fruits.

Micropsittinae, six species in the genus *Micropsitta,* on New Guinea and nearby islands. These are the pygmy parrots, smallest mem-

Kea (*Nestor notabilis*)
M. F. Soper—Bruce Coleman Inc.

bers of the family. They live in forests, where they live on insects and fungi.

Cacatuinae, about 17 species in 5 genera; Australia, New Guinea, and nearby islands. The group includes the large cockatoo (*q.v.*) species and the cockatiel (*Nymphicus hollandicus*), a smaller bird. They are crested and have heavy beaks for cracking nuts.

Psittacinae, the true parrots, about 220 species in 60 genera; worldwide in warm regions. In this varied assemblage the tongue is blunt; the birds eat seeds, buds, and some fruit and insects. Many members of the subfamily are known simply as parrots but some have group names (*see* conure; lovebird; macaw; parakeet).

Among all the psittaciform birds, the gray parrot (*Psittacus erithacus*) of Africa is unsurpassed as a talker; the male may perfectly echo human speech. Captive birds are alert and, for a parrot, relatively good-tempered. Individuals are said to have lived 80 years. About 33 centimetres (13 inches) long, the bird is light gray except for its squared, red tail and bare, whitish face; sexes look alike. Common in the rain forest, gray parrots eat fruits and seeds; they damage crops but are important propagators of the oil palm.

Equally good as mimics are the Amazon parrots. The 26 species of *Amazona*—often simply called parrots—are chunky birds, mostly 25 to 40 cm (10 to 16 in.) long, with slightly erectile crown feathers and a rather short, squared tail. Their predominantly green plumage is marked with other bright colours, chiefly on the upper head; sexes look alike. Amazon parrots live in rain forests of the West Indies and Mexico to northern South America. They are difficult to breed and may be aggressive as well as squawky.

Common in aviaries is the blue-fronted Amazon, *A. aestiva,* of Brazil, which has a blue

Rainbow lorikeet (*Trichoglossus haematodus*)
Bruce Coleman Ltd.

forehead, yellow or blue crown, yellow face, and red shoulders. *A. ochrocephala,* of Mexico and from Ecuador and Brazil, has some yellow on head and neck, a red wing patch, and yellow tail tip.

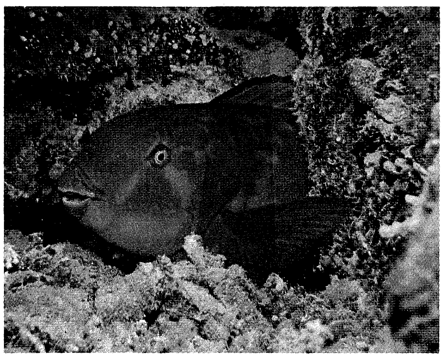
The monk, or green, parakeet (*Myiopsitta monachus*), one of the hardiest parrot species, is native to South America but has escaped from captivity in the U.S. and attempted to nest in several states. Its large stick nest is unique among parrots.

Other remarkable parrots include the caiques, *Pionites* species, small, short-tailed South American birds similar to conures in build and habits.

The night parrot (or night parakeet), *Geopsittacus occidentalis,* a nearly extinct Australian bird, feeds at night on spinifex grass seeds and dozes under a tussock by day. Its nest, in a bush, is a twig platform entered by a tunnel. Equally unusual is the ground parrot (or ground parakeet), *Pezoporus wallicus,* rare and local in wastelands of coastal southern Australia and western Tasmania. Formerly hunted with dogs, it runs in the grass, flushes like a quail, and makes a sudden deceptive pitch. It eats seeds and insects; its nest is a leaf-lined depression under a bush. For sea parrot (not a true parrot), *see* puffin.

parrot fever: *see* psittacosis.

parrot fish, any of about 80 species of fishes of the family Scaridae (order Perciformes) found on tropical reefs. Parrot fishes are elongated,



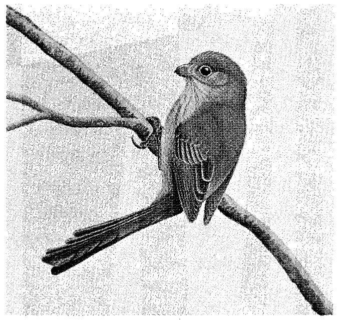
Parrot fish (*Calotomus*)
Douglas Faulkner

usually rather blunt-headed and deep-bodied, and often very brightly coloured. They have large scales and a characteristic birdlike beak formed by the fused teeth of the jaws. The beak is used to scrape algae and the soft part of coral from coral reefs and is strong enough to leave noticeable scars in the coral. The fish grind their food and bits of coral with plate-like teeth in their throats.

Parrot fishes range to a length of about 1.2 metres (4 feet) and weight of about 20 kilograms (45 pounds), or occasionally larger. They are variable in colour, the male of a species often differing considerably from the female, and the young may differ from the adult.

Parrot fishes are edible but are not, as a group, of great economic importance. The surf, or rivulated, parrot fish (*Callyodon fasciatus*) is an Indo-Pacific representative of the family; it grows to 46 centimetres (18 inches) or more, and the male is green and orange or red, the female blue and yellow. Atlantic species include the rainbow parrot fish, which grows to about 90 centimetres and is bright orange and green with a blue beak, and the queen parrot fish (*Scarus vetula*), which grows to about 50 centimetres and is blue with green, red, and orange if male but reddish or purplish with a white stripe if female.

parrotbill, also called CROW-TIT, any of 14 species of the songbird family Panuridae (order Passeriformes) that have a deep and compressed bill like a parrot's. They occur in brushy grasslands of central and eastern Asia. A typical species is Gould's parrotbill (*Paradoxornis flavirostris*); 18 centimetres (7 inches) long, it is brown above and white below, with a heavy-looking head and black markings around the eyes and in the ear region. Some of the smaller species, formerly separated as *Suthora,* are brightly coloured; an example is



Vinous-throated parrotbill (*Paradoxornis webbiana*)
Painting by H. Douglas Pratt

the 11-cm (4½-in.) vinous-throated parrotbill (*P. webbiana*), a garden bird in Chinese cities.

Parrott, Robert Parker (b. Oct. 5, 1804, Lee, N.H., U.S.—d. Dec. 24, 1877, Cold Spring, N.Y.), U.S. inventor who developed the rifled cannon known as the Parrott gun, the most formidable cannon of its time.

Parrott was graduated from the U.S. Military Academy, West Point, N.Y., in 1824 but resigned from the army in 1836 to become superintendent of the West Point Foundry. In 1861 he patented both a method of building stronger cannon by shrinking bands of wrought iron around a cast breech and a projectile suitable for muzzle-loading rifled cannon. The projectile had an encircling brass ring that expanded upon firing to fit the rifling grooves of the barrel. Parrott guns were widely used on land and at sea during the U.S. Civil War.

Parry, Sir (Charles) Hubert (Hastings), BARONET (b. Feb. 27, 1848, Bournemouth, Hampshire, Eng.—d. Oct. 7, 1918, Rusting-

Sir Hubert Parry, detail of a chalk drawing by Sir William Rothenstein, c. 1897; in the National Portrait Gallery, London
By courtesy of the National Portrait Gallery, London

ton, Sussex), composer, writer, and teacher, influential in the revival of English music at the end of the 19th century.

While at Eton, where he studied composition, he took the bachelor of music degree from Oxford (1867). Among his later teachers, the pianist Edward Dannreuther particularly influenced him.

Parry's *Scenes from Prometheus Unbound* (1880) was the first of a series of choral works that showed his gift for the massive effects that characterized English music of the rest of the 19th century. Among his works are *Blest Pair of Sirens* (1887) for chorus and orchestra; the oratorios *Judith* (1888), *Job* (1892), and *King Saul* (1894); and his *Songs of Farewell* (1916–18). His unison song "Jerusalem" (1916), a setting of words from William Blake's *Milton,* became almost a second national anthem during and after World War I. His other works include five symphonies, *Symphonic Variations,* chorale preludes for organ, motets, and many songs.

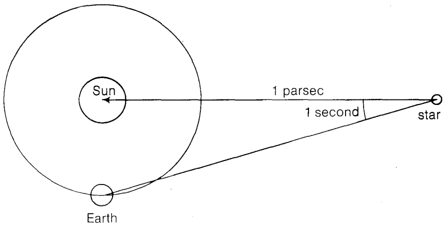
In 1883 Parry was appointed choragus (festival conductor) of Oxford and joined the staff of the Royal College of Music, London, becoming its director in 1894. In 1900 he became professor of music at Oxford. He was knighted in 1898 and created a baronet in 1903. (He died without sons, and the baronetcy became extinct.) His writings on music include *Studies of Great Composers* (1886), *The Evolution of the Art of Music* (1896), *Johann Sebastian Bach* (1909), and *Style in Musical Art* (1911).

Parry Sound, town, seat of Parry Sound District, southeastern Ontario, Canada, on the eastern shore of Georgian Bay of Lake Huron, at the mouth of the Seguin River, 120 mi (190 km) north of Toronto. Named in honour of the Arctic explorer Sir William Parry, the town was founded in the mid-19th century by W.H. Beatty, a British land surveyor. Its deep-water harbour on landlocked Parry Sound and its position on two transcontinental railroads and the Trans-Canada Highway have fostered the town's development as a merchandising, distributing, and shipping centre for the surrounding lumbering and mining region. A gateway to the Thirty Thousand Islands of Georgian Bay (*q.v.*), Parry Sound is a popular summer resort. In 1980 the township of McDougall was merged with Parry Sound. Inc. 1888. Pop. (1981) 6,124.

Parsa (ancient region, Persia): *see* Persis.

Parsa (ancient Persian city): *see* Persepolis.

parsec, unit for expressing distances to stars and galaxies, used by professional astronomers. It represents the distance at which the radius of the Earth's orbit subtends an angle of one second of arc; thus a star at a distance of one parsec would have a parallax of one second, and the distance of an object in parsecs is the reciprocal of its parallax in seconds of arc. For example, the nearest triple-star system, Alpha



Parsec; the angle shown is actually much greater than one second (1″) of arc

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Centauri, has a parallax of 0.753 second of arc; hence, its distance from the Sun and the Earth is 1.33 parsec. One parsec equals 3.26 light-years, which is equivalent to 3.09×10^{13} kilometres (1.92×10^{13} miles). In the Milky Way Galaxy, wherein the Earth is located, distances to remote stars are measured in terms of kiloparsecs (1 kiloparsec = 1,000 parsecs). The Sun is at a distance of 8.5 kiloparsecs from the centre of the Milky Way system. When dealing with other galaxies or clusters of galaxies, the convenient unit is the megaparsec (1 megaparsec = 1,000,000 parsecs). The distance to the Andromeda Galaxy (Messier 31) is about 0.7 megaparsec. Some galaxies and quasars have likely distances on the order of about 3,000 megaparsecs, or 9,000,000,000 to 10,000,000,000 light-years.

Parsi, also spelled PARSEE, member of a group of followers in India of the Iranian prophet Zoroaster; the Parsis, whose name means "Persians," are descended from Persian Zoroastrians who emigrated to India to avoid religious persecution by the Muslims. They live chiefly in Bombay and in a few towns and villages mostly to the north of Bombay, but also at Karachi (Pakistan) and Bangalore (Karnataka, India). Although they are not, strictly speaking, a caste, since they are not Hindus, they form a well-defined community.

The exact date of the Parsi migration is unknown. According to tradition, the Parsis initially settled at Hormuz on the Persian Gulf, but finding themselves still persecuted they set sail for India, arriving in the 8th century. The migration may in fact have taken place as late as the 10th century, or in both. They settled first at Diu in Kāthiāwār but soon moved to Gujarāt, where they remained for about 800 years as a small agricultural community.

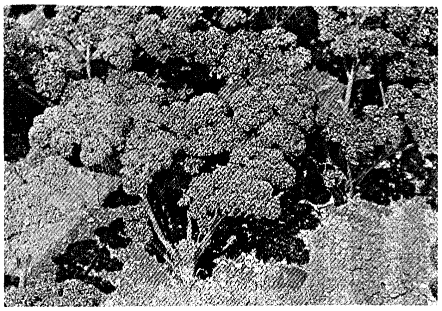
With the establishment of British trading posts at Surat and elsewhere in the early 17th century, the Parsis' circumstances altered radically, for they were in some ways more receptive of European influence than the Hindus or Muslims and they developed a flair for commerce. Bombay came under the control of the East India Company in 1668 and, since complete religious toleration was decreed soon afterward, the Parsis from Gujarāt began to settle there. The expansion of the city in the 18th century owed largely to their industry and ability as merchants. By the 19th century they were manifestly a wealthy community, and from about 1850 onward they had considerable success in heavy industries, particularly those connected with railways and shipbuilding.

Contact of the Parsis with their fellow countrymen appears to have been almost completely severed until the end of the 15th century, when, in 1477, they sent an official mission to the remaining Zoroastrians in Iran, a small sect called Gabars by the Muslim overlords. Until 1768 letters were exchanged on matters of ritual and law; 17 of these letters (*Rivayat*s) have survived. As a result of these deliberations, in which the Parsis' traditions were in conflict with the purer traditions of the Gabars, the Parsis, in the 18th century, split into two sects on questions of ritual and calendar. *See also* Zoroastrianism.

parsimony, law of (logic): *see* Ockham's razor.

Parsippany–Troy Hills, township, Morris County, northeastern New Jersey, U.S., extending eastward from the Appalachian hills to the Passaic River swamps. Early settlers were Abraham and Zackariah Baldwin, missionaries; Zackariah's tombstone is in the old Parsippany Cemetery. Local iron-ore deposits attracted other settlers. About 1713 John Cobb set up a forge at what then became known as Forge Pond in Troy. In the mid-18th century, David and Samuel Ogden established the Boone Town Iron Work, the site of which is now covered by the Jersey City Reservoir. Historic houses include Beverwyck (home of Lucas von Beverhoudt and a meeting place for George Washington and his aides) and the home of William Livingston, New Jersey's first governor. Parsippany, which has had more than 50 different spellings, is derived from Parsippanong, an Indian name for a local stream, meaning perhaps "the Place Where the Waters Rush Through." The name Troy appears on pre-Revolutionary maps, but its origin is unknown. Originally, Parsippany and Troy Hills were included in Whippanong Township (renamed Hanover in 1740). They amalgamated and were incorporated in 1928 when Hanover Township was divided into smaller units. Mainly residential, the community has some light manufacturing including chemicals and cosmetics. Pop. (1980) 49,868.

parsley (*Petroselinum crispum,* or *Petroselinum sativum*), hardy biennial herbs of the family Apiaceae, or Umbelliferae, native to Mediterranean lands. Parsley leaves were used by the ancient Greeks and Romans as a flavouring and garnish for foods. The com-



Parsley (*Petroselinum crispum*)
Shunji Watari—EB Inc.

pound leaves—deep green, tender, and curled or deeply frilled—that develop in a cluster the first season of growth are used fresh or dried today, the mildly aromatic flavour being popular in fish, meats, soups, sauces, and salads. Parsley is often the principal ingredient of bouquet garni and fines herbes.

In the second season of growth, seed stalks rise about three feet (one metre) tall and are topped by compound umbels of small, greenish-yellow flowers followed by tiny fruits, or seeds, similar to those of a carrot but without spines. Parsley seedlings are small and weak; they emerge with difficulty from heavy, crusty soils.

Parsley contains less than 0.5 percent essential oil, the principal component of which is a pungent, oily, green liquid called apiol.

Hamburg parsley, or turnip-rooted parsley (*P. crispum* var. *tuberosum*), is grown for its large, white, parsnip-like root, popular in Europe.

parsnip (*Pastinaca sativa*), member of the parsley family (Apiaceae), cultivated since ancient times for its large, tapering, fleshy white root, edible and with a distinctive flavour.

Parsnip (*Pastinaca sativa*)
G.R. Roberts

The root is found on roadsides and in open places in Great Britain and throughout Europe and temperate Asia. It was introduced in the Americas early in the 17th century and has become extensively naturalized in North America.

Parsnip seed is sown in the spring, thinly in rows about a half metre apart, and the plants are thinned to stand five to seven centimetres (two to three inches) apart in the row. At the end of summer the solids of the root consist largely of starch, but a period of low temperature changes much of the starch to sugar. The root is hardy and not damaged by hard freezing of the soil. It is sweet in flavour and is usually served as a cooked vegetable.

Parsons, Sir Charles Algernon (b. June 13, 1854, London—d. Feb. 11, 1931, Kingston, Jamaica), British engineer whose invention of a multi-stage steam turbine revolutionized marine propulsion.

Parsons entered the Armstrong engineering works at Newcastle upon Tyne in 1877. In 1889, after working for several other companies, he established his own works at Newcastle for the manufacture of steam turbines, dynamos, and other electrical apparatus.

The turbine Parsons invented in 1884 utilized several stages in series; in each stage the expansion of the steam was restricted to the extent that allowed the greatest extraction of kinetic energy without causing the turbine blades to overspeed. Parsons' turbine was fitted with a condenser in 1891 for use in electric generating stations, and in 1897 it was successfully applied to marine propulsion in the "Turbinia," a ship that attained a speed of 34½ knots, extraordinary for the time. The turbine was soon used by warships and other steamers.

In addition to the chairmanship of C.A. Parsons and Company, Parsons held directorial positions on the boards of several other electrical supply and engineering companies. He was made a fellow of the Royal Society (1898), was awarded the Royal Society's Rumford Medal (1902), and was president of the Institute of Marine Engineers (1905–06) and of the British Association (1919–20). He was knighted in 1911 and given the Order of Merit in 1927.

In addition to his turbine, Parsons invented a mechanical reducing gear, which, when placed between the turbine and a screw propeller, greatly improved the efficiency of both. He also invented nonskid automobile chains. A collection of his scientific papers and addresses was published in 1934.

Parsons, Elsie (Worthington) Clews (b. Nov. 27, 1875, New York City—d. Dec. 19, 1941, New York City), U.S. sociologist and anthropologist whose studies of the Pueblo and other Indians of the southwestern United States remain standard references.

After receiving her Ph.D. in sociology from Columbia University (1899), Elsie Parsons taught for several years at Barnard College, New York City. Her earlier writings reflect concern over restrictions imposed on women in many cultures and periods. *The Old-Fashioned Woman* (1913), containing her views on post-Victorian society, includes a discussion of sexual relations. Since the subject matter was considered scandalous, she published the work under the pseudonym John Main. Though she advocated women's rights, her fundamental concern came to be the individual's right of expression without limitation because of race, sex, or social class.

After a visit to the American Southwest (1915), where she met the anthropologists Franz Boas and Pliny E. Goddard, Elsie Parsons began a 25-year career of field study and writing on the Indians of the Americas. Aware of the need for exactness and detail, she collected a vast amount of Pueblo data that led to useful and influential syntheses of knowledge, culminating in *Pueblo Indian Religion*, 2 vol. (1939). Her interest in all possible influences on Pueblo peoples led her to investigations among Indians of the Great Plains and of Mexico, Peru, Ecuador, and the Caribbean. The Zapotec Indians of the state of Oaxaca, in Mexico, were the subject of her widely acclaimed work *Mitla: Town of the Souls* (1936). The results of her Andean researches appeared in *Peguche, Canton of Otavalo* (1945). She also did considerable work on the folklore of New World black people. At the close of her career, she became the first woman to be elected president of the American Anthropological Association, but she did not live to deliver her inaugural address, which dealt with the abuse of anthropology to further racist schemes.

Parsons, Robert, Parsons also spelled PERSONS (b. June 24, 1546, Nether Stowey, Somerset, Eng.—d. April 15, 1610, Rome), Jesuit who, with Cardinal William Allen, organized Roman Catholic resistance in England to the

Robert Parsons, engraving, 1622
By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

Protestant regime of Queen Elizabeth I. He favoured armed intervention by the continental Catholic powers as a means of restoring Catholicism in England, and he probably encouraged the numerous plots against the Queen's life.

Early in 1575 Parsons was forced to resign his teaching position at the University of Oxford because his sympathies lay with the proscribed Roman Catholic religion. He went to Rome and there, on July 4, 1575, entered the Society of Jesus. In 1580 Parsons and his colleague Edmund Campion reentered England to minister to English Catholics. In a year of clandestine activity he did much to bolster their morale; he preached, wrote religious books and pamphlets, and set up a secret printing press.

After Campion's arrest in July 1581, Parsons returned to the Continent and was assigned by William Allen—an influential English Catholic living abroad—the task of directing from abroad the Jesuit mission to England. In 1588 he was sent to Spain, where he spent nearly nine years establishing seminaries for English priests at Valladolid, Seville, and Madrid. He died at the English College in Rome.

Parsons wrote many incisive works. His *Christian Directorie* (1585) became a devotional classic for Protestants as well as for Catholics.

Parsons, Talcott (b. Dec. 13, 1902, Colorado Springs, Colo., U.S.—d. May 8, 1979, Munich), U.S. sociologist and scholar whose theory of social action influenced the intellectual bases of several disciplines in modern sociology. His work is concerned with a general theoretical system for the analysis of society rather than with narrower empirical studies.

After receiving his B.A. from Amherst College (1924), Parsons studied at the London School of Economics and at the University of Heidelberg, where he received his Ph.D (1927). He joined the faculty of Harvard University as instructor in economics; he began to teach sociology in 1931, became full professor in 1944, and was appointed chairman of the new department of social relations in 1946, a post he held until 1956. He remained at Harvard until his retirement in 1973. Parsons served as president of the American Sociological Society in 1949. He united clinical psychology and social anthropology with sociology, a fusion still operating in the social sciences.

In his first major work, *The Structure of Social Action* (1937), Parsons drew on elements from the works of several European writers (Alfred Marshall, Vilfredo Pareto, Émile Durkheim, and Max Weber) to develop a common systematic theory of social action based on a voluntaristic principle (*i.e.*, the choices among alternative values and actions must be at least partially free). Parsons defines the locus of sociological theory as residing not in the internal field of personality as developed by Freud and Max Weber but in the external field of institutional structures developed by society, operating to determine action and deriving continuity through action. In *The Social System* (1951), he turned his analysis to large-scale systems and the problems of the social order, integration, and equilibrium. He advocated a structural-functional analysis, a study of the ways in which the interrelated and interacting units that form the structures of a social system contribute to the development and maintenance of that system.

Other works by Parsons include *Essays in Sociological Theory* (1949; rev. ed. 1954), *Structure and Process in Modern Societies* (1960), *Societies: Evolutionary and Comparative Perspectives* (1966), *Sociological Theory and Modern Society* (1967), *Politics and Social Structure* (1969), and *The American University* (1973; with Gerald M. Platt and Neil J. Smelser).

Critical assessments of Parsons' work, spanning nearly half a century at Harvard, have been published in two volumes of essays in his honour by sociologists who were former students or colleagues: *Stability and Change* (Bernard Barber, Alex Inkeles, eds.; 1971) and *Explorations in General Theory in Social Sciences* (Jan J. Loubser, Rainer C. Baum, eds.; 1971).

Parsons, William: *see* Rosse, William Parsons, 3rd earl of.

Parson's Cause, dispute involving Anglican clergy in colonial Virginia, arising (1755, 1758) when laws commuted clerical salaries, previously paid in tobacco, to currency at the rate of twopence a pound when tobacco was selling at sixpence a pound. A royal veto (1759) encouraged the clergy to sue for back pay. In the most publicized case (1763), Patrick Henry defended a Hanover County parish against a suit by the Rev. James Maury, assailing the crown interference and inducing the jury to return only one penny damages for the plaintiff. After a general twopenny act (1769) that reflected going rates, the clergy gave up their protest.

Parsons table, also called T-SQUARE TABLE, simple, sturdy rectangular table having straight lines, overall flush surfaces, and square legs that form the four corners of the top and whose diameter is identical with the thickness of the top. It is not certain who designed the Parsons table, and it may have been the result of a class project, but prototypes exist in the early work of both the French interior designer Jean-Michel Frank (1896–1941) and the U.S. industrial and motion-picture interior designer Joseph B. Platt (1895–1968), both of whom were connected with the Paris branch of the Parsons School of Design in the 1920s and early 1930s.

The earliest versions were small, square occasional tables constructed of solid wood and covered with such textured surfaces as parchment, snakeskin, decoupage, straw marquetry, leather, sharkskin, or eggshell lacquer. Later, square and oblong models of various sizes often made of printed composition board or plastic, served as desks, sideboards, and game, lamp, and dining tables.

Pārśvanātha, also called PARŚVA, 23rd Tīrthaṅkara, or saint, of the present age, according to the Jaina religion of India. Pārśvanātha (Sanskrit: Lord Serpent) was the first Tīrthaṅkara for whom there is historical evidence, but what is known of his life is intricately interwoven with myth and legend. He is said to have preceded by about 250 years Mahāvīra, the most recent Tīrthaṅkara, who

Pārśvanātha, stone sculpture from Shahdol district, Madhya Pradesh, India, *c.* 10th century; in a private collection
Pramod Chandra

died probably in 527 BC. Mahāvīra's parents followed the teachings of Pārśvanātha, and Mahāvīra himself is said to have joined the religious order founded by Pārśvanātha for some time. The four vows that Pārśvanātha made binding on members of his community (not to take life, not to steal, not to lie, not to own property) became, with the addition of the explicitly stated vow of celibacy introduced by Mahāvīra, the five great vows (*mahāvrata*s) of later Jainism. Pārśvanātha allowed monks to wear an upper and lower garment, while Mahāvīra himself gave up clothing. The two sets of views were eventually reconciled, and the followers of Pārśvanātha were won over to Mahāvīra's reforms.

The legends surrounding Pārśvanātha emphasize his association with serpents. His mother is said to have seen a black serpent crawling by her side before his birth, and in sculpture and painting he is always identified by a canopy of snake hoods shown over his head. According to accounts in the Jaina text the *Kalpa-sūtra*, Pārśvanātha once saved a family of serpents that had been trapped in a log in an ascetic's fire. The snake, later reborn as Dharaṇa, the lord of the underworld kingdom of *nāga*s (snakes), sheltered Pārśvanātha from a storm sent by an enemy demon.

Partāpgarh, also spelled PARTĀBGARH, or PRATĀPGARH, town, Chittorgarh district, Rājasthān state, northwestern India. The town was founded in 1689 and was the capital of the former princely state of Partābgarh (founded in the 15th century), which became part of the state of Rājasthān in 1948. Historic monuments include a palace and several ancient Jaina and Hindu temples. Partāpgarh is an agricultural market centre, with handloom weaving and cotton-ginning industries. Partāpgarh has a government college affiliated with the University of Rājasthān. Pop. (1981) 22,903.

Partāpgarh, also spelled PARTĀBGARH, or PRATĀPGARH, district, Uttar Pradesh state, northern India. Part of the Ganges alluvial plain, it is 1,440 sq mi (3,730 sq km) in area and is bounded on the southwest by the Ganges River and drained by one of its tributaries, the Sai. The district is fertile and partially forested, although there are small, barren saline areas. Rice, barley, millet, and sugarcane are grown, and hemp and hides are produced. Salt, potassium nitrate, and limestone are mined. Bela Pratāpgarh, the district headquarters, lies on the Sai River at a junction of roads and rail lines and is a trade centre for agricultural products. Pop. (1981) Bela Pratāpgarh town, 49,932; district, 1,801,049.

partbook, usual form in which vocal or instrumental polyphonic music was handwritten or printed in the 15th and 16th centuries. Each partbook contained the notation of only one voice, or part. The parts of madrigals, however, were sometimes published crosswise on single sheets, which allowed each of the singers seated around a rectangular table to sing from his particular part. Most commonly there were four partbooks: *cantus* (also *discantus* or *superius*), *altus, tenor,* and *bassus;* additional parts were either indicated *quinta vox,* etc., or were subdivisions of one of the principal parts—*e.g., cantus* I and *cantus* II.

Partch, Harry (b. June 24, 1901, Oakland, Calif., U.S.—d. Sept. 3, 1974, San Diego, Calif.), visionary and eclectic composer and instrument builder, largely self-taught, whose compositions are remarkable for the complexity of their scores (each instrument has its own characteristic notation, often involving 43 tones to each octave) and their employment of unique instruments of his invention. Partch's early works are mainly vocal, based on texts collected during his travels as a hobo during the Depression (*The Letter, a Depression Message from a Hobo Friend,* 1943; *8 Hitchhiker Inscriptions from a California Highway Railing*).

Later his interest in mythology and the occult led him to the magical sounds of common materials such as light bulbs and bowls. Instruments such as the boo (bamboo marimba, 1955–56), marimba eroica (1951–55, the largest plank 8 feet [2.4 metres] long), cloud-chamber bowls, mazda marimba, and many others resulted; some of these were exhibited at the San Francisco Museum of Art (1966) and at the Whitney Museum of American Art in New York.

Typical of his works of the 1950s are *Oedipus* (1951; Partch's first large dramatic work), the theatre pieces *Plectra and Percussion Dances* (1952), the dance satire *The Bewitched* (1955), and the soundtrack of the film *Windsong* (1958). The enormous suite *And on the Seventh Day Petals Fell on Petaluma* (1963–64, revised 1966) comprises 23 one-minute duets and trios among 20 instruments, followed (by means of electronic dubbing) by 10 quartets and quintets and a final septet. The traditional process of development is ignored; musical ideas are simply stated, then abandoned.

Later Partch was involved with "tactile" theatre pieces, which have the nature of rituals. In 1949 he summarized his esoteric theories in a book, *The Genesis of a Music.* In 1953 he began issuing his own recordings, and in 1966 he won an award from the National Institute of Arts and Letters.

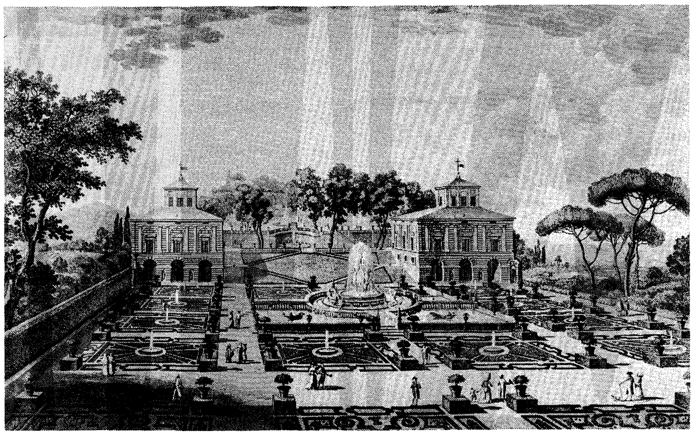
Parteciaco FAMILY, also spelled PARTECIPAZIO, noted Venetian family that produced seven doges between 810 and 942, as well as many bishops and church officials.

The first *dux*, or doge, in the family was one Ursus (or Orso I Parteciaco), who ruled from 727 to 739; but the real founder of the dynasty was Agnello Parteciaco (died 827). Opposing a faction that had placed Venice under the control of Charlemagne's son Pepin, Frankish king of Italy, Agnello moved the government from the island of Malamocco (now Lido) to its present site on the Rialto group of islands, where political independence could be more easily maintained. He undertook the building of many bridges connecting the islands and began the construction of the first Doges' Palace. A merchant as well as a statesman, he obtained important commercial privileges from the Byzantine emperors Leo V the Armenian and Michael II.

Agnello was succeeded by his sons Giustiniano and Giovanni I. Giustiniano is known to economic historians because of his will, which contained large bequests of pepper and other spices, demonstrating that Venice was already engaged in large-scale trade with the Levant in the early 9th century. In 828, during Giustiniano's reign, the remains of St. Mark were smuggled out of Alexandria and the building of a basilica was begun on the site of the present St. Mark's to house the relics. During the rule of Orso II (864–881), many reforms were accomplished, including a reorganization of the national church.

parterre, the division of garden beds in such a way that the pattern is itself an ornament. It is a sophisticated development of the knot garden, a medieval form of bed in which various types of plant were separated from each other by dwarf hedges of box, thrift, or any low-growing controllable hardy plant.

As the patterned area became of greater importance in the 16th century, it became necessary to make it more permanent and precise than was possible with plants. The hedges were replaced by wooden or leaden shapes or by lines of shells or coal, and the areas between were filled with coloured sand or stone chips. The design and making of parterres was a principal gardening skill in the late 17th century, and writers distinguished many sorts, one of which was a plain bowling green of turf. At the end of the 16th century the English philosopher Francis Bacon was the first of many to complain of the artificiality of these gardens, and, with the advent of the *jardin anglais* (*q.v.*) in the 18th century, the elaborate parterre disappeared until the 19th century, when it returned in the form of "carpet-bedding."



Parterre, 16th century, Villa Lante, Bagnaia, Italy
Peter Coats

parterre de broderie (garden design): *see* broderie.

Parthaunisa (ancient city, Parthia): *see* Nisa.

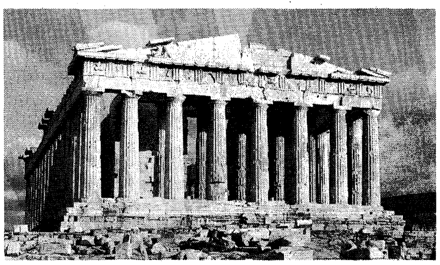
Parthenius OF NICAEA (fl. 1st century BC, Rome), Greek poet and grammarian, described as the "last of the Alexandrians."

Born in Nicaea in Asia Minor, Parthenius was captured in the third Mithradatic war and taken to Italy, where he became Virgil's teacher in Greek. His collection of 36 love stories made for the poet Cornelius Gallus has survived, and fragments from two funeral poems, one on his wife Arete, have come to light in papyri. He also wrote an encomium of the same lady in three books. His poems were favourite reading of the emperors Tiberius and Hadrian.

parthenocarpy, development of fruit without fertilization. The fruit resembles a normally produced fruit but is seedless. Varieties of the pineapple, banana, cucumber, grape, orange, grapefruit, persimmon, and breadfruit exemplify naturally occurring parthenocarpy. Seedless parthenocarpic fruit can be induced in nonparthenocarpic varieties and in naturally parthenocarpic varieties out of season by a type of artificial pollination with dead or altered pollen or by pollen from a different type of plant. The application of synthetic growth substances in paste form, by injection, or by spraying, also causes parthenocarpic development.

parthenogenesis, biological reproduction that involves development of a female (rarely a male) gamete (sex cell) without fertilization. It occurs commonly among lower plants and invertebrate animals, particularly rotifers, aphids, ants, wasps, and bees. An egg produced parthenogenetically may be either haploid (*i.e.,* with one set of dissimilar chromosomes) or diploid (*i.e.,* with a paired set of chromosomes).

Parthenon, chief temple of the Greek goddess Athena on the hill of the Acropolis at Athens. It was built in the mid-5th century BC and is generally considered to be the culmination of the development of the Doric order, the simplest of the three classical Greek architectural orders. The name Parthenon refers to the cult of Athena Parthenos (Athena the Virgin) that was associated with the temple.



Parthenon, on the Acropolis, Athens, by Ictinus and Callicrates, 447–432 BC
Alison Frantz

Directed by the Athenian statesman Pericles, the Parthenon was built by the architects Ictinus and Callicrates under the supervision of the sculptor Phidias. Work began in 447 BC, and the building itself was completed by 438 BC. The same year a great gold and ivory statue of Athena, made by Phidias for the interior, was dedicated. Work on the exterior decoration of the building continued until 432 BC.

Although the rectangular white marble Parthenon has suffered damage over the centuries, including the loss of most of its sculpture, its basic structure has remained intact. A colonnade of fluted, baseless columns with square capitals stands on a three-stepped base and supports an entablature, or roof structure, consisting of a plain architrave, or band of stone; a frieze of alternating triglyphs (vertically grooved blocks) and metopes (plain blocks with relief sculpture, now partly removed); and, at the east and west ends, a low triangular pediment, also with relief sculpture (now mostly removed). The colonnade, consisting of 8 columns on the east and west and 17 on the north and south, encloses a walled interior rectangular chamber, or cella, originally divided into three aisles by two smaller Doric colonnades closed at the west end just behind the great cult statue. The only light came through the east doorway, except for some that might have filtered through the marble tiles in the roof and ceiling. Behind the cella, but not originally connected with it, is a smaller, square chamber entered from the west. The east and west ends of the interior of the building are each faced by a portico of six columns. Measured by the top step of the base, the building is 101.34 feet (30.89 metres) wide and 228.14 ft long.

The Parthenon embodies an extraordinary number of architectural refinements, which combine to give a plastic, sculptural appearance to the building. Among them are an upward curvature of the base along the ends and repeated in the entablature; an imperceptible, delicate convexity (entasis) of the columns as they diminish in diameter toward the top; and a thickening of the four corner columns to counteract the thinning effect of being seen at certain angles against the sky.

The sculpture decorating the Parthenon rivalled its architecture in careful harmony. The metopes over the outer colonnade were carved in high relief and represented, on the east, a battle between gods and giants; on the south, Greeks and centaurs; and on the west, probably Greeks and Amazons. Those on the north are almost all lost. The continuous, low-relief frieze around the top of the cella wall, representing the annual Panathenaic procession of citizens honouring Athena, culminated on the east end with a priest and priestess of Athena flanked by two groups of seated gods. The pediment groups, carved in the round, show, on the east, the birth of Athena and, on the west, her contest with the sea-god Poseidon for domination of the region around Athens. The entire work is a marvel of composition and clarity, which was further enhanced by colour and bronze accessories.

The Parthenon remained essentially intact until the 5th century AD, when Phidias' colossal statue was removed and the temple was transformed into a Christian church; by the 7th century, certain structural alterations in the inner portion had also been made. The Turks, after their capture of Athens in 1458, adopted the Parthenon as a mosque, without material change except for the raising of a minaret at the southwest corner. During the bombardment of the Acropolis in 1687 by Venetians fighting the Turks, a powder magazine located in the temple blew up, destroying the centre of the building. In 1801–03, a large part of the sculpture that remained was removed, with Turkish permission, by the English nobleman Thomas, Lord Elgin, and sold in 1816 to the British Museum in London. Other sculptures from the Parthenon are now in the Louvre, in Copenhagen, and elsewhere, but many are still in Athens.

Parthenopean Republic, Italian REPUBBLICA PARTENOPEA, French RÉPUBLIQUE PARTHÉNOPÉENNE, short-lived republic in Naples proclaimed on Jan. 23, 1799, after a popular uprising of pro-French republicans resulted in the ouster of King Ferdinand IV. A counterrevolution the same year, aided by a papal army and an English fleet under Horatio Nelson and marked by wholesale butcheries of the republicans, resulted in the eventual return of Ferdinand to Naples in 1802, sanctioned by the Peace of Amiens. In 1806 Napoleon revenged himself by sending an invasion force under his brother Joseph, who was proclaimed king of Naples on March 30, 1806. Ferdinand fled to Sicily.

Parthia, ancient land corresponding roughly to the modern region of Khorāsān in Iran; the term is sometimes also used in reference to the Parthian Empire (247 BC–AD 224). The first certain occurrence of the name is as Parthava in the Bīsitūn inscription (*c.* 520 BC) of the Achaemenian king Darius I, but Parthava may be only a dialectal variation of the name Parsa (Persian).

Nothing is known of the history of Parthia while it was part of a satrapy of the Achaemenian Empire. It was joined to Hyrcania (present Gorgān, Iran) in the time of Alexander the Great, and the two remained together as a province of the Seleucid kingdom. During the reigns of Seleucus I (312–281 BC) and Antiochus I Soter (281–261) the Parni (Aparni) nomads probably moved from Central Asia into Parthia and seem to have adopted the speech of the Parthians and been absorbed into the settled population.

Traditionally, the first ruler of the Parthians and founder of the Parthian Empire, Arsaces I, was a governor under Diodotus, king of the Bactrian Greeks, who revolted and fled westward to establish his own rule. By 200 BC Arsaces' successors were firmly established along the southern shore of the Caspian Sea. Later, through the conquests of Mithradates I (reigned 171–138 BC) and Artabanus II (reigned 128–124 BC), all of the Iranian Plateau and the Tigris-Euphrates Valley came under Parthian control. The Parthians, however, were troubled by nomad attacks on their northeastern borders and also by the threat of Roman domination. Their most famous victory over Roman forces was at Carrhae (Harran) in 53 BC. Although one of their capitals, Ctesiphon, was later occupied by the Romans, the Parthians were successful in at least setting a limit to Roman expansion eastward.

The earliest Parthian capital was probably at Dara (modern Abivard); one of the later capitals was Hecatompylos, probably near modern Dāmghān. The empire was governed by a small Parthian aristocracy, which successfully made use of the social organizations established by the Seleucids and which tolerated the development of vassal kingdoms. Although not an inventive people, the Parthians' control of most of the trade routes between Asia and the Greco-Roman world brought them great wealth, which they used on their extensive building activities. The empire lacked tight internal control, however, and in AD 224 Ardashīr, a local ruler in southern Iran, revolted and established the Sāsānian Empire.

Parthian language, Middle Iranian language that originated in the ancient province of Parthia (mainly the northeastern corner of modern Iran) and became the official language of the Arsacid period of Persian dynastic history (2nd century BC to 3rd century AD). Among the earliest records of the language are more than 2,000 ostraca (inscribed pottery fragments), largely records of wine deliveries dating from the 1st century BC, which were discovered in Soviet excavations (1949–58) at Nisa, an Arsacid capital near present-day Ashkhabad in the Turkmen S.S.R. Parthian is also attested by inscriptions of the first Sāsānian kings (224–303), which were accompanied by a Middle Persian version. Manichaean Parthian literature is a very rich source for the language and includes the outstanding hymn cycles of the poet Mar Ammo (second half of the 3rd century). Parthian script was derived from the Aramaic alphabet.

Parti Communiste Français: *see* French Communist Party.

Parti du Crédit Social (Canada): *see* Social Credit Party.

Parti Libéral du Canada: *see* Liberal Party of Canada.

Parti Progressiste-Conservateur du Canada: *see* Progressive Conservative Party of Canada.

Parti Québécois, English QUEBEC PARTY, minor Canadian political party founded in 1968 by René Lévesque and other French Canadian separatists in the largely French-speaking province of Quebec.

In 1968 Lévesque merged his Mouvement Souveraineté-Association, a movement advocating Quebec sovereignty in a new kind of looser association of Canadian provinces, with other separatist groups to form the Parti Québécois. Unsuccessful in the Quebec provincial elections of 1970 and 1973, the party in 1976 won 71 of 110 seats in the provincial National Assembly. The following year, with Lévesque as premier, the Assembly decreed French the only official language of government and business in Quebec. In 1980 Lévesque hazarded a referendum seeking approval for the provincial government to negotiate a new status and relationship with the rest of Canada. The separatists lost, garnering only 40.4 percent of the vote; even a small majority of French speakers voted against the proposal.

Although the party won 80 of 122 seats in the 1981 election, membership declined thereafter as separatist fervour waned. In 1985 the independence plank was removed from the party's platform, and, following a series of defections and by-election defeats that year, Lévesque resigned. Elections in December 1985 swept the party from power.

Parti Radical-Socialiste (France): *see* Radical-Socialist Party.

Parti Républicain (France): *see* Republican Party.

Parti Rouge, English RED PARTY, radical party formed in Lower Canada (now in Quebec) in about 1849 and inspired primarily by the French-Canadian patriot Louis Joseph Papineau. In general the Parti Rouge advocated a more democratic system of government, with a broadly based electorate, and the abolition of the old feudal laws that still survived in Quebec. It also opposed the political influence of the Roman Catholic clergy in French Canada.

In later years the party became more moderate, and in the 1860s it merged with the Liberal Party of Quebec.

Parti Socialiste (France): *see* Socialist Party.

partial derivative, in mathematics, rate of change of a function of several variables with respect to changes in one only—that is, in the case when all variables except one are held constant. Given a function $f(x, y) = z$, the partial derivative of z with respect to x, holding y constant, may be denoted by z_x. For example, if $z = 2x^2y + 3$, then $z_x = 4xy$ and $z_y = 2x^2$. Second partial derivatives and those of higher orders may also be taken.

partial differential equation, in mathematics, equation relating a function of several variables to its partial derivatives. A partial derivative of a function of several variables expresses how fast the function changes when one of its variables is changed, the others being held constant (*see* ordinary differential equation). The partial derivative of a function is again a function, and, if $f(x, y)$ denotes the original function of the variables x and y, the partial derivative with respect to x—*i.e.,* when only x is allowed to vary—is written as $f_x(x, y)$, $\partial f/\partial x$, or $f_1(x, y)$, in which the numerical subscript corresponds to the position of the variable in the parentheses. The operation of finding a partial derivative can be applied to a function that is itself a partial derivative of another function to get what is called a second-order partial derivative, written as $f_{xy}(x, y)$, $\partial^2 f/\partial y \partial x$, or $f_{12}(x, y)$, in the case in which the partial derivative with respect to y of the function $f_x(x, y)$ is to be found. The order and degree of partial differential equations are defined the same as for ordinary differential equations.

In general, partial differential equations are difficult to solve, but techniques have been developed for simpler classes of equations called linear, and for classes known loosely as "almost" linear, in which all derivatives of order higher than one occur to the first power and their coefficients involve only the independent variables.

partial epilepsy: *see* jacksonian epilepsy.

particle, body of negligible dimensions but usually definite mass. If a body does not rotate or if rotational effects can be neglected, the body can be treated as a single particle with all its mass concentrated at its centre of mass. If rotational effects cannot be neglected, the body must be treated as a system of particles, using rigid-body equations that are extensions of Newton's equations. Whether a body should be treated as a particle or a rigid body depends on the dimensions of the body compared with the distances traveled and the nature of the paths traversed. Stars and planets are many thousands of kilometres in diameter but are so small compared with their orbital paths that they may be treated as particles in space; the rotation of a cannonball has negligible influence on its motion as a projectile but cannot be neglected if it is rolling on the ground.

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particle accelerator, any of various devices that increase the speed and kinetic energy of electrically charged atomic and subatomic particles. Particle accelerators serve as important research tools in nuclear and high-energy physics, providing investigators with a means of studying the structure and properties of the atomic nucleus and the interactions of subatomic particles. They also are employed for industrial radiography, cancer therapy, radioactive isotope production, and various other purposes.

A brief treatment of particle accelerators follows. For full treatment, *see* MACROPAEDIA: Particle Accelerators. For recent developments in the technology of particle accelerators, *see* the article "Physics" in the BRITANNICA WORLD DATA ANNUAL.

In 1932 the British physicists J.D. Cockcroft and E.T.S. Walton first observed the disintegration of a nucleus by artificially accelerated particles. Thereafter, the importance of accelerators in basic research became comparable to that of microscopes and telescopes. The particles accelerated are commonly the nuclei of light atoms, such as the proton from hydrogen or the alpha particle from helium; heavier nuclei may also be used, as well as electrons, which are lighter than any nucleus. The energy of an accelerated particle is expressed in units of electron volts (eV). Frequently employed multiple units are kiloelectron volts (keV; 1,000 eV), megaelectron volts (MeV; 1,000,000 eV), and gigaelectron volts (GeV; 1,000,000,000 eV).

Accelerators are generally differentiated according to the arrangement of their accelerating electric fields. They are classified into two basic types: linear and cyclic.

Linear accelerators. In a linear accelerator (commonly abbreviated linac), the path of the particle is a straight line and its final energy is the sum of the voltages generated by the accelerating mechanisms along that line. There are two different kinds of linear devices—the traveling-wave linear accelerator and the standing-wave linear accelerator. The first variety utilizes a traveling longitudinal electromagnetic field to impart kinetic energy to electrons. Its design and operation are based on the generation of the proper electromagnetic wave with electrical power of large peak values at microwave frequencies (*e.g.,* 3,000 megahertz). The acceleration chamber of this kind of machine is an evacuated cylindrical pipe that functions as a waveguide for the accelerating field. The phase velocity of an electromagnetic wave in a cylindrical pipe is greater than the speed of light in free space. Consequently, the wave must be slowed down by the insertion of metal irises several centimetres apart inside the pipe. Pulses of electrons are injected into the pipe at speeds approximately half that of light. During the first stage of acceleration, the electrons are made to gather in bunches, which are then accelerated to nearly the speed of light. Subsequently, the electrons move with the crest of the electromagnetic wave. The largest traveling-wave linac yet constructed is able to accelerate electrons to more than 20 GeV.

The second type of linear device accelerates protons by means of standing electromagnetic waves. Protons are roughly 2,000 times more massive than electrons and thus require a different mode of acceleration. A standing-wave linac consists of a cylindrical vacuum tank that houses a series of drift tubes separated by gaps. A particle injected into the tank is accelerated each time it passes across one of the gaps by an electric field generated by an electromagnetic wave of radio frequency. The successive drift tubes permit the particle to coast from one accelerating gap to another without losing velocity. The most powerful standing-wave linacs are capable of about 200 MeV. Accelerators of this kind are commonly used as a source of protons for higher-energy cyclic devices.

Cyclic accelerators. These accelerators are so designed that the path of a particle is bent by the action of a magnetic field into a spiral or a closed curve that is roughly circular. The particle travels many times through the accelerating mechanisms; the final energy depends on the magnitude of the voltage and the number of times the particle passes through. Cyclic accelerators include a variety of devices, the most important of which are the cyclotron and the synchrotron.

In a cyclotron two semicircular hollow electrodes called dees are arranged within a vacuum chamber between the poles of a magnet. Protons, deuterons, or other heavier ions starting near the centre circulate inside the electrodes, crossing the gap between them twice per revolution. A high-frequency potential difference impressed across the dees will produce repeated acceleration at each crossing provided its frequency is very close to the circulation frequency of the ions. The resultant path of the particles is a spirallike series of semicircles of increasing radius. Some means of focusing is required; otherwise an ion will spiral into the dees and be lost. By arranging a small radial decrease in the magnetic field, a slight outward curvature to the magnetic field is obtained. The magnetic force on the particle then always has a small component toward the median plane of motion and pushes the particle back toward the plane. This is important because the total length of the spiral path that the particle traverses may be a hundred metres or more. The necessity of this focusing, together with the effect of relativity in increasing the mass of the particle as its energy increases, makes inevitable a difference between the circulation frequency of the particle and the oscillation frequency of the accelerating potential over a considerable portion of the path. Under these circumstances the particle will get out of step with the dee voltage. The effect accumulates with each revolution, and, if many revolutions are made, the particle will ultimately arrive at a phase in which the voltage is of the opposite sign, which means that the particle will be decelerated. Hence, a large number of revolutions has to be avoided and a very high voltage must be put on the dees. Because of this, most cyclotrons can attain only about 10 to 50 MeV, though a few are capable of higher energies.

A device known as the synchrocyclotron was designed to overcome the energy limitation of the cyclotron. A synchrocyclotron provides a means of varying the frequency applied to the dees in accordance with the needs of magnetic focusing and the relativistic increase in the mass of a particle. The scheme is made practical by the existence of phase-stable orbits. Such an orbit is one in which the circulation frequency of a particle is the same as the oscillation frequency of the dee voltage. The circulation frequency of the particle decreases with increasing radius because of the decreased value of the magnetic field and the relativistic increase in the mass of the particle. When the frequency of the oscillation approaches the circulation frequency of the particles in the centre of the machine, some of the particles are caught in phase-stable orbits. As the frequency of the oscillator is decreased, the particles tend to stay in these orbits by absorbing energy from the electric field of the dees. By keeping in synchronism with the radio frequency, the particles gain energy and move in orbits of increasing radius up to the maximum allowed by the magnet design. An important advantage of the synchrocyclotron is that there is no limit on the number of revolutions the particle may make to obtain the desired energy.

The synchrotron employs the principle of phase stability to maintain synchronism between the circulating particle and an applied high-frequency electric field. A magnetic field deflects particles in a circular orbit, and the intensity of the field is modulated cyclically from low to high field strength to maintain orbits of nearly constant radius as the particle gains energy. Since the magnetic field is used to maintain the orbit but not for acceleration, magnetic field lines are needed only in the annular region defined by the orbit. This field is produced by a ring magnet. The relatively low weight and cost of such a magnet, compared with the solid-core magnets required for cyclotrons, give the synchrotron a significant economic advantage for high particle energies. Acceleration is effected by radio-frequency voltages. The peak accelerating voltage is ordinarily about twice as large as the average energy gain per turn would require to provide the margin for phase stability.

Electrons are well-suited for acceleration in a ring-shaped magnetic field because they acquire a speed essentially equal to the speed of light at relatively low energies; for higher energies, they circulate about an orbit of fixed radius at constant frequency. Synchrotrons designed specifically for electron acceleration, however, have certain limitations. When deflected in a magnetic field, electrons radiate electromagnetic energy in a continuous spectrum extending into the X-ray region, with an intensity that increases with the third power of electron energy. This radiated energy must be restored by the high-frequency accelerating system. The practical limit on the energy of electron synchrotrons is thus set by the cost of the system.

The highest-energy accelerators so far constructed are proton synchrotrons. Whereas the most powerful electron synchrotron can attain energies of only about 12 GeV, the largest proton devices regularly operate at 800 GeV. The mode of operation of both types of synchrotrons is similar, but there are certain key differences. The speed of a proton does not approach that of light until its energy exceeds 1 GeV, and so the frequency of the accelerating voltage has to be modulated to keep it proportional to the speed of the particle during the initial stage of the acceleration process. Furthermore, a proton does not lose a substantial amount of energy by radiation at energies attainable by existing techniques. As a consequence, the limit on the energy of a proton synchrotron is set by the cost of the magnet ring, which increases only as the first power of the energy or even more slowly.

Over the years researchers have developed several other kinds of accelerators. One of these is the microtron, a cyclic electron accelerator that somewhat resembles a cyclotron in operation. Microtrons have the advantage that the accelerated particles are easily guided out of the magnetic field. Another device used for particle acceleration is the storage ring, which typically consists of a pair of annular vacuum chambers. Such devices, however, are more commonly utilized for storing beams of high-energy particles and effecting near head-on collisions between them. These collisions make it possible to examine interactions at energies not economically feasible with other types of accelerating devices.

particleboard, construction material consisting of flakes, shavings, or splinters of wood glued together in the form of sheets. The particles are mixed with resin, water repellents, and mildew inhibitors, formed into mats, hot-pressed, trimmed to the appropriate size and shape, and finally sanded. Particleboard was developed in the 1940s, when suitable synthetic resins became available; it has made possible the use of residues from lumber production and logging. Particleboard is usually manufactured in thicknesses of 6–25 mm (1/5–1 inch) and in three grades of density. It may be covered with resin-impregnated paper, plastics, or other finishes.

particularism, also called HISTORICAL PARTICULARISM, school of anthropological thought associated with the work of Franz Boas and his students (among them Ruth Benedict, Margaret Mead, and A.L. Kroeber), whose studies of culture emphasized the integrated way of life distinctive of a people. As a philosophy, particularism differed from evolutionism, diffusionism, and geographical determinism, all of which had their adherents at the time in their approach to the question of the existence of general laws of culture.

Boas' own work emphasized studies of individual cultures, each based on its unique history. The anthropologist's primary assignment, in Boas' view, was to describe the particular characteristics of a given culture, with a view toward reconstructing the historical events that led to its present structure. Implicit in this approach was the notion that hypotheses regarding evolutionary development and the influence of one culture on another should be secondary to the careful and exhaustive study of particular societies. Boas urged that the historical method, based on the description of particular culture traits and elements, supplant the comparative method of the evolutionists, who used their data to rank cultures in an artificial hierarchy of achievement. He rejected the assumption of a single standard of rationality to which all cultures could be compared. Under Boas' influence, the particularist approach dominated American anthropology for the first third of the 20th century.

Partido Comunista de Cuba: *see* Communist Party of Cuba.

Partido Revolucionario Institucional (Mexican political party): *see* Institutional Revolutionary Party.

parting, in metallurgy, separating silver from bullion or from doré (gold–silver bars) by placing them in a bath of hot, concentrated sulfuric acid or strong nitric acid to dissolve the silver. Since all gold ores contain some silver and silver ores some gold, the mixture of silver and gold must be purified and then parted. The silver forms water-soluble compounds, silver sulfate or silver nitrate, leaving a residue of gold that is filtered off and washed. The clear solution, containing the silver compounds, is electrolyzed or is treated with ferrous sulfate or copper or iron to precipitate the silver, which is then washed, dried, and melted down to give silver of 99.5 percent purity, or 995 fine.

Partisan, Serbo-Croatian PARTIZAN, member of a Yugoslav guerrilla force led by Josip Broz Tito and his Communists in World War II against the Axis powers and the royalist resistance force, the Chetniks. Germany and Italy invaded and occupied Yugoslavia in April 1941, but it was not until Germany invaded the Soviet Union in June of that year that the Yugoslavian Communists started organizing Partisan detachments to lead popular uprisings against the Axis occupation. By September 1941 a large part of both Serbia and Montenegro had been liberated by the Partisans and Chetniks, but these two movements soon became involved in a civil war with each other, mostly on the Chetniks' initiative, and in November 1941 the Germans drove both resistance forces out of Serbia. In the next two years the Partisans had difficult militarily struggles against the Germans, but their forces grew in size while those of the Chetniks lost ground. This was partly because the Partisans were able to attract Yugoslavs of all ethnic nationalities by their policy of unified resistance to the Axis invaders. This was in notable contrast to the Chetniks, who were Serbian-oriented and who were basically unwilling to fight the Germans.

By late 1943 it became clear to the Allies that the Partisans were fiercely resisting the Germans while many Chetniks were in fact collaborating with the latter. The Allied governments accordingly withdrew their support from the Chetniks and recognized Tito as the head of the Yugoslav resistance. Anglo-American arms and equipment thenceforth were supplied in ever-increasing amounts to the Partisans and became an important factor in the latter's growing military strength. By the end of 1943 the Partisans had grown to about 300,000 troops and were holding down about 20 German divisions. The Partisans provoked seven major German offensives, thus drawing large numbers of enemy forces from other Allied fronts. By the summer of 1944 the Partisans controlled most of the mountainous part of Yugoslavia. In October, Partisan forces took part in the liberation of Belgrade by the Soviet Red Army.

During the war the Partisans held two political conferences (Bihać, November 1942; Jajce, November 1943) at which they established local and federal provisional governments within the areas that they had liberated; the network of Partisan-controlled local governments contributed to the Communists' political success after the war. By 1945 Tito's Communists had established their political and military control over the entire country. The loyalty to Tito and the sense of nationalism that developed among the Partisans during the war enabled Tito to withstand Stalin's political attacks in 1948.

partition, in mathematics and logic, division of a set of objects into a family of subsets that are mutually exclusive and jointly exhaustive; that is, no element of the original set is present in more than one of the subsets, and all the subsets together contain all the members of the original set.

A related concept, central to the mathematical topics of combinatorics and number theory, is the partition of a positive integer—that is, the number of ways that an integer n can be expressed as the sum of k smaller integers. For example, the number of ways of representing the number 7 as the sum of 3 smaller whole numbers ($n = 7$, $k = 3$) is 4 ($5 + 1 + 1$, $4 + 2 + 1$, $3 + 3 + 1$, and $3 + 2 + 2$).

Partito Comunista Italiano: *see* Italian Communist Party.

Partito Liberale Italiano: *see* Italian Liberal Party.

Partito Repubblicano Italiano: *see* Italian Republican Party.

Partito Socialista Democratico Italiano: *see* Italian Democratic Socialist Party.

Partizansk, formerly (until 1972) SUCHAN, city, Primorsky Kray (region), far eastern Russian Soviet Federated Socialist Republic. It lies in the valley of the Partizanskaya River. It was formed in 1932 by the amalgamation of mining settlements that developed near mine shafts in a bituminous coal basin. A thermal power station serving the region is located in the northern suburb of Uglekamensk (formerly Severny [Northern] Suchan). Partizansk has clothing factories and a mining college. Pop. (1974 est.) 49,000.

partnership, voluntary association of two or more persons for the purpose of managing a business enterprise and sharing its profits or losses. In the usual partnership, each general partner has full power to act for the firm in carrying on its business; thus, partners are at once proprietors and also agents of their copartners. Not only is each partner individually liable to third persons for the obligations incurred for the firm, but each is equally liable for obligations incurred by copartners when they are acting within the scope of the firm's business.

If a partner has paid or been required to pay creditors of the firm from personal assets, other partners may be expected to contribute on an equal or some other agreed-upon basis. If copartners have become insolvent, however, this remedy to the problem of unlimited personal liability may be inadequate. The alternative of restricting a partner's liability to third persons on a pro rata basis or of limiting it to the property held in common never gained foothold in the common law. Unlimited personal liability has been one factor restricting the partnership form of business to small enterprises.

Unlike the corporation, the partnership is generally regarded merely as an aggregation of persons doing business under a common name and not as a legal entity separate and apart from its shareholders. The implication of this is that the earnings of the partnership will be taxed only as personal earnings of the partners. Although corporations are usually organized to have perpetual existence, partnerships may be dissolved at any time upon withdrawal of a partner and by operation of law upon the death of a partner. Dissolution may be avoided by issuing transferable shares, but this device is not feasible except by a large organization, in which, as in the case of a corporation, operating control can be centralized in a board of managers. *Compare* limited liability.

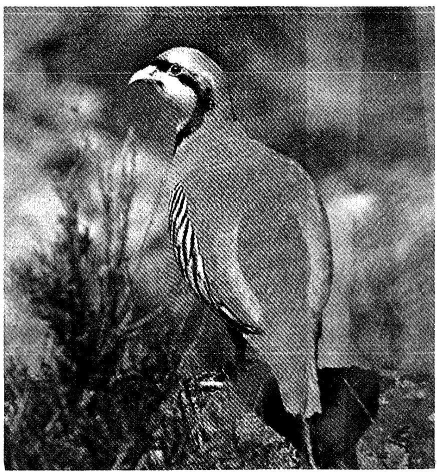
Parton, Sara Payson Willis, *née* GRATA PAYSON WILLIS, pseudonym FANNY FERN (b. July 9, 1811, Portland, Maine, U.S.—d. Oct. 10, 1872, New York City), American author who, under the pen name Fanny Fern, was one of the most popular American woman writers in the 19th century.

Parton's sketches, often dealing with domestic life, were originally published in periodicals in Boston and New York City. They were first collected in *Fern Leaves from Fanny's Port-Folio* (1853), which sold a remarkable 100,000 copies its first year. The success of this and other books led to an offer by the *New York Ledger* that made Parton one of the first woman newspaper columnists in America; from 1855 until her death, she reached an audience estimated at 500,000 readers weekly. Parton was married three times: in 1837 to Charles H. Eldredge (d. 1846), a banker; in 1849 to Samuel P. Farrington, a Boston merchant (divorced three years later); and in 1856 to James Parton (1822–91), a biographical writer.

Parton's writings are considered valuable not for their literary content or style but for their social history and as a mirror of popular taste in the mid-19th century. In addition to her articles, Parton wrote a number of bestselling books, including *Ruth Hall* (1855) and *A New Story Book for Children* (1864).

partridge, any of many small game birds native to the Old World and belonging to the family Phasianidae (order Galliformes). They are larger than quails, with stronger bills and feet. (For New World birds erroneously called partridges, *see* grouse; quail. For dwarf partridges of India called bush quail and for the Mexican bird called long-tailed partridge, *see* quail.)

The typical partridge of Europe is the gray partridge (*Perdix perdix*), called Hungarian (or hun) partridge in North America, where it was introduced in 1889 (Virginia) and again, much more successfully, in 1908–09 (Alberta). It ranges throughout the British Isles and across Europe to the Caspian region. The gray partridge has a reddish face and tail, gray breast,



Chukar (*Alectoris chukar*)
Ellen Trueblood

barred sides, and a dark U shape on the belly; sexes look alike. The hen lays about 15 eggs in a grassy cup in grainfields or hedges. A large male is 30 cm (12 inches) long and may weigh 0.33 kg ($3/4$ pound). Gray partridges prefer farmlands, where family groups (coveys) forage for seeds and insects.

In the rock partridges (*Alectoris*), both sexes have red legs and bill, and the male has blunt leg spurs. The chukar (*A. chukar*), stocked in many countries, is native from southeastern Europe to India and Manchuria (Northeast Provinces). It has a brown back with strongly barred sides and a black-outlined whitish throat. The crested wood partridge, or roulroul (*Rollulus roulroul*), of Malaysia has an iridescent blue-green body, red feet and eye region, and crimson crest.

Francolins are partridges with leg spurs. The 5 Asian and about 35 African species of *Francolinus* are prized game birds, 25–40 cm (10–16 inches) long, with big bills and strong legs; most are an intricately patterned brown, but some are patterned in black, white, or red.

The snow partridge (*Lerwa lerwa*) of high mountains of south-central Asia resembles a ptarmigan in appearance and habits.

Partridge, Eric (Honeywood) (b. Feb. 6, 1894, Waimata Valley, Gisborne, N.Z.—d. June 1, 1979, Moretonhampstead, Devon, Eng.), New Zealand-born English lexicographer, best-known for his *A Dictionary of Slang and Unconventional English* (1937; revised ed. 1970).

Partridge served with the Australian Infantry in World War I and with the Royal Air Force in World War II. He was a fellow at the University of Oxford (1921–23), lectured at English universities, and then ventured into publishing with his Scholartis Press (1927–31). Thereafter, he was a free-lance lexicographer and author. *Usage and Abusage* (1942), *Shakespeare's Bawdy* (1947), *Origins: An Etymological Dictionary of Modern English* (1958; 4th ed., 1966), and *A Dictionary of Catch Phrases* (1977) were among his scholarly and lively books.

partridgeberry (*Mitchella repens*), North American plant of the madder family (Rubiaceae), growing in dry woods from southwestern Newfoundland to Minnesota and southward to Florida and Texas. It is evergreen, with nearly round, 18-millimetre (0.7-inch) leaves, often variegated with white lines; a slender, often whitish, trailing stem; and white flowers, often borne in pairs, which are replaced by scarlet, edible but almost tasteless berrylike drupes. The flowers occur in long-styled and short-styled forms, as in the primrose. The plant, also called checkerberry, squawberry, teaberry, running box, two-eyed berry, squaw vine, and twinflower, is a good wild-garden plant for shady places. It is popular in winter terrariums because of its diminutive size and attractive colour contrast of berries and leaves.

Parts of ———: *see under* substantive word (*e.g.,* Holland, Parts of; Kesteven, Parts of; Lindsey, Parts of).

parturition, also called BIRTH, or CHILDBIRTH, the process of bringing forth an infant from the uterus.

A brief treatment of parturition follows. For full treatment, *see* MACROPAEDIA: Reproduction and Reproductive Systems.

Childbirth in humans is divided into two stages. The first stage, dilatation, is characterized by the opening up of the cervix until it is about 4 inches (10 cm) in diameter, large enough for an infant's head to pass through. Rhythmic muscular contractions of the uterus force the sac of amniotic fluid, which has held the fetus throughout pregnancy, down into the cervix and compresses its contents until it bursts. At the onset of labour, uterine contractions occur every 20 or 30 minutes and last about 40 seconds. When the cervical opening is fully dilated, contractions may recur every three minutes. The period of dilatation varies greatly; in women having their first baby it may take 14 hours, while in those who have borne several children it may require less than an hour.

In the second stage of labour, expulsion, the baby is pushed through the birth canal. In normal deliveries, the crown of the baby's head emerges first, followed by the shoulders, one at a time. The lower part of the baby's body slides out quickly. In first births, the expulsion of the child takes about an hour. Expulsion may be complicated by the incorrect positioning of the baby for delivery. In such cases, the child's position can be changed manually or with forceps. Sometimes, as when it is lying transversely across the mother's pelvis, the baby must be delivered surgically.

The pain of labour can be relieved by the use of analgesic drugs, but these pose some degree of danger to the mother and baby and must be used carefully. If the mother is unconscious owing to a general anesthetic, she will not be able to augment the uterine contractions by bearing down, nor will she experience the birth of the child. Local anesthetics in the genital and pelvic region are sometimes used instead.

The technique of natural childbirth was developed in the 1940s to reduce dependence on anesthesia. Because fear and tension are largely responsible for much of labour pain, pregnant women are often educated in the process of childbirth. In addition, they are taught exercises to strengthen the muscles involved in labour and breathing techniques to reduce pain. If a difficult delivery is expected, natural childbirth is not encouraged.

Several factors may lead to complications in childbirth—*e.g.*, abnormal bleeding, placenta previa (expulsion of the placenta before the child), knotting of the umbilical cord, failure of the mother's blood to clot, weak uterine contractions, and rupture of the uterus. If delivery through the birth canal is likely to prove hazardous to the mother or the child, a cesarean section is performed. This procedure involves making an abdominal incision in the mother through which the baby is removed. The type of incision that is involved in a modern cesarean section and the scar it leaves in the uterine wall usually do not prevent a woman from delivering naturally in subsequent births.

Paru River, Portuguese RIO PARU, river, northern Brazil, rising on the southern slopes of the Tumuc-Humac Mountains, on the Suriname border, and flowing for about 500 miles (800 km) south-southeastward through Pará state. It empties into the Lower Amazon River just above Almeirim. The Paru is navigable for 50 miles (80 km) above its mouth.

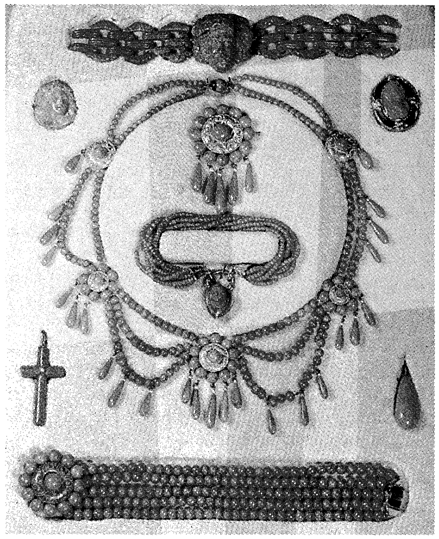
Parulidae, the songbird family of birds, order Passeriformes, consisting of the woodwarblers and bananaquits. The Parulidae comprise about 119 species of small, active birds, notable for their bright spring plumage and dazzling snatches of song, that live in the forests of the Western Hemisphere.

Songbird species range in size from 10 to 18.5 cm (4 to 7.5 inches) long. They have slender, pointed bills, pointed wings, and rounded tails. Most glean small insects among foliage of trees or shrubs; a few forage on the ground. The yellow-breasted chat (*Icteria virens*), the largest of the family, is an excellent mimic and a strong singer. The ovenbird (*Seiurus aurocapillus*), yellow throat (*Geothlypis trichas*), and American redstart (*Setophaga ruticilla*) are distinctive songsters with easily recognizable melodies.

Bananaquits (*Coereba*) and conebills (*Conirostrum*) of Latin America are sometimes given family rank (as the Coerebidae). The Parulidae belongs to the songbird suborder (Passeres).

parure, matched set of jewelry consisting of such pieces as earrings, bracelet, brooch, necklace, and ring. By the mid-17th century, jewels had ceased to be created as individual works of art expressing some idea or fancy and had instead become mere personal ornaments that were beautiful but lacking in any deeper significance. Consequently, as the forms of jewels tended to become stereotyped, the matching set of jewels, or parure, became the dominant style in jewelry.

In about 1700, parures consisted of earrings, brooch, necklace or clasp, ring, and sometimes shoulder brooches or buckles, all set with diamonds, either alone or in combination with rubies, topazes, sapphires, or emeralds. In the 18th century the kings of France had parures of great splendour, most made of diamonds

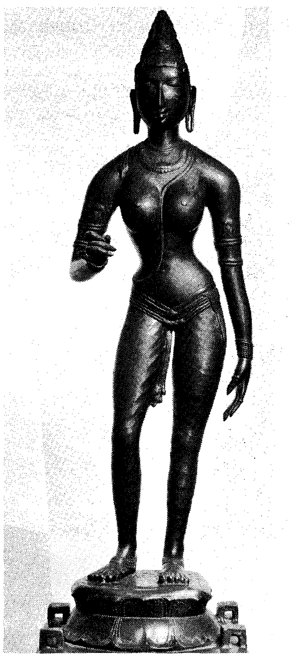


Coral parure, *c.* 1830; in the Musée des Arts Décoratifs, Paris

Arnoldo Mondadori Editore

and including shoe buckles, coat decorations, insignia, and sword hilts. For state occasions, the 19th-century Napoleonic court imitated the parures of the ancien régime, with the addition of a jeweled coronet of classic form. Parures of semiprecious stones were made for everyday wear and for the less affluent. Parures continue to be a staple element in jewelry design.

Pārvatī (Sanskrit: "Daughter of the Mountain"), wife of the Hindu god Śiva (Shiva). Pārvatī is the benevolent aspect of the goddess Śakti and is sometimes identified with Umā. The legendary account of her marriage relates that she won Śiva's notice only after severe ascetic discipline. The couple had two children, the elephant-headed Gaṇeśa and the six-headed Skanda. Pārvatī is often represented in sculpture with Śiva—as an attendant figure, or looking on as he performs a miraculous feat, or engaged in a game with him in their mountain kingdom Kailāsa—and is always depicted as a mature and beautiful woman. The *Tantras*—texts of sects worshiping Śiva—



Pārvatī, bronze image, early Cōḷa period, 10th century AD; in the Freer Gallery of Art, Washington, D.C.

By courtesy of the Smithsonian Institution, Freer Gallery of Art, Washington, D.C.

are written as a discussion between Pārvatī and Śiva.

parve, also spelled PARVEH (Judaism): *see* pareve.

Parvus (Russian-German revolutionary): *see* Helphand, Alexander Israel (Lazarevitsch).

Parys, resort town, northern Orange Free State, South Africa. It is situated on the southern bank of the Vaal River. Parys was founded in 1873 and most likely named by a German surveyor named Schilbach, who had fought in the siege of Paris in 1870. Parys officially became a town in 1887. Tobacco, corn (maize), sorghum, and cattle are raised in the surrounding area. Industries produce processed tobacco, bolts and nuts, hosiery, baskets, farming implements, and milled flour. The Vaal River is dammed by a high barrage and is about ½ mile (0.8 km) wide at Parys. The river's banks have a luxuriant growth of willows, and there are a number of islands in the river that are tourist attractions. Parys lies on the national road from Bloemfontein to Johannesburg. Pop. (1984 est.) mun., 32,400.

Paryuṣaṇa (Sanskrit), Prākrit PAJJUSAṆA, a popular eight-day festival in Jainism, a religion of India. It generally is celebrated by members of the Śvetāmbara sect from the 13th day of the dark half of the month Bhādrapada (August–September) to the 5th day of the bright half of the month. Among Digambaras, a corresponding festival is called Daśalakṣaṇa, and it begins immediately following the Śvetāmbara Paryuṣaṇa.

Paryuṣaṇa closes the Jaina year. Jainas make confessions at the meetinghouse so that no quarrel is carried over into the new year, and many lay members temporarily live the lives of monks, an observance called *poṣadha*. The fourth day of Paryuṣaṇa coincides with the birth anniversary of Mahāvīra.

The last day of the festival, Bhadra-śukla-pañcamī ("Fifth Day of the Bright Fortnight of Bhādra"), is also an ancient Indian festival day known to Hindus as Ṛṣi-pañcamī ("The Fifth of the Seers"), the day on which Hindus pay homage to the seven seers, who are identified with the seven stars of the constellation Ursa Major, then visible. On that day Jainas distribute alms to the poor and take out a Jina (saviour) image in a procession that is headed by an ornamental pole called Indradhvaja ("Staff of Indra"). The *Kalpa-sūtra,* a sacred text that describes the lives of the Jinas, is read before the laity by monks, and the miniature paintings illustrating the incidents are shown and revered. The last day is a day of fasting, though the very pious observe a fast throughout the eight-day festival.

PAS (drug): *see* para-aminosalicylic acid.

Pas, The (town, Manitoba, Canada): *see* The Pas.

pas assemblé: *see* assemblé.

pas brisé: *see* brisé.

Pas-de-Calais, *département,* Nord-Pas-de-Calais *région,* northern France, extending southeast from the English Channel and separated from Belgium by Nord *département.* Created from the historic province of Artois (*q.v.*) and a part of Picardy, it has an area of 2,576 square miles (6,671 square km). The coastline runs north from the boundary of Somme *département* at the Authie River, past Le Touquet-Paris-Plage and Boulogne (*qq.v.*), to Cap Gris-Nez on the Strait of Dover (French Pas de Calais). It continues east-northeast past Calais (*q.v.*) to the estuary of the Aa River bordering Nord. Low and marshy to the south and northeast, the coast has high chalk cliffs around Cap Gris-Nez and Cap Blanc-Nez, facing the cliffs of Dover in England across the English Channel. Extending inland from the Boulogne region, the chalk hills of Artois rise to 700 ft (210 m) and are the watershed of several rivers flowing north to Flanders and south to the Canche, which enters the Channel at Le Touquet-Paris-Plage.

The climate is mild with moderate rainfall. Agriculture thrives: dairy farming and market gardening are intensively pursued in the coastal lowlands, on which large areas have been reclaimed and canalized. Inland, cattle are raised, and sugar beets, cereals, and fodder are grown.

The eastern half of the *département,* which embraces part of the coal basin extending across northern France into Belgium, is highly industrialized. The greatest number of pits is in the Béthune–Liévin–Lens–Hénin–Beaumont–Liétard area, in which coking plants, blast furnaces, steel mills, metalworks, and chemical installations are concentrated. The area is densely populated. Pas-de-Calais is skirted by the Lille–Paris motorway, which passes east of Arras, the capital, in which such industries as textiles and food processing long have been established. Textile, metal, and cement industries are among those in the Calais-Boulogne region. Calais, which, with Boulogne, receives most of the surface traffic from England, is France's major passenger harbour, while Boulogne is France's major fishing harbour.

The *département* has seven *arrondissements:* Arras, Béthune, Boulogne-sur-Mer, Calais, Lens, Montreuil, and Saint-Omer. It is in the educational division of Lille. Pop. (1982) 1,412,413.

pas de deux (French: "step for two"), dance for two performers. The strictly classical balletic pas de deux followed a fixed pattern: a supported adagio, a solo variation for the male dancer, a solo variation for the female dancer, and a coda in which both participants displayed their virtuosity.

pas d'élévation (French: "high steps"), all jumping and leaping movements in classical ballet. The steps are admired for the height at which they are performed and for the dancer's ability to ascend without apparent effort and to land smoothly. Dancers famed for aerial manoeuvres of this kind include Jean Balon, a French dancer of the late 17th century, and Nijinsky, reportedly an early master of the *entrechat-dix* (jump with five leg crossings). *Pas d'élévation* include cabriole, entrechat, and jeté (*qq.v.*).

Grand jeté, pas d'élévation, from Enrique Martinez' "Coppélia," performed by the American Ballet Theatre
Jack Mitchell

Pasadena, city, Los Angeles County, California, U.S., located in the San Gabriel Valley, at the base of the San Gabriel Mountains. Once part of Rancho San Pasqual, it was founded in 1874 by Thomas B. Elliott as Indiana Colony; the name Pasadena (Chippewa: "crown of the valley") was adopted in 1875. Growth as a winter resort and citrus centre was stimulated by the Santa Fe Railroad, and later freeway construction brought it within easy commuting distance to Los Angeles, 12 mi (19 km) southwest.

Based on the California Institute of Technology (1891), which includes the Jet Propulsion Laboratory operated in conjunction with the National Aeronautics and Space Administration, the city has become a centre of research and light manufacturing, chiefly scientific and precision instruments and electronic, aircraft, and missile components.

Pasadena City College (1924), Pacific Oaks College (1945), Ambassador College (1947), and Art Center College of Design (1930) are in the city, which is also the home of the State Theatre of California (formerly Pasadena Community Playhouse). The Pasadena Art Museum is renowned for its collection. The New Year's Day Tournament of Roses (first introduced in 1890) features a televised parade and the Rose Bowl football classic between the champion teams of West Coast and Midwestern U.S. universities. Inc. 1886. Pop. (1980) 119,374.

Pasadena, city, Harris County, southeastern Texas, U.S., bordering Houston (west) between the Houston Ship Channel and the Clear Lake area. Founded in 1895 by J.H. Burnett, its Spanish name, meaning "land of flowers," was inspired by blooming fields along Vince's Bayou. Rapid post-World War II growth was stimulated by adjacent industrial development, particularly petrochemicals and aerospace. Pasadena is the seat of San Jacinto College (1960) and the Texas Chiropractic College (1908). Inc. 1929. Pop. (1980) 112,560.

Pasadenan orogeny, a period of folding and thrust faulting of rock strata in the Coast Ranges of California in middle Pleistocene time (the Pleistocene Epoch began about 2,500,000 years ago and ended 10,000 years ago). This period marks the final disappearance of older, Tertiary depositional troughs in the Coast Range area and probably is only one of a series of deformational events related to the movement of the Pacific Plate in relation to the North American Plate in western California.

Pasargadae, first dynastic capital of the Achaemenian Empire, situated northeast of Persepolis in modern southwestern Iran. Traditionally, Cyrus II the Great (reigned 559–*c.* 529 BC) chose the site because it lay near the scene of his victory over Astyages the Mede

Tomb of Cyrus II the Great at Pasargadae
By courtesy of the Oriental Institute, the University of Chicago

(550). The name of the city may have been derived from that of the chief Persian tribe, the Pasargadae.

The majestic simplicity of the architecture at Pasargadae reflects a sense of balance and beauty that was never equalled in either earlier or later Achaemenian times. The principal buildings stand in magnificent isolation, often with a common orientation but scattered over a remarkably wide area. The dominant feature of the citadel is a huge stone platform, projecting from a low, conical hill. Two unfinished stone staircases and a towering facade of rusticated masonry were evidently intended to form part of an elevated palace enclosure. An abrupt event, however, brought the work to a halt, and a formidable mud-brick structure was erected on the platform instead. It is possible that the building represents the famous treasury surrendered to Alexander the Great in 330 BC.

To the south of the citadel was an extensive walled park with elaborate, irrigated gardens surrounded by a series of royal buildings. One building, designed as the sole entrance to the park, is notable for a unique four-winged, crowned figure that stands on a surviving doorjamb; the figure appears to represent an Achaemenian version of the four-winged genius (guardian spirit) found on palace doorways in Assyria.

Farther to the south, the tomb of Cyrus still stands almost intact. Constructed of huge, white limestone blocks, its gabled tomb chamber rests on a rectangular, stepped plinth, with six receding stages. In Islāmic times the tomb acquired new sanctity as the supposed resting place of the mother of King Solomon. At the extreme southern edge of the site, an impressive rock-cut road or canal indicates the course of the ancient highway that once linked Pasargadae with Persepolis.

After the accession of Darius I the Great (522 BC), Persepolis replaced Pasargadae as the dynastic home.

Pasay, also called RIZAL CITY, chartered city, Rizal province, central Luzon, Philippines, situated on the eastern shore of Manila Bay. A major residential suburb of Manila (immediately north), it is well known for the nightclubs that line the waterfront along Roxas (formerly Dewey) Boulevard. Pasay is densely populated and highly commercialized. Araneta University (1946) is located in the city. Both the domestic and international airports are on its outskirts. Inc. city, 1947. Pop. (1980) mun., 287,770.

Pascagoula, city, seat (1812) of Jackson County, southeastern Mississippi, U.S., situated on Pascagoula Bay of Mississippi Sound, at the mouth of Pascagoula River adjacent to

Moss Point (north), 21 mi (34 km) east of Biloxi. The Gulf Coast settlement developed around the Old Spanish Fort built in 1718 by the Frenchman Joseph Simon de la Pointe. It thrived in the 19th century as a lumber-shipping port. The Pascagoula River is known locally as the Singing River because of strange humming sounds audible in its vicinity. Legends have linked the "singing" with the death chant of the Pascagoula Indians who chose to commit mass suicide in its waters rather than suffer extinction at the hands of the more powerful Biloxi tribe.

A seaport and fishing and shipbuilding centre, the city also has industries manufacturing paper products, petroleum, chemicals, and clothing. The Bayou Casotte Industrial Park is immediately east. Inc. village, 1892; city, 1904. Pop. (1980) 29,318.

Pascal (popes): *see under* Paschal.

pascal, abbreviation PA, unit of pressure in the metre-kilogram-second (SI) system; named in honour of Blaise Pascal, 17th-century mathematician and physicist. A pascal is a pressure of one newton per square metre; this unit is inconveniently small for many purposes, and the kilopascal (kPa) of 1000 newtons per square metre is more commonly used in engineering work (one pound per square inch equals 6.895 kPa).

Pascal, Blaise (b. June 19, 1623, Clermont-Ferrand, Fr.—d. Aug. 19, 1662, Paris), French mathematician, physicist, and religious philosopher and writer who was the founder of the modern theory of probabilities. His ideas on inner religion influenced Jean-Jacques Rousseau, Henri Bergson, and the Existentialists.

A brief account of the life and works of Blaise Pascal follows; for a full biography, *see* MACROPAEDIA: Pascal.

At the age of 17 Pascal published an essay on mathematics that was highly regarded in the academic community and praised by Descartes. He invented the first digital calculator (1642–44) to assist his mathematician father in local administration. Further studies in geometry, hydrodynamics, and hydrostatic and atmospheric pressure led him to invent the syringe and the hydraulic press and to discover Pascal's law of pressure (1647–54).

By the end of 1653 Pascal had begun to feel religious scruples; and the "night of fire" which he experienced on Nov. 23, 1654, he believed to be the beginning of a new life. Though he never became one of the solitaries at the convent of Port-Royal, it was henceforth only at their request that he was ever to take up his pen. In 1655 he entered Port-Royal, where he wrote *Les Provinciales,* a defense of Jansenism against the Jesuits, and the *Pensées.*

Les Provinciales were an immediate success, and their popularity has remained undiminished. This they owe primarily to their form, in which for the first time bombast and tedious rhetoric as exemplified by J.L. Guez de Balzac and Antoine Lemaistre are replaced by variety, brevity, tautness, and precision of style; as Nicholas Boileau recognized, they mark the beginning of modern French prose. The *Pensées,* inappropriately named by the editors when it appeared posthumously, consisted of his notes and manuscript fragments of his Christian apologetics. Pascal spent his last years in scientific research and good works.

Pascal's principle, also called PASCAL'S LAW, in fluid (gas or liquid) mechanics, statement that in a fluid at rest in a closed container a pressure change in one part is transmitted without loss to every portion of the fluid and to the walls of the container. The principle was first enunciated by French scientist Blaise Pascal.

Pressure is equal to the force divided by the area on which it acts. According to Pascal's principle, in a hydraulic system a pressure exerted on a piston produces an equal increase in pressure on another piston in the system. If the second piston has an area ten times that of the first, the force on the second piston is ten times greater, though the pressure is the same as that on the first piston. This effect is exemplified by the hydraulic press, based on Pascal's principle, which is utilized in such applications as hydraulic brakes.

Pascal also discovered that the pressure at a point in a fluid at rest is the same in all directions; the pressure would be the same on all planes passing through a specific point. This fact is also known as Pascal's principle, or law.

Paschal, also spelled PASCAL, Latin PASCHALIS, or PASQUALIS, name of Roman Catholic popes and antipopes, grouped below chronologically and indicated by the symbol •.

• Paschal (I) (d. 692, Italy), antipope against both the rival antipope Theodore and the legitimate pope St. Sergius I during 687.

After the death of Pope Conon in September 687, the Roman populace proceeded to enthrone both Paschal, then an archdeacon, and the archpriest Theodore. No agreement could be reached, and neither Paschal nor Theodore would renounce their claims. To resolve the dispute, the higher clergy, supported by the Roman army, elected the priest Sergius. Among those who supported Sergius was Paschal's patron, John Platyn, the imperial deputy at Ravenna; having been bribed by Paschal into influencing his original nomination, Platyn was also bribed with gold to support Sergius, who was consecrated on Dec. 15, 687. Theodore ceded, but Paschal refused to submit and was deposed and imprisoned in a monastery until his death.

• Paschal I, SAINT (b. Rome—d. Feb. 11, 824, Rome; feast day May 14), pope from 817 to 824.

A priest who had served in the Curia, Paschal was an abbot when elected pope immediately after the death of his predecessor, Stephen IV (V), on Jan. 26, 817. During his pontificate Paschal was continually concerned with the relation of the papacy to the recently founded Frankish Empire under Charlemagne's son and successor, Louis I the Pious. Louis forcibly imposed on the church an unprecedented reform and reorganization of monasteries and dioceses while concurrently arranging the empire and trying to reconcile the safeguarding of Christian order and unity.

St. Paschal I, detail from a 9th century mosaic; in the apse of the church of Sta. Prassede, Rome
Alinari—Art Resource/EB Inc.

Paschal secured from Louis the independence of the Roman see, its suzerainty over the states of the church, and the right of Romans to freedom of election. In 823 he crowned Louis's son Lothair I as co-emperor, a deed that was signficant because it initiated the handing of a sword by the pope to the emperor as a symbol of the temporal power that was to suppress evil. Meanwhile, in Rome an anti-Frankish movement was developing, which Paschal supposedly joined. Some of his servants executed at the Curia two leaders of the Frankish party accused of plotting against Paschal and of favouring imperial control of Rome. Louis ordered an investigation at which Paschal was forced to clear himself by an oath of purgation. The exact proceedings of this investigation are clouded by intrigue and the argument that no mortal can judge a pontiff. It is known, however, that Paschal was hated, and the emotions aroused by the executions caused considerable trouble that necessitated firmer supervision of Rome by the imperial court.

Paschal was further faced with the revival of Iconoclasm (destruction of images) in the East under the Byzantine emperor Leo V the Armenian. The Eastern abbot Theodore Studites, leading defender of orthodoxy and of the veneration of icons, appealed to the Pope, who dispatched legates to Constantinople. Paschal's intervention proved unsuccessful, but he did supply refuge for the Greek monks who fled to Rome.

Paschal's contribution to the building activity in Rome typifies the period that followed Charlemagne's consecration as Holy Roman emperor. Sta. Prassede and the annexed chapel of S. Zeno, both containing magnificent mosaics, were his work; he also built Sta. Maria in Domnica and rebuilt Sta. Cecilia. He was responsible for the translation of the relics of many martyrs, including those of St. Cecilia, from the catacombs to Rome.

• Paschal II, original name RANIERO, Latin RANIERUS (b. Bieda di Galeata, near Ravenna—d. Jan. 21, 1118, Rome), pope from 1099 to 1118.

He entered a monastery as a boy and was made cardinal by Pope St. Gregory VII *c.* 1080. He was legate to Spain under Pope Urban II, whom he was elected to succeed on Aug. 13, 1099.

Although Paschal fostered the First Crusade and followed Gregory's great policies of church reform, his pontificate was dominated by the Investiture Controversy—the long conflict between popes and secular rulers over control of ecclesiastical appointments. In 1107 settlements on the issue of lay investiture were made with kings Henry I of England and Philip I of France (who was excommunicated for his unsanctioned marriage to Bertrada in 1100 but absolved in 1104).

Paschal's struggles with the Holy Roman emperors Henry IV and Henry V, however, proved inconclusive. After unsuccessful negotiations in 1106, 1107, and 1110, he officially condemned Henry V, who invaded Italy. They met at Sutri, where Henry renounced the right to investiture, and Paschal agreed to have the German church return all lands and rights received from the crown—an agreement that, when promulgated at St. Peter's in Rome on Feb. 12, 1111, caused a tumult among the German bishops. They felt deprived of power, and their protests killed the pact. A popular rising forced Henry to leave Rome temporarily, and he took Paschal as prisoner. After two months of harsh captivity, Paschal consented to Henry's demands on royal investiture of bishops, and on April 13, 1111, he crowned Henry as Holy Roman emperor.

Strong opposition arose in the Curia against Paschal. A council declared invalid the privilege he had granted Henry, and, against his will, Archbishop Guido of Vienne excommunicated the Emperor. Paschal finally revoked the privilege in 1112 and renewed his earlier condemnations of regal investiture in 1116.

The problem remained unsolved until 1122, when Pope Calixtus II concluded the Concordat of Worms, which secured peace between the church and the empire.

• **Paschal (III),** original name GUIDO DA CREMA (d. Sept. 20, 1168, Rome), antipope from 1164 to 1168.

Against Pope Alexander III, he was one of the original supporters of the antipope Victor IV, whom he succeeded on April 22, 1164, becoming the second antipope set up by the Holy Roman emperor Frederick I Barbarossa. Elected through the influence of Rainald of Dassel, Frederick's chancellor and vicar in Italy, he won only limited allegiance in the empire. By imperial command in 1165 he canonized Charlemagne at Aachen, a decree never confirmed by the church, although Charlemagne is now regarded as having been informally beatified.

Paschal was enthroned when Rome was seized by Frederick, whom Paschal crowned (for a second time) in August 1167, together with his wife, Béatrix. After a sudden outbreak of pestilence destroyed the imperial army, Frederick retreated to Germany in the spring of 1168, accompanied by Paschal.

Paschal controversies, in the Christian Church, disputes concerning the correct date for observing Easter (Greek *Pascha*). The earliest controversy was over the question of whether Easter should always be celebrated on a Sunday or on the actual day of the Jewish lunar month (14th of Nisan) on which the Paschal lamb was slaughtered. The latter practice, followed by the church in the Roman province of Asia, was generally condemned at the end of the 2nd century because it meant celebrating Easter when the Jews were keeping Passover.

Later controversies concerned the different methods of calculating the Paschal moon, until in the 6th century the computations of Dionysius Exiguus were generally accepted in the West. The Celtic Church, however, did not accept this method until the 7th century (*see* Whitby, Synod of), and there were some difficulties in Gaul in the 8th century.

In the Eastern Orthodox Church, Easter is often observed on a later Sunday than in the Western Church, partly because it adheres to the Julian calendar for the movable year. In the West the subject has ceased to be a matter of dispute, and the second Vatican Council stated in 1963 that there was no objection in principle to observing Easter on a fixed Sunday (probably early in April).

Paschal lamb, in Judaism, the lamb sacrificed at the first Passover, on the eve of the Exodus from Egypt, the most momentous event in Jewish history. According to the story of the Passover (Exodus, chapter 12), the Jews marked their doorposts with the blood of the lamb, and this sign spared them from destruction.

In early Jewish history an unblemished year-old lamb sacrificed in the Temple of Jerusalem on the 14th of Nisan to commemorate the eve of the Exodus was later eaten by the family. For those who had been impeded from visiting the Temple at the prescribed time, a second Passover festival was permitted a month later. In modern times Jews use a roasted shank bone at the seder (*q.v.*) meal as symbolic of the Paschal lamb. St. Paul, drawing a parallel with the sacrifice made by Jesus, referred to Christ as the Paschal lamb (I Corinthians 5:7); hence, the Christian view of Christ as the spotless Lamb of God who by his death freed mankind from the bonds of sin.

Paschasius Radbertus, SAINT (b. *c.* 785, Soissons, Fr.—d. *c.* 860; feast day April 26), French abbot, theologian, and author whose monograph *De corpore et sanguine Christi* ("Concerning Christ's Body and Blood") later became the dominant interpretation of the Eucharist (*q.v.*).

Abandoned as an infant, Paschasius was raised by the monks of St. Peter's, Soissons. Later, he joined the Benedictine abbey of Corbie, near Amiens, under St. Adalhard the Elder and his brother and successor, St. Wala, whose biographies Paschasius was to write. Well read in the Scriptures and patristic works, he was ordained deacon and subsequently became novice master and headmaster at Corbie and at the daughter abbey of New Corbie, Westphalia (now in Höxter, Ger.), which in 822 he had assisted in founding. Under Paschasius' leadership the Corbie schools became famous.

He was elected, *c.* 843, fourth abbot of Corbie. During his office there were disturbances in the monastery and his plans for reform were opposed. His *De corpore,* written in 831 and revised in 844, when he presented it to King Charles II the Bald of the West Frankish kingdom, was seriously challenged by the monk Ratramnus (*q.v.*), who *c.* 850 wrote his famous eucharistic treatise *De corpore et sanguine Domini* ("Concerning the Lord's Body and Blood") partially in reply to Paschasius. Paschasius was further criticized by Rabanus Maurus, abbot of Fulda and later archbishop of Mainz.

Paschasius attended the synods of Paris (847) and Quercy (849). He resigned his abbacy *c.* 851 and retired to the monastery of Saint-Riquier to write in peace, although his last years were supposedly spent at Corbie. During succeeding centuries his eucharistic views were dominant, particularly during the 11th-century eucharistic controversy associated with the noted theologian Berengar of Tours, who was condemned at the Council of Vercelli in 1050 for sympathizing with Ratramnus' views (then falsely attributed to the Irish philosopher and theologian John Scotus Erigena). Modern theologians, however, recognize faults in Paschasius' doctrine. H. Peltier's *Pascase Radbert* appeared in 1938, followed by C. Gliozzo's *La dottrina in Paschasio Radberto e Ratramno, monaci di Corbia* ("The Doctrine of Paschasius Radbertus and Ratramnus, Monks of Corbie") in 1945.

Pascin, Jules, original name JULIUS PINCAS (b. March 31, 1885, Vidin, Bulg.—d. June 1, 1930, Paris), painter of the school of Paris renowned for his delicate draftsmanship and sensitive studies of women.

Born of Italian-Serbian and Spanish-Jewish parents, Pascin spent a number of years in Austria and Germany working for such satirical journals as the *Lustige Blätter* and *Simplicissimus.* In 1905 he moved to Paris where he continued to produce tragically satirical drawings of the demimonde. At the outbreak of World War I he travelled for a while in the United States, where he became a citizen, returning to Paris in 1920. There he began to create a series of large-scale, representational, and very sensitively drawn biblical and mythological paintings. Later he turned to the material for which he is generally known, the delicately toned, thinly painted, but poetically bitter and ironic studies of women, generally prostitutes. On the eve of an important one-man show of his work Pascin hanged himself.

Pasco, department (formed 1944) of central Peru, stretching from the Andes eastward to the Amazon Basin. It occupies an area of 8,438 sq mi (21,854 sq km). Western Pasco, a mountainous and rugged area, is drained by the headwaters of the Río Huallaga. Eastern Pasco, which comprises the steep, rain-drenched eastern slopes of the Andes and the forested plains beyond, is drained by the Río Pachitea. Western Pasco is one of the world's richest and most productive mining regions. Silver ores at Cerro de Pasco (*q.v.*), the departmental capital, were discovered in 1630. Copper has become more important than silver, and numerous other minerals, including lead, zinc, gold, vanadium, and bismuth, are also mined. Pop. (1984 est.) 249,700.

Pasco, city, seat (*c.* 1890) of Franklin County, southeastern Washington, U.S., situated at the confluence of the Snake and Columbia rivers, opposite Kennewick and immediately southeast of Richland. Established in 1880, when the Northern Pacific Railway (now Burlington Northern) reached that point, it was probably named by railroad surveyors for Cerro de Pasco, Peru. It is a busy river port, as well as a rail centre. The Ice Harbor Dam, 13 mi (21 km) up the Snake River, impounds Lake Sacajawea and is the first of four dams that permit navigation to Lewiston, Idaho, 140 mi east. Pasco is the seat of Columbia Basin College (1955). Inc. 1891. Pop. (1980) city, 17,944; (1982 est.) Richland–Kennewick–Pasco metropolitan area (SMSA), 153,600.

Pascoli, Giovanni (b. Dec. 31, 1855, San Mauro di Romagna, Kingdom of Sardinia—d. April 6, 1912, Bologna, Italy), Sardinian classical scholar and poet whose graceful and melancholy Italian lyric poems, perfect in form, rhythmic in style, and innovative in wording, were an important influence on the *crepuscolari* ("twilight poets"; *see* crepuscolarismo).

Pascoli had an extremely painful childhood: his father was mysteriously assassinated when he was 12, his mother died when he was 13, and five other children in the family died by the time he reached adulthood. He also experienced a long period of psychological duress while studying on a scholarship at the University of Bologna under the great poet Giosuè Carducci. Pascoli was arrested and imprisoned for a few months in 1879 for preaching political anarchy. Following his imprisonment he took his younger siblings to live with him, and from 1882 began a career of teaching, first in secondary schools and then in various Italian universities, as professor of Greek, Latin, and Italian literature. In 1905 he was appointed to the chair of Italian literature at the University of Bologna.

Pascoli's first literary work, a great success, was *Myricae* (1891; "Tamarisks"), a volume of short, delicate, musical lyrics inspired by nature and domestic themes and reflecting the psychological unrest of his student years. Some easing of inner turmoil is apparent in his next volume, usually considered his best, *Canti di Castelvecchio* (1903, definitive ed., 1907; "Songs of Castelvecchio"), a collection of moving evocations of his sad childhood and celebrations of nature and family life. Subsequent volumes include the classically inspired and more formal *Poemi conviviali* (1904) and two collections influenced by Virgil's *Georgics,* Carducci's work, and the French Symbolists: *Primi poemetti* (1904, originally published as *Poemetti,* 1897) and *Nuovi poemetti* (1909). Pascoli's Latin poems won poetry prizes and exhibited a fluent skill; Gabriele D'Annunzio considered him the finest Latin poet since the Augustan age. During his later years Pascoli wrote several nationalistic and historic poetic works, notably *Poemi del Risorgimento* (1913). English translations of his poems were published in 1923 and 1927. He also translated poems of Wordsworth, Shelley, and Tennyson. An Italian literary award, the Pascoli Prize, was established in 1962 to commemorate the 50th anniversary of his death, and his birthplace was named San Mauro Pascoli.

Pascua, Isla de (Pacific Ocean): *see* Easter Island.

Pasek, Jan Chryzostom (b. *c.* 1636, Węgrzynowice, near Rawa Mazowiecka, Kingdom of Poland [now in Poland]—d. Aug. 1, 1701, Niedzieliska, near Kraków?), Polish soldier best remembered for his memoirs, which provide an excellent example of Polish Baroque prose.

Pasek received some education in a Jesuit school. He enlisted in the army at age 19, seeing service against the Swedes in Poland, with the Danes against the Swedes in Denmark, and against Muscovy and, later, Turkey. He retired after 11 years of service and married. Lawsuits that arose from his various excesses eventually resulted in his sentence to exile, but the sentence was never enforced. Toward the end of his life he wrote down anecdotes of his life.

Discovered in the 19th century, Pasek's *Pamiętniki* (1836; "Memoirs") is a lively, humorous work that gives a vivid description of the life of an independent, resourceful man of action. In it he relates tales of the 17th-century Swedish and Muscovite wars, the catastrophic last years of the reign of King John II Casimir (1648–68), and the incompetent rule of King Michael Wiśniowiecki (1669–73), and he concludes his narrative with the splendid reign of King John III Sobieski (1674–96). Pasek was an excellent raconteur and a keen observer of the people with whom he came in contact. Both the style and the characters and events of his memoirs influenced a number of later Polish writers.

Consult the INDEX *first*

Pasewalk, town, Mecklenburg-West Pomerania *Land* (state), northeastern Germany, on the Ücker River about 18 miles (29 km) south of Ueckermünde and about 24 miles (39 km) west of Szczecin (Stettin), Poland. Pasewalk is a rail junction, and the town's economic activities include food processing (potato-flour milling), manufacturing (machinery and electrical equipment), metalworking, and lumbering.

Pasewalk contains a 13th–15th-century church and the remains of old town walls and gates. The town passed to Sweden in 1648 and to Prussia in 1720, when it became part of Pomerania. Pop. (1988 est.) 15,682.

pasha, Turkish PAŞA, title of a man of high rank or office in the Ottoman Empire and North Africa. It was the highest official title of honour in the Ottoman Empire, always used with a proper name, which it followed. It was given to soldiers and high civil officials, not to men of religion, and was purely personal and not hereditary, except in 19th-century Egypt. Very occasionally in early times it was applied to a woman; *Validepasha* was the title of the mother of the pasha of Egypt.

The title first appeared in the 13th century among the Seljuqs. Among the Ottomans it was given to a brother and son of Sultan Orhan. Later it became the prerogative of provincial governors and the viziers of the central administration. In the Tanzimat period (19th century) its use was extended to the four highest grades of the civil and military services.

On the fall of the Ottoman dynasty, pasha was reserved only for soldiers but, even after the Turkish Republic finally abandoned its use in 1934, the title survived in former Ottoman possessions—*e.g.,* in Egypt until 1952. By Turks it is still used in conversation as a mark of respect to a social superior.

Pashto language, also called PUSHTU, PAKHTO, or AFGHAN, Eastern Iranian language spoken by the Pashtun in eastern Afghanistan and northern Pakistan. Its dialects fall into two main divisions: the southern, which preserves the ancient *sh* (as in "Pashto") and *zh* sounds, and the northern, which has *kh* (as in "Pakhto") and *gh* sounds instead. Written in a modified Arabic alphabet, Pashto shows strong Indian influence, many Arabic and Persian loanwords, and numerous archaic Persian features. It has been attested from the beginning of the 16th century and became prominent after the creation of the Afghan state in the 18th century. In 1936 Pashto was declared the national language of Afghanistan, and instruction in it is now compulsory. Dari is the other official language.

Pashto literature exists certainly from the 17th century, less certainly from the 11th. The national poet of Afghanistan, Khushḥāl Khān (1613–94), chief to the Khaṭak tribe, wrote spontaneous and forceful poetry of great charm. His grandson Afḍal Khān was the author of a history of the Pashtun. Popular mystical poets were ʿAbd ar-Raḥmān and ʿAbd al-Ḥamīd, in the late 17th or early 18th century, and Aḥmad Shāh Durrānī, founder of the Afghan nation, was himself a poet. The Pashto Academy publishes a variety of literary works.

Pashtun, also spelled PUSHTUN, or PAKHTUN, Hindustani PATHAN, Persian AFGHAN, Pashto-speaking people of southeastern Afghanistan and northwestern Pakistan. They constitute the majority of the population of Afghanistan and bore the exclusive name of Afghan before that name came to denote any native of the present land area of Afghanistan.

The origins of the Pashtun are unclear. Pashtun tradition asserts that they are descended from Afghana, grandson of King Saul of Israel, though most scholars believe it more likely that they arose from an intermingling of ancient Aryans from the north or west with subsequent invaders. Several Pashtun tribes are known to have moved from Afghanistan to Pakistan between the 13th and 16th century. Each tribe, consisting of kinsmen who trace descent in the male bloodline from a common tribal ancestor, is divided into clans, subclans, and patriarchal families. Tribal genealogies establish rights of succession and inheritance and the right to use tribal lands and to speak in tribal council. Disputes over property, women, and personal injury often result in blood feuds between families and whole clans; these may be inherited unless settled by the intervention of clan chiefs or by tribal council.

The Pashtun are farmers, herdsmen, and warriors. Most tribesmen are sedentary farmers, combining cultivation with animal husbandry; some are migratory herdsmen and caravaners. Large numbers of them have always been attracted to military service.

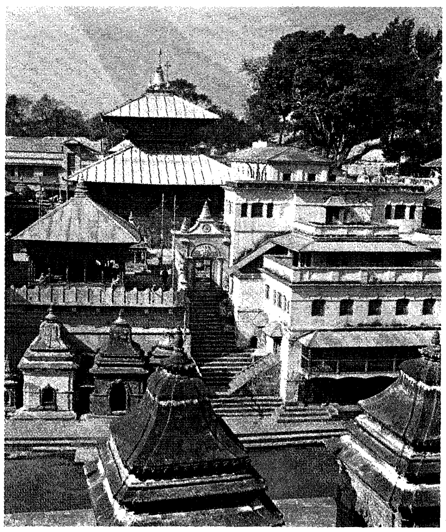
Pashtun tribesman and his daughter
Oliver Clubb

There are estimated to be about 7,500,000 Pashtun in Afghanistan and 14,000,000 in Pakistan. They comprise about 60 tribes of varying size and importance, each of which occupies a particular territory. In Afghanistan, where Pashtun are the predominant ethnic group, the main tribes—or, more accurately, federations of tribes—are the Durrānī south of Kābul and the Ghilzay east of Kābul.

In Pakistan, Pashtun predominate north of Quetta between the Sulaimān Range and the Indus River. In the hill areas the main tribes are, from south to north: the Kākaṛ, Shērāni, and Ustarāna south of the Gumal River; the Maḥsūd, Darwēsh Khēl, Wazīrī, and Biṭanī between the Gumal River and Thal; the Tūrī, Bangash, Ōrakzay, Afrīdī, and Shinwārī from Thal to the Khyber Pass; and the Mahmand, Utmān Khēl, Tarklānī, and Yūsufzay north and northeast of the Khyber.

The settled areas include lowland tribes subject to direct administration by the provincial government. The main tribes there are, from south to north: the Banūchī and Khaṭak from the Kurram River to Nowshera; and the Khalīl and Mandāṇ in the Vale of Peshāwar.

Pashupati, town, central Nepal, situated in the Kāthmāndu Valley on the Bāghmati River, just east of Kāthmāndu. Regarded as the holiest place in Nepal, it is the site of an ancient Śaivite (*i.e.,* devoted to the Hindu god Śiva) temple of Paśupatinātha (Pashupatinath). The temple is built in pagoda style with gilt roof, and the banks of the Bāghmati are paved for several hundred yards. There are numerous other shrines in the vicinity. The Śivarātri festival in February or early March attracts Hindu pilgrims from India and other foreign countries. Pious Hindus also go there to die, believing that they will find salvation if they expire with their feet in the sacred waters of the river at Pashupati.



Śaivite temple of Paśupatinātha (centre left background) at Pashupati, near Kāthmāndu, Nepal
J. Allan Cash—EB Inc.

Pašić, Nikola (b. Dec. 31 [Dec. 19, Old Style], 1845, Zaječar, Serbia [now in Yugoslavia]—d. Dec. 10, 1926, Belgrade), prime minister of Serbia (1891–92, 1904–05, 1906–08, 1909–11, 1912–18) and prime minister of the Kingdom of Serbs, Croats, and Slovenes (1918, 1921–24, 1924–26). He was one of the founders, in 1918, of the kingdom that would later (from 1929) be called Yugoslavia.

Early career. Pašić, who was born into a family of modest means, studied engineering in Belgrade and then graduated from the Zürich Polytechnikum, where his interest in contemporary liberalism and democratic institutions was stimulated by the Russian anarchist Mikhail Bakunin. Returning to Serbia (1873), he joined the Socialist group led by Svetozar Marković and, as editor of the newspaper *Oslobodjenje* ("Liberation"), became an important exponent of Marković's views. Having concluded that King Milan Obrenović's oligarchy was depriving Serbia both of progressive leadership and of national perspective, Pašić decided to enter politics actively. Elected to parliament in 1878, he worked, as leader of the opposition, against the authoritarian monarchy in an endeavour to establish a parliamentary democracy. He also helped to found the Radical Party (1881).

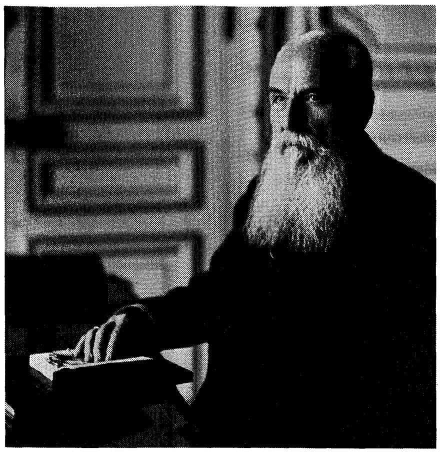
When a popular rising instigated against Milan's government by the Radicals in Zaječar (1883) led to further repression and to the severe punishment of many Radical leaders, Pašić was forced to flee through Austria to Bulgaria. After Milan's abdication in favour of his son Alexander (1889), Pašić returned to Serbia from exile and was then elected president of the Skupština (Parliament) and, on two occasions, mayor of Belgrade. Pašić served as premier for the first time from February 1891 to August 1892 and as foreign minister accompanied the new king, Alexander Obrenović, on a state visit to Russia (1892), where he established firm personal and political ties with the tsarist regime. He became Serbian minister to St. Petersburg in 1893 but resigned in protest at former king Milan's illegal return to Serbia (1894).

After an unsuccessful attempt on Milan's life in 1899, trumped-up charges of regicide were brought against the members of the Radical Party. Pašić, who was among those sentenced to death, won himself an amnesty and then left the country voluntarily to return only when Milan had finally withdrawn.

When Alexander was overthrown and the Karageorgević dynasty, in the person of King Peter I, was restored by the bloody coup d'etat of 1903, Pašić finally emerged as the dominant political figure in Serbia. As leader of the Radical Party, he concentrated his efforts on establishing the party both as the backbone of the new regime and as the moving force in Serbian politics. From December 1904 to May 1905 he served as premier and as minister for foreign affairs—displaying great skill by counteracting Austria-Hungary's attempts to impose a tariff war on Serbia. He held both posts again from May 1906 to June 1908 and was again reappointed premier in October 1909, only to be replaced in 1911 by Milan Milovanović, his greatest political rival. Though Pašić cooperated with Milovanović in concluding a pact with Bulgaria—from which was eventually to develop the Balkan League, whose aim was war against Turkey—younger politicians and many military leaders continually conspired to remove him from his position as party leader, and in 1912 his imminent dismissal was avoided only by Milovanović's sudden death. Thenceforth reinstated as premier and minister for foreign affairs, Pašić led Serbia through two victorious wars, the first against Turkey (1912) and the second against Bulgaria (1913).

Despite his increased prestige, further attempts were made to oust Pašić from office in the months preceding the start of World War I. The accession as regent of Prince Alexander (King Peter's younger son) on June 24, 1914, gave Pašić some support, however, and his position was further confirmed when the threat of war with Austria-Hungary prevented forthcoming new elections from being held.

Leadership during World War I. After the murder of Archduke Francis Ferdinand by a Serb nationalist at Sarajevo on June 28, 1914, Pašić was most compliant in dealing with the



Pašić
H. Roger-Viollet

formidable terms of Austria-Hungary's ultimatum to Serbia but was nevertheless unable to avert the Austrian declaration of war on Serbia on July 28. World War I initially silenced Serbian political discord: parliament, which had already been dissolved, reassembled at Niš, and in November 1914 a coalition government under Pašić's premiership was formed.

The Austro-German conquest of Serbia forced Pašić's government and the army to withdraw from Serbia to Corfu (winter 1915). Pašić remained prime minister of the government-in-exile throughout World War I. He also remained interested in the union of Serbia with provinces inhabited predominantly by Serbs, but not in the formation of a federal Yugoslavia with Serbs, Croats, and Slovenes autonomous and equal. When the coalition government broke up in 1917, Pašić continued to govern with a homogeneous Radical Cabinet. When his position was still further weakened by the fall of Russia's tsarist regime (1917), he was obliged temporarily to abandon his strict Pan-Serbian attitude and to negotiate on equal terms with Ante Trumbić's Yugoslav Committee, a body of South Slav exiles from Austria-Hungary with its seats in London and Paris. The resulting Corfu Declaration (July 1917) laid down the broad lines for a postwar unified Yugoslav state.

Postwar career. As World War I neared its end, Pašić stubbornly insisted that Serbia, as the dominant political and military force among the South Slavs, had the exclusive right to speak on the Allied side on their behalf. In November 1918, however, Pašić, under pressure from the Serbian opposition and from the Allied governments, joined delegates from the Yugoslav Committee, from the National Council recently formed in Zagreb and from the Serbian opposition, in signing a declaration that provisionally envisaged a Yugoslavia in which the Serbian government should share power with the representatives of Austria-Hungary's former South Slav subjects. But the Serbian government, which Pašić himself had secretly dissuaded, rejected the declaration. As a result, when Austria-Hungary collapsed, the Allies were unable to agree on a solution for the relations of the South Slavs with Serbia, while Italy reasserted its territorial claims to South Slavic territory under a secret wartime pact (Treaty of London) made between it and the Allied Powers. Despite the danger, Pašić persevered in his obstructive tactics toward the Yugoslav Committee and to the National Council in Zagreb.

Nevertheless, an uneasy compromise was finally achieved when Serbia and the South Slav provinces were united on Dec. 1, 1918, as the Kingdom of Serbs, Croats, and Slovenes. Though he was denied the premiership of the kingdom, Pašić went with Trumbić and Vesnić as one of the new state's delegates to the Peace Conference at Versailles (1919).

Pašić failed fully to comprehend the fateful difference between Serbia's homogeneity and the complexity of the new kingdom, which comprised several nations, each with its own distinct historical development and cultural identity. Ignoring requests for individual recognition from Croats, Slovenes, Macedonians, and Bosnian Muslims, he continued to regard them simply as Serbs—albeit Serbs of three religions and several names. When, therefore, he was reappointed premier in 1921 he immediately pushed through parliament a unitary constitution for the new nation that, under the guise of establishing a homogeneous state, actually confirmed the existing Serbian hegemony and, by abolishing historic and autonomous provinces, established a strongly centralized regime under a powerful monarchy. He eliminated the Democrats from the government (winter 1921) and formed an entirely Radical Cabinet. He failed to secure a majority in the elections of March 1923 but stayed safely in office, thanks to blunders by the opposition. Though from July to October 1924 he had to give way to a coalition government under Ljubomir Davidović, by adroit interparty manoeuvring he was able immediately afterward to return to power much stronger than before. His relations with King Alexander and with the Anticentralist Croats and Slovenes nevertheless became increasingly strained. In February 1925 Pašić was forced to dissolve parliament, but by adopting drastic measures—among them the imprisonment of Stjepan Radić and other Croatian Peasant Party leaders—he secured a small working majority. A temporary political collaboration with Radić later the same year failed to produce a stable government, and, when Radić publicly criticized the still-increasing tendency toward centralization and unification, Pašić had to resign in March 1926. He died in the following December, three weeks before his 81st birthday.

Carlo Sforza's *Pachitch et l'union des Yougoslaves* (1938; *Fifty Years of War and Diplomacy in the Balkans: Pashich and the Union of the Yugoslavs*) is the only known biography of Pašić in English.

Pasig River, river draining Laguna de Bay, the largest lake in the Philippines, into Manila Bay at Manila. It flows north-northwest through the market town of Pasig and bisects Manila, then enters the bay between the North and South harbours. Its length is 14 mi (23 km). The wharves and quays at the river's mouth served the early interisland trade during the Spanish colonial period. At that time the Pasig was home for a large barge- and raft-dwelling population. The shallow and sluggish stream is now spanned by nine bridges and is navigable by small craft, but its port functions have decreased.

Pasionaria, La: *see* Ibarruri, Dolores.

Pasiteles (fl. 1st century BC), Greek sculptor notable for having written a book, in five volumes, about works of art throughout the world. None of Pasiteles' own sculpture has survived.

Little is known about Pasiteles. He was born in a Greek city in southern Italy and became a Roman citizen in 90/89. He made an ivory and gold statue of Zeus for the temple of Metellus. It is believed that he was one of the originators of the methods of exact copying of statuary by means of plaster casts and the pointing machine, without which the thousands of copies from original Greek statues that were disseminated throughout Greco-Roman civilization could never have been produced. He also worked from nature, however, as is shown in Pliny's story that while sketching a lion he was almost killed by a panther.

Paskevich, Ivan Fyodorovich, Graf Yerevansky (Count of Erivan), Knyaz Varshchavsky (Prince of Warsaw) (b. May 19 [May 8, old style], 1782, Poltava, Russia—d. Feb. 1 [Jan. 20, O.S.], 1856, Warsaw), military officer and administrator in the Russian government who suppressed the Polish insurrection of 1830–31.

Having entered the Russian Army through the imperial institution for pages in 1800, Paskevich gained combat experience fighting against the Turks (1806–12) and against the French during 1812–14 in the Napoleonic Wars. He eventually became one of the emperor Nicholas I's closest associates.

After the revolutionary Decembrists tried to establish a constitutional regime in Russia at the time of Nicholas' accession to the throne, Paskevich participated in their trial; later, appointed governor and military commander in chief of the Caucasus (1827), he treated the Decembrist exiles under his jurisdiction with

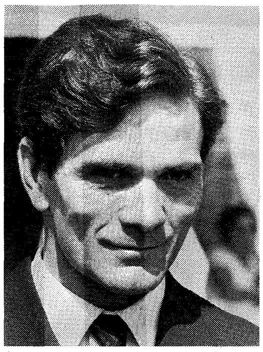
Paskevich, lithograph by Antoine Maurin
Novosti Press Agency

particular severity. After the Russo-Persian war broke out in 1826, he seized the military initiative from the Persians and captured the fortress of Erivan (Yerevan; October 1827) and was rewarded with the title count of Erivan. With successive victories he forced the Persians to cede the provinces of Nakhichevan and Erivan (*i.e.,* Persian Armenia) to Russia (1828; Treaty of Turkmanchay).

Immediately afterward, with the onset of the Russo-Turkish War of 1828–29, Paskevich captured strategic Turkish strongholds, enabling Russia, when it concluded the Treaty of Adrianople with the Turks (1829), to annex territory around the mouth of the Danube River and in eastern Asia Minor. Promoted to the rank of field marshal (1829), he was transferred to Poland (June 1831) to command the Russian forces suppressing the Polish rebels. Despite his overcautiousness and indecisiveness, Paskevich defeated the rebels and was given the title prince of Warsaw. He was subsequently appointed viceroy of Poland and from 1832 to 1856 ruled dictatorially there, trying to Russify the country both culturally and administratively.

When the Hungarian Revolution broke out in March 1848 and the Austrian government requested military assistance from Russia, Paskevich commanded the Russian troops that invaded Hungary in June 1849. Although his forces suffered badly from disease and his leadership was less effective than it had been during the Polish uprising, the rebels were finally suppressed; hoping to receive better treatment from the Russians than from the Austrians, they surrendered directly to Paskevich at Világos (Aug. 13, 1849). For a brief period during the Crimean War he commanded the Russian armies in the western war zone (April–June 1854), but after being defeated by the Turks at Silistria (June 8, 1854) he was relieved of his post.

Pasolini, Pier Paolo (b. March 5, 1922, Bologna, Italy—d. Nov. 2, 1975, Ostia, near Rome), Italian motion-picture director, poet,



Pasolini, 1964
Publifoto from Black Star

and novelist, noted for his socially critical, stylistically unorthodox films.

The son of an Italian army officer, Pasolini was educated in schools of the various cities of northern Italy where his father was successively posted. He attended the University of Bologna, studying art history and literature. Pasolini's stay of refuge among the oppressed peasantry of the Friuli region during World War II led to his later becoming a Marxist, albeit an unorthodox one. His poverty-stricken existence in Rome during the 1950s furnished the material for his first two novels, *Ragazzi di vita* (1955; *The Ragazzi*) and *Una vita violenta* (1959; *A Violent Life*). These brutally realistic depictions of the poverty and squalor of slum life in Rome were similar in character to his first film, *Accattone* (1961), and all three works dealt with the lives of thieves, prostitutes, and other denizens of the Roman underworld.

Pasolini's best known film, *Il Vangelo secondo Matteo* (1964; *The Gospel According to Saint Matthew*), is an austere, documentary-style retelling of the life and martyrdom of Jesus Christ. The comic allegory *Uccellacci e Uccellini* (1966; *The Hawks and the Sparrows*) was followed by two films attempting to re-create ancient myths from a contemporary viewpoint, *Oedipus Rex* (1967) and *Medea* (1969). Pasolini's use of eroticism, violence, and depravity as vehicles for his political and religious speculations in such films as *Teorema* (1968; "Theorem") and *Porcile* (1969; "Pigsty") brought him into conflict with conservative elements of the Roman Catholic Church. He then ventured into medieval eroticism with *Il Decamerone* (1971) and *The Canterbury Tales* (1972). In addition to his motion pictures, Pasolini published numerous volumes of poetry and several works of literary criticism.

Paspalum, genus of annual and perennial grasses of the family Poaceae, containing about 400 species distributed throughout warm regions of the world. Some are valuable forage grasses. *P. dilatatum,* a South American species, is also grown in Australian and North American (where it is known as dallis grass) pastures. *Paspalum urvillei,* known as vasey grass in North America, is grown as hay in other areas in which it is native. Water couch, or knotgrass (*P. distichum*), forms large, flat mats along shores and in ditches in North and South America and Europe; it is used as a lawn grass in Australia.

Pasqualis (popes): *see under* Paschal.

Pasquier, Étienne (b. June 7, 1529, Paris—d. Aug. 30, 1615, Paris), French lawyer and man of letters who is known for his *Recherches de la France,* 10 vol. (1560–1621), which is not only encyclopaedic but also an important work of historical scholarship.

Pasquier studied under the great Humanist legal scholars François Hotman, Jacques Cujas, and Andrea Alciato, and was called to the bar at Paris (1549) and began to practice law there. In 1557 he married a wealthy young widow whom he had defended in court. He became ill in 1560 and convalesced in Amboise and Cognac, where he began work on his *Recherches,* with which he was occupied, off and on, for the next 40 years.

Pasquier hoped that his work would show the people of France the glory of their history and institutions. He consulted original sources, primarily court and government documents, in preference to relying on chronicles. Literary criticism was added later, as were materials from specific periods of French history. Pasquier's correspondence, which was published in 1619, provides a vivid commentary on the political and military aspects of the Wars of Religion (1562–98) and contains discussions of historical and literary problems.

Although a moderate in most respects, Pasquier spent much of his life fighting the

Étienne Pasquier, oil painting by Henri de Rudder; in the Musée National de Versailles et des Trianons, France
Cliche Musees Nationaux, Paris

Jesuits. In 1565 he successfully defended the University of Paris in a suit instituted by the Jesuits, who sought to teach there. His *Catéchisme des Jésuites* (1602; "The Jesuit Catechism") was bitterly satirical. The university trial brought him fame, and he became counsel for many important clients, primarily in cases involving property disputes. He became a commissioner at the assize court at Poitiers in 1579 and at Tours in 1583, and in 1585 Henry III appointed him advocate general in the Chambre des Comptes at Paris.

Pasquier retired from forensic work in 1604 to devote full time to his writing, publishing many more books of the *Recherches.* During this period he also wrote *L'Interprétation des "Institutes" de Justinien* (1847), a work that dealt as much with French law as with Roman law. Near the end of his life he turned to biblical exegesis. He wrote some minor poetry in the style of the Pléiade and some excellent literary criticism.

Pasquier, Étienne(-Denis), duc de (duke of) (b. April 21, 1767, Paris—d. July 5, 1862, Paris), French statesman and the last chancellor of France.

Duc de Pasquier, detail of an engraving after a portrait, 19th century
By courtesy of the Bibliotheque Nationale, Paris

A descendant of the celebrated 16th-century lawyer and man of letters Étienne Pasquier, he became a counsellor in the Paris Parlement in 1787. During the Revolution his father, also a counsellor, was guillotined, and Pasquier himself was arrested as a royalist (1794). He was set free during the Thermidorian reaction and was later created baron (1808) by Napoleon and appointed to the council of state and to the prefecture of police (1810). On the restoration of the monarchy in 1814 Louis XVIII made him director of highways and bridges. He later served as minister of justice and foreign minister and was created duke in 1821. Nine years later he was made president of the Chamber of Peers, which enabled him to sit as supreme judge in political trials. Pasquier was appointed chancellor of France when that office was revived in 1837. He was created duc in 1844, and the hereditary succession to the title was secured for his adopted son, E.-A.-G. d'Audiffret-Pasquier. Pasquier retired from public life on the Revolution of February 1848, which replaced the monarchy with the Second Republic (1848–52).

pasquinade, brief and generally anonymous satirical comment in prose or verse that ridicules a contemporary leader or national event. Pasquinade is derived from "Pasquino," the popular name for the remains of an ancient Roman statue unearthed in Rome in 1501. "Pasquino," supposedly named after a local shopkeeper near whose house or shop the statue was discovered, was the focus for bitingly critical political squibs attached to its torso by anonymous satirists. These pasquinades and their imitations, some ascribed to important 16th-century writers such as Aretino, were collected and published. After the 16th century the vogue of posting pasquinades died out, and the term acquired its more general meaning.

Pass Christian, city, Harrison County, southeastern Mississippi, U.S., just west-southwest of Gulfport, on the Mississippi Sound. It is named for the nearby deepwater channel known as Christian's Pass linking the Gulf of Mexico with Lake Pontchartrain, supposedly navigated in 1699 by Christian L'Adnier, a member of the crew of the French explorer Pierre Le Moyne, sieur d'Iberville. Originally settled by the French and Spanish, it became a trading centre with the opening of the Mississippi Territory. A U.S. garrison was stationed there in 1811, and the misnamed Battle of Pass Christian, fought (1814) during the War of 1812 nearby in the Saint Louis bay, was the last naval engagement (a British victory) to take place in continental U.S. waters against a foreign foe. The first yacht club on the Gulf coast was organized at Pass Christian in 1849, and the town (inc. 1848) became a popular resort for plantation owners. Later, the railroads brought an influx of winter visitors from the North among whom were presidents Theodore Roosevelt, Woodrow Wilson, and Harry S. Truman. A sand beach 28 mi (45 km) long extends from Pass Christian through Gulfport to Biloxi. The town remains as a year-round resort with some fishing interests. Pop. (1980) 5,014.

passacaglia (Italian, from Spanish *passacalle,* or *pasacalle:* "street song"), musical form of continuous variation in $\frac{3}{4}$ time; and a courtly dance. The dance, as it first appeared in 17th-century Spain, was of unsavoury reputation and possibly quite fiery. In the French theatre of the 17th and 18th centuries it was a dance of imposing majesty. Little is known of the actual dance movements and steps. Musically the passacaglia is nearly indistinguishable from the contemporary chaconne; contemporary writers called the passacaglia a graver dance, however, and noted that it was identified more frequently with male dancers.

Both dances gave rise to musical forms. Baroque composers used the two names indiscriminately, writing rondeaux (pieces with recurring refrains) as well as variation forms under both titles (*see* chaconne). Musicians conflict and hedge in defining the two forms. One opinion is that the chaconne is a series of variations over a short repeated theme (ostinato) in the bass—a basso ostinato, or ground bass—whereas in the passacaglia the ostinato may appear in any voice. Another view is that the passacaglia uses an ostinato normally in the bass but possibly in any voice; but the chaconne consists of variations over a harmonic ground, like a jazz riff, a series of chords that underlies the variations. Such a series may imply a constant bass line (of the chords), but merely as a component of the harmony.

Examples of passacaglias include Bach's *Passacaglia and Fugue, in C Minor,* for organ; Walter Piston's *Passacaglia* for piano; and the music of Act I, scene 4, of Alban Berg's opera *Wozzeck.* The dance's original name survives in the *pasacalle,* a lively folk dance for couples popular in western South America.

passage rite, also called RITE OF PASSAGE, French RITE DE PASSAGE, any of numerous ceremonial events, existing in all historically known societies, that mark the passage of an individual from one social or religious status to another. Many of the most important and common rites are connected with the biological stages of life—birth, maturity, reproduction, and death; other rites celebrate changes that are wholly cultural, such as initiation into special societies or groups.

A brief treatment of passage rites follows. For full treatment, *see* MACROPAEDIA: Rites and Ceremonies, Sacred.

The worldwide distribution of passage rites first attracted the attention of the French anthropologist and folklorist Arnold van Gennep, who coined the term *rite de passage* in 1909. Van Gennep emphasized the structural analogies among such various rites by demonstrating that all are characterized by three phases: separation, transition, and reincorporation. Though van Gennep cautioned that these three categories are not developed to the same extent by all peoples or in every set of ceremonies, he declared them to constitute a universal pattern.

The first phase, separation, entails symbolic behaviour that severs the individual from a previously fixed point in the social structure. The old status is erased in preparation for a new one. During the middle phase the ritual subject, or "passenger," stripped of all manifestations of rank or role, enters into a suspended, or liminal, state between past and future identities eluding the usual cultural categories of classification. This phase is frequently likened to death, or to being in the darkness of the womb awaiting a rebirth. In the final phase the ritual subject emerges from the threshold and is reincorporated in society in his new social or religious role.

Rites of passage are characteristically rich in symbolism. The transformative process is expressed in several motifs which have a wide geographical and cultural distribution. In the widespread ritual reenactment of death and rebirth, initiates are ceremonially "killed" to remove them from their former life, treated as infants in the transitional period, and made to mature into their new status. Successful passage of ordeals form a regular feature of the transitional requirements, and doorways are often used to signify entry into the new domain. The new status is usually indicated by some alteration of the body (*e.g.,* circumcision, removal of teeth, tattooing and scarification, dressing of the hair, etc.) or by the addition of special clothing and ornaments.

Most scholarly interpretations of passage rites have considered their sociological function. Social systems require a certain amount of equilibrium in order to function smoothly. Changes in either individuals or groups threaten to disrupt this equilibrium. The primary sociological function of rites of passge, then, is to foster the achievement of a new state of equilibrium after such changes, to restore social order and thereby maintain the society as a system of congruent parts. A rite of passage, being a dramatization of the individual's entry into the new order, characteristically provides instruction and gives assurance of the mastery of a new role to the affected individual. It also serves as an opportunity for the community to demonstrate support of its constituents.

The equally important psychological function of passage rites has received less scholarly attention. According to some interpretations, these rites serve to bridge critical stages in the life process and to help the individual confront certain uncontrollable aspects of the world he inhabits. By providing a predictable, communal context for individual experience, rites of passage act psychotherapeutically to alleviate the inevitable anxiety that accompanies change.

Passaic, city, Passaic County, New Jersey, U.S., on the Passaic River. Established by the Dutch in 1678 as a fur-trading post 9 mi (14.5 km) north of Newark and originally called Acquackanonk, it was renamed for the Passaic River in 1854. During the American Revolution it was occupied by George Washington's troops, and following their retreat the British general Cornwallis was quartered there. Passaic thrived as a river port until the completion of the Morris Canal between Newark and Phillipsburg (1831) and the building of the railroad reduced river commerce. With the construction of a dam (*c.* 1850), Passaic became a textile centre. With industrial expansion, the population grew from 6,532 in 1880 to 54,773 in 1910, the increase including large numbers of eastern European immigrants, especially Hungarians, Slovaks, and Poles. Once a leading woollen producer, Passaic's last mill ceased operation *c.* 1955. The city was the scene of serious labour struggles, notably a construction workers' riot (1906) and textile strikes (1926) against a wage cut and involving the right of free assembly. Still an industrial city, its chief products include rubber goods, communications equipment (television tubes and receivers), textile machinery, clothing, and handkerchiefs. Inc. 1873. Pop. (1980) city, 52,463; (1982 est.) Bergen–Passaic metropolitan area (SMSA), 1,293,200.

Passaic River, river, rising near Morristown, southeastern Morris County, northeastern New Jersey, U.S. It flows south past Millington, then north and east to Paterson and its Great Falls (70 ft [21 m] high), from which point it turns south and east past Passaic and Newark and into Newark Bay. Some 80 mi (130 km) long and with a drainage area of 935 sq mi (2,422 sq km), it has been intensively developed as a source of power and of water. Its most serious of many floods occurred in 1903. Major tributaries are the Whippany, Rockaway, Pequannock, Wanaque, and Ramapo rivers. The name is derived from an Algonkian word meaning "peaceful valley."

Passamaquoddy, Algonkian-speaking Indians who lived on Passamaquoddy Bay, St. Croix River, and Schoodic Lake on the boundary between what are now Maine and New Brunswick. They belonged to the Abnaki (*q.v.*) confederacy, and their language was closely related to that of the Malecite (*q.v.*). They depended on hunting and fishing for subsistence; birch bark and wood were used for manufacture. Villages, consisting of conical dwellings and a large council house, were sometimes palisaded. A tribal council of the war chief, the civil chief, and representatives of each family decided most important matters; a general council of the entire tribe decided war matters.

The pressure of white settlement restricted their territory, and in 1866 they were settled mainly at Sebaik, on the south side of the bay, and on Lewis Island. The Passamaquoddy and the Penobscot (*q.v.*) send to the Maine state legislature a representative who serves without a seat or vote and is permitted to speak only on matters of tribal concern. In the late 20th century there were two Passamaquoddy reservations in Maine and a total tribal population of more than 1,000.

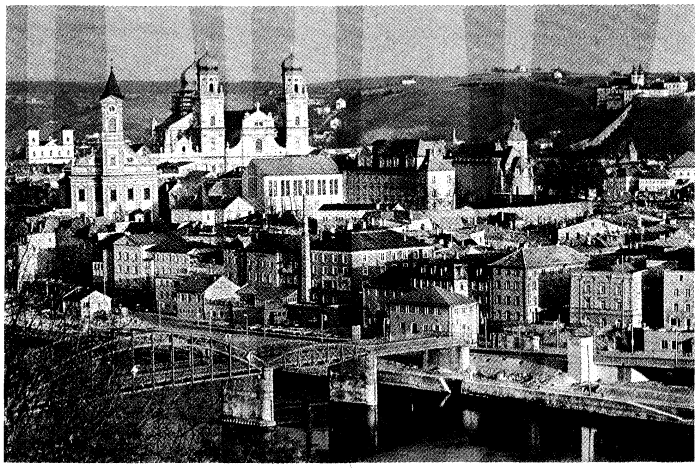
Passamaquoddy Bay, inlet of the Bay of Fundy (Atlantic Ocean), between southwestern New Brunswick, Can., and southeastern Maine, U.S., at the mouth of the St. Croix River. Deer Island and Campobello Island are in its southern part. The bay has an immense tidal flow, with about 70,000,000,000 cu ft (2,000,000,000 cu m) entering and leaving twice daily on the turn of the tide. Passamaquoddy is derived from an Amerindian term meaning "place where pollock leap out of the water."

Passarowitz, Treaty of (July 21, 1718), pact signed at the conclusion of the Austro-Turkish (1716–18) and the Venetian–Turkish (1716–18) wars at Passarowitz (now Požarevac, Yugos.). By its terms the Ottoman Turks lost substantial territories in the Balkans to Austria, thus marking the end of Ottoman westward expansion.

In 1715 the Ottomans forced Venice to surrender the Morea (the Peloponnesus Peninsula, Greece), the major Venetian gain under the Treaty of Carlowitz (1699), and threatened Venetian possessions in Dalmatia and the Ionian Islands. At this point Austria intervened by concluding an alliance with Venice (1716). In ensuing hostilities the Ottomans suffered a series of disastrous defeats at the hands of the Habsburg general Prince Eugene of Savoy. In 1718, at the initiation of Great Britain and Holland, whose eastern Mediterranean trade was disrupted by the war, a treaty was concluded at Passarowitz that provided for a 24-year peace between the Ottoman Empire and Austria and that gave to Austria the Banat of Temesvár (the last important Ottoman stronghold in Hungary), Little Walachia, and Belgrade with parts of northern Serbia. The pact stipulated that Venice surrender the Morea to the Ottomans while retaining the Ionian Islands and making gains in Dalmatia. At the same time an Austro-Turkish commercial treaty was signed, granting Austria commercial privileges in the Ottoman Empire.

Passau, city, Bavaria *Land* (state), southeastern Germany, at the confluence of the Danube, Inn, and Ilz rivers, on the Austrian border. Originating as the Celtic settlement of Bojodurum, it was later the site of a Roman camp, Castra Batava, and was made an episcopal see in 739. The bishops became princes of the Holy Roman Empire in 1217 and ruled Passau until 1803, in spite of citizens' revolts for municipal freedom. Fires in 1662 and 1680 caused great damage, and subsequent rebuilding gave the town a Baroque character. It is dominated by the Oberhaus Fortress (1219), the site of a museum, and the cathedral (1668), which incorporates the remains of an earlier Gothic structure. The cathedral contains one of the largest church organs in the world, with 17,000 pipes (1928). The bishops' palace (1712–30) and numerous fine churches in varied styles recall the era of the prince-bishops. The Gothic town hall (1298–1389) has paintings depicting episodes in the town's past, including its association with the Nibelungen legends. The Niedernburg convent (founded 8th century) contains the tomb of Gisela, the first queen of Hungary.

Passau was an important medieval trade and shipping centre. The Inn salt trade and the making of knife and sword blades were traditional occupations. It has become the economic, cultural, and communications centre of southeastern Bavaria. Passau has city and state libraries, a municipal theatre, and other cultural institutions. Industries include a bell foundry, brewing, and the manufacture of optical instruments, textiles, and tobacco. There is also a tourist trade and a steamer service to Vienna. Pop. (1989 est.) 49,137.



Passau, Ger., showing St. Paul's Church (left) and the cathedral (left centre)
Emil Bauer—Bavaria-Verlag

passenger pigeon (*Ectopistes migratorius*), migratory bird hunted to extinction by man. Billions of these birds inhabited eastern North America in the early 1800s; migrating flocks darkened the skies for days. As settlers pressed westward, however, passenger pigeons were slaughtered by the million yearly and shipped by railway carloads for sale in city markets. From 1870 the decline of the species became precipitous, and it became officially classified as extinct when the last known representative died on Sept. 1, 1914, in the Cincinnati (Ohio) Zoo.

The passenger pigeon resembled the mourning dove and the Old World turtledove but was bigger (32 centimetres [about 13 inches]), with a longer pointed tail. The male had a pinkish body and blue-gray head. A single white egg was laid in a flimsy nest of twigs; more than 100 nests might occupy a single tree. The natural enemies of the passenger pigeon were hawks, owls, weasels, skunks, and arboreal snakes.

The pigeon sometimes foraged in newly planted grainfields but otherwise did little damage to crops. Its greatest legacy to man was the impetus its extinction gave to the conservation movement. A monument to the passenger pigeon, in Wisconsin's Wyalusing State Park, declares: "This species became extinct through the avarice and thoughtlessness of man."

Passenger pigeon, mounted (*Ectopistes migratorius*)
Bill Reasons—The National Audubon Society Collection/ Photo Researchers

passepied (French: "passing feet"), English PASPY, lively dance of Brittany adopted *c.* 1650 by French and English aristocrats, who, during the century of its popularity, frequently danced it dressed as shepherds and shepherdesses. As a court dance the passepied lost its original chain formations and became, like the minuet, a couple dance with figures. Its name probably refers to its characteristic step: the feet crossed and recrossed while gliding forward, one foot often striking the other.

The music, which begins with an upbeat in fairly rapid $\frac{3}{4}$ or $\frac{3}{8}$ time, appears occasionally among the optional movements, or *galanteries,* of the suite, notably in Bach's *Partita in G Major* and English *Suite No. 5.*

Passerat, Jean (b. Oct. 18, 1534, Troyes, Fr.—d. Sept. 14, 1602, Paris), French poet, author of some elegant and tender verse, and one of the contributors to the "Satire Ménippée," the manifesto of the moderate Royalist party in support of Henry of Navarre's claim to the throne.

Passerat, detail of a portrait
H. Roger-Viollet

Passerat studied at the University of Paris, became a teacher at the Collège de Plessis, and in 1572 was made professor of Latin at the Collège de France, where he wrote scholarly Latin works and commentaries on Catullus, Tibullus, and Propertius. He also composed poetry, his best pieces being his short ode "Du premier jour de mai" ("On the First Day of May") and a charming villanelle "J 'ai perdu ma tourterelle" ("I Have Lost My Turtle Dove"). His exact share in the "Satire Ménippée" (1594) is variously stated, but it is generally agreed that he wrote much of the verse. His lines "Sur la journée de Senlis," in which he commends the duc d'Aumale's ability in running away, became a celebrated political song.

Passeres, bird suborder (order Passeriformes) that includes all songbirds. Birds belonging to the suborder Passeres are also referred to as oscines. *See* songbird.

Passeridae, sparrow weaver family of small gregarious birds, based on the genus *Passer*, the well-known sparrows. In this work these birds are classified as a subfamily (Passerinae) in the weaverfinch family (Ploceidae), order Passeriformes.

Articles are alphabetized word by word, not letter by letter

passeriform, also called PASSERINE, or PERCHING BIRD, member of the largest order of birds (Passeriformes), containing about 5,100 species as compared to 3,500 species for all other birds. The passeriform birds are true perching birds, with four toes, three directed forward and one backward. This order is generally divided into the suboscines, containing some 1,100 species, and the oscines, or songbirds, with about 4,000 species.

A brief treatment of passeriforms follows. For full treatment, *see* MACROPAEDIA: Birds.

Passerines are small to medium-sized land birds. Most are insectivorous, although they have adapted many different ways of obtaining food. Some eat fruits and seeds.

Humans have long enjoyed passerines for their songs and their almost infinite variety of colours, patterns, and behavioral traits. This admiration can be hazardous to the existence of some bird species. They are widely kept as cage birds, and until the mid-20th century a number of species of passeriforms were commonly slaughtered for their colourful feathers. Many countries now prohibit the capture and sale of nearly all native songbirds. The birds are still, however, an important food source in certain countries, and are considered delicacies in others.

Passerines are a major factor in maintaining balance in nature. They consume large amounts and varieties of food—grains, fruits, insects, small amphibians—and in turn serve as food for other animals; they act as hosts for parasites; they pollinate plants and flowers and carry seeds to new locations. They can be agricultural pests by their depredations of grain crops.

Most passerines are solitary nesters; a single monogamous pair maintains a territory large enough to support all their mating season activities—courtship, mating, nesting, and food gathering. Nests may be located on the ground, on riverbanks, in rock crevices, on ledges, or in a wide variety of trees, grasses, and shrubs. Most species build cup-shaped open nests. Others, such as the ovenbird, form domed or ball-shaped nests of mud with small entrances on the side or top.

Passerines lay clutches of anywhere from 1 to 14 eggs. As a rule, the female alone incubates the eggs, although occasionally incubation is shared with the male. Incubation lasts from 11 to 21 days. In most species the male helps feed the young, which remain in the nest for 8 to 30 or 35 days but most commonly from 10 to 15 days. After the young fledge, they stay near the nest for some days or weeks before becoming fully independent.

An outstanding characteristic of most perching birds is their ability to sing. The 4,000 songbird (or oscine) species are most notable for their vocalizations, but other members of the order also can produce a variety of sounds. The songbirds have a highly complex vocal organ called a syrinx. Only the male of most passerine species, however, sings a true song.

A characteristic behaviour pattern peculiar to passerines is the practice of anting. About 30 passerine families actively or passively manipulate ants exuding formic acid to crawl through their feathers. Some authorities believe this is a form of stimulation, but others argue that the birds do this to help with feather maintenance. They avoid stinging ants. Some passerines also follow columns of army ants to devour other insects and small animals fleeing from their path.

Although all passerines can perch, not all do so habitually. A number of ground-dwelling species (some tapaculos, larks, pipits) have modified the characteristic four-toed perching foot into a flatter, longer version to aid in walking and running. Other passerines, such as swallows that spend much time airborne, have small, weak feet. And still others, such as woodcreepers and nuthatches that often cling and climb vines and trees, have strong, curved, sharp claws. Most passerines have moderately curved sharp claws.

Passerine bills are broadly classified into eight types that indicate the bill's function or the bird's major food source. The bill types are insectivorous, omnivorous, toothed, tearing, probing, frugivorous (heavily built for tearing apart tough fruits), serrated (found in birds needing plant cutters), and conical (for seed eating).

The males of the order tend to have brighter colours and more striking patterns on their feathers than do females and juvenile birds, which are cryptically coloured to aid in concealment. Many species, especially those in temperate climates, have a bright plumage during breeding season and a dull one in winter.

Studies of modern birds have led to a general agreement that perching birds developed from more than one ancestral type; however, the fossil record gives little definite evidence of direct ancestors. Although some authorities believe that passerines arose about 120,000,000 years ago, the earliest fossils found date from about 40,000,000 years ago.

Passfield, Sidney James Webb, Baron (English socialist): *see* Webb, Sidney and Beatrice.

Passiflorales, the passion-flower order of dicotyledonous flowering plants comprising five families of herbs, shrubs, trees, and vines, mostly of warm regions. The largest genus in the order is *Passiflora,* the passion-flower (*q.v.*) genus, with about 400 species, many of which are highly prized for their showy, unusual flowers.

The plants are characterized by the presence of radially symmetrical male, female, or bisexual flowers with three to five sepals, petals, and stamens (male pollen-producing structures) and a usually one-chambered, superior ovary (*i.e.,* the female structure positioned above the attachment point of the other flower parts) composed of three to five carpels (ovule-bearing segments) with indefinitely numerous ovules attached to the inner ovary walls. Nearly all species have seeds that bear a fleshy appendage called an aril. The flower is also distinctive in most species in having a gynophore or androphore, a pedestal-like structure in the centre of the flower that carries the reproductive parts of both sexes. In the passion-flower family there is an additional whorl of tendril-like structures in the flower called the corona. The fruits are capsules or berries.

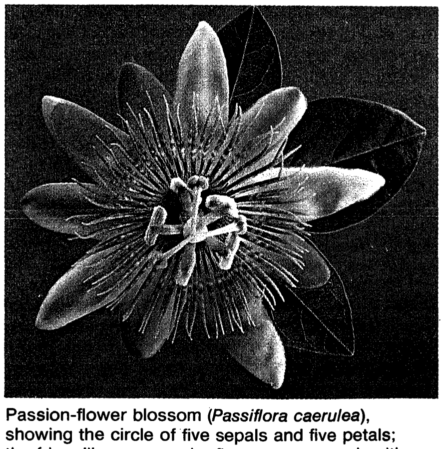
Many *Passiflora* species produce edible fruits, such as the giant granadilla (*P. quadrangularis*); sweet calabash, sweet cup, or pomme d'or (*P. maliformis*); the yellow granadilla, or belle apple (*P. laurifolia*); and the purple granadilla

Purple granadilla (*Passiflora edulis*)
E. Lastovica

(*P. edulis*). Another important member of the order is the papaya (*Carica papaya,* family Caricaceae), a columnar tree with large leaves in a bunch at the top like palm trees, source of the papaya fruit of the tropics. *Passiflora* and *Carica* are the only genera cultivated to any extent.

The order is considered to be evolutionarily derived from the violet order (Violales). The families are Passifloraceae (12 genera and 600 species), Turneraceae (7 genera and 120 species), Malesherbiaceae (1 genus with 35 species), Achariaceae (3 genera and 3 species), and Caricaceae (4 genera and 55 species).

passion-flower, any of the genus *Passiflora* (family Passifloraceae), about 400 species of tendril-bearing, herbaceous vines with characteristic flowers. Some are important as ornamentals; others are grown for their edible fruits.



Passion-flower blossom (*Passiflora caerulea*), showing the circle of five sepals and five petals; the fringelike corona; the five stamens, each with a loaf-of-bread-shaped anther; the ovary; and the three styles
Grant Heilman—EB Inc.

The wild passion-flower, passion vine, or maypop (*P. incarnata*) climbs about 3 to 9 metres (10 to 30 feet) high and has pink and white flowers about 4 to 7½ centimetres (1½ to 3 inches) across and a yellow, berrylike, edible fruit about 2 inches long. The yellow passion-flower (*P. lutea*) is a smaller plant with greenish-yellow flowers and purple fruits.

Some highly perfumed passion fruits are eaten as delicate dessert fruits, as the giant granadilla (*P. quadrangularis*). The purple granadilla (*P. edulis*) and the yellow granadilla (*P. laurifolia*), as well as the wild passion-flower, are widely grown in tropical America for their fruit. *Passiflora maliformis* is the sweet calabash of the West Indies. The size of these fruits usually does not exceed that of a hen's egg, but that of the giant granadilla is like a gourd and may weigh up to seven or eight pounds.

The passion-flower blossom varies in form from a shallow saucer shape to a long cylindrical or trumpet-shaped tube, producing at its upper border five sepals, five petals, and many threadlike or membranous outgrowths from the tube, which constitute the most conspicuous and beautiful part of the flower, called the corona. From the base of the inner part of the tube rises a stalk bearing above the middle a ring of five stamens (the male pollen-producing structures). Above the stamens is the female structure, or ovary, at the top of which arise three widely spreading styles. Each style ends in a button-like stigma, giving an appearance rather like a large-headed nail. The ovary, with a single compartment, contains numerous seeds arranged in three groups and ripens into a berrylike or capsular fruit.

The passion-flower blossom is often used to symbolize events in the last hours of the life of Christ, the Passion of Christ, which accounts for the name of the group. Thus, the corona represents the crown of thorns; the styles represent the nails used in the Crucifixion; the stamens represent the five wounds; and the five sepals and five petals represent 10 of the apostles, excluding Judas, who betrayed Jesus, and Peter, who denied him three times on the night of his trial.

Passion music, musical setting of the suffering and Crucifixion of Christ, based either on biblical texts or poetic elaborations. Dating from the 4th century onward, they range from unaccompanied plainsong to compositions for soloists, chorus, and orchestra. In the medieval Passion the deacon sang the entire text. A range of 11 notes was divided into three parts: the lowest four notes were used for the part of Christ, the middle register for the Evangelist, and the top four notes for the *turba* ("crowd"), which comprised all the other characters. Each of the vocal ranges was distinguished by a characteristic method of performance.

From the 15th century onward, the three parts often were sung by three deacons; in consequence, the dramatic nature of the text was heightened, and the congregation could follow the narrative easily. In the 13th century the Passions were adapted as music-drama. Two versions are found in the famous German manuscript *Carmina Burana*. Later Passion plays abound, and they tended to become longer and more complex. In the early 15th century, wealthy establishments had small choirs capable of singing the *turba* parts. One of the first composers to set this music polyphonically (for more than a single melodic part) was the Burgundian Gilles Binchois (*c.* 1438). The type of Passion in which plainsong alternated with polyphony was set by fine composers throughout Europe.

Latin and German Passion texts were used in Germany early in the Protestant Reformation. The Lutheran composer Johann Walther created a setting of the Passion according to St. Matthew (*c.* 1550) that was still popular in 1806. Other German Passions adopted a style called motet Passion because the entire text is set polyphonically, as in a motet. The 16th-century French composer Antoine de Longaval, who made extensive use of the plainsong formulas, was more concerned with declamation of the text than with elaborate polyphony. Among the Germans, Jacob Handl and Leonhard Lechner produced dignified settings.

The Longaval setting inspired motet Passions by 16th-century Franco-Flemish composers, whereas Antonio Scandello, an Italian working at Dresden, produced a hybrid setting of the Passion according to St. John in German. He amalgamated the two types by setting the *turba* music for five voices, contrasting this with the single line of the Evangelist and with three-part settings of the words of Peter, Pilate, and other characters, while the words of Jesus are in four-part harmony.

The solo vocal and multipart choral styles of Italian Baroque music were strongly influential in Germany. The St. Matthew Passion setting of Thomas Selle (1599–1663) uses a double chorus extensively, while his setting of the St. John Passion incorporates instruments and a "distant choir." Contrast between the interlocutors is achieved by assigning particular instruments or groups to different characters. Chorales, or hymn tunes, were introduced into the German Passions by Johann Theile and Johann Kuhnau. The three unaccompanied Passions by the celebrated composer Heinrich Schütz return to the more austere type.

Settings of the Passion were rare in 17th-century Italy and France, for elaborate music was unwelcome during Holy Week. The St. John Passion setting of Alessandro Scarlatti is a strictly liturgical work that follows the text with scrupulous accuracy and refrains from undue elaboration. In France, Marc-Antoine Charpentier's Passion displays an intensity of emotion and contrast of tone-colour.

Hamburg witnessed early attempts at operatic settings of the Passion, based on new librettos paraphrasing biblical texts. These rhymed, sentimental accounts appealed to German audiences but were not entirely approved by the clergy. The reaction to this trend came with Christian Heinrich Postel's version of the St. John Passion, set by Handel in 1704, and with the St. John and St. Matthew Passions by J.S. Bach. Bach's Passions made the texts important and dignified and wedded to them music of remarkable fervour, heightening the drama by interplay of choral and instrumental forces alternating with vocal solos.

C.P.E. Bach wrote two Passions challenged in popularity only by Karl Heinrich Graun's *Der Tod Jesu* (*Jesus' Death*), famous even outside Germany. Throughout the Classical and Romantic periods, the Passion written as an oratorio was usual, commonly using a large orchestra and chorus. Haydn and Beethoven set fashions in the writing of Passion oratorios. The English composer Sir John Stainer's *The Crucifixion* (1887) achieved great popularity. Passion music of the 20th century includes an oratorio *St. Luke Passion* of Krzysztof Penderecki, a Polish composer, St. Mark Passions by Charles Wood (England), Lorenzo Perosi (Italy), and Kurt Thomas (Germany), and *The Passion of Christ* by Arthur Somervell (England).

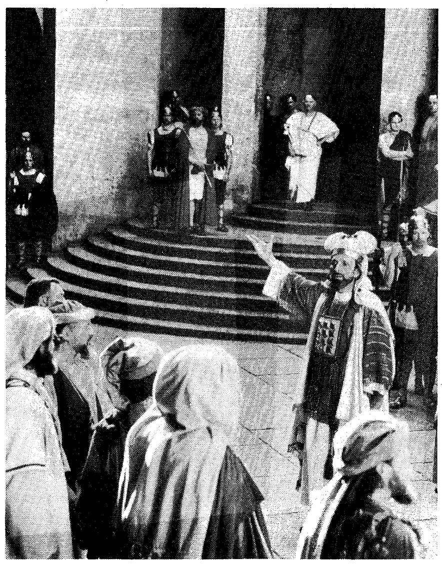
Passion play, religious drama of medieval origin dealing with the suffering, death, and Resurrection of Christ. Early Passion plays (in Latin) consisted of readings from the Gospel with interpolated poetical sections on the events of Christ's Passion and related subjects, such as Mary Magdalene's life and repentance, the raising of Lazarus, the Last Supper, and the lament of the Virgin Mary. Use of the vernacular in these interpolations led to the development of independent vernacular plays, the earliest surviving examples being in German. Such plays were at first only preludes to dramatic presentations of the Resurrection. The introduction of Satan (which became typical of German and Czech plays), and thus of introductory representations of the fall of Lucifer and the Fall of man (as in the early 14th-century Vienna Passion), and of scenes from the Old Testament and of the Last Judgment, led to development of cyclic plays similar to the Corpus Christi cycles. The great Celtic Passion cycles of Cornwall and Brittany, and the St. Gall Passion play (which begins with the entry of St. Augustine, who introduces the Old Testament prophets and patriarchs, and also includes the marriage at Cana), exemplify this type of Passion play.

The Tirol plays early formed a separate group, representing only scenes from the Passion and Resurrection. The Bohemian plays, such as the St. Eger Passion, developed from a simpler version of the Vienna Passion, were also distinct in style and incident.

The earliest Passion plays of France and Flanders are thought to have their source in a nondramatic narrative poem of the 13th century, the *Passion des jongleurs*. These plays became highly elaborated in the course of their development, culminating in performances (Mons, 1501; Valenciennes, 1547) lasting more than a week. Confraternities were founded for performance of Passion plays, the most famous being the Confrérie de la Passion (1402). Passion plays were also performed in Spain, Italy, and elsewhere, with local variations.

By the 16th century, many of the Passion plays, debased by secular influences, had degenerated into mere popular entertainments, full of crude slapstick and buffoonery. Many were forbidden by ecclesiastical authorities, and many more were suppressed after the Reformation.

The most famous of the Passion plays to survive into the 20th century is that performed at Oberammergau, in the Bavarian Alps. According to tradition, the play has been presented every 10 years since 1634, in fulfillment of a vow made after the village was spared an epidemic of plague (shifting to decennial years in 1700), except in 1870 during the Franco-Prussian War and World War II, when religious plays were banned. It remains an entirely local production, with villagers taking all the parts and singing in the chorus. Since 1930 roofed seats have protected the audience from the weather. The production runs from May through September. Some villagers and some Jewish organizations have protested anti-Semitic overtones in the 1860 text. Traditional Passion plays have also been revived in villages in the Austrian Tirol. In northern Spain, during Lent and Holy Week, a Catalan Passion play is performed by villagers; and in Tegelen, in The Netherlands, a modern play



Christ before Pilate and Herod, scene from 1960 performance of the Passion play of Oberammergau
Bavaria-Verlag, Munich

by the Dutch poet Jacques Scheurs is given every five years.

Passion Sunday: *see* Palm Sunday.

Passionist, member of CONGREGATION OF THE PASSION, formally CONGREGATION OF THE DISCALCED CLERKS OF THE MOST HOLY CROSS AND PASSION OF OUR LORD JESUS CHRIST (C.P.), a religious order of men in the Roman Catholic Church, founded by Paolo Francesco Danei (now known as St. Paul of the Cross) in Italy in 1720 to spread devotion to the sufferings and death on the Cross of Jesus Christ.

In regions where the church is established this apostolate (religious activity) is fulfilled especially by the preaching of missions and retreats; in other regions foreign missions are conducted. The members of the order follow an austere rule of life that calls for common recitation of the liturgical office, three days of fasting each week, and other penances. Their habit consists of a black tunic and mantle with a leather belt and rosary. The tunic and mantle have a heart-shaped badge, bearing a white cross and three nails with the inscription *Jesu XPI Passio* (Passion of Jesus Christ).

St. Paul also founded the Passionist Nuns (Nuns of the Cross and Passion of Our Lord Jesus Christ), approved by Pope Clement XIV in 1771. Passionist Sisters were established in 1852 in England.

passive resistance: *see* civil disobedience.

påssjo, the sacred area in a Lapp *kota,* or tent, found directly behind the central hearth; it was furnished with a separate entrance and sometimes set off with poles to separate it from the living space in the rest of the *kota.* The *påssjo* held the cooking utensils, dishes, and food of the household, as well as all objects of value, such as the men's hunting weapons, which the women were not allowed to touch. The Lapp shaman, the *noiade,* also stored his magic drum, the *kobdas,* and other magic implements there. The *påssjo* was strictly forbidden to women. Bear hunters left for and returned from a hunt through the *påssjo* door, after which the women spat alder juice upon them. The dead were also removed through this back door. The entire Lapp *kota* was a microcosmic representation of the ordered cosmos in the Lapp's world view. In such an arrangement the *påssjo* represented the centre of the universe, its most sacred locality.

Passo Fundo, city, northern Rio Grande do Sul state, southern Brazil, lying near the headwaters of the Rio Passo Fundo at 2,326 ft (709 m) above sea level. It was founded in 1857 and given city status in 1890. The city is a service centre for an agricultural and livestock-raising area. In addition to flour mills and plants processing meat and maté (tea), there is some lumbering and sawmilling. A hydroelectric plant serves the city. The Universidade de Passo Fundo (1968) is located there. Passo Fundo, 140 mi (225 km) northwest of Pôrto Alegre, the state capital, is accessible by railway, road, and air. Pop. (1980 prelim.) 103,121.

Passos, city, southwestern Minas Gerais state, Brazil, on the Rio da Bocaina near the Rio Grande, at 2,388 ft (728 m) above sea level. It was made a seat of a municipality in 1848 and became a city 10 years later. Rice, corn (maize), sugarcane, cotton, coffee, and livestock are processed in the city and transported by rail and road to Belo Horizonte, the state capital, 183 mi (295 km) east-northeast. Pop. (1980 prelim.) 56,998.

Passover, Hebrew PESAḤ, or PESACH, in Judaism, one of three major Pilgrim Festivals, this one commemorating the "passing over" of the forces of destruction, or the sparing of the firstborn of the Israelites, when the Lord "smote the land of Egypt" on the eve of the Exodus (Nisan 14). The Jews, in accordance with the Lord's orders to Moses, had marked their doorposts with the blood of a lamb to signify that they were children of God.

"The Seder Meal," illustration for Passover Haggada by Arthur Szyk, 1939

By courtesy of the Jewish Theological Seminary of America, New York, Frank J. Darmstaedter

The festival is celebrated for seven days in Israel and by Reform Jews, and for eight days elsewhere, though the seven-day period from Nisan 15 to 22 is more properly the festival of "unleavened bread" (*see* matza). Passover commences with a special family meal, the seder, at which foods of symbolic significance are eaten; the seder also includes prayers and traditional recitations. In the Ashkenazi synagogues, the Song of Solomon (Song of Songs) is read from the Megillot on the Sabbath as part of the liturgy. Though the festival is meant to be one of great rejoicing, recalling the greatest event in Jewish history, strict dietary laws must be observed, and special prohibitions restrict work at the beginning and end of the celebration. *See also* seder.

Passy, Frédéric (b. May 20, 1822, Paris—d. June 12, 1912, Paris), French economist and advocate of international arbitration who was co-winner (with Jean-Henri Dunant, founder of the Red Cross) of the first Nobel Peace Prize (1901).

Passy, 1901

H. Roger-Viollet

After serving as auditor for the French Council of State (1846–49), Passy devoted himself to writing, lecturing, and organizing on behalf of various economic reforms and philanthropies. An ardent free trader, he belonged to the 19th-century liberal tradition of the British economists Richard Cobden and John Bright, whom he knew personally.

Passy's work for peace began during the Crimean War (1853–56). His plea for peace in the periodical *Le Temps* (1867) helped to avert war between France and Prussia over Luxembourg. In the same year he founded the Ligue Internationale de la Paix, later known as the Société Française pour l'Arbitrage entre les Nations. After the Franco-German War (1870–71) he proposed independence and permanent neutrality for Alsace-Lorraine. As a member of the French Chamber of Deputies (from 1881), he successfully urged arbitration of a dispute between France and The Netherlands concerning the French Guiana–Surinam boundary. He assisted in founding the International Parliamentary Union (1889) and remained active in the peace movement for the rest of his long life.

pasta, any of several starchy food preparations (*pasta alimentaria*) frequently associated with Italian cuisine and made from semolina, the granular product obtained from the endosperm of a type of wheat called durum, containing a large proportion of gluten (elastic protein). It is formed into ribbons, cords, tubes, and various special shapes, all originally developed for specific characteristics, such as ability to retain heat or hold sauces.

In commercial processing, the semolina, mixed with warm water, is kneaded into a smooth, stiff dough and extruded. The dough, moved forward while it is being compacted and mixed, is forced through perforated plates, or dies, that form it into the desired shape. Hollow tubular forms, such as macaroni, result when the perforations are small and contain steel pins; smaller holes without pins produce spaghetti; flat ribbonlike types are made by slitted perforations. Shell forms are produced by a special die; small fancy shapes are produced by rotary knives slicing the dough as it emerges from the die. The formed dough is next dried, reducing moisture content from about 31 percent to approximately 12 percent. Drying is carefully regulated, as very rapid drying may result in cracking, and very slow drying may produce stretching or encourage the growth of mold or of organisms that produce souring.

Doughs may be coloured with spinach juice, producing green pasta; with beet juice, resulting in red types; and with eggs, adding bright-yellow colour. Eggs are frequently added to homemade pastas.

Among the popular cord forms are spaghetti ("little string"), a finer type called spaghettini, and the very fine vermicelli ("little worms"). Tubular types include macaroni, shaped into tubes of ½-inch (12.7-millimetre) diameter, such variations as the small elbow-shaped pieces called *dita lisci,* and the large, fluted, elbow-shaped pieces called rigatoni. Ribbon types include the wide lasagna and the narrow linguini. Farfels are ground, granulated, or shredded. The wide variety of special shapes includes *farfalloni* ("large butterflies"), *lancette* ("little spears"), *fusilli* ("spindles"), and *ricciolne* ("little curls").

Pastas are prepared by boiling and may be cooked until firm and resilient to the bite (*al dente*) or until very tender. Prepared Italian style, they may be tossed with butter, cheese, and seasoning (nutmeg, pepper) or served with a variety of sauces—tomato, cream, seafood, or others. Shaped pastas are often stuffed with meat, cheese, spinach, or a combination of these and other ingredients. Pastas are also cooked in soups and are used in casseroles and other dishes that call for the use of noodles, a similar starch preparation (*see* noodle). Uncooked pastas retain their freshness from three to six months.

Pasta, Giuditta (Maria Costanza), *née* NEGRI (b. Oct. 28, 1797, Saronno, near Milan—d. Apr. 1, 1865, Blevio, Como, Italy), reigning

Italian soprano of her time, acclaimed for her vocal range and expressiveness.

She studied with Bonifazio Asioli and Giuseppe Scappa at Milan and made her debut there in 1815 in Scappa's *Le tre Eleonore.* She gave a brilliant performance in 1821 at the Théâtre-Italien in Paris as Desdemona in Gioacchino Rossini's *Otello,* and in 1824 she conquered London in a series of Rossini roles, including Semiramis in *Semiramide.*

Pasta's vocal range and dramatic power were so remarkable that several leading composers wrote operas for her, including Giovanni Pacini, *Niobe* (1826); Vincenzo Bellini, *Ernani, Beatrice di Tenda, Norma,* and *La sonnambula;* and Gaetano Donizetti, *Anna Bolena.* Even after her voice gave way in the late 1830s, she performed in London and St. Petersburg, until in 1850 she retired to teach at her villa on Lake Como.

paste, heavy, very transparent flint glass that simulates the fire and brilliance of gemstones because it has relatively high indices of refraction and strong dispersion (separation of white light into its component colours). From a very early period the imitation of gems was attempted. The Romans in particular were very skillful in the production of coloured-glass pastes, which copied especially emerald and lapis lazuli. With an increasing demand for jewelry, the number of imitations steadily increased. In 1758 the Viennese goldsmith Joseph Strasser succeeded in inventing a colourless glass paste that could be cut and that superficially approached the sparkle of genuine diamond; the products of this paste are called strass stones.

Before 1940 most imitation gems were made from glass with a high lead content. Such glasses were called paste because the components of the mixture were mixed wet to ensure a thorough and even distribution. Colourless paste is commonly formulated from 300 parts of silica (silicon dioxide, SiO_2), 470 of red lead (a lead oxide, Pb_3O_4), 163 of potassium carbonate (K_2CO_3), 22 of borax (a sodium borate, $Na_2B_4O_7 \cdot 10H_2O$), and 1 of white arsenic (arsenic oxide, As_2O_3). Pigments may be added to give the paste any desired colour: chromium compounds for red or green, cobalt for blue, gold for red, iron for yellow to green, manganese for purple, and selenium for red.

Pastes are softer than ordinary or crown glass but have a higher index of refraction and dispersion that give them great brilliancy and fire. The cheaper paste imitations are pressed or molded, but, on the better-quality stones, the facets are cut and polished. Molded-glass imitations can be identified with a hand lens, because the edges between the facets are rounded whereas cut glass has sharp edges. Cut paste stones may be distinguished from real ones in several ways: (1) paste has air bubbles, natural stones do not; (2) paste is a poor conductor of heat, and so paste stones feel warm to the touch; and (3) paste, like all glass, has an easy conchoidal fracture, yielding brilliant curved surfaces particularly on the girdle (the widest part) of mounted stones near the mounting prongs. Other differentiation methods involve hardness (paste is softer than real stones and will not scratch ordinary glass), index of refraction (1.50–1.80, less than diamond at 2.42), specific gravity (between 2.5 and 4.0, depending on the amount of red lead used), and isotropic character (because paste has the same properties in all directions, it shows only single refraction and no dichroism, whereas most natural stones are partially doubly refractive and dichroic).

pastel, dry drawing medium executed with fragile, finger-size sticks. These drawing crayons, called pastels, are made of powdered pigments combined with a minimum of non-greasy binder, usually gum tragacanth or, from the mid-20th century, methyl cellulose. Made in a wide range of colour values, the darkest in each hue consists of pure pigment and binder, the others having varying admixtures of inert whites. Once the colours are applied to paper, they appear fresh and bright. Because they do not change in colour value, the final effect can be seen immediately. Pastel remains on the surface of the paper and thus can be easily obliterated unless protected by glass or a fixative spray of glue size or gum solution. Fixatives, however, have a disadvantage in that they tend to change the tone and flatten the grain of pastel drawings. When pastel is applied in short strokes or linearly, it is usually classed as drawing; when it is rubbed, smeared,

Portrait of a youth from the Le Blond family, pastel drawing by Rosalba Carriera; in the Accademia, Venice

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and blended to achieve painterly effects, it is often regarded as a painting medium. The latter technique was principally used until the late 19th century, when the linear method came to be preferred. Special papers for pastel have been made since the 18th century with widely varying textures, some like fine sandpaper, with a flocked or suedelike finish, prominently ribbed or strongly marked by the drying felts.

Pastels originated in northern Italy in the 16th century and were used by Jacopo Bassano and Frederico Barocci. The German artist Hans Holbein the Younger and the French artists Jean and François Clouet did pastel portraits in the same period. The greatest popularity of the medium came in the 18th century, when it was primarily used for portraiture. Rosalba Carriera (Italian), Jean-Baptiste Chardin, François Boucher, Maurice-Quentin de La Tour, Jean-Baptiste Perronneau (all French), Jean-Étienne Liotard (Swiss), and Anton Raphael Mengs (German) were among the major masters of pastel. Largely revived and revitalized in the last third of the 19th century by the French artist Edgar Degas, pastels figure importantly in the work of such artists as Auguste Renoir, Henri de Toulouse-Lautrec, Odilon Redon, Gustave Moreau, Edouard Vuillard, Pierre Bonnard (all French), Mary Cassatt (American expatriate), and Paul Klee (Swiss).

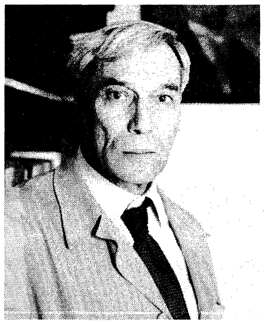
Pasternak, Boris (Leonidovich) (b. Feb. 10 [Jan. 29, Old Style], 1890, Moscow—d. May 30, 1960, Peredelkino, near Moscow), Russian poet whose novel *Doctor Zhivago* helped win him the Nobel Prize for Literature in 1958 but aroused so much opposition in the Soviet Union that he declined the honour. An epic of wandering, spiritual isolation, and love amid the harshness of the Russian Revolution and its aftermath, the novel became an international best-seller but circulated only in secrecy and translation in his own land.

Pasternak grew up in a cultured Jewish household. His father, Leonid, was an art professor and a portraitist of novelist Leo Tolstoy, poet Rainer Maria Rilke, and composer Sergey Rachmaninoff, all frequent guests at his home, and of Lenin. His mother was the pianist Rosa Kaufman.

Young Pasternak himself planned a musical career, though he was a precocious poet. He studied musical theory and composition for six years, then abruptly switched to philosophy courses at Moscow University and the University of Marburg (Germany). Physically disqualified for military service, he worked in a chemical factory in the Urals during World War I. After the Revolution he worked in the library of the Soviet commissariat of education.

His first volume of poetry was published in 1913. In 1917 he brought out a striking second volume, *Poverkh baryerov* ("Over the Barriers"), and with the publication of *Sestra moya zhizn* (1922; "My Sister Life") he was recognized as a major new lyrical voice. His poems of that period reflected Symbolist influences. Though avant-garde and esoteric by Russian standards, they were successful. From 1933 to 1943, however, the gap between his work and the official modes (such as Socialist Realism) was too wide to permit him to publish, and he feared for his safety during the purge trials of the late 1930s. One theory is that Stalin spared him because Pasternak had translated poets of Stalin's native Georgia. His translations, which were his main livelihood, included renderings of William Shakespeare, Johann Wolfgang von Goethe, English Romantic poets, Paul Verlaine, and Rainer Maria Rilke.

Although Pasternak hoped for the best when he submitted *Doctor Zhivago* to a leading Moscow monthly in 1956, it was rejected



Pasternak

Cornell Capa—Magnum

with the accusation that "it represented in a libelous manner the October Revolution, the people who made it, and social construction in the Soviet Union." The book reached the West in 1957 through an Italian publishing house that had bought rights to it from Pasternak and refused to return it "for revisions." By 1958, the year of its English edition, the book had been translated into 18 languages.

In the Soviet Union, the Nobel Prize brought a campaign of abuse. Pasternak was ejected from the Union of Soviet Writers and thus deprived of his livelihood. Public meetings called for his deportation; he wrote Premier Nikita S. Khrushchev, "Leaving the motherland will equal death for me." Suffering from cancer and heart trouble, he spent his last years in his home at Peredelkino.

Pasternak's works in English translation include short stories, the autobiographical *Okhrannaya gramota* (1931; *Safe Conduct*), and the full range of his poetic output, which ended on a note of gravity and quiet inwardness.

In 1987 the Union of Soviet Writers posthumously reinstated Pasternak, a move that gave his works a legitimacy they had lacked in the Soviet Union since his expulsion from the writers' union in 1958 and that finally made possible the publication of *Doctor Zhivago* in the Soviet Union. In addition to effecting Pasternak's rehabilitation, the review commission, headed by poet Andrey Voznesensky, recommended that Pasternak's home in Peredelkino be made a museum.

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Pasteur, Louis (b. Dec. 27, 1822, Dole, Fr.—d. Sept. 28, 1895, Saint-Cloud, near Paris), French chemist and microbiologist who proved that microorganisms cause fermentation and disease; among other achievements, he originated the process called pasteurization.

A brief account of the life and works of Louis Pasteur follows. For a full biography, *see* MACROPAEDIA: Pasteur.

Pasteur, after what seemed like an unpromising start, began the serious study of chemistry at the Sorbonne in 1843 and received his doctorate of sciences in 1847. He worked on the polarization of light by chemical compounds. In 1848 he was appointed professor of physics at Dijon and in 1849 was called to Strasbourg as professor of chemistry; in 1854 he became dean of the science faculty at the University of Lille. From 1857 to 1867 he was director of scientific studies at the École Normale Supérieure. He found means of saving the beer, wine, and silk industries of France and other countries when they were threatened by inimical microorganisms. In 1873 he became a member of the French Academy of Medicine, and in 1874 he received a life pension from the National Assembly.

In 1881 Pasteur was first to vaccinate sheep against anthrax; he was elected (1882) a member of the French Academy, and in 1885 he used vaccination for the first time against rabies. In 1888 the Pasteur Institute was established in Paris, and he served as its head until his death. His *Oeuvres complètes,* 7 vol. (1922–39), and *Correspondance, 1840–1895,* four parts (1940–51), were edited by his grandson Joseph Louis Pasteur Vallery-Radot (known as Pasteur Vallery-Radot).

Pasteurella, genus of rod-shaped bacteria named in honour of Louis Pasteur and causing several serious diseases in domestic animals and milder infections in humans. The species are microbiologically characterized as gram-negative, nonmotile, facultative anaerobes (not requiring oxygen) that have a fermentative type of metabolism. They are 0.3 to 1 μm (micrometre; 1 μm = 10^{-6} metre) across by 1–2 μm long. The infections they cause, referred to by the general term pasteurelloses, are widespread, being transmitted by direct contact and, in some cases, by certain species of ticks and fleas. The genus is closely related to the genera *Haemophilus* and *Actinobacillus,* and together the three genera form the family Pasteurellaceae.

Pasteurella multocida is pathogenic for many animals, causing fowl cholera, blood poisoning in ruminants, pneumonia in young cattle, and respiratory infection in cattle and humans. *P. pneumontropica* produces respiratory infection in laboratory rodents and rabbits, and *P. haemolytica* is a cause of sheep pneumonia. *P. multocida* and *P. pneumotropica* are also often found in the mouths of healthy cats and dogs and can cause infection in bite wounds of those animals.

The agents of tularemia and bubonic plague, previously designated *P. tularensis* and *P. pestis*, respectively, have been reclassified as *Francisella tularensis* and *Yersinia pestis.*

Control by vaccine is variable, as is treatment with penicillin and other antibiotics, such as tetracycline.

pasteurellosis, any bacterial disease caused by *Pasteurella* species. The name is sometimes used interchangeably with the so-called shipping fever, a specific type of pasteurellosis (caused by *Pasteurella multocida*) that commonly attacks animals under stress, as during shipping. In this type of pasteurellosis, fever is followed by respiratory difficulty, which may lead to pneumonia and more severe symptoms. Treatment includes isolation, rest, and antibiotic therapy. Some immunity may be gained from antiserums and other preventive preparations. *P. haemolytica,* another organism that causes pasteurellosis, can produce pneumonia in sheep and cattle and septicemia in other animals.

pasteurization, heat-treatment process that destroys pathogenic microorganisms in certain foods and beverages. It is named for the French scientist Louis Pasteur, who in the 1860s demonstrated that abnormal fermentation of wine and beer could be prevented by heating the beverages to about 57° C (135° F) for a few minutes. Pasteurization of milk, widely practiced in several countries, notably the United States, requires temperatures of about 63° C (145° F) maintained for 30 minutes or, alternatively, heating to a higher temperature, 72° C (162° F), and holding for 15 seconds (and yet higher temperatures for shorter periods of time). The times and temperatures are those determined to be necessary to destroy the *Mycobacterium tuberculosis* and other more heat-resistant of the non-spore-forming, disease-causing microorganisms found in milk. The treatment also destroys most of the microorganisms that cause spoilage and so prolongs the storage time of food.

Ultra-high-temperature (UHT) pasteurization involves heating milk or cream to 138°to 150° C for one or two seconds. Packaged in sterile, hermetically sealed containers, UHT milk may be stored without refrigeration for months. Ultrapasteurized milk and cream are heated to at least 138° C for at least two seconds, but because of less stringent packaging they must be refrigerated. Shelf life is extended to 60–90 days. After opening, spoilage times for both UHT and ultrapasteurized products are similar to those of conventionally pasteurized products.

Pasteurization of some solid foods involves a mild heat treatment, the exact definition of which depends on the food. Radiation pasteurization refers to the application of small amounts of beta or gamma rays to foods to increase their storage time.

Pasto, city, capital of Nariño department, southwestern Colombia, situated 8,291 feet (2,527 m) above sea level at the base of extinct Galeras Volcano (13,999 feet [4,267 m]). Founded in 1539, Pasto was a royalist stronghold during the revolution against Spain. Although now less important as a trade centre than it was in the colonial era, Pasto controls traffic between Ecuador and the Cauca Valley and is the commercial centre for the surrounding agricultural and gold-mining area. The University of Nariño grew from a college established in Pasto in 1827 (university status, 1964). The city lies on the Pan-American Highway, 76 miles (122 km) from the Ecuadorian border, and is linked by road with the Pacific port of Tumaco. The area for which Pasto is an urban centre contains a large Indian population. Pop. (1985) 197,407.

Paston Letters, the largest surviving collection of 15th-century English correspondence, invaluable to historians and philologists, preserved mainly in the British Museum. Part is derived from the circle of the career soldier Sir John Fastolf (*c.* 1378–1459), and part is from the correspondence of the Paston family, Fastolf's neighbours in eastern Norfolk.

One of Fastolf's servants, William Worcester, collected material for personal historical research as well as evidence for several lawsuits involving Fastolf. The Pastons involved in the letters include William (d. 1444), who became a justice of the Court of Common Pleas; his son John I (d. 1466), a London lawyer; John's two sons, John II (d. 1479) and John III (d. 1503), both of whom were knighted; and their respective wives and children. The collection of more than 1,000 items contains legal records, local and national news, and gossip; through all this, the characters of the writers emerge vividly.

Reasons for the initial preservation of the letters must include the desirability, in the litigious world of 15th-century Norfolk, of possessing all possible evidence that might be valuable in lawsuits; employees and estate managers too were eager to preserve their warrants for their expenditures and actions.

How the Paston Letters were kept from the 15th to the 18th century is unknown, but in 1735 Francis Blomefield explored the muniment room at Oxnead, the Paston family seat in Norfolk. He preserved letters judged "of good consequence in history," these eventually being acquired by the Bodleian Library, Oxford, and the British Museum. John Fenn of East Dereham, Norfolk, edited four volumes of *Original Letters* (1787–89); a fifth volume, completed by William Frere, was published posthumously in 1823. The collection was reedited by James Gairdner as *The Paston Letters, 1422–1509* in six volumes in 1904.

The collection remains of outstanding interest to philologists as evidence of the English language at a crucial period in its development. For historians, the letters are a primary source for the political history of 15th-century England and also for the domestic history of medieval English provincial society.

Pastor, Ludwig, FREIHERR (baron) VON CAMPERSFELDEN (b. Jan. 31, 1854, Aachen, Prussia [Germany]—d. Sept. 30, 1928, Innsbruck, Austria), German author of one of the monumental papal histories, *Geschichte der Päpste seit dem Ausgang des Mittelalters,* 16 vol. (1886–1933; *History of the Popes from the Close of the Middle Ages*).

While a student, Pastor became acquainted with the leading historians of his day. He became a lecturer at the University of Innsbruck (1881), where, in 1887, he was appointed professor of modern history. He later became director (1901) of the Austrian Historical Institute, Rome, and Austrian ambassador (1920) to the Vatican. He was knighted by Emperor Francis Joseph of Austria in 1908 and was created a baron in 1916.

Pastor's works include more than 12 monographs, the best-known being his *Geschichte der Päpste.* In 1881 Pastor caused Pope Leo XIII to open the Vatican archives, heretofore unavailable to scholars; Pastor also consulted archives throughout Europe. His papal history emphasized objective scholarship, treated dark periods of the papacy with frankness, and concentrated on individual popes rather than on the papacy as an institution. Another major work is his edition of *Geschichte des deutschen Volkes,* 8 vol. (1893–1926; "History of the German People"), by one of his former teachers, Johannes Janssen.

Pastor, Tony, in full ANTONIO PASTOR (b. May 28, 1837, New York City—d. Aug. 26, 1908, Elmhurst, N.Y., U.S.), impresario and comic singer, considered the father of vaudeville in the United States.

An entertainer from the age of six, Pastor appeared at P.T. Barnum's American Museum in New York City as a child prodigy and then appeared in minstrel shows and in

Tony Pastor
Culver Pictures

the circus before he first performed in a variety show in 1861. He opened his own variety theatre in New York City in 1865 and the Fourteenth Street Theatre (New York City) in 1881. Though at the time variety shows featured coarse humour and were considered to be unsuitable entertainment for ladies, Pastor advertised his Fourteenth Street Theatre as "the first specialty and vaudeville theatre of America, catering to polite tastes, aiming to amuse, and fully up to current times and topics." His unexpected success encouraged other theatre managers to adopt his code of prohibitions, and a more wholesome form of vaudeville soon replaced the earlier form.

Pastora Gómez, Edén, byname ZERO, or COMMANDER ZERO (b. 1937?), Nicaraguan guerrilla leader and legendary fighter.

A military commander of the Sandinista movement, Pastora led the assault on the national palace in Managua on Aug. 22, 1978. Twenty-three men under his command took about 1,000 hostages, about half of them legislators and other government officials, including José Somoza Abrego, nephew of President Anastasio Somoza Debayle, and Somoza's cousin, Luis Paillais Debayle. The government capitulated to the insurgents' demands, freeing 59 political prisoners and paying a reputed ransom of $500,000. The guerrillas, including Pastora, were flown to exile in Panama. This episode initiated a period of heightened political strife that resulted in Somoza's departure from the country and the assumption of power by the Sandinista junta on July 20, 1979. Pastora was named deputy interior minister.

The junta never allotted Pastora much political power, but because of his enormous popularity with the masses he was prominent in every national celebration. In July 1981 Pastora resigned as vice minister of defense and voluntarily exiled himself. He later condemned the junta that he had helped to power for its repressiveness and failure to live up to its ideals and founded an insurgent group, which eventually disbanded because of Pastora's refusal to join the U.S.-supported rebels.

Pastoral Epistles (New Testament writings): *see* Timothy, letters of Paul to.

pastoral literature, class of literature that presents the society of shepherds as free from the complexity and corruption of city life. Many of the idylls written in its name are far remote from the realities of any life, rustic or urban. Among the writers who have used the pastoral convention with striking success and vitality are the classical poets Theocritus and Virgil and the English poets Edmund Spenser, Robert Herrick, John Milton, Percy Bysshe Shelley, and Matthew Arnold.

The pastoral convention sometimes uses the device of "singing matches" between two or more shepherds, and it often presents the poet and his friends in the (usually thin) disguises of shepherds and shepherdesses. Themes include, notably, love and death. Both tradition and themes were largely established by Theocritus, whose *Bucolics* are the first examples of pastoral poetry. The tradition was passed on, through Bion, Moschus, and Longus, from Greece to Rome, where Virgil (who transferred the setting from Sicily to Arcadia, in the Greek Peloponnese, now the symbol of a pastoral paradise) used the device of alluding to contemporary problems—agrarian, political, and personal—in the rustic society he portrayed. His *Eclogues* exerted a powerful effect on poets of the Renaissance, including Dante, Petrarch, and Giovanni Boccaccio in Italy; Pierre de Ronsard in France; and Garcilaso de la Vega in Spain. These were further influenced by medieval Christian commentators on Virgil and by the pastoral scenes of the Old and New Testaments (Cain and Abel, David, the Bethlehem shepherds, and the figure of Christ the good shepherd). During the 16th and 17th centuries, too, pastoral romance novels (by Jacopo Sannazzaro, Jorge de Montemayor, Miguel de Cervantes, and Honoré d'Urfé) appeared, as did in the 15th and 16th centuries the pastoral drama (by Torquato Tasso and Battista Guarini).

In English poetry there had been some examples of pastoral literature in the earlier 16th century, but the appearance in 1579 of Edmund Spenser's *Shepheardes Calender,* which imitated not only classical models but also the Renaissance poets of France and Italy, brought about a vogue for the pastoral. Sir Philip Sidney, Robert Greene, Thomas Nash, Christopher Marlowe, Michael Drayton, Thomas Dekker, John Donne, Sir Walter Raleigh, Thomas Heywood, Thomas Campion, William Browne, William Drummond, and Phineas Fletcher all wrote pastoral poetry. (This vogue was subjected to some satirical comment in William Shakespeare's *As You Like It*—itself a pastoral play.) The first English novels, by Robert Greene and Thomas Lodge, were written in the pastoral mode. Apart from Shakespeare, playwrights who attempted pastoral drama included John Lyly, George Peele, John Fletcher, Ben Jonson, John Day, and James Shirley.

The climax of this phase of the pastoral tradition was reached in the unique blend of freshness and learned imitation achieved by the poetry of Herrick and of Andrew Marvell. Later 17th-century work, apart from that of Milton, was more pedantic. The 18th-century revival of the pastoral mode is chiefly remarkable for its place in a larger quarrel between those Neoclassical critics who preferred "ancient" poetry and those others who supported the "modern." This dispute raged in France, where the "ancient" sympathy was represented in the pastoral convention by René Rapin, whose shepherds were figures of uncomplicated virtue in a simple scene. The "modern" pastoral, deriving from Bernard de Fontenelle, dwelled on the innocence of the contemporary rustic (though not on his miseries). In England the controversy was reflected in a quarrel between Alexander Pope and Ambrose Philips, though the liveliest pastorals of the period were by John Gay, whose mode was burlesque (and whose *Beggar's Opera* is ironically subtitled "A Newgate Pastoral"—Newgate being one of London's prisons).

A growing reaction against the artificialities of the genre, combined with new attitudes to the natural man and the natural scene, resulted in a sometimes bitter injection of reality into the rustic scenes of such poets and novelists as Robert Burns, George Crabbe, William Wordsworth, John Clare, George Eliot, Thomas Hardy, George Sand, Émile Zola, B.M. Bjørnson, and Knut Hamsun. Only the pastoral elegy survived, through Shelley and Matthew Arnold.

In the time since Wordsworth, poets have sometimes revived the pastoral mode, though usually for some special purpose of their own—often ironic, as in the eclogues of Louis MacNeice, or obscure, as when W.H. Auden called his long poem *The Age of Anxiety* "a baroque eclogue." *See also* elegy.

pastoral staff: *see* crosier.

Pastorius, Francis Daniel (b. Sept. 26, 1651, Sommerhausen, Bavaria [Germany]—d. *c.* Jan. 1, 1720, Germantown, Pa. [now U.S.]), German educator, humanitarian, author, and public official who helped settle Pennsylvania and was founder of Germantown, Pa.

After graduating from the University of Altdorf in 1676, Pastorius practiced law in Germany and, from 1680 to 1682, traveled throughout western Europe as a tutor to a young German noble. In April 1683 he became the agent for an association of German Quakers, called the Frankfurt Land Company, who wished to purchase land within the Pennsylvania proprietorship. Pastorius arrived in Philadelphia that summer, purchased 15,000 acres of land from William Penn, and in the autumn established the settlement of Germantown.

Pastorius served Germantown and the province of Pennsylvania until his death. He was the settlement's first mayor and acted in that capacity as well as being town clerk until the community lost its charter in 1707. He also was a member of Pennsylvania's assembly in 1687 and 1691.

Pastorius taught at the Friend's school in Philadelphia from 1698 to 1700. He later founded his own school in Germantown and taught there for 17 years. In 1688 he was one of several Pennsylvania Quakers who signed a protest against keeping slaves that, though unsuccessful, was the first of its kind in the English colonies. He spoke several languages, kept an extensive library, and was well-versed in numerous fields of knowledge. He wrote a number of works in both German and English, among them *A New Primmer or Methodical Directions to Attain the True Spelling, Reading, and Writing of English,* first sold in 1698.

Pastoureaux (French: "Shepherds"), the participants in two popular outbreaks of mystico-political enthusiasm in France in 1251 and 1320. The first Pastoureaux were peasants in northeastern France who were aroused in 1251 by news of reverses suffered by King Louis IX in his first crusade against the Muslims. Accusing the nobles, clergy, and bourgeoisie of indifference to the king's fate, they began pillaging churches and towns. The regent of France, Blanche of Castile, who initially supported the movement, easily had the Pastoureaux put down and dispersed.

More serious was the mass rising of the Pastoureaux in 1320, directed against Philip V, whom they blamed for not undertaking a crusade. Led on by unfrocked priests and charlatans, the Pastoureaux converged on Paris. There they held the king besieged and helpless while they sacked the city and expanded their ranks with convicts released from the prisons. Still clamouring for a crusade, they marched, about 40,000 strong, southwestward into the Garonne Valley, indulging in pogroms against Jews and lepers on the way. They were finally routed by the seneschal of Carcassonne; scattered bands still roamed through southern France in 1322.

pastry, stiff dough made from flour, salt, a relatively high proportion of fat, and a small proportion of liquid. It may also contain sugar or flavourings. Most pastry is leavened only by the action of steam, but Danish pastry is raised with yeast. Pastry is rolled or patted out into thin sheets to line pie or tart pans and to enclose fillings. Poultry, tenderloin of beef and other cuts of meat, and pâtés are sometimes prepared *en croûte*, wrapped in a pastry crust. Thicker sheets may be formed into cases, pinwheels, crescents, or braids, with or without fillings and glazes or icings.

Variations in technique and ingredients yield pastries of varying texture. For a flaky pastry, low-gluten flour is quickly blended with butter, lard, or vegetable shortening so that the fat is broken into bits. A minimum of liquid is used, and the pastry is handled as little as possible. The extreme of flaky pastry is *pâté feuill-etée*, which is formed by folding and refolding a butter-filled pastry to form hundreds of layers of flour and butter that rise in the oven to 12 times the height of the uncooked pastry. A yeast dough is layered with butter in a similar manner to produce *wienbrod*, or Danish pastry. A short pastry is one in which the ingredients are well amalgamated so that the baked pastry is tender and fine-textured, tending to crumble rather than flake. In pastries requiring tensile strength, high-gluten flour is preferred, with eggs and a higher proportion of liquid adding to the malleability of the dough. Phyllo and strudel pastries are of this type, rolled or stretched out to paper thinness.

Pastry War (1838–39), brief and minor conflict between Mexico and France, arising from the claim of a French pastry cook living in Tacubaya, near Mexico City, that some Mexican army officers had damaged his restaurant. A number of foreign powers had pressed the Mexican government without success to pay for losses that some of their nationals claimed they had suffered during several years of civil disturbances. France decided to back up its demand for 600,000 pesos by sending a fleet to Veracruz, the principal Mexican port on the Gulf of Mexico. After bombarding the fortress of San Juan de Ulúa, situated on a reef outside the harbour, and occupying the city (April 16, 1838), the French won a guarantee of payment through the good offices of Great Britain and withdrew their fleet (March 9, 1839). The most important domestic result of the conflict was the further enhancement of the prestige and political influence of the dictator Antonio López de Santa Anna, who lost a leg in the fighting.

Pasture, Rogier de la (painter): *see* Weyden, Rogier van der.

Pāśupata, perhaps the earliest Hindu sect to worship the god Śiva (Shiva) as the supreme deity; it gave rise in turn to numerous subsects that flourished in Gujarāt and Rājasthān, at least until the 12th century, and also travelled to Java and Cambodia. The sect takes its name from Paśupati, an epithet of Śiva meaning Lord of Cattle, which was later extended to convey the meaning "Lord of Souls."

The Pāśupata sect is mentioned in the Indian epic the *Mahābhārata*. Śiva himself was believed to have been the first preceptor of the system. According to legends contained in later writings such as the *Vāyu-Purāṇa* and the *Liṅga-Purāṇa*, Śiva revealed that he would make an appearance on Earth during the age of Lord Vishnu's appearance as Vāsudeva-Krishna. Śiva indicated that he would enter a dead body and incarnate himself as Lakulin (or Nakulin or Lakulīśa, *lakula* meaning "club"). Inscriptions of the 10th and 13th centuries appear to corroborate the legend, as they refer to a teacher named Lakulin, who was believed by his followers to be an incarnation of Śiva. On analogy with the Vāsudeva cult, some historians place the rise of the Pāśupatas as early as the 2nd century BC, while others prefer the 2nd century AD as a date of origin.

The ascetic practices adopted by the Pāśupatas included the thrice-daily smearing of their bodies with ashes, meditation, and chanting the symbolic syllable "om." The school fell into disrepute when some of the mystical practices were distorted. Out of the Pāśupata doctrine developed two extreme schools, the Kālāmukhas and the Kāpālikas, as well as one moderate sect, the Śaivas (also called the Siddhānta school). The Pāśupatas and the extreme sects were called Atimārgika (schools away from the path) to maintain their distinction from the more rational and acceptable Śaivas, whose development led into modern Śaivism. *See also* Kāpālika and Kālāmurkha.

Pasuruan, Dutch PASOEROEAN, *kotamadya* (city) and *kabupaten* (regency), Jawa Timur *propinsi* (East Java province), Java, Indonesia, on Selat (strait) Madura. The Dutch first established a fort at Pasuruan in 1707. It was the capital of a residency from 1811 to 1934, which, by transferring to Malang in 1934, precipitated the industrial decline of the town, with much of its trade being diverted to Probolinggo. The city has institutes of forestry and copper mining, a research institute for pulmonary diseases, a hospital, and a number of schools. Industries include rice milling, tanneries, light engineering, shipbuilding, and cabinetmaking. The surrounding district is a fertile rice-growing area, supplying the local mills. The Surabaya–Banyuwangi railway passes through Pasuruan. Pop. (1980) city, 95,864; regency, 1,034,967.

pāṭ (plant): *see* jute.

Patagonia, semiarid, scrub plateau in southern Argentina. It is the largest desert in the Americas, with an area of about 260,000 sq mi (673,000 sq km). Its approximate boundaries are the Río Colorado in the north, the Atlantic Ocean in the east, the Río Coig in the south, and the Andes in the west.

The following article summarizes information about Patagonia; for full details, *see* MACROPAEDIA: South America.

The Patagonian tableland is a region of vast, steppe-like (virtually treeless) plains. Along the Río Negro, the land rises westward in a series of fairly level plains from about 300 ft (90 m) at the Atlantic coast to about 3,000 ft at the base of the Andes. South of the Río Negro, the plains are more irregular. The Atlantic coast consists largely of high cliffs separated from the sea by a narrow coastal plain. Basaltic sheets cover the tableland east of Lakes Buenos Aires and Pueyrredón. Areas of hilly land are composed of resistant crystalline rocks. The deep, wide valleys bordered by high cliffs that cut the tableland from west to east are all beds of rivers including the Colorado, Negro, Chubut, Chico, and Santa Cruz, that flow from the Andes to the Atlantic.

The northern zone of Patagonia is semiarid, with annual mean temperatures between 54° and 68° F (12° and 20° C); the rainfall varies from 4 to 17 in. (101 to 432 mm) annually. The southern zone has a cold, dry climate, with temperatures that are higher along the coast than they are inland and with strong west winds. The northern zone consists primarily of open bushland. Grasses flourish in the sandy areas, and irrigated crops including peaches, plums, almond, grapes, vegetables, and alfalfa are grown in the valleys. The varied animal life includes guanaco, llama, fox, skunk, mountain cats, puma, eagle, sparrow hawk, and a wide variety of snakes and lizards.

Among the Patagonia's important natural resources are petroleum around Comodoro Rivadavia, Plaza Huincul, and Cartriel; iron ore at Sierra Grande in Río Negro province; copper in Neuquén province; and uranium and manganese in Chubut province.

Pāṭaliputra (India): *see* Patna.

Pātan, town, Mehsāna district, Gujarāt state, west central India, situated on the Saraswati River in the lowlands between the Arāvalli Range and the Gulf of Cambay. Once capital of the Chāvada and Solaṅki dynasties (720–1242), it was sacked in 1024 by Maḥmūd of Ghazna. Pātan is a commercial centre for agricultural produce; industries include cotton milling, weaving, embroidering, and wood and ivory carving. Pottery and swords are also manufactured in the town, which is served by a railroad. Pop. (1981) 79,196.

Pātan (Nepal): *see* Lalitpur.

Pātan-Somnāth (India): *see* Somnāth.

Patángoro, also spelled PANTÁGORO, Indian people of western Colombia, apparently extinct since the late 16th century. They spoke a language of the Chibchan family. The Patángoro were agricultural, raising corn (maize), sweet manioc (yuca), beans, avocados, and some fruit. Land was cleared by slash-and-burn methods, and planting was done with digging sticks by the sisters of the man who owned the field. Fishing was an important food source, but hunting was not; and there were no domesticated animals except possibly tamed fledglings. Their villages of 50 to 100 houses, located in high places, were sometimes fenced by wooden palisades for defense purposes. Clothing was minimal: men went naked, and women wore a small cotton apron. Skull deformation was practiced, and feathers, beads, and (rarely) gold ornaments were worn. Little is known about Patángoro crafts, although evidently pottery was made. Marriage consisted of a trade between two men of their sisters, and most men had several wives, who were often themselves sisters. Marriages were ended without formality if the husband or the wife's brother so wished; in such a case the divorced wife was returned in exchange for the sister originally traded. The Patángoro recognized several deities, the most important of which was Am, a wind god.

Their methods of warfare were cruel. They fought continually with their neighbours and killed and ate their prisoners.

Patani (Thailand): *see* Pattani.

Patañjali, also called GONARDĪYA, or GONIKĀPUTRA (fl. 2nd century BC or 5th century AD), author or one of the authors of two great Hindu classics: the first, *Yoga-sūtras,* a categorization of Yogic thought arranged in four volumes with the titles "Psychic Power," "Practice of Yoga," "Samādhi" (transcendental state induced by trance), and "Kaivalya" (liberation); and the second, the *Mahābhāṣya* ("Great Commentary"), which is both a defense of the grammarian Pāṇini against his chief critic and detractor Kātyāyana and a refutation of some of Pāṇini's aphorisms.

The *Yoga-sūtras* seems to span several centuries, the first three volumes apparently written in the 2nd century BC and the last book in the 5th century AD. Authorities therefore tend to credit more than one author writing under this name, although there is wide variance in opinion. There is a possibility that many men used this name, as it was used by the authors of a number of other works on such diverse subjects as medicine, metrics, music, and alchemy. The name itself is obviously a pseudonym, since it denotes no caste and implies divine descent from the Great Serpent, Śeṣa.

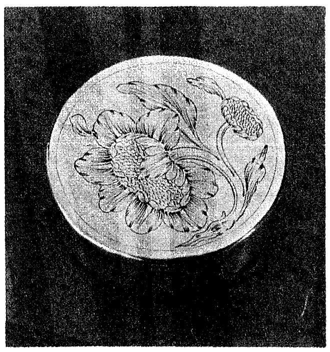
Patarine, also spelled PATARENE, Italian PATARINO, plural PATARINI, member of a medieval group of lay craftsmen, tradesmen, and peasants organized in Milan about 1058 to oppose clerical concubinage and marriage; the group later widened its attack to oppose generally the papacy's moral corruption and temporal powers. The Patarine movement was so called because, under the leadership of Arialdus (Arialdo), a deacon of Milan, its members used to assemble in the Pataria, or ragmen's quarter of the city (*pates* being a dialectal word for "rag"). Viewed by the church as heretical, the Patarines, though short-lived in terms of organized activities, became an impetus for a large number of religious-reform movements that arose during the decline of the feudal system and the beginnings of the aspirations to power of the peasant and middle classes.

In the 13th century the name was appropriated by the Cathari, who said it came from *pati* ("to suffer"), because they endured hardship for their faith.

patas monkey (*Erythrocebus*, or *Cercopithecus, patas*), long-limbed quadrupedal monkey, family Cercopithecidae. Because of its colour and habits, it is also called red guenon and Hussar, military, and dancing red monkey. The adult patas monkey has a shaggy red coat set off by a white mustache and white underparts. It is about 50–70 cm (20–28 inches) long excluding the tail of about the same length. Omnivorous and predominantly terrestrial, it lives in bands in the grass and scrub regions of Central Africa. Single young are born, possibly only at a certain time of year, after a gestation period estimated at 170 days. The patas monkey is said to be a good pet but is somewhat delicate in captivity.

Patas monkey (*Erythrocebus patas*)
George Schaller

patch box, small, usually rectangular, sometimes oval box used mostly as a receptacle for beauty patches, especially in the 18th century. During the days of Louis XV, black patches of gummed taffeta were popular with fashionable women (and sometimes men) who wanted to emphasize the beauty or whiteness of their skin.



Early American silver patch box by William Rouse, about 1690–1705; in the Yale University Art Gallery
By courtesy of the Yale University Art Gallery, the Mable Brady Garvan Collection

The patches varied in form and design from simple spots, stars, or crescents to elaborate animals, insects, or figures. Patches had their own tacit language: a patch at the corner of the eye could indicate passion, one at the middle of the forehead could express dignity. Women sometimes carried their patch boxes (which sometimes also contained rouge) with them. A gift of a patch box could be a costly expression of admiration and sentiment, for they were usually gold, sometimes enameled or painted with amorous scenes and encrusted with jewels.

patch test, controlled application of biological or chemical substances to the skin in order to detect if the subject has an allergic hypersensitivity to one of them. The test was originally developed to test new chemical compounds for their allergic potential on animals but has since become widely used to diagnose allergies in humans. Patch testing is usually done on the skin of the upper back or the outer arm. Small amounts of test substances diluted in a solvent such as water or petroleum jelly are applied to the skin under a patch of cloth or soft paper and an impermeable membrane. The patch is left in place for 48 hours, after which the skin reaction is examined and scored from 0 (no apparent reaction) to 4+, indicating severe blistering as well as angry redness of the exposed skin. Patch testing is an extremely accurate indicator of allergic sensitivity.

Patchen, Kenneth (b. Dec. 13, 1911, Niles, Ohio, U.S.—d. Jan. 8, 1972, Palo Alto, Calif.), American experimental poet, novelist, painter, and graphic designer.

Itinerant in his youth and only occasionally a student, Patchen worked at many jobs before beginning to write and paint. He published many collections of verse from 1936 on, notably *Collected Poems* (1968), and several novels, including *The Journal of Albion Moonlight* (1941), *Memoirs of a Shy Pornographer* (1945), and *See You in the Morning* (1948). He also wrote plays and other works, all of which exhibit a combination of high idealism, abhorrence of violence, isolation from the mainstream of American thought, and shock at materialistic secularism.

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patchwork, the piecing together of shaped bits of fabric. This craft, practiced since early Egyptian times, was extremely popular in Medieval and Renaissance Europe, when it was used for dresses, wall and bed hangings, and ecclesiastical decorations.

Patchwork quilts, usually featuring geometrical patterns, were designed in America by early settlers for utilitarian reasons. The quilts became especially popular in the 18th and 19th centuries and remain a folk art in 20th-century America.

pâté (French: "paste"), in French cuisine, a filled pastry, analogous to the English pie. The term pâté is also used, with modifiers, to denote two other distinct preparations: pâté *en terrine,* a meat, game, or fish mixture wrapped in suet or other animal fat or lining and cooked in a deep oval or oblong dish, without pastry, and served cold; and pâté *en croûte,* a meat, game, or fish filling cooked in a crust and served hot or cold. It is from pâté *en terrine,* more properly abbreviated *terrine,* that the pâté of British and American usage derives.

Certain pâtés are traditionally associated in France with specific occasions. The Pâté *de Pâques,* for example, which is filled with either ground meat, slices of pork, chicken, or rabbit, and hard-boiled egg slices, is an Easter specialty of the Poitou region. Pâté de foie gras, a pastry that is filled with liver of specially fattened goose or duck, is a world-renowned delicacy.

pâte-sur-pâte (French: "paste on paste"), method of porcelain decoration in which a relief design is created on an unfired, unglazed body by applying successive layers of white slip (liquid clay) with a brush. The technique was first employed by the Chinese in the 18th century. It was introduced in Europe in about 1850 at Sèvres, where it was perfected by Marc-Louis Solon, who later worked for Minton. The technique was also used in the

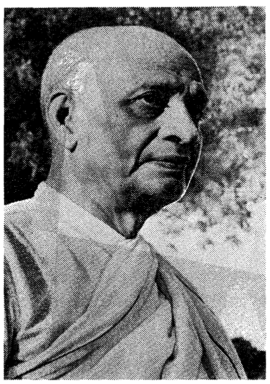
Plaque with pâte-sur-pâte decoration by Marc-Louis Solon, Sèvres, Fr., about 1875; in the Victoria and Albert Museum, London
By courtesy of the Victoria and Albert Museum, London; photograph, EB. Inc.

United States, at the Rookwood factory in Cincinnati, Ohio.

Pategi, town, Kwara state, west-central Nigeria. It lies on the south bank of the Niger River opposite the town of Mureji and the mouth of the Kaduna River. Founded in the late 16th century by the king of the Nupe peoples, the town, the name of which means "small hill," became the capital of the Pategi emirate in 1898. Idrisu Gana, the leader of the Kede (a subgroup of the Nupe), had given aid to the Royal Niger Company in its conquest of Bida, a Fulani-dominated Nupe town (28 miles [45 km] north-northeast), in 1897; and, in return, the company recognized him as the king of the Nupe and the first emir of Pategi. Most of the inhabitants of the area are Muslim Nupe people.

Pategi is a collecting point for the rice grown on the floodplains of the Niger and for dried fish. It is also a market centre for rice, yams, sorghum, millet, corn (maize), sugarcane, kola nuts, peanuts (groundnuts), palm produce, and cotton. Pop. (latest census) 5,399.

Patel, Vallabhbhai Jhaverbhai, byname SARDĀR PATEL (Hindi: "Leader Patel") (b. Oct. 31, 1875, Nadiād, Gujarāt, India—d. Dec. 15, 1950, Bombay), Indian barrister and statesman, one of the leaders of the Indian Na-



Patel
By courtesy of the Information Service of India, London

tional Congress during the struggle for Indian independence. During the first three years of Indian independence after 1947, he served as deputy prime minister, minister of home affairs, minister of information, and minister of states.

Early life. Patel was born into a self-sufficient landowning family of the Leva Patidar caste. Reared in an atmosphere of traditional Hinduism, he attended primary school at Karamasad and high school at Petlād but was mainly self-taught. Patel married at the age of 16, matriculated at 22, and passed the district pleader's examination, which enabled him to practice law. In 1900 he set up an independent office of district pleader in Godhra, and two years later he moved to Borsad, in Kheda district.

Legal career. As a lawyer, Patel distinguished himself in presenting an unassailable case in a precise manner and in challenging police witnesses and British judges. In 1908 Patel lost his wife, who had borne him a son and daughter, and thereafter remained a widower. Determined to enhance his career in the legal profession, Patel traveled to London in August 1910 to study at the Middle Temple. There he studied diligently and passed the final examinations with high honours.

Returning to India in February 1913, he settled in Ahmadābād, rising rapidly to become the leading barrister in criminal law at the Ahmadābād bar. Reserved and courteous, he was noted for his superior mannerisms, his smart, English-style clothes, and his championship in bridge at Ahmadābād's fashionable Gujarāt Club. He was, until 1917, indifferent to Indian political activities.

In 1917 Patel found the course of his life changed after having been influenced by Mohandas K. Gandhi. Patel adhered to Gandhi's satyagraha (policy of nonviolence) insofar as it furthered the Indian struggle against the British. But he did not identify himself with Gandhi's moral convictions and ideals, and he regarded Gandhi's emphasis on their universal application as irrelevant to India's immediate political, economic, and social problems. Nevertheless, having resolved to follow and support Gandhi, Patel changed his style and appearance. He quit the Gujarāt Club, dressed in the white cloth of the Indian peasant, and ate in the Indian manner.

From 1917 to 1924 Patel served as the first Indian municipal commissioner of Ahmadābād and was its elected municipal president from 1924 to 1928. Patel first made his mark in 1918, when he planned mass campaigns of peasants, farmers, and landowners of Kaira district, Gujarāt, against the decision of the Bombay government to collect the full annual revenue taxes despite crop failures caused by heavy rains.

In 1928 Patel successfully led the landowners of Bārdoli in their resistance against increased taxes. His efficient leadership of the Bārdoli campaign earned him the title *sardār* ("leader"), and henceforth he was acknowledged as a nationalist leader throughout India. He was considered practical, decisive, and even ruthless, and the British recognized him as a dangerous enemy.

Political philosophy. Patel, however, was no revolutionary. In the crucial debate over the objectives of the Indian National Congress during the years 1928 to 1931, Patel believed (like Gandhi and Motilal Nehru, but unlike Jawaharlal Nehru and Subhas Chandra Bose) that the goal of the Indian National Congress should be dominion status within the British Commonwealth—not independence. In contrast to Jawaharlal Nehru, who condoned violence in the struggle for independence, Patel ruled out armed revolution, not on moral but on practical grounds. Patel held that it would be abortive and would entail severe repression. Patel, like Gandhi, saw advantages in the future participation of a free India in a British Commonwealth, provided that India was admitted as an equal member. He emphasized the need to foster Indian self-reliance and self-confidence, but, unlike Gandhi, he did not regard Hindu-Muslim unity as a prerequisite for independence.

Patel disagreed with Jawaharlal Nehru on the need to bring about economic and social changes by coercion. A conservative rooted in traditional Hindu values, Patel belittled the usefulness of adapting socialist ideas to the Indian social and economic structure. He believed in free enterprise, thus gaining the trust of conservative elements, and thereby collected the funds that sustained the activities of the Indian National Congress.

Patel was the second candidate after Gandhi to the presidency of the 1929 Lahore session of the Indian National Congress. Gandhi shunned the presidency in an attempt to prevent the adoption of the resolution of independence and exerted pressure on Patel to withdraw, mainly owing to Patel's uncompromising attitude toward the Muslims; Jawaharlal Nehru was elected. During the 1930 Salt Satyāgraha, (prayer and fasting movement), Patel served three months' imprisonment. In March 1931 Patel presided over the Karāchi session of the Indian National Congress. He was imprisoned in January 1932. Released in July 1934, he marshaled the organization of the Congress Party in the 1937 elections and was the main contender for the 1937–38 Congress presidency. Again, because of Gandhi's pressure, Patel withdrew and Jawaharlal Nehru was elected. Along with other Congress leaders, Patel was imprisoned in October 1940, released in August 1941, and imprisoned once more from August 1942 until June 1945.

During the war Patel rejected as impractical Gandhi's nonviolence in the face of the then-expected Japanese invasion of India. On the transfer of power, Patel differed with Gandhi in realizing that the partition of the subcontinent into Hindu India and Muslim Pakistan was inevitable, and he asserted that it was in India's interests to part with Pakistan.

Patel was the leading candidate for the 1945–46 presidency of the Indian National Congress, but Gandhi once again intervened for the election of Nehru. Nehru, as president of the Congress, was invited by the British viceroy to form an interim government. Thus, in the normal course of events, Patel would have been the first prime minister of India. During the first three years of independence, Patel was deputy prime minister, minister of home affairs, minister of information, and minister of states; above all, his enduring fame rests on his achievement of the peaceful integration of the princely Indian states into the Indian Union and the political unification of India. (D.Ar.)

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patellar reflex: *see* knee-jerk reflex.

patent, a government grant of the exclusive right to make, use, or sell an invention, usually for a limited period. Patents are granted to new and useful machines, manufactured products, and industrial processes and to significant improvements of existing ones. Patents are also granted to new chemical compounds, foods, and medicinal products, as well as to the processes for producing them. Patents can even be granted to new plant or animal forms developed through genetic engineering.

The first recorded patent for an industrial invention is the one granted in 1421 in Florence to the architect and engineer Filippo Brunelleschi. The patent gave him a three-year monopoly on the manufacture of a barge with hoisting gear used to transport marble. It appears that such privileged grants to inventors spread from Italy to other European nations over the next two centuries. In many cases such grants dealt with the importation and establishment of new industries, as in England at the time of Queen Elizabeth I. It soon became apparent that unlimited duration of exclusive rights created unfair monopolies, and in 1623 Parliament enacted the Statute of Monopolies. Although it prohibited most royal monopolies, it specifically reserved the right to grant "letters patent" for inventions of new manufactures for up to 14 years. In the United States, Article I, Section 8 of the Constitution authorizes Congress to create a national patent system to "promote the Progress of Science and useful Arts" by "securing for limited Times to . . . Inventors the exclusive Right to their respective . . . Discoveries." Congress passed the first U.S. Patent Statute in 1790. France enacted its patent system the following year. By the end of the 19th century many countries had patent laws, and today there exist approximately 100 separate jurisdictions regarding patents.

In most cases an invention must be considered novel and useful in order to receive a patent. It must also represent a relatively significant advance in the state of the art and can not merely be an obvious change from what is already known to people with ordinary skill in the art. Such stipulations are meant to reduce the number of inventions that modify existing products in minimal ways. Patents are frequently granted for improvements of previously patented articles or processes if the requirements of patentability are otherwise met.

A patent is recognized as a species of property and has the attributes of personal property. It may be sold (assigned) to others or mortgaged or may pass to the heirs of a deceased inventor. Because the patent gives the owner the right to exclude others from making, using, or selling the invention, he or she may authorize others to do any of these things by a license and receive royalties or other compensation for the privilege. If any persons make use of a patented invention without authorization, their infringement can be brought to court in a suit filed by the patent holder, who may ask for an amount of money in damages as well as a court injunction to prevent further infringement.

The duration of patents varies, ranging from 16 to 20 years in most countries. In some countries, like France, certain types of patents are given shorter terms because the inventions have an overall general usefulness. After the patent term expires, the invention is open to public use. In socialist countries like the Soviet Union, where property is treated differently, patents per se have not been recognized. Instead, certificates are issued to inventors to ensure that they receive some form of compensation for their work. This, however, is changing. For example, China, which modeled its earlier patent system on that of the Soviet Union, enacted a wholly revised patent law in 1985. In many respects it mirrors the patent law of European countries, with the exception that enterprises rather than individuals are the usual grantees of Chinese patent rights.

In most countries, patents are granted only after examination of a patent application by trained inspectors, who review prior inventions and patents. Countries vary widely as to the rigour of such examinations. Most countries, in instances of competing claims to an invention, grant the patent to the first to file the application. The United States constitutes the major exception to this rule, granting priority to the party who can prove it was the first actually to invent regardless of time of filing.

It does not always follow that a patent holder will market an invention or even license it to someone who wants to. Such a situation might keep a useful invention from being of service to the public. Thus many laws, from the 19th century on, have included various clauses that stipulate compulsory "working" of an invention. This means that the patentee must manufacture the invention or license it to someone who will. This is also the case when the main patent generates other "dependent" patents; the main patentee may be legally compelled to grant licenses to those who hold dependent patents. Occasionally, companies holding patents may manage to form monopolies that affect entire fields of commerce. Antitrust suits brought by the government may force such companies to license those patents. In the United States, there is no requirement to "work" a patent. An issued U.S. patent that has never been turned into a commercial reality remains the property of the inventor (unless assigned by the inventor) and is presumed to be as valid as one that has spawned an entire new industry.

With the ever-increasing scope of commerce and international business concerns, there has been a need for bilateral patent agreements between nations. In general, inventors must apply for patents in each country where they wish to manufacture, use, or sell their inventions. International efforts have been made to facilitate this process. The first effort to ease multinational patent differences was the International Convention for the Protection of Industrial Property, originally adopted in Paris in 1883 and amended several times since. It gave inventors who file an application in one member country the benefit of using that first filing date for applications in other member states. Similarly, the 1970 Patent Cooperation Treaty simplifies the filing of patent applications on the same invention in different countries by providing, among other things, centralized filing procedures and a standardized application format. More recently, the European Patent Convention, implemented in 1977, created a European Patent Office that can issue a European patent, which acquires the status of a national patent in each of the member nations designated by the applicant.

patent ductus arteriosus, persistence of a channel that shunts blood between the pulmonary artery and the aorta. Normally, after birth, the pulmonary artery carries blood depleted of oxygen and laden with carbon dioxide from the right lower chamber of the heart to the lungs, where the excess carbon dioxide is removed from the blood and replaced with oxygen. Before birth the fetus depends upon its mother's circulation for this function and not on its own lungs. Consequently, most of the blood pumped into the pulmonary artery is shunted through the ductus arteriosus into the aorta for distribution into the general circulation. Normally at birth the ductus arteriosus constricts and closes, becoming a fibromuscular cord.

Persistence of the open passage is a congenital defect that ordinarily causes no symptoms. It is diagnosed from characteristic abnormalities of the heart sounds. If the passageway is large, it can have serious effects, acting as a shunt that carries blood from the aorta into the pulmonary artery. This reversal of the shunt pathway occurs because, as a normal part of the changes from fetal to postnatal circulation, the blood pressure in the aorta rises greatly, while that in the pulmonary artery falls. As a consequence of this shunt, the blood may be routed two or three times from the left ventricle to the lungs before it follows its normal course into the systemic circulation. The left side of the heart is thus greatly overworked and becomes enlarged, and the lungs become congested and their network of blood vessels suffers damage from excessive blood pressure. As a result, the victim's body is deprived of adequate oxygen during exertion—or, in extreme cases, even during rest. The oxygen deprivation is indicated by cyanosis (a bluish discoloration of the skin).

Infants with patent ductus arteriosus can be treated with drugs that effectively close the shunt in many cases. If drug therapy is unsuccessful, the ductus can be tied off surgically.

patent-note hymnal: *see* shape-note hymnal.

patent theatre, any of several London theatres that, through government licensing, held a monopoly on legitimate dramatic production there between 1660 and 1843. In reopening the theatres that had been closed by the Puritans, Charles II issued Letters Patent to Thomas Killigrew and William Davenant giving them exclusive right to form two acting companies. Killigrew established The King's Servants at Drury Lane, where they stayed. Davenant established The Duke of York's Servants at Lincoln's Inn Fields, from which they moved to Dorset Garden, finally settling at Covent Garden in 1732.

The legality of the patents, though continually questioned, was confirmed by Parliament with the Licensing Act of 1737, affirming Drury Lane and Covent Garden as the only legitimate theatres in England. Parliament began authorizing "theatre royals" outside of London in 1768, however, and in 1788 a bill was passed permitting local magistrates to license theatres outside a 20-mile radius of London. In London, evasion of the law was common, with unlicensed theatres offering undefined "public entertainments" and pantomime. In 1766 a third London theatre patent was issued to Samuel Foote for operation of the Haymarket Theatre during the summer months, and in 1807 the Earl of Dartmouth, as lord chamberlain, loosely interpreted the Licensing Act and began licensing other theatres in London. The Theatre Regulation Act of 1843 finally abolished the exclusive rights of the patent theatres to present legitimate drama.

Pater, Walter (Horatio) (b. Aug. 4, 1839, Shadwell, London, Eng.—d. July 30, 1894, Oxford, Oxfordshire), English critic, essayist, and humanist whose advocacy of "art for art's sake" became a cardinal doctrine of the movement known as Aestheticism.

Pater was educated at King's School, Canterbury, and at Queen's College, Oxford, where he studied Greek philosophy under Benjamin Jowett. He then settled in Oxford and read with private pupils. In 1864 he was elected to a fellowship at Brasenose College. Pater's early intention to enter the church gave way at this time to a consuming interest in classical studies. Pater then began to write for the reviews, and his essays on Leonardo da Vinci, Sandro Botticelli, Pico della Mirandola, Michelangelo, and others were collected in 1873 as *Studies in the History of the Renaissance* (later called simply *The Renaissance*). His delicate, fastidious style and sensitive appreciation of Renaissance art in these essays made his reputation

Pater, drawing by Simeon Solomon, 1872; in the Horne Museum, Florence
By courtesy of the Museo Horne, Florence

as a scholar and an aesthete, and he became the centre of a small group of admirers in Oxford. In the concluding essay in *The Renaissance,* Pater asserted that art exists for the sake of its beauty alone, and that it acknowledges neither moral standards nor utilitarian functions in its reason for being. These views brought Pater into an association with Swinburne and with the Pre-Raphaelites.

Marius the Epicurean (1885) is his most substantial work. It is a philosophical romance in which Pater's ideal of an aesthetic and religious life is scrupulously and elaborately set forth. The setting is Rome in the time of Marcus Aurelius; but this is a thin disguise for the characteristically late-19th-century spiritual development of its main character. *Imaginary Portraits* (1887) are shorter pieces of philosophical fiction in the same mode. *Appreciations* (1889) is a return to the critical essay, this time largely on English subjects. In 1893 came *Plato and Platonism,* giving an extremely literary view of Plato and neglecting the logical and dialectical side of his philosophy. Pater's *Greek Studies* (1895), *Miscellaneous Studies* (1895), and *Essays from The Guardian* (privately printed, 1896; 1901) were published posthumously; also published posthumously was his unfinished romance, *Gaston de Latour* (1896).

The primary influence on Pater's mind was his classical studies, coloured by a highly individual view of Christian devotion and pursued largely as a source of extremely refined artistic sensations. In his later critical writings Pater continued to focus on the innate qualities of works of art, in contrast to the prevailing tendency to evaluate them on the basis of their moral and educational value.

Pater's early influence was confined to a small circle in Oxford, but he came to have a widespread effect on the next literary generation. Oscar Wilde, George Moore, and the aesthetes of the 1890s were among his followers and show obvious and continual traces both of his style and of his ideas.

Pater Noster: *see* Lord's Prayer.

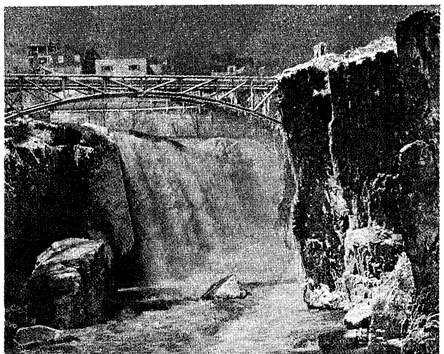
Paterculus, Velleius: *see* Velleius Paterculus.

Paterna ware, tin-glazed earthenware produced in the 14th and 15th centuries at Paterna, near Valencia, in eastern Spain. Although pottery was produced in Paterna as early as the 12th century under the Almohads, it was not famous until the reign of the Naṣrids (1230–1492), the last Islāmic dynasty of Spain. Like the works of the other great Hispano-Moresque pottery centres, Valencia, Manises, and Málaga, the stylistic origins of Paterna ware may be traced ultimately to the Middle East. Paterna ware is somewhat plainer in style, however, than the lustreware (pottery painted with metallic pigments) produced by these other cities, but the decorative effects are highly refined. Representational and abstract designs are usually combined in a rather formal, geometric manner. In spite of occasional Gothic motifs, Paterna ware has a strong Oriental quality, particularly evident in its stylized representations of animal figures. Greens, blues, manganese violets, and browns are the favourite colours painted on a white background. The most common surviving forms of Paterna ware are large plates and bowls, examples of which may be seen in the Louvre, in Paris.

Paternò, town, Catania *provincia,* eastern Sicily, Italy, situated at the southwestern foot of Mount Etna, overlooking the Simeto River, just northwest of Catania. Paternò is believed to occupy the site of the ancient Siculian town of Hybla Major or Hybla Geleatis. Paternò suffered heavily from Allied bombing in

World War II. It is dominated by the restored Norman castle (1073, rebuilt 14th century), and there are several medieval churches. It is a holiday resort with hot mineral springs, and citrus fruits and grapes are cultivated. Pop. (1984 est.) mun., 46,540.

Paterson, city, seat (1837) of Passaic County, northeastern New Jersey, U.S., situated on the Passaic River, 12 mi (19 km) northwest of New York City. It was founded after the American Revolution by advocates of American industrial independence from Europe who saw the Great Falls of the Passaic, which drop 70 ft (21 m), as the best potential industrial site on the Atlantic Seaboard. The enterprise was chartered by the New Jersey legislature in 1791 as the Society for Establishing Useful Manufactures (SUM); the city was named for Gov. William Paterson, one of the framers of the U.S. Constitution.



Great Falls on the Passaic River at Paterson, N.J.
George E. Jones III—Photo Researchers

A successful enterprise, SUM ultimately sold waterpower and building space to private manufacturers. The earliest industries were cotton mills, and in 1828 Paterson mechanics joined mill workers in the first recorded sympathy strike in America. Samuel Colt produced his first revolvers at the Old Gun Mill (preserved) in 1836. By 1837, when the locomotive industry was established, machine manufacturing had become important. The silk industry was introduced in 1839, and linen thread manufacture was begun in 1864. The city was the scene of many labour disputes, but by the mid-20th century it had become a centre of widely diversified industrial activity, including the manufacture of textiles, machinery, machine tools, and chemicals.

The William Paterson College of New Jersey (which was established as a normal school in 1855) is located at nearby Wayne. Paterson Museum is known for its collection of New Jersey rocks and Indian relics. One of the first successful submarines, the *Fenian Ram,* which was built by John P. Holland and sank in the Passaic River in 1881, was recovered in 1927 and placed on exhibit in Westside Park. Lambert Castle (1891) in the Garret Mountain Reservation houses the Passaic County Historical Society Museum. In 1976 the Great Falls area was designated a national historic site. Inc. 1851. Pop. (1984 est.) city, 138,818; Bergen-Passaic metropolitan area (PMSA), 1,299,500.

Paterson, A(ndrew) B(arton), byname BANJO PATERSON (b. Feb. 17, 1864, Narrambla, N.S.W., Australia—d. Feb. 5, 1941, Sydney), Australian poet and journalist noted for his composition of the internationally famous song "Waltzing Matilda." He achieved great popular success in Australia with *The Man from Snowy River and Other Verses* (1895), which sold more than 100,000 copies before his death, and *Rio Grande's Last Race and Other Verses* (1902), which also went through many editions.

Educated as a lawyer, Paterson practiced in Sydney until 1900, then became a journalist, covering the Boer War in South Africa and traveling on assignment to China and the Philippines. He became editor of the *Sydney Evening News* in 1904 but left this post two years later to edit the Sydney *Town and Country Journal.* He later took up ranching; but when World War I broke out, he traveled to Europe for the *Sydney Morning Herald* and later served with the armed forces in France and Egypt. After the war, he spent the rest of his life as a journalist. In 1905 Paterson published a collection of popular Australian songs, *The Old Bush Songs: Composed and Sung in the Bushranging,* and he also published *Digging and Overlanding Days,* another success. The famous "Waltzing Matilda" appeared in 1917 as part of a collection of verses entitled *Saltbush Bill, J.P., and Other Verses.* He also wrote a volume of verse for children (*The Animals Noah Forgot,* 1933) and some short stories.

Paterson, Sir Alexander (Henry) (b. Nov. 20, 1884, Bowden, Cheshire, Eng.—d. Nov. 7, 1947, London), penologist who modified the progressive Borstal system of English reformatories for juvenile offenders to emphasize its rehabilitative aspects.

Before serving as a prison commissioner (1922–47), Paterson had worked with discharged Borstal boys. He was therefore well qualified to undertake reform of the system, emphasizing special location and treatment on reformatory lines of prisoners from age 16 to 21 selected from the ordinary prisons. (The Borstal system had been implemented in 1902 by Sir Evelyn Ruggles-Brise at Borstal, Kent.) Among Paterson's innovations were the introduction of the Borstal house system, in which groups of delinquents live in individual houses, each with its own trained and dedicated housemaster and house staff who try to influence the boys by good example and a training program that includes hard but interesting work, extended education, and sports. Paterson emphasized that rehabilitation consists of sparking a drive for reform within the delinquent rather than imposing it upon him.

Paterson was knighted in 1947.

Paterson, William (b. April, 1658, Tenwald, Dumfries, Scot.—d. Jan. 22, 1719), Scottish founder of the Bank of England, writer on economic issues, and the prime mover behind an unsuccessful British settlement at Darién on the Isthmus of Panama.

By 1686 Paterson was a London merchant and a member of the Merchant Taylors' Company. In 1694 he organized the Bank of England, an institution long desired by the London merchants. He withdrew as a director the next year, following a policy disagreement. After an unsuccessful attempt to organize a rival bank in London, Paterson resumed efforts to start a colony at Darién. Along with a group of Scottish and English merchants seeking investment outlets, he secured in 1695 the passage by the Scottish Parliament of the Act for a Company Trading to Africa and the Indies. Paterson was deprived of his position in the company by the directors because he was suspected of being involved with a loss of company funds, although his guilt was never proved. He nevertheless accompanied the expedition in 1698 as a private citizen.

Paterson lost much of his financial investment in the affair. His wife and child died at Darién, and he was forced to return to England after falling gravely ill. Thereafter, Paterson continued agitation for new expeditions to the West Indies. Shortly before his death, the British government paid him an indemnity for his losses incurred in his ill-fated expedition.

Paterson, William (b. Dec. 24, 1745, County Antrim, Ire.—d. Sept. 9, 1806, Albany, N.Y., U.S.), Irish-born jurist, one of the framers of the U.S. Constitution, U.S. senator (1789–90) and governor of New Jersey (1790–93). He also served as an associate justice of the U.S. Supreme Court from 1793 to 1806.

Paterson emigrated to New Jersey with his family in 1747. He graduated in 1763 from the College of New Jersey (now Princeton University), studied law, and began to practice in 1769. He served twice in the provincial congress (1775–76), was a delegate to the state constitutional convention (1776), and from 1776 to 1783 was attorney general of New Jersey. In 1787 Paterson headed the New Jersey delegation to the federal Constitutional Convention, where he played a leading role in the opposition of the small states to representation according to population in the federal legislature. As an alternative to the Virginia (or large-state) Plan, Paterson submitted the New Jersey (or small-state) Plan, also called the Paterson Plan, which advocated an equal vote for all states. The issue was finally resolved with the compromise embodied in the bicameral legislature.

Paterson was instrumental in securing ratification of the final document in New Jersey and was elected one of the state's first two U.S. senators. Resigning his seat in 1790, he served as governor of New Jersey until 1793, when he was named an associate justice of the U.S. Supreme Court. The city of Paterson, N.J., was named for him.

Pathan (people): *see* Pashtun.

Pathé, Charles (b. Dec. 25, 1863, Paris—d. Dec. 26, 1957, Monte-Carlo), French pioneer motion-picture executive who controlled a vast network of production and distribution facilities that dominated the world film market during the first years of the 20th century.

Pathé
H. Roger-Viollet

With his brother Émile, he founded Pathé Frères (Pathé Brothers, 1896) in Paris, a company that manufactured and sold phonographs and phonograph cylinders. The company placed the Kinetoscope, Thomas A. Edison's newly invented viewing device, in theatres throughout France. Using the camera developed by Louis and Auguste Lumière, Pathé Frères filmed numerous short subjects, the majority of which are sensational criminal adventures, melodramatic love stories, and comic anecdotes. In 1909 Pathé produced his first "long film," *Les Misérables,* a four-reel screen version of the novel by Victor Hugo. That same year he originated the *Pathé Gazette* in France (U.S.: 1910; U.K.: 1911), which was an internationally popular newsreel until 1956. In 1914 Pathé Frères released from its studios in the United States the first episodes of *The Perils of Pauline,* one of the earliest and best remembered screen serials. The company also began publishing the screen magazine *Pathé Pictorial.*

Pathé Frères, with production facilities in France, England, and the United States and distribution offices throughout the world, was an enormously lucrative company. Profits on some pictures were 50 to 100 times the original cost of production. In 1917 Pathé began to sell the company's equipment, production studios, and exhibition circuits. He retired in 1929, but the company remained in existence as a leading film distributor.

Pathet Lao, left-oriented nationalist group in Laos that took control of the country in 1975. Founded in 1950, the Pathet Lao (Lao Country) movement joined with the Viet Minh, the Communist-oriented Vietnamese nationalist organization, in armed resistance to French rule in Indochina. In 1956 a legal political wing, the Lao Patriotic Front (Neo Lao Hak Xat), was founded and participated in several coalition governments. In the 1960s and early '70s the Pathet Lao fought a civil war against the U.S.-backed Vientiane regime, winning effective control in the north and east. In the spring of 1975 Pathet Lao forces consolidated their power throughout the country. The Vientiane government fell in May 1975, and Pathet Lao leaders formed a new government.

pathetic fallacy, poetic practice of attributing human emotion or responses to nature, inanimate objects, or animals. The practice is a form of personification that is as old as poetry, in which it has always been common to find smiling or dancing flowers, angry or cruel winds, brooding mountains, moping owls, or happy larks. The term was coined by John Ruskin in *Modern Painters* (1843–60). In some classical poetic forms such as the pastoral elegy, the pathetic fallacy is actually a required convention. In Milton's "On The Morning of Christ's Nativity," all aspects of nature react affectively to the event of Christ's birth.

The Stars with deep amaze
Stand fixt in steadfast gaze

Ruskin considered the excessive use of the fallacy the mark of an inferior poet. Later poets, however—especially the Imagists of the early 20th century, as well as T.S. Eliot and Ezra Pound—used the pathetic fallacy freely and effectively.

pathology, medical specialty concerned with the determining causes of disease and the structural and functional changes occurring in abnormal conditions. Early efforts to study pathology were often stymied by religious prohibitions against autopsies, but these gradually relaxed during the late Middle Ages, allowing autopsies to determine the cause of death, the basis for pathology. The resultant accumulating anatomical information culminated in the publication of the first systematic textbook of morbid anatomy by the Italian Giovanni Battista Morgagni in 1761, which located diseases within individual organs for the first time. The correlation between clinical symptoms and pathological changes was not made until the first half of the 19th century.

The existing humoral theories of pathology were replaced by a more scientific cellular theory; Rudolf Virchow in 1858 argued that the nature of disease could be understood by means of the microscopic analysis of affected cells. The bacteriologic theory of disease developed late in the 19th century by Louis Pasteur and Robert Koch provided the final clue to understanding many disease processes.

Pathology as a separate specialty was fairly well established by the end of the 19th century. The pathologist does much of his work in the laboratory and reports to and consults with the clinical physician who directly attends to the patient. The types of laboratory specimens examined by the pathologist include surgically removed body parts, blood and other body fluids, urine, feces, exudates, etc. Pathology practice also includes the reconstruction of the last chapter of the physical life of a deceased person through the procedure of autopsy, which provides valuable and otherwise unobtainable information concerning disease processes. The knowledge required for the proper general practice of pathology is too great to be attainable by single individuals, so wherever conditions permit it, subspecialists collaborate. Among the laboratory subspecialties in which pathologists work are neuropathology, pediatric pathology, general surgical pathology, dermatopathology, and forensic pathology.

Microbial cultures for the identification of infectious disease, simpler access to internal organs for biopsy through the use of glass fibreoptic instruments, finer definition of subcellular structures with the electron microscope, and a wide array of chemical stains have greatly expanded the information available to the pathologist in determining the causes of disease. Formal medical education with the attainment of an M.D. degree or its equivalent is required prior to admission to pathology postgraduate programs in many Western countries. The program required for board certification as a pathologist roughly amounts to five years of postgraduate study and training.

Pathum Thani, town and *changwat* (province) in the Central region of Thailand. The provincial capital, Pathum Thani town, is a rice-collecting and milling centre north of Bangkok on the west bank of the Mae Nam (river) Chao Phraya. The province, with an area of 589 sq mi (1,526 sq km), occupies the low, well-irrigated plains of the Chao Phraya and is intensively farmed in rice. Fishing is a secondary economic activity. Pop. (1983 est.) town, 11,583; province, 357,809.

Patiāla, city, administrative headquarters of Patiāla district, Punjab state, northwestern India. The city lies on a major rail line, as well as on a branch of the Sirhind Canal. Founded in 1763 as the capital of the princely state of Patiāla, it is a trade and industrial centre; weaving, cotton ginning, distilling, and manufacturing are among its industries. Punjabi University (established 1962) and 13 affiliated colleges are located in the city, as are an old fort and a modern sports stadium.

Patiāla district, 1,752 sq mi (4,538 sq km) in area, is a dry region watered only by a few *cos* (seasonal streams). Wheat, cotton, corn (maize), and gram (a legume) are the chief crops grown. The princely state of Patiāla, of which the present district was a part, was the most important in the Punjab. It merged with independent India in 1948, and the district became part of the reorganized Punjab state in 1966. Besides Patiāla, other important towns are Nābha, Samāna, and Rājpura. Pop. (1981) city, 205,141; metropolitan area, 206,144; district, 1,568,898.

Patience (card game): *see* Solitaire.

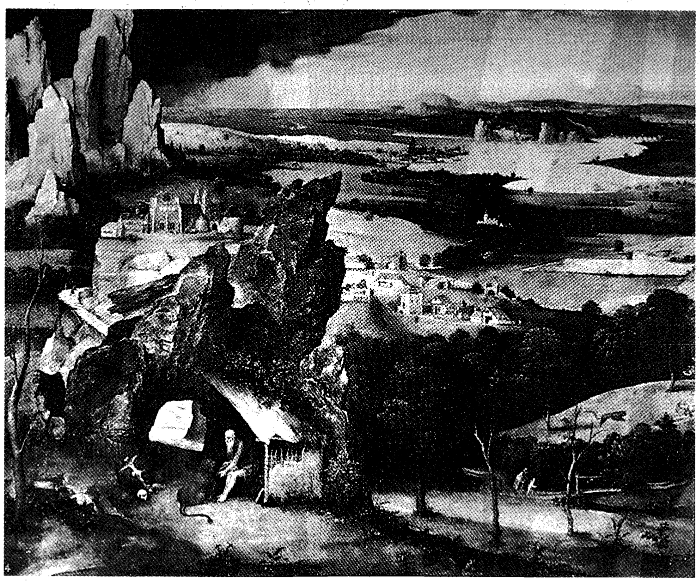
pātimokkha (Pāli: "that which is binding"), Sanskrit PRĀTIMOKṢA, Buddhist monastic code; a set of 227 rules that govern the daily activities of the monk and nun. The prohibitions of the *pātimokkha* are arranged in the Pāli canon according to the severity of the offense—from those that require immediate and lifelong expulsion from the order, temporary suspension, or various degrees of restitution or expiation to those that require confession only. Also given are rules for settling disputes within the monastic community. The entire *pātimokkha* is recited during the *uposatha,* or fortnightly assembly of Theravāda monks.

A comparable set of 250 monastic rules is contained in the Sanskrit canon of the Sarvāstivāda (Doctrine That All Is Real) tradition that was widely known in northern Buddhist countries. The Mahāyāna tradition in China and Japan more generally rejected those rules that were not applicable locally and substituted disciplinary codes that differed from sect to sect and sometimes even from monastery to monastery.

patina: *see* desert varnish.

Patinir, Joachim (de), Patinir also spelled PATINIER, or PATENIER (b. *c.* 1485, Bouvignes, near Dinan, Namur—d. Oct. 5, 1524, Antwerp), painter, the first Western artist known to have specialized in landscape painting. Little is known of his early life, but his work reflects an early knowledge of the painting of Gerard David, the last of the Early Netherlandish painters. He may have studied under Hieronymus Bosch, the painter of fantastic allegories and landscapes.

Patinir seems to have made a practice of supplying landscape settings for figure compositions painted by other Flemish masters, but the only known example of his collaborations is the "Temptation of St. Anthony" (*c.* 1520–24; Prado, Madrid), in which Quentin Massys painted the figures. He did not, however, paint pure landscape pictures, and all



"St. Jerome," panel painting by Joachim Patinir; in the Prado, Madrid
By courtesy of the Museo del Prado, Madrid

his work has a nominal religious subject. Its novelty, anticipated in a different vein by Bosch, lay in the fact that the religious motif in such works as the "Flight into Egypt" (1515–20; Musée Royal des Beaux-Arts, Antwerp), the "St. Christopher" (*c.* 1515–24; Prado, Madrid), and the "St. Jerome" (Prado) was much reduced in scale and immersed in the phenomena of the natural world. The basic elements of his landscape style—the high viewpoint overlooking vast tracts, where earthy brown foregrounds merge into woodland and meadow greens and again into the hazy blues of distant mountains—do not differ from those of his predecessors, particularly Gerard David. Yet the picturesque melancholy with which he invests the woods and rivers and the great ghostly rocks that jut up abruptly in the middle distance of such paintings as his "Baptism of Christ" (*c.* 1515–20; Kunsthistorisches Museum, Vienna) and his "Crossing the Styx" (*c.* 1520–24; Prado) strike a personal note that won Patinir instant success and many imitators.

Patiño, José Patiño, marqués de (marquess of) (b. April 11, 1666, Milan—d. Nov. 3, 1736, San Ildefonso, Spain), Spanish statesman, who was one of the most outstanding ministers of the Spanish crown during the 18th century.

Patiño followed his father in entering the service of the Spanish government in Italy. Later, during the War of the Spanish Succession, he went to Spain and Philip V nominated him to a place on the Council of Military Orders (1707). As intendant first in Extremadura and then in Catalonia, he rendered important services during the siege of Barcelona (1714) and the reconquest of Majorca (1715), and was responsible for implementing the new financial and administrative system introduced by Philip V in 1715. Giulio Alberoni, who now came to direct Spanish affairs, regarded Patiño as his only reliable subordinate and placed him in charge of the rebuilding of the Spanish Navy as *intendente general de marina* (January 1717). At the same time he was appointed superintendent of Seville, where he also controlled trade with the Spanish colonies. In these various capacities, Patiño was responsible for the fitting-out and dispatch of the expeditions which conquered Sardinia and Sicily in 1717–18.

Sudden promotion came to Patiño in May 1726, when, following the fall from power of the Barón de Riperdá, he was appointed Minister for the Navy and the Colonies. Shortly afterward he was also placed in charge of the national finances and foreign affairs. He retained all these offices until his death.

Patiño's great achievement was his creation of the Spanish Navy. This twice enabled Spain to go to war with Great Britain (1718 and 1739), permitted the conquest of Oran in 1732, and allowed a vigorous enforcement by Spain of its traditional monopoly of trade with its American colonies.

patio, in Spanish and Latin-American architecture, a courtyard within a building, open to the sky. It is a Spanish development of the Roman atrium and is comparable to the Italian cortile. The patio was a major feature in medieval Spanish architecture. Seville cathedral has a patio, as did the ducal palace at Guadalajara (1480–92; destroyed 1936), which was a transitional work displaying Moorish, Gothic, and Renaissance architectural details.

During the Spanish Renaissance the patio became a standard element in houses. It differed from its Italian counterpart in having a greater degree of seclusion, possibly due to Moorish custom. In the Alcazar, Toledo (*c.* 1537–53; destroyed 1936–39), the patio could only be seen through a few doorways.

Because of the climate of the Spanish peninsula, arcades surrounding patios took on special importance as shelters and came to be richly decorated. The patio was imported by the Spanish to Latin America, where it is a characteristic feature of ecclesiastic and larger secular and domestic structures.

The patio of contemporary suburban houses in the United States is a small outdoor area adjoining or partially enclosed by the house. It is often paved and provided with some kind of shade.

patio process, also called MEXICAN PROCESS, method of isolating silver from its ore that was used from the 16th to early in the 20th century; the process was apparently common in America before the arrival of the Europeans.

The silver ore was crushed and ground by mule power in arrastras, shallow circular pits paved with stone. Large blocks of stone attached by beams to a central rotating post were dragged around the arrastra, reducing the ore to a fine mud. This was then spread over a courtyard or patio, sprinkled with mercury, salt, and copper sulfate, and mixed by repeatedly driving mules over it. Chemical reactions freed the silver from its compounds and caused it to dissolve in the mercury. When the amalgamation was complete, the material was agitated with water in large tubs and the mud run off. The amalgam remaining at the bottom was collected and heated to drive off the mercury. The process, especially suitable for the silver ores of the dry, barren areas of Mexico, was responsible for a large proportion of the world's silver production for 350 years; it was finally displaced by the cyanide process early in the 20th century.

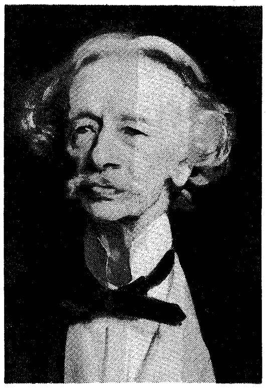
Patkul, Johann Reinhold von (b. July 27, 1660, Stockholm—d. Oct. 10, 1707, Kazimierz, near Poznań, Pol.), Baltic German diplomat who played a key role in the initiation of the Northern War (1700–21).

Born to the Livonian German gentry, Patkul entered the Swedish army in Livonia in 1687. After serving as a representative of the Livonian landowners to the Swedish court in 1690–91, Patkul was arrested and sentenced to death for sedition by the Swedes in 1694 for airing the Livonians' grievances over land questions. He escaped to western Europe, however, via Courland.

Making the acquaintance of highly placed Saxon officials in 1698, Patkul gained an audience in the following year with King Augustus II of Poland (who was also the elector of Saxony), during which he interested the King in a Saxon–Russian alliance against Sweden. Patkul then led negotiations that resulted in the Saxon–Polish–Russian–Danish coalition, which started the Northern War against Sweden in 1700. Patkul entered the Russian diplomatic and military service in 1703, and thereafter he tried unsuccessfully to bring Prussia into the war. In 1707, after angering the Saxons by intriguing with Austria, he was delivered to the Swedish forces in Poland and tortured to death at Kazimierz for desertion and treason.

Patmore, Coventry (Kersey Dighton) (b. July 23, 1823, Woodford, Essex, Eng.—d. Nov. 26, 1896, Lymington, Hampshire), English poet and essayist whose best poetry is in *The Unknown Eros and Other Odes,* containing mystical odes of divine love and of married love, which he saw as a reflection of Christ's love for the soul.

After his father fled to France to escape his creditors, Patmore obtained a position in the library of the British Museum, London, and worked there for 19 years. He published a vast novel in verse, telling the story of two marriages, beginning in the 1850s with *The Angel in the House,* consisting of *The Betrothal* (1854) and *The Espousals* (1856), and continuing with *The Victories of Love* (1863),



Patmore, detail of an oil painting by John Singer Sargent, 1894; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

consisting of *Faithful for Ever* (1860) and *The Victories of Love* (1863).

In 1864 Patmore became a Roman Catholic and married Marianne Byles. *The Unknown Eros* appeared in 1877, but, despite the originality of the poems, they were not widely appreciated. *Amelia* (1878) virtually ended his poetic output, and in later years he concentrated on essays—original and provocative—on literature, art, philosophy, and politics, chiefly for the *St. James's Gazette,* later partly collected in *Principle in Art* (1889) and *Religio Poetae* (1893). Marianne died in 1880, and Patmore married Harriet Robson in 1881. His last work was a collection of aphorisms, *The Rod, the Root, and the Flower* (1895). Patmore's seminal study of *English Metrical Law* (1857) was greatly admired by Gerard Manley Hopkins.

Pátmos, island, the smallest and most northerly of the original 12, or Dodecanese, Greek islands, only 11 sq mi (28 sq km) in area. The barren, arc-shaped island consists of three deeply indented headlands joined by two narrow isthmuses; its maximum elevation is near the centre in Óros (mountain) Áyios Ilías (883 ft [269 m]). Several islets belonging to Pátmos form a semicircle on the east, strongly suggesting that in prehistoric times Pátmos was shattered by the explosion of a giant volcano and is now partially submerged. The only evidence of active vulcanism is a hot-air vent near Psallídha. An ancient acropolis lies on the northern isthmus. The chief town, Pátmos, stands on a ridge in the south central sector.

Successively settled by Dorians and Ionians, Pátmos received scant mention by such ancient writers as Thucydides (5th century BC), Strabo (fl. early 1st century AD), and Pliny (1st century AD). Under the Romans it was a place for exiles, the most noted of whom was John, author of the Fourth Gospel, sent there according to tradition *c.* AD 95. Both the Gospel and the Revelation to John are said to have been written there by John.

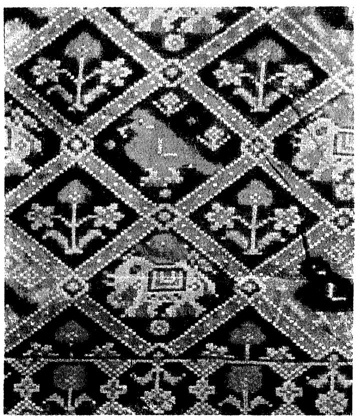
During the Middle Ages, Pátmos appears to have been deserted, probably because of Saracen raids. In 1088 the Byzantine emperor Alexius I Comnenus granted the island to an abbot, who founded a monastery dedicated to St. John on the southern part of the island. Its library contains a celebrated collection of manuscripts and printed books begun by St. Christodoulos. The autonomy of the monastery was confirmed under Venetian rule (1207–1537); during the Turkish occupation (1537–1912) annual tribute was required from the monks. The port of Skála grew out of the original settlement around the monastery. Lacking permanent watercourses but having numerous springs, the island yields grapes, cereals, and vegetables, though not enough for domestic needs. Sponge fishing is the main economic activity. Pátmos is the seat of a school of theology founded in 1669. Pop. (1981) 2,534.

Patna, ancient PĀṬALIPUTRA, capital of Bihār state, northern India. Pāṭaliputra was founded in the 5th century BC by Ajātaśatru, king of Magadha (South Bihār). His son Udāya (Udāyin) made it the capital of Magadha, which it remained until the 1st century BC. The second Magadha dynasty, the Maurya, ruled in the 3rd and early 2nd centuries BC until the city was sacked in 185 by Indo-Greeks. The Śuṅga dynasty then began, ruling until about 73 BC. Pāṭaliputra remained a centre of learning and in the 4th century AD became the Gupta capital. It declined and was deserted by the 7th century. The city was refounded as Patna by an Afghan ruler in 1541 and again rose to prosperity under the Mughal Empire. It passed to the British in 1765. Extensive archaeological excavations have been made in the vicinity.

Prominent among its modern structures are the Government House, the Assembly Chambers, the Oriental Library, a medical college, and an engineering college. Its historic monuments include the mosque of Ḥusayn Shāh of Bengal (1499); the Sikh Temple associated with the 10th Gurū, Govinda Singh; and the granary at Bankipore (now Bānkipur; 1786), popularly called the Golghar. Pop. (1981) 776,371.

Patna painting: *see* Company school.

paṭolā, type of silk sari (characteristic garment worn by Indian women) of Gujarati origin, the warp and weft being tie-dyed (*see* bāndhanī work) before weaving according to a predetermined pattern. It formed part of the trousseau presented by the bride's maternal uncle. Although extant *paṭolās* of Gujarāt do not predate the late 18th century, their history certainly goes back to the 12th century, if not earlier. The technique was also adopted by the weavers of Andhra Pradesh, especially at Pochampalli, where coarse cotton yarn was used as weaving material.



Detail of a *paṭolā* sari from Gujarāt, late 18th century; in the Prince of Wales Museum of Western India, Bombay
P. Chandra

Patterns such as a dancing girl, elephant, parrot, pipal leaf, floral spray, watercress, basketwork, diaper (overall diamond pattern) with a double outline, and flowers were employed on a deep-red ground. The extraordinary laboriousness of the work and the high cost of production led to decreased demand and the decline of this important craft. The technique of *paṭolā* weaving was not confined to India but was also known in Indonesia, where it was called *ikat.*

Paton, Alan (Stewart) (b. Jan. 11, 1903, Pietermaritzburg, Natal, S.Af.—d. April 12, 1988, near Durban, Natal), one of the foremost writers in South Africa, best-known for his first novel, *Cry, the Beloved Country* (1948), which brought international attention to the problem of apartheid in South Africa.

In 1935 Paton left his teaching position to direct Diepkloof Reformatory for delinquent urban African boys, near Johannesburg. The success of *Cry, the Beloved Country,* which he wrote during his tenure at the reformatory, led him to resign his post for full-time writing.

Paton, 1961
UPI—EB Inc.

Both *Cry, the Beloved Country* and his next novel, *Too Late the Phalarope* (1953), exhibit a characteristic balanced, economical, rhythmic prose, which has, especially in dialogue, a singing psalmodic tone. The Diepkloof period provided additional material for some short stories. During that period of his life, Paton became involved in South African politics. In 1953 the Liberal Party of South Africa was formed to offer a nonracial alternative to apartheid; Paton was its national president until its enforced dissolution (a ban on "mixed" racial parties) in 1968. His active opposition to the policy of apartheid led to confiscation of his passport from 1960 to 1970.

His work for the liberal cause included a fortnightly column, "The Long View," for the liberal journal *Contact.* These pieces, along with some public speeches, were collected in *The Long View* (1968) and *Knocking on the Door* (1975). Mainly commentaries on people and affairs, they are diverse in tone: angry, witty, compassionate, and profound.

Paton wrote two notable biographies, *Hofmeyr* (1964), a massive study of the brilliant parliamentarian and Cabinet minister Jan Hofmeyr, and *Apartheid and the Archbishop: The Life and Times of Geoffrey Clayton, Archbishop of Cape Town* (1973). *Towards the Mountain* (1980) is an autobiography of his first 45 years. In *Ah, But Your Land Is Beautiful* (1981), Paton returned to a fictional account of events in South Africa. The second volume of his autobiography, *Journey Continued,* was published shortly after his death.

Patos, city, west-central Paraíba *estado* ("state"), northeastern Brazil, on the Espinharas River at 804 feet (245 m) above sea level. Given city rank in 1903, Patos is a commercial centre for an agricultural hinterland, yielding principally cotton and *feijão* (beans). The city's varied industries include shoe factories, cotton-textile mills, granaries, and vegetable-oil factories. Goods are transported by rail and road to João Pessoa (the state capital) to the east, to Recife, and to other communities in Paraíba and neighbouring states. Pop. (1980) 58,705.

Patos de Minas, city, west-central Minas Gerais *estado* ("state"), Brazil, at 2,808 feet (856 m) above sea level in the highlands. Made the seat of a municipality in 1866, it gained city status in 1892 with the name of Patos, which was lengthened in 1944 to Patos de Minas. Agriculture (*feijão* [beans], corn [maize], cassava, rice, coffee, and oranges) phosphate-fertilizer processing, and livestock raising are the main sources of income. Dairy products, *xarque* (jerked beef), and hog by-products are processed in the city, which is linked by air and by roads with railroad connections to Belo Horizonte, the state capital, 314 miles (506 km) east-southeast. Pop. (1980) 59,849.

Patos Lagoon, Portuguese LAGOA DOS PATOS, shallow lagoon in Rio Grande do Sul *estado* ("state"), Brazil; it is the largest lagoon in Brazil and the second largest in South America. The lagoon is 180 miles (290 km) long and up to 40 miles (64 km) wide, with an area of more than 3,900 square miles (10,100 square km). A sandbar that is 20 miles (32 km) wide separates the lagoon from the Atlantic in the north, but the sandbar narrows in the south, where smaller lagoons predominate. The lagoon receives the Jacuí River (via the Guaíba River) in the north and the Mirim Lagoon overflow (via São Gonçalo Canal) in the south. A mile-wide channel leads to the Atlantic at the city of Rio Grande in the south. The dredged channel allows vessels to ply between Rio Grande and Pôrto Alegre, the state capital. The waters of the Patos Lagoon are fished.

Pátrai, also called PATRAE, or PATRAS, city, capital of the *nomós* (department) of Achaea, and chief port of the Peloponnese and one of the largest ports in Greece, on the Gulf of Patraïkós.

A legendary federation of three villages—Aroë, Antheia, and Mesatis—Pátrai received its name from the Achaean leader Patreus and became one of the 12 cities of Achaea. About 280 BC it helped to form the anti-Macedonian Achaean League. After the Battle of Actium (31 BC), the Roman emperor Augustus colonized it, and as such it prospered commercially until about the 3rd century AD. St. Andrew, the first disciple of Christ, is said to have been crucified there.

The harbour front, Pátrai, Greece
C.J. Coulson—Photo Trends

In the 8th and 9th centuries its population was increased by refugees from the Slavic invasion of the Peloponnese; St. Andrew was confirmed as patron for his supposed role in resisting the combined Slavic and Saracen attack of 805 or 807. In 1205 it became a Frankish barony and the seat of an autonomous Latin archbishop, who later sold it to Venice (1408). It was long contested by Venetians and Turks. Pátrai was the see of Bishop Germanos, who in 1821 raised the standard of the Greek War of Independence at Kalávrita. The Turks burned the city (which was not freed until 1828) before retreating, and the current grid plan of Pátrai dates from the reconstruction.

Since 1899 the seat of a metropolitan bishop of the Orthodox church, Pátrai was previously an archbishopric. The chief exports are currants, sultanas, tobacco, olives and olive oil, figs, citrons, wine, brandy, hides, and valonias (dried acorn cups used in tanning and leather dressing).

An important port of call on shipping lanes between Greece and the West, it is linked by rail to Corinth, Athens, and Kalámai. The port is overlooked by a Byzantine-Turkish-Venetian fortress on the site of the ancient acropolis and is a major port for car-ferry services between Greece and the east coast of Italy. Pop. (1981) 142,163.

patralatā, decorative motif in Indian art, consisting of a lotus rhizome (underground plant stem). A cosmology that identifies water as the source of all life had a great influence on early Indian art, and, of its visual symbols, the lotus is the most important and has been

Sandstone *patralatā*, detail from the Great Stūpa at Sānchi, Madhya Pradesh, India, c. 1st century BC
P. Chandra

a dominant motif in Indian decoration from the earliest times.

The *patralatā,* with flowers issuing from a central undulating stem, is found carved on monuments at Bhārhut (2nd century BC) and Sānchi (1st century BC). Relatively naturalistic in the earlier monuments, the motif was progressively stylized, finally culminating in rich, foamlike foliated scrolls that have little resemblance to the lotus plant. The *patralatā* also appears in the Islāmic art of India, in which it is assimilated to the arabesque motif.

patria potestas, in Roman family law, power that the father exercised over his children and his more remote descendants in the male line, whatever their age, as well as over those brought into the family by adoption. This power meant originally not only that he had control over the persons of his children, amounting even to a right to inflict capital punishment, but that he alone had any rights in private law. Thus, acquisitions of a child became the property of the father. The father might allow a child (as he might a slave) certain property to treat as his own, but in the eye of the law it continued to belong to the father.

Patria potestas ceased normally only with the death of the father; but the father might voluntarily free the child by emancipation, and a daughter ceased to be under the father's potestas if upon her marriage she came under her husband's manus (*q.v.*), a corresponding power of husband over wife.

By classical times, the father's power of life and death had shrunk to that of light punishment, and sons could keep as their own what they earned as soldiers (*peculium castrense*). By Justinian's day (527–565), the rules of *peculium castrense* were extended to many sorts of professional earnings; and in other acquisitions, such as property inherited from the mother, the father's rights were reduced to a life interest.

patriarch, title used for some Old Testament leaders (Abraham, Isaac, Jacob, and Jacob's 12 sons) and, in the Christian church, a title given to bishops of important sees.

The biblical appellation patriarch appeared occasionally in the 4th century to designate prominent Christian bishops. By the end of the 5th century, however, in the course of growing ecclesiastical centralization, it acquired a specific sense. After the Council of Nicaea in 325, the church structure was patterned on the administrative divisions of the Roman Empire; thus, each civil province was headed by a metropolitan, or bishop of the metropolis (the civil capital of the province), while larger administrative units, called dioceses, were presided over by an exarch of the diocese, a title gradually replaced by patriarch. Some patriarchs exercised authority over several dioceses: the bishop of Rome over the entire West; the bishop of Alexandria over the dioceses of Egypt, Libya, and Pentapolis; and, after the Council of Chalcedon (451), the bishop of Constantinople over the dioceses of Pontus, Asia, and Thrace.

Controversy over the growth of major ecclesiastical centres contributed to the schism between East and West. Rome maintained that only apostolic sees, those originally established by apostles, had the right to become patriarchates. The East, however, always took for granted that primacies were based on such empirical factors as the economic and political importance of cities and countries. Constantinople, the new imperial capital and the ecclesiastical centre of the East, had no claims to apostolicity, but new jurisdictional rights were bestowed upon it at Chalcedon (451) for the explicit reason that it was "the residence of the emperor and the Senate."

Five patriarchates, collectively called the pentarchy (*q.v.*), were the first to be recognized by the legislation of the emperor Justinian (reigned 527–565), later confirmed by the Council in Trullo (692): Rome, Constantinople, Alexandria, Antioch, and Jerusalem—though, after the Muslim invasions of Egypt and Syria in 638–640, the bishops of Rome and Constantinople were alone in possessing any real power. Despite Constantinople's efforts to resist any proliferation of patriarchates, new centres emerged in the Slavic centres of Preslav (932), Trnovo (1234), Peć (1346), and Moscow (1589). At present there are nine Orthodox patriarchates: Constantinople, Alexandria, Antioch, Jerusalem, Moscow, Georgia, Serbia, Romania, and Bulgaria. Except in the title, there is no difference between a patriarch and any other head of an autocephalous (independent) church.

In Roman Catholicism, especially since the second Vatican Council, some effort has been made to restore the dignity of the Eastern-rite patriarchs as effective signs of collegiality, balancing Roman centralization.

Patriarchate of ———: *see under* Greek Orthodox Patriarchate of ———, except as below.

Patriarchate of Constantinople: *see* Ecumenical Patriarchate of Constantinople.

patriarchy, hypothetical social system based on the absolute authority of the father or an elderly male over the family group. Inspired by the classical social Darwinism of the 19th century, the pioneering anthropologists Lewis Henry Morgan and Henry Maine envisioned cultures as having developed through evolutionary stages, one of which was patriarchy. Maine felt that all status or relationship in the earliest societies derived from a patriarchal kinship system and that all decisions of social consequence were the arbitrary judgments of a quasi-tyrannical patriarch. Sometimes patriarchy also includes in its meaning patria potestas, the system in which power to govern members of even the extended family rested in the hands of a father and his kin.

Although Morgan did undertake ethnographic work of nonliterate societies, Maine based his conclusions almost entirely on records of ancient Greece and Rome. Later anthropologists were skeptical of such evolutionary schemes, and ethnographers found absolute male authority to be rare even in societies with patrilineal descent systems. The word patriarchy, therefore, has fallen into disuse as a technical or categorical term.

Patrice Lumumba People's Friendship University, Russian UNIVERSITET DRUZHBY NARODOV IMENI PATRISA LUMUMBY, state institution of higher learning in Moscow, founded in 1960 "to give an education to people who had liberated themselves from colonialist oppression." It was named for the Congolese premier after his death in 1961. It draws students from developing nations throughout the world.

As at all Soviet universities, the students are fully financed by the government, including initial transportation to the Soviet Union and their return after graduation.

There are six faculties: engineering; agriculture; medicine; physics, mathematics, and general science; economics and international law; and history and philosophy. There is a strong emphasis on the first three subjects; only about 30 percent of the students are in the humanities. All courses are for six years, the first year being preparatory, during which the student must learn Russian, the language of instruction.

patrician, Latin PATRICIUS, plural PATRICII, member of a privileged citizen class in early Rome. Probably originating as leaders of the rudimentary Roman Senate, they came to monopolize the magistracies and priesthoods in the period before about 400 BC. Because their political influence was reduced by the plebeians, patricians at the end of the early republic retained exclusive control only of some old priesthoods, the office of *interrex,* or interim head of state, and perhaps that of *princeps senatus,* or senate leader. In the late republic (*i.e.,* to the 1st century BC) distinctions between patricians and plebeians lost political importance; some patricians became plebeians by adoption.

During the empire (after 27 BC), patrician rank was a prerequisite for ascent to the throne, and only the emperor could create patricians. Necessary for the continuation of ancient priesthoods, patricians had few privileges other than reduced military obligations. After Constantine's reign (306–337), *patricius* was a nonhereditary title of honour, ranked third after the emperor and consuls. By derivation, *patricius Romanorum* was the title of the patron of the Roman Catholic church, conferred by the pope on emperors from Charlemagne in the 9th century to Frederick I Barbarossa in the 12th. *Compare* plebeian.

Patrick, SAINT (fl. 5th century, Britain and Ireland; feast day March 17), patron saint and national apostle of Ireland, credited with bringing Christianity to Ireland and probably responsible in part for the Christianization of the Picts and Anglo-Saxons. He is known only from two short works, the *Confessio,* a spiritual autobiography, and his *Epistola,* a denunciation of British mistreatment of Irish Christians.

Life. He was born in Britain of a Romanized family. At the age of 16 he was torn by Irish raiders from the villa of his father, Calpurnius, a deacon and minor local official, and carried into slavery in Ireland, where, during six bleak years spent as a herdsman, he turned with fervour to his faith. Hearing at last in a dream that the ship in which he was to escape was ready, he fled his master and found passage to Britain. There he came near to starvation and suffered a second brief captivity before he was reunited with his family. Thereafter, he may have paid a short visit to the Continent.

The best known passage in the *Confessio,* his spiritual autobiography, tells of a dream, after his return to Britain, in which one Victoricus delivered him a letter headed "The Voice of the Irish." As he read it he seemed to hear a certain company of Irish beseeching him to walk once more among them. "Deeply moved," he says, "I could read no more." Nevertheless, because of the shortcomings of his education he was reluctant for a long time to respond to the call. Even on the eve of reembarkation for Ireland he was beset by doubts of his fitness for the task. Once in the field, however, his hesitations vanished. Utterly confident in the Lord, he journeyed far and wide, baptizing and confirming with untiring zeal. In diplomatic fashion he brought gifts to a kinglet here and a lawgiver there but accepted none from any. On at least one occasion he was cast into chains. On another, he addressed with lyrical pathos a last farewell to his converts who had been slain or kidnapped by the soldiers of Coroticus.

Careful to deal fairly with the heathen, he nevertheless lived in constant danger of martyrdom. The evocation of such incidents of what he called his "laborious episcopate" was his reply to a charge, to his great grief endorsed by his ecclesiastical superiors in Britain, that he had originally sought office for the sake of office. In point of fact, he was a most humble-minded man, pouring forth a continuous paean of thanks to his Maker for having chosen him as the instrument whereby multitudes who had worshipped "idols and unclean things" had become "the people of God."

The phenomenal success of Patrick's mission is not, however, the full measure of his personality. Since his writings have come to be better understood, it is increasingly recognized that, despite their occasional incoherence, they mirror a truth and a simplicity of the rarest quality. No diarist has ever bared his inmost soul to the same degree as did the patron saint of Ireland. As D.A. Binchy, the most austerely critical of Patrician (*i.e.,* of Patrick) scholars, has put it, "The moral and spiritual greatness of the man shines through every stumbling sentence of his 'rustic' Latin."

It is not possible to say with any assurance when Patrick was born. There are, however, a number of pointers to his missionary career having lain within the second half of the 5th century. In the Coroticus letter, his mention of the Franks as still heathen indicates that the letter must have been written between 451, the date generally accepted as that of the Franks' irruption into Gaul as far as the Somme River, and 496, when they were baptized en masse. Patrick, who speaks of himself as having evangelized heathen Ireland, is not to be confused with Palladius, sent by Pope Celestine in 431 as "first bishop to the Irish believers in Christ."

Legends. Before the end of the 7th century Patrick had become a legendary figure, and the legends have continued to grow. One of these would have it that he drove the snakes of Ireland into the sea to their destruction. Another, probably the most popular, is that of the shamrock, which has him explain the concept of the Holy Trinity, three Persons in one God, to an unbeliever by showing him the three-leaved plant with one stalk. Today Irishmen wear shamrocks, the national flower of Ireland, in their lapels on St. Patrick's Day, March 17. (T.O'R.)

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Patrick, Lester B. and Frank A. (respectively b. Dec. 30, 1883, Drummondville, Que., Can.—d. June 1, 1960, Victoria, B.C.; b. Dec. 23, 1885, Ottawa—d. June 29, 1960, Vancouver, B.C.), Canadian brothers who as managers, owners, and league officials helped establish professional ice hockey in Canada and who aided the expansion of the National Hockey League (NHL) to the United States.

The brothers played hockey while attending McGill University (Montreal), Lester with the Montreal Amateur Athletic Association team (1901–02) and the amateur Montreal Wanderers (1905–07), both of which won Stanley Cups, and for the Brandon (Man.) team that played for but did not win the Stanley Cup (1903–05). Frank refereed in the Montreal senior league (1903–04), and the two joined the Renfrew Millionaires in the professional league that came to be the National Hockey Association (NHA; formed 1910).

In 1911 the Patrick family moved west to Victoria, where the brothers with their father, Joseph Frank Patrick, a lumberman, formed the Pacific Coast League. They built the first enclosed ice rinks at Vancouver and Victoria; at the time, the Vancouver rink was one of the largest buildings in Canada, seating 10,000. In that league the Patricks introduced many practices that later became standard: allowing the goalie to leave his feet; instituting blue lines in the mid-rink area, thus affecting the offside rule; adding assists to goals scored; and numbering uniform jerseys. Lester introduced the defenseman's practice of bringing the puck up the ice, not merely passing it up, thus changing the offense.

The Pacific League suffered in attendance during World War I, and in 1926 the Patricks sold their six teams and players to the National Hockey League, which used the pool of players to establish new teams and expand the game in the United States.

Lester assembled the New York Rangers and was their manager (1927–46); the team won Stanley Cups in 1928, 1930, and 1940. He developed the first farm team system in ice hockey and was responsible for many rule changes. In 1966 the Rangers instituted the Lester Patrick Trophy to be awarded for outstanding service to ice hockey in the United States.

Frank was manager and director of the NHL (1933–34) and coached for the Boston Bruins and the Montreal Canadiens before he retired in 1941.

Eric Whitehead's *The Patricks: Hockey's Royal Family* (1980) is an account of five generations of the Patrick family's activity in ice hockey.

patristic literature, body of literature that comprises those works, excluding the New Testament, written by Christians before the 8th century AD.

A brief treatment of patristic literature follows. For full treatment, *see* MACROPAEDIA: Christianity.

"Patristic" is derived from the Greek and Latin word *pater* (father) and refers to the works of the Church Fathers. Most patristic literature is in Greek or Latin, but much survives in Syriac and other Near Eastern languages.

The works of the Apostolic Fathers, a collection of short and unpretentious Greek writings largely concerned with Christian conduct, contain the earliest patristic literature. The oldest of these works, including the *Letter to the Church of Corinth,* by Clement of Rome, and possibly part of a manual of church order called the *Didachē,* stem from the last decades of the 1st century AD and antedate some books of the New Testament.

Accounts of martyrdoms are the most moving early patristic writings. The finest of them, the *Passion of Perpetua and Felicitas,* was written in Carthage in about 202 by the Christian noblewoman Perpetua as she awaited execution for her refusal to apostatize.

Apocryphal accounts of Christ's life and the careers of the Apostles flourished in the 2nd and 3rd centuries. Later Christian art drew on their romantic narratives to depict such things as the birth of Mary and the adventures of the apostle Peter.

By the middle of the 2nd century AD Christians wrote to justify their faith to the Roman government and to refute Gnostic ideas they considered heretical. The principal writer then was Justin Martyr, a Christian teacher put to death in Rome in about 165. Beginning with Justin, who wrote in Greek, Christians were increasingly sophisticated in their appropriation of the rhetorical and philosophical heritage of Greco-Roman culture. In this they relied on earlier Jewish literature written in Greek, particularly the works of Philo (*c.* 15 BC–*c.* AD 50), a philosopher who interpreted the Torah symbolically along Platonic lines.

Christian appropriation of Greek philosophy came to fruition in the writings of Origen (*c.* 185–*c.* 254), a Greek author from Alexandria, whose treatise, *On First Principles,* was the first coherent and systematic account of the main doctrines of Christian theology. Origen was the early church's greatest biblical scholar, and his allegorical method of interpretation dominated Christian exegesis until the Reformation.

The first important Latin Christian author, Tertullian of Carthage (*c.* 160–*c.* 225), set forth the main lines Latin theology would follow in writings of unexcelled stylistic brilliance.

The first Council of Nicaea, in 325, is the great watershed in patristic literature. In terms of Christian theology the council, the first convocation of Christian leaders theoretically from throughout the world, marks the beginning of an era, extending through the rest of the patristic period, during which general church councils sought to define Christian dogma ever more precisely. Socially and politically, the Council of Nicaea marks the point at which Christianity ceased to be the religion of a persecuted minority and became the Roman Empire's favoured religion.

The principal author at the time of the first Council of Nicaea, a Greek writer, Eusebius of Caesarea (*c.* 260–*c.* 340), associated himself with Constantine, the first Christian emperor.

Eusebius' *Ecclesiastical History*, published in its final edition around 323, is the first known history of the early church and its literature. Pioneering use of extensive documentation makes the *Ecclesiastical History* especially valuable.

For just over 100 years after Nicaea, patristic literature enjoyed its Golden Age. Theologians, most of them writing in Greek, worked out, after a long and bitter debate, what was to be the normative Christian doctrine of the Trinity. Chief among them were Athanasius (*c.* 293–373), the tenacious bishop of Alexandria, and the three Cappadocian Fathers, so called from their native province in Anatolia: Basil the Great (*c.* 330–379), his brother Gregory of Nyssa (*c.* 335–*c.* 394), and their friend Gregory of Nazianzus (*c.* 330–*c.* 389).

Athanasius and Basil contributed as authors to the development of Christian monasticism. Athanasius popularized it with his *Life of St. Antony*, the idealized biography of St. Anthony of Egypt, and Basil composed what was to become the rule of life for Eastern Orthodox monks.

Preachers and writers during this Golden Age achieved the highest standards of eloquence. Gregory of Nazianzus and John Chrysostom (*c.* 347–407) in Greek and Ambrose of Milan (*c.* 339–397) and Augustine of Hippo (354–430) in Latin were consummate orators, masters of the most respected and popular art form of their time. Ephraem of Nisibis (*c.* 306–373) composed superb Christian verse in Syriac. Jerome (*c.* 347–*c.* 420), the period's greatest man of letters, was largely responsible for the careful and eloquent Vulgate translation of the Bible from its original languages into Latin.

The most influential writer of the patristic period was Augustine of Hippo. His theological treatises pervasively shaped the common tradition of Roman Catholics and Protestants. His sustained meditation on God's grace, the *Confessions*, with its psychologically acute autobiography, is the patristic work most accessible to modern readers. His *City of God*, a treatise occasioned by the shattering news of the Visigothic sack of Rome in 410, initiated Christian philosophical reflection on history.

Two Greek theologians, Theodore of Mopsuestia (*c.* 350–*c.* 428) and Cyril of Alexandria (*c.* 375–444), set forth influential alternative approaches to the problem of how Christ could be both God and man. Theodore of Mopsuestia was the greatest biblical exegete after Origen, whose allegorism he rejected.

The isolation of cultural traditions and characteristically medieval concerns mark later patristic literature. Maximus the Confessor (*c.* 580–662), a Byzantine theologian, exemplifies typically Byzantine concerns with icons and with mystical contemplation. His contemporary Pope Gregory I (540–604), the last significant Latin patristic author, reluctantly assumed more immediately practical concerns. Gregory helped consolidate Benedictine monasticism and the Papacy, the two stable and enduring institutions in an otherwise chaotic time. The rise of Islām effectively closed the patristic era by ending what little cultural unity remained in the Mediterranean world.

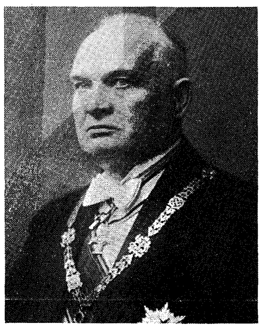
patron saint, saint to whose protection and intercession a person, a society, a church, or a place is dedicated. The choice is often made on the basis of some real or presumed relationship with the persons or places involved. St. Patrick, for example, is the patron saint of Ireland because he is credited with bringing Christianity to the Irish people. In some cultures national or local gods are the equivalent of patron saints; *e.g.*, in China K'uei Hsing is the patron of scholars because he reputedly passed his civil service examination with great distinction and will assist others to do the same.

patronage system (U.S.): *see* spoils system.

patronymic, name derived from that of a father or paternal ancestor, usually by the addition of a suffix or prefix meaning "son." Thus the Scottish name MacDonald originally meant "son of Donald." Usually the "son" affix is attached to a baptismal name, but it is also possible to attach it to the father's occupation (*e.g.*, Clerkson). Sometimes a patronymic is simply the father's given name (Thomas, Edward) or its genitive form (Edwards).

In some cultures the patronymic varies according to the sex of the child receiving it: in Russia, where everyone has a patronymic as well as a given name and surname, sons receive a patronymic ending in *-ovich* (*e.g.*, Ivanovich) and daughters a form ending in *-ovna* (*e.g.*, Ivanovna). A similar situation holds true in Norway.

Päts, Konstantin (b. Feb. 23 [Feb. 11, old style], 1874, Pärnu District, Estonia, Russian Empire—d. Jan. 18, 1956, Kalinin *oblast*, Russian S.F.S.R.), Estonian statesman who served as the last president of Estonia (1938–40) before its incorporation into the Soviet Union in 1940.



Päts, 1938
By courtesy of the Estonian Legation, London

Of peasant stock, Päts was educated in the law but began a career in journalism in 1901, when he founded the Estonian-language newspaper *Teataja* ("Announcer"), which reflected Päts's socialistic leanings. In 1904 Päts became deputy mayor of Tallinn. During an Estonian rising in connection with the 1905 Russian Revolution, Päts, although he had called for restraint, was sentenced to death and had to flee Estonia. He was not able to return until 1910, at which time he served a brief prison term.

Active in the movement for Estonian independence after 1917, Päts became head of a provisional government when independence was declared in February 1918. Almost immediately, Päts was arrested by Estonia's German occupiers, but he resumed his post after the November 1918 armistice.

In 1921–22, 1923, and 1932–33 Päts served as *riigivanem* (equivalent to president and prime minister) of Estonia. After a new constitution providing for a stronger executive was approved in a 1933 referendum, Päts learned of a planned coup d'etat by the Fascist "Vap" movement, which had sponsored the constitution. He arrested the leaders of the movement and assumed dictatorial powers. Päts's authoritarian regime lasted until the Soviet Union occupied Estonia in June 1940. He was deported to the U.S.S.R. at the start of the occupation and died there.

Patsayev, Viktor Ivanovich (b. June 19, 1933, Aktyubinsk, Kazakh S.S.R.—d. June 29, 1971, in space, probably over Iran), Soviet cosmonaut, design engineer on the Soyuz 11 mission, in which he, mission commander Georgy T. Dobrovolsky, and flight engineer Vladislav N. Volkov remained in space a record 24 days and created the first manned orbital scientific station by docking their Soyuz 11 spacecraft with the unmanned Salyut station launched two months earlier. The three were found dead in their space capsule after it made a perfect landing in Kazakhstan. The accident was caused by decompression resulting from a leak in their capsule when a hatch was improperly closed. While in the space station, they had conducted meteorological and plant-growing experiments.

Pattani, also spelled PATANI, town and *changwat* (province) in the Southern region of Thailand, on the east coast of the Malay Peninsula. Pattani town, the provincial capital, located at the mouth of the Pattani River, has been an international trading port since the 16th century or earlier. Its port facilities, which also serve Yala province, export rubber and tin. Its airport has regular flights to other towns of southern Thailand.

Pattani was an independent Muslim city-state, ruling an area larger than the present province, until the 16th century when it became a vassal state of Siam (now Thailand). After 1800 it was divided into seven smaller units, which were incorporated as Siamese provinces in the early 20th century.

The province, one of Thailand's smallest, occupies an area of 749 sq mi (1,940 sq km) and has a 72-mi (116-km) coastline on the Gulf of Thailand. Salt production and fishing are important in the coastal towns of Yaring, Sai Buri, and Pattani. Pattani is drained by the Pattani and the Sai Buri rivers. Sandy ridges, remnants of old offshore sandbars, alternate with strips of clay soils. The ridges are the location of coconut groves and settlements, and the lowlands are filled lagoons ideal for rice and rubber cultivation. There are tin reserves. The population is mainly Muslim, and the culture of the area is oriented toward that of Malaysia, 65 mi south. Pop. (1980) town, 29,286; province, 418,932.

pattern glass, pressed glassware produced in sets of many pieces decorated with the same pattern. Manufactured in large quantities in the United States in 1840–80 by the larger glassworks, it was an offshoot of the U.S. invention (1820s) of mechanically pressed glass, which brought about a cheaper production. Pattern sets sometimes included a staggering number of pieces, ranging from sugar bowls to celery vases. More than 250 major patterns are known to have been made. Some popular patterns, known as camphor glass, combined the use of clear glass with an acid-finished design.

pattern poetry, verse in which the lines or typography are arranged to convey or extend the emotional content of the words. It is also known as *shaped, Cubist,* or *concrete* poetry. Of ancient (probably Eastern) origin, pattern poems are found in the Greek *Anthology* (*c.* 980), where one poem was recorded in the shape of an ax, another as an egg. Notable later examples are the wing-shaped "Easter Wings" of the 16th-century English Metaphysical poet George Herbert and his altar-shaped "The Altar."

In the 19th century, the French Symbolist poet Stéphane Mallarmé employed different type sizes in *Un Coup de dés* (1897; "A Throw of Dice"). The representative 20th-century French poet is Guillaume Apollinaire, whose *Calligrammes* (1918), inspired by the attempts of Cubist painters to represent all aspects of a subject simultaneously, are visual evocations as well as poems; in a poem about rain, the words fall in long, slanting lines. The U.S. poet e.e. cummings (1894–1962) is famous for his typographical eccentricities and was perhaps most successful in making these visual innovations meaningful elements of his poems. Some concrete poets have constructed tangible poems out of iron and other durable materials.

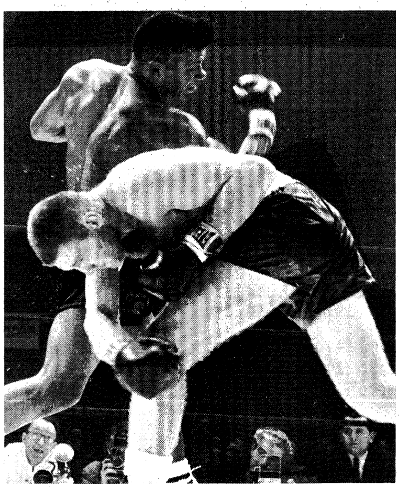
Patterson, Eleanor Medill, byname CISSY PATTERSON (b. Nov. 7, 1884, Chicago—d. July 24, 1948, Marlboro, Md., U.S.), a member of the McCormick-Patterson family of American newspaper publishers and herself the flamboyant editor and publisher of the *Washington Times-Herald.*

Hired by William Randolph Hearst as editor in chief of the *Washington Herald* in 1930, Patterson leased the paper and its evening counterpart, the *Washington Times,* from Hearst in 1937. The *Herald* under her sometimes eccentric editorship more than doubled its circulation. Learning that Eugene Meyer of the *Washington Post* wanted to buy the two Hearst papers, Patterson bought them herself, combining them into the *Washington Times-Herald.* The paper prospered during World War II but declined afterward.

Encouraged by her mother, Eleanor Patterson moved early toward a career as a socialite. She was married at age 19 to a Polish count, Joseph Gizycki, but the couple separated after a few years. As Eleanor M. Gizycka she wrote two novels, *Glass Houses* (1926) and *Fall Flight* (1928). She changed her name legally to Eleanor M. Patterson in 1930, the year in which she became editor of the *Herald.* She was an archconservative politically, a cast reflected by the *Times-Herald,* and she violently opposed President Franklin D. Roosevelt and his New Deal.

Patterson, Floyd (b. Jan. 4, 1935, Waco, N.C., U.S.), American professional boxer, first to hold the world heavyweight championship twice.

Patterson, who was reared in Brooklyn, learned to box while in a school for emotion-



Floyd Patterson (the upright figure) fighting Tom McNeeley, 1961
AP/Wide World Photos

ally disturbed children. He won several Golden Gloves titles in 1951 and 1952 and was the Olympic Games middleweight champion in 1952. His first professional fight took place Sept. 12, 1952. When he won the heavyweight title he had lost only one professional fight, a disputed decision in favour of the clever and far more experienced Joey Maxim, a former 175-pound light-heavyweight champion.

Patterson succeeded retired champion Rocky Marciano by knocking out Archie Moore in five rounds in Chicago, Nov. 30, 1956. He lost the title to Ingemar Johansson of Sweden by a three-round knockout in New York City, June 26, 1959, and regained the championship by knocking out Johansson in five rounds in New York, June 20, 1960. He was subsequently knocked out in one round by Sonny Liston in a title bout in Chicago, Sept. 25, 1962. He later was defeated by Liston and Muhammad Ali in his attempts to recapture the world championship and by Jimmy Ellis, World Boxing Association heavyweight champion, in a match for that version of the disputed world title. He retired from the ring in 1972 and later ran an amateur boxing club and was athletic commissioner for the state of New York.

Patterson, John Henry (b. Dec. 13, 1844, near Dayton, Ohio, U.S.—d. May 7, 1922, near Philadelphia), American manufacturer who helped popularize the modern cash register by means of aggressive and innovative sales techniques.

Patterson began his career as a toll collector for the Miami & Erie Canal and then went into business selling coal with his brother. Convinced that petty pilfering by clerks was cheating him of profits, he bought three new machines called cash registers, invented in 1879 by a Dayton tavern owner, James Ritty. The store eventually showed a profit, and Patterson bought Ritty out and renamed the firm the National Cash Register Company, later to be known familiarly as NCR.

Because the cash register was new and not readily accepted by merchants, Patterson devised a number of mechanical improvements to make the machine easier to use and pioneered several marketing innovations to stimulate sales. He introduced the idea of exclusive territory for each of his salesmen, and he opened a school to train them, a first in marketing history. He also made extensive use of direct-mail advertising and paid generous commissions to his sales staff. To upgrade the quality of his product, he improved working conditions for his labourers at a time when such actions seemed almost unethical to his fellow manufacturers. When Patterson took over Ritty's operation he transformed the ugly slum factory into an attractive workplace and established an industrial welfare organization, with programs aimed at improving the health, education, and working conditions of the employees. In return for these benefits, however, he demanded absolute devotion and high productivity from his subordinates.

Patterson became nationally known when he spearheaded the relief work after a flood devastated Dayton in 1913 and raised $2,000,000 to fund a flood control and prevention plan.

Patterson, Joseph Medill (b. Jan. 6, 1879, Chicago—d. May 26, 1946, New York City), American journalist, coeditor and publisher—with his cousin Robert Rutherford McCormick—of the *Chicago Tribune* from 1914 to 1925; he subsequently became better-known as editor and publisher of the New York *Daily News,* the first successful tabloid newspaper in the United States.

A *Tribune* staff member from 1901, Patterson was an Illinois state legislator (1903–04) and Chicago commissioner of public works (1905–06). During World War I he served as a war correspondent in 1914–15 and, after the United States entered the war in 1917, as a combat officer. With McCormick he founded the New York *Daily News* (first published June 26, 1919), which, because of its sensationalism, soon attained a circulation of nearly 1,000,000, the largest among American tabloids. Relinquishing to McCormick his authority over the *Tribune,* Patterson became sole editor and publisher of the *Daily News* in 1925. A mild Socialist as a young man, he later became more conservative, as did the *Daily News;* the paper switched from support of President Franklin D. Roosevelt's policies to isolationist opposition.

Patti, Adelina, original name ADELA JUANA MARIA PATTI (b. Feb. 19, 1843, Madrid—d. Sept. 27, 1919, Craig-y-Nos Castle, Brecknockshire, Wales), Italian soprano, one of the great coloratura singers of the 19th century.

She went to the United States as a child and appeared in concerts in New York City from age seven. She made her operatic debut as Lucia in Gaetano Donizetti's *Lucia di Lammermoor* in New York City in 1859. Two years later she sang Amina in Vincenzo Belli-

Adelina Patti
By courtesy of the Victoria and Albert Museum, London; photograph, J.R. Freeman & Co. Ltd.

ni's *La sonnambula* at Covent Garden, London, where she sang regularly until 1885. She sang many roles in the operas of Gioacchino Rossini, Bellini, Giacomo Meyerbeer, Charles Gounod, and others and also in several of the early operas of Giuseppe Verdi.

Her voice was considered small but was remarkable for its wide range, evenness of production, and purity of quality. She achieved her greatest successes in comedy, notably in the roles of Dinorah in Meyerbeer's *Dinorah,* Zerlina in Mozart's *Don Giovanni,* and Rosina in Rossini's *The Barber of Seville,* Rossini having arranged much of the music of this part for her. She had three marriages: in 1868 to Henri, marquis de Caux (divorced 1885); in 1886 to the tenor Ernesto Nicolini (d. 1898); and in 1899 to a Swedish baron, Rolf Cederström.

Consult the INDEX *first*

Patton, George S(mith) (b. Nov. 11, 1885, San Gabriel, Calif., U.S.—d. Dec. 21, 1945, Heidelberg, Ger.), U.S. Army officer who was an outstanding practitioner of mobile tank warfare in the European and Mediterranean theatres during World War II. His strict discipline, toughness, and self-sacrifice elicited exceptional pride within his ranks, and the general was colourfully referred to as "Old Blood-and-Guts" by his men.

A 1909 graduate of the U.S. Military Academy at West Point, N.Y., and a descendant of a Virginia family with a long military tradition, Patton became a keen student of the U.S. Civil War (1861–65), particularly of its great cavalry leaders, an interest that no doubt

Patton, 1945
By courtesy of the U.S. Army

contributed to the strategy of bold, highly mobile operations associated with his name. After serving with the U.S. Tank Corps in World War I, Patton became a vigorous proponent of tank warfare. Having taken part in the North African campaign (1942), he commanded the U.S. 7th Army in Sicily, employing his armour in a rapid drive that captured Palermo (1943).

The apogee of his career came with the dramatic sweep of his 3rd Army across northern France in the summer of 1944 in a campaign marked by great initiative, ruthless drive, and disregard of classic military rules. Patton's armoured units, operational since August 1, had by the end of the month captured Mayenne, Laval, Le Mans, Reims, and Châlons. In December his forces played a strategic role in defending Bastogne in the massive Battle of the Bulge. By the end of January 1945 Patton's forces had reached the German frontier; on March 1 they took Trier, and in the next 10 days they cleared the entire region north of the Moselle River, trapping thousands of Germans. They then joined the 7th Army in sweeping the Saar and the Palatinate, taking 100,000 prisoners.

Patton's military achievements caused authorities to overlook strong civilian criticism of some of his methods, including his widely reported striking of a hospitalized, shell-shocked soldier in August 1943. (Patton publicly apologized for the incident.) His public criticisms of the Allied postwar denazification policy in Germany led to his removal from the command of the 3rd Army in October 1945.

The controversial general died in a Heidelberg hospital after an automobile accident near Mannheim. His memoirs, *War As I Knew It,* appeared posthumously in 1947.

Patuākhāli, town, south-central Bangladesh. It is situated along the Patuākhāli River, a distributary of the Ariāl Khān. An important trading centre for rice, jute, oilseeds, sugarcane, and betel nuts, it is also a rice milling and match manufacturing centre. It is connected by road and river steamer with Barisāl. It has five colleges affiliated with the University of Dhākā.

The surrounding area is a floodplain drained by the Hāringhāta, Bishkhāli, and Burishwar rivers and forms part of the Sundarbans (*q.v.*). Rice, jute, sugarcane, coconuts, chilies, and tobacco are the chief crops; freshwater and saltwater fishes are abundant. Pop. (1981 prelim.) town, 45,818.

Patuca River, Spanish RÍO PATUCA, river in northeastern Honduras, formed southeast of Juticalpa by the merger of the Guayape and Guayambre rivers. It flows northeastward for approximately 200 miles (320 km), emerging from the highlands and crossing the Mosquito Coast to empty into the Caribbean Sea at Patuca Point. Near the river's mouth the Tom-Tom Creek branches to empty into Brus Lagoon. The course of the Patuca is interrupted by rapids in several places, most notably Portal del Infierno ("gate of hell"). Its navigable lower course is used to float logs cut from the dense tropical rain forests through which it flows, and it serves as the main transport and communications artery for the isolated regions around its lower course.

Patzinakoi (Turkic people): *see* Pechenegs.

Pau, town, capital of Pyrénées-Atlantiques *département*, Aquitaine region, southwestern France. The capital of the former province of Béarn, Pau is a spa and winter sports centre. It stands on the edge of a plateau 130 feet (40 m) above the valley of the Pau Stream, which descends from the Pyrenees. The town's boulevard des Pyrénées, more than 1 mile (1.6 km) long, is situated high above the valley and offers a magnificent panoramic view of the mountains. A castle in the town, situated on a spur above the river, was the birthplace (1553) of Henry IV of France, who reigned from 1589 to 1610. It is now a national museum and contains a fine collection of the Gobelins tapestries. The house that was the birthplace (1763) of Marshal Jean Bernadotte, who became Charles XIV of Sweden (1818–44), is also a museum. Pau has shown considerable population growth because of recent industrialization (aeronautical equipment and shoes) and also because of its proximity to the natural gas and chemical-extraction complex at Lacq. The University of Pau and the Pays de l'Adour opened in 1970. Pop. (1982) 82,186.

Paul, name of rulers grouped below by country or papacy and indicated by the symbol •.

Foreign-language equivalents:

Greek	Paulos
Latin	Paulus
Russian	Pavel

GREECE

• **Paul** (b. Dec. 14, 1901, Athens—d. March 6, 1964, Athens), king of Greece (1947–64) who helped his country overcome Communist guerrilla forces after World War II.

The third son of King Constantine I of Greece, Paul left Greece with his father following Constantine's deposition in 1917. He refused the crown after the death of his brother, King Alexander (October 1920), but returned home in December 1920 upon Constantine's restoration to the throne. With the rise of republican feeling, however, he again left Greece (December 1923) and remained in exile until 1935, when his brother George was recalled as king. In 1938 Paul married his young cousin, the princess Frederika of Brunswick. He held officer's rank in the Greek Navy, Army, and Air Force and was a member of the army general staff at the outbreak of war with Italy (1940). In 1941 he escaped from occupied Greece and lived in Cairo and South Africa.

After the war Paul again returned home and ascended the throne upon the death of George (April 1, 1947). At that time Greece received U.S. economic assistance and help in putting down the Communist insurrection. Though professing aloofness from politics, he occasionally intervened in domestic issues.

PAPACY

• **Paul I,** SAINT (b. Rome—d. June 28, 767, Rome; feast day June 28), pope from 757 to 767.

Consecrated deacon by Pope St. Zacharias, he became a key member of the Curia under his brother Pope Stephen II (III), whom he was elected on April 26, 757, to succeed. He secured the support of the Frankish king Pepin the Short against the animosity of the Lombard king Desiderius and the Byzantine emperor Constantine V Copronymus.

In 763 Pepin mediated between Paul and Desiderius, who, allied with the Byzantines, had invaded the Papal States. Concurrently, Paul, heretofore loyal to Constantinople, vigorously protested Constantine's revival of Iconoclasm (destruction of images). The ensuing Iconoclastic persecution caused an expulsion of many Greek monks, for whom Paul provided refuge in Rome. He is noted for transporting the relics of many saints from the catacombs to Roman churches and for his building projects, including the church of SS. Peter and Paul.

• **Paul II,** original name PIETRO BARBO (b. Feb. 23, 1417, Venice—d. July 26, 1471, Rome), Italian pope from 1464 to 1471.

He was bishop of the Italian cities of Cervia and Vicenza before being made cardinal by Pope Eugenius IV in 1440. After services in the Curia under popes Nicholas V and Ca-

Paul II, commemorative medallion from the Roman school, 1464–71

By courtesy of the National Gallery of Art, Washington, D.C., the Samuel H. Kress Collection

lixtus III, he became governor of Campania in 1456. Elected Pope Pius II's successor on Aug. 30, 1464, he immediately declared that "capitulations," or binding agreements that determined the subsequent conduct of elected prelates, could affect a new pope only as counsels, not as obligations, investing the papacy with an autocratic tone that was to persist throughout his pontificate.

Paul impaired his relations with King Louis XI of France by his repeated condemnations of the Pragmatic Sanction of Bourges—a pronouncement, issued by King Charles VII of France in 1438, that established the liberties of the French Church, particularly the election of the French king's nominee for successors to vacant prelacies.

He next turned his attention to the state of the Bohemian Church, which had been damaged by religious struggles with the Hussites (followers of the Bohemian religious reformer Jan Hus). Because the Council of Basel (1431–37) recognized the Hussites as a legitimate church released from papal censureship, Paul strove to abolish the Basel decree. He supported the Romanist (Catholic) party, which formed a confederacy against the king of Bohemia, George of Podebrady, a Hussite sympathizer. On Dec. 23, 1466, Paul excommunicated George and declared him deposed for refusing to suppress the Utraquists, an independent national church that branched off from the Hussites and that Rome did not recognize. Paul furthermore forbade all Catholics to continue their allegiance to George. In March 1468 he persuaded King Matthias I Corvinus of Hungary to declare war against George, who, concurrently, gained Louis's support. After Matthias conquered much of Moravia, Paul crowned him king of Bohemia in March 1469, a triumphant gesture of his crusade against the Hussites.

Seeing the advancing Turks as a major threat to Christendom, Paul in 1468 began fruitless negotiations with the Holy Roman emperor Frederick III to mount a crusade against them. He opposed the domineering policy of the Venetian government in Italian affairs and promulgated, with the Romans' consent, new statutes for Rome. In 1466 he initiated a severe prosecution against the Fraticelli (Franciscan extremists) with plans to exterminate them and their associates.

Suspecting that the Roman Academy and its founder, the Italian humanist Julius Pomponius Laetus, were opposing Christian ideals and endorsing a materialistic vision of life inspired by an admiration for the ancient world, Paul dissolved the academy and arrested its members in February 1468, subjecting one of its leading humanists, Bartolomeo Platina, to torture on additional charges of conspiracy. Thus, he incurred the enmity of the humanists, who saw him as an enemy of letters. He was, however, a patron of scholars and also a collector of antiquities and a restorer of monuments. He is responsible for founding the first printing presses at Rome, where he had built the celebrated Palace of St. Mark (now the Palazzo Venezia), his principal residence from 1466. Roberto Weiss's *Un umanista veneziano: Papa Paolo II* ("A Venetian Humanist: Pope Paul II") was published in 1958.

• **Paul III,** original name ALESSANDRO FARNESE (b. Feb. 29, 1468, Canino, Papal States—d. Nov. 10, 1549, Rome), Italian noble who was the last of the Renaissance popes (reigned 1534–49) and the first pope of the Counter-Reformation. The worldly Paul III was a notable patron of the arts and at the same time encouraged the beginning of the reform movement that was to affect deeply the Roman Catholic Church in the later 16th century. He called the Council of Trent in 1545.

Paul III, contemporary medallion; in the coin collection of the Vatican Library
Leonard von Matt—EB Inc.

Background and early years. Alessandro was the son of Pier Luigi Farnese and Giovannella Gaetani. In service to the papacy since the 12th century, the Farnese family had extended its possessions from a stronghold on Lake Bolsena south and westward to include most of the fiefs between Perugia, Orvieto, Sermoneta, and the sea. In 1417 Ranuccio Farnese (the Elder), one of the most celebrated *condottieri* (mercenary soldiers) of his time, had been made a Roman senator by Pope Martin V. Ranuccio's son Pier Luigi, by marriage with the Gaetani heiress, solidified the Farnese position in the Roman nobility. In 1489, Pier Luigi's daughter Giulia la Bella married Orsino Orsini, a relative of the Spanish cardinal Rodrigo Borgia (Borja), and became a favourite at the papal court. Her brother Bartolommeo became lord of Montalto; her other brother, Alessandro, was destined for the church.

Sensitive and talented, Alessandro Farnese was entrusted to the Humanist Pomponio Leto for his early education and then joined the Medici circle in Florence under Lorenzo the Magnificent. There he was associated with Giovanni de' Medici (the future Pope Leo X) and attended the University of Pisa.

Because of an obscure family quarrel, Alessandro's early sojourn in Rome was interrupted by a short prison term under Pope Innocent VIII. But his career was assured when Cardinal Rodrigo Borgia became his patron. On Rodrigo's election to the papacy (taking the name Alexander VI), he made Alessandro treasurer of the Roman Church and a year later, on Sept. 20, 1493, created him a cardinal deacon. Gossip traced Alessandro's rapid preferment to the intimacy between his sister Giulia and the Borgia pope, and Alessandro was referred to as the "petticoat cardinal."

Although a prelate, Alessandro did not become an ordained priest until 1519. Meanwhile, he conducted himself like a Renaissance nobleman. Of wide artistic tastes and philosophic interests, he increased his revenues with multiple benefices. He travelled on diplomatic missions, enjoyed the hunt, and delighted in majestic religious and secular ceremonies. Favoured also by Pope Leo X, he used his wealth to enhance his family position and constructed the famous Palazzo Farnese, on the Via Giulia in Rome. Moreover, despite his unfeigned personal piety, the Farnese cardinal kept a wellborn Roman mistress by whom he fathered four children—Pier Luigi, Paolo, Ranuccio, and Costanza. (Later, as Pope Paul III, he provoked serious charges of nepotism by using his papal influence to further the interests of his children and their families, going so far in one celebrated incident as to appoint two of his grandchildren, still in their teens, to the cardinalate.)

In 1509 Pope Julius II invested Cardinal Alessandro Farnese with the bishopric of Parma. Selecting Bartolomeo Giudiccioni as his vicar general, the Cardinal took seriously the obligation of governing the diocese and decided to change his private way of life. In May 1512 he served as Julius' legate for the Fifth Lateran Council in Rome; then, having discontinued his liaison with his mistress in 1513, he put the reform decrees of that council into effect in Parma with a visitation in 1516 and, three years later, with a synod. In June 1519 he was ordained a priest and said his first mass on Christmas of that year. Thereafter, his private life was without reproach, and the Cardinal was identified with the reform party in the Roman Curia.

Achievements as pope. The Farnese cardinal's diplomatic skills made him an invaluable aid to the five pontiffs in whose election he participated—Pius III, Julius II, Leo X, Adrian VI, and Clement VII—before he himself emerged as the Roman pontiff on Oct. 13, 1534. At the age of 67, Pope Paul, though apparently frail, was a man of great charm and determination. He was described in diplomatic reports as shrewd and affable, deliberately slow of speech yet loquacious, expressing himself in an elegant Italian or Latin with learned allusions, and scrupulously refraining from tying himself down to a definite "yes" or "no" until the final settlement of an issue—but then able to act with swift, uncompromising dispatch.

Of medium height, spare of figure, with an aquiline nose, ruddy complexion, and aristocratic hands, Paul III was portrayed by Titian in 1543 at age 75 in the full vigour of his pontificate. Two later Titian portraits depict the ravages of age on the pontiff but reveal the depth of intelligence and strength that accompanied him to his last breath at 82.

The pontiff kept himself in good health by frequent excursions in Rome and the countryside, supervising urban projects and fortifications. He encouraged agriculture and provided for new food supplies. His coronation was accompanied by tournaments and pageants, signalling the end of the austerity imposed by the sack of Rome in 1527. In 1536 he authorized the revival of the carnival and rearranged the main thoroughfare in Rome for the visit of the Emperor Charles V, restoring the panoply of traditional ceremonies for the reception of princes and ambassadors. His lavish policies brought prosperity to Rome and the Papal States.

Despite charges of paganism levelled against his pontificate for its secular extravagances—even astrologers were admitted to the papal court—Pope Paul was determined to reform the church. Aware, however, of the setback suffered by Pope Adrian VI's precipitate reform policy a decade earlier, he proceeded, in the face of great internal opposition, with a slow but deliberate call for conversion of the Roman clergy and curia, as well as a reorganization of the papal offices. Immediately upon his election he announced his intention to hold a council and summoned the papal ambassadors Girolamo Aleandro and Pietro Paolo Vergerio from Venice and Vienna, respectively, for consultation about the dangerous state of the church in the north. He then dispatched Vergerio to Austria and Germany on a two-year sojourn to enlist prelates and princes in the project of holding a council in Mantua or Turin. The Protestants for years had been clamouring for such an assembly on German soil, free of Roman domination. The papacy, however, had feared the calling of a general council would compromise its authority. Paul, however, proceeded with preparations for the council even after it was rejected by Martin Luther and the Protestant leaders.

In a series of consistories, or consultative assemblies, he created cardinals of proved virtue throughout Europe. He also encouraged the foundation of new religious orders and congregations, such as the Theatines, Somaschi, Barnabites, and the Ursuline nuns. Particularly important was his confirmation of the new Jesuit order, which was to provide the papacy with one of its principal instruments in promoting the Counter-Reformation.

Pope Paul's greatest problems were caused by his relations with Emperor Charles V and the French king Francis I, whom he tried to persuade to cease their inveterate wars and turn their forces against the Ottoman Turks, who menaced the coasts of Italy as well as the outposts of Christendom in the East. He encouraged the Emperor to suppress the Lutheran Schmalkaldic League, urged the French king to eliminate the Huguenots, and employed tortuous diplomatic skill to avoid siding with either monarch. In 1538 he journeyed to Nice in an attempt to bring them together. That same year, he excommunicated the English king Henry VIII, who had declared himself head of the English Church. (An earlier sentence of excommunication under Clement VII had been suspended.) Using the military skill of Pier Luigi (his son by his former mistress) and the diplomacy of his grandson Cardinal Alessandro, Paul asserted papal control over central Italy, skillfully avoiding encirclement by both the imperial and French forces.

The Council of Trent. In May 1536 Pope Paul published a bull of convocation for his proposed council to be held in Mantua. He also authorized a select group of cardinals to draw up a report on the abuses within the church. Guided by Cardinal Gasparo Contarini, this group denounced the ordination of poorly prepared priests, the selection of incompetent bishops, the accumulation of benefices, and the decadence of the religious orders, preaching, and the care of souls. The report, however, fell into Protestant hands and was used by Luther in a violent attack on the Roman Church and the papacy. Nevertheless, the Pope pursued his plans to hold the council, scheduled to open on May 23, 1537, at Mantua. With infinite patience, Paul sought to overcome the opposition of Emperor, kings, prelates, and princes, proroguing and postponing the council's opening again and again over the course of nine years, but finally succeeding in having it inaugurated by his legate, Cardinal Giovanni del Monte, in Trent on Dec. 13, 1545.

In deference to the clamouring of the Protestants, the Emperor insisted that the council confine itself mainly to dealing with discipline and reform. Nevertheless, the Pope's decision that doctrinal matters be given precedence prevailed, and, in its early sessions, the Council of Trent hammered out decrees on the canon of the Scriptures, original sin, justification, and the sacraments, as well as on reform. Fears of the plague and the menace of an attack by armed Protestant forces induced the Pope to accept the council's transfer to Bologna in February 1548. But the Emperor forbade the Spanish and German prelates to go to Bologna, and the Pope had to suspend the Council on Sept. 17, 1549. Nevertheless, this first phase of the Council of Trent had achieved a substantial step forward, leading to a thorough reform of the Church's teaching and discipline.

Throughout his pontificate, Pope Paul frequently visited trouble spots in the Papal States and beyond. He was in Civitavecchia in 1535 and 1537; visited Lucca and Piacenza on his way to Nice in 1538; appeared in Perugia to pacify the city after his forces broke the power of the Colonna family in 1540; and in 1543 visited Bologna on his way to Busseto to meet the Emperor.

Patronage of the arts. As a patron of the arts, Pope Paul restored the University of Rome, increased the subsidies and importance of the Vatican Library, and showed favour to theologians and canonists but did not neglect the fine arts. He cajoled Michelangelo into finishing the fresco "The Last Judgment" in the Sistine Chapel, decorating the Pauline Chapel, and completing the plans for the construction of the new St. Peter's Basilica. He used Antonio da Sangallo the Younger and a host of architects to renew the fortifications of Rome and the Papal States, continued the construction of the Sala Regia (Royal Hall) in the Vatican, and ordered the reconstruction of the buildings on the Capitoline Hill.

In the midst of grave family, political, and military setbacks, the Pope visited the Quirinal Palace in Rome in early November 1549 and was taken with a raging fever. Clear-minded to the end, he received the last sacraments and died on November 10, in his 82nd year. On his deathbed he is reported to have repented of his nepotism.

Whatever the faults of his early career and the political intrigues of his pontificate, Pope Paul III was remembered by contemporaries as "good hearted, obliging and supremely intelligent . . . worthy to be described as magnanimous." He led the church out of the decadent splendour of the Renaissance into the austere rejuvenation of the post-Reformation epoch. His grandiose tomb in St. Peter's by Michelangelo's pupil Guglielmo della Porta befits the place he occupies in the church's history. (F.X.M.)

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• **Paul IV,** original name GIAN PIETRO CARAFA (b. June 28, 1476, Carpriglio, Abruzzi—d. Aug. 18, 1559, Rome), Italian pope from 1555 to 1559, whose anti-Spanish policy renewed the war between France and the Habsburgs.

Of noble birth, he owed his ecclesiastical advancement to the influence of his uncle Cardinal Oliviero Carafa. As bishop of Chieti, Carafa served Pope Leo X as envoy to England and Spain. He resigned his benefices and, with St. Cajetan of Thiene (Gaetano da Thiene), founded the order of the Theatines (Congregation of Clerics Regular) in 1524 to promote clerical reform through asceticism and apostolic work. Having advised Leo's successors in matters of heresy and reform, he was appointed to Pope Paul III's commission for ecclesiastical reform, was made cardinal in 1536, and was responsible for a reorganization of the Roman Inquisition.

Despite his violent antipathies, austerity, uncompromising reformism, and exalted concept of papal authority, Carafa was elected pope

Paul IV, detail from his tomb sculpture by Pirro Ligorio; in the church of Sta. Maria sopra Minerva, Rome

Alinari—Art Resource/EB Inc.

on May 23, 1555, through the influence of Cardinal Alessandro Farnese. Even the veto of the Holy Roman emperor Charles V was ignored. When Paul's excessive violence in orthodoxy and reform was carried over into politics, his pontificate was destined to be strife ridden. He succumbed to the counsels of his nephews, whom he elevated, and to his hatred of the Habsburgs and of the Spaniards, whom he attempted to drive from Naples by allying with France in December 1555. Thus, he provoked war against Charles and King Philip II of Spain. The Spanish victory in August 1557 at Saint-Quentin, Fr., and the advance upon Rome by the Duke of Alba forced Paul to come to terms with Spain; peace was made on Sept. 12, 1557. He continued his animosity toward Spain and the Habsburgs, however, by refusing to recognize the abdication of Charles and the election of his brother Ferdinand I (1558) as successor on grounds that the imperial transaction was effected without papal approval.

Paul's handling of the Protestant question was as disastrous as his politics. He denounced as a pact with heresy the Peace of Augsburg, the first permanent legal basis for the existence of Lutheranism and Catholicism in Germany. In England he ruined Cardinal Reginald Pole, archbishop of Canterbury, who had infuriated Paul by trying to prevent the conflict between France and the Habsburgs. In April 1557 Paul deprived Pole of his authority and in the following June, after England's declaration of war on France, summoned him to Rome on protests of heresy. Queen Mary I of England intervened, saving Pole from the fate suffered by his friend Cardinal Giovanni Morone, whom Paul imprisoned on illegitimate charges of unorthodoxy. He facilitated the ultimate victory of Protestantism in England by insisting upon the restitution of monastic lands that had been sold and by requiring Elizabeth I to submit her claims to the English throne to him.

An enemy to conciliar methods, Paul did not reassemble the Council of Trent (which had been suspended since 1552), preferring instead to work through commissions or congregations. But without a council he stopped many ecclesiastical abuses in Rome, disciplined vagrant clergy, and introduced firmer asceticism in the papal court.

Under him, the Roman Inquisition, established in 1542, launched a reign of terror. Following the trend in the Roman Catholic Church that wrongly suspected Jews of influencing the Reformation to some degree, Paul in 1555 established the ghetto at Rome. He enforced perpetual wearing of the Jewish badge and drastic separation of Jews from Christians. The antagonisms he aroused proved fatal to his reforming cause. G.M. Monti's *Ricerche su Papa Paolo IV Carafa* ("Researches on Pope Paul IV Carafa") was published in 1923.

• **Paul V,** original name CAMILLO BORGHESE (b. Sept. 17, 1552, Rome—d. Jan. 28, 1621, Rome), Italian pope from 1605 to 1621.

A distinguished canon lawyer, he was papal envoy to Spain for Pope Clement VIII, who made him cardinal in 1596. He became vicar of Rome in 1603 and on May 16, 1605, was elected as Pope Leo XI's successor at a time when the Kingdom of Naples and the Venetian Republic were violating ecclesiastical rights.

One of his first acts was to excommunicate the recalcitrant minister of Naples for violating the *privilegium fori—i.e.,* the right of ecclesiastics to be judged in criminal cases not by civil courts but by church courts. In 1606 a conflict erupted between Paul and Venice over papal jurisdiction and ecclesiastical immunity within the republic, where the celebrated theologian Paolo Sarpi encouraged resistance to papal censures. The situation became critical when Paul's interdict against Venice (May 1606) caused firmer defiance, led chiefly by Sarpi. Fear of Venice's breaking with Rome

Paul V, portrait bust by Gian Lorenzo Bernini, *c.* 1618; in the Borghese Gallery, Rome

Alinari—Art Resource/EB Inc.

and the risk of civil war in Italy induced the neighbouring states to intervene. Paul was prepared to appeal to arms, but a compromise was reached on April 21, 1607, mainly through France's mediation. Paul lifted the interdict and excommunicated Sarpi, against whom a murderous attack was made in the following October. Sarpi accused the Curia of instigating the assault, which Paul reprobated. He realized that the effect of interdicts was dead, and they were not used by the papacy against a sovereign state again.

Earlier (Sept. 22, 1606), Paul had expressly forbidden the Roman Catholics of England to take the new oath of allegiance imposed on them by King James I. His contention with Venice, however, made him politically cautious, and he endeavoured to maintain peace between the Habsburgs and France. He considered another crusade against the Turks, though without success. He particularly feared an open breach of the Peace of Augsburg, the first permanent legal basis for the coexistence of Lutheranism and Catholicism in Germany. Thus, when in 1618 hostility between German Catholics and Protestants caused fighting that developed into the Thirty Years' War, Paul gave no support to the Catholic powers.

In doctrinal matters, he was surprisingly undogmatic. He encouraged missions, notably those in Latin America, and confirmed many new congregations and brotherhoods, including St. Philip Neri's Oratorians (approved 1613), a congregation of secular priests. To preserve papal documents he founded the privy Vatican archives. In 1612 he authorized a new version of the *Rituale Romanum,* one of the Roman rite's liturgical books, which he promulgated on June 17, 1614.

Paul was guilty, however, of nepotism and is responsible for his family's inordinate wealth. He especially favoured his nephew Marcantonio Borghese, whom he created prince of Vivaro. His excessive fondness for display, which wasted funds needed for more crucial purposes, made him a spectacular patron of the arts and of building, including the chapel in the Basilica of Santa Maria Maggiore, Rome, where he is buried.

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• **Paul VI,** original name GIOVANNI BATTISTA MONTINI (b. Sept. 26, 1897, Concesio, Italy—d. Aug. 6, 1978, Castel Gandolfo), Italian pope of the Roman Catholic church (reigned

Paul VI
AP/Wide World Photos

1963–78) during a period including most of the second Vatican Council (1962–65) and the immediate postconciliar era, in which he issued directives and guidance to a changing Roman Catholic church. His pontificate was confronted with the problems and uncertainties of a church facing a new role in the contemporary world.

Early life and career. The son of a middle-class lawyer—who was also a journalist and local political figure—and of a mother belonging to the same social background, Montini was in his early years educated mainly at home because of frail health. Later he studied in Brescia. Ordained priest on May 29, 1920, he was sent by his bishop to Rome for higher studies and was eventually recruited for the Vatican diplomatic service. His first assignment, in May 1923, was to the staff of the apostolic nunciature (papal ambassador's post) in Warsaw, but persistent ill health brought him back to Rome before the end of that same year. He then pursued special studies at the Ecclesiastical Academy, the training school for future Vatican diplomats, and at the same time resumed work at the Vatican Secretariat of State, where he remained in posts of increasing importance for more than 30 years.

In 1939 Montini was appointed papal undersecretary of state and later, in 1944, acting secretary for ordinary (or nondiplomatic) affairs. He declined an invitation to be elevated to the Sacred College of Cardinals in 1953. In the beginning of November 1954, Pope Pius XII appointed him archbishop of Milan, and Pope John XXIII named him cardinal in 1958. He was elected pope on June 21, 1963, choosing to be known as Paul VI.

Vatican II and Paul VI's pontificate. The Montini pontificate began in the period following the difficult first session of the second Vatican Council, in which the new pope had played an important, though not spectacular, part. His lengthy association with university students in the stormy atmosphere of the early days of the Fascist regime in Italy, in combination with the generally philosophical bent of his mind—developed by a long-standing habit of extensive and reflective reading—enabled him to bring to the perplexing problems of the times an academic understanding, coupled with the knowledge derived from long years of practical diplomatic experience. Paul VI guided the three remaining sessions of the second Vatican Council, often developing points he had first espoused as cardinal archbishop of Milan. His chief concern was that the Roman Catholic church in the 20th century should be a faithful witness to the tradition of the past, except when tradition was obviously anachronistic.

Upon the completion of the council (Dec. 8, 1965), Paul VI was confronted with the formidable task of implementing its decisions, which affected practically every facet of church life. He approached this task with a sense of the difficulty involved in making changes in centuries-old structures and practices—changes rendered necessary by many rapid transformations in the social, psychological, and political milieu of the 20th century. Paul VI's approach was consistently one of careful assessment of each concrete situation, with a sharp awareness of the many varied complications that he believed could not be ignored.

This prevalently philosophical attitude was often construed by his critics as timidity, indecision, and uncertainty. Nonetheless, many of Paul VI's decisions in these crucial years called for courage. In July 1968, he published his encyclical *Humanae Vitae* ("Of Human Life"), which reaffirmed the stand of several of his predecessors on the long-smoldering controversy over artificial means of birth prevention, which he opposed. In many sectors this encyclical provoked adverse reactions that may be described as the most violent attacks on the authority of papal teaching in modern times. Similarly, his firm stand on the retention of priestly celibacy (*Sacerdotalis Caelibatus,* June 1967) evoked much harsh criticism. Paul VI later likened the large numbers of priests leaving the ministry to a "crown of thorns." He also was disturbed by the growing numbers of religious men and women asking for release from vows or who were abandoning out of hand their religious vows.

From the very outset of his years as pope, Paul VI gave clear evidence of the importance he attached to the study and the solution of social problems and to their impact on world peace. Social questions had already been prominent in his far-reaching pastoral program in Milan (1954–63). During those years he had traveled extensively in the Americas and in Africa, centring his attention mainly on concern for workers and for the poor. Such problems dominated his first encyclical letter, *Ecclesiam Suam* ("His Church"), Aug. 6, 1964, and later became the insistent theme of his celebrated *Populorum Progressio* ("Progress of the Peoples"), March 26, 1967. This encyclical was such a pointed plea for social justice that in some conservative circles the pope was accused of Marxism.

Apostolic journeys. In an address to the council fathers at the end of the first session of the second Vatican Council, the then Cardinal Montini formulated a question that may be called the theme of his pastoral service as pontiff: "Church of Christ, what say you of yourself?" In an effort to answer this fundamental question, Paul VI undertook a series of apostolic journeys that were unparalleled occasions for a pope to set foot on every continent. His first journey was a pilgrimage to the Holy Land (January 1964), highlighted by his historic meeting with the Greek Orthodox patriarch of Constantinople, Athenagoras, in Jerusalem. At the end of that same year, he went to India, the first pope to visit Asia. The following year (Oct. 4, 1965) he traveled to the headquarters of the United Nations in New York City, where he delivered a moving plea for peace to the General Assembly in special session. In 1967 he undertook short visits to Fátima (Portugal) and to Istanbul and Ephesus (Turkey), a journey that had special ecumenical significance: a second meeting with Athenagoras in the patriarch's own episcopal city (Constantinople). In August 1968 the pope went to Bogotá, and he appeared before the International Labour Organisation and the World Council of Churches in Geneva, in June 1969. The following month he was in Uganda, East Africa. In the autumn of 1970, he undertook the longest papal journey in modern history: 10 days spent in visits to Tehrān, East Pakistan, the Philippines, Western Samoa, Australia, Indonesia, Hong Kong, and Ceylon, each stop bringing Paul VI into personal contact with different peoples of the world. His arrival in Manila almost ended in tragedy when an attempt was made on his life within minutes of his descent from the plane, but with no serious injury.

The themes treated by Paul VI on these trips were basically the same: world peace, social justice, world hunger, illiteracy, the brotherhood of man under God, and international cooperation.

Social and ecumenical interests. On Jan. 6, 1971, in the Clementine Hall in the Vatican, Paul VI conferred the Pope John XXIII Peace Prize on the Albanian-born Mother Mary Teresa Bojaxhiu, who had spent most of her life in India, where she had founded a special religious congregation of women dedicated to the alleviation of the countless ills of the poorest classes in the country. Paul VI declared on this occasion that the award was intended to centre attention on how even a humble individual without means can further world peace without fanfare, simply by proving in day-to-day action that "every man is my brother." Here, as in other instances, Paul's aim was to confront the world at large with the inescapable problems of justice and peace while at the same time proving conclusively that even these apparently insoluble problems can and must be settled with realistic courage and individual perseverance.

Paul VI's human concern found further expression in his efforts to lessen the long-standing tensions between the church of Rome and other churches and even with those professing no religion at all. He sought out closer understanding with numerous religious leaders throughout the world, both Christian and non-Christian, placing more emphasis on those aspects that unite the churches than on those that divide. To show that mutual acquaintance is at the very foundation of any plans or hopes for unity, Pope Paul met with prominent religious leaders from various communities in Great Britain, the United States, and the Soviet Union, as well as other countries. Paul VI also set up a special secretariat for nonbelievers, stressing the need of understanding and endeavouring to solve the problems posed by atheism.

Under his guidance the Roman Catholic church drastically revised its legislation governing marriages between its own members and those who profess other faiths, expressing a firm desire to diminish the threat of human tragedy following possible clashes of individual consciences. For this reason Paul VI's *motu proprio* (a type of papal document) was welcomed and praised for its understanding of human problems and its desire to find a satisfactory solution to the problem of mixed marriages without demanding of either side any renunciation of basic principles of conscience.

In the rise of modern ecumenism, Paul VI saw excellent opportunities to encourage world brotherhood, which, he hoped, might enable all men to continue their efforts for human well-being in their pursuit of happiness in unity of faith in God. On May 15, 1971, commemorating the 80th anniversary of Pope Leo XIII's encyclical *Rerum Novarum* on the reform of the social order, Pope Paul issued a forceful apostolic letter, "Octogesima Adveniens" with particular insistence on the necessity of involvement of all men in the solution of the problems of justice and peace. (E.L.H.)

BIBLIOGRAPHY. J.L. Gonzalez and T. Perez, *Paul VI* (1964), is a biography essential to an understanding of the man; substantial extracts from his discourses and other public pronouncements are included. James F. Andrews (ed.), *Paul VI: Critical Appraisals* (1970), is a collection of essays, some strongly disapproving of Paul's position on controversial issues. A more balanced view of his pontificate is presented by Peter Hebblethwaite, *The Year of Three Popes* (1979).

RUSSIA

• **Paul,** Russian in full PAVEL PETROVICH (b. Oct. 1 [Sept. 20, Old Style], 1754, St. Petersburg [now Leningrad], Russia—d. March 23 [March 11], 1801, St. Petersburg), emperor of Russia from 1796 to 1801.

Son of Peter III (reigned 1762) and Catherine II the Great (reigned 1762–96), Paul was reared by his father's aunt, the empress Elizabeth (reigned 1741–61). After 1760 he was tutored by Catherine's close adviser, the learned diplomat Nikita Ivanovich Panin, but the boy never developed good relations with his mother, who wrested the imperial crown from her mentally feeble husband in 1762 and, afterward, consistently refused to allow Paul to participate actively in government affairs.

Having married Sophia Dorothea of Württemberg (Russian name Maria Fyodorovna) in 1776 shortly after his first wife, Wilhelmina of Darmstadt (Russian name Nataliya Alekseyevna), died, Paul and his wife were settled by Catherine on an estate at Gatchina (1783), where Paul, removed from the centre of government at St. Petersburg, held his own small court and engaged himself in managing his estate, drilling his private army corps, and contemplating government reforms.

Despite Catherine's apparent intention to name Paul's son Alexander her heir, Paul succeeded her when she died (Nov. 17 [Nov. 6], 1796) and immediately repealed the decree issued by Peter I the Great in 1722 that had given each monarch the right to choose his successor; in its place Paul established in 1797 a definite order of succession within the male line of the Romanov family. Paul also, in an effort to strengthen the autocracy, reversed many of Catherine's policies; he reestablished centralized administrative agencies she had abolished in 1775, increased bureaucratic control in local government, and sought to impose limits on the authority of the nobles. In the process he provoked the hostility of the nobles, and, when he introduced harsh disciplinary measures in the army and displayed a marked preference for his Gatchina troops, the military, particularly the prestigious guards units, also turned against him.

Paul, detail of a portrait attributed to J. Voille, *c.* 1800; in the collection of Mrs. Merriweather Post, Hillwood, Washington, D.C.
By courtesy of Hillwood, Washington, D.C.

Confidence in his ability dropped even among his trusted supporters because of a number of actions. He demonstrated an inconsistent policy toward the peasantry and rapidly shifted from a peaceful foreign policy (1796) to involvement in the second coalition against Napoleon (1798) to an anti-British policy (1800). By the end of 1800, he had maneuvered Russia into the disadvantageous position of being officially at war with France, unofficially at war with Great Britain, without diplomatic relations with Austria, and on the verge of sending an army through the unmapped khanates in Central Asia to invade British-controlled India.

As a result of his inconsistent policies, as well as his tyrannical and capricious manner of implementing them, a group of highly placed civil and military officials, led by Count Peter von Pahlen, governor-general of St. Petersburg, and General Leonty Leontyevich, Count von Bennigsen, gained the approval of Alexander, the heir to the throne, to depose his father. On March 23 (March 11), 1801, they penetrated the Mikhaylovsky Palace and assassinated Paul in his bedchamber.

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

Paul KARAGEORGEVIĆ, PRINCE, Serbo-Croatian KNEZ (Prince) PAVLE KARAĐORĐEVIĆ (b. April 27, 1893, St. Petersburg [now Leningrad], Russia—d. Sept. 14, 1976, Paris, Fr.), regent of Yugoslavia in the period leading into World War II.

When Yugoslavia's king Alexander I was assassinated (Oct. 9, 1934), Paul was appointed regent for his 11-year-old nephew Peter II. Although Paul's sympathies lay with the British-French entente, he was forced to submit to Hitler's demands and align his country with the Axis powers. On March 27, 1941, two days after signing a treaty with Germany, Paul was deposed by a conspiracy led by General Dušan Simović and other air force officers. Paul fled to Greece, where he was captured by British forces after the war. After internment in Kenya he was released, and he settled in Paris.

Paul OF AEGINA, Latin PAULUS AEGINETA (b. *c.* 625, Aegina, Greece—d. *c.* 690), Alexandrian physician and surgeon, the last major ancient Greek medical encyclopaedist, who wrote the *Epitomēs iatrikēs biblio hepta,* better known by its Latin title, *Epitomae medicae libri septem* ("Medical Compendium in Seven Books"), containing nearly everything known about the medical arts in the West in his time.

Based largely on the works of such earlier Greek physicians as Galen, Oribasius, and Aëtius, the *Epitome* greatly influenced the medical practice of the Arabs, who considered Paul among the most authoritative of Greek medical writers. The Persian master physician ar-Rāzī (Rhazes) drew extensively from the work in writing his *Kitāb al-Manṣūrī* ("Book to al-Manṣūr") and Abū al-Qāsim, one of Islām's foremost surgeons, borrowed heavily from the *Epitome*'s sixth, or surgical, book in compiling the 30th chapter ("On Surgery") of his *at-Taṣrīf* ("The Method"). Thus Paul's work exercised a lasting influence on Western medieval medicine when the Arabic works were adopted as primary references in medieval Europe.

Besides his descriptions of lithotomy (surgical removal of bladder stones), trephination (removal of a disc of bone from the skull), tonsillotomy (removal of part of the tonsil), paracentesis (puncture of a body cavity in order to drain fluid), and amputation of the breast, Paul also devoted much attention in the *Epitome* to pediatrics and obstetrics. He dealt extensively with apoplexy and epilepsy, distinguished 62 types of pulse associated with various diseases, and rendered one of the first known descriptions of lead poisoning.

Paul OF SAMOSATA (fl. 3rd century), heretical bishop of Antioch in Syria and proponent of a kind of dynamic monarchian doctrine on the nature of Jesus Christ (*see* Monarchianism). The only indisputably contemporary document concerning him is a letter written by his ecclesiastical opponents, according to which he was a worldly cleric of humble origin who became bishop of Antioch in 260.

Paul held that it was a man who was born of Mary, through whom God spoke his Word (Logos). Jesus was a man who became divine, rather than God become man. A similar speculative Christology was found among the primitive Ebionites of Judaea; in Theodotus and Artemon of Rome (both of whom were excommunicated); and perhaps in other early Christian writers (and suggested by phrases in the New Testament, such as Acts 2:36). The biblical scholar Lucian of Antioch and his school were influenced by Paul. The 7th-century Paulicians of Armenia may have claimed to continue his traditions, hence their name.

Between 263 and 268 at least three church councils were held at Antioch to debate Paul's orthodoxy. The third condemned his doctrine and deposed him. But Paul enjoyed the patronage of Zenobia, queen of Palmyra, to whom Antioch was then subject, and it was not until late in 272, when the emperor Aurelian defeated Zenobia and brought Antioch under Roman imperial rule again, that the actual deposition was carried out.

Paul OF THE CROSS, SAINT, Italian SAN PAOLO DELLA CROCE, original name PAOLO FRANCESCO DANEI (b. Jan. 3, 1694, Ovada, Republic of Genoa [Italy]—d. Oct. 18, 1775, Rome; canonized 1867; feast day October 19), founder of the order of missionary priests known as the Passionists.

In 1720 Paul dedicated his life to God and began to experience visions, in the last of which the Virgin Mary appeared to him. He was inspired by this vision to found a congregation devoted to the suffering of Christ on the cross, and his rule for the new order was approved in 1741 by Pope Benedict XIV and confirmed in 1769 by Clement XIV. Paul subsequently founded the Passionist Nuns at Corneto (modern Tarquinia); the order was approved by Clement XIV in 1770. By the time of his death, Paul had established 12 monasteries in Italy, and since then his institute has spread throughout the world.

Paul OF THEBES, SAINT, also called PAUL THE HERMIT (b. *c.* 230, near Thebes, Egypt—d. *c.* 341, Theban desert; feast day January 15), ascetic who is traditionally regarded as the first Christian hermit.

According to St. Jerome, his biographer, Paul fled to the Theban desert during the persecution of Christians (249–251) under the Roman emperor Decius. Thereafter, he lived a life of prayer and penitence in a cave, dying at the reputed age of 113. Jerome considered Paul to be the first Christian hermit, an honour in modern times generally accorded to St. Anthony of Egypt. It is said that Anthony visited Paul when the latter was 113 years old and later buried him, wrapped in the cloak given to Anthony by Athanasius, bishop of Alexandria. In art Paul is often represented with a palm tree, symbolizing the source of his sustenance, or with two lions, who allegedly dug his grave.

Paul OF VENICE, Italian PAOLO VENETO, or PAOLO DI VENEZIA, Latin PAULUS VENETUS, original name PAOLO NICOLETTI (b. 1372, Udine, Patriarchate of Aquileia [Italy]—d.

June 15, 1429, Padua, Venetian Republic), Italian Augustinian philosopher and theologian who gained recognition as an educator and author of works on logic.

Influenced by study at Oxford and at Padua, where he also lectured (1408–15), Paul became Venetian ambassador to Poland (1413), but difficulties with the Venetian authorities prompted him to sever his ties with Venice. While teaching in Bologna (1424) and Siena (1422, 1427), where he became rector, he introduced the logic of William of Ockham. His principal works include *Logica parva* (1473), *Logica magna* (1481), *Summa totius philosophiae naturalis* (1496), and several discussions on Aristotle. The first two selections are known as *Logica duplex*, and they were used as a comprehensive textbook during the 15th and 16th centuries.

Paul THE APOSTLE, SAINT, original name SAUL OF TARSUS (b. AD 10?, Tarsus in Cilicia [now in Turkey]—d. 67?, Rome), 1st-century Jew who, after being a bitter enemy of the Christian church, became its leading missionary and possibly its greatest theologian. His extensive travels and his vision of a universal church were responsible for the speed with which Christianity became a world religion. More than half of the Acts of the Apostles deals with his career, and this, together with the letters written by him or in his name, comprises one-third of the New Testament.

A brief treatment of Saint Paul the Apostle follows. For a full treatment, *see* MACROPAEDIA: Paul, the Apostle.

Paul, a Roman citizen whose formal education must have been strictly Jewish, was trained as a rabbi and learned the trade of tentmaking. Although he never met Jesus, he regarded him as a threat to Pharisaic Judaism and persecuted his followers. Converted through a vision he experienced on the road to Damascus, he accepted his call to be the apostle to the Gentiles. After spending time in Arabia and in Damascus, he visited Peter and James in Jerusalem and eventually went with Barnabas to Antioch, where the idea of a planned mission first arose. Paul and Barnabas went to Jerusalem, consulted with the leaders of the Christians there, and reached agreement on future missionary policy. When Peter later visited Antioch, Paul insisted on disregarding the law that forbade Jews to eat with Gentiles.

Paul then began a series of three missionary journeys that took him to cities throughout Asia Minor and Greece. He maintained contact with the churches that he established by means of letters that taught, corrected, encouraged, and sometimes chided the young Christian communities. Paul paid his last visit to Corinth in AD 57 and then went to Jerusalem, where he was arrested. After being imprisoned at Caesarea for two years, he appealed to the emperor. He arrived in Rome in AD 60 and was kept in custody awaiting trial, during which time he wrote several letters.

Paul THE DEACON, Latin PAULUS DIACONUS (b. *c.* 720, Cividale del Friuli, Lombardy [Italy]—d. *c.* 799, Montecassino, Benevento), Lombard historian and poet, whose *Historia Langobardorum* ("History of the Lombards") is the principal source of information about his people.

Born to a rich and noble family of Friuli, northeast of Venice, Paul spent many years at the Lombard court in Pavia, serving as councillor under King Desiderius. After the fall of the Lombard kingdom to Charlemagne, Paul and his brother were involved in an anti-Frankish plot; their property was confiscated, and his brother was carried off as a prisoner to France. Paul took refuge in Benevento in southern Italy at the court of Duke Arichis II, who had married Desiderius' daughter Adalberga, once Paul's pupil. Several years later, when Charlemagne was in Rome, Paul sent verses to him begging for pardon and for the release of his brother. Charlemagne responded by freeing Paul's brother but insisted that Paul become a member of his court at Aachen, where he took part in the Frankish king's palace school, along with the scholars Alcuin and Einhard, meeting with the king for learned discussions.

In 786 Paul returned to Italy with Charlemagne, settling at the abbey of Montecassino, where he spent the rest of his life and wrote his history. Based on written sources and on oral tradition, which would otherwise have been lost, it covers the history of the Lombards to 744. His other works include a history of the bishops of Metz, a collection of homilies for the ecclesiastical year, a commentary on the Rule of St. Benedict, and another history—*Historia Romana*.

Paul THE HERMIT, SAINT: *see* Paul of Thebes, Saint.

Paul, Acts of, one of the earliest of a series of pseudepigraphal (noncanonical) New Testament writings known collectively as the Apocryphal Acts. Probably written about AD 160–180, the *Acts of Paul* is an account of the Apostle Paul's travels and teachings. It includes, among others, an episode reminiscent of the Greek fable of Androcles and the lion, in which Paul escapes from the wild beasts in the arena at Ephesus by recognizing a lion he had baptized earlier.

The *Acts of Paul* was first mentioned by Tertullian (AD 160–230), who found the book heretical because it encouraged women to preach and baptize. Tertullian related that the book had been written by a presbyter of a church in Asia who claimed to have written "out of love of Paul," and who was expelled from his church office. Despite the seemingly anti-Pauline endorsement of female ministry, the author did conform to doctrinal orthodoxy regarding continence and the Resurrection by establishing a close relationship between sexual purity and salvation. The author opposed the moral laxity of heretical Gnostic sects and attacked their denial of Christ's Incarnation and Resurrection.

Little was known of the actual contents of the *Acts of Paul* until the publication in 1904 of a 6th-century Coptic manuscript indicating that the complete apocryphon comprised three different texts: the *Acts of Paul and Thecla;* a letter from the Corinthians to Paul and his reply, commonly styled *III Corinthians;* and the *Martyrdom of Paul.* Each of these had previously been discovered as a separate writing in a number of manuscripts and in a variety of publications. The subsequent publication in 1936 of a substantial Greek fragment corroborated the theory that these texts share a common authorship and originally constituted a single work, the *Acts of Paul.*

Paul, Alice (b. Jan. 11, 1885, Moorestown, N.J., U.S.—d. July 9, 1977, Moorestown), American woman suffrage leader who introduced the first equal rights amendment campaign.

While doing graduate work in England in about 1908, Paul joined the British suffragettes, participating in militant actions and receiving three jail sentences. Returning to the United States, she advocated the use of militant tactics to publicize the need for a federal woman suffrage amendment to the U.S. Constitution. As chairman of the Congressional Union for Woman Suffrage (founded in 1913), later the National Woman's Party, Paul organized marches, White House protests, and rallies. After the suffrage amendment was ratified in 1920, she urged the enactment of a federal equal rights amendment to the Constitution. She wrote the "Lucretia Mott" amendment in 1923.

In 1938 Paul organized the World Party for Equal Rights for Women, known as the World Women's Party. She also successfully lobbied for references to sex equality in the preamble to the United Nations charter and in the 1964 U.S. Civil Rights Act.

Paul, Jean: *see* Jean Paul.

Paul, Lewis (d. 1759, London, Eng.), English inventor who devised the first power spinning machine, in cooperation with John Wyatt.

Paul was the son of a Huguenot refugee, at whose death he became a ward of the Earl of Shaftesbury. He began working with Wyatt about 1730, and they patented their machine in 1738. The idea was evidently Paul's, and the skilled Wyatt translated it into working machinery. The spinning machine operated by drawing cotton or wool through pairs of successively faster rollers. This spinning machine was eventually superseded by Richard Arkwright's water frame. Paul also patented a carding machine in 1748.

Paul, Wolfgang (b. Aug. 10, 1913, Lorenzkirch, Ger.), German physicist who shared one-half of the Nobel Prize for Physics in 1989 with the German physicist Hans G. Dehmelt. (The other half of the prize was awarded to the American physicist Norman F. Ramsey.) Paul received his share of the prize for his development of the Paul trap—an electromagnetic device that captures ions (electrically charged atoms) and holds them long enough for their properties to be accurately measured.

Paul studied at technological institutes in Munich and Berlin and received a doctoral degree in physics from the Technical University in Berlin in 1939. He became a lecturer at the University of Göttingen in 1944 and was a full professor there from 1950. From 1952 he also taught at the University of Bonn.

The Paul trap, which he developed in the 1950s, used a radio-frequency current to maintain an alternating electric field that isolates and confines charged particles and atoms in a small space. The Paul trap allowed physicists to study atomic properties and test physical theories with high degrees of precision and became an important tool in modern spectroscopy. Paul also invented a way of separating ions of different masses and storing them in the Paul trap, using a principle that was subsequently widely applied in modern spectrometers.

Paul-Boncour, Joseph (b. Aug. 4, 1873, Saint-Aignan, Fr.—d. March 28, 1972, Paris), French leftist politician who served as minister of labour, of war, and of foreign affairs and who for four years was France's permanent representative to the League of Nations.

Paul-Boncour
H. Roger-Viollet—Harlingue

After receiving a degree in law from the University of Paris, Paul-Boncour practiced law, organized the legal council of the Bourses du Travail (syndicalist workers' associations), and from 1898 to 1902 was private secretary to Premier Pierre Waldeck-Rousseau. He was elected deputy from his native district in 1909 and served as minister of labour in 1911. He lost his seat in the Chamber in 1914 but was returned to the National Assembly after World War I as a Socialist. In 1931, however, he resigned from the Socialist Party and formed a new group, the Union Socialiste Républicaine, composed of independents. That same year he was elected senator and served until the establishment of Marshal Philippe Pétain's Vichy government in 1940.

Paul-Boncour was permanent delegate to the League of Nations from 1932 to 1936, minister of war in the 1932 Cabinet of Édouard Herriot, premier from December 1932 to January 1933, and minister of foreign affairs from December 1932 to January 1934, from January to June 1936, and in March 1938. In July 1940 he voted against granting constitutional powers to Marshal Pétain and recommended continuation of the war against Germany from Algiers. A member of the Consultative Assembly in 1944, he led the French delegation at San Francisco and signed the United Nations Charter on behalf of France. He was a senator from 1946 to 1948.

Paul-Boncour's books *Le Féderalisme économique* (1900; "Economic Federalism") and *Les Syndicats de fonctionnaires* (1906; "Unions of Civil Servants") showed his interest in trade unionism. He is also the author of *Art et démocratie* (1912; "Art and Democracy") and *Entre deux guerres: souvenirs sur la III^e République* (1946; *Recollections of the Third Republic,* 1958).

Paula (Malta): *see* Paola.

Paulding, James Kirke (b. Aug. 22, 1778, Dutchess County, N.Y., U.S.—d. April 6, 1860, Hyde Park, N.Y.), dramatist, novelist, and public official chiefly remembered for his early advocacy and use of native American material in literature.

At 18 he went to New York City, where he formed a lasting friendship with the Irving brothers. This association aroused his enthusiasm for literature, and he, with William and Washington Irving, founded the *Salmagundi* (1807–08), a periodical consisting mainly of light satires on local subjects. The outbreak of hostilities between England and America encouraged the assertion of Paulding's nationalism. He satirized England's conduct toward America during the war in *The Diverting History of John Bull and Brother Jonathan* (1812) and *The Lay of the Scottish Fiddle: A Tale of Havre de Grace* (1813), the latter a burlesque of Sir Walter Scott. The same spirit of nationalism found expression in two later satires also directed at the British: *A Sketch of Old England: by a New England Man* (1822) and *John Bull in America* (1825).

The advantages and hardships of western migration are the theme of "The Backwoodsman" (1818), a poem written to call the American author home in his search of literary themes. Novels such as *Koningsmarke, the Long Finne, a Story of the New World* (1823), *Westward Ho!* (1832), and *The Old Continental, or, the Price of Liberty* (1846) represent Paulding's attempts to employ the American scene in fiction. His popular play, *The Lion of the West* (first performed 1831; first published 1954), introduced frontier humour to the stage by depicting a character resembling Davy Crockett and helped during the 1830s to contribute to the growing legend of Crockett. His *Life of Washington* (1835) illustrates Paulding's Americanism. Plain, even at times vulgar in style, he yet possessed a playful irony that he shared with the New York writers of his day. He held several public posts in New York and from 1838 to 1841 served as secretary of the navy. His literary work, however, overshadows his routine labours as a government official.

Pauli, Wolfgang (b. April 25, 1900, Vienna—d. Dec. 15, 1958, Zürich), Austrian-born U.S. winner of the Nobel Prize for Physics in 1945 for his discovery (1925) of the Pauli exclusion principle, which states that in an atom no two electrons can have the same energy. This principle clearly relates the quantum theory to the observed properties of atoms.

When he was 20, Pauli wrote a 200-page encyclopaedia article on the theory of relativity. He was appointed a lecturer at the University of Hamburg in 1923, and the following year he proposed that a fourth quantum number, which may take on the numerical values $+1/2$ or $-1/2$, was necessary to specify electron energy states. It was later found that the two values represent the two possible directions of spin for fermions. In 1925 he introduced his exclusion principle, which immediately made clear the reason for the structure of the periodic table of the elements.

In 1928 Pauli became professor of theoretical physics at the Federal Institute of Technology, Zürich. Under his direction the institution became a great centre of research in theoretical physics during the years preceding World War II. In the late 1920s it was observed that when a beta particle (electron) is emitted from an atomic nucleus, there is generally some energy and momentum missing, a grave violation of the laws of conservation. Rather than allow these laws to be discarded, Pauli proposed in 1931 that the missing energy and momentum is carried away from the nucleus by some particle (later named the neutrino by Enrico Fermi) that is uncharged and has little or no mass and had gone unnoticed because it interacts with matter so seldom that it is nearly impossible to detect. The neutrino was finally observed in 1956.

In 1940 Pauli was appointed to the chair of theoretical physics at the Institute for Advanced Study, Princeton, N.J., and in 1946 he became a naturalized citizen of the United States. Following World War II he returned to Zürich.

Pauli exclusion principle, assertion that no two electrons in an atom can be at the same time in the same state or configuration, proposed (1925) by the Austrian physicist Wolfgang Pauli to account for the observed patterns of light emission from atoms. The exclusion principle subsequently has been generalized to include a whole class of particles of which the electron is only one member.

Subatomic particles fall into two classes depending upon their statistical behaviour. Those particles to which the Pauli exclusion principle applies are called fermions. When in a closed system, such as an atom for electrons or a nucleus for protons and neutrons, fermions are distributed so that a given state is occupied by only one at a time.

Particles obeying the exclusion principle have a characteristic value of spin, or intrinsic angular momentum; their spin is always some odd whole-number multiple of one-half. In the modern view of atoms, the space surrounding the dense nucleus may be thought of as consisting of orbitals, or regions, each of which comprises only two distinct states. The Pauli exclusion principle indicates that, if one of these states is occupied by an electron of spin one-half, the other may be occupied only by an electron of opposite spin, or spin negative one-half. An orbital occupied by a pair of electrons of opposite spin is filled: no more electrons may enter it until one of the pair vacates the orbital. An alternative version of the exclusion principle as applied to atomic electrons states that no two electrons can have the same values of all four quantum numbers.

Paulician, member of a dualistic Christian sect that originated in Armenia in the mid-7th century. It was influenced most directly by the dualism of Marcionism, a Gnostic movement in early Christianity, and of Manichaeism, a Gnostic religion founded in the 3rd century by the Persian prophet Mani. The identity of the Paul after whom the Paulicians are called is disputed.

The fundamental doctrine of the Paulicians was that there are two principles, an evil God and a good God; the former is the creator and ruler of this world, the latter of the world to come. From this they deduced that Jesus was not truly the son of Mary, because the good God could not have taken flesh and become man. They especially honoured the Gospel According to Luke and the Letters of St. Paul, rejecting the Old Testament and the Letters of St. Peter. They rejected also the sacraments, the worship, and the hierarchy of the established church.

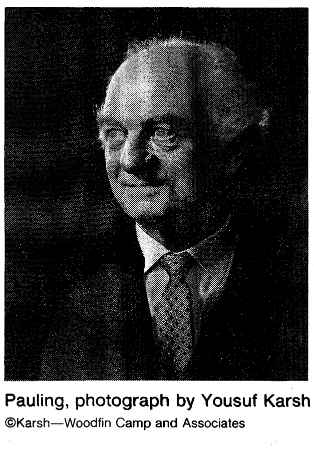
The founder of the Paulicians seems to have been an Armenian, Constantine, who took the additional name of Silvanus (Silas; one of St. Paul's companions). He gave a more distinctively Christian character to the Manichaeism that at the time was prevalent in the Asian provinces of the Byzantine Empire. The sect seems to have started a widespread political and military rebellion within the empire shortly after its appearance. Between 668 and 698 Constantine III and Justinian II sent two expeditions to repress it. Constantine (Silvanus) was stoned to death, and his successor, Simeon (Titus), was burned alive.

In the early 9th century Paulicianism was revived. It expanded into Cilicia and Asia Minor under Sergius (Tychicus), who made it strong enough to survive the persecution and massacre instigated by the emperor Michael I and the empress Theodora. The number and power of the Paulicians were greatest under Karbeas and Chrysocheir, the leaders in the third quarter of the 9th century. An expedition sent by Basil I in 872 broke their military power, but they survived in Asia at least until the Crusades. After the 9th century their importance lay chiefly in Thrace, where many Paulicians had been forcibly located to serve as a frontier force against the Bulgarians.

Paulician doctrines were disseminated among the Macedonians, Bulgarians, and Greeks, especially among the peasants, and it seems that they contributed to the development of the doctrines and practices of the Bogomils, another neo-Manichaean sect, who first appeared in Macedonia in the early 10th century.

To make the best use of the Britannica, consult the INDEX *first*

Pauling, Linus (Carl) (b. Feb. 28, 1901, Portland, Ore., U.S.), U.S. chemist who applied quantum mechanics to the study of molecular structures, particularly in connection with chemical bonding. Pauling received two Nobel Prizes, one for Chemistry in 1954 and another for Peace in 1962 (the latter in recognition of his efforts on behalf of the in-



Pauling, photograph by Yousuf Karsh

ternational control of nuclear weapons and his campaigns against nuclear testing). In 1972 he received the International Lenin Peace Prize.

Education. Pauling was the son of Herman William Pauling, a pharmacist, and Lucy Isabelle (Darling). He received his B.S. in chemical engineering at Oregon State Agricultural College (now Oregon State University), Corvallis, in 1922, then became a graduate assistant at California Institute of Technology, Pasadena, where he took his Ph.D. in physical chemistry in 1925. For two years he was a postdoctoral fellow in Europe, working in the laboratories of such noted scientists as Arnold Sommerfeld in Munich, Niels Bohr in Copenhagen, Erwin Schrödinger in Zürich, and Sir William Henry Bragg in London. He returned to California Institute of Technology as assistant professor of chemistry in 1927, becoming full professor in 1931 and serving as director of the Gates and Crellin Laboratories of Chemistry between 1936 and 1958.

Scientific achievements. Pauling's chemical work dealt with the many aspects of molecular structure, ranging from simple molecules to proteins. He was among the first to apply the principles of quantum mechanics to the structure of molecules and effectively utilized X-ray diffraction (the alteration of the straight course of X-rays by the interference of an atom or group of atoms), electron diffraction (interference with the course of electrons by atoms), magnetic effects, and the heat involved in forming chemical compounds for the calculation of interatomic distances and the angles between chemical bonds. He was successful in relating the distances and angles between chemical bonds to molecular characteristics and to interaction between molecules.

In order to account for the equivalency of the four bonds around the carbon atom, he introduced the concept of hybrid orbitals, in which electron orbits are moved from their original positions by mutual repulsion. Pauling also recognized the presence of hybrid orbitals in the coordination of ions or groups of ions in a definite geometric arrangement about a central ion. His theory of directed (positive and negative) valence (the capacity of an atom to combine with other atoms) was an outgrowth of his early work, as was the concept of the partial ionic character of covalent bonds—*i.e.,* atoms sharing electrons. His empirical concept of electronegativity, the power of attraction for electrons in a covalent bond, was useful in further clarification of these problems. In the case of compounds the molecules of which cannot be represented unambiguously by a single structure, he introduced the concept of resonance hybrids whereby the true structure of the molecule is regarded as an intermediate state between two or more depictable structures. The resonance theory came under heavy but unsuccessful attack in the U.S.S.R. in 1951 when doctrinaire scientists of the Communist Party argued that it conflicted with dialectical materialist principles. The ideas on bonding were developed serially in his numerous journal articles during his early career and were consolidated in his book, *The Nature of the Chemical Bond, and the Structure of Molecules and Crystals* (1939), which grew out of lectures he gave in 1937 and 1938. The textbook proved to be one of the most influential of the century.

In 1934 Pauling began to apply his knowledge of molecular structure to the complex molecules of living tissues, particularly in connection with proteins. His studies of the magnetic susceptibility (the ease with which something can be magnetized) of the hemoglobin (the red protein in the red cells of the blood) molecule during oxygenation inaugurated a succession of studies that led to a theory of native proteins (active proteins as found in living organisms), denatured proteins (ones that through heat or chemical action have broken some of their bonds), and coagulated (solidified) proteins. He became interested in proteins involved in immunological reactions and in 1940, with a German-born biologist, Max Delbrück, developed a concept of molecular complementarity in antibody-antigen reactions (in which the production of antibodies is stimulated in an organism when foreign substances called antigens are introduced). He recognized the importance of hydrogen bonding in protein structure and in interactions between macromolecules (extremely large molecules usually built from repeating groups of smaller molecules). His work with a U.S. chemist, Robert B. Corey, on the structure of amino acids and polypeptides (the chief components of proteins) led him to recognize that certain proteins have helical structures.

Late in the 1940s Pauling became interested in sickle-cell anemia when he learned that the red blood corpuscles show their abnormal crescent shape only in venous blood. Intuitively, he reasoned that the cause of the cell deformity must lie in a genetic defect associated with hemoglobin formation. His studies showed that the sickling effect was nullified by the presence of oxygen in the arterial blood.

Pauling also developed a molecular model for the explanation of anesthesia that was made public in 1961, introduced ideas toward the understanding of memory processes, and in 1965 postulated a theory of the atomic nucleus that had certain advantages over other models. His scientific career has been characterized by the application of intuitive guesses aided by a phenomenal memory of chemical facts. Pauling refers to this as the stochastic method (from the Greek "apt to divine the truth by conjecture").

Campaign for nuclear weapons disarmament. Following the development of nuclear weapons, Pauling became deeply concerned about the possible hazards of exposure to radiation associated with weapons testing. He expressed his view in his book *No More War!* (1958). In January 1958 he brought to the United Nations a petition signed by 11,021 scientists from all over the world urging an end to nuclear weapons tests. In 1963 he left the California Institute of Technology to become a staff member of the Center for the Study of Democratic Institutions at Santa Barbara, where he largely devoted himself to the study of problems of peace and war. No official reason was given for the award of the Peace Prize for 1962 to Pauling in 1963, but it is widely assumed that he received it for his efforts in behalf of the test ban treaty that was concluded in the same year. His pacifist views estranged him from many scientists with whom he had been closely associated during the years of World War II, when he had served as a civilian with the Office of Scientific Research and Development. Though he was equally opposed to nuclear testing by the United States and the Soviet Union, his loyalty to the U.S. was questioned in some conservative political circles.

In 1969 he resigned a position he had held for two years with the University of California, Santa Barbara, in protest against the educational policies of the Governor of California. He joined the chemistry department of Stanford University in California, where he was named professor emeritus in 1974. In addition to winning two Nobel Prizes, Pauling was widely honoured in scientific and pacifist circles. He held guest appointments in many other universities, both at home and abroad. His success as a scientist was based on his capacity for quick insight into new problems, his ability to recognize interrelationships, and the courage to put forward unorthodox ideas. While his concepts were not always correct, they always stimulated discussion and investigation. (A.J.I.)

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Paulinus, SAINT (b. 584?, Rome—d. 644, Rochester, Kent, Eng.; feast day October 10), Italian missionary who converted Northumbria to Christianity, became the first bishop of York, and was later made archbishop of Rochester.

In 601 Paulinus was sent with SS. Mellitus (later first bishop of London) and Justus (later first bishop of Rochester) to England by Pope St. Gregory I the Great to assist Archbishop St. Augustine of Canterbury in his mission of converting England to Christianity. Paulinus was consecrated bishop at Kent (625) by Justus (then fourth archbishop of Canterbury) and escorted the daughter of King Aethelberht (Ethelbert) of Kent to the Northumbrian king Edwin. Paulinus converted and baptized Edwin (627), who made him first bishop of York, after which Paulinus' missions spread throughout Northumbria. When in 632 Edwin was slain by the Anglo-Saxon kings Caedwalla and Penda, Paulinus fled to Kent, where he became bishop of Rochester. He became archbishop in 634, when he received the pallium (*i.e.,* symbol of metropolitan jurisdiction) from Pope Honorius I.

Paulinus OF NOLA, SAINT, byname of MEROPIUS PONTIUS ANICIUS PAULINUS (b. AD 353, Burdigala, Gaul—d. June 22, 431, Nola, Italy; feast day June 22), bishop of Nola and one of the most important Christian Latin poets of his time.

Paulinus became successively a Roman senator, consul, and governor of Campania, a region of southern Italy. Returning to Aquitaine he married and in 389 retired with his wife to Spain. The death of their only child, in 392, influenced them to sell their possessions in Gaul and Spain. In 395 Paulinus was ordained priest and with his wife settled at Nola to live an ascetic life devoted to charity.

Paulinus' act of renunciation caused his old master, the Latin poet and rhetorician Ausonius, to write reproaches in verse, to which Paulinus replied in poetical epistles. Paulinus' style generally echoes that of such classical authors as Virgil, Horace, and Ovid. His poems (395–407) on the feast day of St. Felix of Nola are particularly charming and are regarded as the chief source of Felix' life. Paulinus also promoted the saint's cult and built a basilica at Nola dedicated to him.

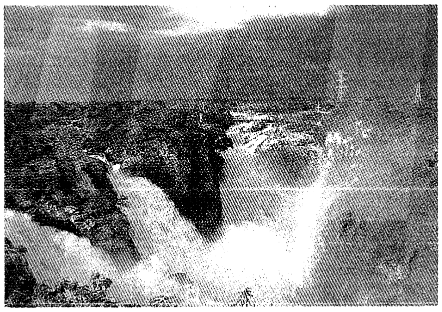
Some 50 of his extant letters correspond with famous contemporaries, including SS. Augustine and Jerome and the celebrated ascetic Sulpicius Severus. Paulinus' prose style is often rhetorical and exuberant: he could describe in dignified language his cold reception by Pope St. Siricius, or satirize the ignorance of those who could not understand the life of renunciation. About 409 Paulinus was consecrated bishop of Nola. P. Fabre's *Essai sur la chronologie de l'oeuvre de S. Paulin de Nole* (1948; "Essay on the Chronology of the Works of St. Paulinus of Nola") was followed by his *S. Paulin de Nole et l'amitié chrétienne* (1949; "St. Paulinus of Nola and Christian Friendship").

Paullus Macedonicus, Lucius Aemilius, Paullus also spelled PAULUS (b. *c.* 229 BC—d. 160), Roman general whose victory over the Macedonians at Pydna ended the Third Macedonian War (171–168 BC).

Paullus' father, a consul of the same name, had been killed fighting the Carthaginians at Cannae in 216. Praetor in 191 and consul in 182, Paullus campaigned against the Lusitanians in Spain (191–189) and the Ingauni in Liguria (181). As consul again in 168, he decisively defeated the Macedonian king Perseus at Pydna (June 22). Paullus carried out the settlement with Macedonia and Greece, and, on orders from the Senate, he sacked the cities of Epirus. He was censor in 164. Paullus was the father of Scipio Aemilianus.

Paulo Afonso, city, northeastern Bahia *estado* ("state"), northeastern Brazil, on the São Francisco River, at the site of the Paulo Afonso Falls and Paulo Afonso National Park. Made the seat of a municipality in 1958, Paulo Afonso is the transportation and commercial centre for its agricultural hinterland. It is accessible by highway from Salvador, the state capital, about 310 miles (500 km) south, and from neighbouring communities in Bahia, Alagoas, and Pernambuco *estados.* The airport has flights to Recife and Salvador. Pop. (1980 prelim.) 62,066.

Paulo Afonso Falls, Portuguese CACHOEIRA DE PAULO AFONSO, series of rapids and three cataracts in northeastern Brazil on the São Francisco River along the Bahia-Alagoas border. Lying 190 miles (305 km) from the river's mouth, the falls have a total height of 275



Paulo Afonso Falls on the São Francisco River, Alagoas, Brazil
Antonio Gusmao/TYBA—Agencia Fotografica Ltda.

feet (84 m) and a width of less than 60 feet (18 m). With an average water discharge of 100,000 cubic feet (3,000 cubic m) per second, the falls are the site of a large hydroelectric station. The falls form the central feature of Paulo Afonso National Park.

Paulos (Greek personal name): *see under* Paul.

Paulownia Sun, Order of the, Japanese TOKWA DAIJUSHO, exclusive Japanese order, founded in 1888 by Emperor Meiji and awarded for outstanding civil or military merit. The order, awarded to males only, is seldom bestowed on anyone below the rank of admiral, general, or ambassador. Actually, this order, consisting of one class, is the highest grade of another Japanese order, the Order of the Rising Sun.

The badge, suspended from a green paulownia flower, consists of a white enamel cross between the arms of which are the green leaves and mauve flowers of the paulownia tree, incorporated into the imperial Japanese emblem. Superimposed on the cross is a red enamel sun with rays of white and gold. The centre medallion is a polished garnet. *See also* Rising Sun, Order of the.

Paulus (Latin personal name): *see under* Paul, except as below.

Paulus, Friedrich von (b. Sept. 23, 1890, Breitenau, Ger. [now in Austria]—d. Feb. 1, 1957, Dresden, E.Ger.), German field marshal on the Eastern Front, whose capture at Stalingrad (now Volgograd) in early 1943 with his entire army became one of the turning points of World War II and contributed substantially to Germany's defeat.

After serving in World War I and as a staff officer early in World War II, Paulus became deputy chief of the German General Staff (1940) and helped draft plans for the invasion of the Soviet Union. As commander of the 6th Army from early 1942, he led the drive on Stalingrad. Surrounded in the city by a Soviet counteroffensive beginning Nov. 19, 1942, the 6th Army surrendered on Feb. 2, 1943. The Stalingrad disaster put an end to Germany's offensive role in the Soviet Union. A tremendous blow to morale, it also deprived Germany of about 300,000 irreplaceable trained men. Captured by Soviet forces, Paulus agitated against Adolf Hitler among German prisoners of war and later testified at the International Military Tribunal at Nürnberg. After his release in 1953, he settled in East Germany.

Paulus Helie, also spelled PAULUS ELIAE, or PAULUS ELIESEN: *see* Helgesen, Paul.

Paulus Macedonicus, Lucius Aemilius: *see* Paullus Macedonicus, Lucius Aemilius.

Paumotu (French Polynesia): *see* Tuamotu Archipelago.

pauraque, also spelled PARAUQUE, also called CUEJO (*Nyctidromus albicollis*), nocturnal bird of brushlands from southern Texas to northern Argentina. It is a relative of the nightjar (*q.v.*), belonging to the family Caprimulgidae. The pauraque is about 30 cm (about 12 inches) long, with rounded wings and a longish tail. It is mottled brown with a bold white bar on each wing; in the male the outer tail feathers are white.

pauropod, any member of the class Pauropoda (phylum Arthropoda), a group of small, terrestrial invertebrates distributed worldwide. The approximately 380 known species are found under dead leaves, stones, and rotten wood. They feed chiefly on fungi and decaying organic matter. Pauropods range in length from 0.5 to 2 mm (0.02 to 0.08 inch). The pauropod head is tiny, with large, branched antennae; deep-set mandibles; and two pairs of maxillae (accessory jaws). There is also a pair of vibration-sensitive organs (pseudoculi) instead of eyes. The body consists of 11 partially fused segments from which project nine pairs of legs, the first pair reduced and five jointed. Respiration occurs at the body surface in pauropods. Their reproductive system is equally simple; the sexes are separate.

Pausanias (d. probably between 470 and 465 BC, Sparta [Greece]), Spartan commander during the Greco-Persian Wars who was accused of treasonous dealings with the enemy.

A member of the Agiad royal family, Pausanias was the son of King Cleombrotus I and nephew of King Leonidas. He became regent for Leonidas' son after the father was killed at Thermopylae (480). Pausanias commanded the allied Greek army that defeated the Persians at Plataea (479), and he led the Greeks in the capture of Byzantium (478).

While Pausanias was at Byzantium, his arrogance and his adoption of Persian clothing and manners offended the allies and raised suspicions of disloyalty. Recalled to Sparta, he was tried and acquitted of the charge of treason but was not restored to his command. When the Athenians separated from the Spartans to form the Delian League, Pausanias returned to Byzantium privately and held the city until expelled by the Athenians (probably in 477). Later, suspected of plotting to seize power in Sparta by instigating a helot uprising, he took refuge in the Temple of Athena of the Brazen House to escape arrest. The Spartans walled in the sanctuary and starved him to death.

Although Herodotus doubted that Pausanias had colluded with the Persians, Thucydides, writing years after the events, was certain of his guilt. It is conceivable that the Spartans had made Pausanias a scapegoat.

Pausanias (fl. AD 143–176; b. Lydia), Greek traveler and geographer whose *Description of Greece* is an invaluable guide to ancient ruins.

Before visiting Greece, Pausanias had traveled widely in Asia Minor, Syria, Palestine, Egypt, Macedonia, Epirus (now in Greece and Albania), and parts of Italy. His *Description* takes the form of a tour of Greece starting from Attica. It is divided into 10 books; the first book seems to have been completed after 143, but before 161. No event after 176 is mentioned in the work.

His account of each important city begins with a sketch of its history; his descriptive narration follows a topographical order. He gives a few glimpses into the daily life, ceremonial rites, and superstitious customs of the inhabitants and frequently introduces legend and folklore.

Works of art are his major concern: inspired by the ancient glories of Greece, Pausanias is most at home in describing the religious art and architecture of Olympia and Delphi. At Athens he is intrigued by pictures, portraits, and inscriptions recording the laws of Solon; on the Acropolis, the great bronze statue of Athena; and, outside the city, the monuments of famous men and of Athenians fallen in battle. The accuracy of his descriptions has been proved by the remains of buildings in all parts of Greece.

The topographical part of his work shows his fondness for the wonders of nature: the signs that herald the approach of an earthquake; the tides; the icebound seas of the north; and the noonday sun, which at the summer solstice casts no shadow at Syene (Aswān), Egypt.

The famed anthropologist and classical scholar Sir James Frazer said of Pausanias: "without him the ruins of Greece would for the most part be a labyrinth without a clue, a riddle without an answer."

Paustovsky, Konstantin Georgiyevich (b. May 31 [May 19, Old Style], 1892, Moscow, Russia [now in Russian S.F.S.R.]—d. July 14, 1968, Moscow), Soviet fiction writer best known for his short stories, which carried the pre-Revolutionary romantic tradition into the Soviet period.

A descendant of Ukrainian Cossacks, Paustovsky attended school in Kiev, St. Petersburg (now Leningrad), and Odessa. Before he began to write, he worked at various jobs; he also traveled a good deal, both in the Soviet Union and abroad.

He wrote novels, novellas, short stories, and historical and biographical fiction. The short novels *Kara-Bugaz* (1932) and *Kolkhida* (1934) brought him wide popularity. His works reveal a lyrical interest in nature and an intense curiosity about people; he has been described as one of the best craftsmen among the writers of the 1920s and '30s. His main work, *Rasskaz zhizni* (1946–62; *The Story of a Life*), published in several volumes, is an autobiographical cycle of reminiscences.

Because of his age and prestige, Paustovsky was able in the 1950s and '60s to act as defender and protector of other Soviet writers who had been subjected to various degrees of official criticism.

pavane (probably from Italian *padovana,* "Paduan"), majestic processional dance of the 16th- and 17th-century European aristocracy. Until about 1650 the pavane opened ceremonial balls and was used as a display of elegant dress. Adapted from the basse danse, an earlier court dance, the pavane presumably traveled from Italy to France and England by way of Spain; in southern Spain it was performed in churches on solemn occasions.

Pavane, "The Dance in the Garden" illumination from the *Roman de la rose*, Toulouse, early 16th century; in the British Library (Harley MS 4425, fol. 14v)
Reproduced by permission of the British Library

The pavane's basic movement, to music in $\frac{2}{2}$ or $\frac{4}{4}$ time, consisted of forward and backward steps; the dancers rose onto the balls of their feet and swayed from side to side. A column of couples circled the ballroom, and the dancers occasionally sang. By about 1600, livelier steps like the *fleuret* (a brief lift of each foot before a step) made the dance less pompous. The pavane was customarily followed by its afterdance, the vigorous galliard. The *passamezzo* was a livelier Italian contemporary of the pavane.

The paired dances, pavane and galliard, were a forerunner of the instrumental dance suites of the 17th century, and pavanes appear in a few early suites—*e.g.*, the *padouanas* in some suites of Johann Hermann Schein. Later composers occasionally used the pavane as an instrumental piece; *e.g.*, Fauré (*Pavane for Orchestra*) and Ravel (*Pavane for a Dead Princess*).

Pavao (Serbo-Croatian personal name): *see under* Paul.

Pavarotti, Luciano (b. Oct. 12, 1935, Modena, Italy), Italian operatic lyric tenor, noted for his mastery of the highest notes of a tenor's range.

Pavarotti graduated from a teaching institute in Modena (1955) and then taught elementary school for two years. He studied opera privately, mostly in Mantua. After winning the Concorso Internationale, a singing competition, he made his professional operatic debut in Reggio Emilia, Italy, in 1961. He then played in opera houses throughout Europe and Australia. In 1968 he made his debut at the Metropolitan Opera House, New York City, and from 1971 was a regular performer there. Pavarotti became known to a wider public than opera connoisseurs; his concerts, recordings, and television appearances—which provided ample opportunity to display his ebullient personality—gained him a wide popular following.

He is considered one of the finest *bel canto* opera singers of recent times. Even in the highest register, his voice is noted for its purity of tone. His most notable operatic roles include the duke in *Rigoletto*, Tonio in *La Fille du Régiment* (with its demanding sequence of high C's), Arturo in *I Puritani*, and Radamès in *Aida*.

Pavel (Russian personal name): *see under* Paul.

Pavelić, Ante (b. July 14, 1889, Bradina, Bosnia—d. Dec. 28, 1959, Madrid), Croatian fascist leader and revolutionist who headed a Croatian state subservient to Germany and Italy during World War II.

As a practicing lawyer in Zagreb, Pavelić entered the nationalist Croatian Party of Rights. In 1920 he was elected city and county alderman at Zagreb. From 1927 to 1929 he was a representative in the Yugoslav Skupština (parliament), in which he vigorously opposed centralization of the country. When King Alexander assumed dictatorial power (1929), Pavelić fled to Italy and organized a group of Croatian terrorists known as the Ustaše (*q.v.*). They achieved their greatest success in organizing the assassination of King Alexander in Marseille on Oct. 9, 1934.

After the conquest of Yugoslavia by Axis forces in April 1941, Pavelić was installed as head (*poglavnik*) of the Independent State of Croatia, which included Bosnia and part of Dalmatia. Under the Ustaše regime, whose slogan was "Za dom Spremni" ("Ready for the Fatherland"), a brutal program of oppression was conducted against the Orthodox Serbs and the Jews. With the defeat of his German sponsors in May 1945, Pavelić left Croatia and went into hiding in Austria and Italy, finally escaping to Argentina in 1948. He survived an assassination attempt in 1957 but soon fled to Paraguay; he later settled in Spain.

pavement, in civil engineering, durable surfacing of a road, airstrip, or similar area. The primary function of a pavement is to transmit loads to the sub-base and underlying soil. Modern flexible pavements contain sand and gravel or crushed stone compacted with a binder of bituminous material, such as asphalt, tar, or asphaltic oil. Such a pavement has enough plasticity to absorb shock. Rigid pavements are made of concrete, composed of coarse and fine aggregate and portland cement, and usually reinforced with steel rod or mesh.

Pavese, Cesare (b. Sept. 9, 1908, Santo Stefano Belbo, Italy—d. Aug. 27, 1950, Turin), Italian poet, critic, novelist, and translator, who introduced many modern U.S. and English writers to Italy.

Pavese
Arnoldo Mondadori Editore

Born in a small town in which his father, an official, owned property, he moved with his family to Turin, where he attended high school and the university. Denied an outlet for his creative powers by Fascist control of literature, Pavese translated many 20th-century U.S. writers in the 1930s and '40s: Sherwood Anderson, Gertrude Stein, John Steinbeck, John Dos Passos, Ernest Hemingway, and William Faulkner; a 19th-century writer who influenced him profoundly, Herman Melville (one of his first translations was of *Moby Dick*); and the Irish novelist James Joyce. He also published criticism, posthumously collected in *La letteratura americana e altri saggi* (1951; *American Literature, Essays and Opinions,* 1970). His work probably did more to foster the reading and appreciation of U.S. writers in Italy than that of any other single man.

A founder and, until his death, an editor of the publishing house of Einaudi, Pavese also edited the anti-Fascist review *La Cultura.* His work led to his arrest and imprisonment by the government in 1935, an experience later recalled in "Il carcere" (published in *Prima che il gallo canti,* 1949; in *The Political Prisoner,* 1955) and the novella *Il compagno* (1947; *The Comrade,* 1959). His first volume of lyric poetry, *Lavorare stanca* (1936; *Hard Labor,* 1976), followed his release from prison. An initial novella, *Paesi tuoi* (1941; *The Harvesters,* 1961), recalled, as many of his works do, the sacred places of childhood. Between 1943 and 1945 he lived with partisans of the anti-Fascist Resistance in the hills of Piedmont.

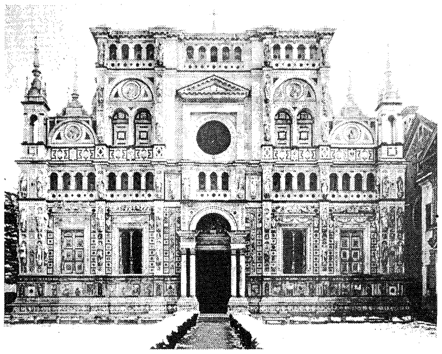
The bulk of Pavese's work, mostly short stories and novellas, appeared between the end of the war and his death. Partly through the influence of Melville, Pavese became preoccupied with myth, symbol, and archetype. One of his most striking books is *Dialoghi con Leucò* (1947; *Dialogues with Leucò,* 1965), poetically written conversations about the human condition. The novel considered his best, *La luna e i falò* (1950; *The Moon and the Bonfires,* 1950), is a bleak, yet compassionate story of a hero who tries to find himself by visiting the place in which he grew up. Several other works are notable, especially *La bella estate* (1949; in *The Political Prisoner,* 1955). Shortly after receiving the Strega Prize for it, Pavese committed suicide in a hotel room.

A Pavese Prize for literature was established in 1957, and some of Pavese's most significant work was published after his death, notably a volume of love lyrics that is thought to contain his best poetry, *Verrà la morte e avrà i tuoi occhi* (1951; "Death Will Stare at Me out of Your Eyes"); the story collection *Notte di festa* (1953; *Festival Night and Other Stories,* 1964); and the striking chronicle of his inner life, *Il mestiere de vivere, diario 1935–1950* (1952; London, *This Business of Living,* New York, *The Burning Brand: Diaries 1935–1950,* both 1961).

Many collections of Pavese's work have appeared, including *Racconti* (1960; *Told in Confidence and Other Stories,* 1971), a collection of much of his best fiction; *Poesie edite e inedite* (1962), edited by Italo Calvino; and *Lettere* (1966), which covers the period from 1924 to 1950. A poetry collection in English, *A Mania for Solitude, Selected Poems 1930–1950,* was published in 1969.

Pavia, Latin TICINUM, city, capital of Pavia province, Lombardia (Lombardy) region, northern Italy, on the left bank of the Ticino River, above its junction with the Po, 20 mi (32 km) south of Milan, with which it is connected by the Naviglio di Pavia (Pavia Canal).

Pavia originated as Ticinum, a settlement of the Papiria tribe, which was conquered by Rome *c.* 220 BC and later became a key point in the Roman defense of upper Italy. Pillaged by the barbarians Attila in AD 452 and Odoacer in 476, it later became an important centre of Gothic resistance against the Byzan-



The Certosa di Pavia, a Carthusian monastery completed in the 17th century, north of Pavia, Italy
SCALA—Art Resource/EB Inc.

tine Empire. From the 6th century, under the Lombards, it was a leading city of Italy, even after it fell to the Franks in 774. After a series of wars with Milan from the 11th to the 13th century, it was finally subdued by the viscounts of Milan and the Visconti of Brittany in the 14th century and became the political centre of Italy under Gian Galeazzo II Visconti, who founded the University of Pavia. The park of the Visconti Castle north of Pavia was the scene in 1525 of the defeat and capture of the French king Francis I by the Holy Roman emperor Charles V, aided by the Pavians and by Swiss militia; this battle demonstrated the superiority of firearms over cold steel and revolutionized military tactics. During the 18th century, Pavia was occupied by the Austrians, French, and Spaniards. It was one of the leading cities of Venetian Lombardy in the campaigns of the Risorgimento (movement for Italian political union) and was joined to the Kingdom of Italy in 1859.

The city still retains the ancient plan of the Roman *castrum* (fortified place), with main crossroads and a network of streets for *centuriae* (companies of soldiers). At its centre is the cathedral with its vast cupola; begun in 1488 by Cristoforo Rocchi and completed in 1898 according to his still extant model, the building has the form of a Latin cross. Among numerous other churches the most notable are S. Michele (1155, on the remains of a 7th-century foundation), the ancient Lombard cathedral where the medieval "kings of Italy" were crowned; S. Pietro in Ciel d'Oro (consecrated 1132), mentioned by the writers Dante, Petrarch, and Boccaccio, with a marble tomb (1362) containing the bones of St. Augustine of Hippo; S. Teodoro (12th century), decorated with 13th-century frescoes; and the Gothic churches of the Carmine (14th century) and S. Francesco (begun 1288). Secular buildings include the 12th- and 16th-century Broletto, or town hall; the Visconti Castle (1360–65) containing valuable artistic collections; and beautiful cloisters and palaces, one of which (Palazzo Malaspina) houses the Pinacoteca (art gallery). North of Pavia on the extreme boundary of the park of the Visconti is the Certosa di Pavia, a Carthusian monastery, the most celebrated religious monument in Lombardy; it was begun in 1396 by Bernardo da Venezia and continued by other notable artists in a transitional style between Gothic and Renaissance.

The University of Pavia, founded in 1361, is linked with the ancient law school, which dates back to 825. The colleges of Ghislieri and Borromeo, founded in the 16th century by Pope Pius V and St. Charles Borromeo, with the addition of the Cairoli, Castiglioni-Brugnatelli, Fraccaro, and Afro-Asiatic colleges, made Pavia the Oxford of Italy. It is particularly noted for the study of law, science, medicine, and surgery and has a central library of more than 400,000 volumes and 1,500 manuscripts.

A centre of communications, agriculture, and industry, the city manufactures sewing machines and has mechanical-engineering, ferrous-metalworking, chemical, and textile industries. Pop. (1983 est.) mun., 84,644; province 510,946.

Pavia, Battle of (Feb. 24, 1525), the decisive military engagement of the war in Italy between Francis I of France and the Habsburg emperor Charles V, in which the French army of 28,000 was virtually annihilated and Francis himself, commanding the French army, was taken prisoner. Francis was sent to Madrid, where, the following year, he concluded peace and surrendered French claims to Italy.

The French army had been besieging the city of Pavia, 20 miles (30 kilometres) south of Milan, when the 23,000-man Habsburg army under Fernando Francisco de Avalos, marchese di Pescara, arrived to aid the 6,000-man garrison and lift the siege. A hasty French attack was on the point of encircling Pescara when 1,500 Spanish arquebusiers opened fire on the rear of the French cavalry and riddled the ranks of the French and their allied Swiss infantry. The French attacks thereafter, made by German and Swiss mercenary infantry, were routed. The Spanish counterattack, supported by the Pavia garrison, which joined in the battle, completely swept the French from the field, destroying Francis' army as a fighting force in the process. Spanish hegemony in Italy dates from this battle.

Pavía y Lacy, Manuel (b. July 6, 1814, Granada, Spain—d. Oct. 22, 1896, Madrid), Spanish general whose defeat in the Spanish Revolution of 1868 helped bring about the deposition of Queen Isabella II.

Pavía was encouraged to enter the military by his father, an infantry colonel, and eventually was admitted to the elite Guards regiment. When Isabella became queen in 1833, he fought for her against her uncle Don Carlos in the First Carlist War (1833–39) and in 1840 he was made marqués de Novaliches. He emigrated to France in 1841 and on his return in 1843 took part in the overthrow of the government of Gen. Baldomero Espartero.

Pavía was named minister of war (1847) in the cabinet of the conservative Gen. Ramón Narváez. Afterward he was captain general of Catalonia, where he attempted to stimulate economic development and also conducted military operations against Carlist rebels. In 1853 he reluctantly accepted the post of captain general of the Philippines, where in the following year he crushed the revolt of José Cuesta.

In the revolution that deposed Isabella, Pavía attempted to halt the rebel army of Gen. Francisco Serrano y Domínguez by seizing a strategic bridge at Alcolea. His forces were repulsed at the bridge, and he was badly wounded. His defeat (Sept. 28, 1868) opened the way to Madrid, and the following day the Queen fled into exile.

Pavía emigrated at the accession of Amadeus as king of Spain (December 1870) but returned after the collapse of the First Republic and the restoration of Alfonso XII (December 1874). Pavía then regained his honours.

Pavía y Rodríguez de Alburquerque, Manuel (b. Aug. 2, 1827, Cádiz, Spain—d. Jan. 4, 1895, Madrid), Spanish general whose coup d'etat ended Spain's First Republic (1873–74).

In 1865 Pavía joined the staff of Gen. Juan Prim, whom he supported in the unsuccessful uprisings of 1866 and, after two years in exile, in the successful revolution of 1868 that deposed Isabella II (1833–68). After the abdication of Amadeus (February 1873) and the proclamation of the First Republic, Pavía suppressed insurrection in the south of Spain and restored the authority of the central government. On three occasions during 1873 he served as captain general of Madrid.

Pavía supported Pres. Emilio Castelar y Ripoll from September 1873 to Jan. 3, 1874, when Castelar was defeated in the Cortes (National Assembly) and was forced to resign. Castelar had governed firmly and had the confidence of the army. Believing the return to power of more radical republicans would harm both the nation and the army, especially his own artillery corps, Pavía forcibly dissolved the Assembly and summoned Gen. Francisco Serrano y Domínguez to form a new government. During Serrano's year of rule the First Republic existed in name only.

After the restoration of Alfonso XII (December 1874), Pavía was elected to the Cortes (1876). He was captain general of Catalonia (1880–81) and of New Castile (1885–86).

Pavie, Auguste (-Jean-Marie) (b. 1847, Dinan, Fr.—d. 1925, Thourie), French explorer and diplomat, who is best known for his explorations of the Upper Mekong Valley and for having almost single-handedly brought the kingdoms of Laos under French control.

Pavie went to Cochinchina (now part of southern Vietnam) as a sergeant in the marines in 1869 and subsequently worked in the Post and Telegraphic Department, directing construction of telegraph lines between Phnom Penh, the Cambodian capital, and Bangkok, the capital of Siam, in 1879 and another between Phnom Penh and Saigon (now Ho Chi Minh City) in 1882. While working on the telegraph lines, he travelled throughout Siam, Cambodia, and Vietnam and gained an intimate knowledge of each country's customs and languages. The French government hoped to gain control of the Lao states of the Mekong River Valley and accredited Pavie to the Siamese government as vice consul in Luang Prabang (Louangphrabang; the former royal capital of Laos) in 1886. During the next five years he travelled throughout northern Laos, winning for France the friendship of local rulers and chiefs and frustrating Siamese attempts to bring order to the region, which was beset by marauding bands of Chinese freebooters (Ho or Haw).

From 1891 to 1893 Pavie served as consul general in Bangkok and helped bring about the Franco-Siamese Conflict of 1893. Arguing that the Lao states intermittently had been vassals of Vietnam (though much longer dominated by Siam), and that France by taking control of Vietnam now succeeded to Vietnam's rights in Laos, Pavie justified military movements into the Lao states, thus provoking the crisis as a result of which all Lao states east of the Mekong River came under a French protectorate.

Before returning to France, Pavie conducted an expedition, defining Laos' borders with China, and with Upper Burma, which the British had annexed in 1886. He wrote *Mission Pavie: Indochine 1879–1895* (Paris, 1898–1919) and *À la conquête des coeurs* (1921).

pavilion, light temporary or semipermanent structure used in gardens and pleasure grounds. Although there are many variations, the basic type is a large, light, airy garden

Garden pavilion, Versailles, Fr.
Edwin Smith

room with a high-peaked roof resembling a canopy. It was originally erected, like the modern canvas marquee, for special occasions such as fetes, garden banquets, and balls, but it became more permanent, and by the late 17th century the word was used for any garden building designed for use on special occasions.

Although many ornamental garden pavilions survive in old gardens, the modern use of the name is usually limited to buildings on sports grounds with accommodations for changing clothes and storing equipment. "Pavilion" has also been used in reference to a tent, a summer residence, a dance hall, a bandstand, an annex or structure connected to a larger building, and to one of several buildings making up a complex.

pavillon chinois (musical instrument): *see* jingling Johnny.

Pavle (Serbo-Croatian personal name): *see under* Paul.

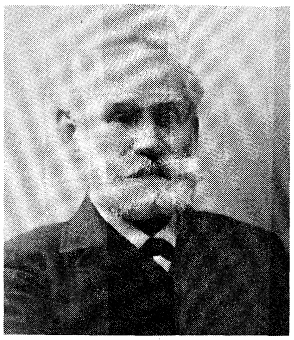
Pavlodar, *oblast* (administrative region), northern Kazakh Soviet Socialist Republic, with an area of 49,250 sq mi (127,500 sq km) along the middle course of the Irtysh River on the southern edge of the West Siberian Plain. Its lands consist mainly of flat steppe, which turns into semidesert in the southwest. The climate is continental and dry. Pavlodar, the capital, and Ekibastuz form a rapidly growing industrial complex based on power generated from the large, though low-grade, Ekibastuz coal deposits; there is also gold mining at Maykain and salt production from the salt lakes. Bozshakol is the site of a major copper deposit. The *oblast* is an important grain producer—mainly wheat and millet—and sheep and cattle also are raised. In 1981 nearly 60 percent of the population was urban. The most numerous nationalities are Russians, Kazakhs, Ukrainians, and Germans. The Irtysh-Karaganda Canal starts near the new town of Yermak (founded 1961), the site of a large power station and a ferro-alloying plant; there is navigation on the Irtysh. Pop. (1983 est.) 867,000.

Pavlodar, city and administrative centre of Pavlodar *oblast* (region), Kazakh Soviet Socialist Republic, and a port on the Irtysh River. The oldest *oblast* centre in northern Kazakhstan, it was founded in 1720 as Koryakovsky outpost on the Russian Irtysh fortified line, near salt lakes. It became the town of Pavlodar in 1861, but, although it did a substantial trade in salt and agricultural produce, its population was only about 8,000 in 1897. Since then and particularly since the mid-1960s, it has grown considerably to become a major industrial centre, with tractor, aluminum, and chemical plants. An oil refinery was completed in 1978. The city has industrial and teacher-training institutes. Pop. (1983 est.) 302,000.

Pavlograd, city, Dnepropetrovsk *oblast* (administrative region), Ukrainian Soviet Socialist Republic. A minor trading centre before the October Revolution (1917) and incorporated in 1797, it is now a major railway junction and centre of the west Donets Coal Basin. Its varied industrial base includes the manufacture of machinery for the chemical industry and for foundries and the production of bricks. There is a linen mill, and consumer industries include the processing of foodstuffs and production of clothes and furniture. Pop. (1983 est.) 115,000.

Pavlov, Ivan Petrovich (b. Sept. 26 [Sept. 14, old style], 1849, Ryazan, Russia—d. Feb. 27, 1936, Leningrad), Russian physiologist known chiefly for his development of the concept of the conditioned reflex. In a now classic experiment, he trained a hungry dog to salivate at the sound of a bell, which was previously associated with the sight of food. He developed a similar conceptual approach, emphasizing the importance of conditioning, in his pioneering studies relating human behaviour to the nervous system. He was awarded the Nobel Prize for Physiology in 1904 for his work on digestive secretions.

Life. Pavlov was the first son of the village priest and the grandson of the village sexton, and he spent his youth in his native village (Ryazan) in central Russia. He attended a church school and theological seminary, where



Pavlov
By courtesy of the Nobelstiftelsen, Stockholm

his seminary teachers impressed him by their devotion to imparting knowledge. In 1870 he abandoned his theological studies to enter the University of St. Petersburg (Leningrad), where he studied chemistry and physiology. After receiving the M.D. at the Imperial Medical Academy in St. Petersburg (graduating in 1879 and completing his dissertation in 1883), he studied during 1884–86 in Germany under the direction of the cardiovascular physiologist Carl Ludwig (in Leipzig), and the gastrointestinal physiologist Rudolf Heidenhain (in Breslau).

Having worked with Ludwig, Pavlov's first independent research was on the physiology of the circulatory system. From 1888 to 1890, in the laboratory of Botkin in St. Petersburg, he investigated cardiac physiology and the regulation of blood pressure.

He became so skillful a surgeon that he was able to introduce a catheter into the femoral artery of a dog almost painlessly without anesthesia and to record the influence on blood pressure of various pharmacological and emotional stimuli. By careful dissection of the fine cardiac nerves he was able to demonstrate the control of the strength of the heartbeat by nerves leaving the cardiac plexus; by stimulating the severed ends of the cervical nerves, he showed the effects of the right and left vagal nerves on the heart.

Pavlov married an attractive pedagogical student in 1881, a friend of the author Fyodor Dostoyevsky, but he was so impoverished that at first they had to live separately. He attributed much of his eventual success to his wife, a domestic, religious, and literary woman, who devoted her life to his comfort and work. In 1890 he became professor of physiology in the Imperial Medical Academy, where he remained until his resignation in 1924. At the newly founded Institute of Experimental Medicine, he initiated precise surgical procedures for animals, with strict attention to their postoperative care and facilities for the maintenance of their health.

During the years 1890–1900 especially, and to a lesser extent until about 1930, Pavlov studied the secretory activity of digestion. While working with Heidenhain, he had devised an operation to prepare a miniature stomach, or pouch; he isolated the stomach from ingested foods, while preserving its vagal nerve supply. The surgical procedure enabled him to study the gastrointestinal secretions in a normal animal over its life-span. This work culminated in his book *Lectures on the Work of the Digestive Glands* in 1897.

Laws of conditioned reflex. By observing irregularities of secretions in normal unanesthetized animals, Pavlov was led to formulate the laws of the conditioned reflex, a subject that occupied his attention from about 1898 until 1930. He used the salivary secretion as a quantitative measure of the psychical, or subjective, activity of the animal, in order to emphasize the advantage of objective, physiological measures of mental phenomena and higher nervous activity. He sought analogies between the conditional (commonly though incorrectly translated as "conditioned") reflex and the spinal reflex.

According to the physiologist Sir Charles Sherrington, the spinal reflex is composed of integrated actions of the nervous system involving such complex components as the excitation and inhibition of many nerves, induction (*i.e.,* the increase or decrease of inhibition brought on by previous excitation), and the irradiation of nerve impulses to many nerve centres. To these components, Pavlov added cortical and subcortical influences, the mosaic action of the brain, the effect of sleep on the spread of inhibition, and the origin of neurotic disturbances principally through a collision, or conflict, between cortical excitation and inhibition.

Beginning about 1930, Pavlov tried to apply his laws to the explanation of human psychoses. He assumed that the excessive inhibition characteristic of a psychotic person was a protective mechanism—shutting out the external world—in that it excluded injurious stimuli that had previously caused extreme excitation. In Russia this idea became the basis for treating psychiatric patients in quiet and nonstimulating external surroundings. During this period Pavlov announced the important principle of the language function in the human as based on long chains of conditioned reflexes involving words. The function of language involves not only words, he held, but an elaboration of generalizations not possible in animals lower than the human.

Opposition to Communism. Pavlov's relationships with the Communists and the Soviet government were unique not only for the Soviet Union but also for the history of science. Although he was never a politician, he spoke fearlessly for what he considered the truth. In 1922, during the distressing conditions in the aftermath of the Revolution, he requested permission from Lenin to transfer his laboratory abroad. Lenin denied this request, saying that Russia needed scientists such as Pavlov and that Pavlov should have the same food rations as an honoured Communist. Although it was a period of famine, Pavlov refused: "I will not accept these privileges unless you give them to every one of my collaborators!" In spite of many honours granted him by Soviet officials, he upbraided them openly. After returning from his first visit to the United States in 1923 (the second was in 1929), he publicly denounced Communism, stated that the basis for international Marxism was false, and said that, "For the kind of social experiment that you are making, I would not sacrifice a frog's hind legs!" In 1924, when the sons of priests were expelled from the Military Medical Academy in Leningrad (the former Imperial Medical Academy), he resigned his Chair of Physiology announcing "I also am the son of a priest, and if you expel the others I will go too!" In 1927, distressed that his was the only negative vote in the Academy of Sciences against the newly recommended "red professors," he wrote to Stalin, protesting that "On account of what you are doing to the Russian intelligentsia—demoralizing, annihilating, depraving them—I am ashamed to be called a Russian!" In the late 1920s, as an anti-Communist gesture, he refused N.I. Bukharin, the Communist commissar of education, admission to his laboratory, though the laboratory was supported by government funds administered by Bukharin.

During the last two years of his life, Pavlov gradually ceased these excoriations and even stated that he hoped to see the success of the government at the helm of his country. This change of heart may have been a result of increased government support of science and of his own feelings of patriotism when war with Japan seemed imminent. He was never a Communist, however, nor was he responsible for the technique of brainwashing that has sometimes been ascribed to him.

In personal habits Pavlov was extremely punctual, never missing an appointment, it was claimed, and arriving on time in the laboratory even when there was revolutionary activity on the streets. To a collaborator, who explained his 10-minute delay as a result of the shooting, Pavlov exclaimed, "What difference does a Revolution make when you have experiments to do in the laboratory!" He was a bold, vehement nonconformist both in science and in his personal life; he fiercely took up the cudgel for what he believed regardless of the force of his opposition. Although Pavlov held to scientific agnosticism, he considered true religion beneficial; he said that he envied no one anything except his wife her devout religious faith.

Assessment. Pavlov's method of studying the normal, healthy animal in natural conditions made possible his contributions to science. He was able to formulate the idea of the conditioned reflex because of his ability to reduce a complex situation to the simple terms of an experiment. Recognizing that in so doing he omitted the subjective component, he insisted that it was not possible to deal with mental phenomena scientifically except by reducing them to measurable physiological quantities.

Although Pavlov's work laid the basis for the scientific analysis of behaviour, and notwithstanding his stature as a scientist and physiologist, his work was subject to certain limitations. Philosophically, while recognizing the preeminence of the subjective and its independence of scientific methods, he did not, in his enthusiasm for science, clarify or define this separation. Clinically, he accepted uncritically psychiatric views concerning schizophrenia and paranoia, and he adopted such neural concepts as induction and irradiation as valid for higher mental activity. Many psychiatrists now consider his explanations too limited, and some neurophysiologists have taken greater interest in other developments, such as electrophysiology and biochemistry. In contrast to Sherrington, he has had few prominent students outside Russia. His method of working with the normal, healthy, unanesthetized animal over its entire life has not been generally accepted in physiology. (W.H.G.)

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Pavlova, Anna (Pavlovna) (b. Feb. 12 [Jan. 31, old style], 1881, St. Petersburg, Russia—d. Jan. 23, 1931, The Hague), Russian ballerina, the most celebrated dancer of her time. She studied at the Imperial School of Ballet at the Mariinsky Theatre from 1891, joined the Imperial Ballet in 1899, and became a prima ballerina in 1906. In 1909 she went to Paris on the historic tour of the Ballets Russes. After 1913 she danced independently with her own company throughout the world.

Early life and the Imperial Ballet. The place and time of Pavlova's birth could hardly have

Anna Pavlova
Culver Pictures

been better for a child with an innate talent for dancing. Tsarist Russia maintained magnificent imperial schools for the performing arts. Entry was by examination, and, although Pavlova's mother was poor—her father had died when she was two years old—the child was accepted for training at the Imperial School of Ballet at the Mariinsky Theatre (now the Kirov State Theatre) in St. Petersburg in 1891.

Following ballet tradition, Pavlova learned her art from teachers who were themselves great dancers. She graduated to the Imperial Ballet in 1899 and rose steadily through the grades to become prima ballerina in 1906. By this time she had already danced *Giselle* with considerable success.

Almost immediately, in 1907, the pattern of her life began to emerge. That year, with a few other dancers, she went on a tour to Riga, Stockholm, Copenhagen, Berlin, and Prague. She was acclaimed, and another tour took place in 1908. In 1909 the impresario Sergey Diaghilev staged a historic season of Russian ballet in Paris, and Pavlova appeared briefly with the company there and later in London. But her experience of touring with a small group had given her a taste for independence, and she never became part of Diaghilev's closely knit Ballets Russes. Her destiny was not, as was theirs, to innovate but simply to show the beauties of classical ballet throughout the world. While she was still taking leave from the Mariinsky Theatre, she danced in New York City and London in 1910 with Mikhail Mordkin.

International acclaim. Once she left the Imperial Ballet in 1913, however, her frontiers were extended. For the rest of her life, with various partners (including Laurent Novikov and Pierre Vladimirov) and companies, she was a wandering missionary for her art, giving a vast number of people their introduction to ballet. Whatever the limitations of the rest of the company, which inevitably was largely a well-trained, dedicated band of young disciples, Pavlova's own performances left those who watched them with a lasting memory of disciplined grace, poetic movement, and incarnate magic. Her quality was, above all, the powerful and elusive one of true glamour.

Pavlova's independent tours, which began in 1914, took her to remote parts of the world. These tours were managed by her husband, Victor Dandré. The repertoire of Anna Pavlova's company was largely conventional. They danced excerpts or adaptations of Mariinsky successes such as *Don Quixote, La Fille mal gardée, The Fairy Doll,* or *Giselle,* of which she was an outstanding interpreter. The most famous numbers, however, were the succession of ephemeral solos, endowed by her with an inimitable enchantment: *The Dragonfly, Californian Poppy, Gavotte,* and *Christmas* are names that lingered in the hearts of her audiences, together with her single choreographic endeavour, *Autumn Leaves* (1918).

Pavlova's enthusiasm for ethnic dances was reflected in her programs. Polish, Russian, and Mexican dances were performed. Her visits to India and Japan led her to a serious study of their dance techniques. She compiled these studies into *Oriental Impressions,* collaborating on the Indian scenes with Uday Shankar, later to become one of the greatest performers of Indian dance, and in this way playing an important part in the renaissance of the dance in India.

Since she was the company's raison d'être, the source of its public appeal, and, therefore, its financial stability, Pavlova's burden was extreme. It was hardly surprising, therefore, that, by the end of her life, her technique was faltering, and she was relying increasingly on her unique qualities of personality.

Pavlova's personal life was undramatic apart from occasional professional headlines, as when, in 1911, she quarrelled with Mordkin. She kept her marriage secret for some time, and there were no children; her maternal instincts spent themselves on her company and on a home for Russian refugee orphans, which she founded in Paris in 1920. She loved birds and animals, and her home in London, Ivy House, Hampstead, became famous for the ornamental lake with swans, beside which she was photographed and filmed, recalling her most famous solo, *The Dying Swan,* which the choreographer Michel Fokine had created for her in 1905. These film sequences are among the few extant of her and are included in a compilation called *The Immortal Swan,* together with some extracts from her solos filmed one afternoon in Hollywood, in 1924, by the actor Douglas Fairbanks, Sr. (K.S.W.)

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Pavlovian conditioning, also called CLASSICAL CONDITIONING, a type of conditioned learning which occurs because of the subject's instinctive responses, as opposed to operant conditioning, which is contingent on the willful actions of the subject. *See* conditioning; Pavlov, Ivan Petrovich.

Pavlovo, city and administrative centre of Pavlovo *rayon* (district), Gorky *oblast* (region), western Russian Soviet Federated Socialist

Republic, on the Oka River. Its metalworking industries are continuations of what was a long handicraft tradition in metal goods, though now the industry produces buses and tractor and automobile parts as well. The city has a technical college devoted to the metalworking industry. Pop. (1983 est.) 70,000.

Pavlovsk, city, Leningrad *oblast* (administrative region), northwestern Russian Soviet Federated Socialist Republic. Founded in 1777 as Pavlovskoye, it became a city and was renamed Pavlovsk in 1796. The site, on the Slavyanka River, was a gift from Catherine II the Great to her son and heir, Paul. She commissioned the Scottish architect Charles Cameron to design the palace and park, most of which was built between 1782 and 1786. Later, other architects made changes and additions to Cameron's original scheme. The main building is the Great Palace, a domed, rectangular structure, surrounded by 1,500 ac (600 ha) of park.

The palace and grounds became a museum after World War I but were extensively damaged by the German occupation of 1941–44. Restoration of the palace and the park began in 1946 and was completed in 1973. Pop. (1970) 20,969.

Pavlovsky Posad, city, Moscow *oblast* (administrative region), western Russian Soviet Federated Socialist Republic, on the Klyazma River. It grew from a monastic village and, in the 18th century, was a centre of peasant silk weaving. In 1844 it became an industrial centre (*posad*) with other villages and had nine silk and three paper factories, employing 2,000 workers. It now has cotton, woollen, clothing, and ceramic industries. Pop. (1983 est.) 71,000.

Pavón, Battle of (Sept. 17, 1861), military clash at Pavón in the Sante Fe province of Argentina between the forces of the Argentine Confederation, commanded by Justo José de Urquiza, and those of Buenos Aires province, led by the governor, Bartolomé Mitre. Mitre's victory there marked the end of decades of internal armed conflict in Argentina.

Following the defeat of Mitre's Buenos Aires army at the Battle of Cepeda in 1859, Buenos Aires was constrained to join the confederation. But Mitre's forces won in a subsequent confrontation at Pavón, though not decisively, and Urquiza concluded that he now had little chance of success in his bid for national leadership. Thus a new national government was set up, with the capital again at Buenos Aires (it had been moved to Paraná, in Entre Ríos province, in 1853, when Buenos Aires had seceded from the confederation), and Mitre became provisional president. When the congress that was elected under the new government convened in May 1862, Mitre was chosen president for a six-year term.

Pawcatuck River, river rising in Worden Pond and Great Swamp, South Kingstown, R.I., U.S. It flows generally southwestward, emptying into Little Narragansett Bay after a course of about 30 mi (50 km). The river passes Shannock, Carolina, Bradford, Potter Hill, and Westerly and forms part of the boundary between Rhode Island and Connecticut. Several dams on the river supply power for manufacturing plants. The name is derived from an Algonkian Indian word that probably means "open divided stream."

Pawhuska, city, seat (1907) of Osage County, northeastern Oklahoma, U.S. It was settled in 1872 and named for an Osage chief, Paw-Hiu-Skah (White Hair), and the first buildings were those of the Indian Agency (established 1873). Cattle and oil (discovered in 1897) provide the basis of the economy, which is augmented by cotton ginning and light manufacturing, including oil-field equipment and clothing. Pawhuska is the tribal capital of the Osage Nation and the site of the Osage Tribal Museum. In 1909 the Rev. John Mitchell organized in the city what is claimed to be the first Boy Scout troop in the U.S. Inc. 1906. Pop. (1980) 4,771.

Pawla (Malta): *see* Paola.

Pawlikowska-Jasnorzewska, Maria (b. Nov. 20, 1893, Krakau, Austria-Hungary—d. July 9, 1945, Manchester), one of the finest Polish poets.

As a daughter of the well-known painter Wojciech Kossak, she grew up in an artistic and intellectual milieu. Her first collection of poems, *Niebieskie migdały* (1922; "Idle Dreams"), was warmly acclaimed by the poets of the Skamander group. Up to 1939 she published a dozen more small volumes of her lyric poetry—including *Pocałunki* (1926; "Kisses") and *Surowy Jedwab* (1932; "Raw Silk")—in which she dealt with such subject matter as the loves, the disenchantments, and the carefree life of a sophisticated modern woman.

During World War II she emigrated to France and later to England, where, lamenting her exile, she expressed her feelings in *Róża i lasy płonące* (1940; "A Rose and Burning Forests") and in *Gołąb ofiarny* (1941; "The Sacrificial Dove").

Pawlowska, Eliza (Polish writer): *see* Orzeszkowa, Eliza.

pawnbroking, business of advancing loans to customers who have pledged household goods or personal effects as security on the loans. The trade of the pawnbroker is one of the oldest known to mankind; it existed in China 2,000 to 3,000 years ago.

Pawnbroking in the West may be traced to three different institutions of the Middle Ages: private pawnbrokers, public pawnshops, and *montes pietatis.* Usury laws in most countries prohibited the taking of interest, and private pawnbrokers were usually persons exempt from these laws by religion or regulation—Jews, for example. Their sometimes exorbitant interest rates, however, caused social unrest, which made public authorities aware of the need for alternative facilities for consumption loans. As early as 1198, Freising, a town in Bavaria, set up a municipal bank that accepted pledges and made loans against moderate interest charges. Such public pawnshops enjoyed only a comparatively short existence; their moderate charges did not cover the risks incurred in this type of business.

The church also recognized the need for institutions to make lawful loans to indigent debtors; the Order of Friars Minor (Franciscans) in Italy in 1462 were the first to establish *montes pietatis* (*mons* denoted any form of capital accumulation), which were charitable funds for the granting of interest-free loans secured by pledges to the poor. The money was obtained from gifts or bequests. Later, in order to prevent the premature exhaustion of funds, *montes pietatis* were compelled to charge interest and to sell by auction any pledges that became forfeit.

In the 18th century many states reverted to public pawnshops as a means of preventing exploitation of the poor. These suffered a decline toward the end of the 18th century because limitation of interest was thought to represent restriction, and the use of public funds seemed to stand for state monopoly. Most states returned again to a system of public pawnshops, however, after finding that complete freedom in pawning was harmful to debtors. In the 20th century, the public pawnshop predominated in the majority of countries on the European continent, sometimes alone, sometimes side by side with private pawnbrokers. Public pawnshops were never established in the United States.

The importance of pawnbroking has declined in the 20th century. Social policies have helped to mitigate the financial needs resulting from temporary interruptions in earnings; operating expenses of pawnshops have risen; and installment credit and personal loans from banks have become widely available.

Articles are alphabetized word by word, not letter by letter

Pawnee, North American Plains Indian people of Caddoan linguistic stock who lived on the Platte River, Nebraska, from before the 16th century to the latter part of the 19th. In the 19th century the Pawnee tribe was composed of relatively independent bands: the Kitkehahki, Chaui, Pitahauerat, and Skidi. Each of these was divided into villages, the basic social unit of the Pawnee people.

An earthlodge in the Pawnee village on the Loup Fork, Nebraska; photograph by William Jackson, 1871

By courtesy of the Smithsonian Institution, Washington, D.C.

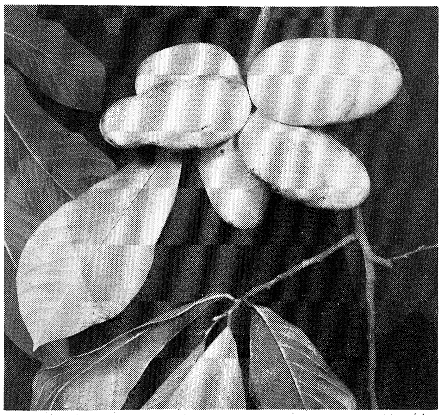
They lived in large, dome-shaped, earth-covered lodges but used skin tepees on buffalo hunts. The women raised corn (maize), squash, and beans. They had developed the art of pottery making, but it declined after the introduction of horses, which they first obtained in the 17th and 18th centuries from Spanish settlements in the southwest.

Class distinctions favoured chiefs, priests, and shamans. Each chief of a village or band had in his keeping a sacred bundle. Shamans had special powers to treat illness and to ward off enemy raids and food shortages. Priests were trained in the performance of rituals and sacred songs. Along with shamanistic and hunt societies, the Pawnee also had military societies.

The religion of the Pawnee was quite elaborate. They believed some of the stars to be gods and performed rituals to entreat their presence, but they also used astronomy in practical affairs (*e.g.,* to determine when to plant corn). Corn was regarded as a symbolic mother through whom the sun god bestowed his blessing. Other important deities were Tirawa, the supreme power, and the morning and evening stars. For a time Pawnee religion included the sacrifice of a captive adolescent girl to the morning star, but this practice was ended in the 19th century.

Relations between the Pawnee and whites were peaceful, and many served as scouts in the armies of the frontier. They ceded most of their lands in Nebraska to the U.S. government by treaties in 1833, 1848, and 1857. In 1876 their last Nebraska holdings were given up, and they were moved to Oklahoma, where they remained. More than 2,300 Pawnee were reported living on or near their Oklahoma reservation in the late 20th century.

pawpaw, also spelled PAPAW (*Asimina triloba*), deciduous tree or shrub of the custard-apple family, Annonaceae (order Magnoliales), native to the United States from the Atlantic coast north to New York state and west to Michigan and Kansas. It can grow to 12 m (40 feet) tall with pointed, broadly oblong, drooping leaves up to 30 cm (12 inches) long. The malodorous, purple five-centimetre (two-inch) flowers appear in spring before the leaves. The edible, 8- to 18-centimetre (3- to 7-inch) long fruits resemble stubby bananas; the skin turns black as the fruit ripens. They vary, depending on the variety, in size, time of ripening, and flavour. Some persons may develop a skin reaction after handling pawpaw fruits. The other seven species of *Asimina*, which are shrubby North American plants, include *A. speciosa* and *A. angustifolia*.



Cluster of unripened fruit of pawpaw (*Asimina triloba*)
John H. Gerard

The name pawpaw is also sometimes applied to the papaya (*q.v.; Carica*).

Pawtucket, city, Providence county, Rhode Island, U.S., on the Blackstone River (there bridged and known locally as the Pawtucket, or the Seekonk), just northeast of Providence and adjoining the city of Central Falls. In the heart of the business district, the river plunges 50 feet (15 m) over a mass of rocks; the city's name is from an Algonquian word for "at the falls." First settlement on the site was made in 1671 by Joseph Jencks, Jr. His smithy, destroyed in 1676 during King Philip's (Indian) War, was rebuilt, and soon the village became a centre for ironmongers. In 1790 Samuel Slater built the first successful water-powered cotton mill in North America, which has been restored and designated a national historic landmark. Highly industrialized, Pawtucket has an industrial economy.

The river has been continually improved by the federal government since 1867; there is a 16-foot (5-metre) channel all the way to Narragansett Bay. Pawtucket town (inc. 1828), east of the river, was originally in Massachusetts and was transferred to Rhode Island and reincorporated in 1862; part of North Providence, west of the river, was annexed to Pawtucket in 1874, and the expanded town was incorporated as a city in 1885. Pop. (1988 est.) city, 74,435; Pawtucket–Woonsocket–Attleboro PMSA, 324,800; Providence–Pawtucket–Fall River CMSA, 1,125,400.

Pax, in Roman religion, personification of peace, probably recognized as a deity for the first time by the emperor Augustus, in whose reign much was made of the establishment of political calm. An altar of Pax Augusta (the Ara Pacis) was dedicated in 9 BC and a great temple of Pax completed by the emperor Vespasian in AD 75.

Pax Romana (Latin: "Roman Peace"), a state of comparative tranquillity throughout the Mediterranean world from the reign of Augustus (27 BC–AD 14) to that of Marcus Aurelius (AD 161–180). Augustus laid the foundation for this period of concord, which also extended to North Africa and Persia. The empire protected and governed individual provinces, permitting each to make and administer its own laws while accepting Roman taxation and military control.

Paxinou, Katina, original name KATINA CONSTANTOPOULOS (b. *c.* 1900, Piraeus, Athens, Greece—d. Feb. 22, 1973, Athens), internationally recognized Greek actress known for her tragic roles in both modern and classic drama. With her second husband, the Greek actor-producer Alexis Minotis, she produced revivals of classic plays in ancient outdoor Greek theatres and translated modern plays into Greek, most notably those of the American playwright Eugene O'Neill.

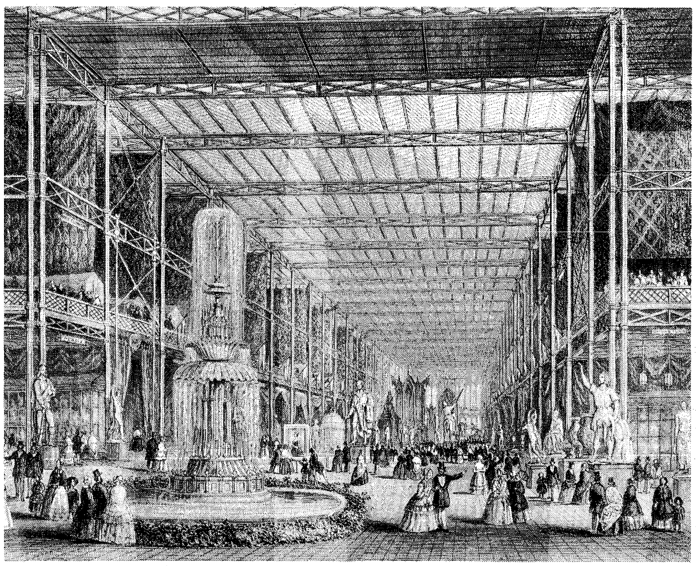
Paxinou was trained in Switzerland as an opera singer; her first professional appearance was in Dimitri Mitropoulos' opera *Sister Beatrice* at Athens in 1920. Four years later she made her debut in a dramatic role in *La Femme nue*. By 1930, when she established an association with Minotis to direct the company of the newly formed National Theatre of Athens, she had abandoned singing roles entirely. Tours of the United States, Germany, and England followed, culminating in her acclaimed London debut in the title role of Sophocles' *Electra* (1939). The war years restricted her activities to the United States, where she continued her stage appearances and made her film debut as Pilar in the screen version of Ernest Hemingway's *For Whom the Bell Tolls* (1943), receiving an Academy Award as best supporting actress.

After the war Paxinou returned to Athens to assist the Greek National Theatre in reviving the classical Greek tragedies, performing in the ancient theatre of Herodes Atticus at Athens and the partially reconstructed theatre at Epidaurus. In addition to her performance in *Electra*, Paxinou was acclaimed for her roles in *Oedipus Rex, Agamemnon, The Bacchae, Medea, Hecuba,* and *Hippolytus*. Her talents were not restricted to classical roles, however; her portrayals of the Henrik Ibsen characters Mrs. Alving in *Ghosts* and Hedda Gabler were considered outstanding. Her company's repertoire also included works by William Shakespeare, O'Neill, and the Spanish dramatist Federico García Lorca. Paxinou's film credits include highly respected performances in *Mourning Becomes Electra* (1947), *The Miracle* (1959), and *Rocco and His Brothers* (1960).

Paxos, Modern Greek PAXOÍ, island, Kérkira *nomós* (department), the smallest of the seven major Ionian Islands of Greece, 8 miles (19 km) southwest of Párga on the coast of Epirus. A hilly mass of limestone covered with olive groves, Paxos rises to about 750 feet (230 m). Gáïos on the east coast is the chief village and port. Papandi, the bishop's residence, stands near the centre with several quaint churches and belfries. Tourism is increasingly a source of revenue. Pop. (1981) 2,247.

Paxton, Sir Joseph (b. Aug. 3, 1801, near Woburn, Bedfordshire, Eng.—d. June 8, 1865, Sydenham, near London), English landscape gardener and designer of hothouses, who was the architect of the Crystal Palace for the Great Exhibition of 1851 in London.

He was originally a gardener employed by the Duke of Devonshire, whose friend, factotum, and adviser he became. From 1826 he was superintendent of the gardens at Chatsworth, the duke's Derbyshire estate; he built in iron and glass the famous conservatory there (1840) and the lily house for the duke's rare *Victoria regia* (1850). Also in 1850, after a cumbersome design had been officially accepted by the Great Exhibition's organizers, Paxton's inspired plan for a building of prefabricated elements of sheet glass and iron was substituted. His design, based on his earlier glass structures, covered four times the area of St. Peter's, Rome, and the grandeur of its conception was a challenge to mid-19th-century technology. Although it was built within six months and he was knighted for his efforts (1851), it was not until later that the structure was seen as a revolution in style. In 1852–54 its components were moved to Sydenham Hill in Upper Norwood, where they remained (reerected in a different form from the original) until destroyed by fire in 1936.



"Interior of the Great Exhibition," the Crystal Palace designed by Sir Joseph Paxton, 1850–51
By courtesy of National Monuments Record, London

Paxton was a member of Parliament for Coventry from 1854 until his death. During the period of his glass structures, he also designed many houses in eclectic styles and laid out a number of public parks.

Paxton Boys uprising, attack by Pennsylvania frontiersmen upon an Indian settlement that occurred in December 1763 during the Pontiac Indian uprising. About 57 drunken rangers from Paxton, Pa., slaughtered 20 innocent and defenseless Conestoga Indians near Lancaster, Pa. Governor John Penn thereupon issued proclamations ordering the local magistrates to arrest and try those men involved in the massacre. Since the residents of that frontier area were sympathetic to the actions of the Paxton Boys, however, no prosecutions were undertaken.

Besides revealing the prevailing bias of frontiersmen against Indians, the Paxton Boys uprising also took on a political tone. Residents of the Pennsylvania backcountry were already embittered over the eastern counties' disproportionate control over the colony's legislature and the failure of the eastern-dominated legislature to provide adequate appropriations for defense of the frontier. Consequently, sparked by the events surrounding the Paxton Boys massacre, about 600 armed frontiersmen marched on Philadelphia in January 1764 to vent their anger against the provincial assembly. A delegation of prominent Philadelphians, including Benjamin Franklin, met the protesters and restrained them from entering the city by promising them that the legislature would provide a thorough hearing of their complaints. The assembly offered no redress for the protesters' main grievances, though, and the colony's Proprietary Party publicized the incident to their advantage in their campaign during the election of 1764.

Payao (Thailand): *see* Phayao.

Payen, Anselme (b. Jan. 6, 1795, Paris, Fr.—d. May 12, 1871, Paris), French chemist who made important contributions to industrial chemistry and discovered cellulose, a basic constituent of plant cells.

Payen, the son of an industrialist, was put in charge of a borax refining plant in 1815. He broke the Dutch monopoly on borax—most of which was mined in the Dutch East Indies—by discovering a process for producing borax from boric acid. In 1820 he turned his efforts to refining beet sugar. Two years later he introduced the use of activated charcoal to remove coloured impurities from beet sugar. In 1833 he discovered and isolated diastase, the first enzyme (organic catalyst) to be obtained in concentrated form. He then pursued the extensive analysis of wood and its components that culminated in the discovery of cellulose. He became professor of industrial and agricultural chemistry in 1835 at the Central School of Arts and Manufactures, Paris. Among his other contributions were studies of starch and bitumen, and the discovery of pectin and dextrin.

Payette River, river formed by confluence of the North and South forks in Boise National Forest, Boise county, southwestern Idaho, U.S., flowing south and then west past Emmett to join the Snake River near Payette on the Oregon border after a course of about 70 miles (110 km). Black Canyon Dam and Reservoir on the Payette and the Cascade Dam and Reservoir on the North Fork are part of the Payette division of the Boise Irrigation Project.

payments, balance of, systematic record of all economic transactions between residents of one country and residents of other countries (including the governments). The transactions are presented in the form of double-entry bookkeeping.

There can be no surplus or deficit in a country's balance of payments as a whole (as distinguished from its balance of trade) because every payment must have its offsetting receipt.

The balance of payments of Japan, for example, records the various ways in which yen are made available to foreigners through Japanese purchases of foreign goods, expenditures of Japanese tourists abroad, donations, loans, etc. These expenditures are shown on the debit side of the balance. The receipts side indicates the various uses to which foreigners put their yen, such as purchases of Japanese goods, interest on Japanese loans, etc. If foreigners do not spend all the yen made available to them, the balance of payments will show on the credit side an increase of foreign-held yen balances, foreign purchases of Japanese securities, gold exports from Japan, or some similar item. *See also* international payment.

Payne, Humfry (Gilbert Garth) (b. Feb. 19, 1902, Wendover, Buckinghamshire, Eng.—d. May 9, 1936, Athens, Greece), English archaeologist noted for the publication *Necrocorinthia* (1931), in which a vast body of important information on archaic vase painting and other arts practiced at Corinth was gathered and classified.

Payne was educated at Christ Church, Oxford, where he studied classics and took two first-class honours. He continued his education by working as a research scholar in Mediterranean archaeology (1924–26). He became a senior scholar at Christ Church (1926–31) and worked as an assistant at the Ashmolean Museum from 1926 to 1928.

Appointed director of the British School of Archaeology at Athens in 1929, Payne published *Necrocorinthia* and *Archaic Marble Sculpture from the Acropolis* (1936; with photographs by Gerard Mackworth Young). Another excellent work, *Perachora,* on the archaic site located near Corinth, was written chiefly by Payne, but it was published after his death. He was buried in Mycenae.

Payne, John Howard (b. June 9, 1791, New York, N.Y., U.S.—d. April 9, 1852, Tunis, Tun.), American-born playwright and actor, who followed the techniques and themes of the European Romantic blank-verse dramatists.

A precocious actor and writer, Payne wrote his first play, *Julia, or, The Wanderer,* when he was 15. Its success caused him to be sent to Union College, Schenectady, N.Y., but family finances forced him to leave two years later. At 18 he made his first stage appearance in John Home's *Douglas,* but he encountered much opposition from established actors, and in 1813, at the height of the War of 1812, he sailed for England. At first interned as an enemy national, he was later released and triumphed at Drury Lane in *Douglas,* repeating his success in other European capitals. In Paris Payne met the actor Talma, who introduced him to French drama, from which many of his more than 60 plays were adapted; and Washington Irving, with whom he was to collaborate on two of his best plays.

The play considered Payne's finest, *Brutus: or, The Fall of Tarquin,* was produced at Drury Lane on Dec. 3, 1818. *Brutus* persisted for 70 years, serving as a vehicle for three of the greatest tragedians of the 19th century: Edwin Booth, Edwin Forrest, and Edmund Kean. Other important plays were *Clari: or, The Maid of Milan,* which included Payne's famous song "Home, Sweet Home"; *Charles the Second* (1824), written with Irving; and *Thérèse* (1821), a French adaptation. Because of weak copyright laws, Payne received little return from his successful plays, and in 1842 he accepted a consular post in Tunis.

Payne, Peter, Czech PETRA PAYNA (b. *c.* 1380, Hough-on-the-Hill, Lincolnshire, Eng.—d. *c.* 1455, Prague, Czech.), English theologian, diplomat, and follower of the early religious Reformer John Wycliffe; he was a leading figure in securing Bohemia for the Hussites.

At about the time Payne was principal of St. Edmund Hall, Oxford (1410–12), he joined the Lollards, and when the influential Lollard soldier Sir John Oldcastle was indicted in 1413, Payne felt it prudent to flee to Bohemia. There he supported the Utraquist Hussites. He became a central figure in the consistory that governed the Hussite church and was entrusted with several diplomatic missions. At the Council of Basel in 1433 he spoke out against state seizure of church property. Taken prisoner at the Battle of Lipany, in 1434, he was soon freed and took part in peace negotiations. With the return of the anti-Hussite king Sigismund to Bohemia, the Hussites were temporarily proscribed, and Payne was expelled from Prague. He was imprisoned for two years in Austria, then ransomed by fellow Hussites to return to Bohemia and participate in unification of the scattered Hussite church. Respected by all factions, he sought in vain to reconcile the extreme Taborites with the elected archbishop, Jan Rokycana. By 1448, when Payne went back to Prague, Rokycana's party was firmly established. Though he never learned Czech, Payne served the Hussites also through his theological works.

Pays Basque (France): *see* Basque Country (France).

Pays de la Loire, *région de programme* (planning region), encompassing the western French *départements* of Mayenne, Sarthe, Maine-et-Loire, Vendée, and Loire-Atlantique. The capital is Nantes. The region has an area of 12,386 square miles (32,082 square km) and is bounded by the *départements* of Morbihan, Ille-et-Vilaine, Manche, and Calvados to the north, Eure-et-Loire to the northeast, Loir-et-Cher and Indre-et-Loire to the east, and Vienne, Deux-Sèvres, and Charente to the south. The Bay of Biscay lies to the west. The Massif Armoricain extends into Mayenne and Loire Atlantique and the northern fringes of Vendée and Maine-et-Loire. Sarthe and eastern Maine-et-Loire belong to the Paris Basin. The massif of Vendée rises in the south. The Loire River flows east to west. An oceanic climate prevails.

The population remained static between 1851 and 1946, in distinction to the general trend of rural population loss in France during this period; it has subsequently increased at a rate approaching the national average. Demographic recovery has favoured the Loire Valley between Saumur and Saint-Nazaire, and the agglomerations of Angers and Nantes. Emigration has depleted the population of inland Vendée, northern Maine-et-Loire, and Mayenne and Sarthe outside Laval and Le Mans. The rural population density is relatively high, with the result that farms in general are small.

Soils tend to be acid and heavy; lime and fertilizers are widely used. Viticulture is concentrated in Maine-et-Loire around the towns of Souzay-Champigny, Brissac-Quincé, and Quarts-de-Chaume. Animal husbandry dominates agriculture. The region is a leading producer of milk, beef, and pork. Ducks are raised along the Atlantic coast. Fishing ports include Pornic and Le Croisic in Loire-Atlantique, and Les Sables-d'Olonne in Vendée.

Iron is mined at Segré in Maine-et-Loire and Rougé in Loire-Atlantique; Gétigné in Loire-Atlantique produces uranium. Manufactures are diverse and include ships, automobiles, and textiles. Pop. (1988 est.) 3,057,600.

Paysandú, city, western Uruguay, on the Uruguay River. The city was founded in 1772 by a priest, Policarpo Sandú, and 12 families of Christianized Indians, who translated the Spanish word *padre* ("father") into the Guaraní Indian word *pay,* from which stems the name Paysandú. Now Uruguay's third largest city, Paysandú has a relatively varied economy, with tanneries, textile factories, flour mills, distilleries, breweries, and meat-processing plants. A branch of the Faculty of Agriculture of the National University and a government-owned television station are located in Paysandú. The port is active, since cargo destined for northwestern Uruguay must be transferred at Paysandú from oceangoing ships to the shallow-draft vessels that ply the upper Uruguay. A bridge was built between Colón, Argentina, and Paysandú in 1970. Paysandú is linked also by rail, highway, and air services to Montevideo. Pop. (1985 prelim.) 75,200.

The cathedral at Paysandú, Uruguay
Walter Aguiar—EB Inc.

Payton, Walter (Jerry) (b. July 25, 1954, Columbia, Miss.), American professional football player who was regarded as the best yardage gainer in history.

Payton played football in high school and at Jackson State University, Miss., from which he graduated in 1975. He was drafted by the National Football League (NFL) Chicago Bears in 1975. Payton played with the Bears until his retirement after the 1987 season, filling the position of halfback for most of that time. In his 12 years as a professional football player, Payton was perhaps the greatest running back in the history of the game. He set the records for total career rushing yardage (16,726 yards), most combined career yards gained (rushing and pass receiving; 21,803 yards), most seasons with 1,000 or more yards rushing (10), most yards gained in a single game (275 yards), most games with 100 or more yards gained in a career (77), and most career touchdowns earned by rushing (110). Besides being football's all-time leading rusher, Payton was a capable blocker, pass receiver, and passer. He was an exceptionally durable, injury-free player and started in more than 130 consecutive games in his career.

Paz, Manuel de Godoy, príncipe de la (prince of): *see* Godoy, Manuel de.

Paz, Octavio (b. March 31, 1914, Mexico City), Mexican poet, writer, and diplomat, recognized as one of the major literary figures in Latin America after World War II.

Paz's family was ruined financially by the Mexican Civil War, and Octavio grew up in straitened circumstances. He was educated at a Roman Catholic school and at the University of Mexico. He turned to writing and published his first book of poetry, *Luna silvestre* ("Forest Moon"), in 1933 at age 19. Paz visited Spain in 1937, where he identified strongly with the Republican cause in the Spanish Civil War. He wrote his reflections on that experience in *Bajo tu clara sombra y otros poemas* ("Beneath Your Clear Shadow and Other Poems"), which, published in Spain in 1937, identified him as a young writer of real promise. Before returning home he visited Paris, where Surrealism exerted a profound influence on him.

Back in Mexico, Paz founded and edited several important literary reviews, including *Taller* (1939; "Workshop") and *El hijo pródigo* (1943; "The Prodigal Son"). He edited another review of literature and politics, *Plural*, in the 1970s. His major poetic publications include *No pasaran!* (1937; "They Shall Not Pass!"), *Libertad bajo palabra* (1949; "Freedom Under Parole"), *¿Águila o sol?* (1951; *Eagle or Sun?*), and *Piedra de sol* (1957; *The Sun Stone*). In the same period, he produced prose volumes of essays and literary criticism, including *El laberinto de la soledad* (1950; *The Labyrinth of Solitude*), an influential essay in which he analyzes the character, history, and culture of Mexico; and *El arco y la lira* (1956; *The Bow and the Lyre*) and *Las peras del olmo* (1957; "The Pears of the Elm"), which are studies of contemporary Spanish American poetry.

Paz entered Mexico's diplomatic corps in 1946 and served in a variety of assignments, including one as Mexico's ambassador to India from 1962 to 1968; in the latter year he resigned in protest over Mexico's brutal treatment of student radicals that year.

His poetry after 1962 includes *Blanco* (1967), *Ladera este* (1971; "East Slope"), and *Hijos del aire* (1981; *Airborn*). *Early Poems, 1935–55* was published in 1973 and *Selected Poems* in 1979. His later prose works include *Conjunciones y disyunciones* (1970; *Conjunctions and Disjunctions*) and *El mono gramático* (1974; *The Monkey Grammarian*).

Paz was influenced in turn by Marxism, Surrealism, Existentialism, Buddhism, and Hinduism. In the poetry of his maturity, he used a rich flow of Surrealistic imagery in dealing with metaphysical questions. His most prominent theme was man's ability to overcome his existential solitude through erotic love and artistic creativity.

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

Paz Estenssoro, Víctor (b. Oct. 2, 1907, Tarija, Bolivia), Bolivian statesman, founder and principal leader of the left-wing Bolivian political party National Revolutionary Movement (MNR), who served three times as president of Bolivia (1952–56, 1960–64, and from 1985). His first administration marked the beginning of a process of revolutionary social, economic, and political change in Bolivia.

Paz Estenssoro began his career as professor of economics at the University of San Andrés in La Paz. He was economic adviser to President Germán Busch (1937–39) and in 1939 was elected to the Chamber of Deputies. In 1941 he and others established the MNR; when it seized power in 1952, Paz Estenssoro became president. During his administration the right to vote was extended to Indians, and the three largest tin companies in the country were expropriated by the government. Most fundamental of all, an agrarian-reform law began the process of transferring the arable land of the central plateau to the Indians.

During 1956–60, Paz Estenssoro served as ambassador to the United Kingdom. He again became the MNR candidate for president in 1960 and won a decisive victory. During his second administration, his government reached an agreement with the U.S. government, the Inter-American Development Bank, and West German industrialists providing for a reorganization of the tin industry.

In the election of 1964, about 70 percent of the eligible voters cast their ballots for Paz Estenssoro. Nevertheless, he was overthrown by a military coup d'état in early November 1964 and went into exile in Peru. He remained in Lima as a professor of economics at the university until August 1971, when he returned to Bolivia as an adviser to the government led by the right-wing president Hugo Banzer Suárez.

Paz Estenssoro ran unsuccessfully for the presidency in 1979, and he ran again as the MNR's candidate in July 1985. He finished second to Banzer in the popular vote, in which no candidate gained a majority. On Aug. 5, 1985, Congress elected Paz Estenssoro president, and he was installed the next day. He immediately reduced government subsidies of consumer goods, devalued the peso, and streamlined state enterprises. These policies ended the hyperinflation that had imperiled Bolivia's economy.

Pazardzhik, also spelled PAZARDJIK, or PAZARDŽIK, town, west-central Bulgaria. It lies along the upper Maritsa River, between the Rhodope Mountains to the south and the Sredna Mountains to the north. It is a rail junction and an industrial centre, specializing in textiles, rubber, furniture, engineering, and the processing of agricultural produce.

The National Museum in Pazardzhik has artifacts dating the settlement from 2000 BC. The present town was founded by Russian Tatars, was under Turkish rule from the 15th to the 19th century, and until 1934 was called Tatar Pazardzhik. The Church of the Virgin Mary, which is half buried in the ground, contains masterpieces of Bulgarian carvings. Pop. (1986 est.) 77,378.

Pazyryk, Scythian burial site in a dry valley opening on the Bolshoy Ulagan River valley in the Kazakh Soviet Socialist Republic. The site, consisting of five large and nine smaller burial mounds and dating from about the 5th to the 3rd century BC, was excavated in 1929 and 1947–49. It is perhaps the richest source of information about the customs and artifacts of the Scythians before their westward migrations into western Asia and Europe. The site and its significance are described in S.I. Rudenko's *Frozen Tombs of Siberia: The Pazyryk Burials of Iron Age Horsemen* (1970).

PBI test (medicine): *see* protein-bound iodine test.

p'Bitek, Okot (b. 1931, Gulu, Uganda—d. July 19, 1982, Kampala), Ugandan poet, novelist, and social anthropologist whose three verse collections—*Song of Lawino* (1966), *Song of Ocol* (1970), and *Two Songs* (1971)—are considered to be among the best African poetry in print.

As a youth p'Bitek had varied interests; he published a novel in the Acholi language, wrote an opera, and played on Uganda's association football (soccer) team. He was educated at the University of Bristol in England (certificate in education), University College of Wales at Aberystwyth (bachelor of law), and the Institute of Social Anthropology at Oxford (degree in social anthropology). From 1964 to 1966 he taught at Makerere University in Kampala, Uganda.

His first collection of poetry, *Song of Lawino*, addresses the issue of the conflict of cultures. It is the lament of a nonliterate woman over the strange ways of her university-educated husband, whose new ways are incompatible with traditional African concepts of manhood. This book p'Bitek followed with *Song of Ocol*, which is the husband's response. A third volume, *Two Songs*, includes *Song of a Prisoner* and *Song of Malaya*.

After serving as director of Uganda's National Theatre and National Cultural Centre (1966–68), p'Bitek accepted a position as senior research fellow and lecturer at University College, Nairobi, Kenya (1971–78). He was also a visiting lecturer or writer-in-residence at several universities. From 1978 to 1982 he taught at the University of Ife in Nigeria.

In addition to writing poetry, p'Bitek produced several books on Acholi culture. Some of his essays are collected in *Africa's Cultural Revolution* (1975). *The Horn of My Love* (1974) contains Acholi poetry in both Acholi and English, and *Hare and Hornbill* (1978) is a collection of Acholi folktales that p'Bitek compiled and translated.

PCB (chemistry): *see* polychlorinated biphenyl.

PCF (political party): *see* French Communist Party.

PCI (political party): *see* Italian Communist Party.

PCP, abbreviation of PHENCYCLIDINE, byname ANGEL DUST, hallucenogenic drug with anesthetic properties, having the chemical name 1-(1-phencyclohexyl) piperidine. PCP was first developed in 1956 by Parke Davis Laboratories of Detroit for use as an anesthetic. In the early 1960s, however, clinical tests on humans revealed side effects ranging from distorted self-perception to severe disorientation and unpredictable, psychotic behaviour. The drug was never marketed for human use, although it is in use in veterinary medicine. Because PCP is relatively easy and inexpensive to manufacture, an illicit drug trade sprang up during the mid-1960s, and violence related to the use of PCP—including suicide and homicide—grew to alarming proportions in the mid- to late 1970s.

As with other hallucinogenic drugs, PCP does not cause physical dependence. In low doses, it produces toxic effects similar to those of LSD, although violent and psychotic behaviour seem to be more characteristic of PCP. The PCP user exhibits emotional instability, excited intoxication, lack of coordination, high blood pressure, and increased deep-tendon muscle reflexes, and is often impervious to pain. At high doses, PCP is highly toxic and can cause convulsions and coma.

The drug is typically smoked, mixed in powdered form with a leafy substance such as parsley, mint, tobacco, or marijuana; it may also be dissolved in a liquid and sprayed onto the leaves. Rarely, it is injected.

The effects of PCP depend on the susceptibility of the user and other variables such as mood, dosage, and setting. Effects are evident one to two hours after ingestion and generally last four to six hours. Among chronic users, the reappearance of symptoms such as disorientation and visual, memory, and speech disorders has been noted.

Pe-har, popular Tibetan divinity, the chief of the Five Great Kings. *See* Five Great Kings.

pea, any of several species, comprising hundreds of varieties, of herbaceous annual plants belonging to the family Leguminosae, grown virtually worldwide for their edible seeds. *Pisum sativum* is the common garden pea of the Western world. While their origins have not been definitely determined, it is known that these legumes are one of the oldest of cultivated crops; fossil remains have been found in Swiss lake villages. Wild peas grew in medieval Britain. Peas in the United States were introduced in early colonial times. Common garden peas in a monastery garden in Austria in the mid-1800s were used by the monk Gregor Mendel in his pioneering studies of the nature of heredity.

The pea plant is a hardy, leafy annual with hollow trailing or climbing stems of up to 1.8 metres (6 feet) in length, ending in tendrils that facilitate climbing. Each leaf has three pairs of leaflets. The reddish-purple, pink, or white flowers, growing two to three per stalk, are butterfly shaped. The fruit is a many-seeded pod that grows to 10 centimetres (4 inches) long, splitting in half when ripe. Inside the pod, 5 to 10 seeds are attached by short stalks. The seeds are green, yellow, white, or variegiated. Widely grown varieties include dwarf, half-dwarf, trailing, smooth-seeded, wrinkled-seeded, black-eyed, and sugar. The pods of sugar peas are customarily picked before the seeds reach maturity and are eaten raw or cooked like green beans.

Pea (*Pisum sativum*)
Walter Chandoha

In the home garden, peas should be planted in fertile, well-drained soil in an unshaded spot. The cool part of the growing season favours growth and development. The most common diseases that affect peas are root rot, powdery mildew, and several viral diseases. In the United States, peas are grown in the winter and early spring in parts of the Southwest and southern California. The commercial production in the United States centres in the northern tier of states, especially the Great Lakes states and the Pacific Northwest. Washington and Idaho produce dry, edible peas used in soup. Dried peas are sometimes ground into flour. Some of the dried-pea crop is exported. Asia and the U.S.S.R. lead in the world's dried-pea production. Europe and the North American continent produce the majority of the fresh pea crop for table use. Canning and freezing processes vary according to variety, plant size, shape and size of the pods, and period of maturation.

pea crab (*Pinnotheres*), any of a genus of crabs (order Decapoda of the class Crustacea) living in certain bivalved mollusks as a commensal (*i.e.,* on or in another animal host but not deriving nourishment from it). Females of *Pinnotheres ostreum,* also known as the oyster crab, are found in oysters of the Atlantic coastal waters of North America and are especially abundant in oysters of Chesapeake Bay. The body of the female is pinkish white and up to 2 centimetres (about 0.75 inch) across. An irregular stripe runs from front to back across the carapace, or back. Males, seldom seen, are smaller, dark brown, and usually free-swimming. The female pea crab holds her eggs with the back legs until they hatch. The larvae leave their mollusk home and swim before settling in another mollusk shell.

Pea crab (*Pinnotheres pisum*) in opened shell
Jane Burton—Bruce Coleman Ltd.

P. maculatus, with a range similar to that of *P. ostreum,* is found in the shells of scallops, clams, and mussels. *P. pisum,* found in European coastal waters, lives in mussel and cockle shells.

pea picker's disease: *see* leptospirosis.

Pea Ridge, Battle of (March 7–8, 1862), also called BATTLE OF ELKHORN TAVERN, bitterly fought U.S. Civil War clash in Arkansas, during which 11,000 Union troops under Gen. Samuel Curtis defeated 16,000 attacking Confederate troops led by generals Earl Van Dorn, Sterling Price, and Ben McCulloch. Following a fierce opening assault from the rear that almost overwhelmed Curtis' forces, the outnumbered Union troops rallied. After a desperate struggle with severe losses on both sides, Union forces counterattacked on March 8. The Confederates were forced to retreat, thus thwarting their hopes of regaining control of Arkansas.

Peabody, city, Essex County, northeastern Massachusetts, U.S., 15 mi (24 km) northeast of Boston. Originally part of Salem, it became part of Danvers in 1752 and was separately incorporated as the town of South Danvers in 1855. In 1868 it was renamed to honour the philanthropist George Peabody (1795–1869), who was born there. Glassmaking began there as early as 1638, and tanneries were established before the American Revolution. One of the nation's major leather-processing centres, it also produces chemicals, fabricated metals, and wood products. Inc. city, 1916. Pop. (1980) 45,976.

Peabody, Elizabeth Palmer (b. May 16, 1804, Billerica, Mass., U.S.—d. Jan. 3, 1894, Jamaica Plain, Mass.), U.S. educator and participant in the Transcendental movement, who opened the first English-language kindergarten in the U.S.

She was educated at a small private school by her mother, as were her sisters Sophia (who married the writer Nathaniel Hawthorne) and Mary (who married the educator Horace Mann). Peabody started her own school in Boston in 1820. From 1825 to 1834 she was secretary to William Ellery Channing, the early leader of Unitarianism in the United States; she then began an association with Bronson Alcott in his Temple School, of which she wrote in *Record of a School* (1835). After two years with the school, she became involved in adult education in Boston, where she lectured in history.

In 1839 Peabody opened her West Street bookstore, which became a sort of club for the intellectual community of Boston; the early planners of the Brook Farm experiment in communal living met there. On her own printing press she published translations by Margaret Fuller and three of Nathaniel Hawthorne's earliest books. For two years she published and wrote articles for *The Dial,* the critical literary monthly and organ of the Transcendental movement; she also wrote for other periodicals.

Peabody's kindergarten, opened in 1860, marked the American adoption of what until then had been primarily a German institution, inspired chiefly by the work of Friedrich Froebel. She went to Europe in 1867 to study Froebel's methods and brought several experienced German kindergarten teachers back with her. She devoted herself thereafter to organizing public and private kindergartens and to lecturing and writing in the field. As editor of the *Kindergarten Messenger* (1873–77) she played a major role in gaining acceptance for kindergarten as a part of regular public schooling. Her numerous books included *Kindergarten Culture* (1870), *The Kindergartner in Italy* (1872), and *Letters to Kindergartners* (1886).

Peabody, George (b. Feb. 18, 1795, Peabody, Mass.—d. Nov. 4, 1869, London), U.S.-born merchant and financier whose banking operations in England helped establish U.S. credit abroad.

When his brother's Newburyport, Mass., dry goods store burned down in 1811, Peabody went to Georgetown in Washington, D.C., to work in a wholesale dry-goods warehouse. By 1814, he had become a partner in the business, which relocated in Baltimore. By 1829 he was the senior partner of a business with branches in Philadelphia and New York City.

He made several business trips to purchase goods in England. On one trip, he negotiated an $8,000,000 loan for the near-bankrupt state of Maryland, accepting no commission on the transaction. In 1837 he moved to London permanently and established a merchant banking house that specialized in foreign exchange.

Peabody amassed a fortune of $20,000,000 and spent most of it on philanthropic works. His Baltimore institute provided a library, art gallery, and music academy. He also funded a historical museum and library in Peabody, Mass., a natural-history museum at Yale University, and a museum of archaeology at Harvard University; and he contributed to many other colleges and historical societies. His Peabody Education Fund was endowed with $3,500,000 to promote education of Southern children of all races.

In 1862 he gave $2,500,000 for the construction of apartment settlements for London's working people. He refused to accept a baronetcy from Queen Victoria. In 1868 the name of his birthplace (also his hometown) was changed to Peabody in his honour. The following year a statue of him was erected in London.

peace, disturbing the (law): *see* disturbing the peace.

peace, justice of the: *see* justice of the peace.

Peace Corps, U.S. government agency of volunteers, created by the Peace Corps Act of 1961. (From 1971 to 1982 it was a subagency of an independent agency called ACTION.)

The purpose of the Peace Corps is to assist other countries in their development efforts by providing skilled workers in the fields of education, agriculture, health, trade, technology, and community development. Peace Corps volunteers are assigned to specific projects on the basis of their skills, education, and experience. Once abroad, the volunteer is expected to function for two years as a good neighbour in the host country, to speak its language, and to live on a level comparable to that of his counterparts there.

The Peace Corps grew from 900 volunteers serving 16 countries in 1961 to more than 10,000 volunteers in 52 countries in 1966. By the early 1980s, however, the corps had been asked to leave a number of countries.

In the 1970s the Peace Corps began to place greater emphasis on the recruitment of skilled craftsmen, facilitated by a new policy of accepting volunteers with families. Efforts were also made toward closer consultation with the host countries in designing programs.

Overseas volunteer services similar to the Peace Corps are maintained by several European countries, including France, Germany, and Great Britain. These services, which are not always entirely publicly funded, usually involve one or two years of service by young volunteers in various types of development projects.

Peace Democrat (U.S. history): *see* Copperhead.

Peace Mission, predominantly black 20th-century religious cult in the United States, founded and led by Father Divine (1878/80–1965), who was regarded, or worshiped, by his followers as God, Dean of the Universe, and Harnesser of Atomic Energy.

According to most accounts, Father Divine was born George Baker and reared in Savannah, Ga., during the post-Reconstruction period, when black messiahs flourished in an atmosphere of misery and degradation. He received indelible impressions from his immersion in primitive mysticism and the Holiness and Pentecostal movements.

The transition from George Baker to Major J. Devine to Father Divine essentially was completed when he set up his first "heaven" in Sayville, Long Island, in 1919. Legal entanglements forced him to relocate in Manhattan (Harlem) and Philadelphia, but the cult continued to grow and spread through many cities of the northern and western United States.

Heaven, according to Father Divine, is symbolized by separation of sexes and union of all races in a communion composed of a multicourse feast. He also preached total racial integration, that all things and persons are to be forsaken for the Father, and that heaven is on earth. Although he owned almost nothing directly, a cult of between 500,000 and 2,000,000 followers provided him free access to a fortune worth at least $1,500,000.

Father Divine supported blacks in businesses that became successful and that fulfilled basic needs. The key to Father Divine's success was the devotion of competent disciples. In the late 20th century, this cohesion diminished and the movement dwindled.

Peace of ———: *see under* substantive word (*e.g.*, God, Peace of).

peace pipe: *see* sacred pipe.

Peace River, river in northern British Columbia and Alberta, Canada, forming the southwestern branch of the Mackenzie River system. From headstreams (the Finlay and the Parsnip) in the Canadian Rockies of British Columbia, the Peace flows northeastward across the Alberta prairies, receiving its major tributaries (the Smoky and the Wabasca) before joining the Slave River in Wood Buffalo National Park near the Lake Claire–Lake Athabasca complex. The river's total course (from the head of the Finlay) is 1,195 miles (1,923 km).

The river, named for Peace Point, Alta., where the Cree and Beaver Indians settled their territorial dispute, became an important fur-trade route after it was explored by Sir Alexander Mackenzie (1792–93). Farming, the valley's economic mainstay during the early decades of the 20th century, is now supplemented by lumber, coal, petroleum, and natural gas. In 1968 the W.A.C. Bennett Dam (600 feet [190 m] high and 1.25 miles [2 km] long) near Hudson Hope, B.C., was completed, creating Williston Lake and providing

The Peace River at Taylor Flats, B.C.
Tourism Canada; photograph, E. Bork

the valley with hydroelectric power and flood control. The Peace is navigable from the town of Peace River, Alta., to the Slave, except for a stretch of falls near Fort Vermilion.

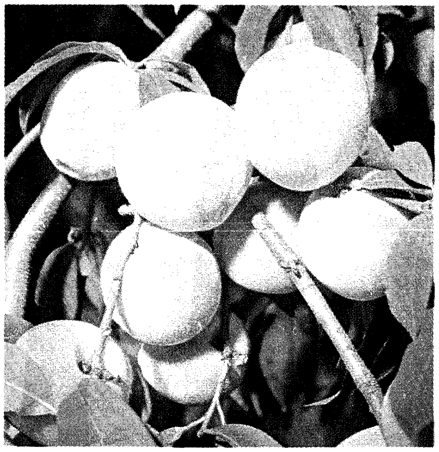
Peacekeeper missile, also called MX, U.S. intercontinental ballistic missile (ICBM) that entered service in 1986.

Under development from 1971, the MX (for "missile experimental") evolved into a 71-foot (22-metre) ICBM with a "bus," or fourth stage, located in its front end that carried 10 or 12 independently targetable thermonuclear warheads. This endowed each missile with several times the firepower of the two- or three-warhead Minuteman III, which it was designed to replace. In addition, the MX's extremely accurate guidance—an inertial system capable of being updated in flight by signals from navigation satellites—gave its 300-kiloton warheads greater potential to destroy reinforced missile silos and command bunkers in the Soviet Union. The MX had a range of approximately 7,000 miles (11,000 km).

In order to be able to evade attack by Soviet ICBMs, which lagged behind U.S. ICBMs in accuracy but were far more powerful, several types of bases for the MX were proposed. These included launching by air from huge transport jets, "deep basing" in silos located more than 1,000 feet (305 m) underground, shuttling the missiles continuously on trucks or rail cars among "multiple protective shelters," and grouping silos close together in a "dense pack," so that incoming nuclear warheads would destroy or deflect one another. All of these modes proved to be prohibitively expensive, and none was politically popular; in 1983 it was decided to place the missiles in Minuteman III silos. Although plans called for 100 Peacekeepers, only 50 were authorized for deployment at Warren Air Force Base, Wyoming.

peach (*Prunus persica*), fruit tree of the rose family (Rosaceae), grown throughout the warmer temperate regions of both the Northern and Southern hemispheres.

Small to medium-sized, the tree seldom reaches 6.5 m (21 feet) in height. Under cultivation, however, it is usually kept between 3 and 4 m (10 and 13 feet) by pruning. Leaves are glossy green, lance-shaped, and long pointed; they usually have glands at their bases that secrete a fluid that attracts ants and



Peach (*Prunus persica*)
Grant Heilman—EB Inc.

other insects. The flowers, borne in the leaf axils, are arranged singly or in groups of two or three at nodes along the shoots of the previous season's growth. The five petals, usually pink but occasionally white, five sepals, and three whorls of stamens are borne on the outer rim of the short tube that forms the base of the flower. The pistil consists of a single carpel with a relatively long style and an enlarged basal portion, the ovary, which becomes the fruit.

The peach develops from a single ovary that ripens into a fleshy, juicy exterior, making up the edible part of the fruit, and a hard interior, called the stone or pit. Of the two ovules in the ovary, usually only one becomes fertilized and develops into a seed, which is enclosed within the stone. This frequently results in one half of the fruit being slightly larger than the other, the two halves forming the slight longitudinal cleft typical of drupe fruits. The flesh may be white, yellow, or red. Varieties may be freestone types, which have stones that separate easily from the ripe flesh, or clingstones, which have flesh that adheres firmly to the stone.

Widely eaten fresh, often with cream, as a dessert fruit, the peach is also baked in pies and cobblers. Canned peaches are a staple commodity in many regions.

The peach probably originated in China, then spread westward through Asia to the Mediterranean countries and later to other parts of Europe. The Spanish explorers brought the peach to the New World, and as early as 1600 the fruit was found in Mexico. Large-scale commercial peach growing did not begin until the 19th century, in the U.S. Early plantings were seedling peaches, inevitably variable, often of poor quality. The practice of budding superior strains onto hardy seedling rootstocks, which came later in the century, led to the development of large commercial orchards.

The peach does well on various soil types ranging from coarse-textured sand or gravelly loams and shales to silt loam, but in general it grows best on well-drained sandy or gravelly loams. On most soils the peach responds well to nitrogen-rich fertilizers or manures, without which satisfactory growth cannot be obtained.

Most peach varieties produce more fruits than can be maintained and developed to full size. Some shedding of fruitlets takes place naturally, about a month to six weeks after full bloom, but the number remaining may have to be reduced further by hand thinning.

Peach trees are relatively short-lived as compared with some other fruit trees. In some regions orchards are replanted after 8 to 10 years, while in others trees may produce satisfactorily for 20 to 25 years or more, depending upon their resistance to diseases, pests, and winter damage.

Worldwide, the peach is the third most important of the deciduous-tree fruits, ranking after the apple and the pear. The U.S., where the peach ranks second to the apple, produces about a fifth of the world's supply. Italy is second, with about one-sixth the world supply. The Soviet Union, France, China, Spain, Greece, Argentina, Japan, Turkey, Mexico, South Africa, and Australia also produce substantial crops.

Peach, Charles William (b. Sept. 30, 1800, Wansford, Northamptonshire, Eng.—d. Feb. 28, 1886, Edinburgh), English naturalist and geologist who made valuable contributions to the knowledge of marine invertebrates and of fossil plants and fish.

While in the revenue coast guard (1824–45) in Norfolk, his attention was attracted to seaweeds and other marine organisms, and he began to collect them. In Cornwall, Peach found fossils in some of the older rocks previously regarded as unfossiliferous. This discovery proved the presence of Bala beds (Ordovician strata, 430,000,000 to 500,000,000 years old) nearby. In 1841 he wrote a paper entitled "On the Fossil Organic Remains Found on the Southeast Coast of Cornwall," and in 1843 he gave an account of his discovery of fish remains in the Devonian slates (345,000,000 to 395,000,000 years old) near Polperro, Cornwall.

Peach was appointed to a position with customs at Fowey, Cornwall, in 1845, and four years later he went to Scotland. He studied the Old Red Sandstone (Devonian strata), the boulder clay of Caithness, and the Carboniferous plants (280,000,000 to 345,000,000 years old) of Scotland. During a stay at Durness, Sutherland, in 1854, he found the first fossils in the Cambrian limestone (500,000,000 to 570,000,000 years old). He also identified many new species of sponges, coelenterates, and mollusks.

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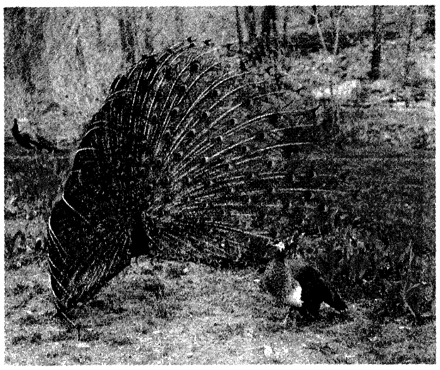
Peacham, Henry (b. *c.* 1576, North Nimms, Hertfordshire, Eng.—d. *c.* 1643), English author best known for his *The Compleat Gentleman* (1622), important in the tradition of courtesy books. Numerous in the late Renaissance, courtesy books dealt with the education, ideals, and conduct befitting a gentleman or lady of the court.

Peacham was educated at Cambridge and was successively schoolmaster, travelling tutor, and author. Of his time as master of the free school at Wymondham, Norfolk, he wrote "whiles that it was free, Myselfe, the Maister, lost my libertie." He wrote on a variety of themes and also published some of his pen-and-ink drawings, but his chief work remained *The Compleat Gentleman.* It was a full expression of his theories on education, and its table of contents exhibits the wide range of his interests: cosmography, geometry, poetry, music, sculpture, drawing, painting, heraldry. Samuel Johnson drew the heraldic definitions for his *Dictionary* from the 1661 edition.

peachblow glass, U.S. art glass made in the latter part of the 19th century by factories such as the Mount Washington Glass Works of New Bedford, Mass., and the New England Glass Company of East Cambridge, Mass. The name is derived from a Chinese porcelain glaze called "peach-bloom." Peachblow is made with either a shiny or a mat finish. Its colours range from bluish white or cream to violet red or pink. The glass is sometimes made with a milk-white lining.

peacock, any of several resplendent birds of the family Phasianidae (order Galliformes). Strictly, the male is a peacock, and the female is a peahen; both are peafowl. Two species of



Peacock (*Pavo cristatus*) displaying before peahen
Norman Tomalin—Bruce Coleman Inc.

Pavo are the blue, or Indian, peacock (*P. cristatus*), of India and Sri Lanka (Ceylon), and the green, or Javanese, peacock (*P. muticus*), from Burma to Java. The Congo peacock (*Afropavo congensis*) was discovered in 1936 after a search that began in 1913 with the finding of a single feather.

In both species of *Pavo,* the male has a 75-centimetre (30-inch) body and 150-centimetre (60-inch) train in which each feather is tipped with an iridescent "eye," ringed with blue and bronze. In display the cock elevates the tail, which lies under the train, thus elevating the train and bringing it forward, as he struts and quivers, audibly rattling the quills.

The blue peacock's body is mostly metallic blue green. The green peacock, with train much like that of the blue, has a green-and-bronze body. Hens of both species are green and brown and almost as big as the male but lack the train and the head ornament. In the wild, both species live in open lowland forests, flocking by day and roosting high in trees. The male forms a harem of one to five hens, each of which lays four to eight whitish eggs in a depression in the ground.

As ornamental birds, peacocks must be kept apart from other fowl, because of their bad disposition. Blue peacocks, though native to hot steamy lands, can survive northern winters; green peacocks, however, cannot tolerate much cold.

The Congo peacock is the only large phasianid in Africa. The cock is mainly blue and green, with a short rounded tail; the hen is reddish and green, with brown topknot.

Peacock, Thomas Love (b. Oct. 18, 1785, Weymouth, Dorset, Eng.—d. Jan. 23, 1866, Lower Halliford, Middlesex), English author who satirized the intellectual tendencies of his

Peacock, oil painting by H. Wallis, 1858; in the National Portrait Gallery, London
By courtesy of the National Portrait Gallery, London

day in novels in which conversation predominates over character or plot. His best verse is interspersed in his novels.

Peacock met Shelley in 1812, and the two became such close friends that Shelley made Peacock executor of his will. Peacock spent several months near the Shelleys at Great Marlow in 1817, a period of great importance to his development as a writer. The ideas that lie behind many of the witty dialogues in his books probably found their origin in the conversation of Shelley and his friends. Peacock's essay *The Four Ages of Poetry* (1820) provoked Shelley's famous "Defence of Poetry" (written 1821, pub. 1840).

Peacock considered his novels to be "comic romances." *Headlong Hall* (1816), the first of his seven novels, already sets the pattern of all of them: characters seated at table, eating and drinking, and embarking on learned and philosophical discussions in which many common opinions of the day are criticized.

In his best-known work, *Nightmare Abbey* (1818), romantic melancholy is satirized, with the characters Scythrop drawn from Shelley, Mr. Flosky from Coleridge, and Mr. Cypress from Byron.

Peacock worked most of his life for the East India Company, the last 20 years as its chief examiner.

peacock pine: *see* Japanese cedar.

Peacock Throne, famous golden throne stolen from India by the Persians in 1739. Thereafter lost, it (and its reproductions) remained the symbol of the Persian, or Iranian, monarchy.

The original throne, built for the Mughal emperor Shāh Jahān in the early 17th century, was reportedly one of the most splendorous thrones ever made. It was ascended by silver steps and stood on golden feet set with jewels; and it was backed by representations of two open peacocks' tails, gilded, enamelled, and inset with diamonds, rubies, and other stones. The throne was seized along with other plunder when the Iranian conqueror Nāder Shāh captured Delhi in 1739. Before leaving India, he had a divan made in the same style and brought both Peacock Thrones back to Iran, only to lose both in warfare with the Kurds, who apparently dismantled them and distributed the precious stones and metals. Later Peacock Thrones or divans (probably reproductions) were made for subsequent *shāh*s, notably Fath 'Alī Shāh (reigned 1797–1834). The dazzling chairlike throne used by the two Pahlavi *shāh*s at their coronations (1926, 1941) was a reproduction dating from the Qājār dynasty.

peacock tree: *see* royal poinciana.

peacock worm (*Sabella*), any of a genus of segmented marine worms of the class Polychaeta (phylum Annelida). This type of fanworm (*q.v.*) lives in a tube about 30 to 40 centimetres (12 to 16 inches) long that is open at one end and constructed of mud particles cemented together by mucus. All but the top few centimetres of the tube is buried in the substratum. The front end of the worm has a fan of striped feathery tentacles, used for feeding and respiration, that protrudes from the tube into the overlying seawater. Inorganic and organic particles suspended in the water are trapped in mucus secreted by the tentacles. They are then transported down the tentacles by beating cilia and used either for tube building or passed into the mouth as food. Peacock worms rapidly withdraw their tentacles into the safety of the tube when predators approach. These worms are found both in the intertidal zone and in shallow subtidal areas.

Peak District, hill area in the county of Derbyshire, England, forming the southern end of the Pennines, the upland "spine" of England. The northern half is dominated by high gritstone moorlands, rising to Kinder Scout 2,088 ft (636 m). The limestone central plateau is cut through by scenic dales, notably those of the Rivers Wye and Dove. The Peak District National Park was formed in 1950–51, and its area of 542 sq mi (1,404 sq km) includes parts of Cheshire, Derbyshire, Staffordshire, and South Yorkshire.

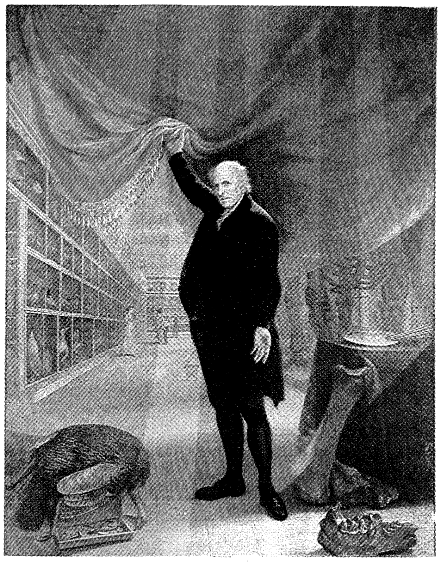
Peak Downs, fertile region of northeast central Queensland, Australia, comprising rolling scrub- and grass-covered country studded with peaks of volcanic rock. Bounded by the Rivers Belyando (west) and Nogoa (east) and drained by the Mackenzie River system, the Downs were once the source of gold and copper. Cattle, sheep, and grains are now produced there, and the region is also a source of timber and coal. Visited in 1844–45 and named for the Peak Range, whose granite summits rise above 2,000 ft (600 m), by the explorer Ludwig Leichhardt, the area was pioneered by pastoralists in 1854. Principal settlements include Clermont, Blair Athol, Emerald, and Springsure.

Peake, Mervyn (b. July 9, 1911, Kuling, Kiangsi Province, China—d. Nov. 17, 1968, Burcot, Oxfordshire, Eng.), English novelist, poet, painter, playwright, and illustrator, best known for the bizarre Titus Groan trilogy of novels and for his illustrations of his novels and of children's stories.

Educated in China and in Kent, Peake went to art school and trained as a painter, but he was stricken with a progressive illness that made him increasingly helpless until his death.

His Titus Groan novels—consisting of *Titus Groan* (1946), *Gormenghast* (1950), and *Titus Alone* (1959)—display a gallery of eccentric and freakish characters in an idiosyncratic Gothic setting. Peake's drawings and paintings, particularly his illustrations for the novels and for children's books, are only a little less known, and his poem *The Glassblowers* (1950) won a literary prize, together with *Gormenghast*. Peake also wrote a play, *The Wit to Woo* (performed 1957).

Peale, Charles Willson (b. April 15, 1741, Queen Annes County, Md., U.S.—d. Feb. 22, 1827, Philadelphia), U.S. painter best remembered for his portraits of the leading figures of the American Revolution and as the founder of the first major U.S. museum.



"The Artist in His Museum," oil painting by Charles Willson Peale, 1822; in the Pennsylvania Academy of the Fine Arts, Philadelphia

By courtesy of the Pennsylvania Academy of the Fine Arts, Philadelphia

Peale—who was a saddler, watchmaker, and silversmith—began his art career by exchanging a saddle for a few painting lessons from John Hesselius. He was also advised and influenced by John Singleton Copley. In 1766 a group of Maryland patrons sent him to London, where he studied for three years with Benjamin West. Peale's ideas were firmly democratic, and it is recorded that he even refused to take off his hat when the coach of King George III passed by.

On his return to America, Peale immediately became the fashionable portrait painter of the middle Colonies. He moved to Philadelphia in 1775, entered wholeheartedly into the Revolutionary movement, and served with the city militia in the Trenton–Princeton campaign. From 1779 to 1780 he represented the "Furious Whig" party in the Pennsylvania assembly, an activity that damaged his professional career. He opened a portrait gallery of Revolutionary heroes in 1782 and in 1786 founded an institution intended for the study of natural law and display of natural history and technological objects. Known as the Peale Museum, it grew to vast proportions and was widely imitated by other museums of the period and later by P.T. Barnum. Located in Independence Hall, the museum was a mélange of Peale's paintings, curious gadgets, and stuffed animals. Its most celebrated exhibit was the first complete skeleton of an American mastodon, unearthed in 1801 on a New York farm. Peale, who had accompanied the expedition, chronicled the excavation in his painting "Exhuming the Mastodon" (1806; Peale Museum, Baltimore).

In his long life, Peale painted about 1,100 portraits, including ones of Washington, Franklin, Jefferson, and John Adams. Crisply outlined and firmly modelled, they paralleled the Neoclassical style developed in France by J.-L. David. His seven life portraits of Washington were repeated many times by himself and other painters of his family. Peale was also a master of *trompe l'oeil* painting; his "The Staircase Group" (1795; Philadelphia Museum of Art), a life-sized double portrait of his sons Raphaelle and Titian, intentionally framed in a real door jamb and with a projecting bottom step, is said to have deceived George Washington into doffing his hat to the boys' images. Peale's brother James (1749–1831) and his sons Raphaelle (1774–1825), Rembrandt (1778–1860), Rubens (1784–1865), and Titian (1799–1881) were also painters.

Peale, Rembrandt (b. Feb. 22, 1778, Bucks County, Pa.—d. Oct. 3, 1860, Philadelphia), U.S. painter, writer, and portraitist of prominent figures in Europe and the post-Revolutionary U.S.

One of the sons of Charles Willson Peale, he studied first with his father, whose sculpturesque Neoclassical style is reflected in "Thomas Jefferson" (1805; New York Historical Society)—Rembrandt Peale's acknowledged masterpiece and the best existing portrait of Jefferson. Peale continued his training at the Royal Academy in London. Between 1808 and 1810 he went to Paris, where his work was admired by Jacques-Louis David, and he was offered the post of court painter to Napoleon.

Apparently because of unfavourable criticism, he ceased to paint for several years, and, following his father's example, he opened a museum and portrait gallery in Baltimore, where he also established the first illuminating-gas works. He sold his museum in 1822; it is now known as the Peale Museum and is devoted to local history.

When he took up painting again he was ambitious to rise above portraiture, so he turned to formal subject pieces. "The Court of Death" (1820; Detroit Institute of Arts) was the culmination of this series. Peale exhibited this painting throughout the country, earning over $8,000 during the first year.

With equal vigour he promoted his portrait of George Washington (1823; Pennsylvania Academy of the Fine Arts, Philadelphia), seeking to replace the popular accepted likeness of Washington, Gilbert Stuart's "Athenaeum" head (1796), with his own work. He had painted Washington from life in 1795, and of this later likeness he painted 76 replicas. Peale's painting and writing—*Notes on Italy* (1831), *Portfolio of an Artist* (1839)—occupied him for the remainder of his life.

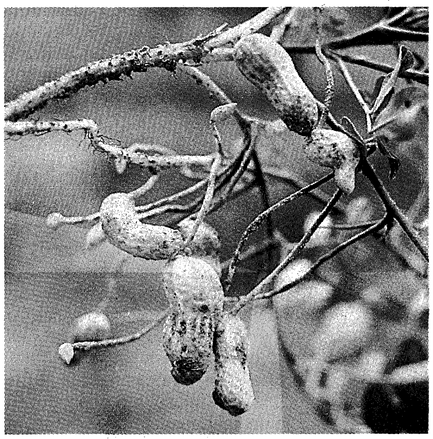
Peano, Giuseppe (b. Aug. 27, 1858, Cuneo, Sardinia—d. April 20, 1932, Turin, Italy), Italian mathematician and a founder of symbolic logic whose interests centred on the foundations of mathematics and on the development of a formal logical language.

He became a lecturer of infinitesimal calculus at the University of Turin in 1884 and professor in 1890. He also held the post of professor at the Accademia Militare, Turin, from 1886 to 1901. His *Formulaire de mathematiques* (Italian *Formulario Mathematico;* "Mathematical Formulary"), published 1894 to 1908 with collaborators, was intended to develop mathematics in its entirety from its fundamental postulates using Peano's logic notation. This work, and others, profoundly changed the outlook of mathematicians and was a major influence upon later efforts to restructure mathematics, notably the program by the French mathematicians whose works appear under the pseudonym Nicolas Bourbaki. Part of Peano's logic notation was adopted by Bertrand Russell and Alfred North Whitehead in their *Principia Mathematica*, 3 vol. (1910–13).

Peano's *Calcolo differenziale e principii di calcolo integrale* (1884; "Differential Calculus and Principles of Integral Calculus") and *Lezioni di analisi infinitesimale*, 2 vol. (1893; "Lessons of Infinitesimal Analysis") are two of the most important works on the development of the general theory of functions since the work of the French mathematician Augustin Cauchy (died 1857). In *Applicazioni geometriche del calcolo infinitesimale* (1887; "Geometrical Applications of Infinitesimal Calculus") Peano introduced the basic elements of geometric calculus and gave new definitions for the length of an arc and for the area of a curved surface. *Calcolo geometrico* (1888; "Geometric Calculus") contains his first work on mathematical logic.

Peano is also known as the creator of *Latino sine Flexione,* later called *Interlingua,* an artificial language. Based upon a synthesis of the vocabulary from Latin, French, German, and English, with a greatly simplified grammar, *Interlingua* was intended for use as an international auxiliary language. Peano compiled a *Vocabulario de interlingua* (1915) and was for a time president of the Academia pro Interlingua.

peanut, also called GROUNDNUT, EARTHNUT, or GOOBER, the pod, or legume, of *Arachis hypogaea* (family Fabaceae), which has the peculiar habit of ripening underground. (Despite its several common names, it is not a true nut.)



Peanut (*Arachis hypogaea*)
G. Tomsich—Photo Researchers

It is a concentrated food; pound for pound, peanuts have more protein, minerals, and vitamins than beef liver; more fat than heavy cream; and more food energy (calories) than sugar. The plant is an annual, ranging from an erect or bunch form 450–600 millimetres (18–24 inches) high, with short branches, to a spreading, or runner, form 300–450 mm high with branches up to 600 mm long that lie close to the soil. The stems and branches are sturdy and hairy; leaves are pinnately compound with two pairs of leaflets. The flowers are borne in the axils of the leaves; what appears to be a flower stalk is a slender calyx up to 40 mm long; the golden-yellow petals are about 10 mm across. The pods are most commonly 25–50 mm long, with two or three seeds, oblong, roughly cylindrical with rounded ends, contracted between the seeds, and have a thin, netted, spongy shell. The seeds vary from oblong to nearly round; seed coat colours range from whitish to dark purple, but mahogany red, rose, and salmon predominate.

After pollination and the withering of the flower, an unusual stalklike structure called a peg is thrust from the base of the flower toward the soil. In the pointed tip of this slender, sturdy peg the fertilized ovules are carried downward until the tip is well below the soil surface. Only then does the tip start to develop into the characteristic pod. The pegs sometimes reach down 100 mm or more before their tips can develop fruits. The fruits appear to function as roots to some degree, absorbing mineral nutrients directly from the soil. The pods may not develop properly unless the soil in which they lie is well supplied with available calcium, regardless of the nutrients available to the roots.

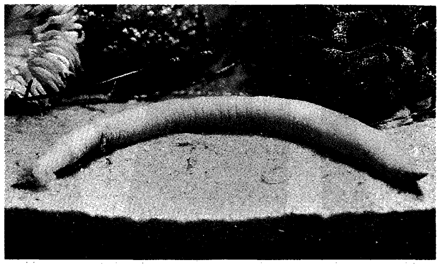
Native to tropical South America, the peanut was at an early time introduced into the Old World tropics. India, China, West Africa, and the U.S. have become the largest commercial producers of peanuts.

Peanut growing requires at least five months of warm weather with rainfall (or irrigation equivalent) of 600 mm or more during the growing season. In Asia the peanut is grown under irrigation. The best soils are well-drained sandy loams underlain by deep, friable loam subsoils. At harvest the entire plant, except the deeper roots, is removed from the soil. The nuts are best cured by allowing the harvested plants to wilt for a day, then placing them for four to six weeks in stacks built around a sturdy stake driven upright into the soil. The pods are placed toward the inside of each stack to protect them from weather.

The peanut is grown mainly for its edible oil, except in the U.S., where it is produced for grinding into peanut butter (half the harvested crop); for roasted, salted nuts; and for use in candy and bakery products. A small percentage of the U.S. crop is crushed for oil. In the southern U.S. the peanut is used extensively as feed for livestock. The tops of the plants, after the pods are removed, usually are fed as hay, although the entire plant may be so used. The development of some 300 derivative products from peanuts—including flour, soaps, and plastics—stems mainly from research conducted in the early 20th century by George Washington Carver (*q.v.*).

Peanuts, comic strip drawn and authored by Charles Schulz (*q.v.*).

peanutworm, also called SIPUNCULID, any member of the invertebrate phylum Sipuncula, a group of elongated, often spindle-shaped, unsegmented marine worms. The head usually has one or more rings of tentacles. Peanutworms vary in length from a few to 300 millimetres (1 inch) or more in length. Though rare, they may be locally common on seabeds throughout the oceans of the world. Peanut-

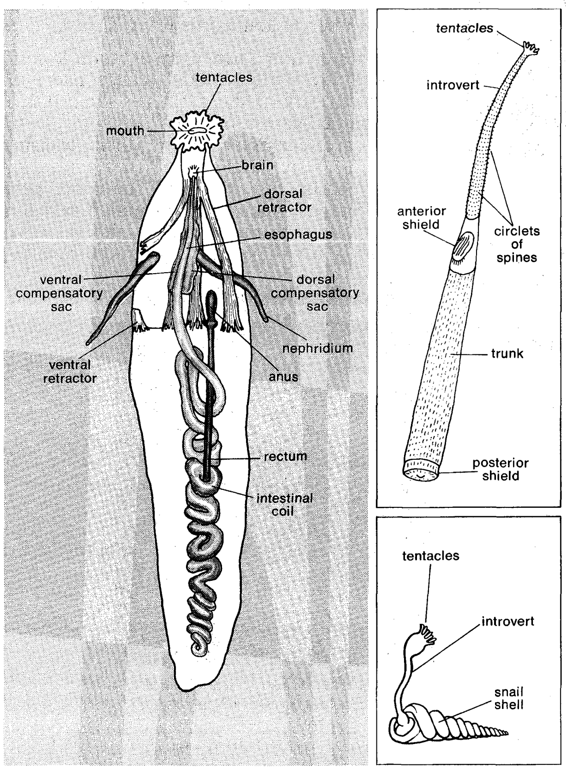


Peanutworm
Bucky Reeves—The National Audubon Society Collection/Photo Researchers

worms are bottom-dwelling (benthic) animals; most burrow in the mud or sand between tide levels or in oozes of the deepest ocean trenches. Some species have other habitats and live in discarded mollusk shells, in sponge siphons, in corals, among the twisted tubes of encrusting polychaetes (marine annelid worms), and even in tangled roots of marine plants.

Life cycle. Externally the sexes are alike and separate, with one exception. Gametes (mature germ cells) are shed into the body cavity and collect in nephridia (excretory organs) that become modified as egg- and sperm-storage organs; they are emitted into the sea from nephridiopores. Fertilization takes place outside the body. The trochophore (free-swimming) larva, which results from spiral cleavage of the zygote (the cell formed by two gametes), undergoes metamorphosis to its characteristic shape.

Form and function. Peanutworms consist of a muscular trunk, cylindrical to globular in shape, and a slender, anterior introvert (retractable proboscis) that is muscular, highly extensible, and capable of being withdrawn



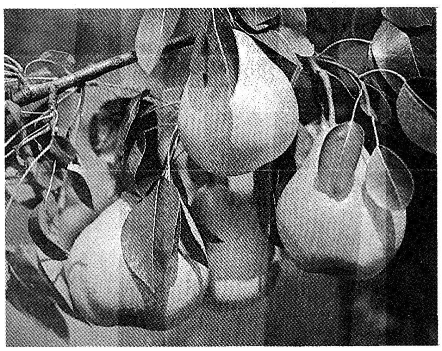
Principal parts of peanutworms
(Left) *Sipunculus nudus*, (top) *Aspidosiphon*, and (bottom) *Phascolion*
From *Invertebrate Zoology* by Paul A. Meglitsch. Copyright © 1967 by Oxford University Press, Inc. Reprinted by permission

into the trunk by retractor muscles. Hooks or spines are often present toward the tip of the introvert, while glandular pores and papillae are scattered over both trunk and introvert. Within the body cavity (coelom) a long alimentary canal spirals backward from the mouth to the posterior region of the trunk, then forward to the dorsal anus near the anterior end of the trunk. A contractile vessel, or compensatory sac associated with the esophagus, extends forward to the tentacles. Fluid passes to extended tentacles, returning to the vessel as they contract; both this and coelomic fluid contain blood cells with hemerythrin. One or two nephridia discharge to the exterior. Gonads develop at the base of the ventral retractor muscles.

Classification. The affinities of the peanutworms are obscure. Their development, like that of spoonworms (echiuroids), resembles that of annelids in that spiral cleavage and a trochophore larva occur. They differ from annelids, however, in their unsegmented bodies and absence of setae. They differ from spoonworms by the absence of setae, anterior anus, absence of anal vesicles, and presence of tentacles surrounding the mouth at the tip of the introvert. Fossils from the Middle Cambrian have been considered to be sipunculan.

pear, any of several species of *Pyrus,* especially *Pyrus communis,* of the rose family (Rosaceae), one of the most important fruit trees of the world, cultivated in all temperate-zone countries of both hemispheres.

The pear tree is broad-headed and up to 13 metres (about 43 feet) high at maturity;



Pear (*Pyrus communis*)
Grant Heilman—EB Inc.

it is taller and more upright than the apple tree. The roundish to oval, leathery leaves, somewhat wedge-shaped at their bases, appear about the same time as the flowers, which are 25 millimetres (one inch) wide and usually white. The pear flower, similar to that of the apple, differs in that the bases of the five styles are separated.

Pears are generally sweeter and of softer texture than apples. The fruit is distinguished by the presence of hard cells in the flesh, the so-called grit, or stone cells, which are absent in apples. In general, pear fruits are elongate, being narrow at the stem end and broader at the opposite end, although some types are apple-shaped.

The common pear, probably of European origin, has been cultivated since long before the Christian era. Thousands of varieties have been bred and named since ancient times in Europe alone. The pear was introduced into the New World by British and other Europeans as soon as the colonies were established. Also at an early date, Spanish missionaries carried the fruit to Mexico and California.

The pear is propagated by budding or grafting onto a rootstock. Many are grafted on seedling pears, usually of *Pyrus communis* origin. In Europe the main rootstock used is quince, which produces a dwarfed tree that fruits at an earlier age than most of the trees on pear rootstocks.

Pear trees are relatively long lived (50 to 75 years) and may reach considerable size unless carefully trained and pruned. Within four to seven years of setting out, the tree begins to bear satisfactorily; at age 20 to 25 it should yield 25 to 45 bushels of fruit.

The pear is commercially the second most important of the world's deciduous fruit trees, exceeded only by the apple. In the U.S., however, the pear ranks third, after the apple and peach.

In most pear-growing countries of the world outside Asia, by far the most widely grown pear variety is Williams' Bon Chrêtien, known in America as Bartlett. In the U.S. and Canada, varieties such as Beurre Bosc, Beurre d'Anjou, and Winter Nelis are grown. A highly popular variety in England and The Netherlands is Conference and in Italy, after Williams', are Curato, Coscia, and Passe Crassane, the last named being also popular in France. The pear often acclaimed as having the finest flavour and texture is Doyenne du Comice, first produced in France in 1849. In Asiatic countries the pear crop comprises primarily local varieties of native species.

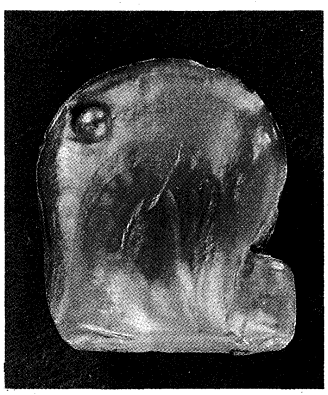
Italy is the world's leading pear producer, followed by China and the U.S. Other countries producing sizable quantities are France, Japan, Spain, Germany, Turkey, Australia, Bulgaria, and South Africa.

In the U.S., Canada, New Zealand, South Africa, and Australia, a large percentage of the crop is used for canning. In Europe, canning is secondary to the use of pears for desserts and for perry.

Pearic languages, small group of languages spoken mainly in Kampuchea (Cambodia), classified as Mon-Khmer languages in the Austro-Asiatic phylum. Included are Chong, Pear, Samre, Saoch, and possibly Angrak, located in the Poŭthĭsăt, Kâmpôt, and Siĕmréab provinces, in Kampuchea, and in Trat Province, Thailand. The languages are sometimes subgrouped with the Khmer language but are generally considered distinct, with a large number of loanwords from Khmer.

pearl, concretion formed by a mollusk consisting of the same material (called nacre or mother-of-pearl) as the mollusk's shell. It is a highly valued gemstone (*q.v.*).

Pearls are characterized by their translucence and lustre and by a delicate play of surface colour called orient. The more perfect its shape (spherical or droplike) and the deeper its lustre, the greater is the value of the pearl. Only those pearls produced by mol-



Blister pearl attached to the shell of an Oriental pearl oyster (*Pinctada martensii Dunker*)
By courtesy of The American Museum of Natural History, New York

lusks whose shells are lined with mother-of-pearl (*e.g.,* certain species of both saltwater oysters and freshwater clams) are really fine pearls; pearls from other mollusks are reddish or whitish, porcellaneous, or lacking in pearly lustre. Jewellers commonly refer to saltwater pearls as Oriental pearls and to those produced by freshwater mollusks as freshwater pearls.

The chief component of the nacre that constitutes the pearl is aragonite ($CaCO_3$). Nacre also contains a small amount of conchiolin, a hornlike organic substance (albuminoid) that is the main consituent of the mollusk's outer shell. The shell-secreting cells of the mollusk are located in the mantle, or epithelium, of its body; when a foreign particle penetrates the mantle, the cells attach to the particle and build up more or less concentric layers of pearl around it. Irregularly shaped pearls called baroque pearls are those that have grown in muscular tissue; pearls that grow adjacent to the shell are often flat on one side and are called blister pearls.

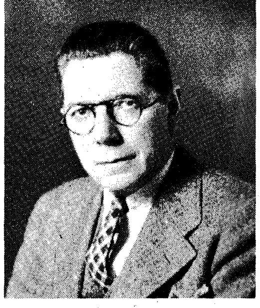
The colour of pearls varies with the mollusk and its environment. It ranges from black to white, with the rose of Indian pearls esteemed most. Other colours are cream, gray, blue, yellow, lavender, green, and mauve. All occur in delicate shades. The surface of a pearl is rough to the touch. Pearls come in a wide range of sizes. Those weighing less than 1/4 grain (1 pearl grain = 50 milligrams = 1/4 carat) are called seed pearls. The largest naturally occurring pearls are the baroque pearls; one such pearl is known to have weighed 1,860 grains.

The finest Oriental pearls are produced by the *mohar,* a variety of the *Pinctada martensii* species of saltwater mollusk. Found in the Persian Gulf, with the richest harvest taken from the waters off the great bight that curves from the peninsula of Oman to that of Qatar, the pearls come from depths of 8 to 20 fathoms (48 to 120 feet). Other notable sources of fine-quality pearls include the Gulf of Mannar between South India and Sri Lanka; the waters off Celebes, Indonesia; and the islands of the South Pacific. In the Americas, the Gulf of California, the Gulf of Mexico, and the waters of the Pacific coast of Mexico have yielded dark-hued pearls with a metallic sheen as well as white pearls of good quality.

Freshwater mussels in the temperate zone of the Northern hemisphere have produced pearls of great value, as for example those from the Mississippi River. Pearling is a carefully fostered industry in central Europe, and the forest streams of Bavaria, in particular, are the source of choice pearls. Freshwater pearling in China has been known from before 1000 BC. In all pearl fisheries, however, production has declined significantly since the widespread introduction of cultured pearls (*see* cultured pearl.

Pearl, Raymond (b. June 3, 1879, Farmington, N.H., U.S.—d. Nov. 17, 1940, Hershey, Pa.), U.S. zoologist, one of the founders of biometry, the application of statistics to biology and medicine.

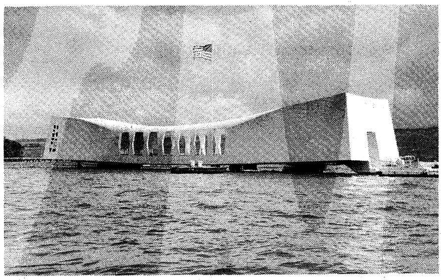
As an instructor at the University of Michigan, where he had earned a Ph.D. in zoology (1902), Pearl recognized the advantages to be gained from applying standard statistical pro-



Pearl
By courtesy of the Johns Hopkins University, Baltimore

cedures to biological problems. He served as head of the biology department at the Maine Agricultural Experimental Station (1907–18) and as chief of the statistical division of the U.S. Food Administration (1917–19). He was then invited to organize the department of medical statistics and biometry at Johns Hopkins University. Pearl founded the *Quarterly Review of Biology* (1926) and *Human Biology* (1929) and was the author of more than 700 articles and books, including *Introduction to Medical Biometry and Statistics* (1923), which became a prototype for such college texts.

Pearl Harbor, naval base and headquarters of the U.S. Pacific Fleet, Honolulu county, southern Oahu Island, Hawaii, U.S. In U.S. history the name recalls the Japanese surprise air attack on Dec. 7, 1941, that temporarily crippled the U.S. Fleet and resulted in the United States' entry into World War II. (*See*



USS *Arizona* National Memorial in Pearl Harbor, Oahu, Hawaii
Charles Giugno

Pearl Harbor Attack.) Pearl Harbor centres on a cloverleaf-shaped, artificially improved harbour on the southern coast of Oahu, 6 miles (10 km) west of Honolulu. The harbour is virtually surrounded (west to east) by the cities of Ewa, Waipahu, Pearl City, Aiea, and Honolulu. It has 10 square miles (26 square km) of navigable water and hundreds of anchorages and covers a land area of more than 10,000 acres (4,000 hectares). Its four lochs are formed by the Waipio and Pearl City peninsulas and Ford Island. Pearl Harbor Entrance (channel) connects its virtually landlocked bay with the Pacific Ocean.

Pearl Harbor was called Wai Momi ("pearl waters") by the Hawaiians because of the pearl oysters that once grew there. In 1840 Lieutenant Charles Wilkes of the U.S. Navy made the first geodetic survey and urged the dredging of the coral-bar entrance to the harbour. About 30 years later, Colonel John McAllister Schofield further recommended that the United States secure harbour rights. A subsequent treaty (1887) granted the United States the exclusive use of the harbour as a coaling and repair station, but work was not begun until after 1898, when the Spanish-American War indicated its strategic value as a Pacific base. A naval station was established after 1908, and a drydock was completed in 1919.

During the Pearl Harbor Attack in 1941 the USS *Arizona* sank with a loss of more than 1,100 men; a white concrete and steel structure now spans the hull of the sunken ship, which was dedicated as a national memorial on May 30, 1962. Present facilities at Pearl Harbor include a naval shipyard, supply centre, and submarine base. The naval supply centre is on Pearl City Peninsula. Pearl Harbor Entrance is bounded on the east by Hickam Air Force Base and on the west by a naval reservation. During the Korean and Vietnam wars the harbour complex was a staging area for forces and equipment bound for the combat zones.

Pearl Harbor Attack (Dec. 7, 1941), surprise aerial attack on the U.S. naval base at Pearl Harbor on Oahu Island, Hawaii, by the Japanese that precipitated the entry of the United States into World War II. The attack climaxed a decade of worsening relations between the United States and an increasingly expansionist and militaristic Japan. Japan's invasion of China in 1937, its subsequent alliance with the Axis powers (Germany and Italy) in 1940, and its occupation of French Indochina in July 1941 prompted the United States to respond that same month by freezing Japanese assets in the United States and declaring an embargo on petroleum shipments and other vital war materials to Japan. By late 1941 the United States had severed practically all commercial and financial relations with Japan. Though Japan continued to negotiate with the United States up to the day of the Pearl Harbor attack, the government of Prime Minister Tōjō Hideki decided on war.

Admiral Yamamoto Isoroku, the commander in chief of Japan's Combined Fleet, had planned the attack against the U.S. Pacific Fleet with great care. Once the U.S. fleet was out of action, the way for the unhindered Japanese conquest of all of Southeast Asia, the Indonesian Archipelago, and the South Pacific would be open. On November 26 a Japanese fleet, under Vice Admiral Nagumo Chuichi and including 6 aircraft carriers, 2 battleships, 3 cruisers, and 11 destroyers, sailed to a point some 275 miles (440 km) north of Hawaii. From there, a total of about 360 planes was launched.

The first Japanese dive bomber appeared over Pearl Harbor at 7:55 AM (local time). It was followed by a first wave of nearly 200 aircraft, including torpedo planes, bombers, and fighters. The reconnaissance at Pearl Harbor had been lax; a U.S. Army private who noticed this large flight of planes on his radar screen was told to ignore them, since a flight of B-17s from the United States was expected at that time. The anchored ships in the harbour made perfect targets for the Japanese bombers, and since it was Sunday morning (a time chosen by the Japanese for maximum surprise) they were not fully manned. Similarly, the U.S. military aircraft were lined up on the airfields of the Naval Air Station on Ford Island and adjoining Wheeler and Hickam Fields to guard against sabotage, and very few became airborne. Most of the damage to the battleships was inflicted in the first 30 minutes of the assault. The *Arizona* was completely destroyed and the *Oklahoma* capsized. The *California, Nevada,* and *West Virginia* sank in shallow water. Three other battleships, three cruisers, three destroyers, and other vessels were also damaged. More than 180 aircraft were destroyed. U.S. military casualties totaled more than 3,400, including more than 2,300 killed. The Japanese lost from 29 to 60 planes, five midget submarines, perhaps one or two fleet submarines, and fewer than 100 men.

The Pearl Harbor Attack severely crippled U.S. naval and air strength in the Pacific. However, the three aircraft carriers attached to the Pacific Fleet were not at Pearl Harbor at the time and thus escaped. Of the eight battleships, all but the *Arizona* and *Oklahoma* were eventually repaired and returned to service, and the Japanese failed to destroy the important oil storage facilities on the island. The "date which will live in infamy," as U.S. President Franklin Roosevelt termed it, unified the U.S. public and swept away any earlier support for neutrality. On December 8 Congress declared war on Japan with only one dissenting vote (Representative Jeannette Rankin of Montana, who had also voted against U.S. entry into World War I).

The extent of the disaster and the unpreparedness of the U.S. military provoked considerable criticism. Admiral Husband Kimmel and General Walter Short, the Navy and Army commanders on Oahu, were relieved of duty, and official investigations were begun at once. Some historians and others went so far as to accuse President Roosevelt of having invited the attack (or at least done nothing to stop it) in order to bring the United States into the war against the Axis. However, later investigations indicated that, while U.S. officials had been aware that an attack by Japan was probable, they had no knowledge of the time or place at which it would occur.

Pearl Islands, Spanish ARCHIPIÉLAGO DE LAS PERLAS, archipelago, in the Gulf of Panama, about 50 miles (80 km) southeast of Panama City, consisting of 183 islands, of which 39 are sizable. The most important islands include the mountainous del Rey Island on which the principal town, San Miguel, is located; San José; Pedro González; and Saboga. The islands are visited by fishermen in search of the fishes that abound in the local waters. Pop. (1980) 2,942.

Pearl River, river in the southern United States, rising in east-central Mississippi and flowing southwestward, through Jackson, the capital of the state, then generally southward into Louisiana, past Bogalusa, and emptying into Mississippi Sound on the Gulf of Mexico. West of Picayune, Miss., the river divides into two streams: the East Pearl, which enters the sound near Grand Island, and the West Pearl, which parallels the East Pearl several miles to the west. Approximately 411 miles (661 km) long, the Pearl and its tributaries (Yockanookany and Strong rivers and the Bogue Chitto) drain about 7,600 square miles (19,700 square km). Locks on the West Pearl (1953) provide a 7-foot (2-metre) channel from the mouth to Bogalusa (58 miles [93 km] upstream). Chief river cities are Columbia, Monticello, and Jackson, all in Mississippi, and Bogalusa, in Louisiana. The Ross Barnett Reservoir north of Jackson provides water, flood and pollution control, and recreation facilities. The lower course of the Pearl and the East Pearl form the boundary between Mississippi and Louisiana. Honey Island Swamp, lying in the mid-delta area southwest of Picayune, is noted for its wildlife and fishing.

Pearl River Delta, Chinese (Wade–Giles) CHU CHIANG SAN-CHIAO-CHOU, (Pinyin) ZHU JIANG SANJIAOZHOU, also called CANTON DELTA, extensive low-lying area formed by the junction of the Hsi, Pei, Tung, and Pearl (Chu) rivers in south Kwangtung province, China. It covers an area of 2,900 square miles (7,500 square km) and stretches from the city of Canton (north) to the Portuguese overseas territory of Macau (south). The delta is a maze of streams and canals between small rice paddies that, because of the 12-month growing season, commonly support three rice crops annually. It is one of the most crowded areas of China. Fishing, silk weaving, and the raising of hogs and poultry supplement the farm-crop income.

pearlfish, also called FIERASFER, or CUCUMBER FISH, any of about 27 species of slim, eel-shaped marine fishes of the family Carapidae noted for living in the bodies of sea cucumbers, pearl oysters, starfishes, and other invertebrates. Pearlfishes are primarily tropical and are found around the world, mainly in shallow water. They are elongated, scaleless, and often transparent. The long dorsal and anal fins meet at the tip of the long, pointed tail. Most pearlfishes are about 15 cm (6 inches) or less in length. They penetrate sea cucumbers by way of the anus of the host, in some instances apparently feeding on its reproductive and respiratory organs.

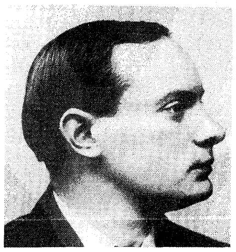
pearlstone (natural glass): *see* perlite.

Pears, Sir Peter (Neville Luard) (b. June 22, 1910, Farnham, Surrey, Eng.—d. April 3, 1986, Aldeburgh, Suffolk), British tenor, a singer of outstanding skill and subtlety who was closely associated with the works of Sir Benjamin Britten. He received a knighthood in 1977.

Pears studied at Oxford, at the Royal College of Music, and then with Elena Gerhardt and Dawson Freer. In 1936 he met Britten, and in 1938 he gave the first of many song recitals with Britten as accompanist. The two men became lifelong companions. In 1942 Pears made his opera debut in London in Jacques Offenbach's *Tales of Hoffman.* He then joined the Sadler's Wells Opera, where he created the title role in Britten's *Peter Grimes* (1945). In 1946 Pears helped Britten found the English Opera Group, and in 1947 they were instrumental in founding the Aldeburgh Festival.

Pears sang in the first performances of all of Britten's operas, including *Albert Herring, Billy Budd, Owen Wingrave,* and *Death in Venice.* He also performed notably in Wolfgang Amadeus Mozart's *Die Zauberflöte,* Bedřich Smetana's *The Bartered Bride,* and much of the Italian operatic repertory as well as in the song cycles of Robert Schumann and Franz Schubert and the Passions of J.S. Bach.

Pearse, Patrick Henry, Patrick also spelled in Irish PÁDRAIC (b. Nov. 10, 1879, Dublin—d. May 3, 1916, Dublin), leader of Irish nationalism and Irish poet and educator. He



Pearse
BBC Hulton Picture Library

was the first president of the provisional government of the Irish Republic proclaimed in Dublin on Easter Monday, April 24, 1916, and was commander in chief of the Irish forces in the anti-British uprising that began on the same day.

The son of an English sculptor and his Irish wife, Pearse became a director of the Gaelic League (founded 1893 for the preservation of the Irish language) and edited (1903–09) its weekly newspaper, *An Claidheamh Soluis* ("The Sword of Light"). To promote further the Irish language as a weapon against British domination, he published tales from old Irish manuscripts and a collection (1914) of his own poems in the modern Irish idiom. He founded St. Enda's College, near Dublin (1908), as a bilingual institution with its teaching based on Irish traditions and culture.

On the formation (November 1913) of the Irish Volunteers as a counterforce against the Ulster Volunteers (militant supporters of the Anglo-Irish union), Pearse became a member of their provisional committee, and he contributed poems and articles to their newspaper, *The Irish Volunteer.* In July 1914 he was made a member of the supreme council of the Irish Republican Brotherhood (IRB). After the Irish Volunteers split (September 1914), he became a leader of the more extreme Nationalist section, which opposed any support for Great Britain in World War I. He came to believe that the blood of martyrs would be required to liberate Ireland, and on that theme he delivered a famous oration at the burial (August 1915) of Jeremiah O'Donovan, known as O'Donovan Rossa, a veteran of Sinn Féin.

As an IRB supreme council member, Pearse helped to plan (January 1916) the Easter Rising. On Easter Monday he proclaimed the provisional government of the Irish Republic from the steps of Dublin General Post Office. On April 29, when the revolt was crushed, he surrendered to the British. After a court-martial, he was shot by a firing squad. More than any other man, Pearse was responsible for establishing the republican tradition in Ireland.

Pearse's *Collected Works* appeared in 1917–22 (3 vol.) and again in 1924 (5 vol.), and his *Political Writings and Speeches* in 1952. *Patrick H. Pearse,* Desmond Ryan's English translation of Louis N. Le Roux's *Vie de Patrice Pearse,* was published in 1932.

Pearson, Drew, byname of ANDREW RUSSELL PEARSON (b. Dec. 3, 1897, Evanston, Ill., U.S.—d. Sept. 1, 1969, Rockville, Md.), one of the most influential newspaper columnists in the United States.

Pearson was the son of a Quaker professor who became governor of the U.S. Virgin Islands. He was educated at Phillips Exeter Academy and attended Swarthmore College, where he was elected to Phi Beta Kappa and graduated in 1919. After traveling in postwar Europe, he taught industrial geography for three years at the University of Pennsylvania, quit teaching, and settled on a career in journalism. He combined reporting and lecturing on his travels with interviews and covered numerous major international events, including anti-foreigner strikes in China in 1925 and the Geneva Naval Conference of 1927. He was on the staff of the *United States Daily* from 1926 to 1933 and wrote for the Baltimore *Sun* from 1929 to 1932. Pearson and Robert S. Allen, another Washington, D.C., reporter, wrote a book, *Washington Merry-Go-Round* (1931), a gossipy treatment of the scene in the U.S. capital. He and Allen were fired for writing the irreverent book, but its success brought them an invitation to write a column with the same name for syndication. The column first appeared in 1932, setting a style for many similar columns by other writers. Pearson and Allen went their separate ways in 1942, Allen to do a column of his own, while Pearson continued "Washington Merry-Go-Round."

As his reputation grew Pearson visited and interviewed many world leaders, among them Premier Nikita S. Khrushchev of the Soviet Union. In 1947 he hired as a reporter Jack Anderson, who became his partner in 1965 and inherited the column on Pearson's death. Among Pearson's books was *Will Khrushchev Bury Us?* (1962). He began to keep an informal diary in 1949 and continued it until his death. Portions were published in 1974 as *Drew Pearson's Diaries: 1949–1959.*

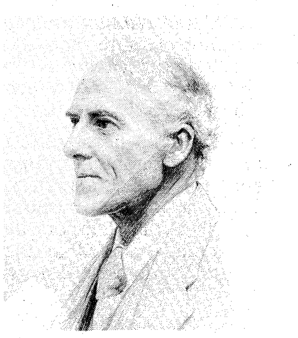
Pearson, Hesketh (b. Feb. 20, 1887, Hawford, Worcestershire, Eng.—d. April 9, 1964, London), English actor, director, and biographer.

After attending the Bedford Grammar School, he took his first job in a shipping office. In 1911 Pearson turned to the theatre, but his acting career was interrupted by World War I; he joined the army and fought as a private in Mesopotamia and Persia from 1914 to 1918. Pearson then returned to the stage as both actor and director. It was not until 1921 that he began his career as a writer, with *Modern Men and Mummies* (1921), which contained amusing portraits of his prominent contemporaries in the theatre.

Pearson's output largely consisted of lively and popular biographies of famous literary and artistic figures. Among such works are *Doctor Darwin* (1930); *Gilbert and Sullivan* (1935); *A Life of Shakespeare* (1942); *G.B.S: A Full-Length Portrait* (1942); *Conan Doyle: His Life and Art* (1943); *The Life of Oscar Wilde* (1946); *The Man Whistler* (1952); and *Henry of Navarre* (1963). A posthumous autobiography, *Hesketh Pearson, by Himself,* appeared in 1965.

Pearson, Karl (b. March 27, 1857, London—d. April 27, 1936, London), English mathematician, one of the founders of modern statistics.

Part of Pearson's multifaceted nature is revealed by his three-year law practice begun in 1881, his radical political activities in London, and the publication of two literary works by him—*The New Werther* (1880) and *The Trinity: A Nineteenth Century Passion-Play* (1882). In 1884 he was appointed professor of applied mathematics and mechanics at University College, London, where he taught, until his retirement in 1933, as Gresham professor of geometry (1891), head of the department of applied mathematics (1907), and Galton professor of eugenics (1911). Pearson's lectures as professor of geometry evolved into *The Grammar of Science* (1892), his most widely read book and a classic in the philosophy of science.

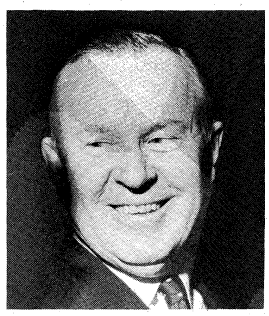


Karl Pearson, pencil drawing by F.A. de Biden Footner, 1924
By courtesy of Professor D.V. Lindley; photograph, J.R. Freeman & Co. Ltd.

Stimulated by the evolutionary writings of Francis Galton and a personal friendship with Walter F.R. Weldon, Pearson became immersed in the problem of applying statistics to biological problems of heredity and evolution. The methods he developed are essential to every serious application of statistics. From 1893 to 1912 he wrote a series of 18 papers entitled *Mathematical Contributions to the Theory of Evolution,* which contained much of his most valuable work, including the chi-square test of statistical significance. He was a cofounder (with Galton and Weldon), editor of (1901–36), and major contributor to the statistical journal *Biometrika.* He was also editor of *The Annals of Eugenics* (1925–36).

Pearson's other works include *The Chances of Death and Other Studies in Evolution* (1897); *The Life, Letters and Labours of Francis Galton* (1914, 1930); *Tables for Statisticians and Biometricians* (1914, 1931); *Tables of the Incomplete Gamma Function* (1922); and *Tables of the Incomplete Beta Function* (1934).

Pearson, Lester B(owles) (b. April 23, 1897, Toronto—d. Dec. 27, 1972, Ottawa), politician, diplomat, and prime minister of Canada, who was prominent as a mediator in international disputes in 1963–68.



Lester Pearson, 1963
Canadian Press

Pearson served in World War I (1914–18) and lectured in history at the University of Toronto (1924–28), after studying there and at the University of Oxford. He joined the Canadian foreign service in 1928 and became first secretary in the Department of External Affairs. He served on two royal commissions (1931) and as counselor of the Canadian high commissioner's office in London (1935).

Recalled to Canada in 1941, Pearson then served as ambassador to the United States in 1945–46. He headed the Canadian delegation at the United Nations from 1948 to 1956, and he was president of the United Nations General Assembly in 1952–53. In 1948 he became secretary of state for external affairs in the Liberal government of Louis Saint Laurent and entered Parliament for Algoma East. He represented Canada at the founding of the North Atlantic Treaty Organization (NATO) in 1949, and in 1951 he was chairman of that organization. In 1957 he received the Nobel Prize for Peace for his efforts to solve the Suez crisis of 1956. Pearson succeeded Saint Laurent as leader of the Liberal Party in 1958 and became prime minister in 1963; he resigned as prime minister in 1968 and retired from politics.

Pearson, Weetman Dickinson: *see* Cowdray of Midhurst, Weetman Dickinson Pearson, 1st Viscount.

Peary, Robert Edwin (b. May 6, 1856, Cresson, Pa., U.S.—d. Feb. 20, 1920, Washington, D.C.), U.S. Arctic explorer usually credited with leading the first expedition to reach the North Pole (1909).

Peary entered the U.S. Navy in 1881 and pursued a naval career until his retirement, with leaves of absence granted for Arctic exploration. In 1886, with his black American associate Matthew Henson, he traveled inland from Disko Bay over the Greenland ice sheet for 100 miles (161 km), reaching a point 7,500 feet (2,287.5 m) above sea level. In 1891 Peary returned to Greenland with seven companions, including his wife and Frederick A. Cook, who in 1909 would claim to have reached the North Pole before Peary. On this expedition Peary sledged 1,300 miles (2,100 km) to northeastern Greenland, discovered Independence Fjord, and found evidence of Greenland's being an island. He also studied the "Arctic Highlanders," an isolated Eskimo tribe who helped him greatly on later expeditions.

During his expedition of 1893–94 he again sledged to northeastern Greenland—this time in his first attempt to reach the North Pole. On summer trips in 1895 and 1896 he was mainly occupied in transporting masses of meteoric iron from Greenland to the United States. Between 1898 and 1902 he reconnoitred routes to the pole from Etah, in Inglefield Land, northwestern Greenland, and from Fort Conger, Ellesmere Island, in the Canadian Northwest Territories. On a second attempt to reach the pole he was provided with a ship built to his specifications, the *Roosevelt,* which he sailed to Cape Sheridan, Ellesmere Island, in 1905. But the sledging season was unsuccessful owing to adverse weather and ice conditions, and his party reached only 87°06′ N. Peary returned to Ellesmere in 1908 for his third attempt and early the following March left Cape Columbia on his successful journey to the pole. On the last stage of the trek he was accompanied by Henson and four Eskimo. Peary and his companions purportedly reached the North Pole on April 6, 1909. Peary returned to civilization only to discover that his former colleague, Cook, was claiming to have reached the North Pole independently in April 1908. Cook's claim, though subsequently discredited, marred Peary's enjoyment of his triumph. In 1911 Peary retired from the navy with the rank of rear admiral. His published works include *Northward over the "Great Ice"* (1898), *The North Pole* (1910), and *Secrets of Polar Travel* (1917).

Peary's claim to have reached the North Pole was almost universally accepted, but in the 1980s the examination of his 1908–09 expedition diary and other newly released documents cast doubt on whether he had actually reached the pole. Through a combination of navigational mistakes and record-keeping errors, Peary may actually have advanced only to a point 30–60 miles (50–100 km) short of the pole. The truth remains uncertain.

Peary Land, region, northern Greenland, extending about 200 miles (320 km) east and west along the Arctic Ocean, between Victoria Fjord and the Greenland Sea. One of the northernmost land regions of the world, ending at Cape Morris Jesup, it is Greenland's largest ice-free part, with a generally mountainous surface rising to 6,398 feet (1,950 m). The coastline is deeply indented by fjords. Although the region is without human habitation, its vegetation supports herds of muskoxen. It was partially explored in 1892, 1895, and 1900 by Robert E. Peary, the American Arctic explorer.

Peasant Party: *see* Bulgarian Agrarian National Union.

peasant, any member of a class of persons who till the soil as small landowners or as agricultural labourers. The term peasant originally referred to small-scale agriculturalists in Europe in historic times, but many other societies, both past and present, have had a peasant class.

The peasant economy generally has a relatively simple technology and a division of labour by age and sex. The basic unit of production is the family or household. One distinguishing characteristic of peasant agriculture is self-sufficiency. Peasant families consume a substantial part of what they produce, and while some of their output may be sold in the market, their total production is generally not much larger than what is needed for the maintenance of the family. Both productivity per worker and yields per unit of land are low.

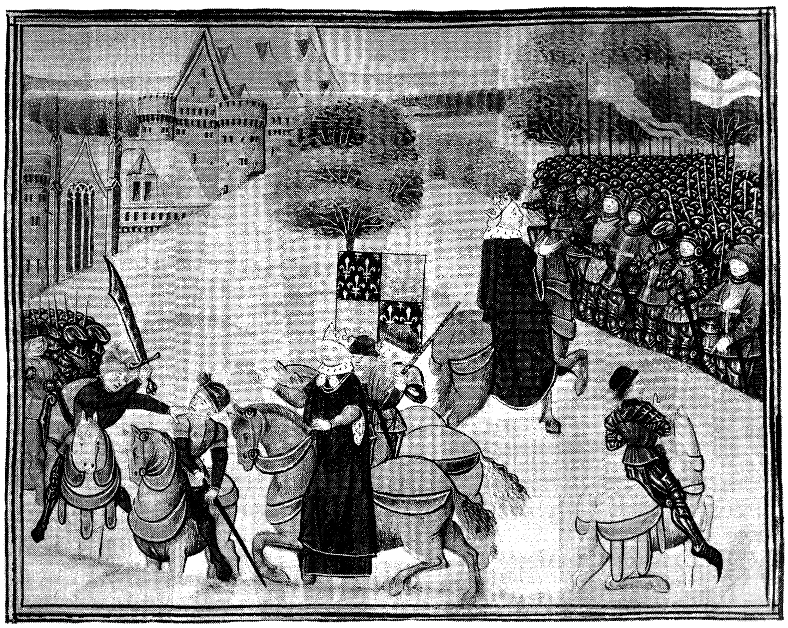
Peasants as a class have tended to disappear as a society industrializes. This is due to the mechanization of farming, the resulting consolidation of farming plots into larger units, and the accompanying emigration of rural dwellers to the cities and other sites of industrial employment. The small-scale agriculture associated with peasant labour is simply too inefficient to be economically viable in developed countries.

Peasants' Revolt, also called WAT TYLER'S REBELLION (1381), first great popular rebellion in English history. Its immediate cause was the imposition of the unpopular poll tax of 1381, which brought to a head the economic discontent that had been growing since the middle of the century. The rebellion drew support from several sources and included well-to-do artisans and villeins as well as the destitute. Probably the main grievance of the agricultural labourers and urban working classes was the Statute of Labourers (1351), which attempted to fix maximum wages during the labour shortage following the Black Death.

The uprising was centred in the southeastern counties and East Anglia, with minor disturbances in other areas. It began in Essex in May, taking the government of the young king Richard II by surprise. In June rebels from Essex and Kent marched toward London. On the 13th the Kentish men, under Wat Tyler (*q.v.*), entered London, where they massacred some Flemish merchants and razed the palace of the king's uncle, the unpopular John of Gaunt, Duke of Lancaster. The government was compelled to negotiate. On the 14th Richard met the men of Essex outside London at Mile End, where he promised cheap land, free trade, and the abolition of serfdom and forced labour. During the king's absence, the Kentish rebels in the city forced the surrender of the Tower of London; the chancellor, Archbishop Simon of Sudbury, and the treasurer, Sir Robert Hales, both of whom were held responsible for the poll tax, were beheaded.

The king met Tyler and the Kentishmen at Smithfield on the following day. Tyler was treacherously cut down in Richard's presence by the enraged mayor of London. The king, with great presence of mind, appealed to the rebels as their sovereign and, after promising reforms, persuaded them to disperse. The crisis in London was over, but in the provinces the rebellion reached its climax in the following weeks. It was finally ended when the rebels in East Anglia under John Litster were crushed by the militant bishop of Norwich, Henry le Despenser, on about June 25.

The rebellion lasted less than a month and



The death of Wat Tyler (left) and Richard II addressing the peasants (right), miniature from a manuscript of Jean Froissart's *Chronicles*, 15th century; in the British Library failed completely as a social revolution. The king's promises at Mile End and Smithfield were promptly forgotten, and manorial discontent continued to find expression in local riots. It succeeded, however, as a protest against the taxation of poorer classes insofar as it prevented further levying of the poll tax.

Pease, Edward Reynolds (b. Dec. 23, 1857, Henbury Hill, Dorset, Eng.—d. Jan. 5, 1955, Limpsfield, Surrey), English writer, one of the founders of the Fabian Society.

Born to a prosperous family, Pease left a business career and joined with Frank Podmore, a spiritualist and socialist writer, to found the Fabian Society in London in January 1884. It was named for the Roman consul Fabius Cunctator, known for his strategy of cautious gradualism in the war against Hannibal. The Fabians sought a gradualist approach to socialism in Britain. Early members included such leading intellectuals as George Bernard Shaw, Beatrice and Sidney Webb, and Graham Wallas. Following the notions of William Morris, the socialist who stressed craftsmanship, Pease left the business world and became a cabinetmaker. In 1890 the society hired Pease as a nominally paid part-time secretary. The following year the position became full-time and was held by Pease until 1913, when he became honorary secretary until 1938. In 1900 he helped form the Labour Representation Committee that became the Labour Party in 1906, serving as the representative of the influential Fabian Society for 14 years.

Pease wrote *The Case for Municipal Drink Trade* (1904) and *The History of the Fabian Society* (1916; rev. ed., 1925).

peat, organic fuel consisting of a light, spongy material formed chiefly in temperate humid environments by the accumulation and partial decomposition of vegetable remains under conditions of deficient drainage. Vast beds occur in Europe, North America, and northern Asia, but they are worked only where coal is deficient.

Dried peat burns readily with a smoky flame and a characteristic odour. The ash is powdery and light, except in certain varieties that have a high content of sand and other inorganic matter. Peat is used for domestic heating purposes and forms a fuel suitable for boiler firing in either briquetted or pulverized form; it also has been used in gas producers. In Ireland millions of tons of peat are consumed annually; the Soviet Union, Sweden, Germany, and Denmark also produce and use considerable quantities, and peat is used locally in England and Scotland.

Peat is usually hand-cut, although progress has been made in the excavation and spreading of peat by mechanical methods. Peat is cut by spade in the form of blocks, which are spread out to dry (peat in its natural state contains 90 to 95 percent water); when dry, these blocks weigh from three-quarters of a pound to two pounds each. In one method of mechanized winning, a dredger or excavator digs the peat from the drained bog and delivers it to a macerator, which extrudes the peat pulp through a rectangular opening; the pulp is then cut into blocks, which are spread to dry. Maceration promotes drying and tends to yield more uniform shrinkage and a denser and tougher fuel. Hydraulic excavating can also be used, particularly in bogs that contain roots and tree trunks. The peat is washed down by a high-pressure water jet, and the pulp runs to a sump. There, after slight maceration, it is pumped to a draining ground in a layer about 9 inches (230 mm) thick, which after partial drying is cut up and then dried.

Peat deposition is the first step in the formation of coal. The humid climate of the Carboniferous period (360 to 286 million years ago), which favoured the growth of huge tropical seed ferns and giant nonflowering trees, created the vast swamp areas that comprise the coal beds of today. As the plants died and fell into the boggy waters, which excluded oxygen and killed bacteria, they partially decomposed but did not rot away. The vegetation was changed into peat, some of which was brown and spongy, some black and compact, depending on the degree of decomposition. The sea advanced and withdrew over such deposits, and new sediments were laid down. Under pressure the peat dried and hardened to become low-grade coal, or lignite; further pressure and time created bituminous coal; and even more extreme pressures created anthracite.

peat moss, also called BOG MOSS, or SPHAGNUM MOSS, any of more than 160 species of plants of the subclass Sphagnidae, constituting the order Sphagnales, comprising the family Sphagnaceae, which contains one genus, *Sphagnum*. The pale green to deep red plants,

Peat moss (*Sphagnum flexuosum*)

K.G. Preston-Mafham—The Natural History Photographic Agency

up to 30 cm (about 12 inches) tall, form dense clumps around ponds, in swamps and bogs, on moist, acid cliffs, and on lakeshores from tropical to subpolar regions. The veinless leaves and stem cortex contain many interconnected, enlarged dead cells, with external openings through which water can enter; the plants hold up to 20 times their weight in water.

Each spherical brown sporangium, or spore case, shrinks as it dries, creating internal pressure that casts off the lid (operculum) and shoots the spores as far as 10 cm from the plant. The metabolic processes of growing peat moss cause an increase in the acidity of the surrounding water, thus reducing bacterial action and preventing decay. The plants also contain sphagnol, a phenolic compound with antiseptic properties.

Peat moss forms several types of bogs in northern areas. Compression and chemical breakdown of dead plants and other vegetable debris cause formation of the organic substance known as peat, which is harvested and dried for use as fuel. Dried peat moss has been used for surgical dressings, diapers, lamp wicks, bedding, and stable litter. It is commonly employed as a packing material by florists and shippers of live aquatic animals, and as a seedbed cover and soil additive by gardeners who value its ability to increase soil moisture, porosity, and acidity. Peat mosses are valuable in erosion control, and properly drained peat bogs provide useful agricultural land.

Some botanists believe peat mosses constitute a class; others consider them to be a subclass or order.

peat sampler, device for collecting uncontaminated samples of sediment from various kinds of deposits containing fossil pollen and other organic remains. Several instruments have been developed to retrieve controlled samples, and, although they are termed peat samplers, they are used to study many kinds of deposits other than peat. In general, peat samplers consist of closed sections of tubing that are forced into a sedimentary deposit to a required depth and then opened, filled, and withdrawn with the core sample.

pebble chopper, also called PEBBLE TOOL, primordial cutting tool, the oldest type of tool made by forerunners of modern man. The tool consists of a rounded stone struck a number of blows with a similar stone used as a pounder, which created a serrated crest that served as a chopping blade. The tool could be used as a crude hunting knife, to grub roots, and for other purposes.

pebble mosaic, type of mosaic work that uses natural pebbles arranged to form decorative or pictorial patterns. It was used only for pavements and was the earliest type of mosaic in all areas of the eastern Mediterranean, appearing in Asia Minor in excavated floors from the 8th and 7th centuries BC.

The first pebble mosaics had rough geometric designs, but artists in Greece by the 5th century BC had achieved a degree of technical proficiency that allowed them to create designs and figures with delicacy and considerable detail, as in a series of black-and-white mosaic floors depicting mythological scenes at Olynthus in northern Greece (*c.* 400 BC). Most pebble mosaics were made simply with dark and light patterns, but a few were multicoloured, such as the magnificent floors from the late 4th century BC found at Pella in Macedonia, which show monumental figures of people and animals rendered with impressive naturalism and grace. Pebble mosaics persisted as the major form of mosaic decoration until about the 3rd century BC, when they began to be replaced with mosaics of cut stone cubes, or tesserae. The later pebble mosaics, including those at Pella, were increasingly supplemented

Bellerophon, mounted on Pegasus, fighting the chimera, detail of a Greek pebble mosaic from Olynthus, Greece, *c.* 400 BC

By courtesy of the University of Mississippi; photograph, David Moore Robinson

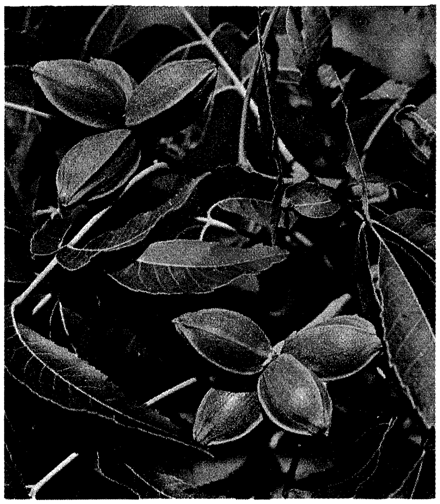
with stone tesserae chosen for colour intensity and with lead or terra-cotta strips for delineation of detail.

Peć, formerly IPEK, Latin PESCIUM, most populous town in the autonomous *pokrajina* (province) of Kosovo, republic of Serbia, Yugoslavia. Lying on a small tributary of the Beli Drim River, between the North Albanian Alps (Prokletije) and the Mokra Mountain Range, Peć is the terminus of a rail line from Niš. A majority of its inhabitants is Albanian. The town, with mosques, narrow streets, and old Turkish houses, has an Oriental character. It serves as a local market centre for agricultural produce; industries are leatherworking, food processing, and handicrafts.

Peć was especially important as a religious centre and was from *c.* 1253 to 1766, with brief interruptions, the chief see of the Orthodox Church of Serbia. The patriarchal monastery, repeatedly ravaged and restored, consists of four churches with fine frescoes, library, and treasury. About 12 mi (19 km) south of Peć is Dečani Monastery (1327–35), which has more than 1,000 frescoes and represents one of the finest extant examples of Serbian architecture and ornamentation. Pop. (1981 prelim.) mun., 111,067.

Pecalongan (Indonesia): *see* Pekalongan.

pecan (*Carya illinoensis*), nut of the walnut family (Juglandaceae), native to temperate North America. The tree occasionally reaches a height of about 50 metres (160 feet) and a trunk diameter of 2 m. It has a deeply furrowed bark and compound leaves with 9–17 finely toothed leaflets, arranged in feather fashion. The male flowers form hanging catkins; the female flowers are arranged in tight clusters at the ends of the shoots. At maturity the fleshy hulls of the short-clustered fruits dry, split along suture lines, and separate into four approximately equal sections, thus gradually freeing the nuts. The nuts have brown, mottled shells, varying greatly in thickness; size varies from 100 to 500 per kilogram (45 to 225 per pound) and shape from long and cylindrical with pointed apex to short and roundish



Pecan (*Carya illinoensis*)
Grant Heilman—EB Inc.

Rich and distinctive in flavour and texture, the pecan has one of the highest fat contents of any vegetable product and a caloric value close to that of butter. Its production is the basis of a considerable industry in the southeastern United States. The pecan may be eaten raw, sweetened or salted. It is widely used in pastries, such as coffee cakes, and often in conjunction with chocolate. In the southeastern United States the pecan pie, consisting of pecans baked in a clear custard, and the pecan praline candy are traditional sweets.

Native pecan trees occur in the United States (near the Rio Grande in Texas, and in Nebraska, Iowa, Indiana, and occasionally Alabama). Limited cultivation of grafted varieties had begun in Louisiana by 1847; some important varieties were introduced before 1890. Georgia, Alabama, and Mississippi are today the most important producers of grafted pecan nuts. The pecan has been introduced into many countries; it is cultivated to a limited extent in Australia and South Africa.

peccary, also called JAVELIN, or JAVELINA, New World counterpart of the swine, forming the family Tayassuidae (order Artiodactyla). The name javelin, or javelina, derives from their spearlike upper canines.

Resembling small pigs with small, erect ears and almost no tails, peccaries reach a length of 75–90 centimetres (30–35 inches) and a weight of 15–30 kilograms (33–66 pounds). They are hunted for their hides and meat; although ferocious when molested, they are sometimes tamed by South American Indians.

Collared peccary (*Dicotyles tajacu*)
Jen and Des Bartlett—Bruce Coleman Inc.

Peccaries differ from true pigs (family Suidae) in certain skeletal and dental features. They also have a scent gland under the skin that opens on the ridge of the back and gives off a strong, musky odour; this gland is the source of the tale that they have two navels, one above and one below. Peccaries are found from Texas to Patagonia. They feed on a variety of plants, small animals, and carrion. They have a barklike alarm call and when disturbed make a rattling sound by chattering their teeth. Litters usually consist of two young, born after a five-month gestation period.

There are two species. The collared peccary (*Dicotyles,* or *Tayassu, tajacu*) is dark gray with a white band across the chest and lives in deserts and forests in bands of about 5 to 25 individuals. The white-lipped peccary (*Tayassu pecari*) is slightly larger and darker, with a white area around the mouth. Found in wet, tropical forests, it lives in herds of 50 to more than 100 individuals.

Pecci, Vincenzo Gioacchino (pope): *see* Leo XIII *under* Leo (Papacy).

Pech Morena (India): *see* Morena.

Pechenegs, Byzantine PATZINAKOI, Latin BISSENI, Hungarian BESENYO, nomadic Turkic people who occupied the steppes north of the Black Sea (6th–12th century) and by the 10th century were in control of the lands between the Don and lower Danube rivers (after having driven the Hungarians out); thus they had become a serious menace to Byzantium. Originally inhabiting the area between the Rivers Volga and Yaik (Ural), the Pechenegs were attacked by the Khazars and the Oghuz (*c.* 889). They moved westward (especially as the Khazar state declined and could no longer impede the migration), driving the Hungarians into the Carpathian Basin and attacking Russian territory.

Kept at bay by the Russians and the Hungarians, the Pechenegs repeatedly invaded Thrace (10th century); they increased the frequency and intensity of their raids (11th century) after Byzantium conquered Bulgaria (1018) and became an immediate neighbour of the Pechenegs. In 1090–91 the Pechenegs advanced to the gates of Constantinople, where Emperor Alexius I with the aid of the Kumans annihilated their army and effectively destroyed Pecheneg power. Important Pecheneg settlements were later established in Hungary, probably after their defeat by Byzantium. The main source on Pecheneg history is the *De administrando imperii* of the Byzantine emperor Constantine VII Prophyrogenitus.

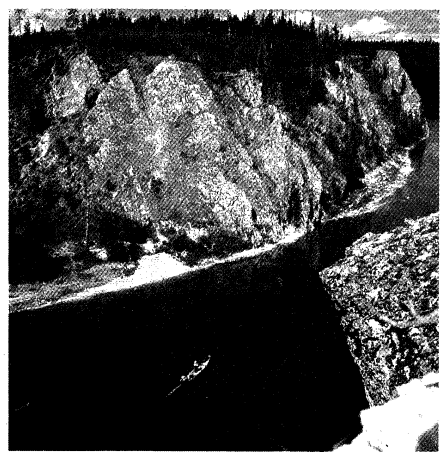
Pechenga, formerly (1919–44) PETSAMO, town, Murmansk *oblast* (administrative region), northwestern Russian Soviet Federated Socialist Republic, at the head of Pechenga Bay on the Barents Sea coast. Dating from the 16th century, the town was in northern Finland between 1919 and 1940 and was the terminus of the Arctic Highway from the Gulf of Bothnia. It is linked by rail to Murmansk, but its port functions, especially for the adjacent copper- and nickel-mining area, have largely been usurped by its outport of Liinakhamari. Pop. (latest census) 3,500.

Pechiney, French state-owned, multinational holding company formed in December 1971 as Pechiney Ugine Kuhlmann SA after the merger of Pechiney SA, an aluminum producer established in 1855, and Société Ugine Kuhlmann, a chemical company established in 1889. The combination is a major world producer of aluminum and a leading European copper fabricator. In 1982 the French government nationalized the company, and its name was shortened to the present one in 1983. Headquarters are in Paris.

One of the company's founders, A.R. Pechiney (1833–1916), pioneered in aluminum production by introducing the Sante-Claire Deville process at a plant in Salindres, Gard, Fr. However, he at first failed to foresee the potential value and marketability of the lightweight metal in its pure form. When in the mid-1880s Paul-Louis-Toussaint Héroult, who had been experimenting in ways to extract aluminum through electrolysis, sought Pechiney's advice on how next to proceed, Pechiney convinced him to abandon the project and instead concentrate on the development of aluminum alloys, particularly the copper-rich aluminum bronze.

The company now specializes in processing nonferrous metals and chemicals. In addition to aluminum and copper products, it produces stainless steel, ferroalloys, carbon products, rare metals, dyes, organic and inorganic chemicals, various metallurgical products, drugs, and electric products related to metal production. Pechiney operates facilities in the United States, Australia, India, Brazil, Malaysia, and a number of European countries.

Pechora River, also spelled PEČORA, river in the Russian Soviet Federated Socialist Republic. Rising in the northern Urals near Mt. Koyp, it flows 1,124 mi (1,809 km), first south in a narrow, deep valley, then west and north across an extensive, level basin to enter the Barents Sea by a delta. It drains an area of 124,500 sq mi (322,000 sq km). Freeze-up extends from early November to early May. Navigation is possible as far as Ust-Unya;



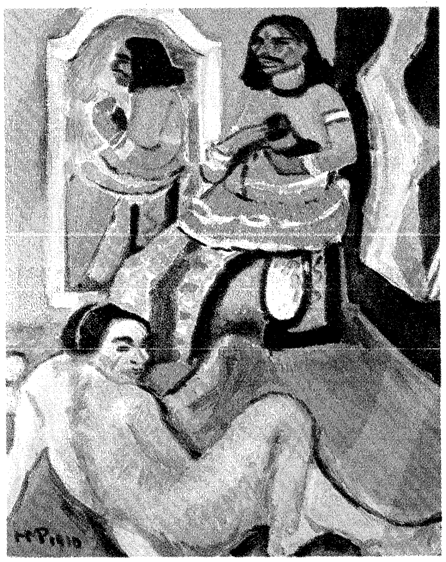
The Pechora River, Russian S.F.S.R., along its upper course
Syndication International Ltd., London

there is much timber rafting. In its basin are large deposits of coal, petroleum, and natural gas.

Pechora Sea, also spelled PEČORA, Russian PECHORSKOYE MORE, sea lying to the north of European Russian Soviet Federated Socialist Republic, between Kolguyev Island to the west and the Yugorsky Peninsula to the east. To the north is Novaya Zemlya. The Pechora Sea is, in effect, a southeastern extension of the Barents Sea. Its average depth is 20 feet (6 m), but it reaches a maximum depth of 690 feet (210 m). In the southern part of the sea run the eastward-flowing Kolguyev Current and its extension, the Novaya Zemlya, the flow of which is interrupted by the inflow of the Pechora River.

The Pechora Sea is blocked by floating ice from November until June. Cod, seals, and other marine life are exploited. The main port is Naryan-Mar on the Pechora River, an important exporter of timber.

Pechstein, Max (b. Dec. 31, 1881, Zwickau, Ger.—d. June 29, 1955, Berlin), painter and printmaker who was a leading member of the group of German Expressionist artists known as Die Brücke. He is best known for his paintings of nudes and landscapes.



"Indian and Woman," oil painting by Max Pechstein, 1910; in the collection of Morton D. May
By courtesy of Morton D. May

In 1906, when Pechstein joined Die Brücke, he was painting in the style of the Impressionists. But his association with the members of Die Brücke and exposure to the works of Matisse led Pechstein to use vigorous brushstrokes and jarring combinations of unmixed colours, as in his "Indian and Woman" (1910).

In 1910 Pechstein joined the Neue Sezession (New Secession), an association of artists in Berlin. His works of this period have simpler compositions and more sombre colours. In 1914 he traveled to Palau in the western Pacific, where he painted exotic subjects in a deliberately primitive manner.

Back in Europe, he designed stained glass and mosaics and took a teaching position at the Berlin Academy. He was forced to resign when the Nazis declared his work "decadent" but regained his post after World War II. His late work, however, lost much of the vigour of his earlier styles.

peck, unit of capacity in the U.S. Customary and British Imperial systems of measurement. In the United States the peck is used only for dry measure and is equal to 8 dry quarts, or 537.6 cubic inches (8.811 l). In Great Britain the peck may be used for either liquid or dry measure and is equal to 8 quarts (2 imperial gallons), or 554.84 cubic inches (9.094 l). The peck has been in use since the early 14th century, when it was introduced as a measure for flour. The term referred to varying quantities, however, until the modern units were defined in the 19th century.

Peck, (Eldred) Gregory (b. April 5, 1916, La Jolla, Calif., U.S.), American motion-picture actor.

Peck gave up training in medicine to pursue his interests in the acting profession in the early 1940s. His first stage performance in *The Morning Star*, a 1942 Broadway production, was well received, and he appeared in several other stage productions before his first film roles in *Days of Glory* and *The Keys of the Kingdom* (both 1944). Peck rapidly acquired a reputation for capable, conscientious acting with his performances in such films as *Spellbound* (1945), *Duel in the Sun* (1946), *The Yearling* (1946), *Gentleman's Agreement* (1947), and *Twelve O'Clock High* (1949). His portrayal of the weary, cynical title character of *The Gunfighter* (1950), however, established him as an actor of formidable skill. The Academy of Motion Picture Arts and Sciences awarded him an Oscar for his performance as the humane southern lawyer in *To Kill a Mockingbird* (1962).

His other films include *Roman Holiday* (1953), *The Big Country* (1958), *The Guns of Navarone* (1961), *Behold a Pale Horse* (1964), *Arabesque* (1966), *The Omen* (1976), *MacArthur* (1977), and *The Sea Wolves* (1981). Peck frequently played a likeable, honest man of measured speech who showed high moral qualities when put to the test. *Gregory Peck*, a biography by Michael Freedland, was published in 1980.

Peckham, Rufus Wheeler (b. Nov. 8, 1838, Albany, N.Y., U.S.—d. Oct. 24, 1909, Altamont, N.Y.), associate justice of the U.S. Supreme Court from 1896 to 1909.

Peckham was educated in Albany and Philadelphia and was admitted to the bar in 1859, after which he practiced law in Albany. In 1883 he was appointed a justice of the New York State Supreme Court, and in 1886 he became a member of the Court of Appeals of New York, the highest court in the state. He was nominated to the U.S. Supreme Court by President Grover Cleveland after the nomination of his brother, Wheeler Hazard Peckham, had failed Senate confirmation. Rufus took office in January 1896.

Peckham was basically a conservative justice who was noted for his careful and lucidly reasoned opinions. He is best known for the majority opinion he wrote in *Lochner* v. *New York* (1905), a case in which a baker had contracted with his employees for longer than a 10-hour working day in defiance of a state law setting 10 hours a day as the legal maximum. Peckham wrote that the Fourteenth Amendment prohibited the states from curtailing a man's liberty to make his own economic arrangements with his employees. This decision drew a stinging rebuke from Justice Oliver Wendell Holmes, Jr., in a memorable dissent. By the 1930s Holmes's opinion had become the prevailing interpretation of the Fourteenth Amendment, and legislation such as maximum-hours laws was held to be constitutional.

Peckinpah, Sam, byname of DAVID SAMUEL PECKINPAH (b. Feb. 21, 1925, Fresno, Calif., U.S.—d. Dec. 28, 1984, Inglewood, Calif.), American motion-picture director and screenwriter known for spectacular, violent westerns.

Peckinpah began his career in television, writing for and directing such western programs as "Gunsmoke," "The Westerner," and "The Rifleman." He made his debut as a film director with *The Deadly Companions* (1961). *Ride the High Country* (1962) and *Major Dundee* (1965) set the formulas for which he became famous: magnificent landscapes, embittered characters drifting in a West that has lost its code of honour, and—most notably—gruesome, realistically choreographed gunplay. *The Wild Bunch* (1969), considered his finest film, and *Pat Garrett and Billy the Kid* (1973) were especially bloody Peckinpah productions. The violence spilled over into such nonwesterns as *Straw Dogs* (1971), *The Getaway* (1972), and *Cross of Iron* (1977).

The Ballad of Cable Hogue (1970) and *Junior Bonner* (1972), plaintive evocations of the modern West, showed another side of Peckinpah.

Pecos, city, seat (1883) of Reeves County, southwestern Texas, U.S. It is situated in the Pecos River Valley, 77 miles (124 km) southwest of Odessa. It began in 1881 as a station on the Texas and Pacific Railway and as a cow town at the intersection of old cattle and wagon trails. It developed as a livestock distribution and service centre and is credited with holding the first Texas rodeo in 1883 (now held annually in July).

The city's West of the Pecos Museum depicts frontier life in the West. In the 1940s its commercial activities became more diversified when underground water was pumped for irrigation, oil and natural gas were tapped, and sulfur was processed. Farming (especially cotton, cantaloupes, and vegetables), cattle ranching, oil and gas production, and tourism are now major economic factors. Large automotive (tire) proving grounds are nearby. Inc. 1903. Pop. (1984 est.) 13,105.

Pecos Bill, in American folklore, cowboy hero of the Pecos River region of Texas who was an exaggerated personification of Western stamina and values; his vivid exploits are analogous to those of the legendary giant lumberjack Paul Bunyan of the North Woods.

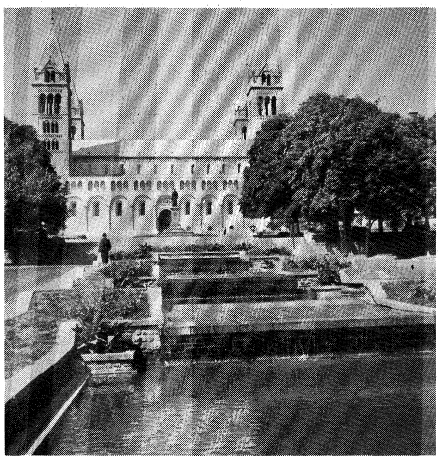
Created by journalists, primarily Edward O'Reilly in *Century* magazine, the Pecos Bill character was based on little authentic oral tradition and no historical prototype. He is said to have been born in Texas about 1832 and raised by coyotes after his parents lost him near the Pecos River. As a man he rode a mountain lion and used a rattlesnake as a lasso, besting the toughest of cowboys. He died, according to one tradition, after washing down a meal of barbed wire with a drink of nitroglycerin. Although Pecos Bill stories were read primarily by nonfrontier Americans, they were adopted by cowboys of Australia and the Argentine.

Pecos River, river in the southwestern United States, rising in Mora County, north-central New Mexico, in the Sangre de Cristo Mountains, and flowing about 735 miles (1,183 km) through eastern New Mexico and western Texas. It drains about 38,300 square miles (99,200 square km) before emptying into the Rio Grande at the Amistad National Recreation Area. After leaving the mountains, the Pecos flows over desertlike land, and its channel is dry much of the year. Near Roswell, N.M., the river widens into a basin, which closes somewhat to a broad, shallow valley at the Texas–New Mexico border. In the last 125 miles (201 km) of its course, the river has cut a narrow canyon more than 1,000 feet (300 m) deep. Dams controlling the river and providing water for irrigation include: Alamogordo Dam (1937), Avalon Dam (1907), McMillan Dam (1908), part of the Carlsbad Reclamation Project, and Red Bluff Dam (1936). Santa Rosa, Fort Sumner, Roswell, and Carlsbad, N.M., and Pecos, Texas, are important towns on or near the river.

Pécs, German FÜNFKIRCHEN, medieval Latin QUINQUE ECCLESIAE ("Five Churches"), capital of Baranya *megye* (county), southwestern

Hungary. It lies at the southern foot of the wooded Mecsek Mountains, 135 miles (220 km) south-southwest of Budapest. It is one of several city-county administrative units in Hungary. The site was occupied by the Roman town of Sopianae, the capital of the province of Southern Pannonia, which succeeded an Illyrian and Celtic settlement. In 1009 Stephen I, the first king of Hungary, made the town a bishopric. The name Pécs first appeared in the late 11th century. The town has a large main square with a well-preserved mosque (Ghazi Kassim Pasha), which is now a Roman Catholic church. The town's cathedral, which was founded in 1009 on the site of an old Roman church, was extensively renovated and restored in the 1960s.

Pécs is an old-established trade and handicrafts town, and during the 14th and 15th



Cathedral at Pécs, Hung.
Salmer—Plessner International

centuries it was also a great centre of humanist studies. It was occupied by the Turks from 1543 to 1686. The earliest university in Hungary, the University of Pécs, founded in 1367 by Louis I, was abolished by the Turks but was reopened in 1922. The Medical University of Pécs (1951) is also situated in the town. In the 18th century, German immigrant miners came to work the local coal seams, and there remains in Pécs one of the few German minorities in Hungary. In 1780 the city received a free royal charter. The Pécs–Komló coalfield, which supplies coking coal to Dunaújváros, formed the basis for the rapid development of the city in the 19th and 20th centuries.

Pécs's industries include engineering, furniture, tobacco, china, brewing, and leatherworking. An oil refinery in Pécs is supplied by pipeline from the Soviet Union. The Zsolnay factory, producing ceramic ware (majolica), is one of the best-known sites in Pécs. In the vicinity are extensive vineyards dating from Roman times. The town has good road and rail connections with Dunaújváros, Budapest, and other cities. The marked rise in Pécs' population in the 20th century was the result of an influx of Hungarian peasants from the countryside. Pop. (1989 est.) 183,000.

pectin, any of a group of water-soluble carbohydrate substances that are found in the cell walls and intercellular tissues of certain plants. In the fruits of plants, pectin helps keep the walls of adjacent cells joined together. Immature fruits contain the precursor substance protopectin, which is converted to pectin and becomes more water-soluble as ripening proceeds. At this stage the pectin helps ripening fruits to remain firm and retain their shape. As a fruit becomes overripe, the pectin in it is broken down to simple sugars that are completely water-soluble. As a result, the overripe fruit becomes soft and begins to lose its shape.

Because of its ability to form a thick gel-like solution, pectin is used commercially in the preparation of jellies, jams, and marmalades. Its thickening properties also make it useful in the confectionery, pharmaceutical, and textile industries. Pectic substances consist of an associated group of polysaccharides that are extractable with hot water or with aqueous solutions of dilute acids. The chief sources of commercial pectin are the peels of citrus fruits, and to a lesser extent apple pomace (residue from cider presses). Very small amounts of pectin suffice in the presence of fruit acids and sugar to form a jelly.

pectoralis muscle, any of the muscles that connect the front walls of the chest with the bones of the upper arm and shoulder. There are two such muscles on each side of the sternum (breastbone) in the human body: pectoralis major and pectoralis minor.

The pectoralis major, the larger and more superficial, originates at the clavicle (collarbone), the sternum, the ribs, and a tendinous extension of the external oblique abdominal muscle. The pectoralis major extends across the upper part of the chest and is attached to a ridge at the rear of the humerus (the bone of the upper arm). Its major actions are adduction, or depression, of the arm (in opposition to the action of the deltoideus muscle) and rotation of the arm forward about the axis of the body. When the raised arms are fixed (as in mountain climbing), it assists the latissimus dorsi and teres major muscles in pulling the trunk up. The pectoralis minor lies, for the most part, beneath the pectoralis major, arising from the middle ribs and inserting into (attaching to) the scapula (shoulder blade). It aids in drawing the shoulder forward and downward (in opposition to the trapezius muscle).

For a depiction of the pectoralis muscles in human anatomy, shown in relation to other parts of the body, *see* the colour Trans-Vision in the PROPAEDIA: Part Four, Section 421.

pectus excavatum, a chest deformity caused by depression of the breastbone, or sternum. Pectus excavatum is generally not noticeable at birth but becomes more evident with age unless surgically corrected. In most instances the abnormality is due to a shortened central tendon of the diaphragm, the muscular partition between the chest and the abdominal cavity. It may also result from displacement of the heart to the left of mid-chest or from excessive pulling downward by the diaphragm. Corrective surgery is best performed in early childhood. The heart and lungs are most affected by pectus excavatum. The heart is displaced to the left, there is more pressure on the heart, and the respiratory movements of the lungs are impaired. The effects include breathlessness upon exertion, pain around the heart, and dizziness.

pedal harp, musical instrument in which pedals control a mechanism raising the pitch of given strings by a semitone (single action) or by both a semitone and a whole tone (double action). The modern double-action pedal harp, the standard orchestral harp, covers six and a half octaves (three below and three and a half above middle C). Along the neck, or harmonic curve, are two sets of rotating brass disks; concealed inside the forepillar and in the deep metal plates running along both sides of the neck is a mechanism operated by seven pedals, one for each group of strings of a given pitch name. Depression of the pedal to the first notch shortens the appropriate strings by a semitone, to the second notch, by a whole tone. The shortening is effected by the rotating disks, which grip the string at the proper point. The harp is normally tuned diatonically (to a seven-note octave) in C♭; depressing all pedals to the first notch puts it into C, to the second notch, into C♯. Playing the pedal harp demands skilled coordination between the hands, which pluck the strings with the fleshy part of the fingertips, and the feet, which, with the pedals, select the necessary pitch changes for the strings.

Pedal harps were developed in the 18th century in response to changing musical styles demanding a full chromatic (12-note) octave. In the 17th century, small hooks were placed on the harp neck near each string; when turned, a hook shortened the string by a semitone. Besides interrupting the harpist's playing, however, the hooks pulled the strings out of plane and sometimes out of tune. In 1720 Celestin Hochbrucker, a Bavarian, attached the hooks to a series of levers in the forepillar (which thenceforth became hollow), controlled by seven pedals.

In about 1750 the Parisian harp-maker Georges Cousineau replaced the hooks by metal plates that gripped the strings while leaving them in plane. Cousineau also expanded the chromatic capability of the harp by building instruments with 14 pedals; although unwieldy, the second seven raised the strings an additional semitone. In 1792 the Parisian maker Sébastien Érard substituted rotating disks for the metal plates. In 1810 he produced a double action by adding a second set of disks controlled by the same pedals, thus virtually establishing the modern harp capable of playing in all major and minor keys.

pedal point, also called PEDAL TONE, in music, a sustained note, ordinarily in the bass, over which changing harmonies are played. The name may derive from the low tones sustained by organ pedals, although a pedal point can occur in the middle voices or the soprano. Pedal points are usually important notes in a key (normally the tonic and dominant; in the key of C, the notes C and G). Fugue No. 2 in J.S. Bach's *The Well-Tempered Clavier,* Book I, ends with a pedal point on the tonic. In the sonata-allegro form used in symphonies and sonatas, pedal points on the dominant often appear in the retransition (the passage preceding the recapitulation of the principal themes in the tonic key). This persistent dominant tone leads the listener to anticipate the eventual return to the tonic. An example occurs in the first movement of Mozart's *Symphony No. 41 in C Major* (*Jupiter*).

Pedal points are special instances of the use of drone (*q.v.*) and are occasionally called bourdons. François Couperin and Jean-Philippe Rameau utilized them in a number of pieces for the harpsichord.

Pedersen, Charles J(ohn) (b. Oct. 3, 1904, Pusan, Korea—d. Oct. 26, 1989, Salem, N.J., U.S.), American chemist who, along with Jean-Marie Lehn and Donald J. Cram, was awarded the 1987 Nobel Prize for Chemistry for his synthesis of the crown ethers—a group of organic compounds that would selectively react with other atoms and molecules much as do the molecules in living organisms.

Born to a Norwegian father and a Korean mother, Pedersen went in the early 1920s to the United States to study chemical engineering at the University of Dayton in Ohio, where he took his bachelor's degree. He received a master's degree in organic chemistry at the Massachusetts Institute of Technology and in 1927 went to work for E.I. du Pont de Nemours & Co. as a research chemist. He worked there for the next 42 years.

In the 1960s Pedersen synthesized a group of compounds that he named crown ethers for their structure—a loose, flexible ring of carbon atoms punctuated at regular intervals with oxygen atoms. By varying the size of the rings, he found that crown ethers would bind the ions of certain metal elements at the centre of the "crown." His discoveries were expanded upon by Lehn and Cram, and the result was the laboratory synthesis of molecules that could selectively react with other molecules in much the same way that enzymes and other natural biological molecules do.

Pedersen, Christiern (b. *c.* 1480, Helsingør, Den.—d. Jan. 16, 1554, Helsingør), Danish humanist who was among the first to rediscover Denmark's national literary and historical heritage and to encourage the development of a vernacular style in Danish literature.

Pedersen studied at Greifswald and took orders in 1505. In 1508 he went to Paris and there produced the first edition (now lost) of Saxo Grammaticus' *Gesta Danorum,* under the title *Historia danica* (1514). He also edited Peder Laale's proverbs and published a Latin–Danish lexicon. Returning to Denmark, he supported the Reformation and became secretary to Christian II, following him into exile in 1525. In Holland he translated, from the Vulgate, part of the New Testament (1529) and the Psalms (1531) into Danish and also adapted some of Luther's tracts. In 1532 he set up as a printer at Malmö, publishing Danish versions of French romances and the legends of Charlemagne. He had a share in the Danish translation of the Bible published in 1550, which was based on Luther's translation and which marked an important stage in the development of Danish literature as well as in the progress of the Reformation.

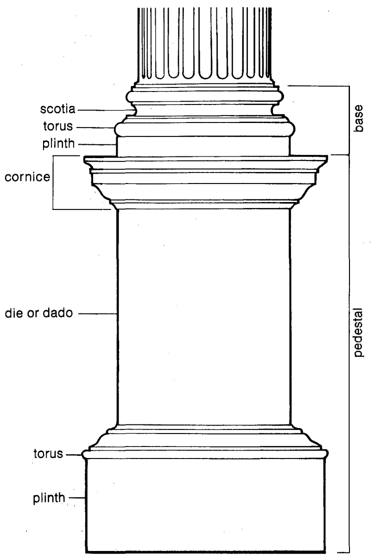
Pedersen, Holger (b. April 7, 1867, Gelballe, Den.—d. Oct. 25, 1953, Copenhagen), Danish linguist of exceptional accomplishment, especially in comparative Celtic grammar.

After receiving his doctorate in 1897, Pedersen proceeded, as professor at the University of Copenhagen, to enrich language science with an enormous number of books and articles of high originality. Trained in the exacting methodology of the Neogrammarian school of linguistics, he went far beyond its limits to become a participant in, or a critic of, most succeeding schools of linguistic thought, and he also anticipated some new trends. His Celtic researches appeared in many papers, in his monumental *Vergleichende Grammatik der keltischen Sprachen,* 2 vol. (1909–13; "Comparative Grammar of the Celtic Languages"), and in the *Concise Comparative Celtic Grammar* (1937), done in collaboration with H.

Holger Pedersen
By courtesy of Det Kongelige Bibliotek, Copenhagen

Lewis. About 30 books by Pedersen in Danish, English, French, and German offer authoritative treatments of Albanian, Armenian, Russian, and Indo-European dialects; Lithuanian, Hittite, Tocharian, Czech, and Turkish phonology; the relationship of Indo-European to the Semitic and Finno-Ugric languages; and the origin of runes. A work on the history of linguistic science was reissued under a new title, *The Discovery of Language,* in 1962.

pedestal, in Classical architecture, support or base for a column, statue, vase, or obelisk. Such a pedestal may be square, octagonal, or circular. The name is also given to the vertical members that divide the sections of a balustrade. A single pedestal may also support a group of columns, or colonnade. A pedestal is divided into three parts, from bottom to top: the plinth (or foot), the die (or dado), and the cornice (cap, cap mold, or surbase).



Corinthian pedestal
From John Fleming, Hugh Honour, Nikolaus Pevsner, *The Penguin Dictionary of Architecture,* copyright © John Fleming, Hugh Honour, Nikolaus Pevsner, 1966, 1972; Penguin Books Ltd.

The pedestal was first employed by the architects of ancient Rome to make a single column look more imposing; it was also featured in triumphal arches. In Renaissance Italy, architectural theorists decreed that the pedestal was an integral part of the order (*see* order) of the column and entablature and inseparable from it. At the same time, specific rules were established concerning the proportional height of pedestal to column: the higher the column is, the higher the pedestal must be.

pedestal rock: *see* perched rock.

Pedi, also called TRANSVAAL SOTHO, NORTHERN SOTHO, or BAPEDI, a Bantu-speaking people inhabiting the northeastern Transvaal, South Africa, and comprising the major group of the Northern Sotho ethnolinguistic cluster of peoples, who numbered about 2,370,000 in the late 20th century. Their territory, which is known as Bopedi, is located between the Olifants and Steelpoort rivers. Lebowa, a nonindependent Black State, is their officially designated "homeland," demarcated from the Bopedi area.

The ancestors of the Pedi are thought to have settled in the present region about 500 years ago after having migrated from Central Africa. After an initial period of peaceful settlement the Pedi empire arose, built on a number of military conflicts with neighbouring peoples. Pedi fortunes peaked during the rule of the king Thulare in the early 19th century, but the Pedi were subsequently defeated by the forces of Mzilikazi, the eventual founder of the Ndebele (Matabele) people. The Pedi recovered and successfully resisted Afrikaner encroachments on their territory in the 1850s, '60s, and '70s, but in 1879 the British completely crushed the Pedi. The British divided the Pedi country into two parts under different rulers in 1896, thus occasioning conflicts between rival Pedi leaders.

The Pedi area was designated for their exclusive settlement and use as part of the Natives' Land Act of 1913 and the Natives' Trust and Lands Act of 1936. Rainfall in the Pedi area is fairly low, but corn (maize), wheat, sorghum, millet, and beans are grown. A considerable variety of livestock is raised, including cattle, goats, sheep, fowl, and pigs. Pedi have been recruited to a great extent for labour elsewhere in the Republic of South Africa.

The basic Pedi social and living unit is the *kgoro,* which is a semicircular residential cluster of dwellings sheltering an extended family that is established around a group of related males but that may also include other people. The important son of a chief often establishes *kgoros.* The Pedi chief (*kgosi*) is the overall executive and judicial authority. In modern South Africa, however, the traditional chief must balance his traditional functions with the European-based legal system.

pediatrics, medical specialty dealing with the development and care of children and with the diagnosis and treatment of childhood diseases. The first important review of childhood illness, an anonymous European work called *The Children's Practice,* dates from the 12th century. The specialized focus of pediatrics did not begin to emerge in Europe until the 18th century. The first specialized children's hospitals, such as the London Foundling Hospital, established in 1745, were opened at this time. These hospitals later became major centres for training in pediatrics, which began to be taught as a separate discipline in medical schools by the middle of the 19th century.

The major focus of early pediatrics was the treatment of infectious diseases that affected children. Thomas Sydenham in Britain had led the way with the first accurate descriptions of measles, scarlet fever, and other diseases in the 17th century. Clinical studies of childhood diseases proliferated throughout the 18th and 19th centuries, culminating in one of the first modern textbooks of pediatrics, published by Frédéric Rilliet and Antoine Barthez in France in 1838–43, but there was little that could be done to cure these diseases until the end of the 19th century. As childhood diseases came under control through the combined efforts of pediatricians, immunologists, and public-health workers, the focus of pediatrics began to change, and early in the 20th century the first well-child clinics were established to monitor and study the normal growth and development of children. By the mid-20th century, the use of antibiotics and vaccines had all but eliminated most serious infectious diseases of childhood in the developed world, and infant and child mortality had fallen to the lowest levels ever. In the last half of the century, pediatrics again expanded its boundaries to incorporate the study of behavioral and social as well as specifically medical aspects of child health. *See also* childhood diseases and disorders.

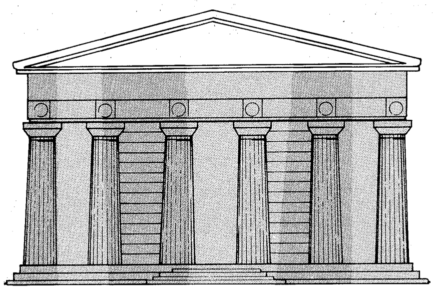
pedicab, three-wheeled vehicle with a hooded carriage body balanced on two of the wheels. The body may be placed in front or in back of the driver, who propels the vehicle by pedaling. Pedicabs are the successors to rickshas (*q.v.*) and have been widely used in East and Southeast Asia. The pedicab has been adapted for specialized uses; one example is a pedicab school bus.

Pedieos River, also spelled PEDIEAS, Greek PEDIAÍOS, Turkish PEDIYAS, river in central and eastern Cyprus. It rises in the Troödos range and flows in a northeasterly direction toward Nicosia, where it takes an easterly turn through the part of the central lowlands called the Mesaoria Plain toward Famagusta Bay. Although the longest (about 60 miles [100 km]) in Cyprus, the river is not navigable. Formerly emptying into the bay near the ancient city of Salamis, it now drains into irrigation reservoirs near Akhyritou and Kouklia, west of Famagusta.

pedigree, a record of ancestry or purity of breed. Studbooks (listings of pedigrees for horses, dogs, etc.) and herdbooks (records for cattle, swine, sheep, etc.) are maintained by governmental or private record associations or breed organizations in many countries.

In human genetics, pedigree diagrams are utilized to trace the inheritance of a specific trait, abnormality, or disease. A male is represented by a square or the symbol ♂, a female by a circle or the symbol ♀. Mating is shown by a horizontal line (marriage line) connecting a male symbol and a female symbol; offspring symbols are connected in a row (sibship line) beneath the mated pair. The offspring symbols appear from left to right in the order of birth and are connected to the marriage line by a vertical line. Possession of the character under study is shown by a solid or blackened symbol, and absence is shown by an open or clear symbol. Multiple births are designated by joining the individual symbols to the same point on the sibship line. Siblings not shown as individual symbols are indicated by a number within a large symbol for each sex.

pediment, in architecture, triangular gable crowning a portice (area, with a roof supported by columns, leading to the entrance of a building); or a similar form used decoratively over a doorway or window. The pediment



Pediment of a Greek temple

was the crowning feature of the Greek temple front. The triangular wall surface of the pediment, called the tympanum, rested on an entablature (a composite band of horizontal moldings) carried over the columns. The tympanum was often decorated with sculpture, as in the Parthenon (Athens, 447–432 BC), and was always crowned by a raking, or slanted, cornice.

The Romans adapted the pediment as a purely decorative form to finish doors, windows, and especially niches. Their pediments frequently appeared in a series consisting of alternating triangular and segmentally curved shapes, a motif revived by High Renaissance Italian designers; particularly fine examples are the window pediments of the piano nobile (floor above the ground floor) of the Palazzo Farnese (Rome, begun in 1517), built by Antonio da Sangallo the Younger.

Following a late Roman precedent, in which the line of the raking cornice is broken before it reaches the apex, the designers of the Baroque period developed many varieties of fantastic broken, scrolled, and reverse-curved pediments, an example of which can be seen on the Church of San Andrea al Quirinale (Rome, 1658–70) by Gian Lorenzo Bernini.

In some cases the designers even reversed the direction of the form so that the high points of a broken pediment faced toward the outside of the composition rather than toward the centre; and in the elaborate Churrigueresque, or late Renaissance, architecture of Spain, small sections of pediment were used as decorative motifs.

pediment, in geology, any relatively flat surface of bedrock (exposed or veneered with alluvial soil or gravel) that occurs at the base of a mountain or as a plain having no associated mountain. Pediments, sometimes mistaken for groups of merged alluvial fans, are most conspicuous in basin-and-range-type desert areas throughout the world.

The angle of a pediment's slope is generally from 0.5° to 7°. Its form is slightly concave, and it is typically found at the base of hills in arid regions where rainfall is spasmodic and intense for brief periods of time. There is frequently a sharp break of slope between the pediment and the steeper hillside above it. Water passes across the pediment by laminar sheet flow, but if this is disturbed, the flow becomes turbulent and gullies develop.

Though features characteristic of pediments attain their fullest development in arid regions, beveled bedrock surfaces also occur in humid areas. In the tropics, for example, the surfaces tend to be mantled with soils and obscured by vegetation. Many tropical towns sited on pediments (which offer easier building sites than the steep hillsides above or the river marshes below) show severe gullying where the water flow has been concentrated between walls and buildings.

Pediyas River (Cyprus): *see* Pedieos River.

Pedo, Albinovanus: *see* Albinovanus Pedo.

pedo- (combining form, "child"): *see under* paedo-, except as below.

pedodontics, also spelled PAEDODONTICS, dental specialty that deals with the care of children's teeth. The pedodontist is extensively concerned with prevention, which includes instruction in proper diet, use of fluoride, and practice of oral hygiene. The pedodontist's routine practice deals basically with caries (tooth decay) but includes influencing tooth alignment. Lengthy treatment may be required to correct incipient abnormalities in tooth position. Braces or other correctional devices may be used. The pedodontist needs patience and a basic knowledge of children's behavioral patterns, as well as a knowledge of the effects on the mouth of physical and mental diseases. In the United States a two-year postgraduate course leads to a certificate in pedodontics.

pedology, scientific discipline concerned with all aspects of soils, including their physical and chemical properties, the role of organisms in soil production and in relation to soil character, the description and mapping of soil units, and the origin and formation of soils. Accordingly, pedology embraces several subdisciplines, namely, soil chemistry, soil physics, and soil microbiology. Each employs a sophisticated array of methods and laboratory equipment not unlike that used in studies of the physics, chemistry, or microbiology of nonsoils systems. Sampling, description, and mapping of soils is considerably simpler, however. A soil auger is used to obtain core samples in places where no subsurface exposure can be found, and the soil units are defined, delineated, and mapped in a manner similar to procedures in stratigraphy. Such soils studies, in fact, overlap the concerns of the stratigrapher and the geologist, both of whom may treat the soils layers as strata of the Quaternary period (from 1.6 million years ago to the present).

pedophilia, also spelled PAEDOPHILIA, psychosexual disorder in which an adult's arousal and sexual gratification occur primarily through sexual contact with prepubescent children. The typical pedophile is unable to find satisfaction in an adult sexual relationship and may have low self-esteem, seeing sexual activity with a child as less threatening than that with an adult. Most pedophiles are men; the condition is extremely rare in women.

Frequently the sexual encounter stops short of intercourse, the pedophile obtaining sexual gratification through fondling the child and sometimes through genital display alone. Reactions of the child victim can range from fright, particularly if force or violence is involved, to bewilderment or passive enjoyment. Although some children seem more upset by previous parental warnings than by an actual encounter, the sexual encounter can often be quite traumatic to them, especially if there is associated violence. There is also evidence that children who have been sexually victimized are more likely to be troubled adults. Studies have determined that boys who were sexually abused are more likely to become adult sex offenders. Sexually abused girls more frequently respond by self-destructive behaviours such as substance abuse or prostitution.

Legally, pedophilia is considered in most Western nations to be one of the most serious of sexual offenses. In general, the younger the child and the greater the disparity in age between pedophile and victim, the more severe the penalty. Most severe penalties are usually reserved for pederasty, sexual contacts between adult males and young boys. More than half of those arrested for pedophilia are friends, relatives, or acquaintances of the child.

Pedrarias Dávila: *see* Arias Dávila, Pedro.

Pedrell, Felipe (b. Feb. 19, 1841, Tortosa, Spain—d. Aug. 19, 1922, Barcelona), Spanish composer and musical scholar who devoted his life to the development of a Spanish school of music founded on both national folk songs and Spanish masterpieces of the past.

When Pedrell was a choirboy, his imagination was first fired by contact with early Spanish church music. Largely self-taught, he composed several operas, mostly on national subjects. The first, *El último Abencerraje,* founded on a text by Chateaubriand, was produced in an Italian version in Barcelona in 1874. In 1891 he published his manifesto *Por nuestra música,* which attracted much attention; misunderstood as favouring Wagnerian reforms, it advocated a Spanish opera with musical roots in the Spanish folk song. He published an invaluable four-volume collection of folk songs, the *Cancionero musical popular español.* In the eight-volume *Hispaniae schola musica sacra,* Pedrell edited, for the first time, a vast quantity of early Spanish church, stage, and organ music, including the keyboard works of Antonio de Cabezón and the complete works of Tomás Luis de Victoria. At the same time, he was working on an operatic trilogy, the first part of which, *Los Pirineos* ("The Pyrenees"; to a Catalan libretto), was produced in an Italian version in 1902. The second part, *La Celestina,* though it contained some of his finest music, remained unperformed. As a composer, Pedrell was to a certain extent hampered by technical shortcomings. His influence on later Spanish composers, however, was incalculable, and his pupils included Manuel de Falla, Isaac Albéniz, and Enrique Granados. His editions of early Spanish music laid the foundations of Spanish musicology.

Pedro (Portuguese or Spanish personal name): *see under* Peter, except as below.

Pedro I (b. Oct. 12, 1798, Lisbon, Port.—d. Sept. 24, 1834, Lisbon), founder of the Brazilian empire and first emperor of Brazil, from Dec. 1, 1822, to April 7, 1831, also reckoned as King Pedro (Peter) IV of Portugal.

Generally known as Dom Pedro, he was the son of King John VI of Portugal. When Napoleon conquered Portugal in 1807, Pedro accompanied the royal family in its flight to Brazil. He remained there as regent when King John returned to Portugal in 1821.

Pedro surrounded himself with ministers who counseled independence. When the Portuguese Cortês (Parliament), preferring colonial status for Brazil, demanded that Pedro return to Lisbon to "complete his political education," he issued a declaration of Brazilian independence on Sept. 7, 1822. Within three months he was crowned emperor.

Pedro's initial popularity waned, and in 1823, when the Brazilian Assembly was preparing a liberal constitution, he dissolved that body and exiled the radical leader José Bonifácio de Andrada e Silva. On March 25, 1824, however, Pedro accepted another liberal constitution drafted by the Council of State.

Although adoption of that charter may have saved Pedro from deposition, it did not reestablish his popularity. His autocratic manner, his lack of enthusiasm for parliamentary government, and his continuing interest in Portuguese affairs antagonized his subjects, as did the failure of his military forces in a war with Argentina over what is now Uruguay. Strong opposition in the Brazilian Parliament and a series of local uprisings induced him to abdicate in 1831 in favour of his son Dom Pedro II, who was then five years old. Pedro I then returned to Portugal.

On the death of King John VI (March 10, 1826), Pedro I had become titular king of Portugal as Pedro IV. Two months later, still in Brazil, he issued a parliamentary charter for Portugal and conditionally abdicated the Portuguese throne in favour of his daughter Maria da Glória, the future Queen Maria II. He died in Portugal while attempting to secure his daughter's claim against that of his brother, the regent Miguel.

Pedro II, original name DOM PEDRO DE ALCÂNTARA (b. Dec. 2, 1825, Rio de Janeiro, Braz.—d. Dec. 5, 1891, Paris, Fr.), second and last emperor of Brazil (1831–89), whose benevolent and popular reign lasted nearly 50 years.

On April 7, 1831, when he was five years old, his father, Pedro I (Pedro, or Peter, IV of Portugal), abdicated in his favour; and for nine years Brazil was governed by a regency. Pedro was declared of age on July 23, 1840, and crowned emperor on July 18, 1841. Although the disturbances in the provinces that had plagued the regency continued for the next five years, the young emperor's intellectual curiosity and profound concern for his subjects soon became apparent. He considered himself the arbiter of Brazil's political life, and he used the power granted him by the constitution to regulate the antagonistic groups that sought to dominate the country. The first Brazilian monarch to be born in Brazil, Pedro guarded his country's sovereignty in disputes with Great Britain and the United States. He led Brazil into the War of the Triple Alliance against Paraguay (1864–70), gaining new territory and prestige for Brazil.

The rule of Pedro II, a calm, serious, and intelligent man, brought stability and progress to the troubled economy. He encouraged coffee production instead of sugar, and under his guidance Brazil made significant gains in railroad, telegraph, and cable construction. As a result of his leadership, he enjoyed almost unqualified support for 40 years.

During Pedro's 49-year reign, he presided over 36 different cabinets, most of which received and merited public support, as Pedro was generally served by excellent councillors and ministers. By astutely alternating support for the Liberal and Conservative parties, he ensured that both enjoyed a roughly equal amount of time in power, and he provided orderly, nonviolent transitions between them. Both parties, however, represented the landholding oligarchy, and, as a result, issues that affected other sectors of Brazilian society were often hedged.

Thus, despite Pedro's generally benign and progressive leadership, by the end of his reign his support had crumbled. The crucial issue was the abolition of slavery. Personally opposed to slavery (he had freed his own slaves in 1840), Pedro felt that abolition in the agriculturally based Brazilian economy would have to occur gradually so as not to upset the landowners. When complete emancipation was at last decreed (1888), 700,000 slaves were freed, and no provision was made for compensation to the owners. Pedro also had strained relations with the Roman Catholic church after 1872 because of his opposition to the anti-Masonic laws passed by the church. In addition, the emperor, who represented the colonial countryside and landed classes, found himself removed from increasingly powerful elements in society, particularly the emerging urban middle class and the military. These and other factors combined to bring about his downfall. On Nov. 15, 1889, a military coup forced him to abdicate. The royal family went into exile in Europe. His remains and those of his wife were returned to Brazil in 1920 and placed in a chapel in the city of Petropolis, named in his honour.

Pedro HISPANO: *see* John XXI *under* John (Papacy).

Pedro, Dom: *see* Coimbra, Pedro, 1º duque de.

Pedro Juan Caballero, town, eastern Paraguay, founded in 1899. It lies in the Amambay Mountains at 2,296 feet (700 m) above sea level, opposite Ponte Porã, Braz. Pedro Juan Caballero is the region's largest town and principal trade centre. The hinterland is utilized primarily for cattle ranching and coffee growing. In the town are a government delegation, a radio station, a commerce school, a teachers college, and a school maintained by North American priests. The town is accessible by highway from Concepción and by the Brazilian railroad that terminates in Ponte Porã. Pop. (1985 est.) 37,688.

Pedrolino, French PIERROT, stock character of the Italian commedia dell'arte, a simple-minded and honest servant, usually a young and personable valet. One of the comic servants, or *zanni,* Pedrolino functioned in the commedia as an unsuccessful lover and a victim of the pranks of his fellow comedians. His costume consisted of a white jacket with a neck ruff and large buttons down the front, loose trousers, and a hat with a wide, floppy brim. Unlike most of the other stock characters, he played without a mask, his face whitened with powder.

Pedrolino became tremendously popular in later French pantomimes as the naive and appealing Pierrot. For 20 years at the Théâtre des Funambules, the great French mime Jean-Gaspard Deburau (1796–1846) played Pierrot as the pathetic, white-robed lover eternally mooning over the beautiful Columbine. The clown hero of Ruggero Leoncavallo's opera *I pagliacci* (1892) was a later use of a Pierrot-like figure.

Pedrolino, detail from "Actors of the Comédie-Italienne," oil painting by Nicolas Lancret, 18th century; in the Louvre, Paris
Giraudon—Art Resource/EB Inc.

Pee Dee River, river rising as the Yadkin River in the Blue Ridge Mountains in northwestern North Carolina, U.S. Flowing northeast past Wilkesboro and Elkin, then southeast past Badin, it becomes the Pee Dee (named for the Pedee Indians) after a course of about 200 miles (320 km). As the Pee Dee, it continues for 230 miles (370 km), generally southeast into South Carolina, past Cheraw, being joined by the Little Pee Dee approximately 20 miles (32 km) before emptying into Winyah Bay near Georgetown. As the Yadkin, the river is dammed to form High Rock and Badin lakes (by the Uwharrie National Forest) and, as the Pee Dee, to form Tillery and Blewett Falls lakes. The lower Pee Dee is navigable for 90 miles (145 km).

Peebles, royal burgh (1367) and seat of the district of Tweeddale (*q.v.*), Borders region, Scotland, at the junction of Eddleston Water with the River Tweed. Peebles grew up under the shelter of the royal castle, which was a favourite residence of the Scottish kings when they hunted in nearby Ettrick Forest.

The modern town is an agricultural centre and has large mills producing tweed and knitwear. Portions of the town walls still exist. The old market cross still stands, but little survives of Crosskirk, erected in 1261 to contain a supposed relic of the True Cross. Pop. (1981) 6,692.

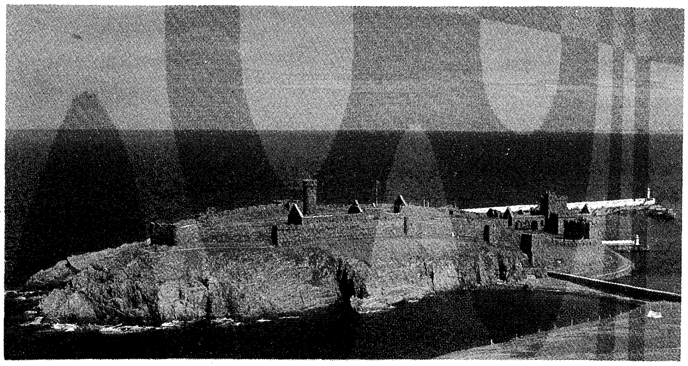
Peeblesshire, also called PEEBLES, or TWEEDDALE, former county and historic region of southeastern Scotland that formed a triangle between the counties of Midlothian (north and northeast), Selkirkshire (east and southeast), Dumfriesshire (south), and Lanarkshire (west). It had an area of 347 square miles (900 square km). Since the reorganization of 1975, it constitutes the district of Tweeddale (*q.v.*), of Borders region.

Occupation of Peeblesshire in the early Iron Age is indicated by the remains of numerous hill forts around the burgh of Peebles, and there are standing stones near the confluence of Lyne Water and the Tweed. The Romans left traces of their military rule in the camp at Lyne, locally known as Randal's Walls. In medieval times a series of peels (fortified towers) were erected; the best preserved is that of Neidpath Castle, a 15th-century stronghold of the Frasers just outside the royal burgh of Peebles.

The former county is closely associated with the legend of Merlin and has provided background and other material for Sir Walter Scott, James Hogg, and other writers.

Peekskill, city, Westchester county, southeastern New York, U.S., on the east bank of the Hudson River, 41 miles (66 km) north of New York City. Its name derives from Jan Peek, a Dutchman who established a trading post in 1654 at the point where a *kil* (Dutch for "creek") joins the Hudson. An early river port and agricultural-trade centre, it was attacked and burned by the British during the American Revolutionary War. Manufactures now include yeast, gin, electrical items, and stationery. Important emery mines are nearby. The city is also a tourist base for nearby Palisades recreational areas. Inc. village, 1839; city, 1940. Pop. (1988 est.) 19,528.

Peel, town on the west coast of the Isle of Man, one of the British Isles, on Peel Bay at the mouth of the River Neb, which forms the harbour. On the west side of the river mouth is Patrick's Isle, connected with the main island by a causeway; it is occupied by the ruined



Ruins of the castle at the entrance to Peel harbour, Isle of Man
Colour Library International

keep and guardroom of an ancient castle (the name Peel is Celtic for "fort"). Nearby are the remains of the cathedral of St. German. There are also ruins of the bishop's palace, palace of the lords of Man, and an ancient round tower. St. Patrick is said to have founded the first church on Man and a small chapel dedicated to him probably dates from the 8th or 10th century. Peel has a long-established fishing industry and is a seaside resort. Pop. (1981) 3,688.

Peel, Lady (entertainer): *see* Lillie, Beatrice.

Peel, Sir Robert, 2nd Baronet (b. Feb. 5, 1788, Bury, Lancashire, Eng.—d. July 2, 1850, London), British prime minister (1834–35, 1841–46) and founder of the Conservative Party, who was responsible for the repeal (1846) of the Corn Laws that had restricted imports.

Peel, detail of an oil painting by John Linnell, 1838; in the National Portrait Gallery, London
By courtesy of the National Portrait Gallery, London

Early political career. He was the eldest son of a wealthy cotton manufacturer, Robert Peel (1750–1830), who was made a baronet by William Pitt the Younger. The younger Robert was educated at Harrow and at Oxford, and, with his father's money, a parliamentary seat was found for him as soon as he came of age, in 1809.

As an able young government supporter, Peel received appointment as undersecretary for war and colonies in 1810. Two years later he accepted the difficult post of chief secretary for Ireland. There he made his reputation as an able and incorruptible administrator and at the end of his Irish secretaryship was marked out for early promotion. He had also distinguished himself as the ablest of the "Protestant" party that resisted the admittance of Roman Catholics to Parliament, and in 1817 he gained the coveted honour of election as member of Parliament for Oxford University. Though declining immediate office after his return from Ireland, he was made chairman, in 1819, of the important currency commission that brought about a return to the gold standard.

In the 1822 ministerial reconstruction pursued by Robert Banks Jenkinson, 2nd earl of Liverpool, Peel accepted the post of secretary of state for the home department and a seat in the Cabinet. His first task was to meet the long-standing demands in Parliament for a radical reform of the criminal laws. He then proceeded to a comprehensive reorganization of the criminal code. Between 1825 and 1830 he effected its fundamental consolidation and reform, covering three-quarters of all criminal offenses. Rising crime statistics convinced him that legal reform should be accompanied by improved methods of crime prevention. In 1829 he carried through the Metropolitan Police Act, which set up the first disciplined police force for the Greater London area. As a result of Peel's efforts, the London police force became known as Bobby's boys and later simply bobbies.

When George Canning succeeded Liverpool as prime minister in 1827, Peel resigned on the issue of Roman Catholic emancipation. He returned to office under Arthur Wellesley, 1st duke of Wellington, early in 1828 as home secretary and leader of the House of Commons. Differences with Wellington led to the resignation of several followers of Canning after only four months in office, thus considerably weakening the government. This was followed by the Catholic crisis of 1828–29 that grew out of the renewal of the Irish movement for emancipation in 1823 with the formation of the Catholic Association. Its growing strength culminated in the victory of Daniel O'Connell, the Irish "Liberator," at a by-election for County Clare in 1828. Convinced that further resistance was useless, Peel proffered his resignation and urged the Prime Minister to make a final settlement of the Catholic question. Faced with severe opposition from the King and the Anglican Church, Wellington persuaded Peel, in 1829, to remain in office and assist in carrying through the policy of concession to the Catholics on which they now both agreed. Peel was bitterly attacked for his sudden change of heart and lost his seat for Oxford. Wellington's declaration against parliamentary reform in November 1830 finally brought about the fall of his weak and unpopular government.

Prime minister and Conservative leader. In the reform crisis following Wellington's fall, Peel's position was difficult and ambiguous. Though not opposed to moderate parliamentary reform, he was shocked by the sweeping measure introduced by the ministry of Charles Grey, 2nd Earl Grey, in March 1831. But, on the other hand, he made no effort to conciliate the ultra-Tories, and his refusal to form a new ministry with Wellington and pass a Tory reform bill in 1832 further weakened his standing with his former followers. Yet he was already looking to the growth of conservative opinion in the country, and his moderation in the first reformed Parliament (1833–34) did much to restore his political stature. The premature dismissal of the ministry of William Lamb, 2nd Viscount Melbourne, in November 1834 and Peel's appointment as prime minister gave him an impossible task because he did not possess, and the Conservative Party lacked the organization and men necessary to procure, a majority in the House of Commons (even though the general election of 1835 added considerably to their numbers). Nevertheless, his Tamworth Manifesto was an epoch-making statement of the new Conservative reform principles, and for the first time the party came under his acknowledged leadership. In April 1835, defeated by a combination of Whigs, radicals, and Irish nationalists, he resigned his office. During the next six years, aided by his astute and cautious tactics, the Conservative Party steadily increased in numbers and confidence. Following the general election of 1841, in which he gained a majority of more than 70 in the House of Commons, Peel formed an administration that was one of the most memorable of the century.

Peel was faced with war in China and Afghanistan, strained relations with France and the United States, severe commercial distress at home, agitation by the workingmen's reform movement of the Chartists and the Anti-Corn Law League, O'Connell's campaign for the repeal of the union of Ireland and Great Britain, and a five-year accumulation of budgetary deficits. His policy aimed at peace and security abroad, a reduction in the cost of living for the working classes, and encouragement to trade and industry. On the controversial issue of the Corn Laws, to which the landed interest in his party was very sensitive, he brought forward as one of his first measures a new bill drastically reducing the scale of protective duties. In the same year, the bold reintroduction of the income tax (originally instituted during the Napoleonic Wars) established the internal revenue on a sound footing and enabled him to make sweeping reductions of duties on food and raw materials entering the country. The Bank Charter Act of 1844, establishing a tight connection between note issue and gold reserves, completed the foundations of the Victorian banking and currency system. The success of these measures encouraged Peel to launch a second great free-trade budget in 1845. The income tax was renewed, and there was another even more massive round of tariff reductions.

With the return of prosperity, Chartism died down and the Anti-Corn Law League turned to more constitutional methods of agitation. Abroad, a firm but conciliatory policy led to better relations with France. The boundary disputes with the United States were settled by the mission of Alexander Baring, 1st Baron Ashburton, in 1842 and the Oregon treaty of 1846. The same combination of firmness and conciliation was followed in Ireland. Once the threatening campaign for repeal of the union was brought to a halt in 1843 with O'Connell's trial for conspiracy, Peel turned to more constructive measures. A commission was set up to inquire into the relations between landlord and tenant, and a wide scheme for Irish university education was passed into law in 1845.

The liberality of Peel's Irish policy, especially the greatly increased grant to the Catholic seminary of Maynooth, aroused strong Protestant feeling in England, severely straining relations with his own party. The potato disease in 1845, bringing with it the certainty of widespread famine in Ireland, completed the breach. Peel had already come to the conviction that the Corn Laws would have to be abolished sooner or later. His decision in the autumn of 1845 that a relief program for Ireland must be accompanied by the repeal of the Corn Laws split his Cabinet and led to his resignation. But, when Lord John Russell failed to form a free-trade ministry in December 1845, Peel returned to office. After savage parliamentary debates the repeal of the Corn Laws was finally carried through in June 1846. Peel believed that the attempt to preserve the Corn Laws in the changed social and political conditions of Britain would imperil the rule of the aristocracy. Nevertheless, a majority of his party voted against him, and a smaller number joined the opposition to bring about his defeat and resignation later the same month. For the rest of his career he dedicated himself to the support of free-trade principles and the maintenance of Russell's Whig ministry as the only safeguard against a protectionist government. He died in 1850 as a result of a riding accident.

Assessment. A proud, shy person, Peel was by nature quick-tempered, courageous, stubborn, and often autocratic. With a first-class intellect, an exact memory, and great capacity for work, he was a superb administrator and an outstanding parliamentary debater. Though he has an unchallenged place as founder of the modern Conservative Party, his political outlook was formed in the pre-reform era. He regarded ministers of the crown as servants of the state rather than as mouthpieces for sectional or party views. By insisting on fundamental changes in the national interest, he did much to preserve the continuity of aristocratic parliamentary government in an age of rapid industrial change, social distress, and class conflict. More than any other, he was the architect of the mid-Victorian age of stability and prosperity that he did not live to see.

(N.G.)

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Peel Commission, in full, ROYAL COMMISSION OF INQUIRY TO PALESTINE, group headed by Lord Robert Peel, appointed in 1936 by the British government to investigate the causes of unrest among Palestinian Arabs and Jews.

Discontent in Palestine dated back to 1920 when the British government was given a mandate to control Palestine; this mandate, intended to implement the Balfour Declaration of 1917, provided for both the establishment of a Jewish national home in Palestine and the preservation of the rights of non-Jewish Palestinian communities. Palestinian Arabs, desiring political autonomy and resenting the continued Jewish immigration into Palestine, disapproved the mandate, and by 1936 their dissatisfaction grew into open rebellion.

The Peel Commission published its report in July 1937. The report admitted that the mandate was unworkable because Jewish and Arab objectives in Palestine were incompatible, and it proposed that Palestine be partitioned into three zones: an Arab state, a Jewish state, and a neutral territory containing the Holy Places. Although the British government initially accepted these proposals, by 1938 it recognized that such partitioning would be infeasible and ultimately rejected the commission's report.

Peel River, river in northern Yukon Territory and northwestern Mackenzie District of the Northwest Territories, Canada, the northernmost tributary of the Mackenzie River. From its major headstream, the Ogilvie River, in the mountains of central Yukon Territory, the river flows generally northeastward for 425 mi (684 km) to join the Mackenzie near Fort McPherson, a fur-trading post and the only significant riverine settlement at the northern end of the Peel River Game Reserve. Its upper course through Peel Plateau is characterized by canyons as deep as 1,000 ft (300 m); its lower valley, much of which consists of nature preserve and game sanctuary, is wide, with braided channels, gravel bars, and small wooded islands. The river was named for Sir Robert Peel, the British statesman.

Peele, George (b. 1556, London—d. 1596), British dramatist, who experimented in many forms of theatrical art: pastoral, history, melodrama, tragedy, folk play, and pageant.

Peele began his varied literary career while at Oxford by translating into English a play of Euripides. In 1581 he moved to London but returned to Oxford in 1583 as a technical director for Christ Church's presentation of two spectacular plays by William Gager.

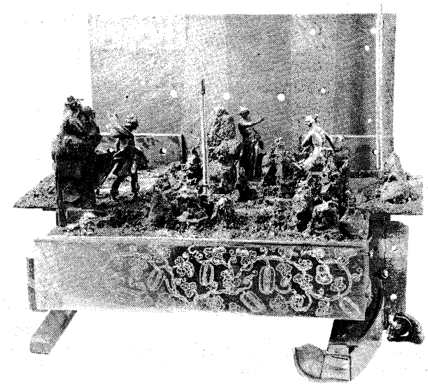
About this time Peele had joined a group of Oxonians living just outside the London city wall and had begun to experiment with poetry in various metres. From this association with the so-called university wits came two mythological pastoral plays: *The Arraignment of Paris* (1584) and *The Hunting of Cupid* (1591). He then produced a series of pageants for the city.

The Arraignment of Paris was produced for the courtiers, but the rest of Peele's life was devoted to writing for the popular stage. Of the many playhouse dramas he must have had a hand in, only four can be certainly ascribed to him: *The Battle of Alcazar* (1594), *The Old Wives' Tale* (1595), *Edward I* (1593), and *The Love of King David and Fair Bethsabe* (1599). In addition, Peele turned out commemorative poems to supplement a meagre income.

Peenemünde, village, Mecklenburg-West Pomerania *Land* (state), northeastern Germany, at the northwestern end of Usedom Island in the estuarine mouth of the Peene River on the Baltic Sea coast. It was mentioned as a fishing village in 1282. During World War II it was the site of the chief German research and testing facility for rockets and missiles (the so-called V-weapons), which were eventually used against England during the Blitz. Although the site was known to the Allies, it was not bombed until August 1943 by the Royal Air Force. It was captured by Soviet troops in April 1945. Pop. (1981 est.) 600.

peep, also called STINT, any of about a dozen species of small sandpipers. Some are also called oxbirds or oxeyes. *See* sandpiper.

peep show, children's toy and scientific curiosity, usually consisting of a box with an eyehole, through which the viewer sees a miniature scene or stage setting, painted or constructed in perspective. Peep shows of an earlier time are often the only accurate representation of the stage design and scenery of the period.



Model of a peep show representing the discovery of Diana by Actaeon, by Christoph Margraf, 1596; in the Kunsthistorisches Museum, Vienna
By courtesy of the Kunsthistorisches Museum, Vienna

The earliest known peep shows are the perspective views said to have been painted in transparent colours on glass and lighted from behind for various effects, from sunshine to moonlight, by Leon Battista Alberti in 1437. Later models (some preserved in the Kunsthistorisches Museum in Vienna) have designs that are apparently patterned on Renaissance court masques and pageants, such as that of the discovery of Diana by Actaeon, with fully modelled figures set against a background painted in careful perspective.

In the 17th century, peep shows in their cabinets were often exhibited in the streets by itinerant showmen, and the device became a popular children's toy. Some, equipped with movable scenery and wooden or cardboard figures, developed into the juvenile theatres of the 19th century (*see* toy theatre). The peep show was also the precursor of many types of optical toys, including the stereoscope and the magic lantern.

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

peeping tom, person who derives sexual satisfaction from watching from hiding places as others disrobe or engage in sexual acts. The term derives from the legendary Peeping Tom, a prying tailor who was struck blind (in some accounts, struck dead) for opening his window and watching Lady Godiva as she rode naked through Coventry to demonstrate against heavy taxes on the town. Though Godiva's ride supposedly took place in the 11th century and was recorded as early as the 13th, the legend of Peeping Tom was not added to the story until about the 17th century. *See also* voyeurism.

peewee (bird): *see* pewee.

Pegasus, in Greek mythology, a winged horse that sprang from the blood of the Gorgon Medusa as she was beheaded by the hero Perseus (*q.v.*). With Athena's (or Poseidon's) help, another Greek hero, Bellerophon, captured Pegasus and rode him first in his fight with the Chimera (*q.v.*) and later while he was taking vengeance on Stheneboea (Anteia), who had falsely accused Bellerophon. Subsequently Bellerophon attempted to fly with Pegasus to heaven but was unseated and killed, the winged horse becoming a constellation and the servant of Zeus. Pegasus' story became a favourite theme in Greek art and literature, and in late antiquity Pegasus' soaring flight was interpreted as an allegory of the soul's immortality; in modern times it has been regarded as a symbol of poetic inspiration.

Pegasus, any of a series of three U.S. scientific satellites launched in 1965. These spacecraft were named for the winged horse in Greek mythology because of their prominent winglike structure. This "wing," which spanned 96 feet (29 metres), was specially designed to record the depth and frequency with which it was pierced by micrometeoroids. The information was used to design the outer shell of the manned Apollo spacecraft to prevent penetration of such high-speed particles of space dust. The data also enabled engineers to develop space suits that would shield astronauts from micrometeoroids when working outside their craft. The Pegasus ranks among the largest U.S. spacecraft ever built, with its center section extending 71 ft (21.6 m) in length.

Peggy Guggenheim Collection (Venice): *see* Guggenheim Collection.

Pegler, (James) Westbrook (b. Aug. 2, 1894, Minneapolis, Minn., U.S.—d. June 24, 1969, Tucson, Ariz.), U.S. conservative columnist whose continual crusades, combined with an acerbic, original style, attracted nationwide attention. In the column "As Pegler Sees It," introduced by William Randolph Hearst's King Features Syndicate in 1944, Pegler attacked the Supreme Court, the Newspaper Guild, the wealthy, the U.S. tax system, unions, and many national figures, among others. In 1954 Pegler was sued by the subject of one such attack, the author Quentin Reynolds, in a famous libel trial. Reynolds won $200,000 in punitive damages, then a record award in such a trial. In an effort to rein in the free-swinging columnist, the Syndicate began to edit his material, and he discontinued the column in 1962.

Pegler was the son of a star reporter from Minneapolis and Chicago, and he was still attending a Chicago high school when he started working for United Press (UP). Six years later, in 1916, after holding jobs in UP bureaus in Des Moines, St. Louis, and Dallas, Pegler was assigned to the agency's London bureau. After serving in the U.S. Navy in 1918 and 1919, he wrote and edited sports material for United News (1919–25) and the *Chicago Tribune* (1925–33). Beginning in 1933, he wrote a syndicated column, "Fair Enough," for the *New York World-Telegram.* In 1941 he received a Pulitzer Prize for exposing labour racketeering.

pegmatite, almost any wholly crystalline igneous or metamorphic rock that is at least in part very coarse grained, the major constituents of which include minerals typically found in ordinary igneous rocks and in which extreme textural variations, especially in grain size, are characteristic. Giant crystals, with dimensions measured in metres, occur in some pegmatites, but the average grain size of all such rocks is only 8 to 10 cm (3 to 4 inches).

Most bodies of pegmatite are tabular, podlike (cigar-shaped), or irregular in form and range in size from single crystals of feldspar to dikes (tabular bodies injected in fissures) many tens of metres thick and more than a kilometre long; many are intimately associated with masses of fine-grained aplite. Pegmatites occur in all parts of the world and are most abundant in rocks of relatively great geologic age. Some are segregations within much larger bodies of intrusive igneous rocks, others are distributed in the rocks that surround such bodies, and still others are not recognizably associated with igneous rocks.

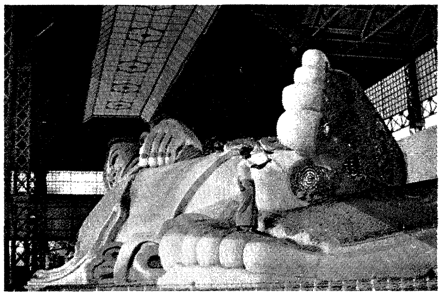
Granitic and syenitic pegmatite deposits are the chief source of commercial feldspar, sheet mica, and beryllium, tantalum–niobium, and lithium minerals. They also yield significant quantities of gem minerals, mica, molybdenite, cassiterite, tungsten minerals, rare-earth minerals, and certain types of kaolin, either directly or as the sources of placer deposits. Economic lode concentrations generally occur in zoned pegmatite bodies (*i.e.,* those within which two or more different rock types are systematically disposed).

Pegmatites are little different from the common igneous rocks in major elements of bulk composition, and they range from acid to basic (silica-rich to silica-poor); granitic and syenitic types are most abundant. Quartz and alkali feldspars are the essential constituents; the most common varietal and accessory minerals are muscovite, biotite, apatite, garnet, and tourmaline. Many granitic pegmatites contain unusual concentrations of the less-abundant elements. Ore minerals, chiefly sulfides and oxides, are widespread in pegmatites but rarely are abundant.

Pegolotti, Francesco Balducci (fl. 1315–40, Florence [Italy]), Florentine mercantile agent best known as the author of the *Pratica della mercatura* ("Practice of Marketing"), which provides an excellent picture of trade and travel in his day.

Pegolotti was a commercial agent in the service of the mercantile house of the wealthy and powerful Bardi family of Florence, and he visited Antwerp, Brabant (now in Belgium), in about 1315–17, London in 1317, and Cyprus in 1324–27. He again visited Cyprus in 1335, obtaining trading privileges for the Florentines from Little Armenia (now in Turkey). Compiled between 1335 and 1343, the *Pratica* begins with a kind of glossary of foreign terms then in use for all kinds of taxes or payments on merchandise as well as entries for "every kind of place where goods might be bought or sold in cities." The work next describes some of the chief trade routes of the 14th century and many of the principal markets then known to Italian merchants; the imports, exports, and business customs of important commercial regions; and the comparative value of the leading moneys, weights, and measures. There is one manuscript of the *Pratica* in the Riccardian Library, Florence. The most interesting sections of the work appeared in English translation in Sir Henry Yule's *Cathay and the Way Thither* (vol. 2, 1866).

Pegu, Burmese BAGO, port city, southern Myanmar (Burma), on the Pegu River, 47 miles (76 km) northeast of Yangon (Rangoon).



Reclining Buddha, Pegu, Myanmar (Burma)
Slim Aarons—Photo Researchers/EB Inc.

Pegu was the capital of the Mon kingdom and is surrounded by the ruins of its old wall and moat, which formed a square, with 1.5-mile (2.4-kilometre) sides. On the Yangon–Mandalay railway, it is the start of a branch line southeast along the Gulf of Martaban, an inlet of the Bay of Bengal, and has extensive road links in all directions. Pegu is a major rice- and timber-collecting centre and has numerous rice mills and sawmills.

Of its many pagodas, the ancient Shwemawdaw ("Golden Shrine"), 288 feet (88 m) high, is the most venerable. Said to contain two hairs of Gautama Buddha, it is of Mon origin and was severely damaged by an earthquake in 1930, but restoration was completed in 1954. The Shwethalyaung, a colossal reclining statue of Buddha (181 feet [55 m] long), is to the west of the modern town and is reputedly one of the most lifelike of all the reclining Buddha figures; allegedly built in 994, it was lost when Pegu was destroyed in 1757 but was rediscovered under a cover of jungle growth in 1881. From the nearby Kalyani Sima ("Hall of Ordination"), founded by the Mon king Dhammazedi (1472–92), spread one of the greatest reform movements in Myanmar Buddhist history. Its story is related in 10 stone inscriptions erected by the king close to the Sima. The Mahazedi, Shwegugale, and Kyaikpien are other notable pagodas.

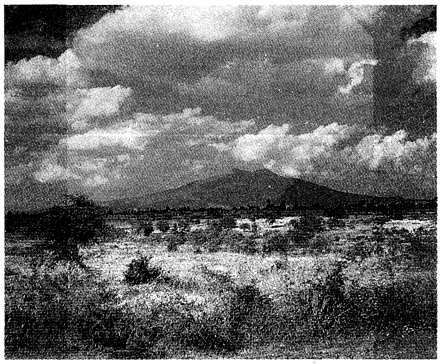
Pegu city is said to have been founded in 573 by Mon emigrants from Thaton to the southeast, but the most likely date of its foundation as the capital of a Mon kingdom is 825. The earliest record of the kingdom shortly before 850 was by the Arab geographer Ibn Khurradādhbih, who called it Ramaññadesa (the Rmen, or Mon, land). In 1057, when the Burman king Anawrahta of Pagan conquered the kingdom, he depopulated it by transporting 30,000 Mon to Pagan. Pegu was little heard of until Pagan fell to the Mongols in 1287. When the Mons recovered their independence, Pegu became the capital of their new kingdom in 1369. It functioned as a port, easily accessible from all parts of the alluvial plain. It was also a centre of Buddhist culture.

When in 1539 the Mon kingdom fell to the Burman Toungoo dynasty, Pegu was made the capital of a united kingdom until 1599 and again from 1613 to 1634. It was used in the 16th century as a base for the invasion of Siam. Many Europeans visited it, including the Venetian trader Cesare Federici (1569) and the English merchant Ralph Fitch (1587–88), whose description detailed its magnificence.

After the Burmans moved their capital to Ava in 1635, Pegu became a provincial capital, but a Mon revolt in 1740 restored it as the capital of their short-lived kingdom. When in 1757 the Burman king Alaungpaya invaded the Mon land, wiping out the last vestiges of independence, he destroyed Pegu but left the religious buildings intact. The British annexed the Pegu area in 1852, and in 1862, when the province of British Burma was created, the capital was moved from Pegu to Rangoon. Because of Alaungpaya's wars and the flight of the Mon people, the area was again virtually depopulated. The British later developed that area into the main rice-growing and exporting region of Burma.

Pegu is located between the forested Pegu Mountains (west) and the Sittang River (east). The area has a major irrigation scheme; rice is practically the only crop and is exported through Yangon. The Pegu Sittang Canal, which crosses the area, is navigable for nearly 40 miles (nearly 65 km) with locks. Pop. (1983) 150,447.

Pegu Mountains, Burmese BAGO YOMA, mountain range of south-central Myanmar (Burma), extending 270 miles (435 km) north–south between the Irrawaddy and Sittang rivers and ending in a ridge at Yangon (Rangoon). The range averages about 2,000 feet (600 m) in elevation, reaching its highest point in the north at Popa Hill (4,984 feet [1,519 m]), an extinct volcano. Teak and other tropical hardwoods are extracted in the eastern Pegu Mountains. Ethnic minorities (hill tribes) practice shifting cultivation in these mountains, growing upland rice, corn (maize), and millet. During the 1960s the Pegu Mountains were a refuge for communist insurgents.



Popa Hill, in the Pegu Mountains, Myanmar
Joe Cummings

Péguy, Charles (b. Jan. 7, 1873, Orléans, Fr.—d. Sept. 5, 1914, near Valleroy), French poet and philosopher who combined Christianity, socialism, and patriotism into a deeply personal faith that he carried into action.

Péguy was born to poverty. His mother, widowed when he was an infant, mended chairs for a living. He attended the *lycée* at Orléans on a scholarship and in 1894 entered the

École Normale Supérieure in Paris, intending to teach philosophy. In 1895 he turned to socialism, convinced it was the sole means by which poverty and destitution in the modern world could be overcome. He also abandoned the conventional practice of Roman Catholicism, though he retained to the end of his life a fervent religious faith. At this time he wrote his first version of *Jeanne d'Arc* (1897), a dramatic trilogy that formed a declaration and affirmation of his religious and socialist principles. Péguy was then caught up in the Dreyfus affair; he threw himself unreservedly into the battle to establish Dreyfus' innocence and helped to bring many of his fellow socialists onto the same side.

Besides running a bookstore that was a centre of pro-Dreyfus agitation, Péguy in 1900 began publishing the influential journal *Cahiers de la Quinzaine* ("Fortnightly Notebooks"), which, though never reaching a wide public, exercised a profound influence on French intellectual life for the next 15 years. Many leading French writers, including Anatole France, Henri Bergson, Jean Jaurès, and Romain Rolland, contributed work to it.

Péguy published several collections of his essays in the years before World War I, but the most important works of his maturity are his poems. Chief among them is *Le Mystère de la charité de Jeanne d'Arc* (1910), a mystical meditation that enlarges upon some of the scenes in the *Jeanne d'Arc* of 1897; *Mystère des Saints Innocents* (1912); and the culmination of the meditative and devotional outpouring of his final years, *Eve* (1913), a statuesque poem of 4,000 alexandrines in which Péguy views the human condition in the perspective of the Christian revelation.

When World War I broke out, he went to the front as a lieutenant, dying in the first Battle of the Marne. More information can be found in Y. Servais's *Charles Péguy: the Pursuit of Salvation* (1953) and Marjorie Villiers's *Charles Péguy, A Study in Integrity* (1965).

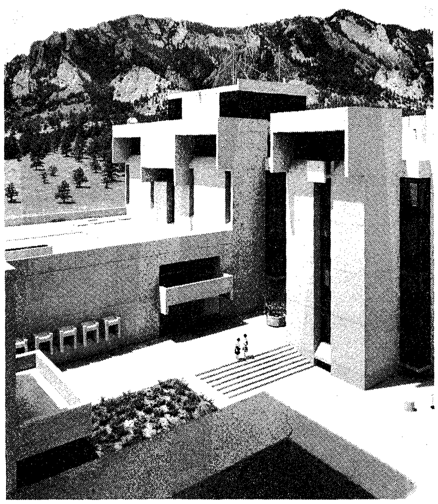
Pehlevi alphabet: *see* Pahlavi alphabet.

Pehowa, city, north-central Haryāna state, northwestern India. It lies along the Saraswati River. It is an important pilgrimage centre housing the Pirthudakeshwar (Pirthuveshwar) temples built by the Marāṭhās in honour of the goddess Sarasvatī. The name is derived from the Sanskrit name Pṛthūdaka ("Pool of Pṛthu"; the son of the legendary Raja Vena). Excavations have revealed inscriptions dating to the 9th century AD. Pop. (1981) 17,279.

Pei, I(eoh) M(ing) (b. April 26, 1917, Canton), Chinese-born American architect noted for his large but elegantly designed urban buildings and complexes.

Pei went to the United States in 1935, enrolling initially at the University of Pennsylvania, Philadelphia, and then transferring to the Massachusetts Institute of Technology, Cambridge, as a student of architectural engineering. He graduated in 1939 and, unable to return to China because of the outbreak of World War II, carried out various architectural contracts in Boston, New York City, and Los Angeles. During World War II he worked with a unit of the National Defense Research Committee. From 1945 to 1948 he was an assistant professor at the Graduate School of Design of Harvard University.

In 1948 Pei joined the firm of Webb & Knapp, New York City, as director of the architectural division. Working closely with the real estate developer William Zeckendorf, head of the firm, Pei created such urban projects as the Mile High Center in Denver, Colo. (1955), the Hyde Park Redevelopment in Chicago (1959), and the Place Ville-Marie in Montreal (1965).



National Center for Atmospheric Research by I.M. Pei, completed 1967, Boulder, Colo.
© Ezra Stoller (ESTO)

Pei formed his own architectural firm, I.M. Pei & Associates (later I.M. Pei and Partners), in 1955. Among the notable early designs of the firm were the Luce Memorial Chapel, Taiwan; the National Center for Atmospheric Research, Boulder, Colo., which, located near mountains, mimicked the broken silhouettes of the surrounding peaks; and the Everson Museum of Art, Syracuse, N.Y., which was actually four buildings joined by bridges. For the Federal Aviation Agency, Pei designed a type of pentagonal control tower that was installed in many American airports.

On the basis of a 1960 design competition Pei was selected to design the multiairline terminal at John F. Kennedy International Airport, New York City. In 1964 he was also selected to design the John F. Kennedy Memorial Library at Harvard University. Pei's innovative East Building of the National Gallery of Art, Washington, D.C. (1978), is an elegant triangular composition that was hailed as one of his finest achievements. In addition to designing public buildings, Pei was active in urban renewal planning. He was chosen to design the New York City Convention Center, the Gateway office complex in Singapore, and the Dallas Symphony Hall. Other works include the John Hancock Tower in Boston (1973), Indiana University Museum (1979), the west wing of the Boston Museum of Fine Arts (1980), Nestlé Corporate Headquarters (1981), El Paso Tower (1981), the Beijing Fragrant Hill Hotel (1982), and a controversial glass pyramid for one of the courtyards in the Louvre Museum in Paris.

In general, Pei's designs represent an extension of and elaboration on the rectangular forms and irregular silhouettes of the prevailing International Style. He is notable, however, for his bold and skillful arrangements of groups of geometric shapes and for his dramatic use of richly contrasted materials, spaces, and surfaces.

Pei, Mario (Andrew) (b. Feb. 16, 1901, Rome—d. March 2, 1978, Glen Ridge, N.J., U.S.), Italian-born American linguist whose many works helped to provide the general public with a popular understanding of linguistics and philology.

Pei immigrated to the United States with his parents when he was seven years old. By the time he was out of high school he knew not only English and his native Italian but also Latin, Greek, and French. Over the years he became fluent in five languages, capable of speaking some 30 others, and acquainted with the structure of at least 100 of the world's 3,000 spoken languages.

As a graduate student at Columbia University, New York City, he learned such early languages as Sanskrit, Old Church Slavonic, and Old French. He joined the Columbia faculty in 1937 and from 1952 to 1970 was professor of Romance philology. Besides compiling the companion popular sellers *The Story of Language* (1949) and *The Story of English* (1952; revised 1967 as *The Story of the English Language*), he published a large number of both technical and popular works, including *A Dictionary of Linguistics* (edited with Frank Gaynor, 1954), *Languages for War and Peace* (1943), a guide to seven key world tongues and 30 minor languages, and *Weasel Words: Saying What You Don't Mean* (1978).

Pei River, Wade–Giles romanization PEI CHIANG, Pei also spelled PAI, or PEH, Pinyin BEI JIANG, English NORTH RIVER, river in central Kwangtung Province, southeastern China. It is formed by the union of two smaller rivers, the Wu and the Chen, at Shao-kuan, in northern Kwangtung Province. The Pei River flows about 220 miles (350 km) south to join the Hsi (West) River, west of Canton. For centuries the Pei has played an important role in the transport system between North and South China.

Pei-hai, Pinyin BEIHAI, also called PAK-HOI, city and port in the Chuang Autonomous Region of Kwangsi, China. The city was in Kwangtung Province until 1965, when it became part of Kwangsi. It is on the shore of a small peninsula on the eastern side of Ch'inchou Bay on the Gulf of Tonkin, immediately south of the delta of the Nan-liu River, about 12½ miles (20 km) south of Ho-p'u.

Pei-hai was opened to foreign trade in 1876. Despite its poor harbour, badly exposed to northerly winds and impeded by sandbanks, Pei-hai became a moderately important port and the principal outlet for the trade of southern and western Kwangsi. Later the opening to trade of Wu-chou on the Hsi River and of Meng-tzu on the Red River in Yunnan Province robbed Pei-hai of much of its importance, and it became no more than a minor port, much of its foreign trade being in the hands of French trading companies. Pei-hai enjoyed a revival after 1937, when the Sino-Japanese War (1937–45) began, but in 1940 it was itself occupied by the Japanese.

Since 1949 Pei-hai has flourished as one of the most important fishing ports of southern China. Although much of the fishing fleet was destroyed during World War II, after 1945 the fishing industry was rapidly rehabilitated. After 1949 Pei-hai developed a shipbuilding industry for small craft and also began to manufacture cables, sails, and nets; a canning industry was established, and there are plants making such various fish products as fish-liver oil, dried fish, and glue. As the nearest Chinese port to Vietnam, Pei-hai traditionally had strong trading links with the Vietnamese port of Haiphong. In 1984 it became one of 14 Chinese coastal cities opened to Western trade and investment. Pop. (1985 est.) city centre, 115,700; city, 171,600.

Pei-p'iao, Pinyin BEIPIAO, mining town, western Liaoning Province, China. Located northwest of the Ta-ling Stream and east of the Ta-ch'ing Mountains, it is the site of a coal combine. The vertical shafts, which extend nearly 3,280 feet (1,000 m), are among the deepest mines in China. They produce coking coal from a southwestern extension of the Fu-hsin basin. Pop. (mid-1970s est.) 100,000–300,000.

Pei Wei DYNASTY: *see* Wei dynasty.

peine forte et dure (French: "strong and hard punishment"), in English law, punishment that was inflicted upon those who were accused of a felony and stood silent, refusing to plead either guilty or not guilty, or upon those who challenged more than 20 prospective jurors. By the Statute of Westminster, 1275, the *peine* was usually to imprison and starve until submission, but in 1406 pressing to death by heavy weights was added to this. An individual who chose to stand mute under the threat of *peine forte et dure* often did so to ensure that his goods and estates would be inherited by his family; if he entered a plea and was subsequently tried and convicted, his goods would pass directly to the crown. In treason cases *peine forte et dure* was not applicable, because standing mute in such cases meant a plea of guilty.

Peine forte et dure was abolished in 1772, when "standing mute" was made equivalent to conviction. By an act of 1827 a plea of "not guilty" was to be entered against any prisoner refusing to plead, and that has since remained the rule in English law. *Peine forte et dure* was rarely used in the American colonies. The few instances of its use helped to prompt the constitutional prohibition against cruel and unusual punishments.

Peipus, Battle of Lake, also called BATTLE OF LAKE CHUDSKOYE (April 5, 1242), encounter in which Alexander Nevsky of Novgorod was victorious over the invading Teutonic Knights. In 1239 the Livonian Knights (Order of the Brothers of the Sword) began a military campaign in northwestern Russia to expand their territory and convert the Russians to Roman Catholicism. Interrupted by the Mongol invasion of Poland and Silesia (1241), the campaign was resumed by the Teutonic Knights (with whom the Livonian Knights were affiliated). In 1241 the Knights captured Pskov, then proceeded against Novgorod in March 1242. But Nevsky led an army against them. Recovering all the territory seized by the Knights, he engaged them in battle on the frozen Lake Peipus (Chudskoye Ozero), known as the "battle on the ice." His victory forced the grand master of the Knights to relinquish all claims to the Russian lands that he had conquered and substantially reduced the Teutonic threat to northwestern Russia.

Peipus, Lake, Russian CHUDSKOYE OZERO, Estonian PEIPSI JÄRV, lake forming part of the boundary between the Estonian Soviet Socialist Republic and Pskov *oblast* (administrative region) of the Russian Soviet Federated Socialist Republic. It is connected by the narrow Tyoploye Ozero (lake) to a southern extension, Lake Pskov. Lake Peipus has an area of 1,400 sq mi (3,600 sq km), although this varies. The lake bottom, reaching a depth of about 50 ft (15 m), consists of gray mud; only in the south is it sandy. The banks are predominantly low-lying. The lake, which is frozen for six months of the year, forms the headwaters of the Narva River. In 1242 the Russians under Alexander Nevsky defeated the Germanic Teutonic Knights on the frozen Lake Peipus.

Peirce, Benjamin (b. April 4, 1809, Salem, Mass., U.S.—d. Oct. 6, 1880, Cambridge, Mass.), American mathematician, astronomer, and educator who computed the general perturbations of the planets Uranus and Neptune.

Peirce graduated from Harvard College in 1829 and accepted a teaching position with George Bancroft at his Round Hill School in Northampton, Mass. Two years later he was asked to join the faculty at Harvard as a tutor in mathematics. Much of Peirce's reputation was based on two of his early works. The first was his solution to a mathematical problem proposed in the journal *Mathematical Diary* in which he proved that there is no odd perfect number with fewer than four distinct prime factors; the second was his commentary and revision of Nathaniel Bowditch's translation of the first four volumes of the Marquis de Laplace's *Traité de mécanique céleste* ("Treatise on Celestial Mechanics").

In 1833 Peirce received his M.A. from Harvard and was named university professor of astronomy and mathematics. During the next decade he wrote a series of textbooks and monographs dealing with trigonometry, algebra, geometry, astronomy, and navigation, as well as *An Elementary Treatise on Sound* (1836), based on the work of physicist J.F.W. Herschel. Peirce was instrumental in establishing the Harvard Observatory, and in 1842 he became Harvard's Perkins professor of mathematics and astronomy, a position he held until his death. In this capacity he helped determine the orbit of the newly discovered planet Neptune and calculated the perturbations produced between its own orbit and those of Uranus and other planets.

Considered the leading American mathematician of his day, Peirce was named to a five-man committee by the American Academy of Arts and Sciences in 1847 to plan and organize what was to be the Smithsonian Institution. From 1849 to 1867 Peirce served as consulting astronomer to the newly created *American Ephemeris and Nautical Almanac,* and in 1852 he began a long association with the U.S. Coast Survey. Starting as director of longitude determinations, he eventually became superintendent of the Survey (1867–74) and oversaw the production of the first geodetic map of the country independent of local surveys. Peirce also served, in 1863, as one of the 50 incorporators of the National Academy of Science. His best work is *Linear Associative Algebra* (1870), a study of possible systems of multiple algebras.

Peirce, Charles Sanders (b. Sept. 10, 1839, Cambridge, Mass., U.S.—d. April 19, 1914, near Milford, Pa.), American scientist, logi-

Charles Sanders Peirce, 1891

cian, and philosopher who is noted for his work on the logic of relations and on Pragmatism as a method of research.

Life. Peirce was one of four sons of Sarah Mills and Benjamin Peirce, who was Perkins professor of astronomy and mathematics at Harvard University. After graduating from Harvard College in 1859 and spending one year with field parties of the U.S. Coast and Geodetic Survey, Peirce entered the Lawrence Scientific School of Harvard University, from which, in 1863, he graduated summa cum laude in chemistry. Meanwhile, he had reentered the Survey in 1861 as a computing aide to his father, who had undertaken the task of determining, from observations of lunar occultations of the Pleiades, the longitudes of American survey points with respect to European ones. Much of his early astronomical work for the Survey was done in the Harvard College Observatory, in whose *Annals* (1878) his *Photometric Researches* (concerning a more precise determination of the shape of the Milky Way Galaxy) appeared.

In 1871 his father obtained an appropriation to initiate a geodetic connection between the surveys of the Atlantic and Pacific coasts. This cross-continental triangulation lent urgency to the need for a gravimetric survey of North America directed toward a more precise determination of the Earth's ellipticity, a project that Charles was to supervise. In pursuit of this project, Peirce contributed to the theory and practice of pendulum swinging as a means of measuring the force of gravity. The need to make accurate measurements of lengths in his pendulum researches, in turn, led him to make a pioneer determination of the length of the metre in terms of a wavelength of light (1877–79). Between 1873 and 1886 Peirce conducted pendulum experiments at about 20 stations in Europe and the United States and (through deputies) at several other places, including Grinnell Land in the Canadian Arctic.

Though his experimental and theoretical work on gravity determinations had won international recognition for both him and the Survey, he was in frequent disagreement with its administrators from 1885 onward. The amount of time he took for the careful preparation of reports was ascribed to procrastination. His "Report on Gravity at the Smithsonian, Ann Arbor, Madison, and Cornell" (written 1889) was never published, because of differences concerning its form and content. He finally resigned as of the end of 1891, and, from then until his death in 1914, he had no regular employment or income. For some years he was a consulting chemical engineer, mathematician, and inventor.

Peirce was elected a fellow of the American Academy of Arts and Sciences in 1867 and a member of the National Academy of Sciences in 1877. He presented 34 papers before the latter from 1878 to 1911, nearly a third of them in logic (others were in mathematics, physics, geodesy, spectroscopy, and experimental psychology). He was elected a member of the London Mathematical Society in 1880.

Work in logic. Though Peirce's career was in physical science, his ambitions were in logic. By the age of 31, he had published a number of technical papers in that field, besides papers and reviews in chemistry, philology, the philosophy of history and of religion, and the history of philosophy. He had also given two series of Harvard University lectures and one of Lowell Institute lectures, all in logic. Though Peirce aspired to a university chair of logical research, no such chair existed, and none was created for him: the day of logic had not yet come. His nearest approach to this ambition occurred at Johns Hopkins University, where he held a lectureship in logic from 1879 to 1884 while retaining his position in the Survey.

Logic in its widest sense he identified with semiotics, the general theory of signs. He laboured over the distinction between two kinds of action: sign action, or semiosis, and dynamic, or mechanical, action. His major work, unfinished, was to have been entitled *A System of Logic, Considered as Semiotic.*

Though he made eminent contributions to deductive, or mathematical, logic, he was a student primarily of "the logic of science"—*i.e.,* of induction and of what he called "retroduction," or "abduction," the forming and accepting on probation of a hypothesis to explain surprising facts. His lifelong ambition was to establish abduction and induction firmly and permanently along with deduction in the very conception of logic—each of them clearly distinguished from the other two, yet positively related to them. It was for the sake of logic that Peirce so diversified his scientific researches, for he felt that the logician should ideally have an insider's acquaintance with the methods and reasonings of all the sciences.

Work in philosophy. Peirce's Pragmatism was first elaborated in a series of "Illustrations of the Logic of Science" in the *Popular Science Monthly* in 1877–78. The scientific method, he argued, is one of several ways of fixing beliefs. Beliefs are essentially habits of action. It is characteristic of the method of science that it makes its ideas clear in terms first of the sensible effects of their objects, and second of habits of action adjusted to those effects. Here, for example, is how the mineralogist makes the idea of hardness clear: the sensible effect of x being harder than y is that x will scratch y and not be scratched by it; and believing that x is harder than y means habitually using x to scratch y (as in dividing a sheet of glass) and keeping x away from y when y is to remain unscratched. By the same method Peirce tried to give equal clarity to the much more complex, difficult, and important idea of probability. In his Harvard lectures of 1903, he identified Pragmatism more narrowly with the logic of abduction. Even his evolutionary metaphysics of 1891–93 was a higher order working hypothesis by which the special sciences might be guided in forming their lower order hypotheses; thus, his more metaphysical writings, with their emphases on chance and continuity, were but further illustrations of the logic of science.

When Pragmatism became a popular movement in the early 1900s, Peirce was dissatisfied both with all of the forms of Pragmatism then current and with his own original exposition of it, and his last productive years were devoted in large part to its radical revision and systematic completion and to the proof of the principle of what he by then had come to call "pragmaticism."

His "one contribution to philosophy," he thought, was his "new list of categories" analogous to Kant's a priori forms of the understanding, which he reduced from 12 to 3: Quality, Relation, and Representation. In later writings he sometimes called them Quality, Reaction, and Mediation; and finally, Firstness, Secondness, and Thirdness. At first he called them concepts; later, irreducible elements of concepts—the univalent, bivalent, and trivalent elements. They appear in that order, for example, in his division of the modalities into possibility, actuality, and necessity; in his division of signs into icons, indexes, and symbols; in the division of symbols into terms, propositions, and arguments; and in his division of arguments into abductions, inductions, and deductions. The primary function of the new list was to give systematic support to this last division.

Peirce was twice married: first in 1862 to Harriet Melusina Fay, who left him in 1876, and second in 1883 to Juliette Pourtalai (*née* Froissy). There were no children of either marriage. For the last 26 years of his life, he and Juliette lived on a farm on the Delaware River near Milford, Pa. He called himself a bucolic logician, a recluse for logic's sake. He lived his last years in serious illness and in abject poverty relieved only by aid from such friends as William James.

Significance. Peirce is now recognized as the most original and the most versatile intellect that the Americas have so far produced. The recognition was slow in coming, however, and much of his work is still known only to specialists, each grasping a small part of it, severed from its connections with the rest. Even his Pragmatism is viewed in relation to that of other Pragmatists rather than to other parts of his own work. A philosopher will know him also for his evolutionary metaphysics (theory of basic reality) of chance and continuity. A mathematician may know him for his contributions to linear algebra. A logician will know him as one of the creators of the algebra of logic—including the logic of relations; quantification theory (on the usages of "every . . . ", "no . . . ", and "some . . . "); and three-valued logic, which admits a third truth value between true and false—and may know him also for his two systems of logical graphs, which he called entitative and existential. A psychologist may discover in him the first modern psychologist in the United States. A worker in semiotics will know him as co-founder of that science. A philologist may encounter him as an authority on the pronunciation of Elizabethan English. A computer scientist may find in one of his letters the first known sketch of the design and theory of an electric switching-circuit computer. But all of this, and much besides, lay beyond the scope of his professional career.

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Peiresc, Nicolas-Claude Fabri de (b. Dec. 1, 1580, Belgentier, Fr.—d. June 24, 1637, Aix-en-Provence), French antiquary, Humanist, and influential patron of learning who discovered the Orion Nebula (1610) and was among the first to emphasize the study of coins for historical research.

Peiresc, engraving by J. Lubin
By courtesy of the trustees of the British Museum; photograph, R.B. Fleming

Travels in Italy (1599–1602), studies at Padua, and acquaintance there with Galileo stimulated Peiresc's antiquarian and astronomical interests. A senator at the Parlement of Aix from 1605, he corresponded with the Flemish painter Peter Paul Rubens and many of the noted scholars of the day. Peiresc was first to verify William Harvey's discovery of the circulation of blood, and Sir Isaac Newton made use of his work on optics. He encouraged the legal studies of the Dutch jurist Hugo Grotius, on whose writings much of international law is based, and was largely responsible for the publication of a well-known political satire of the time, *Argenis,* by the Scottish poet John Barclay (1621). No published works by Peiresc are known, but the records of his correspondence indicate the catholicity of his interests.

Peirithous (Greek mythology): *see* Pirithous.

Peisistratus, also spelled PISISTRATUS (b. early 6th century BC—d. 527 BC), tyrant of ancient Athens whose unification of Attica and consolidation and rapid improvement of Athens' prosperity helped to make possible the city's later preeminence in Greece.

Rise to power. In 594 Peisistratus' mother's relative, the reformer Solon, had improved the economic position of the Athenian lower classes, but the Solonian reorganization of the constitution had not eliminated bitter aristocratic contentions for control of the archonship, the chief executive post. As Peisistratus reached manhood, the two major vying factions were called the Plain, led by Lycurgus, and the Coast, led by Megacles.

During a war with the city of Megara about 565, Peisistratus gained military fame by taking the Megarian harbour. He organized his own faction, named the Hillsmen, a group that included noble families from his own district, the eastern part of Attica, and also a very considerable part of the growing population of the city of Athens. At one point Peisistratus slashed himself and the mules of his chariot and made a dramatic entrance into the agora (marketplace) to show how his enemies had wounded him. The people voted him use of a bodyguard of citizens armed with clubs, with the aid of which he seized the Acropolis and held power briefly in 560/559. To increase his support he contracted a short-lived marriage with the daughter of Megacles and again acquired temporary power in Athens (probably 556–555), but Lycurgus and Megacles united to force him out.

For several years Peisistratus was an exile in northern Greece. He laid a solid base for his return, exploiting the silver and gold mines of Mt. Pangaeum and gaining the support of conservatives in Thebes, Argos, Naxos, and elsewhere. In 546 he went to Eretria on the island of Euboea, with the force provided by his own funds and by his friends, and from this base invaded Attica. At Pallene, near Mt. Hymettus, he launched a surprise attack on the Athenian army in the heat of midday, while his enemies were gambling or sleeping. After a complete victory, Peisistratus became master of Athens for the third time and remained in power until his death in 527. His sons Hippias and Hipparchus succeeded him.

The occasional modern efforts to interpret the factions involved in the rise of Peisistratus as representing simply different economic interests or purely geographical blocs seem misconceived, nor can one hope to penetrate the legends about Peisistratus to discern his personality. His career down to 546 shows persistence, dexterity, and diplomatic ability; once master, he followed a program that pleased the city population especially but that also appealed to the rural majority.

Tyrant of Athens. Peisistratus was master of Athens by the use of force, so in Greek terms he was a *tyrannos.* He maintained a mercenary bodyguard, composed in part of Scythian archers; he may have disarmed the citizens; and he certainly placed hostages from major families in safekeeping on the island of Naxos. Yet he preserved the constitutional forms of government and made them operate more efficiently. Some aristocrats cooperated and were permitted to hold the yearly post of archon; others went into exile. Once Peisistratus, accused of homicide, appeared before the court on the day of the trial, but his accuser dared not press the charge.

His internal policies appear to have been designed to increase the unity and majesty of the Athenian state. Since religion was closely interwoven with the structure of the Greek polis, or city-state, many of his steps were religious reforms. He brought the great shrine of Demeter at Eleusis under state control and constructed the first major Hall of the Mysteries (Telesterion) for the annual rites of initiation into the cult. Many local cults of Attica were either moved to the city or had branch shrines there. Artemis, for instance, continued to be worshiped at Brauron, but now there was also a shrine to Artemis on the Acropolis. Above all, Athena now became the main deity to be revered by all Athenian citizens. Peisistratus constructed an entry gate (Propylaea) on the Acropolis and perhaps built an old Parthenon under the temple that now stands on the crest of the Acropolis. Many sculptured fragments of limestone from Peisistratid buildings have been found on the Acropolis, and the foundations of a major, unfinished temple can still be seen.

Festivals and literature also flourished in Peisistratid times. The tyrant enhanced the glory of the Panathenaea, a yearly festival to Athena, by accentuating the Great Panathenaea (every four years) with athletic contests and prizes for bards who recited the Homeric epics. After the cult of Dionysus was placed under state sponsorship, prizes were awarded at the yearly Dionysia for the singing of dithyrambs and, from 534, for the performance of tragedies. Poets such as Anacreon lived at the court of Peisistratus and his sons, who also encouraged the collection of oracles and supported the famous soothsayer Onomacritus.

Contribution to the growth of Athens. At this time Athens itself was becoming a city, rather than an agglomeration of villages. Peisistratus improved its water supply by building an aqueduct that fed the Enneakrounos fountain on the edge of the agora. He also beautified and systematized the marketplace itself; 6th-century markers of its borders have been found in agora excavations. Just outside the city, on the banks of the Ilissus stream, he began a temple to Olympian Zeus, but this was not finished until the reign of the Roman emperor Hadrian.

In the countryside, Solon had encouraged the growing of olive trees and vines to produce cash crops; Peisistratus made loans to small farmers for tools and equipment. In a few cases the estates of exiled aristocrats appear to have been broken up, but the major force in reducing aristocratic control over rural Attica seems to have been the regularization of government. Peisistratus instituted a system of traveling judges to provide state trials of rural cases on the spot; he himself made inspection tours.

This extensive cultural and political activity was financed by Peisistratus' revenues from the mines of Mount Pangaeum and from internal sources. The silver mines of Laurium were state property, and dues were exacted from the growing trade at Athenian harbours. Peisistratus instituted a tax, probably of 10 percent, on agricultural production. On one tour of inspection, according to a famous story, he saw a farmer digging in a field of stones and asked what his income was. When the farmer replied, "Just so many aches and pains; and of these aches and pains Peisistratus ought to take his 10 percent," the tyrant remitted all taxes to the frank farmer.

Athenian industry and commerce expanded tremendously in the latter half of the 6th century; the main contribution of Peisistratid rule to these developments was probably the guarantee of internal tranquility and the protection of foreign immigrants.

Externally, the tyrant pursued a policy of peace, probably because he dared not allow the Athenian citizenry to bear arms in a major war. But at this time the Greek world was also in a temporary state of balance. In the Aegean, Peisistratus helped such friends as Lygdamis of Naxos to become local tyrants. He purified the sacred island of Delos by removing the old graves near its temple of Apollo. His main efforts, however, were concentrated in gaining control of the Hellespont, through which came the exported grain of south Russia. To this end he secured command of Sigeum and installed a younger son, Hegesistratus, as its ruler. More important, he encouraged the Athenian Miltiades to lead a private venture that gained mastery over the Chersonesus.

On the death of Peisistratus, Athens was still much less important politically and militarily than was Sparta. Commercially, states such as Miletus, Corinth, and Aegina were at least as active, and the contemporary tyrant Polycrates of Samos was as important a patron of the arts and letters. Nonetheless, the religious and patriotic unification of Athens had made great progress during Peisistratus' calm, even rule. As Aristotle reports, it became a common saying that the tyranny of Peisistratus had been the age of Cronus, the golden age.

(C.G.St.)

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Pekalongan, also spelled PECALONGAN, *kotamadya* (municipality) and *kabupaten* (regency), Jawa Tengah *provinsi* ("province"), central Java, Indonesia, situated on the northern coastal plain. The city, capital of the regency, has a fort (1753) and a small harbour and is the main distributing centre for the area, exporting tea, rubber, and sugar, which is locally refined. The city is a main centre of batik production, textiles forming an important cottage industry. Pekalongan regency, with an area of 2,176 square miles (5,636 square km), was granted to the Dutch East India Company by the Susuhunan of Mataram. The very fertile river valleys and coastal plain support crops that produce sugar, rice, kapok, cinchona, indigo, and corn (maize). Pop. (1980) city, 132,558; regency, 651,709.

pekan (mammal): *see* fisher.

Pekanbaru, *kotamadya* (municipality) and capital of Riau *provinsi* ("province"), central Sumatra, Indonesia. It is a port on the Siak Stream, located about 100 miles (160 km) upstream from the Strait of Malacca. It is a collection centre for agricultural produce from the hinterland, including rubber, tea, and coffee, together with petroleum, bauxite, and gold. Household industry includes wood carving, metalwork, basket weaving, and textile production. The city has an airport, and roads link it with Parit, Dumai, Bangkinang, Payakumbuh, and Taluk. The Grand Mosque of Shaykh Burhanuddin and Riau University (founded 1962) are located in Pekanbaru. Pop. (1980) 186,262.

Pekea nut: *see* souari nut.

Pekin, city, seat of Tazewell county, central Illinois, U.S., on the Illinois River (bridged) just south of Peoria. The first settler was Jacob Tharp in 1824; the town was laid out in 1829 and was named Pekin by Mrs. Nathan Cromwell, wife of a founder, on the false assumption that it was directly opposite Peking, China, on the other side of the Earth. (Many of the older city streets are named for Mrs. Cromwell's friends—Ann Eliza, Cynthiana, Henrietta, Matilda). Pekin's first schoolhouse (Snell School) was fortified during the Black Hawk War (1832) as Fort Doolittle. Pekin for many years remained a rough river port. Abraham Lincoln argued many cases in its courthouse. The city was the birthplace and home of U.S. Senator Everett M. Dirksen, who is buried there.

A shipping centre for grain, cattle, and coal, Pekin is served by several railroads and is on the Illinois Waterway. Manufactures include corn (maize) products, alcohol, liquor, malt, steel tanks, barrels, burial vaults, and copper, brass, iron, and aluminum castings. The Spring Lake Conservation Area is nearby. Inc. 1839. Pop. (1986 est.) 32,950.

Peking, Wade–Giles romanization PEI-CHING, Pinyin BEIJING, city, capital of Peking *shih* (municipality) and of the People's Republic of China. Peking is located in northeastern China at the northern end of the triangular North China Plain, about 100 miles (160 km) inland from the Gulf of Chihli of the Yellow Sea. With but few interruptions, the city has been China's capital almost continuously since AD 1272, when the Mongol ruler Kublai Khan established his political base there. In 1420 it was made the official capital city of the Ming dynasty (1368–1644), under the name of Peking ("Northern Capital"). The city has thus constituted an integral part of the country's history over the past eight centuries.

A brief treatment of Peking follows. For full treatment, *see* MACROPAEDIA: Peking.

The municipality of Peking is almost surrounded by Hopeh province and is bordered at two points by Tientsin municipality. Peking's lowland (elevation 100–130 feet [30–40 m]) site is bounded on the north by the fringe of the Mongolian Plateau and on the northeast by the Yen Mountains; a concave arc of lowland, termed the Bay of Peking by geologists, circles Peking from the northeast to the southwest. This embayment opens onto the great plain to the south and east.

Standing at the southern convergence of important mountain passes, Peking is a natural gateway on the long-distance land-communication route between the North China Plain and the northern ranges, plains, and plateaus. Because of its strategic position, Peking has been for more than 700 years an important terminus of the trade routes leading to and from the vast Central Asian hinterland.

Since the early 15th century, the city of Peking and its surrounding territories have been organized as a metropolitan district of enormous size. The present metropolitan area was established in 1959 and consists of four urban and six suburban *ch'u* (districts) surrounded by nine annexed *hsien* (counties). It may be divided into three concentric zones, based on urban functions. The central zone, including the formerly walled city, is mainly occupied by old palaces, government buildings, commercial districts, and old residential areas. The second zone, the near suburb, provides sites for new factories, schools, government buildings, and workers' dormitories; its outer fringe is agricultural. The third zone, the far suburb, constitutes the majority of the municipality's land area and functions as the economic base, supplying resources to the urban population of the other zones.

Peking's climate is of the continental monsoon type that occurs in the temperate zone. Winters are long, cold, and dry, influenced by Siberian air from the Mongolian Plateau; temperatures are lowest in January, with a mean of 24° F (−4° C). In summer the warm and humid air from the southwest often penetrates into North China, bringing most of the area's annual precipitation of 25 inches (635 mm). July is the warmest month, with a mean temperature of 79° F (26° C).

During the 1950s and 1960s, Peking became one of the nation's principal industrial centres. Primary activities include the production of steel, machines (chiefly for construction, transportation, mining, and farming), precision instruments, textiles, and petrochemicals and electrical engineering. The traditional handicrafts industry continues to be strong, producing rugs and carpets, porcelain and chinaware, jade and ivory sculpture, and other goods.

Many service industries, operated mainly by government agencies, have greatly expanded. Tourism is promoted by the China International Travel Service and by the Overseas Chinese Tourist Service, both based in Peking, and by a growing number of hotels and hostels. The People's Bank of China, whose head office is located in Peking's inner city, plays a key role in the country's nationwide and centralized system of banking. This bank functions as the agent of the national treasury, centralizing the financial resources of the government and the major sectors of China's economy. Working in cooperation with the People's Bank, and under its supervision, are the People's Construction Bank, which finances basic construction; the Agricultural Bank of China, which handles agricultural investment; and the Bank of China, which specializes in foreign trade and exchange.

Peking has striven for a high degree of self-sufficiency in secondary food supplies, such as vegetables, fruits, fish, and poultry. Vegetables are grown in a belt around the central city. Many state farms and communes have planted orchards on reclaimed land.

Peking lacks the compact central business district that characterizes most cities in the Western world. The historical market areas of the city were located to the southwest and southeast of the Imperial Palace, and the East and West markets are still major shopping centres. Since 1949 a number of multistory department stores have been erected; the Peking Department Store is the largest in China. In addition, there are many traditional bazaars that have developed distinctive reputations over many years.

Peking city proper essentially consists of two old walled cities, the northern inner city (or "Tatar City," lying approximately on the site of the Mongol city of Ta-tu) and the southern, outer city (or "Chinese City," added during the Ming dynasty). Within the inner city is the former Imperial City, which in turn contains the moated "Forbidden City," where the Imperial Palaces (now a museum) are located.

The symmetrical, rectangular layout of the inner city about a single straight north–south line is striking. All the city walls, important city gates, main avenues and streets, religious buildings, and daily shopping markets are arranged in relation to this central axis; few cities in the world can rival Peking in the regularity and harmony of its plan. Peking also has a high proportion of recreational land.

Peking represents, better than any other existing city, the heritage of Chinese architectural achievement. Care has been taken throughout the centuries to preserve the traditional sites, even while modernizing parts of the city. Since 1949, the greatest change in appearance has been the demolition of the old city walls and the extension of the city's streets immediately outside the old walls.

Among the historical and religious structures in Peking, the Temple of Heaven (T'ien T'an) is unique, both for its unusual geometric layout, which embodies the age-old belief that heaven is round and the Earth square, and because it represents the supreme level of Chinese architectural enterprise. Other important sites include the Temple of the Imperial Ancestors (now the People's Cultural Park) on the east side of the axis, which is balanced by the Altar of Earth and Harvests (now the Chungshan Park) on the west. Perhaps the most imposing structure built since 1949 in the heart of the city is the two-block-long Great Hall of the People. In its grand auditorium the National People's Congress (the supreme organ of state power) holds its sessions.

Peking's position as a centre of higher education has been firmly established since 1949. A scientific and educational district has emerged, containing the prestigious Peking (1898) and Ch'ing-hua universities. Also within this district are other institutions for ideological training, for music and medical education, and for training in specialized technical fields. The Chinese Academy of Sciences, China's highest research institute, is located there as well. Peking also offers a number of foreign-language institutions.

As the cultural focus of China for several centuries, Peking possesses what are probably the finest cultural institutions in the nation, including libraries (such as the Peking Library, containing imperial collections), museums (the Palace Museum and the Museum of Chinese History), and theatres. Peking is also the chief publishing and media centre in China.

Intracity transport is provided by a network of buses and trolleys, but bicycles constitute the bulk of street traffic. Highways, which have regular bus service, are the chief links with nearby communities. Peking is the railroad and airline centre of China. It is linked by direct express trains with several large urban centres and also occasionally with foreign cities such as Moscow; P'yŏngyang, N.Kor.; Ulaanbaatar, Mongolia; and Hanoi, Vietnam. A dozen major highways radiate from Peking, along which regular bus services run. Its international airport is located 14 miles (23 km) from the city. Area city, 1,763 square miles (4,567 square km); metropolitan area, 6,500 square miles. Pop. (1988 est.) city, 5,468,540; mun. 9,926,000.

Peking duck, one of the most celebrated dishes of Pekingese, or Mandarin Chinese, cuisine. In its classic form, the dish calls for a specific breed of duck, the Imperial Peking, that is force-fed and housed in a small cage so that inactivity will ensure tender meat. The neck and head are left intact as the bird is killed and dressed, and, after the entrails are removed, the lower opening is sewed shut. Air is forced between the skin and flesh to puff out the skin so that the fat will be rendered out during roasting and the skin, the choicest part of the dish, will be very crisp. The inflated bird is painted with a sweet solution, hung up to dry for several hours, then roasted suspended in a cylindrical clay oven.

Peking duck is served in three courses. The skin is accompanied by hoisin sauce (a commercially prepared, reddish brown sweet and spicy sauce), scallions cut into brushes, and thin wheat-flour pancakes or steamed wheat-flour "lotus buns," all of which are eaten together as a sandwich. The meat of the duck is cut up and served with vegetables as a second course, and a soup of the duck's bones with celery cabbage follows. Because it must be roasted in a special oven, Peking duck is primarily restaurant fare.

Peking man, extinct hominid of the species *Homo erectus,* known from fossils found at Chou-k'ou-tien (Zhoukoudian) cave near Peking. Peking man was identified as a new fossil human by Davidson Black in 1927 on the basis of a single tooth. Later excavations yielded 14 skullcaps, several mandibles, facial bones and limb bones, and the teeth of about 40 individuals. These Chou-k'ou-tien hominid fossils are dated to the Middle Pleistocene, (about 900,000 to 130,000 years ago), although a more exact date has not been determined. Before being assigned to *Homo erectus,* they were variously classified as *Pithecanthropus* and *Sinanthropus.*

Peking man is characterized by a cranial capacity averaging 1,075 cubic cm (range 850–1,300 cubic cm, overlapping the range of modern man, whose average is 1,350 cubic cm), a skull flat in profile but with a small forehead, a sagittal ridge on top of the head for attachment of powerful jaw muscles, very thick skull bones, heavy browridges, an occipital torus, a large palate, and a large, chinless jaw. The teeth are essentially human, though the canines and molars are quite large, and the enamel of the molars is often wrinkled. The limb bones are indistinguishable from those of modern man. Core tools, primitive flaked tools, worked-bone tools, charred animal bones, and the remains of hearths found in association with these human bones show Peking man had a well-developed communal culture, practiced hunting, and used fire domestically. Peking man postdates Java man and is considered more advanced in having a larger cranial capacity, a forehead, and nonoverlapping canines.

The original fossils were under study at the Peking Union Medical College in 1941, when, with Japanese invasion imminent, an attempt was made to smuggle them out of China and to the United States. The bones disappeared and have never been recovered, leaving only plaster casts for study. Renewed excavation in the caves, beginning in 1958, brought new specimens to light.

Peking Man (1975) by Harry L. Shapiro describes the original finding of the fossils, discusses their significance, and reconstructs the circumstances under which they vanished.

Peking opera: *see* ching-hsi.

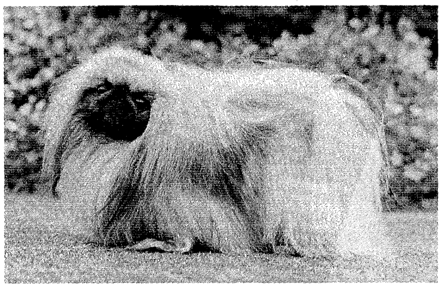
Peking University, Chinese (Wade–Giles) PEI-CHING TA-HSÜEH, (Pinyin) BEIJING DAXUE, byname PEI-TA, or BEIDA, in Peking, one of the oldest and most important institutions of higher learning in China. It originated as the Capital College, which was founded in 1898 by the emperor Kuang-hsü as part of his short-lived program to modernize and reform China's institutions. This school languished after the empress dowager Tz'u-hsi's coup d'état of the same year. After the overthrow of the Ch'ing dynasty in 1911, the school was renamed Peking University. It was subsequently reinvigorated, and by 1920 it had become a centre for the most progressive currents among China's intelligentsia and students. During the 1920s two founders of the Chinese Communist Party, Li Dazhao and Chen Duziu, were on the university's faculty, and the young Mao Zedong began studying Marxism in 1918 under their influence, while he worked in the university's library. The noted writer Lu Hsün lectured on Chinese literature at Peking University in the 1920s.

Student demonstrations at the university in 1919 marked the start of the influential May Fourth Movement. During the Japanese invasion of China (1937–45), the university was temporarily relocated to K'un-ming in Yunnan province. In 1952 the university was reorganized and merged with Yen-ch'ing (Yanjing) University, which had been founded by American Methodist missionaries in 1922. Peking University relocated to Yen-ch'ing's more spacious campus, on the northwestern outskirts of Peking. The first disturbances of the Cultural Revolution began at Peking University in 1966. Education there ceased from 1966 to 1970 and did not regain a firm basis until after the end of the Cultural Revolution in 1976. Peking University has since reasserted its position as the foremost nontechnical university in China. Students who score the highest in nationwide competitive examinations are admitted to it. The university has about 25 academic departments and several research institutes. It also has the largest university library in China. All Peking University students live in dormitories and receive a government stipend for food. Tuition, books, equipment, and medical care are free.

Peking Zoological Garden, also called PEKING ZOO, zoological garden on the western outskirts of Peking, founded in 1906 by the empress dowager Tz'u-hsi. The zoo is managed by the Peking Office of Parks and Forestry, financed with government funds, and noted for its collection of rare Asian species.

The Peking Zoo served chiefly as an experimental farm from 1911 to 1949, when the Chinese Communists took control of Peking. The Communist government renovated the 56-ha (138-ac) zoo and reopened it to the public shortly thereafter. In 1952 an elephant house was built, and since that time a large carnivore enclosure, a primate house, and an aquatic animal house have been added. The zoo's collection has grown to more than 4,000 specimens of about 485 species. Among the rare primates in the collection are snub-nosed monkeys and white-headed langurs. It also includes unusual ungulates such as the kiang (a wild ass), the white-lipped deer, and the little-known takin (a heavily built, mountain-dwelling, hoofed mammal). The very rare white-eared pheasant was kept from extinction by the work of the Peking Zoo, and the zoo was the first to breed the giant panda. A large collection of fishes featuring unusual varieties of goldfish is also maintained by the zoo.

Pekingese, breed of toy dog developed in ancient China, where it was held sacred and was kept as a palace dog by members of the Imperial family. It was introduced to the West by English forces that looted the Imperial Palace at Peking in 1860. The Pekingese has been



Pekingese
Sally Anne Thompson—EB Inc.

known, both in the Orient and in the West, as the "lion dog"—presumably because of its appearance, although it is also acclaimed as having a lionlike independence and courage. It stands about 6 to 9 inches (15 to 23 centimetres) and weighs up to about 14 pounds (6.5 kilograms). The celebrated "sleeve dogs" are very small Pekingese once carried by Chinese royalty in the sleeves of their robes. A long-haired dog, the Pekingese has a full mane and heavily haired thighs, forelegs, tail, and toes. Its head is broad and flat, with hanging ears and a short, wrinkled muzzle. The coat may be solid or variegated in colour, but there is always a black mask across the face.

Peko, in Estonian religion, an agricultural deity who aided the growth of grain, especially barley. Peko was represented by a wax image that was kept buried in the grain in the granary and brought out in early spring for a ritual of agricultural increase. An entire village might participate in such a ceremony, for which the food and beer were furnished in common. After the ceremonial feast, leftovers would be distributed among the poor, and the men would engage in ritual wrestling or fence jumping to determine who would be the host for Peko in the following year. The first one to get a bleeding wound would take Peko home and store him in his granary. The word Peko itself is thought to derive from the name of the Swedish deity Beyggvir, in turn deriving from *bjugg* ("barley"), which in its earliest form was *beggwu.*

pelage, hairy, woolly, or furry coat of a mammal, distinguished from the underlying bare skin. The pelage is significant in several respects: as insulation; as a guard against injury; and, in its coloration and pattern, as a species adornment for mutual recognition among species members, concealment from enemies, or, in the case of many males, as a sexual allurement to promote courtship and mating. *Compare* plumage.

Pelagia OF ANTIOCH, SAINT (d. *c.* 311, Antioch, Syria; feast day June 9), 15-year-old Christian virgin who, probably during the persecution of Christians by the Roman emperor Diocletian, threw herself from a housetop to save her chastity and died instantly. Her authenticity was endorsed and praised by St. Ambrose and St. John Chrysostom who celebrated her martyrdom in a homily.

The memory of this historical Pelagia influenced two legends of fictitious Pelagias—Pelagia the Penitent (or Margarito) and Pelagia Margaret of Tarsus. Pelagia the Penitent was a prostitute of Antioch who experienced sudden conversion to Christianity and then lived her remaining life in a cave at Jerusalem, disguised as a man. Pelagia of Tarsus, for refusing to marry Diocletian, was roasted to death. Both legends are associated with that of St. Margaret of Antioch.

Pelagianism, also called PELAGIAN HERESY, a 5th-century Christian heresy taught by Pelagius (*q.v.*) and his followers that stressed the essential goodness of human nature and the freedom of the human will. Pelagius was concerned about the slack moral standards among Christians, and he hoped to improve their conduct by his teachings. Rejecting the arguments of those who claimed that they sinned because of human weakness, he insisted that God made human beings free to choose between good and evil and that sin is a voluntary act committed by a person against God's law. Celestius, a disciple of Pelagius, denied the church's doctrine of original sin and the necessity of infant Baptism.

Pelagianism was opposed by Augustine, bishop of Hippo, who asserted that human beings could not attain righteousness by their own efforts and were totally dependent upon the grace of God. Condemned by two councils of African bishops in 416, and again at Carthage in 418, Pelagius and Celestius were finally excommunicated in 418; Pelagius' later fate is unknown.

The controversy, however, was not over. Julian of Eclanum continued to assert the Pelagian view and engaged Augustine in literary polemic until the latter's death in 430. Julian himself was finally condemned, with the rest of the Pelagian party, at the Council of Ephesus in 431. Another heresy, known as Semi-Pelagianism (*q.v.*), flourished in southern Gaul until it was finally condemned at the second Council of Orange in 529.

Pelagianism, Semi-: *see* Semi-Pelagianism.

pelagic zone, ecological realm that includes the entire ocean water column. Of all the inhabited Earth environments, the pelagic zone has the largest volume, 1,370,000,000 cubic kilometres (330,000,000 cubic miles), and the greatest vertical range, 11,000 metres (36,000 feet). Pelagic life is found throughout the water column, although the numbers of individuals and species decrease with increasing depth. The regional and vertical distributions of pelagic life are governed by the abundance of nutrients and dissolved oxygen; the presence or absence of sunlight, water temperature, salinity, and pressure; and the presence of continental or submarine topographic barriers.

Pelagic life consists of three categories. The phytoplankton, which constitute the food base of all marine animals, are microscopic organisms that inhabit only the sunlit uppermost oceanic layer, using sunlight to photosynthetically combine carbon dioxide and dissolved nutrient salts. Zooplankton are the marine animals that rely mainly upon water motion for transport, although some forms such as jellyfish are feeble swimmers. Zooplankton subsist on phytoplankton and smaller zooplankton and are dominated in their numbers by small crustacean copepods and euphasiids. Nekton, the free swimmers, are dominated by the bony and cartilaginous fishes, molluscans, and decapods, with rarer mammals and reptiles.

Pelagie Islands, Italian ISOLE PELAGIE, group of islands in the Mediterranean Sea between Malta and Tunisia, south of Sicily; administratively they form the commune of Lampedusa in Agrigento province, Sicily, Italy. The group consists of the islands of Lampedusa (*q.v.*) and Linosa and the Isolotto (islet) Lampione, standing on the eastern edge of the submarine platform of the east coast of Tunisia. Pop. (1981 prelim.) Lampedusa and Linosa mun., 4,495.

Pelagius (b. *c.* 354, probably Britain—d. after 418, possibly Palestine), monk and theologian whose heterodox theological system known as Pelagianism (*q.v.*) emphasized the primacy of human effort in spiritual salvation.

Coming to Rome *c.* 380, Pelagius, though not a priest, became a highly regarded spiritual director for both clergy and laymen. The rigorous asceticism of his adherents acted as a reproach to the spiritual sloth of many Roman Christians, whose moral standards greatly distressed him. He blamed Rome's moral laxity on the doctrine of divine grace that he heard a bishop cite from the *Confessions* of Saint Augustine, who in his prayer for continence beseeched God to grant whatever grace the divine will determined. Pelagius attacked this teaching on the grounds that it imperilled the entire moral law and soon gained a considerable following at Rome. Henceforth his closest collaborator was a lawyer named Celestius.

After the fall of Rome to the Visigoth chieftain Alaric in 410, Pelagius and Celestius went to Africa. There they encountered the hostile criticism of Augustine, who published several denunciatory letters concerning their doctrine, particularly Pelagius' insistence on man's basically good moral nature and on man's own responsibility for voluntarily choosing Christian asceticism for his spiritual advancement.

Pelagius left for Palestine *c.* 412. There, although accused of heresy at the synod of Jerusalem in 415, he succeeded in clearing himself and avoiding censure. In response to further attacks from Augustine and the Latin biblical scholar Jerome, Pelagius wrote *De libero arbitrio* ("On Free Will") in 416, which resulted in the condemnation of his teaching by two African councils. In 417 Pope Innocent I endorsed the condemnations and excommunicated Pelagius and Celestius. Innocent's successor, Zosimus, at first pronounced him innocent on the basis of Pelagius' *Libellus fidei* ("Brief Statement of Faith"), but after renewed investigation at the council of Carthage in 418, Zosimus confirmed the council's nine canons condemning Pelagius. Nothing more is known of Pelagius after this date.

Pelagius I (b. Rome—d. March 4, 561, Rome), pope from 556 to 561. His ecclesiastical roles under popes St. Agapetus I, St. Silverius, and Vigilius were highly important in the history of the church.

As a deacon, Pelagius accompanied Agapetus to Constantinople to help him dissuade the Byzantine emperor Justinian I from attempting the reconquest of Italy. Before he died at Constantinople, Agapetus appointed Pelagius nuncio. When the Byzantine empress Theodora, Justinian's wife, apparently effected the deposition and banishment in March 537 of Agapetus' successor, Silverius, Pelagius returned to Rome. After the deacon Vigilius was made pope, Pelagius went to Constantinople, where he counselled Justinian, returning to Rome as imperial representative.

In the church, a massive complication, subsequently called the "Three Chapters Controversy," arose in reaction to Justinian's edict of 544 against certain Nestorian writings (*see* Nestorians). When Vigilius was summoned to Constantlnople in 545 to ratify the edict, Pelagius served as defender of Rome when it was captured in 546 by the Ostrogothic king Totila, whom he courageously persuaded to spare the Romans. Since the Goths had been warring with the Byzantines in Italy, Totila sent Pelagius on an unsuccessful mission to Constantinople to negotiate a settlement with Justinian.

Pelagius remained in Constantinople with Vigilius, whom he accompanied to Rome and back to Constantinople in 552, where they refused to attend the council of 553 to settle the "Three Chapters Controversy." The council condemned the Nestorian writings and their authors. When, however, Vigilius decided, in 554, to sanction Justinian's edict and the council's condemnation, Pelagius withdrew his support of the Pope, for which he was excommunicated. To Justinian, Pelagius wrote letters against Vigilius, the Byzantine emperor, and to the Council of Constantinople. Imprisoned, he was not released until the death in 555 of Vigilius, whom he formally condemned in his *In defensione trium capitulorum* ("In Defense of the Three Chapters"). Pelagius was reconciled with Justinian and was elected, through imperial insistence, to succeed Vigilius in 555, being consecrated at Rome on April 16, 556.

Italy, however, was in chaos. The West had not accepted the decrees of the Council of Constantinople, and a schism immediately erupted that continued until 610. One of Pelagius' most urgent problems was to rebuild Rome, a task made easier because Justinian in 554 had promulgated his Pragmatic Sanction, confirming and increasing the pope's temporal power. In effect, Pelagius was the official protector of the civil population. By making his new rights resolute and by organizing the temporal government of papal sovereignty, Pelagius began the foundation of the papacy's political power. With the Eastern emperors no longer papal opponents, his role as spiritual head of the church shifted to the danger of barbarian invasion and the protection of the Italian peoples.

Pelagius was unable to prevent the bishops of Milan and Istria from schism because as pope he reversed his opinion and upheld the Council of Constantinople. His aim was church unification, and his power was set by the imperial government. Pelagius' pontificate illustrates the enormous difficulties of his time. Editions of his writings appeared in 1932 and 1956.

Pelagius II (b. Rome—d. Feb. 7, 590, Rome), pope from 579 to 590.

Of Gothic descent, he was consecrated as Pope Benedict I's successor on Nov. 26, 579, without imperial confirmation. His pontificate was continually troubled by the Lombards who were besieging Rome and threatening the Italian peoples, for whom the papacy was responsible.

Pelagius sent the deacon Gregory (later Pope St. Gregory I the Great) as nuncio to Constantinople for aid from the Byzantine emperor Tiberius II. Involved in wars with Persia, Tiberius was unable to help, and for the first time in papal history Pelagius appealed to the Catholic Franks. In a letter (580) to the Frankish bishop of Auxerre he declared it was the Franks' duty as Christians to defend Rome and Italy against the "deathly race" of the Lombards. Gregory persuaded Tiberius to approve Pelagius' unprecedented appeal and to grant the Franks subsidies. Halted in their advance, the Lombards took up a defensive position; but, when the Franks withdrew, the Lombards threatened again, and Pelagius made an appeal to Tiberius' successor, Maurice. The imperial representative in Italy, Exarch Smaragdus of Ravenna, finally negotiated peace in 585.

In the meantime, Pelagius tried unsuccessfully to end the long-standing schism in northern Italy, where certain bishops had broken with Rome over the "Three Chapters Controversy," a complicated dispute among the papacy, Justinian, and the Council (553) of Constantinople over the censuring of Nestorian writings. Despite Pelagius' efforts, the schism continued until 610.

Although relationships between Rome and Maurice were good, a dispute arose over St. John IV the Faster, bishop of Constantinople. Pelagius protested when John assumed the title—traditional at Constantinople since the 5th century—of ecumenical patriarch, which seemed to make him Pelagius' equal, if not his superior. Maurice supported John, and thus began a titular controversy between the Byzantine and Western churches, sharpened by Pelagius' refusal to accept the decrees of a Constantinopolitan council endorsed by John.

Pelagius was responsible for building projects in Rome, including a basilica adjacent to San Lorenzo fuori le Mura. He died in a plague that struck Rome after a disastrous flood.

Pelasgi, also called PELASGIANS, the people who occupied Greece before the 12th century BC. The name was used only by ancient Greeks. The Pelasgi were mentioned as a specific people by several Greek authors, including Homer, Herodotus, and Thucydides, and were said to have inhabited various areas, such as Thrace, Argos, Crete, and Chalcidice. In the 5th century BC the surviving villages apparently preserved a common non-Greek language.

It is uncertain whether any ancient people actually called themselves Pelasgi. In later Greek usage their name was applied to all "aboriginal" Aegean populations.

Pelavicino, Oberto, Pelavicino also spelled PALLAVICINO (b. 1197, Polesine, near Cremona, Lombardy—d. May 8, 1269, Gisalecchio, near Pontremoli, Tuscany), leader of the Ghibelline (imperial) party in northern Italy and powerful supporter of the Holy Roman emperor Frederick II and his sons.

As a member of a great feudal family of Lombardy, Pelavicino fought at Frederick's side in 1238 against Brescia, near Milan, and the following year became imperial vicar (deputy of the emperor) in Lunigiana and Pontremoli, near Genoa. He acted as Frederick's representative in several north Italian cities, serving as *podestà* (chief magistrate) of Reggio in 1246 and at Cremona in 1249 and after 1249 as imperial vicar over the area from Pavia to Tuscany.

After Frederick's death (1250), he served in 1253 as imperial vicar in Lombardy for Frederick's son Conrad IV and, after Conrad's death (1254), took advantage of political turmoil to become lord of Pavia, Cremona, and Piacenza, allying himself with the Veronese tyrant Ezzelino da Romano against the Guelfs (supporters of the pope). In 1258 he quarrelled with Ezzelino over the possession of Brescia. Transferring his allegiance to Conrad's younger brother, King Manfred, he made an alliance with Azzo d'Este of Ferrara that contributed to Ezzelino's defeat by Guelf forces in 1259. The following year the Della Torre family, lords of Milan, made Oberto captain general for five years, with nominal control over several neighbouring cities. The invasion of Charles of Anjou's Guelf army in 1264–65 drove him out of Milan, and he died four years later, his power greatly diminished by the Ghibelline defeat.

Pelayo (d. *c.* 737), founder of the Christian kingdom of Asturias in northern Spain, which survived through the period of Moorish hegemony to become the spearhead of the Christian Reconquistá in the later Middle Ages.

Pelayo's historical personality is overshadowed by legend. As far as can be ascertained, he was a page, or possibly a member of the royal bodyguard, of the Visigothic king Roderick, and may have been of royal blood. He survived the defeat (711) of the Visigoths by the Moors at the Battle of Guadalete near Medina Sidonia and reached his native Asturias, where he led a revolt of Asturians and Visigothic refugees against the Moorish governor Munuza. He was captured and sent to Córdoba as a hostage but escaped (717) and again assumed leadership of the Asturian rebellion. The rebels, though driven into the uplands of the Picos de Europa, were able to survive massive attacks by Moorish armies, especially at the Battle of Monte Auseba, and, eventually, Pelayo—accepted as their ruler (*c.* 718–*c.* 737)—was able to set up a tiny kingdom with its capital at Cangas de Onís. The stories and relics of Pelayo associated with the nearby shrine of Covadonga belong to legend rather than to fact; it was, however, in this legendary guise that he became an important symbol of Christian resistance in medieval Spanish history and literature.

Articles are alphabetized word by word, not letter by letter

Pelé, byname of EDSON ARANTES DO NASCIMENTO (b. Oct. 23, 1940, Três Corações, Braz.), association football (soccer) player, in his time probably the most famous and possibly the best paid athlete in the world. In competition for the World Cup (Jules Rimet Trophy) he led the Brazilian national team to three victories (1958, 1962, and 1970) and permanent possession of the trophy.

Pelé
A.F.P.—Pictorial Parade/EB Inc.

After playing for a minor league club at Bauru, São Paulo state, Pelé (whose nickname apparently is without significance) was rejected by major league teams in the city of São Paulo. In 1956, however, he joined the Santos Football Club, which, with Pelé at inside left forward, won several South American clubs' cups and, in 1962, its first world club championship. On Nov. 20, 1969, in his 909th first-class match, he scored his 1,000th goal. A medium-sized man (5 feet 8 inches, 160 pounds), he combined kicking power and accuracy with a remarkable ability to anticipate other players' moves. Sometimes called "Pérola Negra" ("Black Pearl"), he became a Brazilian national hero.

Pelé announced his retirement in 1974 but in 1975 agreed to sign a three-year, $7,000,000 contract with the New York Cosmos of the North American Soccer League (NASL) and to promote the game in the United States. He retired after leading the Cosmos to the league championship in 1977.

Pelé was the 1978 recipient of the International Peace Award, and in 1980 he was named Athlete of the Century. In addition to his accomplishments in sports, he published several best-selling autobiographies, starred in several successful documentary and semi-documentary films, and composed numerous musical pieces, including the entire soundtrack for the film *Pelé* (1977).

pelecaniform, order (Pelecaniformes) of relatively large, aquatic birds that share the common characteristic of webbing between all four toes. The three suborders are the Phaethontes, (including the tropic bird; *q.v.*) the Fregatae (the frigate bird; *q.v.*) and the Pelecani (including the pelican, booby, gannet, cormorant, and snakebird (*qq.v.*).

A brief treatment of pelecaniforms follows. For full treatment, *see* MACROPAEDIA: Birds.

The three species of tropic birds, confined to the tropics, are the most pelagic (free-flying over open ocean) of the pelecaniforms. They range far out to sea in search of small fish and squid, which they detect while hovering over the sea, then plunging into a powerful dive to capture prey just below the surface of the water. Their courtship display is conducted in midair. The birds fly around in a group and then a pair leaves the group and flies together. The nuptial display often ends with one or both birds flying to the nest site located on open ground under the shelter of a bush or rock where a single egg is laid.

Frigate birds are also found solely in the tropics. They can be distinguished by their long powerful wings, deeply forked tail, and long, hooked beak. Frigate birds use their mastery of flight to advantage in pursuing other seabirds, which they harry until the seabirds disgorge their prey. The frigate birds then catch the food in the air or retrieve it from the surface. They also catch their own prey, particularly flying fish, which they catch in midair. They also snatch fish, and possibly squid, from the surface without alighting.

Courtship behaviour of the frigate bird includes a display in which the male, while leaning back and extending his wings, inflates his scarlet throat (gular) sac, vibrates his wings, and claps his bill. This display is also used in individual recognition. As with the tropic birds, a single egg is laid. Five living species of frigate bird are known.

Pelicans are found in both freshwater and marine habitats from the tropics to the temperate zones. These large, buoyant birds tend to fish while swimming, thrusting their large beaks and long necks below the surface to scoop up fish, which they store in their distensible throat pouches. Their buoyancy is due to pneumatic bone structure and water-repellent plumage. Groups of pelicans will cooperate to herd fish into the shallows. The brown pelican (*Pelecanus occidentalis*) of the Pacific coast of Central and South America, unlike the other species, is known to forage some distance offshore, plummeting into the water to seize its prey. Pelicans build nests on the ground, large but untidy constructions of twigs, grass, algae, and feathers. They lay one to three eggs. Incubation and feeding of the young are shared between the male and female.

Boobies are found from the tropics to the temperate zones in marine habitats. Both gannets and boobies are strong fliers, capturing prey by diving from great heights to spear fish underwater. The blue-footed booby (*Sula nebouxii*) exhibits cooperation when hunting in a group. Boobies are colonial nesters. Their courtship display consists of raising the head and tail and partially lifting the wings. Most boobies lay their eggs in small depressions on open ground, although some species nest on cliff ledges. Gannets and boobies lay one or two eggs.

The cormorants and snakebirds (also called darters, or anhingas) are long-necked, underwater swimmers who pursue and lie in wait for prey below the surface of the water. Snakebirds are found in freshwater habitats from the tropics to the temperate zones. The cormorants inhabit both freshwater and marine environments and are dispersed from the Equator to the polar regions. While cormorants pursue fish and sometimes mollusks on their underwater dives, snakebirds lie in wait underwater and stab passing fish. The cormorants can engage in cooperative fishing activity. Adaptations for diving in these species include the closed external nostrils. Both cormorants and snakebirds are colonial nesters; male courtship display consists of raising the head and tail and lifting and waving their wings. The clutch consists of two to five eggs.

While few external features unite the pelecaniforms, certain anatomical features are common to species with similar habits. For example, the more aerial species have pneumatized skeletons. Those types that dive from great heights, such as boobies, tropic birds, and brown pelicans, have air sacs under the skin, forming a spongy, protective mattress that aids in buoyancy. In cormorants and snakebirds the large contour feathers are wettable and trap little air. This keeps buoyancy low and enables them to submerge.

Because most pelecaniform birds nest in exposed situations they are subject to overheating and commonly protect their young by shading them with their wings. A common method of cooling is by rapid panting of the throat pouch (absent in tropic birds) to maximize evaporative cooling. The water required for evaporation comes from food and seawater, the excess salt being secreted by nasal salt glands. In most seabirds the salt flows out through the nostrils, but in boobies and cormorants, where the nostrils are closed, the solution trickles down from the end of the bill. In all species, both parents share the feeding and incubating of the young.

Pelée, Mount, French MONTAGNE PELÉE, active volcanic mountain on the Caribbean island of Martinique, French West Indies. Situated 15 mi (24 km) northwest of Fort-de-France, it is 4,583 ft (1,397 m) high. The Pelée (French: Bald) massif consists of volcanic ash and lavas. A gently sloping cone, it is scored with ravines and supports luxuriant forests. Minor eruptions occurred in 1792 and 1851, but on May 8, 1902, it violently destroyed the port of Saint-Pierre, killing approximately 30,000 people, 15 percent of the island's population. So dramatic was this event that the name of the mountain has been adopted as typifying that particular kind of eruption, the pelean-type eruption of ash, gas, and nuée ardente ("flaming cloud"). A minor eruption occurred in 1929.

Pelee Island, island, in Lake Erie, southern Ontario, Canada. It lies near the Ohio boundary, a few miles south of Point Pelee National Park and has an area of 18 sq mi (47 sq km). Originally leased from the Indians by Thomas McKee in 1788, it was acquired in 1823 by William McCormick. Viticulture was practiced until 1855, when John Scudder drained marshes for raising vegetables and tobacco. Soybeans later became the leading crop. Middle Island, a rock off its southern coast, is the southernmost point of Canada. Pop. (1981) 247.

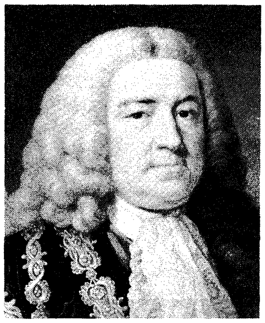
Peletier, Jacques, byname JACQUES PELETIER DU MANS (of Le Mans) (b. 1517, Le Mans, Fr.—d. 1582, Paris), French poet and critic whose knowledge and love of Greek and Latin poetry influenced the group of French poetry reformers known as La Pléiade. In the preface to his translation of Horace's *Ars Poetica* (1545) and in his *Art poétique française* (1555), he put forward his own program for the reform of French poetry. He insisted that poets must imitate the classics if French literature was to rise to great heights. In addition to lyric poetry, Peletier wrote major works on mathematics and spelling reform.

Peleus, in Greek mythology, king of the Myrmidons of Thessaly; he was most famous as the husband of Thetis (a sea nymph) and the father of the hero Achilles, whom he survived. When he and his brother Telamon were banished from Aegina, the kingdom of their father Aeacus', he went to Phthia to be purified by his uncle King Eurytion, whose daughter Antigone he married, receiving a third of Eurytion's kingdom. During the Calydonian boar hunt he accidentally killed Eurytion. He then went to Iolcos to be purified by King Acastus, whose wife Astydameia made advances to him. When he refused her, she told Antigone that he wanted to marry her daughter, causing Antigone to hang herself. Peleus later won the sea nymph Thetis by capture, and all the gods except Eris came to the wedding. But after Thetis bore Achilles to him, she returned to the depths of the sea, later fetching Peleus to dwell with her.

Pelew (Caroline Islands): *see* Palau.

Pelham, Henry (b. 1696—d. March 6, 1754, London), prime minister of Great Britain from 1743 to 1754. A somewhat colourless politician, he worked for peace abroad and introduced important financial reforms.

First elected to Parliament in 1717, Pelham



Pelham, detail of a portrait by John Shackleton, *c.* 1752; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

became a supporter of Robert Walpole (prime minister 1730–42), who helped him obtain appointments as lord of the Treasury (1721), secretary for war (1724), and paymaster to the forces (1730). After Walpole resigned under pressure from the House of Commons in 1742, Pelham became prime minister and chancellor of the exchequer in a ministry that included his brother Thomas Pelham-Holles, duke of Newcastle, and John Carteret, a favourite of King George II.

Carteret's attempts to involve England more deeply in conflict with France and Prussia (War of the Austrian Succession, 1740–48) caused Pelham to dismiss him in 1744, shortly after Carteret had been created Earl Granville. When George II continued to push for the return of Granville, Pelham retaliated by calling for a mass resignation of the ministers on Feb. 11, 1746—the first such action in English history. Since Granville was unable to form a new ministry, Pelham returned to office three days later, bringing into his ministry William Pitt (later earl of Chatham), whom the King disliked. Subsequently, Pelham's only serious political opposition came from Frederick Louis, prince of Wales, who unsuccessfully endeavoured to depict his father, George II, as a captive of the Pelhams. In 1748 Pelham signed the Treaty of Aix-la-Chapelle, which ended the War of the Austrian Succession, which he had seen as a severe financial drain on the country. After the war he accomplished a major reduction of the military establishment and of government expenses, and he reduced the land tax and consolidated the national debt. The subject is treated in John W. Wilkes, *A Whig in Power* (1964).

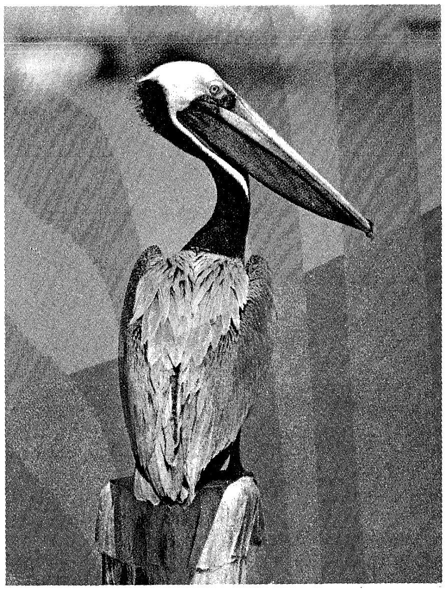
Pelham-Holles, Thomas: *see* Newcastle (under Lyme), Thomas Pelham-Holles, 1st duke of.

Pelias, in Greek mythology, a king of Iolcos in Thessaly who imposed on his half-nephew Jason the task of bearing off the Golden Fleece. According to Homer, Pelias and Neleus were twin sons of Tyro (daughter of Salmoneus, founder of Salmonia in Elis) by the sea god Poseidon, who came to her disguised as the river god Enipeus, whom she loved. The twins were exposed at birth but were found and raised by a horse herder. Later, Pelias seized the throne and exiled Neleus.

Later legend relates that on Jason's return with the fleece, his wife Medea, the enchantress, took revenge on Pelias by persuading his daughters, except for Alcestis, to cut up and boil their father in the mistaken belief that he would thereby recover his youth.

pelican (*Pelecanus*), any of seven or eight species of water birds constituting the family Pelecanidae (order Pelecaniformes), distinguished by their large, elastic throat pouches. Pelicans inhabit lakes, rivers, and sea coasts in many parts of the world. With some species reaching a length of 180 centimetres (70 inches), having a wingspan of 3 metres (10 feet), and weighing up to 13 kilograms (30 pounds), they are among the largest of living birds. Pelicans eat fish, which they catch by using the extensible throat pouch as a dip-net. The pouch is not used to store the fish, which are swallowed immediately. One to four bluish-white eggs are commonly laid in a stick nest and hatch in about a month. The young live on regurgitated food obtained by thrusting their bills down the parent's gullet. They mature at three to four years. Though ungainly on land, pelicans are impressive in flight. They usually travel in small flocks, soaring overhead and often beating their wings in unison. The sexes are similar in appearance, but males are larger.

Best known are the two species called white pelicans: *Pelecanus erythrorhynchos* of the New World, the North American white pelican, and *P. onocrotalus* of the Old World, the European white pelican. The smaller, 107–137-cm brown pelican (*P. occidentalis*) of the New World is a coastal species listed as endangered by the U.S. Fish and Wildlife Service. Its U.S. populations declined drastically as a result of DDT and related pesticides—which interfere with calcium metabolism, thus causing weak shells that tend to break during incubation—but breeding improved after DDT was banned.



Brown pelican (*Pelecanus occidentalis*)
Norman Tomalin—Bruce Coleman Inc.

Pelicans usually breed in colonies on islands; there may be many small colonies on a single island. The gregarious North American white pelican breeds on islands in lakes in north central and western North America; all pairs in any colony at any given time are in the same stage of the reproductive cycle. It is migratory, as are some other species. The brown pelican breeds along the tropical and subtropical shores of both the Atlantic and Pacific coasts.

Pelindaba, site of South Africa's first nuclear research reactor, south central Transvaal, South Africa. It is located about 20 mi (32 km) west of Pretoria, on former farmland near the man-made lake called Hartbeespoort. The reactor, Safari I, was inaugurated there in 1965. The National Nuclear Research Centre, located at Pelindaba, undertakes applied nuclear research, and the reactor serves as a source of neutron radiation and radioactive isotopes. Enriched uranium is also produced at adjoining Valindaba.

Pelion, Mount, Modern Greek ÓROS PÍLION, mountain range on the Magnesia peninsula of southeastern Thessaly, Greece, rising to 5,417 ft (1,651 m). Mt. Pelion (5,075 ft), just northeast of Vólos, has a wooded western flank overlooking a gulf whose ancient ports were Iolcus and Pagasae. In Greek mythology it was the home of Centaurs. The ship "Argo" of the Argonauts allegedly was built of wood from its trees.

Pélissier, Aimable-Jean-Jacques, DUC DE (duke of) MALAKOFF (b. Nov. 16, 1794, Maromme, Fr.—d. May 22, 1864, Algiers), French general who distinguished himself in the conquest of Algeria and was the last French commander in chief in the Crimean War.

Pélissier, engraving
H. Roger-Viollet

Educated at the military schools of La Flèche and Saint-Cyr, Pélissier was commissioned as an artillery second lieutenant in 1815. In 1823 he served in the Spanish campaign to suppress the revolution against Ferdinand VI, and in 1828–29 he fought against the Turks in the Peloponnese. After his first brief service in Algeria in 1830, he returned there in 1839 to take part in the campaign against the patriot emir of Mascara, Abdelkader. He fought with distinction, being promoted to general in 1846, and served as military commander of the coastal province of Oran from 1848 to 1851. During the 1852 coup d'etat of Napoleon III, he was interim governor of Algeria. Subsequently, he played a leading role in the subjugation of the tribes of southern Algeria.

In January 1855 Pélissier was given command of an army corps in the Crimea. He defeated a Russian attack on the Traktir Ridge on August 16 and captured the fort of Malakhov and the city of Sevastopol on September 8. Four days later he was made marshal of France, and in July 1858 he was created duc de Malakoff. From March 1858 to April 1859 Pélissier was French ambassador to London. He was governor of Algeria from 1860 until his death.

Pella, ancient capital of King Archelaus of Macedonia at the end of the 5th century BC and birthplace of Alexander the Great. Originally known as Bounomos, the city developed rapidly under Philip II, but after the defeat of the last Macedonian king by the Romans (167 BC) it became a small provincial town.

The site of Pella, in northern Greece, about 24 miles northwest of Thessaloníki, has long been known. Excavations by the Greek Archaeological Service begun in 1957 have revealed the rectangular grid plan of the town and large, well-built houses with colonnaded courts and rooms with mosaic floors portraying scenes of lion hunts and of Dionysus riding a panther.

pellagra, nutritional disorder caused in large part by a deficiency of niacin, a member of the vitamin B complex, and characterized by skin lesions and by gastrointestinal and neurological disturbances—the so-called classical three Ds of pellagra: dermatitis, diarrhea, and dementia.

The skin lesions are the most characteristic and usually the earliest symptoms. They result from an abnormal sensitization of the skin to sunlight and tend to occur symmetrically on the exposed surfaces of the arms, legs, and neck. They may look at first like a severe sunburn, later becoming reddish brown, rough, and scaly.

Gastrointestinal symptoms usually consist of alternate constipation and diarrhea, with an accompanying inflammation of the mouth and the tongue, and fissuring and dry scaling of the lips and corners of the mouth.

Neurological signs appear later in most cases, when the skin and alimentary manifestations are prominent. The dementia, or mental aberrations, may include general nervousness, confusion, depression, apathy, and delirium. In humans, pellagra is seldom a deficiency of niacin alone; response to niacin therapy tends to be partial, whereas the therapeutic administration of multivitamins commonly brings swift recovery. Mild or suspected instances of niacin deficiency can be effectively treated with a well-balanced diet alone.

The breakthrough in the understanding of pellagra took place in 1937, when it was shown that the disorder known as black tongue in dogs could be cured by the administration of niacin (also called nicotinic acid) or the amide of niacin (nicotinic acid amide or nicotinamide). Pellagra is now seldom encountered in countries in which the population generally eats a well-balanced diet, but it still occurs widely where the diet is high in starchy foods and low in essential amino acids and vitamins. Corn (maize), for example, is low in both niacin and tryptophan, the latter being an amino acid that is converted to niacin in the body. Such foods as milk and eggs, although low in niacin, will protect the body from pellagra because their proteins contain sufficient tryptophan for the synthesis of niacin. Pellagra can also be a side effect of chronic alcoholism. Symptoms closely resembling those of pellagra are seen in Hartnup disease (*q.v.*).

Pellegrini, Carlo, pseudonym APE (b. March 1839, Capua, Kingdom of Naples—d. Jan. 22, 1889, London), caricaturist notable for his portraits of prominent Englishmen appearing in *Vanity Fair.*

As a young man he was a part of Neapolitan society, whose members he caricatured in a good-natured way. Following an unhappy love affair and the death of a sister, he went to England in 1864 and turned his hand to cartooning. His first effort—a cartoon of Benjamin Disraeli—appeared in the British literary magazine *Vanity Fair* in 1869, shortly before he adopted the signature "Ape." His second, of William Gladstone, appeared a week later. One of the best known is of the writer Thomas Carlyle, which appeared in 1870. His portraits were gently humorous, in keeping with his genial disposition.

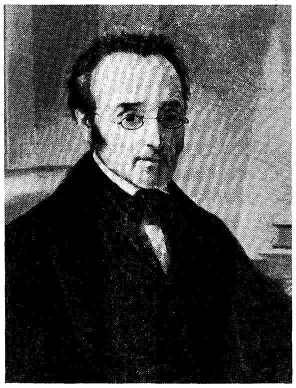
Pellegrino PELLIGRINI, also called PELEGRINO DA BOLOGNA (Italian painter): *see* Tibaldi, Pellegrino.

Pelletier, Pierre-Joseph (b. March 22, 1788, Paris, Fr.—d. July 19, 1842, Paris), French chemist who helped found the chemistry of alkaloids.

Pelletier was professor at and, from 1832, director of the School of Pharmacy, Paris. In 1817, in collaboration with the chemist Joseph-Bienaimé Caventou, he isolated chlorophyll, the green pigment in plants that is essential to the process of photosynthesis. His interests soon turned to a new class of vegetable bases now called alkaloids, and he isolated emetine. With Caventou he continued his search for alkaloids, and in 1820 they discovered brucine, cinchonine, colchicine, quinine, strychnine, and veratrine. Some of these compounds soon found medicinal uses. Such applications marked the beginning of the gradual shift away from the use of crude plant extracts and toward the use of natural and synthetic compounds found in nature or formulated by the chemist.

In 1823 Pelletier published analyses of several alkaloids, thus providing a basis for alkaloid chemistry. He also did important studies of other compounds, including caffeine, piperine, and picrotoxin.

Pellico, Silvio (b. June 25, 1789, Saluzzo, Kingdom of Sardinia [now in Italy]—d. Jan. 31, 1854, Turin), Italian patriot, dramatist, and author of *Le mie prigioni* (1832; *My Prisons*), memoirs of his sufferings as a political prisoner, which inspired widespread sympa-



Pellico, detail of an oil painting by Luigi Norfini
SCALA—Art Resource/EB Inc.

thy for the Italian nationalist movement, the Risorgimento.

Educated at Turin, Pellico spent four years in France, returning to Italy in 1809 to begin his career as a poet and playwright. His romantic tragedy *Francesca da Rimini* (published 1818) was a success on its first performance (1815) and was followed by several others. He had already become one of the circle of Romantic revolutionary writers including Vincenzo Monti, Ugo Foscolo, Giovanni Berchet, and Alessandro Manzoni, and in 1818 he collaborated in founding a liberal and patriotic newspaper, *Il Conciliatore,* of which he became editor. After its suppression by the Austrian police (1819), he joined the Carbonari and, in October 1820, was arrested for treason. In 1822 he was sentenced to death, but the sentence was commuted to life imprisonment, of which he served eight years in prisons in Milan, Venice, and the infamous Spielberg (Spilberk) fortress (used as a political prison by the Habsburgs) in Brunn. From 1838 he lived with his wife in Turin. Of his plays, poetry, and prose works, *Le mie prigioni* is still widely read and translated for its simple, direct style, spiritual revelation, and Christian piety.

Pelloutier, Fernand (b. Oct. 1, 1867, Paris, Fr.—d. March 13, 1901, Paris), a leading organizer and theoretician of the French labour movement who deeply influenced the philosophy and methods of anarcho-syndicalist labour unionism.

As a young journalist in the town of Saint-Nazaire, Pelloutier became a member of the Parti Ouvrier, the largest Marxist Socialist party in France at the time; but he left it in 1892 after the party's leader repudiated the idea of the general strike as romantic and impractical. Disillusioned by leftist party politics, he turned to anarchism and in 1895 became secretary of the Fédération des Bourses du Travail, an institution combining the functions of workers' clubs, employment exchanges, and local labour-union federations. He criticized orthodox Marxists for relying upon the apparatus of the state, a bourgeois institution, as a means of changing society and asserted that the state would be replaced by a "voluntary and free association of producers." This association would be based upon the Bourses du Travail. Through them, Pelloutier believed, the workers would evolve communistic forms of production and create "a socialist state within the bourgeois state."

Pelloutier was a gifted organizer as well as a theoretician, and under his guidance the bourses grew in number until he claimed more than 250,000 members throughout France. In 1900 he founded the Office Nationale de la Statistique et de la Placement, for the purpose of getting satisfactory employment for workers and reducing job competition.

In his *Histoire des bourses du travail* (1902), Pelloutier defined the theory and practice of anarcho-syndicalism.

Pelloux, Luigi (Girolamo) (b. March 1, 1839, La Roche, Savoy [now in France]—d. Oct. 26, 1924, Bordighera, Italy), Italian general and prime minister (1898–1900) who brought his country to the brink of crisis by adopting an extremely repressive domestic policy.

After graduation from the military academy at Turin (1857), Pelloux fought in several battles against Austria, distinguishing himself as a brave and capable leader. He rose through the ranks and as major commanded the artillery that first breached Rome's Porta Pia, thus allowing the occupation of the city (1870), which the troops of a uniting Italy made the country's capital.

In 1880 Pelloux began his political career in the House of Deputies. Promoted to general in 1885, he was minister of war in three cabinets (1891–92, 1892–93, 1896–97). In 1896 he was made a senator. When disturbances broke out in Bari, where he was commander of the army corps, he recognized that the unrest arose from extreme economic need and refused to declare martial law, thus gaining the favour of the leftists. Similar outbursts in other Italian cities, however, led to the downfall of the government.

Invited to form a government (June 1898), Pelloux began correcting the excesses of the previous administration. Soon, however, his training as an army officer asserted itself, and he introduced a repressive bill that would have greatly curtailed civil liberties (February 1899). To avoid defeat on his foreign policy, which featured an unsuccessful military expedition to China, Pelloux resigned (March 1899) and formed a second, more conservative government.

Although the country was now quite calm, Pelloux attempted to make his earlier bill more repressive, thus finally uniting the left in opposition against him. Pelloux prorogued the chamber and tried to have the bill passed by royal decree.

When the decree was ruled void by the Court of Cassation (February 1900), Pelloux had to resubmit his bill to a thoroughly hostile chamber. Forced to resign on June 18, 1900, he was given command of an army corps at Turin (1900–02).

Pelly River, stream in central Yukon Territory, Canada, one of the main headstreams of the Yukon River. It was named in 1840 by Robert Campbell for Sir John Henry Pelly, governor of the Hudson's Bay Company. Rising in the Mackenzie Mountains near the southeastern boundary of the territory, the river flows westward, receiving its two major tributaries, Ross and Macmillan rivers, before joining the upper course of the Yukon at Fort Selkirk. The Pelly, 378 miles (608 km) in length, is navigable for small boats for more than 200 miles (320 km), to Hoole Canyon, except in the shallows of Bradens Canyon.

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pelog, Javanese and Balinese seven-pitch scale. *See* gamelan.

Pelopidas (d. 364 BC, Cynoscephalae, Thessaly [now in Greece]), Theban statesman and general responsible, with his friend Epaminondas, for the brief period (371–362) of Theban hegemony in mainland Greece.

In 385 Pelopidas served in a Theban contingent sent to support the Spartans at Mantineia, where he was seriously wounded but was saved by Epaminondas. Upon the seizure of the Theban citadel by the Spartans (382), Pelopidas fled to Athens and took the lead in a conspiracy to liberate Thebes. In 379 his party surprised and killed their chief political opponents and, by arousing the Theban people, were able to force the Spartan garrison to surrender. In this and subsequent years he was elected boeotarch, or chief magistrate, of Thebes. Pelopidas was the leader of the Sacred Band, a selected infantry body of 300, which routed a large Spartan force at Tegyra (near Orchomenus, Boeotia) in 375 and distinguished itself in the defeat of Sparta at the decisive battle of Leuctra (371).

In 369, in response to a petition of the Thessalians, an army under Pelopidas checked the ambitions of Alexander, tyrant of Pherae, and drove the forces of the king of Macedonia out of Thessaly. Later Pelopidas was seized by Alexander, and two expeditions from Thebes were needed to win his release. Finally Pelopidas defeated Alexander at Cynoscephalae (364) but was killed in the combat.

Peloponnese, also called PELOPONNESUS, Modern Greek PELOPÓNNISOS, peninsula of 8,278 square miles (21,439 square km), a large, mountainous body of land jutting southward into the Mediterranean that since antiquity has been a major region of Greece, joined to the rest of mainland Greece by the Isthmus of Corinth. The name, which is derived from Pelopos Nisos (Island of Pelops, a legendary hero), does not appear in Homer, who preferred to apply the name of Argos, a Mycenaean city-state, to the whole peninsula. The Mycenaean civilization flourished in the 2nd millennium BC at such centres as Mycenae, Tiryns, and Pylos. The city-state of Sparta was long the major rival of Athens for political and economic dominion over Greece during the classical period, from about the 5th century BC until the Roman conquest in the 2nd century. Under the Byzantine Empire the Peloponnese suffered repeated incursions by warrior tribes from the north. In the 13th century AD it was taken by the Franks, who held it for two centuries until it reverted to the last Byzantine emperors. It was conquered by the Turks in 1460. By the 14th century the Peloponnese was known as the Morea (Mulberry), first applied to Elis, a northwestern mulberry-growing district, and it was the site of the Despotate of Morea. Patras (Pátrai), the major city in modern times, located in the northern Peloponnese, has continued to gain commercial importance since the War of Greek Independence (1821–29). Highways link all the major regions of the Peloponnese, and there is an independent railway network that serves all the districts except Laconia.

Peloponnesian League, also called SPARTAN ALLIANCE, military coalition of Greek city-states led by Sparta, formed in the 6th century BC. League policy, usually decisions on questions of war, peace, or alliance, was determined by federal congresses, summoned by the Spartans when they thought fit; each member state had one vote. The league was a major force in Greek affairs, forming the nucleus of resistance to the Persian invasions (480–479) and fighting against Athens in the Peloponnesian War (431–404). Spartan power declined after the defeat at Leuctra (371), and the league disintegrated in 366–365 BC.

Peloponnesian War (431–404 BC), war fought between the two leading city-states in ancient Greece, Athens and Sparta. Each stood at the head of alliances that, between them, included nearly every Greek city-state. The fighting engulfed virtually the entire Greek world, and it was properly regarded by Thucydides, whose contemporary account of it is considered to be among the world's finest works of history, as the most momentous war up to that time.

A brief treatment of the Peloponnesian War follows. For full treatment, *see* MACROPAEDIA: Greek and Roman Civilizations, Ancient.

The Athenian alliance was, in fact, an empire that included most of the island and coastal states around the northern and eastern shores of the Aegean Sea. Sparta was leader of an alliance of independent states that included most of the major land powers of the Peloponnese and central Greece, as well as the sea power Corinth. Thus, the Athenians had the stronger navy and the Spartans the stronger army. Further, the Athenians were better prepared financially than their enemies, owing to the large war chest they had amassed from the regular tribute they received from their empire.

Athens and Sparta had fought each other before the outbreak of the Great Peloponnesian War (in what is sometimes called the First Peloponnesian War) but had agreed to a truce, called the Thirty Years' Treaty, in 445. In the following years their respective blocs observed an uneasy peace. The events that led to renewed hostilities began in 433, when Athens allied itself with Corcyra, a strategically important colony of Corinth. Fighting ensued, and the Athenians then took steps that explicitly violated the Thirty Years' Treaty. Sparta and its allies accused Athens of aggression and threatened war.

On the advice of Pericles, its most influential leader, Athens refused to back down. Diplomatic efforts to resolve the dispute failed. Finally, in the spring of 431, a Spartan ally, Thebes, attacked an Athenian ally, Plataea, and open war began.

The years of fighting that followed can be divided into two periods, separated by a truce of six years. The first period lasted 10 years and began with the Spartans, under Archidamus, leading an army into Attica, the region around Athens. Pericles declined to engage the superior allied forces and instead urged the Athenians to keep to their city and make full use of their naval superiority by harassing their enemies' coasts and shipping. Within a few months, however, Pericles fell victim to a terrible plague that raged through the crowded city, killing a large part of its army as well as many civilians. Thucydides survived an attack of the plague and left a vivid account of its impact on Athenian morale. In the meantime (430–429), the Spartans attacked Athenian bases in western Greece but were repulsed. The Spartans also suffered reverses at sea. In 428 they tried to aid the island state of Lesbos, a tributary of Athens that was planning to revolt. But the revolt was headed off by the Athenians, who won control of the chief city, Mytilene. Urged on by the demagogue Cleon, the Athenians voted to massacre the men of Mytilene and enslave everyone else, but they relented the next day and killed only the leaders of the revolt. Spartan initiatives during the plague years were all unsuccessful except for the capture of the strategic city Plataea in 427.

In the next few years the Athenians took the offensive. They attacked the Sicilian city Syracuse and campaigned in western Greece and the Peloponnese itself. In 425 the picture was bleak for Sparta, which began to sue for peace. But led by Brasidas, hero of the Battle of Delium, a Spartan force gained important successes in Chalcidice in 424, encouraging Athenian subject states to revolt. In a decisive battle at Amphipolis in 422, both Brasidas and the Athenian leader Cleon were killed. This set the stage for Cleon's rival Nicias to persuade the Athenians to accept the Spartans' offer of peace.

The so-called Peace of Nicias began in 421 and lasted six years. It was a period in which diplomatic maneuvers gradually gave way to small-scale military operations as each city tried to win smaller states over to its side. The uncertain peace was finally shattered when, in 415, the Athenians launched a massive assault against Sicily. The next 11 years made up the war's second period of fighting. The decisive event was the catastrophe suffered by the Athenians in Sicily. Aided by a force of Spartans, Syracuse was able to break an Athenian blockade. Even after gaining reinforcements in 413, the Athenian army was defeated again. Soon afterward the navy was also beaten, and the Athenians were utterly destroyed as they tried to retreat.

By 411 Athens itself was in political turmoil. Democracy was overthrown by the oligarchical party, which was in turn replaced by the more moderate regime of the Five Thousand. At the end of 411 the rebuilt Athenian navy, fresh from several victories, acted to restore democratic rule. However, the democratic leaders refused Spartan peace offerings, and the war continued at sea with the Spartan and Athenian fleets trading costly victories. The end came in 405 when the Athenian navy was destroyed at Aegospotami by the Spartan fleet under Lysander, who had received much aid from the Persians. The next year, starved by an impenetrable blockade, Athens capitulated. Athens' defeat was perhaps the worst casualty in a war that crippled Greek military strength, and thus the most culturally advanced Greek state was brought into final eclipse.

Pelops, legendary founder of the Pelopid dynasty at Mycenae in the Greek Peloponnese, which was probably named for him. Pelops was a grandson of Zeus, the king of the gods. According to many accounts, his father, Tantalus, cooked and served Pelops to the gods at a banquet. Only Demeter, bereaved over the loss of her daughter, failed to recognize him and partook. When the body was ordered by the gods to be restored, the shoulder, Demeter's portion, was missing; the goddess provided a replacement of ivory.

According to Pindar, however, the sea god Poseidon loved Pelops and took him up to heaven; the ghastly feast was merely malicious gossip to account for his disappearance. Pelops, however, had to return to mortal life because his father had abused the favour of heaven by feeding mere mortals with nectar and ambrosia, of which only gods partook. Later, according to Pindar, Pelops strove for the hand of Hippodamia, daughter of King Oenomaus of Pisa in Elis. Oenomaus, who had an incestuous love for his daughter, had previously killed 13 suitors. He challenged Pelops to a chariot chase, with Hippodamia the prize of victory and death the price of defeat. Though Oenomaus' team and chariot were the gift of his father, the god Ares, Pelops' chariot was from Poseidon. Pelops won the bride and killed Oenomaus.

In more hostile versions, Pelops bribed Oenomaus' charioteer, Myrtilus, to remove the linchpins from Oenomaus' chariot. After his victory, for reasons that are given differently in different sources, he threw Myrtilus into the sea that afterward was called the Myrtoan. Myrtilus—or Oenomaus—was said to have uttered the curse that dogged the Pelopid house of Atreus. Preparations for the chariot race are depicted in the east pediment of the Temple of Zeus at Olympia. *See also* Atreus.

pelota (Spanish: "ball"), also called PILOTA, or PELOTE BASQUE, any of a number of glove, racket, or bat court games requiring a rubber-cored ball. These games arose from the old French game known as *jeux de paume.* Varieties of this game are played in many parts of the world.

The variations of pelota can be classified as either *jeux directs*—games in which the players face each other and the pelota is hit freely between opponents—or *jeux indirects*—games in which the ball is hit off a wall. The second class has many variations, including barehand (*main nue*), the most popular. Pelota courts include the one-walled *place libre,* the two- or three-walled *fronton,* and the small, covered court, called the *trinquet.* The surfaces of these courts range from dirt to highly polished cement.

In Spain and elsewhere, pelota is a professional game on which spectators wager. Most popular is the difficult and fast variation of *remonte,* a 35-point game that requires two players on each side and is played with a special *chistera,* a curved glove with a chestnut or ash frame. The *fronton* version of pelota, popular in Spain, Mexico, the Philippines, and parts of the United States, is called jai alai.

Pelota was popular among all social classes by the 16th century but decreased in popularity by the middle of the 18th century, except among the Basques. By the end of the 19th century, the game had spread worldwide. It is widely used as a medium for gambling; amateur play revived at the beginning of the 20th century.

Pelota was played as a demonstration sport in the Olympic Games in 1924. The Federación Internacional de Pelota Vasca, which organizes the world championships, the first of which was played in 1952, was founded in 1925. *See also* jai alai.

Pelotas, coastal city, southeastern Rio Grande do Sul *estado* ("state"), southern Brazil, on the left bank of the Canal de São Gonçalo, the river that connects the Mirim Lagoon with the dos Patos Lagoon. Founded in 1780 as São Francisco de Paula, it was raised to town status and renamed in 1830; it became a city in 1835. Located at 23 feet (7 m) above sea level, it serves with the port of Rio Grande (25 miles [40 km] southeast) as a transfer point for ocean vessels that cannot cross the shallow dos Patos to Pôrto Alegre fully loaded. It is also the chief port for the cattle-ranching area of southern Rio Grande do Sul. Pelotas is Brazil's largest producer of *xarque* (jerked beef) and has meat-packing plants, flour and rice mills, tanneries, and other factories. It is the site of the Sul Riograndense, Rural do Sul, and Católica de Pelotas universities (all established in 1960) and the Universidade Federal de Pelotas (1883). It is easily accessible by road, railway, and air. Pop. (1980 prelim.) 197,092.

Pelotas River, Portuguese RIO PELOTAS, also called ALTO URUGUAI RIVER, river in southern Brazil, rising on the western slope of the Serra do Mar at Alto do Bispo in Santa Catarina state, on the Atlantic coast. It arches northwestward across the uplands for approximately 280 miles (450 km) before receiving the Canoas River and becoming the Uruguay River (*q.v.*) near Marcelino Ramos. It forms much of the border between Santa Catarina and Rio Grande do Sul states and is used for navigation. Heavy snows and rains in the winter cause flooding.

Peltier, Jean-Charles-Athanase (b. Feb. 22, 1785, Ham, Fr.—d. Oct. 27, 1845, Paris), French physicist who discovered (1834) that at the junction of two dissimilar metals, an electric current will produce heat or cold, depending on the direction of current flow. The effect, known by his name, is used in devices for measuring temperature and, with the discovery of new conducting materials, in refrigeration units.

Peltier, detail of a lithograph by Maurin
Giraudon—Art Resource/EB Inc.

A clockmaker, Peltier retired when he was 30 years old to devote his time to scientific investigations. In 1840 he introduced the concept of electrostatic induction, a method of charging a conductor by closely juxtaposing another charged object to attract all charges of one sign and then grounding the conductor to bleed off the other group of charges, leaving a net charge behind. He wrote numerous papers on atmospheric electricity, waterspouts, the boiling point at high elevations, and related phenomena.

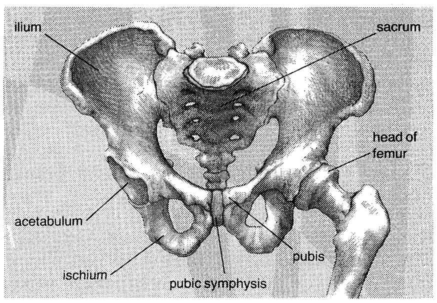
Peltier effect, the cooling of one junction and the heating of the other when electric current is maintained in a circuit of material consisting of two dissimilar conductors; the effect is even stronger in circuits containing dissimilar semiconductors. In a circuit consisting of a battery joined by two pieces of copper wire to a length of bismuth wire, a temperature rise occurs at the junction where the current passes from copper to bismuth, and a temperature drop occurs at the junction where the current passes from bismuth to copper. Discovered (1834) by the French physicist Jean-Charles-Athanase Peltier, this effect was used in the 1960s to produce commercial thermoelectric refrigerators.

Pelucón (member of a Chilean political group): *see* Pipiolo and Pelucón.

Péluse, Gaspard Monge, comte de (count of): *see* Monge, Gaspard.

Pelusium, Greek PELOUSION, ancient Egyptian city on the most easterly mouth of the Nile (long since silted up). It was probably called by the Egyptians Sa'inu and also Per-Amon (House of Amon), whence perhaps the modern name of the site, Tell Farama. It is situated about 20 miles (32 km) southeast of Port Said, in the Sinai Peninsula. The city is referred to in the Bible (Ezekiel 30:15) as "the stronghold of Egypt" (the name being given in the King James Version as Sin, transliterated from the Hebrew). In the 26th and later Egyptian dynasties, Pelusium was the main frontier fortress against Palestine and was a customs post for Asiatic goods. In 525 BC the Persians, under Cambyses II, defeated the Saite pharaoh Psamtik III there. During the periods of Egyptian independence from Persia (28th–29th dynasty) it was a vital defensive centre. In Roman times it was a station on the route to the Red Sea. The site's ruins date from the Roman period.

pelvic girdle, also called BONY PELVIS, in human anatomy, basin-shaped complex of bones that connects the trunk and legs, supports and balances the trunk, and contains and supports the intestines, urinary bladder, and internal



Front view of female pelvic girdle

sex organs. The pelvic girdle consists of paired hipbones, connected in front at the pubic symphysis and behind by the sacrum; each is made up of three bones—the blade-shaped ilium, above and to either side, which accounts for the width of the hips; the ischium, behind and below, on which the weight falls in sitting; and the pubis, in front. All three unite in early adulthood at a triangular suture in the acetabulum, the cup-shaped socket that forms the hip joint with the head of the femur (thighbone). The ring made by the pelvic girdle functions as the birth canal in females. The pelvis provides attachment for muscles that balance and support the trunk and move the legs, hips, and trunk. In the infant the pelvis is narrow and nonsupportive. As the child begins walking, the pelvis broadens and tilts, the sacrum descends deeper into its articulation with the ilia, and the lumbar curve develops.

In the semierect apes, the centre of gravity falls near the shoulder, and the abdominal organs depend from the vertebral column. The ilium is elongated and somewhat spoon-shaped, and the pelvis is oriented horizontally. In a human being, when standing erect, the centre of gravity falls over the centre of the body, and the weight is transmitted via the pelvis from the backbone to the thighbone, knee, and foot. Morphological differences from apes include the following: the ilium is broadened backward in a fan shape, developing a deep sciatic notch posteriorly; a strut of bone, the arcuate eminence, has developed on the ilium diagonal from the hip joint (concerned with lateral balance in upright posture); the anterior superior iliac spine, on the upper front edge of the iliac blade, is closer to the hip joint; and the ischium is shorter. The pelvis of *Australopithecus africanus*, which lived more than 2,000,000 years ago, is clearly hominid. *Homo erectus* and all later fossil hominids, including Neanderthal man, had fully modern pelvises.

Sex differences in the pelvis are marked and reflect the necessity in the female of providing an adequate birth canal for a large-headed fetus. In comparison with the male pelvis, the female basin is broader and shallower; the birth canal rounded and capacious; the sciatic notch wide and U-shaped; the pubic symphysis short, with the pubic bones forming a broad angle with each other; the sacrum short, broad, and only moderately curved; the coccyx movable; and the acetabula farther apart. These differences reach their adult proportions only at puberty. Wear patterns on the pubic symphyses may be used to estimate age at death in males and females.

pelvic inflammatory disease (PID), general, acute inflammation of the pelvic cavity in women, caused by a bacterial infection of the uterus, the Fallopian tubes, or other structures in the upper reproductive tract. Such bacterial infections can be sexually transmitted and often occur secondary to infection with chlamydia or gonorrhea. Women who use oral contraceptives are somewhat more likely to contract PID. The infective bacteria can also gain entry to the uterus after childbirth or through use of an intrauterine device (IUD). The symptoms of PID are similar to and may be mistaken for those of gonorrhea. They include pain in the abdomen and lower pelvis, chills, nausea, fever, and a thick and peculiarly odorous vaginal discharge. Treatment of PID consists of intensive antibiotic therapy to fight the infection, along with bed rest, pain-killing medications, and abstention from sexual intercourse until the infection disappears.

Pematangsiantar, city, Sumatera Utara *propinsi* (North Sumatra province), Sumatra, Indonesia. It lies about 50 miles (80 km) southeast of Medan, the provincial capital, with which it is connected by a major road and railway. The second most populous city in the province, after Medan, Pematangsiantar is inhabited mainly by Batak; there are also Chinese and Indians who are mostly traders, merchants, and businessmen. Located in the midst of rubber and palm plantations, it is a centre of trade and transshipment for rubber, tobacco, tea, natural fibres, palm oil, and rice. Industries include food processing, soap and oil production, and rice milling. Wood carving, gold and silver filigree work, handloom weaving, and plaiting are among the crafts. The Universitas H.K.B.P. Nomensen (private) is located in Pematangsiantar. There is also the Simalungun Museum and a zoo. Pop. (1980) 150,376.

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Pemba Island, Arabic JAZĪRAT AL-KHUḌRAH, island in the Indian Ocean, lying 35 miles (56 km) off the coast of East Africa, opposite the port of Tanga, Tanzania. The island embraces 380 square miles (984 square km) and is 42 miles (67 km) long and 14 miles (22 km) wide. As the Arabic name, which means Green Island, suggests, it is more fertile than its sister island, Zanzibar, which lies 30 miles (48 km) to the southwest. Pemba is the world's leading producer of cloves. As in Zanzibar, the population and culture of the island have been greatly influenced by infusions of peoples from mainland Africa, the Middle East, and the Indian subcontinent. The administrative headquarters is at Wete on the western side of the island. Pop. (1978 prelim.) 205,870.

Pemberton, John Clifford (b. Aug. 10, 1814, Philadelphia—d. July 13, 1881, Penllyn, Pa.), Confederate general during the American Civil War, remembered for his tenacious but ultimately unsuccessful defense of Vicksburg.

Pemberton grew up and was educated in

Philadelphia, entered West Point in 1833, and graduated four years later. He fought in the Mexican War and was cited for bravery while participating in many of the crucial battles of 1846 and 1847.

Upon the outbreak of the American Civil War, Pemberton resigned his commission on April 24, 1861, and went to Richmond to offer his services to the Confederacy. Made a lieutenant colonel on April 28, 1861, Pemberton began organizing the cavalry and artillery in Virginia. On May 8 he was promoted to colonel and on June 17 to brigadier general; on Feb. 13, 1862, he became a major general in command of South Carolina, Georgia, and Florida. In October 1862 Pemberton was made lieutenant general and given command over Mississippi, Tennessee, and eastern Louisiana.

Ordered by President Jefferson Davis to hold Vicksburg at all costs, Pemberton conducted a stubborn defense despite his lack of adequate food, ammunition, and manpower. General Ulysses S. Grant laid siege on both land and water, and by early July 1863 the Confederate defenders were suffering from starvation and exhaustion. On July 4 Pemberton accepted Grant's terms for unconditional surrender. Shortly thereafter he resigned his commission as lieutenant general and served out the balance of the war as an ordnance inspector with the rank of colonel.

After Appomattox, Pemberton retired to a farm near Warrenton, Va. In 1876 he moved to Philadelphia.

Pembroke, Welsh PENFRO, town, seat of South Pembrokeshire district, Dyfed county, Wales, comprising the localities of Pembroke and Pembroke Dock on the south shore of the Milford Haven inlet.

The older locality, Pembroke, incorporated in 1090 by royal charter, was a walled town built along a narrow limestone ridge, at the west end of which the castle, dominating the Haven, was the seat of the earls of Pembroke in the 12th and 13th centuries. St. Mary's Church was founded in 1260, and nearby are the ruins of a Benedictine priory established in 1098: its church was fully restored in 1882. Pembroke is now mainly a small market town and tourist centre. Pembroke Dock grew up around a naval dockyard that opened in 1814 (closed 1926). Pop. (1981) 15,576.

Pembroke, EARLS OF, titled English nobility of several creations, most notably in the families FitzGilbert, Marshal, and Herbert, grouped below chronologically and indicated by the symbol •.

• Pembroke, Richard FitzGilbert, 2nd Earl of, byname RICHARD STRONGBOW, also called RICHARD DE CLARE (b. *c.* 1130—d. April 20, 1176, Dublin, Ire.), Anglo-Norman lord whose invasion of Ireland in 1170 initiated the opening phase of the English conquest.

The son of Gilbert FitzGilbert, 1st Earl of Pembroke, he succeeded to his father's estates in southern Wales in 1148/49. Pembroke had evidently lost these lands by 1168; it was probably in that year that he agreed to aid Dermot MacMurrough, king of Leinster, who had been expelled from his kingdom by Roderic (Rory O'Connor), high king of Ireland. King Henry II of England (reigned 1154–89) granted Pembroke permission to invade Ireland, and on Aug. 23, 1170, the earl landed near Waterford. Waterford and Dublin quickly fell to the Normans. After the death of MacMurrough in May 1171, Pembroke was besieged in Dublin by Roderic, but in September his forces broke out and routed Roderic's army. In order to prevent Pembroke from setting himself up as an independent ruler, Henry II had him acknowledge royal authority over his conquests in Leinster. Pembroke helped the king suppress a rebellion in Normandy in 1173–74, and in return Henry granted him custody of Wexford, Waterford, and Dublin. By the time Pembroke died, all Ireland had been committed to his care, but within Ireland his supremacy was recognized only in Leinster.

His son Gilbert de Striguil (or Strigoil) died unmarried, certainly before 1189, and as a minor was never styled earl. The earldom passed with Richard's daughter Isabel (d. 1220) to her husband William Marshal, the 1st Earl of Pembroke in the Marshal line.

• Pembroke, William Marshal, 1st Earl of, also called WILLIAM THE MARSHAL (b. *c.* 1146—d. May 14, 1219, Caversham, Berkshire, Eng.), marshal and then regent of England who served four English monarchs as a royal adviser and agent and as a warrior of outstanding prowess.

Marshal's father, John (FitzGilbert) the Marshal (d. 1165), fought for the empress Matilda (widow of the German emperor Henry V and daughter of Henry I of England) in her unsuccessful struggle to gain the throne of her cousin King Stephen (reigned 1135–54). After proving his bravery in warfare and in tournaments, Marshal became a guardian (1170) to Prince Henry, eldest son of King Henry II (reigned 1154–89). In 1187, four years after the prince's death, Marshal reentered Henry II's service and fought beside him in France until the king died in 1189.

Upon the accession of Henry's third son, Richard I the Lion-Heart (reigned 1189–99), Marshal married Isabel, the heiress of Richard FitzGilbert (or de Clare), Earl of Pembroke, thereby acquiring vast estates in England, Normandy, Wales, and Ireland. Richard set forth on a crusade in 1190, leaving William Longchamp in charge of the kingdom. In the following year Pembroke joined the opposition that drove Longchamp into exile. While Richard was held captive in Germany (1192–94), Pembroke struggled to prevent the king's brother, John, from seizing power in England.

Upon the death of Richard I in 1199, Pembroke helped John succeed peacefully to the throne; he was formally recognized as Earl of Pembroke. By 1213 he had become the king's closest adviser, and he remained loyal to John during the disputes with the barons that led to the signing of the charter of liberties known as Magna Carta (June 1215). John died during the ensuing civil war with the barons, who had invited Louis of France (later King Louis VIII) to be their king. Designated *rector regis et regni* ("governor of the king and of the kingdom") for John's son, King Henry III, Pembroke defeated the English barons and French invaders and in September 1217 concluded a treaty with Louis that wisely granted amnesty to the rebellious barons.

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• Pembroke, Jasper Tudor, Earl of: *see* Bedford, Jasper Tudor, Duke of.

• Pembroke, William Herbert, 1st Earl of, BARON HERBERT OF CARDIFF, also called (until 1551) SIR WILLIAM HERBERT (b. *c.* 1506—d. March 17, 1570, Hampton Court, near London, Eng.), the Earl of Pembroke of the second Herbert creation, a leading figure in the reigns of Edward VI, Mary I, and Elizabeth I of England. His father, Sir Richard Herbert, was an illegitimate son of William, the 1st Earl of Pembroke of the first creation. Sir William's first wife, Anne Parr, was a sister of Catherine Parr, who married Henry VIII in 1543.

In January 1544 Sir William was granted the rich estates formerly belonging to Wilton Abbey. Appointed a governor to the young king Edward VI, Sir William helped to suppress the rebellion in Wiltshire, Devon, and Cornwall in 1549. In October 1551 he was created Baron Herbert of Cardiff and Earl of Pembroke. After Edward VI's death he did homage to Lady Jane Grey but withdrew his allegiance in time to attend the proclamation of Mary I in London. Mary made him a privy councillor, and he led her troops against the rebel Sir Thomas Wyat early in 1554.

On the accession of Queen Elizabeth I, Pembroke continued as a member of the privy council, and, from 1568 until his death, he served as steward of the royal household. Imprisoned in September 1569 for having favoured a proposed marriage between Mary Stuart and Thomas Howard, 4th Duke of Norfolk, he was released shortly afterward. He was succeeded by his son Henry, the 2nd earl (*c.* 1538–1601).

Pembroke, Mary Herbert, Countess of, *née* MARY SIDNEY (b. Oct. 27, 1561, near Bewdley, Worcestershire, Eng.—d. Sept. 25, 1621, London), patroness of the arts and scholarship and a notable translator. She was the sister of Sir Philip Sidney, who dedicated to her his *Arcadia.* After his death she published it and completed his verse translation of the Psalms.

In 1575 Queen Elizabeth I invited Mary to court, promising "a speciall care" of her. Two years later Mary wed Henry Herbert, 2nd Earl of Pembroke, and lived mainly at Wilton House, near Salisbury, Wiltshire. Their sons, William and Philip, were the "incomparable pair of brethren" to whom William Shakespeare's First Folio (1623) was dedicated.

Among those who praised her for her patronage of poetry was Edmund Spenser, who dedicated his *Ruines of Time* to her, and Michael Drayton, Samuel Daniel, and John Davies. A lutanist, she inspired Thomas Morley's dedication of *Canzonets* (1593); and, in his dedication to her of *Pilgrimage to Paradise* (1592), Nicholas Breton likened her to the Duchess of Urbino, patroness in an earlier time to Baldassare Castiglione. Lady Pembroke ranked after the queen as the most admired of Elizabethan *femmes savantes.*

Lady Pembroke translated Robert Garnier's tragedy *Marc-Antoine* and Philippe Duplessis-Mornay's *Discours de la vie et de la mort* (both 1592) and elegantly rendered Petrarch's *Trionfo della morte* into terza rima.

Pembroke table, light, drop-leaf table designed for occasional use, probably deriving its name from Henry Herbert, 9th Earl of Pembroke (1693–1751), a noted connoisseur and amateur architect. The table has two drawers and flaps on either side that can be raised by brackets on hinges (known as "elbows") to increase its size. Usually provided with casters (it was often used for bedside meals), the legs of the common English versions, as illustrated by Thomas Sheraton and others, are X-shaped.

Pembroke table, satinwood painted in grisaille, English, 1792; in the Victoria and Albert Museum, London

By courtesy of the Board of Trustees of the Victoria and Albert Museum, London

In the United States a distinctive type of support, shaped like a lyre, became popular toward the end of the century. It is also known as a flap and elbow table.

Pembrokeshire, also called PEMBROKE, Welsh PENFRO, former county and historic region of south Wales, once bounded on the northeast by Cardiganshire, on the east by Carmarthenshire, on the south by Bristol Channel, and on the west and northwest by St. Bride's Bay and Cardigan Bay of St. George's Channel. It covered an area of 614 square miles (1,590 square km). With the reorganization of 1974, Pembrokeshire became a part of Dyfed county.

The outstanding feature of the early history of Pembrokeshire is its importance in Megalithic times. The northwestern section of the region (including the southern slopes of the Prescelly Hills) is especially rich in Megalithic remains—dolmens, alignments, standing stones, and stone circles.

In ancient times Pembrokeshire was known to the Welsh as Dyfed. In 877 Dyfed fell nominally under the sway of the princes of south Wales, but the coast towns fell prey to Scandinavian pirates; a large number of Scandinavian place-names are found along the coast. With the building of Pembroke Castle (1090), the Normans began to spread over southern Dyfed. Flemish settlers were established in the region during the 12th century, and, as a result, the south was better populated than the north and maintained a closer contact with the affairs of the English; the south was also the Norman stronghold and has long been famous for its medieval castles. The earldom of Pembroke was formally established as a shire by Henry VIII in 1536, and English law was imposed from 1542.

Pembrokeshire, South (Wales): *see* South Pembrokeshire.

pemphigus, a group of diseases characterized by the development of large water blisters on otherwise normal-appearing skin or mucous surfaces. The blisters may first appear on skin surfaces prone to frictional contact, such as the groin, armpits, and palms, or may erupt generally over the body. Microscopically, the condition is characterized by a degeneration of the intercellular bridges of the cells of the epidermis, the outermost nonvascular layer of the skin, resulting in a separation and destruction of skin cells. The clefts and splits within the degenerating skin layer form blisters filled with a serumlike fluid containing fragments of dead cells. These blisters eventually burst, leaving denuded and eroded skin areas.

There are several clinical variants of pemphigus. The most common form of pemphigus is pemphigus vulgaris; others are pemphigus erythematosus and pemphigus foliaceus. In pemphigus vulgaris, cell destruction occurs just above the base of the epidermis, whereas in pemphigus erythematosus and pemphigus foliaceus, usually more benign types, this process occurs higher up within the epidermis.

Pemphigus was formerly fatal within a few months or years of onset because of secondary bacterial infection of the blisters and the loss of body fluids and proteins through denuded skin areas. The disease can now be relieved with the administration of corticoids or other suitable hormones. The cause of pemphigus has not yet been established, but evidence thus far suggests a virus.

pen, tool for writing or drawing with a coloured fluid, such as ink. The earliest ancestor of the pen probably was the brush used for writing by the Chinese by the 1st millennium BC. The early Egyptians employed thick reeds for penlike implements about 300 BC. A specific allusion to the quill pen occurs in the 7th-century writings of St. Isodore of Seville, but such pens made of bird feathers were probably in use at an even earlier date. They provided a degree of writing ease and control never realized before and were used in Europe until the mid-19th century, when metallic pens and pen nibs (writing points) largely supplanted them. Such devices were known in classical times but little used (a bronze pen was found in the ruins of Pompeii). John Mitchell of Birmingham, Eng., is credited with having introduced the machine-made steel pen point in 1828. Two years later the English inventor James Perry sought to produce more flexible steel points by cutting a centre hole at the top of a central slit and then making additional slits on either side.

The inconvenience of having to continually dip a pen to replenish its ink supply stimulated the development of the fountain pen, a type of pen in which ink is held in a reservoir and passes to the writing point through capillary channels. The first practical version of the fountain pen was produced in 1884 by the American inventor L.E. Waterman.

Ball-point pens date from the late 19th century. Commercial models appeared in 1895, but the first satisfactory model was patented by Lazlo Biro, a Hungarian living in Argentina. His ball-point pen, commonly called the "biro," became popular in Great Britain during the late 1930s, and by the mid-1940s pens of this type were widely used throughout much of the world. The writing tip of a ball-point pen consists of a metal ball, housed in a socket, that rotates freely and rolls quick-drying ink onto the writing surface. The ball is constantly bathed in ink from a reservoir, one end of which is open and attached to the writing tip.

Soft-tip pens that use points made of porous materials became commercially available during the 1960s. In such pens a synthetic polymer of controlled porosity transfers ink from the reservoir to the writing surface. These fibre-tipped pens can be used for lettering and drawing as well as for writing and may be employed on surfaces such as plastic and glass.

PEN, International, international organization of writers. The original PEN was founded in London in 1921 by the English novelist John Galsworthy, and it has since grown to include writers worldwide. The name PEN is an acronym standing for "poets, playwrights, editors, essayists, and novelists." International PEN promotes international intellectual exchanges and goodwill among writers. It promotes freedom of expression for all writers regardless of their nationality, race, or religion, or of the political system under which they live. PEN is especially active in defending and supporting writers who are being harassed, persecuted, or oppressed by their government. The organization also bestows literary awards, sponsors translations of works written in obscure or neglected languages, holds conferences on current politico-literary topics, and publishes pamphlets and newsletters. To become a member of PEN an author must usually have published at least two books, one of which shows considerable literary distinction. PEN is headquartered in London, and there are more than 80 PEN Centres (branch organizations) situated in a total of about 60 countries worldwide.

Pen-ch'i (China): *see* Pen-hsi.

pen drawing, artwork executed wholly or in part with pen and ink, usually on paper. Pen drawing is fundamentally a linear method of making images. In pure pen drawing in which the artist wishes to supplement his outlines with tonal suggestions of three-dimensional form, modeling must necessarily be effected by the close juxtaposition of a series of strokes forming areas of hatching or cross-hatching. Many pen studies, however, are produced with the substitution of tonal washes (layers of colour spread over a broad surface) laid onto the drawing with a brush, in which case the outlines or other important definitions of the figures or landscape are established by the pen lines. *See* wash drawing.

Inks of various types used in pen studies contribute additional diversity to the final effects. Historically, three types of ink were most frequently used. One was black carbon ink, made from extremely fine particles of the soot of burnt oils or resins in a solution of glue or gum arabic. The finest type of black carbon ink was known as Chinese ink and was the prototype of the modern black India ink. A brown ink popular with the old masters because of its warm, luminous colour qualities was known as bistre. It was prepared by boiling wood soot to obtain a liquid, transparent brown extract. The third important ink was an iron gall, or chemical, ink. Its principal ingredients were iron sulfate, the extract of gall nuts, and a gum arabic solution. It was, in fact, the common writing ink for centuries and was employed for most early drawings. Its colour when first applied to the paper is bluish black, but it rapidly turns blackish and, over the years, a dull brown.

Pens are the oldest and most popular of all the drawing media of the Western artist, in part because of the variety of linear effects provided by the three basic types of pens and their adaptability to the changing styles of draftsmanship over many centuries. These three basic types are quill pens, cut from the wing feathers of fowls and birds; reed pens, formed and trimmed from stems of bamboo-like grasses; and metal pens, fabricated from various metals, especially fine steel. The outstanding master of the reed pen, the Dutch artist Rembrandt, used it often in combination with the quill pen and washes to produce the richly suggestive atmospheric illusionism of his works. The reed pen never had the widespread popularity of quill or metal pens, but for special effects it has served artists admirably; for example, the 19th-century Dutch artist Vincent van Gogh in his last years used it in his drawings to produce the blunt, powerful strokes that were counterparts of the heavy brush strokes typical of many of his canvases.

Until the acceptance of the modern steel pen,

"View of Arles," reed pen drawing by Vincent van Gogh, 1888–89; in the Museum Boymans-van Beuningen, Rotterdam most Western master draftsmen used quill pens. During the Middle Ages the quill pen was used for the fine delineations of images in manuscripts; its nibs, which can be sharpened to extreme fineness, permit the craftsman to create small linear figures or ornamental decorations on the pages or along the borders of the parchment leaves. This characteristic, combined with the flexibility of the quill point, which responds to pressure for varying the widths of lines or forming accents, made it adaptable to the diverse personal styles of draftsmen from the 15th to the end of the 19th century.

The development of excellent steel pens by the Englishman James Perry in the 1830s and the mass production by stamping pens from steel blanks led to the metal pen's supplanting the quill. Nevertheless, artists only reluctantly adopted the steel pen, and most drawings in pen and ink done before the 20th century were still produced with quills. The steel pen is now used for drawing almost exclusively and is available in many shapes, sizes, and degrees of stiffness or flexibility. It has become standard studio equipment of the illustrator, cartoonist, and designer. Pen drawings by such outstanding painters and sculptors as Pablo Picasso, Henri Matisse, and Henry Moore demonstrate the virtue of the steel pen in producing the sharp linear definitions generally preferred by modern masters.

Pen-hsi, also spelled PEN-CH'I, Pinyin BENXI, or BENQI, city in Liaoning *sheng* (province), China. It is situated some 45 miles (70 km) southeast of Shen-yang (Mukden) on the T'ai-tzu River.

From the time of the Liao dynasty (907–1125) it was the centre of a small-scale iron industry, and coal began to be mined in the late 18th century. The startling modern growth of Pen-hsi began with the establishment in 1905 of the Pen-hsi Coal Mining Company with joint Chinese and Japanese capital. In 1911 the company began iron smelting and changed its name to the Pen-hsi Coal and Iron Company. It was efficiently managed and remained important but gradually became dominated by Japanese interests.

After the establishment of the Japanese puppet state of Manchukuo (formerly Chinese Manchuria) in 1932 and the formulation of the Manchurian Industrial Development Plan in 1936, the Manchukuo government developed Pen-hsi's iron and steel production. Much of the iron from Pen-hsi had low phosphorus and sulfur content and was in demand for the munitions industry. The city's works also began to produce special steels for the Japanese navy.

In 1945–46 the occupying Soviet forces dismantled most of the equipment, but the plant was restored by 1950, and during the early 1950s much new equipment was installed by Soviet technicians. By 1957 Pen-hsi's iron production had reached the World War II level, and new local sources of ore were being exploited. The iron industry is closely integrated with the large iron and steel complex at An-shan, to which much of Pen-hsi's pig iron production is transported. Since 1958 the steel output of Pen-hsi has been greatly increased. Pen-hsi also has large cement, chemical, and nonferrous alloy manufacturing industries. It also has thermal power stations. It is connected by rail with Shen-yang, An-shan, and Lü-ta. Pop. (1988 est.) 725,600.

penal colony, distant or overseas settlement established for punishing criminals by forced labour and isolation from society. Although a score of nations in Europe and Latin America transported their criminals to widely scattered penal colonies, such colonies were developed mostly by the English, French, and Russians. England shipped criminals to America until the American Revolution and to Australia into the middle of the 19th century. France established penal colonies in Africa, New Caledonia, and French Guiana (of which those in the latter, including Devil's Island, were still operating during World War II). French Guiana epitomized the worst features of penal colonies: harsh punishments and the underfeeding of prisoners assigned to hard labour were routine. The Siberian colonies maintained by the Soviet Union were initially organized under the tsars but were most widely employed from the Russian Revolution through the Stalin era. Governments have since turned to alternative means of crime control, and most penal colonies have been abolished. *See also* exile and banishment.

Penal Laws, laws passed against Roman Catholics in Britain and Ireland after the Reformation that penalized the practice of the Roman Catholic religion and imposed civil disabilities on Catholics. Various acts passed in the 16th and 17th centuries prescribed fines and imprisonment for participation in Catholic worship and severe penalties, including death, for Catholic priests who practiced their ministry in Britain or Ireland. Other laws barred Catholics from voting, holding public office, owning land, bringing religious items from Rome into Britain, publishing or selling Catholic primers, or teaching.

Sporadically enforced in the 17th century and largely ignored in the 18th, the Penal Laws were almost completely nullified by the Roman Catholic Relief Act (1791), the Catholic Emancipation Act (1829), the Roman Catholic Charities Act (1832), and the Roman Catholic Relief Act (1926). *See* Catholic Emancipation.

penal science: *see* penology.

Penang, also called PENANG ISLAND, Malay PINANG, or PULAU PINANG, island of Malaysia, lying off the northwest coast of peninsular Malaya, from which it is separated by a strait whose smallest width is 2.5 miles (4 km). Its area is about 113 square miles (293 square km). Penang Island is roughly oval, with a granitic, mountainous interior (highest point 2,428 feet [740 m]) and narrow coastal plains, most extensive in the northeast, where Malaysia's chief port, George Town, uses the sheltered harbourage of the strait. Long one of Asia's busiest shipping centres, Penang in the late 20th century became Malaysia's prime tourist centre, with luxury and tourist resort hotels mainly on the north coast at Batu Feringgi.

The island's strategic location in the northern part of the Strait of Malacca led Captain Francis Light of Britain's East India Company to found a British colony there in 1786. The British occupation was made legal in 1791 by a treaty with the sultan of Kedah; the adjacent mainland area was added in 1800. In 1826 Penang combined with Malacca and Singapore to form the Straits Settlements (*q.v.*). In the beginning, the island (called Prince of Wales Island until after 1867) was virtually uninhabited and had excellent shelter and water for sailing vessels plying the India-China run. It quickly attracted a cosmopolitan population of Chinese, Indians, Sumatrans, and Burmans and rapidly surpassed any other trading post in western Malaya. From the mid-19th century Penang became a market and point of transit for the valuable tin and rubber of the mainland. Although the countryside contined to be Malay, Malay influence, tradition, and economic life almost disappeared from the urban and port areas, where Penang became predominantly Chinese by race and European in manner and economic outlook. In 1948 the island became part of the Federation of Malaya, later Malaysia.

The island's rural population grows rice, vegetables, and fruit. During the alternating seasons of northeast and southwest winds, the incidence of rain is affected by the "shadow" of the hilly interior. In George Town the rainfall averages 105 inches (2,700 mm) annually with maxima in October and May, no month having less than 3 inches (76 mm). Mean monthly temperatures at the coast are 80° F (27° C). A coast road encircles the island. From the mainland the island can be reached either by ferry or by a modern bridge, some 5.2 miles (8.4 km) in length, connecting Perai on the mainland to Glugo. There is an international airport in the southeast corner of Penang near the town of Bayan Lepas. Pop. (1980 prelim.) 467,042.

Penates, formally DI PENATES, household gods of the Romans and other Latin peoples. In the narrow sense, they were gods of the *penus* ("storeroom"), but by extension their protection reached the entire household. They are associated with other deities of the house, such as Vesta, and the name was sometimes used interchangeably with that of the Lares, any of various tutelary deities. The Penates are all or some specific group of deities with household connections, but their number and precise identity were a puzzle even to the ancients.

The Penates were worshiped privately as protectors of the individual household and also publicly as protectors of the Roman state. Each house had a shrine with images of them that were worshiped at the family meal and on special occasions. Offerings were of portions of the regular meal or of special cakes, wine, honey, incense, and, more rarely, a blood sacrifice. The state as a whole worshiped the Penates Publici. This state cult occupied a significant role as a focal point of Roman patriotism and nationalism.

pencil, slender rod of a solid marking substance, such as graphite, enclosed in a cylinder of wood, metal, or plastic; used as an implement for writing, drawing, or marking. In 1565 the German-Swiss naturalist Conrad Gesner first described a writing instrument in which graphite, then thought to be a type of lead, was inserted into a wooden holder. Gesner was the first to describe graphite as a separate mineral, and in 1779 the Swedish chemist Carl Wilhelm Scheele showed it to be a form of carbon. The name graphite is from the Greek *graphein,* "to write." The modern lead pencil became possible when an unusually pure deposit of graphite was discovered in 1564 in Borrowdale, Cumberland, Eng.

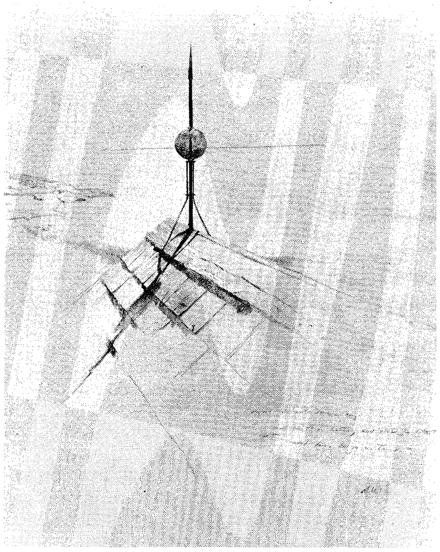
The hardness of writing pencils, which is related to the proportion of clay (used as a binder) to graphite in the lead, is usually designated by numbers from one, the softest, to four, the hardest. Artists' drawing pencils range in a hardness designation generally given from 8B, the softest, to F, the hardest. The designation of the hardness of drafting pencils ranges from HB, the softest, to 10H, the hardest.

The darkness of a pencil mark depends on the number of small particles of graphite deposited by the pencil. The particles are equally black regardless of the hardness of the lead; only the size and number of particles determine the apparent degree of blackness of the pencil mark. The degree of hardness of a lead is a measure of how much the lead resists abrasion by the fibres of the paper.

pencil cedar: *see* eastern red cedar.

pencil drawing, drawing executed with an instrument composed of graphite enclosed in a wood casing and intended either as a sketch for a more elaborate work in another medium, an exercise in visual expression, or a finished work. The cylindrical graphite pencil, because of its usefulness in easily producing linear gray-black strokes, became the successor of the older, metallic drawing stylus, with which late medieval and Renaissance artists and tradesmen sketched or wrote on paper, parchment, or wood.

Although graphite was mined in the 16th century, the use by artists of pieces of natural graphite, inserted in a *porte-crayon* ("pen-



"Lightning Rod," pencil on white paper by Andrew Wyeth; in a private collection

cil holder"), is not known before the 17th century. Then minor graphite details were included in sketches, notably in landscape renderings by Dutch artists. During that century and most of the 18th, graphite was used to make preliminary sketch lines for drawings to be completed in other media, but drawings completely finished with graphite were rare.

Although pencil drawings were much less commonly produced by artists of those centuries than sketches in chalks, charcoal, and pen and ink, the use of graphite gradually increased among painters, miniaturists, architects, and designers. By the late 18th century, an ancestor of the modern pencil was constructed in the form of a rod of natural graphite fitted into a hollow cylinder of wood. Not until 1795, however, did the French inventor Nicolas-Jacques Conté devise a method of producing pencil rods from mixtures of graphite and clays, a true prototype of the modern graphite pencil. Conté's technical improvement made possible the production of fine pencils the strokes of which could be controlled, varying from type to type in softness and hardness, darkness and lightness. These excellent quality graphite pencils encouraged wider use by 19th-century artists, and pencil drawing became commonly used for studies and preliminary sketches. The graphite pencil could be used on almost any type of drawing surface, a fact that helped make it indispensable in the artist's studio.

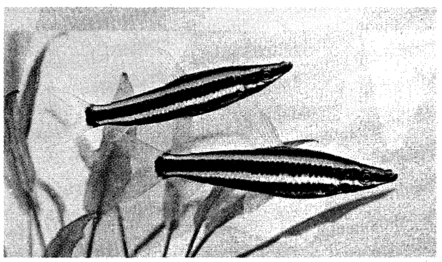
Although graphite pencils provided a substantial range of light-dark effects and the opportunity for tonal modeling, the greatest masters of pencil drawing always kept the elements of a simple linearism or limited shading that were appropriate to pencil drawing. This concept of pencil drawing contrasted with that sometimes employed in the 18th and 19th centuries in which extensive tonal modeling of three-dimensional forms and elaborate effects of light and shade were produced by artists and miniaturists by rubbing the soft graphite particles with a stump, a tightly rolled piece of soft paper or chamois.

The preciseness and clarity associated with the use of a moderately hard graphite pencil were developed in the highly selective draftsmanship of the 19th-century French Neoclassicist Jean-Auguste-Dominique Ingres. His figure sketches and portrait studies were the epitome of pencil drawing in which lucid contours and limited shading combined to create a spirit of elegance and restraint. Many artists throughout Europe accepted this manner, including such German draftsmen as Adrian Ludwig Richter, who preferred the hardest of pencils and sharpest of points to produce wirelike delineations of figures and landscapes. Softer and darker graphite pencils offered appropriate effects to artists whose tastes required more freedom and spontaneity. The sketches of the Romantic artist Eugène Delacroix, created swiftly and filled with flamboyant and undetailed strokes, had a suggestiveness of dramatic figures and compositions. Vincent van Gogh chose a broad carpenter's pencil for powerful, blunt strokes.

One of the most sensitive users of the graphite pencil in the 19th century was the French artist Edgar Degas. A master pastelist and draftsman with coloured chalks and charcoal, Degas created pencil drawings of warmth and charm that were quite unlike the cool, classic works of Ingres or the highly animated, sometimes violent sketches of Delacroix. Degas, with high selectivity, combined graciously fluid outlines with soft, limpid tonal shadings.

Artists of the 20th century continue to use the graphite pencil as a device for autonomous artworks as well as for sketching and for making preliminary rehearsals of conceptions later carried out in painting or sculpture—*e.g.*, Henri Matisse, Amedeo Modigliani, Pablo Picasso, and others whose taste for basically linear conceptions is revealed in their graphic works.

pencil fish, any of several slender South American fishes belonging to three groups of



Pencil fish (*Anostomus anostomus*)
Gene Wolfsheimer

characins, treated by some authorities as three separate families and by others as a single family, Characidae. Pencil fish pick animal food from the bottom or from plant surfaces. Most species inhabit slow-moving water and all live in fresh water. Some habitually swim at an angle, tail down, others horizontally, and still others tail up.

The larger pencil fish grow to somewhat over 20 cm (8 inches) long and include well-known aquarium fishes as *Anostomus anostomus* (family Anostomidae) and various species of *Hemiodus* (family Hemiodontidae). Several species of pygmy pencil fish belong to the genus *Nannostomus* (family Lebiasinidae) and reach a length of 2.5 to 4 cm (1 to 2 inches). *N. eques, N. beckfordi,* and *N. marginatus* are common aquarium species.

Pend Oreille Lake, lake in Kaniksu National Forest, northwestern Idaho, U.S. The largest lake in Idaho, it is about 40 miles (65 km) long and 4 miles (6.5 km) wide and covers an area of 125 square miles (325 square km); it is about 2,500 feet (760 m) deep and is noted for the highly prized Kamloops rainbow trout. The lake (the name of which is derived from the French name [Pend d'Oreille] for the Kalispel Indians, who wore ear pendants) receives the Clark Fork River, which becomes the Pend Oreille River when it leaves the lake.

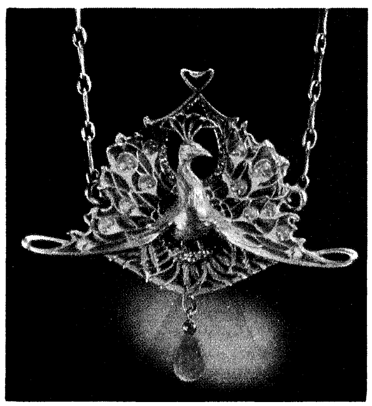
Penda (d. Nov. 15, 654), Anglo-Saxon king of Mercia from about 632 until 654, who made Mercia one of the most powerful kingdoms in England and temporarily delayed the rise of Northumbria.

In 628 Penda defeated a West Saxon people known as the Hwicce at the Battle of Cirencester (in present-day Gloucestershire) and annexed their territory. He and King Cadwallon of Gwynedd (in northern Wales) invaded Northumbria in 632 and defeated and killed the Northumbrian king Edwin. That victory carried Penda into the Mercian kingship, but in 633 he was forced to recognize Northumbrian overlordship. Penda did not recover his independence until 641, when his army killed King Oswald of Northumbria. He then proceeded to extend his power over an area corresponding to modern Cheshire, Shropshire, and Hereford and Worcester. His son Peada had been made subking of Middle Anglia by 653. East Anglia was subjugated, and King Cenwalh was driven from Wessex for three years (645–648). In 654 Penda invaded Northumbria with forces drawn from many kingdoms, but he was slain by the Northumbrian king Oswin at the Battle of the Winwaed near Leeds (in present-day Yorkshire). Although Penda was a pagan, he allowed Peada to introduce Christianity into Middle Anglia.

pendant, also spelled PENDENT, in architecture, sculpted ornament or elongated boss terminating the fan, or pendant, vaulting, associated with late English Gothic architecture of the Perpendicular period (15th century). Such devices are also to be found hanging from the framing of open timber roofs of this as well as the earlier Decorated period.

In stone ceilings the use of pendant vaulting was a solution to the difficulty of adapting fan vaulting to church naves built much wider than previously. Strong transverse arches were made to span the area, and these in turn supported the elongated voussoirs, ending in pendants. Intermediate rib and panel vaults spring from the pendants. Examples include Oxford's cathedral (1480–1500) and divinity schools (1480–83). In Henry VII's chapel (1503–19), Westminster, London, the pendant vaulting is supported by hidden arches above the ceiling. This type of fan vaulting was also a feature of the Flamboyant period (14th to early 16th century) in France.

pendant, in jewelry, ornament suspended from a bracelet, earring, or, especially, a necklace. Pendants are derived from the primitive practice of wearing amulets or talismans around the neck. The practice dates from the Stone Age, when pendants consisted of such objects as teeth, stones, and shells.



Art Nouveau pendant by L. Gautrait, *c.* 1900; in the Schmuckmuseum, Pforzheim, Ger.
By courtesy of the Schmuckmuseum, Pforzheim, Ger.

The pharaohs of ancient Egypt wore pendants that were sometimes of huge dimensions, usually bearing commemorative or auspicious scenes in which the sovereign is being deified. Other pendants were in the shape of flies, winged scarabs, vultures, the eye of the god Horus, falcons, and sacred serpents. An exquisite example of an early gold pendant is that of two hornets clasped together, found in Mycenae and dating from the 17th century BC (Archaeological Museum, Iráklion, Crete). Etruscan pendants were decorated with spindles and cylinders, figured, or in the shape of human heads. Greek and Hellenistic pendants usually formed the entire necklace. Pendants in the shape of a bulla (*q.v.*) are frequent in Roman necklaces, but there are also examples of cameos (*q.v.*), intaglios, and gold coins mounted as pendants.

During the Middle Ages, characteristic jewels were the reliquary, or devotional, pendant and the cross, chased or enamelled with religious subjects and often set in an architectural frame. One of the most famous early pendant reliquaries, which belonged to Charlemagne (cathedral treasury, Reims, Fr.), contained relics of the True Cross and the crown of thorns under a sapphire set with gold. In the 14th century it was customary for noblemen to wear necklaces with pendants bearing heraldic subjects; pendants worn by women generally depicted sentimental subjects.

Toward the beginning of the 16th century, pendants became decorative rather than religious objects. The Renaissance artists created numerous beautiful crosses and figured pendants modelled in high relief and depicting numerous subjects, such as mermaids, tritons, animals and ships, and mythological and religious scenes. Often, the irregular shapes of baroque pearls (*q.v.*) were exploited and adapted for the bodies of human beings or animals, whose faces and limbs were modelled in gold and enamelled.

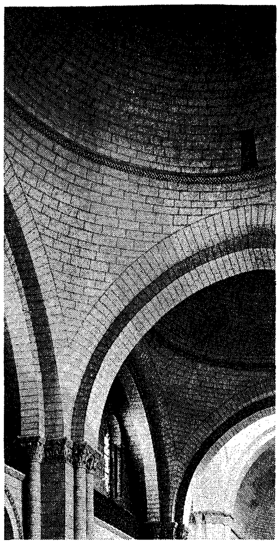
In the Baroque period there was a return in pendants to engraved figures and intaglio and cameo cutting, framed in geometric decorative designs containing gems and, later, in ribbons and floral designs done mainly in diamonds, rubies, emeralds, and pearls. Such pendants continued to be popular until the end of the 18th century.

The Empire style attached no great importance to pendants, and most of the rare examples consist of cameo medallions. In the 19th century the Art Nouveau (*q.v.*) school created pendants with a lovely aesthetic line in which the most common motifs were women's figures and profiles, butterflies, peacocks, insects, and flowers.

Pendéli Óros (Greece): *see* Pentelicus, Mount.

pendentive, in architecture, a triangular segment of a spherical surface, filling in the upper corners of a room, in order to form, at the top, a circular support for a dome. The problem of supporting a dome over an enclosed square or polygonal space assumed growing importance to the Roman builders of the late empire. It remained for the Byzantine architects, however, to recognize the possibilities of the pendentive and fully develop it. One of the earliest examples of the use of the pendentive is also one of the largest—that of Hagia Sophia (completed AD 537) at Istanbul.

In the Romanesque period pendentives occur commonly in western Europe in the domed churches of the Aquitaine in France, as in Saint-Front at Perigueux (begun 1120) and the cathedral of Saint-Pierre at Angoulême (1105–28), but they occur only occasionally in Italian churches. During the Renaissance and the Baroque the preference for domed churches, especially in Catholic Europe and



Romanesque pendentives supporting domes in the nave of the cathedral of Saint-Pierre at Angoulême, Fr., 1105–28
Archives Photographiques

Latin America, gave great importance to the pendentive. As a result of Byzantine influence, pendentives are frequent in Islāmic architecture. They are often decorated with stalactite work or sometimes, as in Iran, with delicate ribbing.

A vaulting form in which the curve of the pendentive and dome is continuous, without a break, is known as a pendentive dome. *See also* dome; squinch.

Penderecki, Krzysztof (b. Nov. 23, 1933, Debica, Poland), outstanding Polish composer of his generation whose novel and masterful treatment of orchestration won worldwide acclaim.

Penderecki
CAF, Warsaw

Penderecki studied composition at the Superior School of Music in Kraków (graduated 1958), subsequently becoming a professor there. He first drew attention in 1959 at the third Warsaw Festival of Contemporary Music, where his *Strophes* for soprano, speaker, and ten instruments was performed. The following year was marked by the performances of both *Anaklasis,* which premiered at the Donaueschingen Festival, and the *Threnody for the Victims of Hiroshima* for 52 strings. The *Threnody* illustrates Penderecki's skilled and refined treatment of instruments, making use of quarter-tone clusters (close groupings of notes a quarter step apart), glissandi (slides), whistling harmonics (faint, eerie tones produced by partial string vibrations), and other extraordinary effects. Penderecki received the UNESCO Award and the Polish Minister of Culture Prize in 1961 for his innovative composition. The techniques used in *Threnody* were extended to his vocal work *Dimensions in Time* (1961) and his operas *The Devils of Loudun* (1968) and *Paradise Lost* (1978).

Penderecki's *Psalms of David* (1958) and *Stabat Mater* (1962) reflect a simple, linear trend (letting interwoven melodic lines predominate and determine harmonies) in his composition. The *Stabat Mater* combines traditional and experimental elements and led to his other well-known masterpiece, the *Passion According to St. Luke* (1963–66). In form, the latter work resembles a Baroque passion, such as those by J.S. Bach, and Penderecki makes use of traditional forms such as the passacaglia (a variation form), a chantlike freedom of metre, and a twelve-tone row (ordering of the 12 notes of the chromatic scale) based on the motif B♭-A-C-B (in German notation, B-A-C-H) in homage to Bach.

Penderecki's 1962 *Canon* for 52 strings made use of polyphonic techniques (based on interwoven melodies) known to Renaissance composers. On the other hand, he also made some use of aleatory (chance music) freedoms, percussive vocal articulation, nontraditional musical notation, and other devices that stamped him as a leader of the European avant-garde. Later works include *Utrenja* (in two parts, 1969–71; *Morning Prayer*), a cello concerto (1972), *Magnificat* (1973–74), *Rajutracony* (1976–78; *Paradise Lost*), *De Profundis* (1977), and a violin concerto (1977).

Pendergast, Thomas J(oseph) (b. July 22, 1872, St. Joseph, Mo., U.S.—d. Jan. 26, 1945, Kansas City, Mo.), U.S. politician who created a powerful political machine in Missouri. Critics of Pres. Harry S. Truman frequently linked his name with Pendergast, a former associate.

Pendergast went to Kansas City in 1893, where he learned the rudiments of municipal politics from precinct captains and where, by 1916, he had become political boss of Kansas City's Democrats, a position he held for almost 25 uninterrupted years. His political machine dominated state as well as city politics and had strong influence in Democratic national conventions. Political foes labelled him a ruthless leader of a corrupt political machine that had made Kansas City a hotbed of vice and crime.

Pendergast was toppled not by his political opponents but by the U.S. government, which found him guilty of evading payment of income taxes on $443,550. This sum allegedly included a $315,000 bribe he had received from some fire-insurance companies for favouring their side in a rate-increase dispute. Pendergast was sentenced to federal prison in May 1939 and served a year and a day.

Pendle, district (borough), county of Lancashire, England. It lies on the eastern boundary of the county and takes its name from Pendle Hill, 1,831 ft (707 m) high, famous for its association with Lancashire witches in the 17th century. In the early 18th century woollen textiles were an important domestic industry, but they were replaced by cotton by the end of the century, when the Leeds and Liverpool Canal gave easy transport of the raw cotton from Liverpool. More recently industrial diversification has added engineering—including Rolls-Royce at Barnoldswick—and the manufacture of furniture, carpets, and plastics. Much of the area is rural, and agriculture is also important. The district has an area of 65 sq mi (168 sq km). Pop. (1983 est.) 85,200.

Pendleton, city, northeastern Oregon, U.S., on the Umatilla River, adjacent to the Umatilla Indian Reservation. On the Oregon Trail, it was founded in 1869 by G.W. Bailey as the seat of Umatilla County and named for George Hunt Pendleton. It became a wheat and cattle centre after the arrival of the railroad in 1889. Industries include food processing and lumber and woollen mills. It is headquarters for Umatilla National Forest and the site of an Oregon State University agricultural experiment station and of Blue Mountain Community College (1962). The Pendleton Round-Up (rodeo) has been held annually in September since 1910. Inc. 1880. Pop. (1980) 14,521.

Pendleton, Edmund (b. Sept. 9, 1721, Caroline County, Virginia—d. Oct. 26, 1803, Caroline County, Va., U.S.), Virginia patriot during the American Revolution.

Pendleton's father and grandfather died the year of his birth, and the young man grew up without paternal care. Apprenticed at the age of 14 to the clerk of the Caroline County court, Pendleton acquired a legal education, and in 1741 he was admitted to the bar.

In 1751 Pendleton became a justice of the peace, and the following year he was elected to the House of Burgesses. A conservative, he clashed repeatedly with Patrick Henry (whom Pendleton considered a demagogue) over Henry's radical opposition to the Stamp Act and other divisive issues between Britain and the American colonies. Pendleton did charge that Parliament had exceeded its authority in passing the Stamp Act, and he soon emerged as a leader among the patriots.

Selected in 1773 as a member of Virginia's Committee of Correspondence, Pendleton represented the colony at the first Continental Congress in 1774. In 1775 he served as president of the Virginia Committee of Public Safety, which acted as a temporary government during the critical period just prior to independence. At the Virginia convention of 1776, Pendleton drew up the instructions to Virginia's representatives in Congress, directing them to propose a declaration of independence. He later helped revise the laws of Virginia and helped draft the state's first constitution.

Under the new constitution, Pendleton served as first speaker of Virginia's House of Delegates. In 1779 he became president of the supreme court of appeals, but except for trips to Richmond in order to preside, he spent much of the remainder of his life at his estate, "Edmunsbury," in Caroline County. He nonetheless exerted influence over national affairs by corresponding regularly with his friends in Congress, especially James Madison. Elected president of Virginia's ratifying convention in 1788, Pendleton vigorously supported acceptance of the new federal Constitution. He thereafter refused several positions in the national government offered by his long-time friend George Washington and spent his final years at his Virginia estate.

Pendleton, George (Hunt) (b. July 29, 1825, Cincinnati, Ohio, U.S.—d. Nov. 24, 1889, Brussels), American lawyer and legislator, an advocate of civil service reform and sponsor of the Pendleton Civil Service Act (1883), which created the modern civil service system.

Admitted to the bar in 1847, Pendleton, a Democrat, practiced law in Cincinnati and in 1853 was elected to the state senate. As a member of the U.S. House of Representatives (1857–65), he opposed suspension of *habeas corpus* and other extraordinary measures taken by Pres. Abraham Lincoln during the Civil War. In 1864 he was the Democratic vice-presidential nominee, sharing the ticket with the former Union Army general George B. McClellan. The Democrats, who made peace their primary issue, were soundly defeated.

After the war Pendleton was a Greenbacker and a principal advocate of the Ohio Idea, a proposal for redeeming certain Civil War bonds in paper currency (greenbacks) instead of in gold. On this issue he alienated Eastern Democrats, who in turn deprived him of the 1868 Democratic presidential nomination. As a U.S. senator from Ohio (1879–85), he sponsored the Pendleton Civil Service Act (1883), which provided for a federal civil service commission and a corps of professional civil servants recruited by means of competitive examinations. Appointed minister to Germany by Pres. Grover Cleveland in 1885, Pendleton served abroad until his death.

Pendleton Civil Service Act (Jan. 16, 1883), landmark U.S. legislation establishing the tradition and mechanism of permanent federal employment based on merit rather than on political party affiliation (the spoils system).

Widespread public demand for civil service reform was stirred after the Civil War by mounting incompetence, graft, corruption, and theft in federal departments and agencies. After Pres. James A. Garfield was assassinated in 1881 by a disappointed office seeker, civil service reform became a leading issue in the midterm elections of 1882. In January 1883, Congress passed a comprehensive civil service bill sponsored by Sen. George H. Pendleton of Ohio, providing for the open selection of government employees—to be administered by a Civil Service Commission—and guaranteeing the right of citizens to compete for federal appointment without regard to politics, religion, race, or national origin. Only about 10 percent of the positions in the federal government were covered by the new law, but nearly every president after Chester A. Arthur, who signed the bill into law, broadened its scope. By 1980 more than 90 percent of federal employees were protected by the act.

Where the same name may denote a person, place, or thing, the articles will be found in that order

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Pendred's syndrome, hereditary metabolic condition that is characterized by deafness and defective incorporation of iodine into thyroid hormone, resulting in goitre or enlargement of the thyroid gland. Pendred's syndrome is a major cause of congenital deafness. It does not produce symptoms of hypothyroidism (deficiency of thyroid activity) in most patients, nor does the condition affect life expectancy.

pendulum, body suspended from a fixed point so that it can swing back and forth under the influence of gravity. Pendulums are used to regulate the movement of clocks because the interval of time for each complete oscillation, called the period, is constant. The scientist Galileo first noted (*c.* 1583) the constancy of a pendulum's period by comparing the movement of a swinging lamp in a Pisa cathedral with his pulse rate. The Dutch mathematician and scientist Christiaan Huygens invented a clock controlled by the motion of a pendulum in 1656. The priority of invention of the pendulum clock has been ascribed to Galileo by some authorities and to Huygens by others, but Huygens solved the essential problem of making the period of a pendulum truly constant by devising a pivot that caused the suspended body, or bob, to swing along the arc of a cycloid rather than that of a circle.

A simple pendulum consists of a bob suspended at the end of a thread that is so light as to be considered massless. The period of such a device can be made longer by increasing its length, as measured from the point of suspension to the middle of the bob. A change in the mass of the bob, however, does not affect the period, provided the length is not thereby affected. The period, on the other hand, is influenced by the position of the pendulum in relation to the Earth. Because the strength of the Earth's gravitational field is not uniform everywhere, a given pendulum swings faster, and thus has a shorter period, at low altitudes and at the Earth's Poles than it does at high altitudes and at the Equator.

There are various other kinds of pendulums. A compound pendulum has an extended mass, like a swinging bar, and is free to oscillate about a horizontal axis. A special reversible compound pendulum called Kater's pendulum is designed to measure the value of g, the acceleration of gravity.

Another type is the Schuler pendulum. When the Schuler pendulum is vertically suspended, it remains aligned to the local vertical even if the point from which it is suspended is accelerated parallel to the Earth's surface. This principle of the Schuler pendulum is applied in some inertial guidance systems to maintain a correct internal vertical reference, even during rapid acceleration.

A spherical pendulum is one that is suspended from a pivot mounting, which enables it to swing in any of an infinite number of vertical planes through the point of suspension. In effect, the plane of the pendulum's oscillation rotates freely. A simple version of the spherical pendulum, the Foucault pendulum (*q.v.*), is used to show that the Earth rotates on its axis. *See also* ballistic pendulum.

Penedo, port city, Alagoas state, northeastern Brazil, on the north bank of the lower São Francisco River, bordering Sergipe state, 25 mi (40 km) above its mouth on the Atlantic Ocean. Founded in the 16th century during the Portuguese conquest, it has developed a thriving trade in hides, rice, and cotton. There is light industrial development, including cotton spinning, weaving, vegetable-oil processing, and rice husking. Pop. (1980 prelim.) 27,064.

Penelope, in Greek mythology, a daughter of Icarius of Sparta and the nymph Periboea and wife of the hero Odysseus. In the *Odyssey* is told the story of how, during her husband's long absence after the Trojan War, many chieftains of Ithaca and nearby islands became her suitors. To spare herself their importunities she insisted that they wait until she had woven a shroud for Laertes, father of Odysseus. Every night for three years, until one of her maids revealed the secret, she undid the piece that she had woven by day in order to delay the date at which she would have to forsake her lost husband by remarrying. She was finally relieved by the arrival of Odysseus. According to later writers, after the death of Odysseus, Penelope married Telegonus, son of Odysseus and the sorceress Circe.

peneplain, gently undulating, almost featureless plain that, in principle, would be produced by fluvial erosion that would, in the course of geologic time, reduce the land almost to baselevel (sea level), leaving so little gradient that essentially no more erosion could occur. The peneplain concept was named in 1889 by William M. Davis, who believed it to be the final stage of his geomorphic cycle of landform evolution.

There has been much debate on the peneplain theory. The lack of present-day peneplains tends to discredit it, but some attribute this lack to geologically recent diastrophism, or uplifting, of the Earth's crust. Other geomorphologists question whether the Earth's crust has ever remained stable long enough for peneplanation to occur.

Criteria considered by its proponents to be evidence for the theory are (1) the accordant summits, or remnants of an uplifted, dissected peneplain; (2) the occurrence of uniform truncation of strata of varying erosional resistance;

and (3) the presence of remnants of a mantle of residual soil formed on the peneplain. Opponents of the theory hold that even if some examples do represent almost flat plains (which they consider unlikely), they were not necessarily formed by fluvial erosion within the confines of a geomorphic cycle.

Peneus River (Greece): *see* Piniós River.

Peng Dehuai, Wade-Giles P'ENG TE-HUAI (b. *c.* 1898, Hsiangt'an, Hunan province, China—d. Nov. 29, 1974, Peking), military leader, one of the greatest in Chinese communist history, and minister of national defense of China from 1954 until 1959, when he was removed for criticizing the military and economic policies of Mao Zedong.

Peng was a military commander under Chiang Kai-shek but broke with him in 1927 when Chiang attempted to rid the Nationalist Party (Kuomintang) of leftist elements. In 1928 Peng became a communist and soon afterward became involved in guerrilla activity, leading a series of peasant uprisings. He became a senior military commander under Mao and participated in the Long March (1934–35), the communist retreat of 6,000 miles (9,650 km) from southeast to northwest China.

Peng was the second-ranking man in the communists' military hierarchy from the outbreak of the Sino-Japanese War in 1937 to 1954. He led Chinese forces in the Korean War and signed the armistice at P'anmunjŏm on July 27, 1953. In 1954 he became minister of national defense and a member of the Politburo of the Chinese Communist Party. In 1959, however, he criticized as impractical the policies of Mao's Great Leap Forward, which emphasized ideological purity over professional expertise in both the military forces and the economy. Peng was deprived of office and membership in the party and disappeared from view. Peng was posthumously "rehabilitated" in December 1978 under the post-Mao regime.

Penghu Islands, Chinese (Wade-Giles) P'ENG-HU CH'ÜN-TAO, or P'ENG-HU LIEH-TAO, or (Pinyin) PENGHU QUNDAO, or PENGHU LIEDAO, also called PESCADORES, archipelago and *hsien* (county) of Taiwan, consisting of about 64 small islands, approximately 30 miles (50 km) west of the coast of Taiwan, from which it is separated by the Penghu Channel. Of volcanic origin, many of the islands consist of weathered basalt, and they are surrounded by coral reefs. The islands are low-lying, most rising only about 100–130 feet (30–40 m) above sea level. The highest peak is about 157 feet (48 m). The islands have a warm climate, being situated in the path of the Kuroshio (Japan Current), and the annual temperature range is from 61° to 82° F (16° to 28° C). The rainfall is roughly 35 inches (900 mm) annually, nearly all of which falls between June and September. For the rest of the year there is a shortage of water, and there are no rivers. In winter the islands are swept by severe winds. The largest islands are Penghu (25 square miles [64 square km]), on which more than half of the population lives, Pai-sha, Yü-weng, and Pa-chao. Penghu and Pai-sha are linked by a causeway. The total area of the entire group and of the county is 49 square miles (127 square km).

Women mending fishnets, Ma-kung, Penghu Islands, Taiwan

George Holton—Photo Researchers/EB Inc.

About half of the islands are cultivated, but the soils are poor and the climate harsh; the main crops—sweet potatoes, peanuts (groundnuts), corn (maize), and millet—are those associated with poor hill country in southern China. A large part of the population are fishermen, and the European name Pescadores ("Fishermen") was given to the islands by the Portuguese in the 16th century.

The islands were probably known to the Chinese (under the name Liu-chiu) as early as the 7th century AD. Their name first appears as P'eng-hu (or P'ing-hu) in Chinese sources of the 12th century, and it was at this time that they were probably first settled by Chinese fishermen from Fukien or Chekiang provinces on the mainland. At the beginning of the Ming dynasty (1368–1644), the Chinese government built a fort on Penghu, established a civil government there, and imposed taxes on the fisheries. In 1388, however, the entire population was transported to the mainland. Penghu was then abandoned and became a lair for pirates. Only in the reign of the Ming emperor Wan-li (1572–1620) did Chinese settlers again begin to colonize the islands, first establishing fisheries and then in 1625 military colonies. Meanwhile, between 1622 and 1624, the islands had been occupied by the Dutch. At the end of the Ming dynasty, many Fukienese settlers came to the islands to escape the fighting in southeast China, mostly from Chang-chou and Ch'üan-chou. By 1683 there were said to be some 6,000 inhabitants on the islands, who were formally placed under the control of the civil authorities in Taiwan. In 1721 the islands became the base for government punitive action against Chu I-kuei, a rebel on Taiwan.

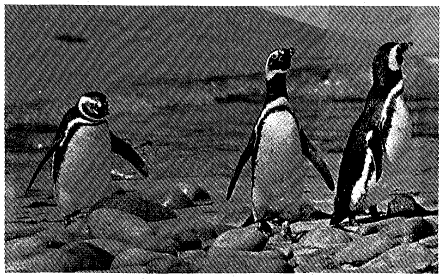
In the 19th century, when the Western powers began to have designs on Taiwan, the islands again became an important strategic area. They were occupied by the French in 1884–85, and, after the Sino-Japanese War of 1894–95, they were ceded to Japan, together with Taiwan. Returned to China in 1945, the islands were made a *chen* (township) under Taiwan and, in 1950, became a *hsien* of Taiwan province.

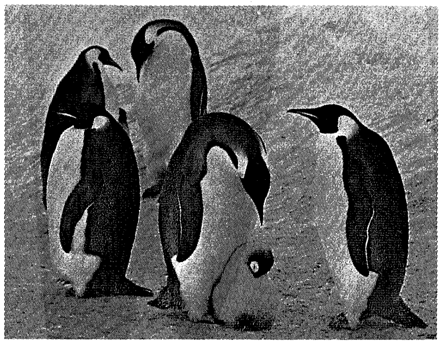
Since 1949 the islands have been under the control of the government of the Republic of China on Taiwan; a Chinese Nationalist naval base, Ma-kung (now the county seat), was established on Penghu. In addition to the fishing industry, the working of the islands' phosphate deposits have also provided income. Pop. (1989 est.) 97,327.

penguin, any member of Sphenisciformes, an order of flightless marine birds containing one family, Spheniscidae.

A brief treatment of penguins follows. For full treatment, *see* MACROPAEDIA: Birds.

Of all birds, penguins are the most fully adapted to water and extreme cold. Penguins are flightless and clumsy on land but at home in the water. They breed on islands in the subantarctic and on cool coasts of Africa, Australia, New Zealand, and South America. Only the Adélie penguin (*Pygoscelis adeliae*) and the emperor penguin (*Aptenodytes forsteri*) reach Antarctica itself; the Galápagos penguin (*Spheniscus mendiculus*) is confined to the tropics off South America.





(Top) Magellan penguins (*Spheniscus magellanicus*) and (bottom) emperor penguins (*Aptenodytes forsteri*)

(Top) Peter Johnson from Natural History Photographic Agency—EB Inc., (bottom) Michael C.T. Smith from The National Audubon Society Collection/Photo Researchers—EB Inc.

The Adélie, the best-known penguin, has, like the others, a dark back and a white belly. The species differ mainly in head pattern and in size, from 40 cm (16 inches) in the little blue, or fairy, penguin (*Eudyptula minor*) to almost 120 cm (4 feet) in the emperor penguin. Sexes are alike in size and plumage. At sea for weeks at a time, flocks of penguins feed on fish, squid, and crustaceans. In turn, penguins are the prey of leopard seals and killer whales. Some species migrate long distances inland to ancestral nesting colonies. The eggs, usually one or two, are incubated in turns by both parents, one remaining on the nest while the other goes off to feed. Young penguins are fed by regurgitation and are often tended in crèches, or "kindergartens."

Penibético Mountain System, Spanish SISTEMA PENIBÉTICO, also called CORDILLERA PENIBÉTICA, or BAETIC CORDILLERA, mountain system comprising the Andalusian mountains of southern Spain, of which the northern range runs about 360 miles (580 km) from Cape Trafalgar to Cape Nao. The central and southern ranges, the Penibético proper, extend a shorter distance from Estepona to Cape Gata. Separating the two systems is a complex series of structures, traceable in longitudinal corridors and high basins for 180 miles (290 km) between Antequera and Baza and again between Lorca and the Guadalentín Valley. To the south, in the Penibaetic proper, the interior mountains include the Sierra Nevada, with the highest peak of the Iberian Peninsula, Mount Mulhacén, 11,411 feet (3,478 m).

penicillin, one of the first and still one of the most widely used antibiotic agents, derived from the *Penicillium* mold. Alexander Fleming (later Sir Alexander Fleming) in 1928 first observed that colonies of *Staphylococcus aureus* (the pus-producing bacterium) failed to grow in those areas of a culture that had been accidentally contaminated by the green mold *Penicillium notatum.* He isolated the mold, grew it in a fluid medium, and found that it produced a substance capable of killing many of the common bacteria that infect humans. Other researchers created an injectable agent for therapeutic use in 1940.

The several kinds of penicillin synthesized by various species of the mold *Penicillium* may be divided into two classes: biosynthetic penicillins (those formed during the process of mold fermentation) and semisynthetic penicillins (those in which the structure of a chemical substance—6-aminopenicillanic acid—found in all penicillins is altered in various ways). Because it is possible to change the characteristics of the antibiotic, different types of penicillin are produced for different therapeutic purposes. Benzylpenicillin, or penicillin G, is the only naturally occurring penicillin that is still used clinically. Because of its poor stability in acid, much of penicillin G is broken down as it passes through the stomach; as a result of this characteristic, it must be given by intramuscular injection, which limits its usefulness. Some of the semisynthetic penicillins are more acid-stable and so may be given as oral medication.

All penicillins work in the same way, namely, by inhibiting the bacterial enzymes responsible for cell-wall synthesis and activating other enzymes to break down the organisms' protective walls; therefore, they are not effective against microorganisms that do not produce cell walls.

Some strains of previously susceptible bacteria have developed a specific resistance to penicillin; these bacteria either produce penicillinases, enzymes that disrupt the internal structure of penicillin and thus destroy the antimicrobial action of the drug, or they lack cell-wall receptors for penicillin, greatly reducing the drug's ability to enter bacterial cells.

Among the bacteria sensitive to penicillin are those that cause throat infections, pneumonia, spinal meningitis, gas gangrene, diphtheria, syphilis, and gonorrhea. The chief side effects of penicillin are allergic or hypersensitivity reactions, including skin rashes, hives, swelling, and anaphylaxis, or allergic shock. Milder symptoms may be treated with corticosteroids but usually are prevented by switching to alternative medications; anaphylactic shock, which can occur in previously sensitized individuals within seconds or minutes, may require immediate administration of epinephrine to end the life-threatening process.

Penicillium, genus of blue or green mold fungi (division Mycota) of the form-class Deuteromycetes (Fungi Imperfecti). Those species for which the sexual phase is known are

Penicillium notatum, the source of penicillin
Carlo Bevilacqua—SCALA from Art Resource/EB Inc.

placed in the Eurotiales. Found on foodstuffs, leather, and fabrics, they are of economic importance in the production of antibiotics (penicillin, *q.v.*), organic acids, and cheeses.

Peninsular Campaign (April 4–July 1, 1862), in the American Civil War, large-scale but unsuccessful Union effort to capture the Confederate capital at Richmond, Va., by way of the peninsula formed by the York and the James rivers. Following the engagement between the ironclads *Monitor* and *Merrimack* at nearby Hampton Roads (March 9), Federal supplies and 100,000 troops were disembarked at Fort Monroe under Major General George B. McClellan. The first phase of the campaign, during which the North reached the town of White House, within striking distance of Richmond, concluded with the indecisive Battle of Seven Pines (May 31–June 1), in which Confederate General Joseph E. Johnston was seriously wounded and field command passed to Robert E. Lee. A second phase was characterized by three weeks of inactivity. The final phase ended triumphantly for the Confederate forces of General Lee, who forced the withdrawal of the Federal Army of the Potomac after the Seven Days' Battles (*q.v.;* June 25–July 1).

Peninsular War (1808–14), Spanish GUERRA DE LA INDEPENDENCIA ("War of Independence"), that part of the Napoleonic Wars fought in the Iberian Peninsula, where the French were opposed by British, Spanish, and Portuguese forces. Napoleon's peninsula struggle contributed considerably to his eventual downfall; but until 1813 the conflict in Spain and Portugal, though costly, exercised only an indirect effect upon the progress of French affairs in central and eastern Europe. The war in the Peninsula did interest the British, because their army made no other important contribution to the war on the continent between 1793 and 1814; the war, too, made the fortunes of the British commander Arthur Wellesley, afterward Duke of Wellington.

Napoleon's pact with Russia at Tilsit (July 7, 1807) left him free to turn his attention toward Britain and toward Sweden and Portugal, the two powers that remained allied or friendly to Britain. Russia, it was decided, would deal with Sweden, while Napoleon, allied to Spain since 1796, summoned (July 19) the Portuguese "to close their ports to the British and declare war on Britain." His intention was to complete the Continental System designed to make economic war against Britain, for there was no other means to bring it to seek peace than by striking at its trade. When the Portuguese proved dilatory, Napoleon ordered General Andoche Junot, with a force of 30,000, to march through Spain to Portugal (October–November 1807). The Portuguese royal family fled, sailing to Brazil, and Junot arrived in Lisbon on November 30. The French army that conquered Portugal, however, also occupied parts of northern Spain; and Napoleon, whose intentions were now becoming clear, claimed all of Portugal and certain provinces of northern Spain. Unable to organize government resistance, the Spanish minister Godoy persuaded his king, Charles IV, to imitate the Portuguese royal family and escape to South America. The journey from Madrid was halted at Aranjuez, where a revolt organized by the "Fernandista" faction (March 17, 1808) procured the dismissal of Godoy and the abdication of Charles IV in favour of his son Ferdinand VII. Napoleon, taking advantage of the situation, sent in General Joachim Murat to occupy Madrid and, by a mixture of threats and promises, induced both Charles and Ferdinand to proceed to Bayonne for conferences. There, on May 5, 1808, Napoleon forced Ferdinand to abdicate in favour of Charles and Charles in favour of himself. In exchange, Napoleon promised that Spain should remain Roman Catholic and independent, under a ruler whom he would name. He chose his brother Joseph Bonaparte. On May 2, however, the people of Madrid had already risen against the invader, and the war for Spanish independence had begun.

The rebellion in Madrid began the movement that ultimately proved fatal to Napoleon's power. Although the Madrid revolt was ruthlessly suppressed by the French, provincial insurrections took place thoroughout Spain, and the Spaniards showed great capacity for guerrilla warfare. The French were repulsed from Valencia, and General Pierre Dupont, who had advanced into Andalusia, was compelled to retreat and ultimately to capitulate with all his army at Bailén (July 23). The Spaniards now advanced upon the capital and expelled Joseph Bonaparte (August).

The French counterattack, leading to the recapture of Madrid (December 1808), forced the junta to retreat southward to Seville. In January 1810 General Nicolas de Dieu Soult began the conquest of Andalusia, and, with the fall of Seville in the same month, the central junta fled to Càdiz. Only the obstinate resistance of Wellington in Portugal, the continuous activity of the guerrillas, and dissensions among the French saved the peninsula from final submission. Indeed, the British forces, which had first landed in Portugal on Aug. 1, 1808, quickly achieved some successes, conquering Lisbon and forcing the evacuation of the French from Portugal (Convention of Cintra, Aug. 30, 1808). In 1809 the French returned to Portugal, briefly holding Oporto and Lisbon; but Wellington, with some difficulties, was able to outflank them and lead a force toward Madrid. His victory at the Battle of Talavera (July 27–28, 1809) was short-lived, nevertheless, and he was compelled to retreat to central Portugal, where he fortified himself within the country around Lisbon, now again under British rule. His celebrated "lines of Torres Vedras" were defensive works designed to resist any army that Napoleon could send against them.

For the next two years the battles and campaigns in various parts of Spain and Portugal, though numerous, were inconclusive. They did, however, wear down the resources of the French, in both men (now numbering more than 200,000) and matériel; and, when Napoleon in 1811–12 directed his whole attention toward Russia, not only were the depleted peninsular armies not reinforced but as many as 30,000 men were withdrawn for the Grand Army marching east.

Thus, from his base in Portugal, which he had successfully defended, Wellington in 1812 began his gradual advance into Spain. His defeat of Marshal Jean-Baptiste Jourdan at the Battle of Vitoria on June 21, 1813, finally decided the issue in the peninsula. Joseph Bonaparte withdrew from Spain, and Wellington fought his way across the Pyrenees into France (August 1813). Napoleon, after his crushing defeat at Leipzig (Oct. 16–19, 1813), recognized the impossibility of retaining his hold on Spain and released Ferdinand, who had been detained by the French at Valençay since his abdication in 1808. In March 1814 Ferdinand VII returned to Spain and the throne.

penis, the copulatory organ of the male of higher vertebrates that in mammals usually also provides the channel by which urine leaves the body. The corresponding structure in lower invertebrates is often called the cirrus.

The human penis is anatomically divided into two continuous areas—the body, or external portion, and the root. The root of the penis begins directly below the bulbourethral glands with a long cylindrical body of tissue known as the corpus spongiosum (or corpus cavernosum urethrae). This tissue extends through the body of the penis to the tip, where it expands into a mushroom-shaped structure called the glans penis. Running through the centre of the corpus spongiosum is the urethra, a common passage for semen and urine; the urethra ends in a slitlike opening at the tip of the glans penis. Beginning alongside of the bulbourethral glands are a pair of long cylindrical bodies called the corpora cavernosa penis. These continue through the body of the penis, occupying the sides and upper portion directly above the corpus spongiosum; they terminate immediately before the glans penis.

The corpora cavernosa consist of empty spaces divided by partitions of tissue. The tissue consists of muscle, collagen (a fibrous protein), and elastic fibre. The corpora cavernosa are termed erectile tissue (*see* erection), because during sexual excitation, their fibrous tissue is expanded by blood that flows into and fills their empty spaces. The blood is temporarily trapped in the penis by the constriction of blood vessels that would normally allow it to flow out. The penis becomes enlarged, hardened, and erect as a result of this increased blood pressure. The corpus spongiosum is also considered erectile tissue. This area, however, does not become as enlarged as the other two during erection, for it contains more fibrous tissue and less space; unlike the corpora cavernosa, the corpus spongiosum has a constant blood flow during erection.

The corpora cavernosa and corpus spongiosum are enclosed by a circular layer of elastic tissue. This in turn is covered by a thin layer of skin. The skin, which is slightly darker in colour than the rest of the body, is loose and folded while the penis is in a flaccid state. At the beginning of the glans penis, a circular fold of skin, commonly called the foreskin (or prepuce), extends forward to cover the glans. Frequently at birth or during early childhood, the foreskin is removed by an operation called circumcision.

For a depiction of the penis in human anatomy, shown in relation to other parts of the body, *see* the colour Trans-Vision in the PROPAEDIA: Part Four, Section 421.

penis bone: *see* baculum.

penitential book, any of the manuals used by priests of the Western Church, especially during the early Middle Ages, in administering ecclesiastical penance. (The name penance is applied to both a sacramental rite and acts performed in satisfaction for sins.) Penitentials contained (1) detailed lists of sins that the priest was to consider in assisting an individual penitent with his examination of conscience and confession during the rite and (2) corresponding penances or acts that were to be assigned to the penitent.

The first penitential books appeared in Ireland and Wales, and the earliest extant compilations are probably those associated with St. David and various Welsh synods of the 6th century, though the *Canons of St. Patrick* (*c.* 450) are occasionally, and somewhat loosely, spoken of as the first penitential. These and later Celtic penitentials were brought to the continent of Europe by missionary monks at an early date. Their introduction met with the opposition of ecclesiastics who favoured the older, traditional public penance, but there is considerable documentary evidence that penitential books were in use among the Franks by the late 6th century, in Italy by the late 8th century, and among the Spanish Visigoths by the early 9th century. Recognition that errors had crept into the penitential books and that they had imposed arbitrary penances, combined with the proscription of local councils and bishops, led to the decline in influence of these books. The ultimate effect of the penitentials and of the reaction against them was the official codification of disciplinary and penitential canons or laws.

Besides their importance in the history of theology and canon law, the penitentials are of value to the philologist as source material for comparative studies of Latin, Anglo-Saxon, Old Irish, and Icelandic forms; to the social historian for the vivid, often revolting picture they present of the manners and morals of barbarous peoples just coming under the influence of Christianity; and to the student of jurisprudence for the information they afford about the early history of the *wergild* (blood money), which defined in monetary terms the value of a man's life and was the basis for a system of compensation for wrongs by money payment.

Penkovsky, Oleg Vladimirovich (b. April 23, 1919, Ordzhonikidze, Russia—d. May 1963, U.S.S.R.), colonel in the Soviet army intelligence directorate (GRU) and deputy chief of the foreign section of the State Committee for the Coordination of Scientific Research (1960–62), who was convicted of spying for the United Kingdom and the United States.

Penkovsky became an intelligence officer after attending the Military Diplomatic Academy (1949–53) and served primarily in Moscow except while he was assistant military attaché in Ankara, Tur. (1955–56). In April 1961, through Greville M. Wynne, a British businessman, he offered his services to British intelligence. Between April 1961 and August 1962 Penkovsky passed more than 5,000 photographs of classified military, political, and economic documents to British and U.S. intelligence forces. He was arrested on Oct. 22, 1962, and executed for high treason soon after his trial. In 1965 his journal, *The Penkovskiy Papers,* was published in the United States.

Penn, Arthur (Hiller) (b. Sept. 27, 1922, Philadelphia), U.S. motion-picture director whose films are noted for their critical examination of the American social fabric, often exposing the darker undercurrents of American society.

Penn became interested in theatre during his stint in the Army (1943–46), and after World War II he attended Black Mountain College in North Carolina and studied literature at the universities of Perugia and Florence in Italy. When he returned to the United States he studied at the Actors Studio in Los Angeles. Penn received his early training as a director during what is known as the golden age of television; from 1953 he wrote dramas and directed plays for such noted television series as "Philco Playhouse" and "Playhouse 90." He also gained a solid reputation as a theatrical director. His Broadway plays included *Two for the Seesaw* (1958); *The Miracle Worker* (1959), a successful adaptation of the play that he originally directed for television; *Toys in the Attic* (1960); *All the Way Home* (1960); and *An Evening With Mike Nichols and Elaine May* (1960–61).

Penn's first movie was *The Left-Handed Gun* (1958), a psychological view of Billy the Kid that is vastly different from his image in popular mythology. In 1962 Penn directed the screen version of *The Miracle Worker,* a commercial and artistic success that brought him the first of three Academy Award nominations for best director. His next two films, *Mickey One* (1965) and *The Chase* (1966), dealt with the ambiguous heroism of the outsider in society. *Bonnie and Clyde* (1967), which used graphic violence as a mode of social criticism, brought him international acclaim. It was followed by *Alice's Restaurant* (1969), a rather wistful paean to the youth counterculture of the time, and by the revisionist western *Little Big Man* (1970), a directorial tour de force that parodied the conventional Hollywood western and depicted American frontier policy as brutal, racist, and at times outright genocidal. His later films included *Night Moves* (1975), *The Missouri Breaks* (1976), *Altered States* (1980), and *Four Friends* (1981).

Penn, Irving (b. June 16, 1917, Plainfield, N.J., U.S.), U.S. photographer, influential for his incisive portraits and his innovations in colour photography.

His early ambition was to be a painter. But at the age of 26 he took a job designing photographic covers for the fashion magazine *Vogue.* He soon developed a photographic style characterized by bold graphic design and brilliant contrast.

During his career, Penn photographed a large number of celebrities, sparring with each sitter to reveal his personality to the camera. In his early portraiture, he often used props to draw

Irving Penn, 1960
Alexander Liberman

out the subject's personality. He also made a memorable series of portraits of the Indians of Cuzco, Peru, and a series of portraits, collectively called *Small Trades,* of labourers formally posed in their work clothes and holding the tools of their trade. Three hundred of his pictures were published in *Moments Preserved* (1960). His other books include *Worlds in a Small Room* (1974), *Inventive Paris Clothes, 1909–1939* (1975), and *Flowers* (1980).

Penn is especially known for his innovations in colour photography. He often achieved very large-grained colour through extreme enlargement and applied such romantic effects as image diffusion and soft focus to such unlikely subjects as industrial equipment.

Penn, William (b. Oct. 14, 1644, London—d. July 30, 1718, Buckinghamshire, England), English Quaker leader and advocate of reli-

William Penn, pastel portrait by Francis Place; in the Historical Society of Pennsylvania
By courtesy of the Historical Society of Pennsylvania

gious freedom who oversaw the founding of the American Commonwealth of Pennsylvania as a refuge for Quakers and other Nonconformists and religious minorities of Europe. He twice visited the colony (1682–84, 1699–1701).

Early life and education. William was the son of Adm. Sir William Penn, who could serve only as a distant model during the child's first dozen years because he was almost always at sea. Young William's mother, Margaret (*née* Jasper) van der Schuren Penn, was a childless widow when the elder Penn married her in 1644. In addition to William, the firstborn, their children included Margaret, born in 1652, and Richard, in 1656. The Penns lived in London until, shortly after William's serious bout with smallpox at the age of three, they moved into the Essex countryside near the village of Chigwell, the seat of a renowned grammar school. From his 6th to his 12th year, young Penn pored over Greek and Latin 8 to 10 hours a day, laying the foundations of his classical education. The strong sense of the past that was thus engendered may have contributed to the feeling of security in his young life.

This stable world was shaken by Admiral Penn's naval defeat in the West Indies in 1655 and brief imprisonment in the Tower of London. This caused the family to move back to London and then, because of continuing political uncertainty, to Ireland the following year. It was while he was thus uprooted in early adolescence, William Penn later recalled, that "the Lord first appeared unto me . . . about the 12th Year of my Age, Anno 1656," a divine encounter probably fostered by the Puritan influence of Chigwell. In Ireland he heard Thomas Loe, a Quaker itinerant, preach to his family at the Admiral's invitation, an experience that apparently intensified his religious feelings.

Four years were spent in Ireland, with tutors tending to Penn's education. He was now in closer association than ever with his land-bound father. At the restoration of the Stuart dynasty in 1660, the Admiral was knighted and named a commissioner of the navy. William, who was academically well prepared, the same year entered Oxford, where he demonstrated his piety by rejecting the Anglican formalism of the university. He was fined for refusing to attend chapel and dismissed in his second year. Admiral Penn was outraged by this conduct. Determined to thwart his son's religiosity, he sent the 18-year-old on a grand tour of the Continent and to the Protestant college at Saumur, in France, to complete his studies. The Admiral's purpose was to prepare the young man for high public office, but William devoted most of two years to the study of theology at Saumur. Summoned back to England, he entered Lincoln's Inn and spent a year reading law before his studies were cut short in early 1666 by the London plague.

His limited legal knowledge was put to use in managing the family estate in Ireland. Barely 21, he accepted his father's decision that he follow this worldly course, but then he crossed paths again with Thomas Loe. At a meeting in Cork, Penn heard Loe preach on the text "There is a Faith that overcomes the World, and there is a Faith that is overcome by the World." He committed himself from that moment to the Quakers, religious radicals who were reviled by respectable society and subject to official persecution.

Quaker leadership and political activism. Bent on converting a reluctant world to righteousness, the first Quakers would stop at nothing to preach the Truth. Penn joined the sect in this spirit and was imprisoned four times for publicly stating his beliefs in word and print. He published 42 books and pamphlets in the seven years immediately following his conversion, including the famous *No Cross No Crown* in 1669, a defense of his beliefs written in the Tower of London. Penn's willingness to withstand the harshness of his confinements, when he might have used his father's position to obtain release, as well as his missionary efforts on the Continent, convinced other Quakers of his commitment. He was on the way to a position of leadership at a time when the nature of the movement was changing.

In reaction to official persecution, George Fox, the founder of the Society of Friends, was imposing discipline on his people to control the excesses of radical Quakers and, thus, to give the government less provocation. Penn's contribution to the transformation of the society was a tireless advocacy of liberty of conscience, the fundamental principle of his social thought and action. This liberty could be realized only through an official policy of tolerating dissent; but to seek toleration was to admit, implicitly, that there might be many truths. Both Fox and Penn were accommodating "a Faith that overcomes the World" to the necessity of social survival.

Penn's move from zeal to moderation reflected not only a pragmatic temperament but also a change in his personal life. Though his academic training was extensive, Penn's theorizing was almost always a response to particular problems. His views on toleration were expressed not in a philosophical treatise but in a number of timely tracts. An example is "The People's Ancient and Just Liberties Asserted, in the Trial of William Penn and William Meade" (1670), a vindication of the independence of the jury, which Penn defended in a court case that stands as a landmark in English legal history. In his own life, the death of Admiral Penn in 1670, of his brother Richard in 1673, and of four of his eight children in infancy after his marriage to Gulielma Springett in 1672 were sorrowful and sobering experiences. Penn reached middle age more mellow than millenarian, content to work within the system. Inevitably, this led to political action.

Again the Quaker leader turned to his pen, and he began lobbying as well. He not only presented his case to men of influence but also prevailed upon fellow Quakers to compile a record of persecutions (institutionalized in the Meeting for Sufferings) and lay petitions before Parliament. His entrance into politics coincided with the emergence of the Whigs, whose advocacy of legislative power and religious toleration was naturally appealing to him. His *England's Great Interest in the Choice of this New Parliament* (1679) was one of the first clear statements of Whig policy. Among his personal acquaintances, however, were Tory leaders, the King (Charles II), and the King's brother, the Duke of York (later James II).

Founding and governorship of Pennsylvania. Within the Society of Friends there was resentment of the worldly militance Penn represented; older Quakers stymied his strategy. Nor did Penn's foray into politics serve him well when the Whigs faded before a Tory resurgence. Frustrated in England, Penn turned toward America as a means of institutionalizing his political and religious principles. Friends had been preaching across the Atlantic since 1655. By 1674 two Quakers had come into possession of West New Jersey, only to engage in a conflict over ownership that Penn was asked to mediate. Convinced of the virtue of single proprietorship, he applied to the crown for a grant of land in the New World, drew upon his connections with men of rank, and received Pennsylvania through a charter that named him the supreme governor.

Penn did not lay full claim to this privilege. Torn between the advice of Whigs and liberal Quakers, who advocated a vigorous popular legislature to offset executive power, and the need to lure politically conservative financial backing, he drew a frame of government that limited republicanism. Power was concentrated in the governor and his council, but he also guaranteed liberty of conscience and promised that the freemen could alter the system if they so chose. The response to this gesture was a political fray in Pennsylvania that was wilder than Penn could have imagined—the consequence of the Quakers' quest for legislative power.

The turbulence in Pennsylvania caught the attention of English officials, who were already suspicious of such Quaker peculiarities as pacifism and the refusal to take oaths. As proprietor, Penn divided his energies between the demands of provincial Quakers and the threats of the home government. Because the latter were more crucial to the autonomy of his colony, he was forced to spend most of his time in England, living in Pennsylvania less than four years.

Penn's first visit (1682–84) was cut short by a boundary controversy with Maryland, which he settled advantageously after a hasty return to London. Simultaneously, James II took the throne and began to accelerate the absolutist policies of his older brother. Penn was personally sympathetic to James, persuaded by his professions favouring toleration and fearful that Pennsylvania's independence would be sacrificed to the Dominion of New England. Penn thus became implicated in a reign abruptly terminated by revolution. Ironically, the establishment of parliamentary ascendancy and religious toleration by statute in 1689 was coincident with Penn's alienation from the government. Pennsylvania was briefly brought under royal rule (1692–94), primarily because Quakers would not cooperate in the colonial war effort.

By the mid-1690s, when Penn emerged from hiding and began rebuilding his political alliances, he found both the King and Parliament intent on strengthening the crown's colonial policy and, concomitantly, undermining the autonomy of the chartered and proprietary colonies. Penn, who led the fight against passage of the Navigation Act of 1696 that embodied the new imperial designs, emerged as spokesman for the continued independence of these colonies. His own was commercially and strategically the most important and, therefore, the most visible and open to attack.

Final years. The provincial Quakers, who were indifferent to Penn's situation, continued to hammer away at executive power, even after he granted the Pennsylvania assembly preeminence in the Charter of Privileges, the climax of his second visit (1699–1701) to the colony. Discouraged by this lack of gratitude, shocked by the discovery that his personal steward had defrauded him of thousands of pounds, and disappointed by the un-Quakerly behaviour of his eldest son, William Penn, Jr., he initiated negotiations in 1702 to sell the "holy experiment" (while simultaneously defending it). On the verge of concluding an agreement of sale in 1712, Penn suffered a crippling stroke, lingering on pathetically until his death six years later. The province, in trusteeship because of his indebtedness, passed to Hannah Callowhill Penn, whom Penn had married in 1696, two years after the death of his first wife. In the 18th century, Pennsylvania was distinguished by its unicameral legislature and its cultural diversity, late testimony to Penn's principles of republicanism and toleration. (J.E.I./Ed.)

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Penn, Sir William (b. April 23, 1621, Bristol, Gloucestershire, Eng.—d. Sept. 16, 1670, London), British admiral and father of William Penn, the founder of Pennsylvania.

In his youth he served at sea, and in the English Civil War he fought for Parliament, being appointed rear admiral of the Irish seas in 1647. He was arrested in 1648 on suspicion of corresponding with Charles I but was soon released. He fought in the First Anglo-Dutch War (1652–54) as vice admiral and then as general of the fleet. After secretly offering in 1654 to deliver the fleet to the exiled Charles II, he commanded the expedition sent by Oliver Cromwell to the West Indies, which captured Jamaica (May 1655) but failed to take Hispaniola. On his return he was briefly imprisoned, for reasons that are uncertain.

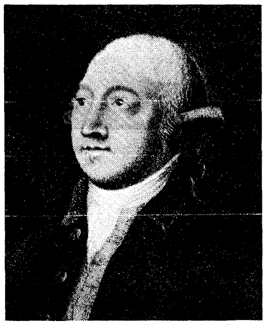
Retiring to his estate in Munster in Ireland, he engaged in secret communication with the Royalists. At the Restoration (1660) he was knighted and appointed a commissioner for the navy. In the Second Dutch War (1665–67) he served as captain of the fleet with the Duke of York (afterward James II). Penn was the author of a code of naval tactics that was the basis of the "Duke of York's Sailing and Fighting Instructions," long the orthodox tactical guide of the navy.

Pennacook, Algonquian-speaking American Indians whose villages were located in what are now southern and central New Hampshire, northeastern Massachusetts, and southern Maine. Like other New England Algonquian tribes, they depended on hunting, fishing, and the cultivation of corn (maize). They were semisedentary, moving seasonally in response to changing food resources.

Smallpox and other causes reduced the Pennacook population from an estimated 2,000 in 1600 to 1,250 in 1674. The treachery of the whites subsequently caused the Pennacook to flee their territory, most removing to Canada and eventually settling at Saint-François-du-Lac. The remainder moved westward and eventually settled at Schaghticoke, Rensselaer County, N.Y.

Pennant, Thomas (b. June 14, 1726, Downing, Flintshire, Wales—d. Dec. 16, 1798, Downing), Welsh naturalist and traveler, one of the foremost zoologists of his time.

Pennant was a landowner of independent means. His books were valued for their highly readable treatment of the existing knowledge of natural history. His volume on *British Zoology* (1766) stimulated zoological research,



Pennant, detail from a lithograph
BBC Houlton Picture Library

particularly in ornithology, in Great Britain, and his *History of Quadrupeds* (1781) and *Arctic Zoology,* 2 vol. (1784–85), were also widely read. His travel books presented valuable information on the local customs, natural history, and antiquities of Scotland, Wales, England, and the European continent.

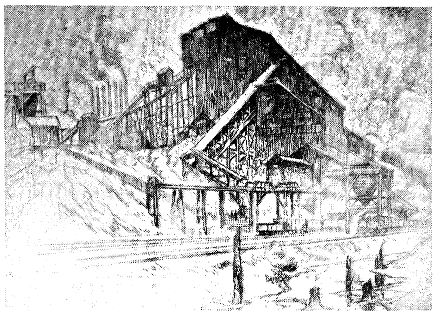
Pennant's cat, also called PENNANT'S MARTEN: *see* fisher.

Pennel, John (Thomas) (b. July 25, 1940, Memphis, Tenn., U.S.), American pole-vaulter who was the first to jump more than 17 feet (5.18 m) and was a world-record holder (1963, 1966, 1969).

At Coral Gables (Florida) High School, from which he graduated in 1958, he divided his extracurricular time between vaulting and playing sousaphone in the band. He competed for Northeast Louisiana State College (later Northeast Louisiana University, Monroe) from 1959 through 1963. His 1963 world record was set with a vault of 5.20 m (17 feet ¾ inches). At the 1964 Olympic Games at Tokyo he competed despite a back injury and placed eleventh. He won the pole vault at the Amateur Athletic Union meet in 1965 and regained the world record in 1966 with a vault of 5.34 m. In the 1968 Olympic Games at Mexico City, he placed only fifth. In 1969 he made his highest vault, 5.44 m, and held the world record once more until the following year, when Wolfgang Nordwig of East Germany vaulted 5.45 m. A succession of injuries ended Pennel's vaulting career.

Pennell, Joseph (b. July 4, 1857, Philadelphia—d. April 23, 1926, Brooklyn, N.Y., U.S.), American etcher, lithographer, and writer who was one of the major book illustrators of his time.

Pennell, after attending the Pennsylvania Academy of the Fine Arts, went to Europe



"Things that Tower—Coal Collieries," drypoint by Joseph Pennell; in the Metropolitan Museum of Art, New York City
By courtesy of the Metropolitan Museum of Art, New York, gift of David Keppel, 1917

in 1884 and made his home in London. He produced numerous books (many of them in collaboration with his wife, Elizabeth Robins Pennell), but his chief distinction is as an original etcher and lithographer and as an illustrator. During his lifetime Pennell produced more than 900 etchings and mezzotints and more than 600 lithographs, on architectural and landscape subjects ranging from the Panama Canal and Yosemite National Park to the factories of England and the temples of Greece. His publications include several books on drawing and printmaking, and his famous biography of his friend J.M. Whistler, written with Mrs. Pennell (1908). Pennell moved back to the United States during World War I.

Penner River, also called NORTHERN PENNER RIVER, river rising on the Deccan Plateau 7 miles (11 km) west-southwest of Chik Ballāpur, Karnātaka (formerly Mysore) state, southern India. It flows north into Andhra Pradesh state and turns east-southeast toward the Coromandel Coast, emptying into the Bay of Bengal near Nellore, about 350 miles (560 km) from its source. The river is seasonal, becoming a torrent after the rains and a thin stream during dry periods.

Penney, J(ames) C(ash) (b. Sept. 16, 1875, Hamilton, Mo., U.S.—d. Feb. 12, 1971, New York City), merchant who established one of the largest chains of department stores in the United States.

Penney's first job was clerking in a general store for a salary of $2.27 per month. For medical reasons he moved to Colorado in 1897 and was soon hired by local dry-goods merchants Guy Johnson and T.M. Callahan. The company opened another store in Kemmerer, Wyo., in 1902, and young Penney became a one-third partner for an investment of $500 and a promissory note for $1,500. Five years later Penney bought out his partners' shares and launched the beginning of the J.C. Penney Co.

As each new store opened, Penney offered a profit-sharing plan to its manager. Even in 1927, when the company ceased operating as a partnership and sold its stock publicly, managers were given stock in the company, and eventually all employees were included in profit-sharing plans.

Offering a wide variety of relatively inexpensive general merchandise, J.C. Penney stores appeared in every state in the United States. Before his death in 1971 at the age of 95, Penney saw his company grow from a frontier-town dry-goods store to the second largest nonfood merchandiser in the country, behind Sears, Roebuck and Co. Annual sales had reached $4,000,000,000 produced by 1,660 different stores.

Penney (of East Hundred), William (George) Penney, Baron (b. June 24, 1909, Gibraltar), English nuclear physicist who led Britain's development of the atomic bomb.

Penney studied physics at the Imperial College of Science and Technology of the University of London (B.S. 1929, Ph.D. 1931) and at the University of Cambridge (Ph.D. 1935). He taught at the Imperial College from 1936 to 1945. Penney was engaged in research for the Ministry of Home Security and the Admiralty during World War II and was principal scientific officer of the department of scientific and industrial research in 1944–45 at the Los Alamos Scientific Laboratory, New Mexico, where he helped develop the American atomic bomb. In 1946 he was appointed chief superintendent of armaments research for the British Ministry of Supply, and in this capacity he supervised Britain's development of its own atomic bomb. He directed the successful first test of that weapon in 1952. He was knighted that same year. Penney was director of atomic-weapons research and development at Aldermaston, Berkshire, from 1953 to 1959, and he served as chairman of the U.K. Atomic Energy Authority from 1964 until 1967. In 1967 he was created a life peer.

Penney Company, in full J.C. PENNEY COMPANY, INC., U.S. retail company founded in 1902 by James Cash Penney (1875–1971) and today engaged in marketing apparel, home and automotive products, drugstore merchandise, and insurance. The firm serves consumers principally through stores, including catalog operations, in the United States and Puerto Rico. The company was called J.C. Penney Stores Company from 1913 to 1924, when it was reincorporated as J.C. Penney Co. Its present name was adopted in 1968. It is headquartered in Dallas, Texas.

On April 14, 1902, founder Penney and two partners opened the Golden Rule dry goods store in the small town of Kemmerer, Wyo., in a coal-mining and sheep-raising area. In the following two years they opened stores in two other Wyoming frontier towns. In 1907 Penney bought out his original partners and took on new ones, beginning with Earl Corder Sams (president of the company, 1914–46). By the time the firm was incorporated on Jan. 17, 1913, as the J.C. Penney Stores, there were 34 stores in the American West. In the following year the company's headquarters were moved to New York City. By 1929 J.C. Penney had become a public corporation listed on the New York Stock Exchange and had increased its number of stores to 1,392.

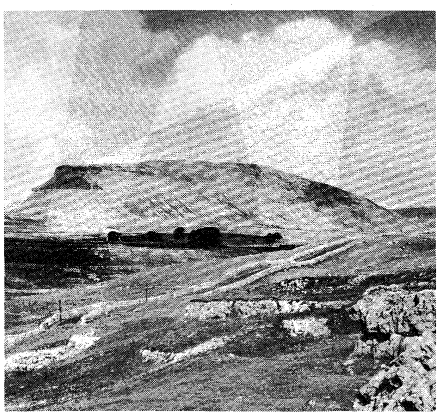
Penney retired in 1946, taking the title of honorary chairman, but until 1958 his conservative policies remained influential. (For many years any employee known to use tobacco or liquor, even privately, was discharged.) In 1958 the firm's traditional policy of strict cash-and-carry gave way to credit selling, and the emphasis on apparel and notions was broadened to include a more complete range of hard and soft goods and more fashionable merchandise. In 1962 the firm entered the catalog field, the first *Penney Catalog* being issued the following year. In 1966 it acquired two insurance companies. Overseas operations began in 1968–69, when it acquired Sarma, SA, a Belgian retail chain; and in 1971 it inaugurated stores in Italy under the name J.C. Penney, SpA. In 1988 the firm relocated its headquarters from New York City to Dallas.

Pennine Alps, Italian ALPI PENNINE, French ALPES PENNINES, segment of the Central Alps along the Italian-Swiss border, bounded by the Great St. Bernard Pass and the Mont Blanc group (southwest), by the Upper Rhône

The village of Courmayeur in the Pennine Alps, Italy
J. Alex Langley—DPI

Valley (north), by Simplon Pass and the Lepontine Alps (*qq.v.;* northeast), and by the Dora Baltea River valley (south). The highest point is Dufour Peak (*q.v.;* 15,203 feet [4,634 m]) in the Monte Rosa group; other important peaks include the Matterhorn and the Weisshorn. Most of the glaciers lie on the north slopes, including the well-known Gorner Glacier near Zermatt, Switz. Mountain climbing has long been the main activity of the region. The Swiss portion of the range is sometimes called the Walliser Alpen (German) or Alpes du Valais (French).

Pennines, major upland mass forming a relief "backbone," or "spine," in the north of England, extending southward from Northum-



Pen-y-Ghent in the northern section of the Pennines
Kenneth Scowen, F.I.I.P., F.R.P.S.

berland into Derbyshire. The uplands have a short, steep western slope and dip gently eastward. They are surrounded on the east, west, and south by the Vale of York, the Lancashire and Cheshire plains, and the valley of the River Trent, respectively. On the north, the Tyne Gap and Eden Valley separate the Pennines from the Cheviots and the Lake District mountains.

The Pennine system is often wrongly called a chain, but it is hardly even a range. Its hills are broken up into numerous short ranges by valleys (often called dales) cut back into them in every direction. The Pennines, in fact, form a north and south watershed that determines the course of all the larger rivers in northern England. The Pennines are divided into two main sections by a gap formed by the Rivers Aire (flowing east) and Ribble (flowing west). The northern section of the Pennines is broader and generally higher than the southern. The highest points in the northern section are Cross Fell (2,930 feet [893 m]), Whernside (2,419 feet [737 m]), Ingleborough (2,373 feet [723 m]), and Pen-y-Ghent (2,273 feet [693 m]). In the southern section, heights of more than 2,000 feet (600 m) are rare, apart from Kinder Scout (2,088 feet [636 m]), part of the Peak District of Derbyshire.

The geological structure of the Pennines consists of carboniferous limestone and Millstone Grit with some local shales. On the drier areas, heather moor predominates, while the wet, peaty areas are covered mostly with cotton grass. The summits of the hills are rounded or nearly flat, but geological structures and glacial action have helped to produce fine scenery in the dales. Water action has developed remarkable underground caverns and watercourses in the limestone of the Pennines. Among these caverns and chasms are Ingleborough Cave near Clapham, Gaping Gill (more than 350 feet [107 m] deep), and Rowten Pot (365 feet [111 m]). The stream draining Malham Tarn (brook) disappears below ground and reappears at the foot of the cliffs at Malham Cove. A notable underground watercourse in Derbyshire is the River Wye, which disappears into Plunge Hole and then traverses Poole's Hole, near Buxton. There are few lakes in the Pennines, but reservoirs in Millstone Grit areas supply the manufacturing regions of West Yorkshire and Lancashire with water.

The economy of the Pennines is based mainly on sheep farming and the quarrying of limestone. The valleys contain numerous small market towns, among them Hawes, Muker, and Grassington. Tourism has become an important element in the economy, helped by the designation of the Peak District, Yorkshire Dales, and Northumberland national parks. The Pennine Way, a footpath running along the hills of the Pennines from end to end for 250 miles (400 km), was opened in 1965.

There are numerous prehistoric remains, such as the great circle of stones at Arbor Low Hill. Hadrian's Wall, an ancient Roman defensive line against the peoples of what was, in large part, to become Scotland, extends east-west along the northern edge of the Pennines.

Pennington (England): *see* Lymington and Pennington.

Pennisetum, genus of the grass family (Poaceae), containing about 80 species of annual and perennial plants, native to tropical and subtropical areas. Kikuyu grass (*P. clandestinum*), a perennial sod-forming species, is

Feathertop (*Pennisetum villosum*)
Hartmut Noeller—Peter Arnold

grown for pasturage in Central America. Several varieties of feathertop (*P. villosum*) and fountaintop, or fountain grass (*P. setaceum,* formerly *P. ruppelii*), both native to Ethiopia, are cultivated in North America as ornamentals for their arching form and feathery, coloured flower clusters.

Pearl millet (*P. glaucum*), an annual species, which bears a cattaillike flower cluster, is cultivated in tropical areas for its edible grain. Napier grass, or elephant grass (*P. purpureum*), a tall African perennial, is cultivated for forage in Central American pastures.

Pennsylvania, officially COMMONWEALTH OF PENNSYLVANIA, constituent state of the United States of America, one of the Middle Atlantic states, located in the eastern United States. The state is bounded on the north by Lake Erie and the state of New York, on the east by New York and New Jersey, on the south by Delaware, Maryland, and West Virginia, and on the west by the Panhandle of West Virginia and by Ohio. The state capital is Harrisburg.

A brief treatment of Pennsylvania follows. For full treatment, *see* MACROPAEDIA: United States of America: *Pennsylvania.*

Four major Indian groups occupied Pennsylvania at the time of European arrival: the Delaware, or Lenni Lenape; the Susquehanna; the Shawnee; and various segments of the Iroquois League. Swedes (1643), Dutch (1647), and others were the first European settlers. The English seized control of the region in 1664, and in 1681 King Charles II of England signed a charter giving the region to William Penn. Under Penn's guidance a Quaker colony was established in 1682, based on government by popular will and religious tolerance.

In the century that followed, the Indians increasingly resisted the expansion of European settlements. Much of the fighting during the French and Indian War (1754–63) took place in Pennsylvania.

By the eve of the U.S. War of Independence, Pennsylvania had become a keystone state geographically and a centre of military, economic, and political activity. The first (1774) and second (1775–76) Continental Congresses met in Philadelphia, the Declaration of Independence was signed there, and the city temporarily became the capital of the confederation (1783–89) and of the fledgling United States.

When the American Civil War broke out in 1861, Pennsylvania once again became a centre of military activity, and at Gettysburg the Union Army won one of the most decisive victories of the war. The end of the war brought a period of great economic, industrial, and population growth, consolidating Pennsylvania's position as a major commercial power.

The Allegheny Front (escarpment) and Allegheny Mountains form a northeast-to-southwest diagonal across the centre of the state, while to the north and west a rugged plateau region falls almost at the lakefront into the Lake Erie Lowland. In the southeast are the fertile Coastal Plains around Philadelphia and the Piedmont, one of the state's most productive agricultural regions. The eastern part of the state is drained by the Delaware River and its tributaries and the western part is drained by the Ohio River system. The Susquehanna River, wide, shallow, and meandering, drains the largest part of the state.

Pennsylvania has a continental climate that is characterized by wide fluctuations in seasonal temperatures, with prevailing winds from the west. Annual rainfall averages some 39 inches (991 mm), and average temperatures in the north range from about 69° F (21° C) in July to about 25° F (−4° C) in January. In more southerly parts of the state, averages are several degrees higher.

The major ethnic groups constituting the population are the English, Germans, Scots-

Irish, French, Welsh, Cornish, and Irish, who settled in colonial times, and Italians and Slavic peoples, who immigrated primarily in the 20th century. Pennsylvania is also noted for its large religious populations of Quakers, Amish, Mennonites, Moravians, Schwenckfelders, and Dunkards. The state population has been growing very slowly, well below the national average. In this largely urban state, the greatest population density is found in Philadelphia, Delaware, and Allegheny counties, the latter including Pittsburgh.

Pennsylvania is one of the nation's most prosperous states, with both its past and present prosperity based on fertile farmland, commercial forestland, seemingly inexhaustible supplies of coal, many navigable waterways, and an economically strategic location. Pennsylvania still has a sizable farm population, and about one-third of the land is under cultivation. The major agricultural products are dairy and poultry products, meat animals, mushrooms, corn (maize), hay, apples, and grapes. It is one of the largest producers of coal in the nation, and it has small deposits of natural gas, iron ore, limestone, silver and gold, copper, cobalt, zinc, and salt. Pennsylvania's foremost industry was steel, but food processing, chemicals, machinery, and electrical and electronic equipment surpass it in terms of value added by manufacture. The state continues to produce much of the nation's specialty steel. The state's manufacturing industries are well diversified, and Pennsylvania ranks high in the nation in manufacturing employment.

The state's three major ports, Philadelphia, Pittsburgh, and Erie, are supplemented by others along the Delaware, the Susquehanna, and the channelized Inland Waterway System. Pennsylvania's highway system is one of the largest in the nation. The railway system links the state's major industrial centres and provides an important economic link for the Middle Atlantic region. The most important of the state's international airports are at Philadelphia and Pittsburgh.

Pennsylvania has an active cultural life, centred in Philadelphia and Pittsburgh. The Philadelphia Orchestra and the Pittsburgh Symphony Orchestra are two of the nation's major orchestras. The Curtis Institute of Music, founded in 1924, is one of the world's leading conservatories. The religious music of the Moravians is displayed at the Bach Choir's Bach Festival in Bethlehem. A great diversity of museums includes the Philadelphia Museum of Art. There is an active theatrical community, and a number of prominent 20th-century writers originated in Pennsylvania. Educational opportunities are plentiful. Philadelphia is a major centre of medical education, and Pittsburgh is a centre of scientific study. Area 45,308 square miles (117,348 square km). Pop. (1990 est.) 11,827,000.

Pennsylvania, University of, private university located in Philadelphia, founded in 1740 as a charity school. Largely through the efforts of Benjamin Franklin and other leading Philadelphians, it became an academy in 1753, with Franklin as president of the first board of trustees. Two years later it was chartered as the College and Academy of Philadelphia. With the foundation in 1765 of the first medical school in North America, the institution became in fact a university, but it was not so called until 1779, when for a time it received state support. Since 1791 it has been a privately endowed and controlled institution, although it continues to receive state aid.

University institutes include the Wistar Institute of Anatomy and Biology (the first anatomical institute in America devoted entirely to research, 1892) and the Henry Phipps Institute of Genetics and Community Diseases (1910). The University Museum (archaeology and ethnology) is a teaching and research organization.

Pennsylvania Academy of the Fine Arts, in Philadelphia, oldest art academy and museum in the United States, founded 1805. Specializing in American painting and sculpture of the 18th to the 20th century, the Academy's Art Museum was built between 1872 and 1876 according to designs by the architect Frank Furness (1839–1912). The building's architectural style is high Victorian. For its centennial year (1976), which coincided with the U.S. Bicentennial, the museum underwent a complete renovation.

The museum's collections of 19th- and 20th-century American landscape and genre paintings include pieces by such artists as Mary Cassatt, Thomas Eakins, Charles Willson Peale, and Andrew Wyeth. A 9,000-volume library of art history focuses primarily on American painting and sculpture.

Pennsylvania Avenue, major thoroughfare of Washington, D.C. It runs for 7 miles (11 km) in a northwesterly direction from the District of Columbia-Maryland line over the Anacostia River (John Philip Sousa Bridge) and through Washington's well-known central section lined with government buildings between the Capitol and the White House. It continues past George Washington University to end in Georgetown just west of Rock Creek. Pennsylvania Avenue is the traditional route of presidential inaugural and other major parades.

Pennsylvania Dutch (from German *Deutsch,* or *Deitsch,* "German"), 17th- and 18th-century German settlers in Pennsylvania and their descendants. They now live largely in Lehigh, Berks, Lebanon, Lancaster, and York counties. Some groups still speak a German dialect, known as Pennsylvania Dutch or Pennsylvania German (*Pennsylfawnish Deitsch*), and much larger numbers retain such elements of their traditional culture as a special cookery (*e.g.,* shoofly pie, a pie of molasses and dough crumbs) and distinctive decorative motifs, including geometric hex signs painted on barns and floral patterns stenciled on furniture and housewares. Most Pennsylvania Dutch are thoroughly assimilated and live lives scarcely different from the life of other Americans. Some groups, notably the Amish, however, wear plain, old-style garb, drive horse-drawn buggies, and live according to relatively strict religious principles.

The liberal and tolerant principles of William Penn's government in colonial Pennsylvania attracted a large flow of immigrants from the Rhine country of Germany. The immigration began with the Mennonite Francis Daniel Pastorius, who came to Pennsylvania with some German Quakers in 1683 and founded Germantown, the pioneer German settlement. The early German settlers were for the most part members of the smaller sects who came and settled as groups—Mennonites, Amish, Dunkers, or German Baptists, Schwenckfelders, and Moravians. After 1727 the immigrants were mostly members of the larger Lutheran and Reformed churches. Their farming skills made their region of settlement a rich agricultural area. By the time of the American Revolution they numbered about 100,000, more than a third of Pennsylvania's population.

Pennsylvania Railroad Company, byname PENNSY, largest of the trunkline railroads that connected the East Coast of the United States with the interior. It was chartered in 1846 by the Pennsylvania legislature to build a line between Harrisburg and Pittsburgh. Its first passenger train ran in 1848 between Philadelphia and Pittsburgh.

Through buying the Pittsburgh, Fort Wayne and Chicago Railway, the railroad reached Chicago in 1856. After the American Civil War the railroad expanded to St. Louis, Mo., and Cincinnati, Ohio, in the west and to New York City, Washington, D.C., and Norfolk, Va., in the south and east, ultimately becoming a 10,000-mile (16,000-kilometre) system. In 1910, with the completion of a tunnel under the Hudson River, it became the only railroad to enter New York City from the south. It also acquired control of the Long Island Railroad Company.

Throughout most of its history the Pennsylvania was a prosperous railroad, losing money for the first time in 1946. It suffered from the disadvantage that its route to Chicago had to cross the Appalachians, with grades of greater than 0.5 percent. Its chief competitor, the New York Central, had a water-level route to Chicago. In February 1968 the two railroads, together with the New York, New Haven and Hartford, merged to form the Penn Central Transportation Company. The new corporation also had a number of subsidiaries in real estate, oil refining, and a variety of other industries.

Penn Central encountered serious management and financial difficulties, however, and was forced into bankruptcy in June 1970. Its passenger services were taken over by the federally established National Railway Passenger Corporation (Amtrak) in 1971. The Penn Central continued to lose money, and, when efforts at reorganization failed, the assets of the railroad were acquired by Consolidated Rail Corporation (Conrail) in April 1976. Operation of the New York-Washington route was later transferred to Amtrak. The Penn Central Corporation continued in business as a diversified corporation not connected with the railroad industry.

Pennsylvania system, penal method based on the principle that solitary confinement fosters penitence and encourages reformation. The idea was advocated by the Philadelphia Society for Alleviating the Miseries of Public Prisons, whose most active members were Quakers. In 1829 the Eastern State Penitentiary, on Cherry Hill in Philadelphia, applied this so-called separate philosophy. Prisoners were kept in solitary confinement in cells 16 feet high, nearly 12 feet long, and 7.5 feet wide (4.9 by 3.7 by 2.3 m). An exercise yard, completely enclosed to prevent contact among prisoners, was attached to each cell. Prisoners saw no one except institution officers and an occasional visitor. Solitary penitence, however, was soon modified to include the performance of work such as shoemaking or weaving. The Pennsylvania system spread until it predominated in European prisons. Critics in the United States argued that it was too costly and had deleterious effects on the minds of the prisoners. The Pennsylvania system was superseded in the United States by the Auburn system.

Pennsylvanian period, in North America, interval of geologic time roughly equivalent to what is internationally designated the Late Carboniferous epoch (320 to 286 million years ago). Because the rocks that originated during this span of time are widespread in the state of Pennsylvania, U.S., some American geologists favour the term over Late Carboniferous, which was first adopted in Europe. *See* Carboniferous period.

Penny Post, private postal service created by the London merchant William Dockwra in 1680. All letters and packets up to one pound in weight were delivered for one penny (1 *d*). The packets were also insured up to £10. Dockwra's system consisted of several hundred receiving offices from which an hourly collection was made; the letters were taken to six central sorting offices. There were 4 deliveries per day in the greater part of London and 6 or 8 in the business centres.

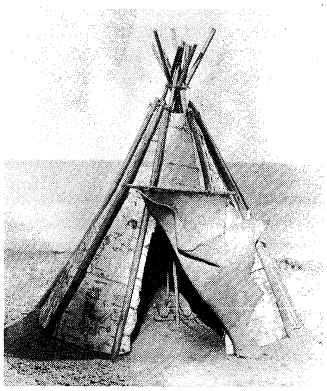
There was also a daily delivery, for which an additional penny was charged, to places 10 to 15 miles (16 to 24 kilometres) outside of London. In 1683 the Penny Post was taken over by the government-operated General Post Office, and Dockwra was forced to pay damages for having encroached on the crown's monopoly of the mail service which had been effected by Charles I in 1635.

pennycress, any plant of the genus *Thlaspi*, of the mustard family (Brassicaceae), named and sometimes grown for its round seedpods.

Pennycress (*Thlaspi rotundifolium*)
A.J. Huxley—EB Inc.

Most of the 60 species are Eurasian, but a few are native to North and South America, mostly in mountain areas. Common pennycress, or field pennycress (*T. arvense*), has spikelike clusters of penny-shaped, notched pods topped by small, white, four-petalled flowers.

Penobscot, Algonkian-speaking Indians who lived on both sides of the Penobscot Bay and throughout the Penobscot River Basin in what is now Maine, U.S. They were members of the Abnaki (*q.v.*) confederacy. Penobscot subsistence was based on hunting, fishing, and collecting, with seasonal movements following



Tepee-shaped wigwam of the Penobscot Indians of Maine
By courtesy of the American Museum of Natural History, New York

food resources. In winter small family groups lived in hunting camps within separate family territories, rights to which were inherited through the male line; larger camps and villages were inhabited during the summer. The office of tribal chief embodied little power, the individual acting generally as a tribal representative in ceremonies or in dealings with outsiders and sometimes adjudicating disputes.

Europeans first encountered the Penobscot early in the 16th century; a French mission was established among them in 1688. The Penobscot assisted the French against the English in all the wars on the New England frontier until 1749, when they made peace with the English. As a result they did not remove to Canada with the other groups of the Abnaki confederacy, and they remain in their old territory to the present. The Penobscot and the Passamaquoddy (*q.v.*) send to the Maine state legislature a representative who has no seat or vote and is permitted to speak only on tribal affairs.

Penobscot River, river in Maine, U.S., formed by several headstreams draining numerous lakes that were initially created by melting glaciers; it is the state's longest river, about 350 mi (560 km) in length. Its western and eastern branches join at Medway and run in a southeasterly direction to empty into the Atlantic via Penobscot Bay near Bucksport. The river's major tributary is the Mattawamkeag; Bangor, 23 mi from the ocean, is the head of navigation. Once an important source of salmon, the river with its hydropower facilities has become economically important to the lumbering and pulp and paper industries. The bay extends 35 mi inland and is 27 mi wide; it includes many islands and sheltered harbours, and tourism is significant.

Navigated by English voyagers in 1603, and in 1604 by Samuel de Champlain, the river was named after the Penobscot Indians. Its valley became a bloody battleground for the French and British between 1673 and 1759 and between the British and Americans until 1815.

penology, also called PENAL SCIENCE, that part or division of criminology which concerns itself with the philosophy and practice of society in its efforts to repress criminal activities. As the term signifies (from Latin *poena*, "pain," or "suffering"), penology has stood in the past and, for the most part, still stands for the policy of inflicting punishment on the offender as a consequence of his wrongdoing; but it may reasonably be extended to cover other policies, not punitive in character, such as probation, medical treatment, and education, aimed at the cure or rehabilitation of the offender; and this is, in fact, the accepted present sense of the term.

The principal aims of penal science are: to bring to light the ethical bases of punishment, along with the motives and purposes of society in inflicting it; to make a comparative study of penal laws and procedures through history and between nations; and, finally, to evaluate the social consequences of the policies in force at a given time. Thus conceived, penology represents a grouping of studies, some of which, dealing with the aims and the moral or social justifications of punishment, date from a remote past, while others, having to do with the wider social implications of the system, have scarcely yet made a beginning.

Modern penology dates from the publication of Cesare Beccaria's pamphlet on *Crimes and Punishments* in 1764. This represented a school of doctrine, born of the new humanitarian impulse of the 18th century, with which Jean-Jacques Rousseau, Voltaire, and Montesquieu in France and Jeremy Bentham in England were associated. This, which came afterwards to be known as the classical school, assumed every criminal act to be a deliberate choice determined by a calculation of the prospective pleasures and pains of the act contemplated. All that was needed to overcome the criminal purpose was to provide for each and every crime a penalty adequate to overbalance its assumed advantages. Excessive penalties, such as death, were unnecessary and therefore unjust.

The classical school was followed, a generation later, by the neoclassical school of the revolutionary period in France, which modified Beccaria's rigorous doctrine by insisting on the recognition of varying degrees of moral, and therefore of legal, responsibility, as in the case of children and the insane, as well as of mitigating circumstances in general. The doctrine of the "individualization of punishment"—that is to say, of the punishment of the individual rather than of the crime committed by him, which is of commanding importance in present day penology—is only a development of this fundamental principle of the neoclassical school.

This normal historical development of penology was interrupted during the last quarter of the 19th century by the widespread acceptance of the theory of crime and its treatment promulgated by Cesare Lombroso and his disciples. This, at first known as the Italian, or continental, school of criminology, was later named the positive school, so-called because it pursued the positive methods of modern science. Its fundamental doctrine was that the criminal was doomed by his inherited traits to a criminal career and was therefore a wholly irresponsible actor. Society must, of course, protect itself against him, but to punish him as if he were a free moral agent was as irrational as it was unethical.

Although the enthusiasm for the doctrines of the positive school waned and the alleged facts on which they were based were largely discredited, it nevertheless left a valuable legacy of influence. To it must be given much of the credit for the present active tendency to make the mental study of the criminal an essential part of his diagnosis, a fact which has given the psychologist and, particularly, the psychiatrist a leading place in the development of modern penological theory. From studies such as these, criminologists discovered that there was no single formula that accounted for all violators of the penal code, while the policy of the individualization of punishment took on the form of individualization of treatment.

Indeed, the emphasis turned to research—research into the factors, whether individual or social, which determine criminal activities and research into the resources of the community for making such disposition of the offender as will effectually protect the former without destroying the latter.

Penrith, city, east central New South Wales, Australia, on the Nepean River, a section of the Hawkesbury River. Founded in 1815, it was known as Evan and Castlereagh before being renamed after Penrith in Cumberland, England. It was declared a municipality in 1871 and a city in 1959. A suburb of Sydney (30 mi [48 km] east), to which it is linked by rail and the Great Western Highway, Penrith is also a resort and agricultural centre (dairying, fruits, poultry, vegetables, and beef). Its industries include the manufacture of aluminum foil, concrete and building materials, plastics, textiles, pharmaceutical products, and engineering and electrical products. Pop. (1981) 108,720.

Penrith, locality, Eden district, county of Cumbria, England. It is situated on a main route to Scotland, at the foot of Penrith Beacon (937 ft [286 m]) overlooking the mountains of the scenic region known as the Lake District.

Penrith Castle was built in the 14th century as a defense against the Scottish raids and was dismantled during the mid-17th-century English Civil War. The parish Church of St. Andrew, of Norman foundation, has a 13th-century tower, but the body of the building is 18th century.

The town, on the edge of the Lake District National Park, is now a tourist and agricultural centre, with a weekly livestock market. Places of interest include the Giant's Grave (ancient hogsback stones and cross shafts) in the churchyard and the Gloucester Arms (associated with Richard III of England [reigned 1483–85]). The ruins of Brougham Castle, with a 12th-century keep, stand on the site of a Roman fort, $1\frac{1}{2}$ mi (2.5 km) to the southeast. Pop. (1981 prelim.) 12,205.

Penrose, Boies (b. Nov. 1, 1860, Philadelphia—d. Dec. 31, 1921, Washington, D.C.), U.S. legislator and longtime party boss of Pennsylvania. He served as U.S. senator from Pennsylvania from 1897 to 1921.

Penrose was admitted to the Pennsylvania bar in 1883, began to practice law in Philadelphia, and soon became interested in government and politics. He was elected as a Republican to the state legislature in 1884 and to the state senate in 1887. In that year he also published *The City Government of Philadelphia,* a study prepared in collaboration with law partner Edward P. Allinson, which advocated certain municipal reforms. The politics of reform did not long hold his interest, however, as he became associated with state party boss Matthew S. Quay. In 1895 Penrose ran unsuccessfully for the Republican nomination for mayor of Philadelphia. Two years later he was elected to the U.S. Senate and was successively reelected until his death.

Succeeding Quay as Republican boss of Pennsylvania in 1904, Penrose thereafter maintained a firm grip on state affairs that was broken only temporarily in 1912, when Progressives, led by former Pres. Theodore Roosevelt on the national level, succeeded in challenging his authority. In a dispute over campaign funds, Roosevelt and others stepped up their attacks, characterizing Penrose as the archetypal political boss whose corrupting influence stood in the way of clean, honest government. Although never charged with bribery or otherwise profiting financially from his role in politics (he was independently wealthy), Penrose was undisputedly the chief power broker in Pennsylvania in the first decades of the century and used that power without reservation. In the Senate he rose to the post of chairman of the Finance Committee in 1911. He opposed virtually all measures the Progressives brought forth during this period, including prohibition and women's suffrage.

Penrose, Roger (b. Aug. 8, 1931, Colchester, Essex, Eng.), British mathematician and relativist who in the 1960s calculated many of the basic features of black holes.

In 1969, with Stephen Hawking, Penrose proved that all matter within a black hole collapses to a singularity, a geometrical point in space where mass is compressed to infinite density and zero volume. Penrose also developed a method of mapping the regions of space–time surrounding a black hole. (Space–time is a four-dimensional continuum comprising three dimensions of space and one of time.) Such a map, called a Penrose diagram, allows one to visualize the effects of gravitation upon an entity approaching a black hole.

In the early years of his career Penrose held temporary posts at a number of universities in both England and America. From 1964 to 1973 he served as reader and eventually professor of applied mathematics at Birbeck College, London. From 1973 he held the Rouse-Ball Chair of mathematics at Oxford University. Penrose received the Adams Prize in 1966 and the Dannie Heineman Prize for Physics in 1971. He was elected to the Royal Society in 1972, and he shared the Royal Astronomical Society's Eddington Medal with Hawking in 1975.

Penryn, locality and English Channel port, Kerrier district, county of Cornwall, England. It lies at the head of the River Penryn's estuary. The town owed its development to the bishops of Exeter, who granted the first charter (1265). James I (reigned 1603–25) granted and renewed the charter of incorporation. Penryn is the principal English port for the shipment of granite, which is extensively quarried in the district. Pop. (1981 prelim.) 5,090.

Pensacola, city, seat (1821) of Escambia County, extreme northwestern Florida, U.S., on Pensacola Bay. A Spanish settlement was made on the bay coast in 1559 but was abandoned in 1661. The Spaniards formally took possession in 1698 and built Ft. San Carlos, but this was ravaged during the French–Spanish colonial fighting of 1719–20. After the British gained control following the Seven Years' War, Pensacola (a name derived from Pansfalaya, a local Indian tribe) became the capital of West Florida. During the Revolution it became a haven for Tories but in 1781 was taken by a Spanish force from New Orleans. In 1818 Gen. Andrew Jackson captured the city, accusing the Spanish of encouraging Indian raids against the U.S. After Florida was ceded to the U.S. in 1821, Pensacola acquired a federal navy yard. The city was seized by Confederates at the outbreak of the Civil War, but Ft. Pickens on Santa Rosa Island offshore remained in Federal hands; in 1862 the Confederates evacuated the city.

Lumbering and commercial fishing increased after the war, and industry developed. The navy yard became a naval air station in 1913, and the large aviation training school helped the city's economy. Pensacola's landlocked deepwater port, although important, suffers because of its proximity to Mobile, Ala. (61 mi [98 km] northwest). Tourism and chemical and wood industries are significant economic factors. Pensacola Junior College opened there in 1948, and the University of West Florida opened in 1967. The Fiesta of Five Flags, reflecting the city's checkered history, is an annual event in June. Gulf Islands National Seashore is to the south. Inc. 1822. Pop. (1980) city, 57,619; (1982 est.) metropolitan area (SMSA), 308,500.

pension, series of periodic money payments to a person who retires from employment because of age, disability, or the completion of an agreed span of service. The payments usually continue for the rest of the natural life of the recipient, and sometimes to a widow or other survivor. Military pensions have existed for many centuries; private pension plans originated in Europe during the 19th century.

Eligibility for and amounts of benefits are based on a variety of factors, including length of employment, age, earnings, and, in some cases, past contributions. Benefits are sometimes also arranged to complement payments from public social security programs. Although public and private pension plans have undergone parallel development in the United States and Britain, in other countries—*e.g.,* Italy and Sweden—the existence of social security programs paying generous retirement benefits has to some extent precluded significant development of private pension plans. In other cases, though, as in Germany, private programs have been widely adopted in spite of large social security benefits.

Pensions may be funded by making payments into a pension trust fund (or a pension foundation in some European countries) or by the purchase of annuities from insurance companies. In plans known as multi-employer plans, various employers contribute to one central trust fund administered by a joint board of trustees. Such plans are particularly common in The Netherlands and France and in industries in the United States.

The United States has recognized that many of its workers are ineligible for pension plans and has taken steps to extend eligibility to these workers. In 1962 U.S. Representative Eugene Keogh was instrumental in the passage of a bill that became the Self-Employed Individuals Tax Retirement Act. This legislation allowed self-employed individuals and their employees to be covered by qualified pension plans administered by the self-employed individual, thus extending to them some of the tax benefits that had been available to employees of corporations. Few people utilized the original Keogh Plan, causing Congress to remove certain restrictions on the Plan in 1968. Further liberalization of the Plan came about through the Employee Retirement Income Security Act of 1974, which created another form of tax-supported retirement savings plan, the Individual Retirement Account, or IRA.

IRA's are sponsored by banks, brokerage houses, and other financial institutions and are designed to allow participation by individuals not otherwise actively participating in a tax-supported retirement plan. In certain circumstances, a person eligible for IRA participation may also establish an IRA for an unemployed spouse (spousal IRA). Special plans known as rollover IRA's can be set up to receive pension funds even when an individual's employment with the employer sponsoring a pension plan is severed. These funds, if reinvested in the individual's rollover IRA within a specified period of time, are allowed to continue to increase untaxed until their distribution at or after the individual's retirement.

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

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pensionary, Dutch PENSIONARIS, powerful political office in the Dutch Republic (United Provinces; 1579–1795). Pensionaries, originally the secretaries and legal advisers of the town corporations, were first appointed in the 15th century. They were members of the town delegations in the provincial States (assemblies). The pensionaries of the provinces of Holland and Zeeland were particularly influential and, by the end of the 16th century, virtually dominated certain city governments.

In Holland the nobility had its own pensionary who served as chairman of the States. This land advocate, as he was then known, held a position of national power in the period 1586–1618, when Johan van Oldenbarnevelt, a former pensionary of Rotterdam, dominated the domestic and foreign policy of the republic. His power came not from his office but from the fact that he was the leader of the ruling oligarchy of Holland, the preponderant province. With the fall of Oldenbarnevelt in 1618, the office, renamed councillor pensionary (*raadpensionaris*) in 1619, declined as that of the stadholder increased in power. In 1653, during the first stadholderless period (1650–72), the office again became ascendant with the appointment of Johan de Witt, the pensionary of Dordricht from 1650. No succeeding grand pensionary equalled his power and prestige.

The office of councillor pensionary (including the less important equivalent in Zeeland) was abolished with the fall of the republic in 1795. The title was briefly revived in 1805 but referred to a newly created national office.

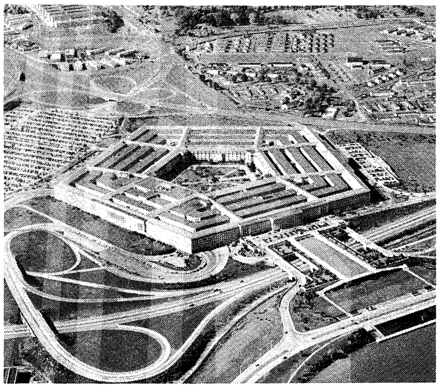
Penstemon, the beard-tongue genus of the figwort family (Scrophulariales; *q.v.*), containing about 250 species of plants native to North America, particularly the western United States. The flowers are usually large and showy, tubular, bilaterally symmetrical, and have four fertile stamens and one sterile stamen (staminode). Many species and varieties are popular in home gardens. The colourful flowers are white, yellow, blue, purple, or scarlet.

Pentaceratops, genus of five-horned, large herbivorous dinosaurs found as fossils in Late Cretaceous rocks of North America and possibly eastern Asia (the Cretaceous period began 144,000,000 years ago and lasted 77,600,000 years); it was a relative of the more familiar *Triceratops.* Especially well known from the Kirtland Shale of New Mexico, *Pentaceratops* had one horn on its snout, one above each eye, and one on each side of the large, bony neck frill. The frill served as an attachment area for powerful muscles that aided in chewing and controlling movements of the head. It also protected vulnerable areas from attack by predators.

The forelimbs of Pentaceratops were shorter than the hind limbs, a circumstance indicating that these horned dinosaurs descended from bipedal dinosaurs and had reverted to a quadrupedal mode of locomotion. The back had a characteristically arched appearance caused by the unequal development of the limbs.

pentaerythritol tetranitrate (explosive): *see* PETN.

Pentagon, large five-sided building in Arlington county, Va., near Washington, D.C., that serves as headquarters of the U.S. Department of Defense, including all three services—Army,



The Pentagon, Arlington County, Va.
Ewing Galloway

Navy, and Air Force. Designed by George Edwin Bergstrom, it was built in 1941–43 to bring under one roof the U.S. War Department offices then housed in widely scattered buildings. On its completion it was the world's largest office building, covering 34 acres (14 hectares; including a 5-acre [2-hectare] central court) and offering 3,700,000 square feet (343,730 square m) of usable floor space for as many as 25,000 persons, military and civilian. Built of structural steel and reinforced concrete with some limestone facing, the structure has five floors, excluding the mezzanine and the basement. The building consists of five concentric pentagons, or "rings," with 10 spokelike corridors connecting the whole. A huge concourse within it provides a shopping centre for Pentagon workers, and beneath this concourse are bus and taxi terminals. Parking areas adjacent to the building can accommodate as many as 10,000 cars, and a heliport for the Pentagon was added in 1956.

Pentagon Papers, papers that contain a history of the U.S. role in Indochina from World War II until May 1968 and that were commissioned in 1967 by U.S. Secretary of Defense Robert S. McNamara. They were turned over (without authorization) to *The New York Times* by Daniel Ellsberg, a senior research associate at the Massachusetts Institute of Technology's Center for International Studies.

The 47-volume history, consisting of approximately 3,000 pages of narrative and 4,000 pages of appended documents, took 18 months to complete. Ellsberg, who worked on the project, had been an ardent early supporter of the U.S. role in Indochina but, by the project's end, had become seriously opposed to U.S. involvement. He felt compelled to reveal the nature of U.S. participation and leaked major portions of the papers to the press.

On June 13, 1971, *The New York Times* began publishing a series of articles based on the study, which was classified as "top secret" by the federal government. After the third daily installment appeared in the *Times,* the U.S. Department of Justice obtained in U.S. District Court a temporary restraining order against further publication of the classified material, contending that further public dissemination of the material would cause "immediate and irreparable harm" to U.S. national-defense interests.

The *Times*—joined by *The Washington Post,* which also was in possession of the documents—fought the order through the courts for the next 15 days, during which time publication of the series was suspended. On June 30, 1971, in what is regarded as one of the most significant prior-restraint cases in history, the U.S. Supreme Court, in a 6–3 decision, freed the newspapers to resume publishing the material. The court held that the government had failed to justify restraint of publication.

The Pentagon Papers revealed that the Harry S. Truman administration gave military aid to France in its colonial war against the communist-led Viet Minh, thus directly involving the United States in Vietnam; that in 1954 President Dwight D. Eisenhower decided to prevent a communist takeover of South Vietnam and to undermine the new communist regime of North Vietnam; that President John F. Kennedy transformed the policy of "limited-risk gamble" that he had inherited into a policy of "broad commitment"; that President Lyndon B. Johnson intensified covert warfare against North Vietnam and began planning to wage overt war in 1964, a full year before the depth of U.S. involvement was publicly revealed; and that Johnson ordered the bombing of North Vietnam in 1965 despite the judgment of the U.S. intelligence community that it would not cause the North Vietnamese to cease their support of the Viet Cong insurgency in South Vietnam.

The release of the Pentagon Papers stirred nationwide and, indeed, international controversy because it occurred after a decade of growing dissent over the legal and moral justification of intensifying U.S. actions in Vietnam. The disclosures and their continued publication despite top-secret classification were embarrassing to the administration of President Richard M. Nixon, who was preparing to seek reelection in 1972. So distressing were these revelations that Nixon authorized unlawful efforts to discredit Ellsberg, efforts that came to light during the investigation of the Watergate Scandal (*q.v.*).

The papers were subsequently published in book form as *The Pentagon Papers* (1971).

pentameter, line of verse containing five metrical feet. In English verse, in which pentameter has been the predominant metre since the 16th century, the preferred foot is the iamb—*i.e.,* an unstressed syllable followed by a stressed one, represented in scansion as ∪ ′.

Geoffrey Chaucer employed iambic pentameter in his *Canterbury Tales* as early as the 14th century, although without the regularity that is found later in the heroic couplets of John Dryden and Alexander Pope. Most English sonnets have been written in iambic pentameter, as in this example:

∪ ′ ∪ ′ ∪ ′ ∪ ′ ∪ ′
So long | as men | can breathe | or eyes | can see,
∪ ′ ∪ ′ ∪ ′ ∪ ′ ∪ ′
So long | lives this | and this | gives life | to thee.
(Shakespeare, Sonnet 18)

Shakespeare also used pentameter in his blank-verse tragedies.

pentarchy, in early Byzantine Christianity, the proposed government of universal Christendom by five patriarchal sees, under the auspices of a single universal empire. Formulated in the legislation of the emperor Justinian I (527–565), especially in his *Novella* 131, the theory received formal ecclesiastical sanction at the Council in Trullo (692), which ranked the five sees as Rome, Constantinople, Alexandria, Antioch, and Jerusalem.

Since the end of the 4th century, the five patriarchates were indeed the most prominent centres of the universal Christian church, enjoying a de facto primacy based on such empirical factors as the economic and political importance of their cities and countries. The church of Constantinople, the "New Rome," for example, occupied second rank because it was the capital of the empire.

According to the views of Roman bishops, however, only apostolic sees, churches actually founded by apostles, were eligible for primacy; this view thus excluded any patriarchal role for Constantinople. In fact, the popes always opposed the idea of pentarchy, gradually developing and affirming a universal ecclesiastical structure centred on Rome as the see of Peter. Byzantine imperial and conciliar legislation practically ignored the Roman view, limiting itself to the token recognition of Rome as the first patriarchal see. The tensions created by the opposing theories contributed to the schism between East and West.

The pentarchy lost its practical significance with the christological disputes of the 5th and 6th centuries, which separated the see of Alexandria from imperial Christendom, and after the Muslim domination of the Orthodox patriarchates of Alexandria, Antioch, and Jerusalem in the 7th century. The patriarch of Constantinople remained the only real primate of Eastern Christianity, and new influential ecclesiastical centres in Bulgaria, Serbia, and Russia, with new and powerful patriarchates, eventually began to compete with Constantinople and overshadow the ancient patriarchates of the East.

pentastomid, any of about 70 species of tiny parasites belonging to the Pentastomida, usually considered a class. Pentastomids are considered to lie between annelids and arthropods in evolutionary development. They range from a few millimetres to 14 cm (about 6 inches) in length and lack respiratory, circulatory, and excretory organs.

Pentastomids live in the respiratory systems of vertebrate hosts. Although they are mostly tropical or subtropical, those with homoiothermic (warm-blooded) hosts may also be found in cold regions. Reptiles are the most common victims of pentastomid infestation. *Porocephalus* is parasitic in snakes and rodents. *Lingulata* species parasitize various mammals, including dogs. A few species are of medical interest because they infest human hosts.

Pentateuch, the first five books of the Old Testament. *See* Torah.

pentathlon, athletic contest entailing five distinct types of competition. In the ancient Greek Olympics, the pentathlon included a race the length of the stadium (about 180 or 200 yards [165 or 183 m]), the long jump, discus throw, javelin throw, and a wrestling match between the two athletes who performed best in the previous four events. This Greek pentathlon was adapted for modern track-and-field competition by setting the sprint distance at 200 m and by substituting a 1,500-metre run for the wrestling match. The event was included in the Olympic Games from 1912 through 1924.

The modern, or military, pentathlon, based on the skills needed by a battlefield courier, was first included in the Olympic Games of 1912, and it has been a team event since 1952. It is not a women's event in the Olympics. The modern pentathlon is a five-day contest involving five events; competition includes a 600-metre equestrian steeplechase on a horse selected by lot, a series of épée fencing matches, pistol shooting at standing silhouette targets, a 300-metre freestyle swim, and a 4,000-metre cross-country run. The modern pentathlon is governed by the Union Internationale du Pentathlon Moderne et Biathlon. Each nation may enter a three-member team. Scoring is on a point basis; the individual and team winners are determined by total scores from the five events. From 1964 to 1980, individual women competed in an Olympic athletics event known as the pentathlon, which included shot put, high jump, 80-metre hurdles, 200-metre dash, and long jump (*see also* heptathlon). *See also* Olympic Games.

pentatonic scale, also called FIVE-NOTE SCALE, or FIVE-TONE SCALE, musical scale containing five different tones. It is thought that the pentatonic scale represents an early stage of musical development, because it is found, in different forms, in most of the world's music. The most widely known form is anhemitonic (without semitones; *e.g.,* c–d–f–g–a–c′), the hemitonic form (with semitones; *e.g.,* c–e–f–g–b–c′) occurring less frequently.

Pentatonic scales may have been used in ancient times to tune the Greek kithara (lyre), and some early Gregorian chant incorporated pentatonic melodies. A variety of pentatonic scales occur in the music of American Indians, black Africa, and Asia (*e.g.,* the Javanese five-tone *slendro*), as well as in many European folk melodies. In Western art music, 20th-century composers such as Claude Debussy have used pentatonicism for special effects.

Pentecost (island, Vanuatu): *see* Pentecôte.

Pentecost (from Greek *pentecostē,* "50th day"), also called WHITSUNDAY, major festival in the Christian church, celebrated on the Sunday that falls on the 50th day after Easter. It commemorates the descent of the Holy Spirit on the disciples, which occurred on the Jewish Pentecost, after the death, Resurrection, and Ascension of Jesus Christ (Acts of the Apostles, chapter 2), and it marks the beginning of the Christian church's mission to the world.

The Jewish feast was primarily a thanksgiving for the firstfruits of the wheat harvest, but the rabbis associated it with remembrance of the Law given by God for the Hebrews to Moses on Mount Sinai. The church's transformation of the Jewish feast to a Christian festival was thus related to the belief that the gift of the Holy Spirit to the followers of Jesus was the firstfruits of a new dispensation that fulfilled and succeeded the old dispensation of the Law.

When the festival was first celebrated in the Christian church is not known, but it was mentioned in a work from the Eastern church, the *Epistola Apostolorum,* in the 2nd century. In the 3rd century it was mentioned by Origen, theologian and head of the catechetical school in Alexandria, and by Tertullian, Christian priest and writer of Carthage.

In the early church, Christians often referred to the entire 50-day period following Easter as Pentecost. Baptism was administered both at the beginning (Easter) and end (the day of Pentecost) of the season. Eventually, Pentecost became a more popular time for baptism than Easter in northern Europe, and in England the feast was commonly called White Sunday (Whitsunday) for the special white garments worn by the newly baptized. In *The First Prayer Book of Edward VI* (1549), the feast was officially called Whitsunday, and this name has continued in the Anglican churches.

Pentecost (Judaism): *see* Shabuoth.

Pentecostal Assemblies of the World, Inc., Protestant denomination organized in the United States in 1916 after many members withdrew from the Assemblies of God during the Jesus Only controversy, a movement that denied the standard Pentecostal belief in the Trinity—Father, Son, and Holy Spirit. Originally an interracial church, it was divided by the splitting off of the whites into the Pentecostal Church, Inc., in 1924. This church merged with the Pentecostal Assemblies of Jesus Christ in 1945 to form the United Pentecostal Church, Inc. The Pentecostal Assemblies of the World, Inc., baptizes in the name of Jesus rather than in the name of the Trinity. In organization it resembles Methodism. Headquarters are in Indianapolis, Ind.

Pentecostal Church of God of America, Inc., Protestant denomination organized in Chicago in 1919 as the Pentecostal Assemblies of the U.S.A. by a group of ministers who had earlier refused affiliation in the General Council of the Assemblies of God (1914); the present name was adopted in 1922. Citing the *Statement of Fundamental Truths* issued by a subsequent Council as a regression to the conventional ecclesiasticism from which many Pentecostals had just recently emerged, the new group demonstrated its independence by establishing rather liberal policies on ordination, church membership, and the issue of divorce and remarriage of the clergy.

Though not very active in the area of foreign missions, the Pentecostal Church of God has conducted an extensive ministry among the American Indians. Headquarters and a publishing house are located in Joplin, Mo.

Pentecostal Fellowship of North America (PFNA), cooperative organization established in Chicago in 1948 by eight Pentecostal denominations for the purpose of "inter-denominational Pentecostal cooperation and fellowship." Several Canadian and U.S. Pentecostal bodies are members of the organization. It is governed by a 13-member Board of Administration and a 5-member Executive Committee.

Pentecostal Holiness Church, Inc., Protestant denomination organized in Falcon, N.C., in 1911 by the merger of the Fire-Baptized Holiness Church (organized in 1898 by several Pentecostal associations) and the Pentecostal Holiness Church (organized in 1900). A third group, the Tabernacle Pentecostal Church, joined the consolidation in 1915.

Unlike most other Pentecostal churches, the denomination permits candidates for baptism to "have the right of choice between the various modes as practised by the several evangelical denominations." It even permits the baptism of infants. In matters of polity, it is decidedly less democratic than other Pentecostal bodies. Reflecting the Methodist Episcopal heritage of its Holiness constituents, the denomination is divided into conferences: general, annual, district, and missionary.

The General Board of Education oversees the operations of three church-related institutions of higher learning: Emmanuel College, a fully accredited academy and junior college in Franklin Springs, Ga., close to the denominational headquarters; Holmes Theological Seminary in Greenville, S.C.; and Southwestern Pentecostal Holiness College in Oklahoma City, Okla., which Oral Roberts, a faith healer and evangelist, helped to establish. *See* Holiness movement.

Pentecostalism, charismatic religious movement that gave rise to a number of Protestant churches in the United States in the 19th and 20th centuries and that is characterized by the belief that all Christians should seek a postconversion religious experience called the baptism with the Holy Spirit. This experience corresponds to the first outpouring or descent of the Holy Spirit upon the 12 disciples of Christ assembled in Jerusalem on the day of Pentecost, as recorded in Acts 1:12–2:4, and it is accompanied by the same sign: the gift of glossolalia, or "speaking in tongues" (*see* tongues, gift of). Pentecostals also hold that a Spirit-baptized believer may receive at least one of the other supernatural gifts that were known to have been in existence in the early church—the ability to prophesy, to heal, or to interpret what is said when someone speaks in unknown tongues. Beyond these unique distinctions, Pentecostal churches reflect those patterns of faith and practice characteristic of the Fundamentalist–Holiness branches of Protestantism that also originated in 19th-century America, with their emphases of biblical literalism, conversion, and moral rigour (*see also* Fundamentalism; Holiness movement). Despite a common belief in certain doctrines, such as baptism of the Spirit, speaking in tongues, and healing, Pentecostals have not united in a single denomination.

The sources of Pentecostalism's appeal. The initial success of the Pentecostal movement during the early decades of the 20th century, as well as its widespread appeal since then, had its roots in the post-Civil War period. That period was a time of mounting indifference to the claims of the biblical faith. Denominations that had been noted for their revivalistic fervour suddenly changed; they became subdued. Emotional modes of religious expression—enthusiastic congregational singing, spontaneous testimonies, prayer in unison, and extemporaneous sermons on simple biblical themes by lay preachers—gave way to ordered, formal worship services that were conducted by "reverends" who had been trained in homiletics (preaching skills) and influenced by higher biblical criticism. Lecture centres and elegantly appointed sanctuaries had replaced camp-meeting sites and crude frame tabernacles.

As the large popular denominations became transformed into churches of the upper-middle class, people of limited means began to feel more and more out of place. They yearned to return to a "heart religion" that would satisfy not only their craving for religious certainty but also their emotional, psychological, and physical needs. The newly emerging Holiness and Pentecostal movements fulfilled these needs for churchgoers and nonchurchgoers alike. Moreover, Pentecostal churches continued to minister to all levels of society, especially to the economically and culturally neglected and socially isolated.

Another probable source of Pentecostalism's appeal is the emphasis placed on the doctrine of healing. From the very beginning of the Pentecostal revival, its evangelists—Mrs. Mary B. Woodworth-Etter, Charles Price, Aimee Semple McPherson, and, more recently, Oral Roberts—have taught that deliverance from sickness was provided for in Christ's atonement and is, therefore, the privilege of all who have the requisite faith. This effort to minister to the physical needs of people most likely has been responsible for winning many followers to Pentecostalism.

Modern origins. The roots of the modern Pentecostal movements are traceable to a number of charismatic outgrowths of the 19th-century Holiness revival that developed in various parts of the United States. Perhaps the most far-reaching of these movements was the one that originated around the turn of the 20th century at a small religious school called Bethel Bible College in Topeka, Kan. The director of the institution, Charles Fox Parham, one of many ministers who had been influenced by the Holiness movement, believed that what he saw as a complacent, prosperity-ridden, and coldly formalistic church of the era needed to be revived and that such a revival could only be achieved by another outpouring of the Holy Spirit. He therefore instructed his students, many of whom already held ministerial credentials with Methodist, Friends, or Holiness churches, to pray, fast, study the Scriptures, and await an endowment of Pentecostal blessing and power that would be very much like the events recounted in the book of Acts.

On Jan. 1, 1901, the first of Parham's many students to experience a Spirit baptism began speaking in an unknown tongue. Henceforth, most Pentecostals usually declared that glossolalia was the "initial evidence" that one had been truly Spirit-baptized. These recurrences of Pentecost also had prophetic overtones that Parham and his students interpreted as meaning that they must be living in the last days. Imbued with this sense of urgency, they set out to evangelize the American Southwest before the end came. Their efforts were so successful that by 1905, according to Parham, approximately 25,000 persons in Texas alone had embraced Pentecostal faith and practice. The embryonic charismatic movement was at first significant only regionally: in the tri-state region of Kansas, Missouri, and Texas and in Alabama and western Florida. The national and international expansion occurred as a consequence of what is recorded as the Azusa Street revival of 1906.

The Apostolic Faith Gospel Mission at 312 Azusa Street in the industrial section of Los Angeles was unpretentious. Its leader, William Seymour, a one-eyed black former Holiness preacher, had been exposed to Pentecostal teaching at a Bible school that Charles Parham had established in Houston, Texas. Under his guidance, the old frame building, which formerly had housed a Methodist congregation, became a Pentecostal mecca (or pilgrimage centre). From April 1906 onward, rich and poor, blacks and whites, native Americans and those from abroad, and seekers and skeptics flocked to the Azusa Street Mission to receive spiritual help.

Spiritually energized and convinced that they had been charismatically endowed, scores of men and women spread out to tell of their experiences, extolling the reality and purposiveness of speaking in tongues. Soon storefront missions, modest tabernacles located in sparsely populated rural areas, and upper-story lofts in squalid urban neighbourhoods housing lively groups of Pentecostal believers sprang up in many parts of the world. These congregations represented the effects of a novel revival that was known variously as the Latter Rain, Apostolic Faith, or Pentecostal movement.

At first, the ultimate in organizational development among Pentecostal Christians was an amorphous sort of "spiritual union." Little if any thought was given to forming a separate "Pentecostal" branch of the Christian church. Despite the fact that scores of members of the historic Protestant churches embraced the teachings and practices of healing, prophesying, and speaking in tongues, they initially had no intention of withdrawing from their own churches to form another denomination. They merely wanted to be agents of reform and revival, helping to rid their churches of formalism in worship, modernism in belief, and worldliness in practice and striving to transform them into vibrant, spirit-filled communities similar to those described in the New Testament book of Acts. They fully expected the "showers of blessing," the prophetically promised Latter Rain of which they had received a few droplets, to fall copiously upon their respective denominations, which would make them wholly Pentecostal.

But the triumphant conquest of the Protestant religious world by Pentecostal ideas during those early years never materialized. In fact, the embryonic movement became the object of rather widespread opposition. Pastors who endorsed Pentecostal practices were relieved of their pulpits by their churches; missionaries who were sympathetic toward the charismatic movement were notified by their mission boards that their financial support was being stopped; and parishioners who practiced speaking in tongues found their names being stricken from membership rolls. Resolutions were passed and anathemas (rigorous ecclesiastical denouncements) were pronounced against those exhibiting Pentecostal practices. Those who desired to retain their charismatic religious way of life found it increasingly difficult to do so within the institutional framework of conventional Protestantism, with the result that many holding such views withdrew from their churches to form new and distinctly Pentecostal groups.

At the outset, most Pentecostals shunned anything reminiscent of the religious bodies they had left. They were particularly wary of the multiplication of, or the concentration of power in, administrative bureaus. They were unwilling to subject themselves to external ecclesiastical control or to be bound by common practices in matters of faith or polity. The result of such fears was a heterogeneity that was totally ineffectual. What became viewed as false doctrines spread unchecked; self-styled evangelists preyed on congregations that found it difficult to discriminate between sincere and insincere preachers; and financial accounts and records went unaudited. Leading Pentecostals, recognizing that the problems created by unbridled individualism and autonomy far surpassed the evils of organization and bureaucracy, attempted to establish a denomination that was unmistakably charismatic. A unitive Pentecostal movement, however, never developed. Some groups favoured ardour, spontaneity, legalism, and independence; others preferred order, ritual, tolerance, and hierarchical control.

Pentecostal denominations are widespread throughout the United States and are found in many other countries, notably Mexico, Chile, and other Latin-American countries, Sweden, Norway, Great Britain, South Africa, and the Soviet Union. Forty or more identifiable groups in America practice glossolalia; in addition, there are hundreds of obscure "storefront" congregations that cannot be included in any reliable computation. Pentecostal churches abound also in remote mountain and other rural areas, and it is mainly among these that the pronounced emotional manifestations are found. The larger bodies are organized in the Pentecostal World Conference, an international fellowship headquartered in Wales.

Pentecôte, also called PENTECOST, formerly ARAGH, or RAGA, island of Vanuatu, in the southwestern Pacific Ocean, 60 miles (100 km) southeast of Espiritu Santo. Volcanic in origin, it occupies 169 square miles (438 square km) and has a central mountain ridge that rises to 3,107 feet (947 m). Many permanent streams flow down the eastern slopes into fertile valleys, where copra and coffee are cultivated. Pentecôte is known for its land divers—men who construct towers up to 80 feet (24 m) tall of bush timber and vines from which they dive headfirst to within inches of the ground. The divers are suspended only by vines, short and springy enough to break their fall, attached to the tower and to their ankles. Precise planning allows them to survive these plunges. The island has one hospital and an airstrip. Pop. (1987 est.) 11,780.

Pentelicus, Mount, also called PENTELIKON, Modern Greek PENDÉLI ÓROS, historically BRILESSOS, or BRILETTOS, mountain range enclosing the Attic plain on its northeast but within the *nomós* (department) of Attikí. The chief summit, about 10 miles (16 km) northeast of Athens, is Kokkinarás (3,638 feet [1,109 m]), which yields white Pentelic marble on its north slope. In classical times the peak had 25 quarries on the south slope at elevations between 2,500 and 3,300 feet (760 and 1000 m). These provided excellent marble for most of the buildings and sculptures of Athens in the 5th and 4th centuries BC. At the summit was a sanctuary to the goddess Athena. In the 1960s a ban was imposed on quarrying on the south slope to avoid scarring the landscape.

Penthièvre, Louis-Joseph, duc de (duke of): *see* Vendôme, Louis-Joseph, duc de.

Penthoraceae, family of a single genus (*Penthorum*) of perennial herbs, in the order Saxifragales, native to eastern Asia and eastern North America. All three species in the genus have underground stems, toothed leaves, and one-sided flower clusters borne at the branch tips. The ditch, or Virginian, stonecrop (*Penthorum sedoides*) grows to about 0.6 m (2 feet) tall. It has pale, greenish yellow flowers and pale green leaves that turn bright orange as they mature. Ditch stonecrop is planted as an ornamental at the edges of pools or in shallow water.

penthouse, enclosed area on top of a building. Such a structure may house the top of an elevator shaft, air-conditioning equipment, or the stairs leading to the roof; it can also provide living or working accommodations. Usually a penthouse is set back from the vertical face of a building, thus providing open spaces or terraces on one or more sides; but in recent practice architects and rental agents have referred to the top floor of any building, regardless of setbacks, as a penthouse.

Although the word now denotes a luxurious and expensive apartment, commanding a panoramic view, historically a penthouse was a mere lean-to, or shed, or other small structure attached to a comparatively large building. In medieval times a penthouse, or pentice, was important in siege craft, being the temporary structure that protected besieging forces as they prepared for an attack on the enemy.

Penticton, city, southern British Columbia, Canada, between Skaha and Okanagan lakes, 245 miles (394 km) east of Vancouver. First settled in 1865, its name was derived from a Salish Indian word, *phthauntauc* (*pen-hik-ton*), meaning "place to stay forever." Centred in an apple-, peach-, and apricot-growing area, the city's economy depends on tourism, fruit canning and packing, lumber products, construction, transport and storage, and livestock raising. The Dominion Radio Astrophysical Observatory, Okanagan Game Farm, and the Copper Mountain Ghost Town are nearby. Penticton became a district municipality in 1908 and was incorporated as a city in 1948. Pop. (1986) 23,588.

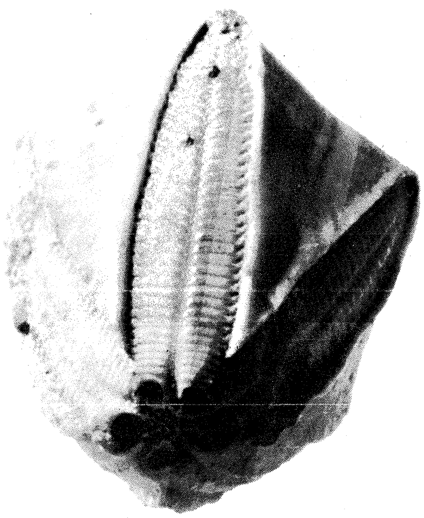
pentimento (from Italian *pentirsi:* "to repent"), in art, the reappearance in an oil painting of original elements of drawing or painting that the artist tried to obliterate by overpainting. If the covering pigment becomes transparent, as may happen over the years, the ghostly remains of earlier marks may show through. Pentimenti most commonly occur owing to slight repositionings by the artist of the outlines of figures or of their clothing. Many signs of such "repentances," or pentimenti, are found among the thinly painted Dutch panels of the 17th century. One of the most famous examples is a double hat brim in Rembrandt's "Flora" (*c.* 1665).

pentlandite, a nickel and iron sulfide mineral, the chief source of nickel. It is nearly always found with pyrrhotite and similar minerals in silica-poor rocks such as those at Bushveld, S.Af.; Bodø, Nor.; and Sudbury, Ont. It has also been found in meteorites. Pentlandite forms crystals that have isometric symmetry. For chemical formula and detailed physical properties, *see* sulfide mineral (table).

pentode, electronic vacuum tube with five electrodes. Besides the cathode, anode, and control grid of the triode (*q.v.*) and the added screen grid of the tetrode (*q.v.*), there is still another grid (suppressor grid) placed between screen grid and plate and maintained at cathode potential. Thus any electrons emitted from the plate surface by secondary emission are repelled back to the plate. The pentode can be used for almost all purposes for which vacuum tubes are used, including amplification, mixing, oscillation, and pulse generation, and in circuits for timing, control, and counting.

pentosuria, inborn error of carbohydrate metabolism, characterized by the excessive urinary excretion of the sugar xylitol. It is caused by a defect in the enzyme xylitol dehydrogenase, by which xylitol is normally metabolized. No disabilities are incurred, and no dietary or other measures are necessary. Reducing properties of the urine of affected individuals may lead to confusion with, and unnecessary treatment for, diabetes mellitus, which is not related to pentosuria. Pentosuria has been observed almost exclusively in persons of Jewish descent.

Pentremites, extinct genus of stemmed, immobile echinoderms (forms related to the



Pentremites pyriformis, collected from the Paint Creek Formation at Floraville, Ill.
By courtesy of the Buffalo Museum of Science, Buffalo, N.Y.

starfish) abundant as marine fossils in Mississippian and Pennsylvanian rocks (345,000,000 to 280,000,000 years old), especially in the midcontinent region of North America. The genus is mainly restricted to the Mississippian Period; more than 80 Mississippian species are known. Specimens are frequently well preserved, allowing detailed anatomical and evolutionary studies to be made.

penumbra (from Latin *paene*, "almost"; *umbra*, "shadow"), in astronomy, the outer part of a conical shadow, cast by a celestial body, where the light from the Sun is partially blocked—as compared to the umbra (*q.v.*), the shadow's darkest, central part, where the light is totally excluded. The definition of the term may be extended to include the partial shadow of any large source of light or electromagnetic radiation. An observer in the penumbra sees the Sun (or other light source) partially obscured. The term also is used for the outer portion of a sunspot.

Penutian languages, major grouping (phylum or superstock) of American Indian languages, spoken along the west coast of North America from British Columbia to central California and central New Mexico. The phylum consists of 15 language families with about 20 languages; the families are Wintun (two languages), Miwok-Costanoan (perhaps five Miwokan languages, plus three extinct Costanoan languages), Sahaptian (two languages), Yakonan (two extinct languages), Yokutsan (three languages), and Maiduan (four languages)—plus Klamath-Modoc, Cayuse (extinct), Molale (extinct), Coos, Takelma (extinct), Kalapuya, Chinook (not to be confused with Chinook jargon, a trade language or lingua franca), Tsimshian, and Zuni, each a family consisting of a single language. All but four of the surviving familes are spoken by fewer than 150 persons.

Major languages in the phylum are Zuni, spoken in New Mexico; Tsimshian, spoken in British Columbia; and the Sahaptian dialects (Klikitat, Umatilla, Wallawalla, Warm Springs, and Yakima), spoken in north central Oregon.

The Penutian languages are sometimes grouped into a yet larger stock, called either Penutian or Macro-Penutian, that includes several Meso-American Indian languages. The Totonacan, Huave, and Mixe-Zoque language families are often included, and some scholars suggest the inclusion of the large Mayan language family. The American linguist Benjamin L. Whorf proposed to include not only Mixe-Zoque, Huave, Totonacan, and Mayan (including Huastec) but also Uto-Aztecan, another major North and Meso-American language family. This grouping has not been generally accepted.

The Penutian languages tend toward the use of formal or inflecting suffixes and changes in the stems of words. In this respect they resemble European languages.

Penwith, district, county of Cornwall, extreme southwestern England. It is a promontory occupying an area of 117 sq mi (303 sq km) at the westernmost tip of England, bordered by St. George's Channel on the north and the English Channel on the south. Penwith has contrasting landscapes. As in much of Cornwall, the physiography alternates between moorlands of igneous-based (granite) intrusives and sedimentary-based valleys, such as the Hayle Valley. Land's End peninsula on the west includes windswept moorlands 600 to 800 ft (185 to 245 m) high, with bold and rugged cliffs along its northern shore that descend on the south into protected coves and headlands with rich vegetation. Plants normally associated with the subtropics (such as hydrangeas, camellias, and orange trees) thrive in sheltered valleys because of the maritime climate, greatly influenced by the North Atlantic Drift. Dairy cattle are grazed throughout the district, and pigs, beef cattle, poultry, early season vegetables, and some fruits thrive in the fertile Hayle Valley in eastern Penwith. The larger coastal resorts of Penzance (the district seat), St. Ives, and Land's End are popular with artists and adventure seekers; the villages of the district have retained an unspoiled appearance.

The village of Pendeen at the northwestern tip of Penwith district is the site of a small tin mine still operating in the 1980s, exemplifying an industry that was an economic mainstay until the late 19th century of both the district and the county. Pilchard and mackerel are caught offshore by fishermen operating out of Newlyn. Assorted prehistoric remains, including cromlechs (stone circles) dating from 2000–1600 BC, are found in the moorlands. Pop. (1984 est.) 54,700.

Penza, *oblast* (administrative region), western Russian Soviet Federated Socialist Republic, occupying an area of 16,680 sq mi (43,200 sq km) across the western flank of the Volga Upland, which falls gently to the Oka–Don Plain in the extreme west. The *oblast* lies in the zone of forest-steppe. About one-fifth of its surface is in pine or oak forest, mostly in the Sura Basin, but natural vegetation has been widely plowed up, resulting in severe soil erosion. Agriculture, the major economic activity, is dominated by grain, especially winter rye and spring wheat. Hemp, sugar beets, and sunflowers are also grown. Engineering, the main industry, is concentrated in Penza city, the *oblast* headquarters, and Kuznetsk; the other cities are small and are mainly concerned with processing food and agricultural products. Timber working is important in the surviving forest areas, and paper is made. Pop. (1984 est.) 1,499,000.

Penza, city and administrative centre of Penza *oblast* (region), western Russian Soviet Federated Socialist Republic, at the confluence of the Penza and Sura rivers. The city was founded in 1666 as a major fortress; after 1684 it formed the western end of the Syzran defensive line. It was frequently attacked by the Crimean Tatars, suffering especially in their last assault of 1717. With the settlement of the surrounding lands, Penza became an important agricultural centre. Grain was sent to Moscow, first by the Sura River and, after the 1870s, by rail. The processing of farm products is still a significant economic factor, but it has been surpassed in importance by industries producing machinery, diesel engines, compressors, calculating machines, and bicycles; there are also watchmaking, papermaking, and timber-working industries. The city's tree-lined streets have spread from the hill, on which the fortress originally stood, onto the level Sura floodplain. Penza has teacher-training, polytechnic, engineering, and agricultural institutes, an observatory, and several industrial-research institutions. Pop. (1984 est.) 522,000.

Penzance, parish, Penwith district, county of Cornwall, England, and the country's most westerly town. It overlooks Mounts Bay where the English Channel meets the Atlantic Ocean, and has a remarkably equable climate, allowing many subtropical plants to flourish. Early vegetables and flowers are raised locally and also in the offshore Scilly Islands, with which it is linked by sea and air services. Newlyn, nearby, is a small fishing port, much frequented by artists. The occasional pirate raids Penzance experienced during the 17th century, due to its location on a sheltered bay on England's southwest tip, made it the location for the Gilbert and Sullivan operetta, "The Pirates of Penzance." The chief modern function of Penzance is as a tourist centre and local service centre for Penwith district. Pop. (1981) 19,210.

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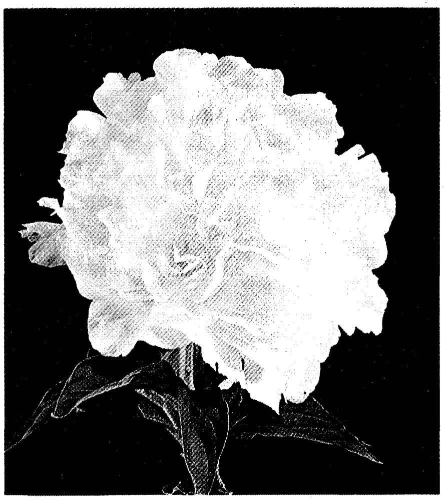
Penzias, Arno (Allan) (b. April 26, 1933, Munich, Ger.), German-American astrophysicist who won a Nobel Prize for a discovery that supported the "big bang" theory of creation.

Educated at City College of New York in New York City and Columbia University, where he received his doctorate in 1962, Penzias joined Bell Telephone Laboratories in Holmdel, N.J. In collaboration with Robert Wilson he began monitoring radio emissions from a ring of gas encircling the Milky Way Galaxy. Unexpectedly, the two scientists detected a uniform background static that suggested a residual thermal energy throughout the universe of about 3 K, which most scientists now agree is the residual background radiation stemming from the primordial explosion billions of years ago from which the universe was created (*see* big-bang model). For this work Penzias and Wilson shared half of the 1978 Nobel Prize for Physics. In 1976 Penzias became director of the Bell Radio Research Laboratory and in 1981 vice-president of research at Bell Laboratories.

peonage, form of involuntary servitude, the origins of which have been traced as far back as the Spanish conquest of Mexico, when the conquerors were able to force the poor, especially the Indians, to work for Spanish planters and mine operators. In both the English and Spanish languages, the word peon became synonymous with labourer but was restricted in the United States to those workers compelled by contract to pay their creditors in labour. Although the Thirteenth Amendment to the Constitution and congressional legislation after the American Civil War prohibited any such involuntary servitude in the United States, the former slaveholding states of the South devised certain legislation to make labour compulsory. Under these state laws, employers could induce or deceive men into signing contracts for labour to pay their debts or to avoid fines that might be imposed by the courts.

Another form of peonage exists when prisoners sentenced to hard labour are farmed out to either private or governmental labour camps.

peony, any of the flowering plants in the genus *Paeonia* (family Paeoniaceae) known for their large, showy blossoms. All but two species are native to Europe and Asia; *P. browni* and *P. californica* are found along the Pacific coastal mountains of North America.



Peony (*Paeonia*)
Gilbert H. Wild & Son, Inc.

There are two distinct groups of peonies: the herbaceous and the tree, or moutan, peonies. The herbaceous peonies are perennials that grow to a height of almost 1 m (about 3 feet) and have large, glossy, much-divided leaves borne on annual stems produced by fleshy rootstocks. In late spring and early summer they produce large single and double flowers of white, pink, rose, and deep-crimson colour. The fragrant Chinese *P. lactiflora* and the European common peony (*P. officinalis*) have given rise to most of the familiar garden peonies. *P. lactiflora* has provided hundreds of cultivated varieties, including the Japanese types, with one or two rows of petals surrounding a cluster of partially formed petals in the centre (petaloid stamens).

The tree peonies have developed from the wild Chinese species *P. suffruticosa.* They are shrubby, with permanent woody stems. The plants sometimes attain a height of 1.2 to 1.8 m (about 4 to 6 feet); they begin flowering in late spring. The blossoms vary in colour from white to lilac, violet, and red. Tree peonies require a hot, dry summer season for best growth, and they can be grafted in late summer or autumn on the roots of herbaceous peonies. A race of hybrids, developed by crossing the tree peony with the yellow Chinese *P. lutea,* has both single and double flowers, sometimes tinged with red. Many varieties have been grafted onto supportive rootstock and so cannot be readily propagated by simple division. Peonies are seldom grown from seeds except in breeding programs to find new varieties; the seed takes about two years to germinate.

people of the Book (Islām): *see* ahl al-Kitāb.

people's commune (Chinese agricultural unit): *see* commune.

People's Council (Indonesian history): *see* Volksraad.

People's Daily (newspaper): *see* Renmin ribao.

People's Friendship University (Moscow): *see* Patrice Lumumba People's Friendship University.

People's Will, also called PEOPLE'S FREEDOM (Russian revolutionary organization): *see* Narodnaya Volya.

Peoria, city, seat of Peoria county, central Illinois, U.S., on the Illinois River where it widens to form Peoria Lake. With Peoria Heights, West Peoria, Bartonville, Bellevue, East Peoria, Creve Coeur, and Pekin, Peoria forms an urbanized industrial complex.

Named for one of the five Indian tribes in the Illinois Confederacy, Peoria represents one of the state's oldest settled locations. The French under Robert Cavelier, sieur de La Salle, built Fort-Crèvecoeur on the bluffs, opposite the present city in 1680, but it was plundered and deserted later that same year. There were later settlements around Peoria Lake by the French, Indians, and later colonists. After 1813 the location was known as Fort Clark, named for the American Revolutionary War general George Rogers Clark; but when Peoria county was formed in 1825, the community, chosen as the county seat, reverted to the French–Indian name of Peoria. There, on Oct. 16, 1854, Abraham Lincoln denounced slavery in rebuttal to a speech by Stephen A. Douglas.

A major port on the Illinois Waterway, Peoria is a trading and shipping centre for a large agricultural area (corn [maize] and livestock). Highly industrialized, its manufactures include earth-moving equipment, trailers, steel, wire, paper products, and chemicals. The Caterpillar Tractor Company, the city's largest employer, has its international headquarters there. Distilling and brewing are also major industries. The U.S. Department of Agriculture's Northern Regional Research Laboratory (completed 1940) is located there. Educational institutions include Bradley University (established as Bradley Polytechnic Institute in 1897) and Illinois Central College, in East Peoria (1966). Peoria's cultural and recreational activities focus on Lakeview Park, which contains the Lakeview Center for the Arts and Sciences, Lakeview Planetarium, Peoria Players Theater, and Lakeview Swimming Pool and Ice Skating Rink. Jubilee College State Park and Historic Site is 14 miles (23 km) west. Inc. town, 1835; city, 1845. Pop. (1988 est.) city, 108,841; Peoria MSA, 340,400.

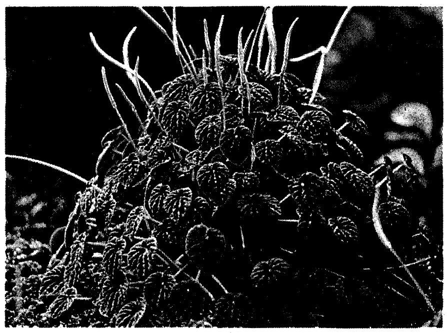
Pepe, Guglielmo (b. Feb. 13, 1783, Squillace, Calabria, Kingdom of the Two Sicilies [now in Italy]—d. Aug. 8, 1855, Turin, Piedmont), Neapolitan soldier prominent in the Italian Risorgimento and author of valuable eyewitness accounts.

After briefly attending a military academy, Pepe enlisted at 16 in the republican army formed in Naples as a result of the French Revolution. He was wounded and taken prisoner by the royalists, but his life was spared because of his youth. In 1800 he fought under Napoleon at Marengo and continued in French service for several years, commanding a brigade in Spain in 1811–13. After the Bourbon restoration in Naples, Pepe accepted a commission in the royal army and helped suppress brigands in Calabria; but, when revolution broke out in 1820, he took command of the republican army. Failure of the revolution sent him into exile, mainly in England, where he spent the next several years writing of his experiences, including *A Narrative of the Political and Military Events Which Took Place at Naples in 1820 and 1821* (1821). His memoirs appeared in 1846, but in 1848, following the major revolution of that year, he was once more back in Naples. Sent north to aid in the war against Austria, he was recalled to Naples but instead joined in the defense of Venice. After the city's surrender he went to Paris; but, after Louis-Napoléon's coup d'état (1851), Pepe moved to Turin. His *Casi d'Italia negli anni 1847, 1848, 1849* (*Narrative of Scenes and Events in Italy, from 1847 to 1849*) was published in 1850.

Pepel, town, Atlantic seaport, western Sierra Leone, on Pepel Island, near the mouth of the Sierra Leone River (an estuary formed by the Rokel River and Port Loko Creek). Beginning in 1933 it exported iron ore brought by rail from the Sierra Leone Development Company's mines at Marampa, 41 miles (66 km) east-northeast. Until iron-ore mining was suspended in 1975, Pepel, the nation's only iron-ore port, had an annual turnover of 2–3 million tons of ore. Only Pepel and the port of Freetown have docking facilities. The local Temne population is also engaged in fishing and rice farming. Pop. (1984 est.) 6,469.

peperite, subsurface rock containing fragments ejected by an underground volcanic explosion (*see* tuff).

Peperomia, genus of the pepper family (Piperaceae), comprising more than 500 species of tropical and subtropical fleshy herbs, annuals as well as perennials. Some are epiphytic (growing on the branches of trees). The leaves,



Peperomia (*Peperomia*)
F.K. Anderson—EB Inc.

sometimes attractively coloured with veins or spots, are oval, thick, fleshy, and smooth-edged. The thick, red stalk of the leaf is in some species fixed to the interior of the leaf. Flowers are minute and densely packed on a slender spike, which is likely to be curved.

A few species, particularly *P. argyreia* (sometimes called *P. sandersii*), are popular houseplants because of their attractive foliage. *P. argyreia,* native to Brazil, grows about 10 to 15 cm (4 to 6 inches) tall. Dark red leafstalks support alternate leaves, which are up to 10 cm (4 inches) long and 7.5 cm (3 inches) wide. The leaves are handsomely marked with broad, creamy bands parallel to the veins.

P. obtusifolia (sometimes *P. magnoliifolia*), another popular cultivated species, is also native to the tropics. It lies close to the soil and has wrinkled, reddish stems. The minute flowers are red. The leaves, about 7.5 to 12.5 cm (3 to 5 inches) long, have small notches near the tip and are red along the margins. The young leaves and stems of *P. vividispica* are used as food in Central and South America.

Pepi, also spelled PHIOS, PHIOPS, MERIRE, or MERYRE, name of Egyptian kings, grouped below chronologically and indicated by the symbol •.

• **Pepi I,** third king of the 6th dynasty (*c.* 2325–*c.* 2150 BC) of ancient Egypt, whose reign saw the spread of trade and conquest and a growth in the influence of powerful provincials from Upper Egypt.

Pepi was the son of Teti, founder of the 6th dynasty. Before succeeding his father, Pepi had to cope with a usurper whose early success forced Pepi to seek the aid of Upper Egyptian potentates to gain control of the kingdom. Two of Pepi's chief queens were sisters of his vizier, one of the Upper Egyptian potentates; they each bore a son who succeeded to the throne.

Pepi I initiated a policy of intensive penetration of Nubia, south of the First Nile Cataract. Inscriptions record journeys southward early in his reign. Fragments of vessels bearing the king's name were excavated at Kerma, though some scholars believe that the vessels were brought there later. Uni, another Upper Egyptian and a close confidant of the king, recruited troops from Nubia as well as from Egypt in preparation for raids against rebellious Bedouins of the northeastern frontier.

Extensive trade with Lebanon is attested by numerous vessels made during Pepi's reign and found at Byblos. An Upper Egyptian biography mentions frequent journeys to Punt, on the Somali coast of eastern Africa. Pepi's courtiers also led quarrying expeditions to various parts of Egypt, and remains of a temple of the king have been found deep in the Nile delta. Pepi's pyramid complex was built at Ṣaqqārah, southwest of Cairo; its name, MeneferPepi, eventually became attached to Memphis, the capital of Egypt.

• **Pepi II** NEFERKARE, fifth king of the 6th dynasty (*c.* 2325–*c.* 2150 BC) of ancient Egypt, during whose extensive reign the government became weakened because of internal and external troubles. Late Egyptian tradition indicates that Pepi II acceded at the age of six and, in accord with king lists of the New Kingdom, credits him with a 94-year reign. Contemporary texts record his 62nd and 65th years.

Pepi II was a son of Pepi I and was born late in his father's reign. While still very young he succeeded his half-brother Merenre, who died at an early age. His mother served as coregent for a number of years, and the old group of officials serving the royal family maintained the kingdom's stability. Expeditions of trade and conquest to lower Nubia and Punt (the Somali coast of Africa), however, met with resistance, and the signs of external trouble are unmistakable.

Internally, the vizierate passed from the family that had served Pepi's predecessors and descended through a number of other officials. The excessive devotion of resources to funerary endowments drained the country's resources. Furthermore, powerful provincial nobles drew talent away from the capital. Biographies of the era reveal that Pepi had more interest in duties toward the dead than concern for the kingdom. Finally, because of the unusually long reign of the king, Egypt had a senile ruler when it needed vigorous leadership. Those of his children who survived Pepi had brief, ephemeral reigns and failed to cope with the political and economic crises that arose as the 6th dynasty ended.

Pepi's pyramid complex at Ṣaqqārah, across the Nile from Cairo, was among the largest of the 5th and 6th dynasties. Structural weakness, aggravated by an earthquake, later required that a girdle wall be built around the pyramid.

Pepin, also spelled PEPPIN, name of rulers grouped below by country or dynasty and indicated by the symbol •.

Foreign-language equivalents:

French	Pépin
German	Pippin
Italian	Pipino

AQUITAINE

• **Pepin I** (d. Dec. 13, 838), Carolingian king of Aquitaine, the second son of the emperor Louis I the Pious.

He was granted Aquitaine in July 814 and was recognized as king in 817, though it was clear that he was to remain subordinate to his elder brother Lothair, the heir to the imperial title. It was Pepin who in 830 started the revolt of Louis I's elder three sons against their father, but in February 831 he became reconciled with Louis. Rebelling again in 832, he was then deposed from his kingship by Louis but could still exploit separatist feeling in Aquitaine and took part in renewed rebellion against Louis in 833. He finally repented in 834 and helped to restore the emperor's authority. Aquitaine was then given back to him, with Anjou in addition. He probably died insane.

• **Pepin II** (d. after AD 864, Senlis, Fr.), Carolingian king of Aquitaine.

The son of Pepin I of Aquitaine, he gained the throne about 845, after defeating the emperor Charles II the Bald in 844. War soon broke out again, however, and Charles slowly advanced through Aquitaine. Pepin took refuge with Sancho, duke of the Gascons, but in 852 was handed over to Charles, tonsured, and relegated to a monastery. Escaping in 854, he renewed the struggle, but in 859 the Aquitanians began to abandon him. Thereafter he became a wanderer, sometimes joining Viking raiders, with a band of whom he attacked Toulouse in 864. Captured soon afterward, he died during imprisonment at Senlis.

CAROLINGIAN DYNASTY

• **Pepin I,** byname PEPIN OF LANDEN, or PEPIN THE ELDER, French PÉPIN DE LANDEN, or PÉPIN LE VIEUX (d. *c.* 640), councillor of the Merovingian king Chlotar II and mayor of the palace in Austrasia.

Through the marriage of his daughter Begga with Ansegisel, son of Arnulf (d. 641; bishop of Metz), Pepin was the founder of the Carolingian dynasty. Deprived of his mayoralty at the accession (629) of Dagobert I, he regained power in Austrasia after that king's death (January 639) but did not long survive to enjoy it.

• **Pepin II,** byname PEPIN OF HERSTAL, French PÉPIN D'HÉRISTAL (d. Dec. 16, 714, Jupille, near Liège [now in Belgium]), ruler of the Franks (687–714), the first of the great Carolingian mayors of the palace.

The son of Begga and Ansegisel, who were, respectively, the daughter of Pepin I and the son of Bishop Arnulf of Metz, Pepin established himself as mayor of the palace in Austrasia after the death of Dagobert II in 679 and defended its autonomy against Theodoric III of Neustria and Ebroïn, Theodoric's mayor of the palace. Defeated by Ebroïn in 680 at Lucofao (near Laon), Pepin gained his revenge on the Neustrians in 687 at Tertry (near Péronne) and became sole effective ruler of the Franks. He nevertheless retained Theodoric III on the throne and after his death replaced him with three successive Merovingian kings. After several years of warfare Pepin defeated the Frisians on his northeastern border (689) and married his son Grimoald to Theodelind, daughter of the Frisian chief Radbod. He also forced the Alemanni to recognize Frankish authority again and encouraged Christian missionaries in Alemannia and Bavaria. Charles Martel was his son.

• **Pepin III,** byname PEPIN THE SHORT, French PÉPIN LE BREF, German PIPPIN DER KURZE (b. *c.* 714—d. Sept. 24, 768, Saint-Denis, Neustria [now in France]), the first king of the Frankish Carolingian dynasty and the father of Charlemagne. A son of Charles Martel, Pepin became sole de facto ruler of the Franks in 747 and then, on the deposition of Childeric III in 751, king of the Franks. He was the first Frankish king to be anointed—first by St. Boniface and later (754) by Pope Stephen II.

Background and kingship. For years the Merovingian kings had been unable to prevent power from slipping from their hands into those of the counts and other magnates. The kings were gradually eclipsed by the mayors of the palace, whose status developed from that of officer of the household to regent or viceroy. Among the mayors, a rich family descended from Pepin of Landen (Pepin I) held a position of especial importance. When Charles Martel, the scion of that family, died in 741, he left two sons: the elder, Carloman, mayor of Austrasia, Alemannia, and Thuringia, and Pepin III, mayor of Neustria, Burgundy, and Provence. No king had ruled over all the Franks since 737, but to maintain the fiction of Merovingian sovereignty, the two mayors gave the crown to Childeric III in 743.

Charles had had a third son, however—Grifo, who had been born to him by a Bavarian woman of high rank, probably his mistress. In 741, when his two brothers were declared mayors of the Franks, Grifo rebelled. He led a number of revolts in subsequent years and was several times imprisoned. In 753 he was killed amid the Alpine passes on his way to join the Lombards, at this time enemies of the Franks as well as of the papacy.

Numerous other rebellions broke out. In 742 men of the Aquitaine and Alemannia were in revolt; in 743 Odilo, duke of Bavaria, led his men into battle; in 744 the Saxons rebelled, in 745 Aquitaine, and in 746 Alemannia, both the latter for the second time.

In 747, when Carloman decided to enter monastic life at Rome, a step he had been considering for years, Pepin became sole ruler of the Franks. But Pepin was ambitious to govern his people as king, not merely as mayor. Like his father, he had courage and resolution; unlike his father, he had a strong desire to unite the papacy with the Frankish realm. In 750 he sent two envoys to Pope Zacharias with a letter asking: "Is it wise to have kings who hold no power of control?" The pope answered: "It is better to have a king able to govern. By apostolic authority I bid that you be crowned King of the Franks." Childeric III was deposed and sent to a monastery, and Pepin was anointed as king at Soissons in November 751 by Archbishop Boniface and other prelates.

Pepin and Pope Stephen II. The pope was in need of aid. Aistulf, king of the Lombards, had seized Ravenna with its lands, known as the exarchate. Soon, Lombard troops marched south, surrounded Rome, and prepared to lay siege to its walls. So matters stood when in 752 Zacharias died and Stephen II became pope. In November 753 Pope Stephen made his way over the stormy mountain passes to Frankish territory. He remained in France until the summer of 754, staying at the abbey of Saint-Denis, Paris. There he himself anointed Pepin and his sons, Charles and Carloman, as king and heirs of the crown.

The pope returned to Italy accompanied by Pepin and his army. A fierce battle was fought in the Alps against Aistulf and the Lombards. The Lombard king fled back to his capital, Pavia; Pepin and his men plundered the land around Pavia until Aistulf promised to restore to papal possession Ravenna and all the Roman properties claimed by the pope.

Aistulf broke his word. Again and again Pope Stephen wrote to Pepin of his difficulties. In

756 the Frankish king once more entered Italy. Aistulf was once more constrained to make promises, but the same year he died—of a fall from his horse—and in April 757 a new king, Desiderius, became ruler of the Lombards. That year Stephen II also died, and Paul I was elected pope. He, too, constantly wrote to Pepin asking for help.

But the King of the Franks had other concerns. He had to put down revolts in Saxony in 748 and 753 and a rising in Bavaria in 749. He was continually marching against rebellious Aquitaine. In 768 Pepin died at Saint-Denis, on his way back from one of his Aquitainian expeditions.

Pepin is remembered not only as the first of the Carolingians but also as a strong supporter of the Roman Church. The papal claims to territory in Italy originated with Pepin's campaigns against Aistulf and the latter's pledge to return the Roman territories. His letters also show him calling for archbishoprics in Frankish territory, promoting synods of clergy and layfolk, and as deeply interested in theology. (E.S.D.)

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ITALY

• **Pepin** (d. July 8, 810, Milan), king of Italy (781–810) and second son of the Frankish emperor Charlemagne.

Given the title of king of Italy in 781, Pepin took part in campaigns against Duke Tassilo III of Bavaria from 787 and led an army against the Avars in 796. His Venetian campaign (809–810) enabled Charlemagne later to come to favourable terms with the Byzantine Empire. As early as 806 Charlemagne, in planning the division of his lands, had decided that on his death Pepin should inherit Italy, Bavaria, and the territory of the Alemanni, but Pepin predeceased his father by four years.

Pepin, Donation of (754), promise made by the Carolingian Frankish king Pepin III the Short to win for Pope Stephen II (III) lands in Italy that had been conquered by the Lombards; it was later (756) embodied in a document that became the origin of papal rule over central Italy, which lasted until the 19th century. Pepin had, with papal agreement, deposed the last Merovingian ruler of the Franks and had then been elected king himself. He received the Pope at Quierzy-sur-Oise (near Laon, Fr.), made the donation, and was subsequently anointed as king by the Pope. Fulfilling his promise, Pepin fought two campaigns (754 and 756) in Italy, wresting from the Lombard king Aistulf former Byzantine territory, which he then awarded to the Pope. Pepin's donation was confirmed and extended by his successor, Charlemagne, in 774 and justified by the claim that it was based on a grant supposed to have been originally made to the papacy by Constantine I, the first Christian Roman emperor, in the 4th century AD (the Donation of Constantine).

pepino hill (from Spanish *pepino,* "cucumber"), also called HUM (Serbo-Croatian: "hill"), or HAYSTACK HILL, conical hill of residual limestone in a deeply eroded karst region. Pepino hills generally form on relatively flat-lying limestones that are jointed in large rectangles. In an alternating wet and dry climate, high areas become increasingly hard and resistant while low areas are subjected to greater erosion and solution. In some places, such as the Kwangsi area of China, pepino hills may have almost vertical sides and may be riddled with caves. Pepino hills develop to greater heights in regions having subtropical or equatorial rainfall and are then generally called mogotes (Spanish: "hillocks").

peplos, also spelled PEPLUS, garment worn by Greek women during the early Archaic, Classical, and Hellenistic periods (*i.e.,* up to about AD 300). It consisted of a large, rectangular piece of material folded vertically and hung from the shoulders, with a broad overfold. During the early periods, it was belted around the waist, usually beneath the overfold; if the overfold was long, however, the belt was sometimes placed on top of it, as seen in many statues of Athena.

In Hellenistic times the overfold was belted below the bust. To allow for growing, young girls wore peploses with long overfolds. When worn with other types of dress, the peplos was the outermost garment. Initially, it was made of wool or linen; later, cotton and silk were also used.

The goddess Eirene wearing a peplos, Roman copy of a Greek sculpture by Cephisodotus the Elder of Athens, marble, 4th century BC; in the Metropolitan Museum of Art, New York City

By courtesy of The Metropolitan Museum of Art, New York, Rogers Fund, 1906

Pepo, Bencivieni di (painter): *see* Cimabue.

Pepoli FAMILY, family that played an important role in the political and economic life of 13th- and 14th-century Bologna.

The Pepoli, wealthy bankers, were leaders of the Guelf (papal) party and helped expel the Ghibelline (imperial) Lambertazzi from the city in 1274. Romeo de' Pepoli ruled the city for several years, but an insurrection forced him to flee with his family, and he died in exile in 1321. His son Taddeo, who had received a doctorate in law from the University of Bologna, followed his father into banishment, but after six years he returned to Bologna and in 1337 was acclaimed lord of the city, assuming the title of "keeper of peace and justice." Pope Benedict XII later recognized him as papal vicar.

After Taddeo's death, his sons were forced to yield Bologna to the growing power of the Visconti of Milan, and the city fell under the rule of Archbishop Giovanni Visconti in 1352. Unable to recover their political position, the Pepoli became soldiers, scholars, literary men, and jurists. In the 19th century the family was active in the Risorgimento, the movement for Italy's unification.

pepper (*Piper nigrum*): *see* black pepper.

pepper, also called GARDEN PEPPER (*Capsicum*), any of a great number of plants of the nightshade family, Solanaceae, notably *Capsicum annuum, C. frutescens,* and *C. boccatum,* extensively cultivated throughout tropical Asia and equatorial America for their edible, pungent fruits. Peppers, which have been found in prehistoric remains in Peru, were widely grown in Central and South America in pre-Columbian times. Pepper seeds were carried to Spain in 1493 and from there spread rapidly throughout Europe.

The genus *Capsicum* comprises all the varied forms of fleshy-fruited peppers grown as herbaceous annuals—the red, green, and yellow peppers rich in vitamins A and C that are used in seasoning and as a vegetable food. Hot peppers, used as relishes, pickled, or ground into a fine powder for use as spices, derive their pungency from the compound capsaicin, a substance characterized by acrid vapours and burning taste, that is located in the internal partitions of the fruit. First isolated in 1876, capsaicin stimulates gastric secretions and, if used in excess, causes inflammation.

In addition to the cherry (Cerasiforme group) and red cluster (Fasciculatum), these hot varieties, which are red when mature, include the tabasco (Conoides), which is commonly ground and mixed with vinegar to produce a hot sauce, and the long "hot" chili and cayenne (Longum), often called capsicums. Cayenne pepper, said to have originated in Cayenne in French Guiana, is one of the spices derived from these peppers and is produced in many parts of the world.

The mild bell or sweet peppers (Grossum) have larger, variously coloured but generally bell-shaped, furrowed, puffy fruits that are used in salads and in cooked dishes. These varieties are harvested when bright green in colour—before the appearance of red or yellow pigment—about 60–80 days after transplanting.

The term "pimiento," from the Spanish for "pepper," is applied to certain mild pepper varieties possessing distinctive flavour but lacking in pungency; these include the European paprikas, which include the paprika (*q.v.*) of commerce, a powdered red condiment that was known in Hungary by the late 16th century. "Pimiento," often pronounced the same as "pimento," should not be confused with the latter, which is allspice.

Pepper plants are treated as tender summer annuals outside their native habitat. They are propagated by planting seed directly in the

Red peppers (*Capsicum annuum*) from which paprika is made

G.R. Roberts

field or by transplanting seedlings started in greenhouses or hotbeds after six to ten weeks.

pepper coral (marine animal): *see* millepore.

pepper tree (*Schinus molle*), small ornamental tree, of the cashew family (Anacardiaceae), native to tropical America and cultivated in warm subtropical regions. The long leaves

Pepper tree (*Schinus molle*)
Thase Daniel

have storage cells that contain a volatile oil. The small white flowers are borne in clusters at the ends of the branches. Each small, pealike fruit has a hard kernel surrounding one seed. The fruits are used in beverages and medicines because of their hot taste and aroma. Pepper tree is a host plant for scale insects that damage orange trees.

peppered moth (*Biston betularia*), a European moth of the family Geometridae (order Lepidoptera), having speckled black-and-white wings. It is of significance in exemplifying natural selection through industrial melanism.

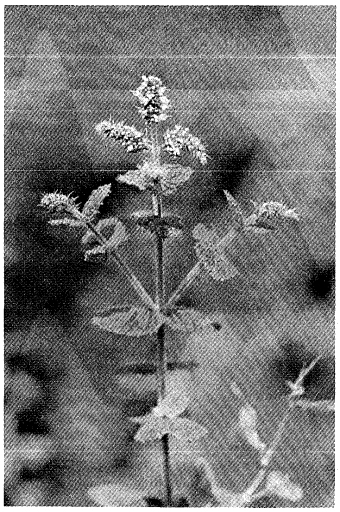
The peppered moth had originally been white-coloured, but a dark (melanic) form of the peppered moth, first noticed in Manchester, Eng., in 1848, had outnumbered the usual light-coloured moth by 99 to 1 by 1898. The explanation of this phenomenon is that the dark moth, which originally was a chance mutation, was rendered less conspicuous to bird predators than the light moth against tree trunks which had become covered with black soot owing to the air pollution caused by nearby industries. The difference is genetic and of interest as a striking example of rapid evolutionary change in a localized area.

peppergrass, also called PEPPERWORT, any of about 100 species of herbs constituting the genus *Lepidium*, of the mustard family (Brassicaceae), distributed throughout the world. Many, such as *L. perfoliatum*, are lawn and field weeds, but some are useful salad plants. Most species have long taproots, broad basal leaves differing from the narrow leaves on the flowering stalks, and spikelike clusters of small, greenish or whitish, four-petalled flowers. Each seed is in a flat, round pod. Gar-

Peppergrass (*Lepidium perfoliatum*)
F.K. Anderson—EB Inc.

den cress (*q.v.; L. sativum*), a North African annual, is sometimes cultivated for its piquant basal leaves. Virginia peppergrass (*L. virginicum*), spread throughout North America, sometimes is known as canary grass because its seed stalks are fed to cage birds. Its leaves are used in salads. Lentejilla, or little lentil (*L. intermedium*), native to Europe but long naturalized in Mexico, is used as a folk medicine. Pepperwort, or field pepper (*L. campestre*), a widespread weed, is native in Europe and naturalized in North America. It has hairy, arrow-like stem leaves and once was marketed as a poison antidote under the name of mithridate pepperwort.

peppermint (*Mentha piperita*), strongly aromatic perennial herb, source of a widely used flavouring. It has stalked, smooth, dark-green leaves and blunt, oblong clusters of pinkish-lavender flowers, which are dried and used to flavour candy, desserts, beverages, salads, and other foods. Peppermint has a strong,



Peppermint (*Mentha piperita*)
Shunji Watari—EB Inc.

sweetish odour, and a warm, pungent taste with a cooling aftertaste. Indigenous to Europe and Asia, it has been naturalized in North America and is found near streams and in other wet sites. It is cultivated in Europe, Asia, and North America for its essential oil. Natural hybridization among wild species has yielded many varieties of peppermint, but only two, the black and the white, are recognized by growers. The former has purplish and the latter green stems. Black peppermint, also called English peppermint or mitcham mint, is extensively grown in the United States. The white variety is less hardy and less productive, but its oil is considered more delicate in odour and obtains a higher price.

Oil of peppermint, a volatile essential oil distilled with steam from the herb, is widely used for flavouring confectionery, chewing gum, dentifrices, and medicines. Pure oil of peppermint is nearly colourless. It consists principally of menthol (*q.v.*) and menthone. Menthol, also called mint camphor or peppermint camphor, has long been used medicinally as a soothing balm. Oil of Japanese mint (*Mentha arvensis* variety *piperascens*) is very different from peppermint oil but is also a rich source of menthol. The name Japanese peppermint is sometimes used for this plant, but it is not a true peppermint.

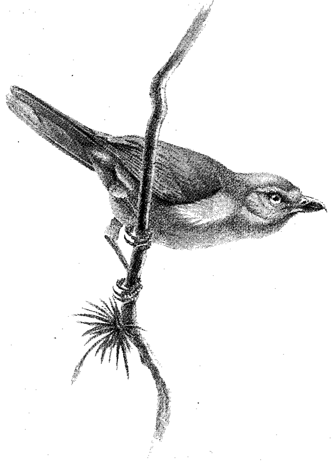
Pepperell, Sir William, BARONET, Pepperell also spelled PEPPERELL (b. June 27, 1696, Kittery, Mass.—d. July 6, 1759, Kittery), colonial American merchant, politician, and soldier who in 1745 commanded land

Pepperrell, detail of a portrait by Peter Pelham after a painting by John Smibert; in the collection of the Massachusetts Historical Society
By courtesy of the Massachusetts Historical Society

forces that, with a British fleet, captured the French fortress of Louisbourg (in present-day Nova Scotia). For this exploit in King George's War, he was created a baronet (1746), the first man born in one of the 13 colonies to be so honoured. He was also given the rank of lieutenant general in the British Army. For a brief period (1756–57), he was acting governor of Massachusetts.

Pepperrell became prosperous as an associate in his father's mercantile firm and in real estate investments. He served as a member of the Massachusetts General Court and of the Governor's Council and as chief justice of the Court of Common Pleas. His one son predeceased him, and the baronetcy became extinct upon his death.

peppershrike, family name CYCLARHIDAE, either of two species of stout-billed tropical American songbirds (order Passeriformes). (They are included by some authorities in the vireo family, Vireonidae.) Both peppershrikes are olive green above and yellow and white below; they are about 15 centimetres (6 inches) in length. The bill is high and termi-



Peppershrike (*Cyclarhis nigrirostris*)
Painting by H. Jon Janosik

nally hooked. Peppershrikes are found in open woodland from southern Mexico to Argentina and Paraguay. They feed on large insects and some fruit, taken as they move about in foliage. Their song is a sweet warble, repeated frequently.

pepperwort (plant): *see* peppergrass.

Peppin (personal name): *see under* Pepin.

PepsiCo, Inc., American conglomerate producing various products and services, including beverages, food, sporting goods, cargo transportation, and building construction. The company of the current name was formed in 1965, in the merger of Pepsi-Cola Company and Frito-Lay, Inc. After its merger PepsiCo began further diversification.

The Pepsi-Cola Company had a checkered career, running through several different ownerships from 1902 to 1941. The first beverage of the name was created by Caleb D. Bradham (1866–1934), a pharmacist in New Bern, N.C., who gave it its name in 1898 and incorporated the Pepsi-Cola Company in 1902. After moderate prosperity for many years, the company fell on hard times and was reorganized and reincorporated in 1922 as The Pepsi-Cola Company. In the following year, however, this effort went bankrupt; and, after a few months of ownership under a holding company, the trademark and assets were sold in 1923 to a newly formed Pepsi-Cola Corporation, again reformed in 1928 as National Pepsi-Cola Corporation.

When this "National" company went bankrupt in 1931, the trademark and assets were picked up by Charles G. Guth (1876–1948), the real founder of modern Pepsi-Cola. He established a new Pepsi-Cola Company, had a chemist reformulate a better drink, set up new bottling operations, and began merchandising a spectacularly successful 12-ounce bottle of Pepsi-Cola for five cents. Guth concurrently had been president of Loft, Incorporated, a candy manufacturer and soda-fountain chain (founded in 1919), but, in a proxy war in 1935–36, lost control of the company. Then, because he had used Loft money, personnel, and facilities to build up his separate Pepsi-Cola operations, the new Loft management brought suit in court in 1937–38, won the case, and won ownership of Pepsi-Cola. Finally, on June 30, 1941, Pepsi-Cola Company was merged into Loft, and the name Loft, Incorporated, was simultaneously changed to Pepsi-Cola Company.

In the immediate postwar years, Pepsi-Cola's business again slumped, but in 1949 Alfred N. Steele (1901–59), a former vice president of Coca-Cola Company, was hired and, in the next year, was made chief executive officer. His emphasis on giant advertising and sales promotions increased Pepsi-Cola's net earnings elevenfold in the course of the 1950s. (After his death in 1959, his wife, the actress Joan Crawford, became an active director of the company.) In the next decades, the conglomerate mergers and acquisitions began. After the merger of Pepsi-Cola Company and Frito-Lay, Inc., the company acquired several other companies, Pizza Hut, Inc. (1977); Taco Bell Inc. (1978); Seven-Up International (1986); and Kentucky Fried Chicken Corp. (1986).

Company headquarters of Pepsi-Cola and PepsiCo underwent several moves, from New Bern, N.C. (1902–23), to Richmond, Va. (1923–31), Baltimore, Md. (1931–35), New York City (1935–70), and Purchase, N.Y. (from 1970).

pepsin, the powerful enzyme in gastric juice that digests proteins such as those in meat, eggs, seeds, or dairy products.

Pepsin was first recognized in 1836 by the German physiologist Theodor Schwann. Nearly a century later, in 1930, it was crystallized and its protein nature established by John H. Northrop of the Rockefeller Institute for Medical Research.

Glands in the mucous-membrane lining of the stomach make and store an inactive protein called pepsinogen. Impulses from the vagus nerve and the hormonal secretions of gastrin and secretin stimulate the release of pepsinogen into the stomach, where it is mixed with hydrochloric acid and rapidly converted to the active enzyme pepsin. The digestive power of pepsin is greatest at the acidity of normal gastric juice (pH 1.5–2.5). In the intestine the gastric acids are neutralized (pH 7), and pepsin is no longer effective.

In the digestive tract pepsin effects only partial degradation of proteins into smaller units called peptides, which then either are absorbed from the intestine into the bloodstream or are broken down further by pancreatic enzymes.

Small amounts of pepsin pass from the stomach into the bloodstream, where it breaks down some of the larger, or still partially undigested, fragments of protein that may have been absorbed by the small intestine.

Pepsin is prepared commercially from swine stomachs. Crude pepsin is used in the leather industry to remove hair and residual tissue from animal hides prior to their being tanned. It is also used in the recovery of silver from discarded photographic films by digesting the gelatin layer that holds the silver compound.

peptic ulcer, sharply circumscribed, punched-out defect or erosion of tissue in the lining of the stomach or duodenum, produced by the corrosive and digestive action of acid gastric juice. Gastric (stomach) ulcers appear to be caused by failure of the normal mechanisms for protection of the stomach wall: the mucous cells may not secrete an adequate protective layer of mucus; or gastric acid, though normal or even below normal in quantity, may not be adequately buffered and diluted by swallowed food and by regurgitated intestinal contents. Duodenal ulcers, on the other hand, usually occur in the presence of greater than normal amounts of gastric juice with a high acid concentration. Peptic ulcers occasionally occur in the lower portion of the esophagus, as a result of repeated regurgitation of gastric contents.

Peptic ulcer occurs in 10 to 15 percent of the world's population; men are affected more frequently than women, and, except in Japan, duodenal ulcers are more common than gastric ones. The causes are not completely understood, although many factors have been implicated, including nervous tension, ingestion of certain drugs (such as salicylates and corticoid), and hormonal factors.

The symptoms of gastric and duodenal ulcer are similar, consisting of gnawing, burning, aching, hungerlike pain in the mid-upper abdomen, occurring from one to three hours after meals and several hours after retiring. Characteristically, this pain is relieved by ingestion of materials such as food, milk, and baking soda, which dilute and neutralize acid.

Complicating conditions may occur secondarily to peptic ulcer: obstruction of the stomach outlet, caused by inflammation or scar formation, may cause vomiting; bleeding may occur, leading to weakness and anemia; and the intestinal wall may perforate, causing severe localized abdominal pain and peritonitis.

During the late 1970s and '80s a variety of drugs were developed that both promoted the healing of peptic ulcers and prevented their recurrence. These drugs achieved their effect by reducing the secretion of acid gastric juice, neutralizing acid, directly protecting ulcers from the acid, or helping to promote mucosal secretion. When complications occur, or when the ulcer fails to heal with drug treatment, surgery may be necessary; a major portion of the stomach is often removed to decrease acid production and thus prevent recurrence.

peptide, any organic substance of which the molecules are structurally like those of proteins, but smaller. The class of peptides includes many hormones, antibiotics, and other compounds that participate in the metabolic functions of living organisms. Peptide molecules are composed of two or more amino acids joined through amide formation involving the carboxyl group of each amino acid and the amino group of the next. The chemical bond between the carbon and nitrogen atoms of each amide group is called a peptide bond. Some or all of the peptide bonds, which connect the consecutive triplets of atoms in the chain regarded as the backbone of the molecule, can be broken by partial or complete hydrolysis of the compound. This reaction, producing smaller peptides and finally the individual amino acids, is commonly used in studies of the composition and structure of peptides and proteins.

The number of amino-acid molecules present in a peptide is indicated by a prefix: a dipeptide contains two amino acids; an octapeptide, eight; an oligopeptide, a few; a polypeptide, many. The distinction between a polypeptide and a protein is imprecise and largely academic; some authorities have adopted, as an upper limit on the molecular weight of a polypeptide, 10,000 (that of a peptide composed of about 100 amino acids).

Pepusch, John Christopher, German JOHANN CHRISTOPH PEPUSCH (b. 1667, Berlin [Germany]—d. July 20, 1752, London, Eng.), composer who was an important musical figure in England in the years before G.F. Handel.

After studying theory and organ music, Pepusch at age 14 obtained a position at the Prussian court; he remained there until 1697. He traveled to the Netherlands, and in 1700 he settled in England. In 1712 he became music director to the Duke of Chandos. He took a doctorate in music from the University of Oxford in 1713. About this time he became music director at Lincoln's Inn Fields Theatre, for which he wrote several masques and arranged the tunes and composed the overtures for John Gay's *Beggar's Opera* (1728) and its sequel *Polly* (unperformed until 1777). In 1737 he became organist at the Charterhouse. He was in demand as a teacher; William Boyce was among his pupils. He also collected a magnificent library of music books and scores. Deeply interested in music of the Renaissance and of ancient Greece and Rome, he had a strong influence on the early development of musical antiquarianism in England; one consequence was the publication of Boyce's anthology *Cathedral Music* (of 16th- and 17th-century England). Pepusch helped form the Academy of Ancient Music, which performed works by 16th-century composers, and he edited some works of Arcangelo Corelli. His compositions include cantatas, concerti, and chamber music.

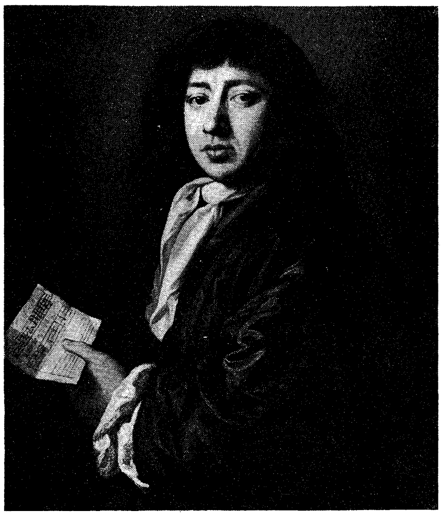
Pepys, Samuel (b. Feb. 23, 1633, London, Eng.—d. May 26, 1703, London), English diarist and naval administrator, celebrated for his *Diary* (first published in 1825), which gives a fascinating picture of the official and upper-class life of Restoration London from Jan. 1, 1660, to May 31, 1669.

Life. Pepys was the son of a working tailor who had come to London from Huntingdonshire, in which county, and in Cambridgeshire, his family had lived for centuries as monastic reeves, rent collectors, farmers, and, more recently, small gentry. His mother, Margaret Kite, was the sister of a Whitechapel butcher. But, though of humble parentage, Pepys rose to be one of the most important men of his day, becoming England's earliest secretary of the Admiralty and serving in his time as member of Parliament, president of the Royal Society (in which office he placed his imprimatur on the title page of England's greatest scientific work, Sir Isaac Newton's *Philosophiae Naturalis Principia Mathematica*), master of Trinity House and of the Clothworkers' Company, and a baron of the Cinque Ports. He was the trusted confidant both of Charles II, from whom he took down in shorthand the account of his escape after the Battle of Worcester, and of James II, whose will he witnessed before the royal flight in 1688. The friends of his old age included Sir Christopher Wren, Sir Isaac Newton, John Evelyn, Sir Godfrey Kneller, John Dryden, and almost every great scholar of the age.

Early career. Samuel Pepys (pronounced peeps) was sent, after early schooling at Huntingdon, to St. Paul's School, London. In 1650 he was entered at Trinity Hall, Cambridge, but instead went as a sizar to Magdalene College, obtaining a scholarship on the foundation. In March 1653 he took his B.A. degree and in 1660 that of M.A. Little is known of his university career save that he was once admonished for being "scandalously overserved with drink." In later years he became a great benefactor of his college, to which he left his famous library of books and manuscripts. He was also once offered—but refused—the provostship of King's College, Cambridge.

In December 1655 he married a penniless beauty of 15, Elizabeth Marchant de Saint-Michel, daughter of a French Huguenot refugee. At this time he was employed as factotum in the Whitehall lodgings of his cousin Adm. Edward Montagu, later 1st earl of Sandwich, who was high in the lord protector Cromwell's favour. In his diary Pepys recalls this humble beginning, when his young wife "used to make coal fires and wash my foul clothes with her own hand for me, poor wretch! in our little room at Lord Sandwich's; for which I ought forever to love and admire her, and do." While there, on March 26, 1658, he underwent a serious abdominal operation, thereafter always celebrating the anniversary of his escape by a dinner—"This being my solemn feast for my cutting of the stone."

In 1659 Pepys accompanied Montagu on a voyage to the Sound. About the same time he was appointed to a clerkship of £50 per annum in the office of George Downing, one of the tellers of the Exchequer, after whom Downing Street was later named. It was while working in Downing's office and living in a small house in Axe Yard that on Jan. 1, 1660, he began his diary. A few months later he sailed, as his cousin's secretary, with the fleet



Pepys, oil painting by John Hayls, 1666; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

that brought back Charles II from exile. Appointed, through Montagu's interest at court, clerk of the acts of the navy at a salary of £350 per annum and given an official residence in the navy office in Seething Lane, he became in the next few years a justice of the peace, a commissioner for and, later, treasurer of, Tangier, and surveyor of naval victualling. When he entered upon his functions, he was ignorant of almost everything that belonged to them. His chief use of his position was to enjoy his newfound importance and the convivial companionship of his colleagues, admirals Sir William Batten and Sir William Penn. But early in 1662 there came a change. The colleagues whose bacchanalian habits and social position had made them so attractive began to prove irksome, and their insistence on their superior experience and status galled Pepys's pride. In his isolation, he sought for ways by which he could show himself their equal. He had not far to look, for his fellow officers were anything but attentive to business. "So to the office," Pepys wrote, "where I do begin to be exact in my duty there and exacting my privileges and shall continue to do so." He had found his vocation.

Naval administration. It was not in Pepys's nature to do things by halves. Having resolved to do his duty, he set out to equip himself for its performance. In the summer of 1662 he occupied his leisure moments by learning the multiplication table, listening to lectures on shipbuilding, and studying the prices of naval stores: "into Thames Street, beyond the Bridge, and there enquired among the shops the price of tar and oil, and do find great content in it, and hope to save the King money by this practise." At the same time, he began his habit of making careful entries of all contracts and memoranda in large vellum books—beautifully ruled by Elizabeth Pepys and her maids—and of keeping copies of his official letters.

The qualities of industry and devotion to duty that Pepys brought to the service of the Royal Navy became realized during the Second Dutch War of 1665–67—years in which he remained at his post throughout the Plague and saved the navy office in the Great Fire of London. Before trouble with his eyesight caused him to discontinue his diary in 1669—an event followed by the death of his wife—these qualities had won him the trust of the King and his brother James, the duke of York, the lord high admiral. In 1673, in the middle of the Third Dutch War, when York's unpopular conversion to Catholicism forced him to resign his office, Pepys was appointed secretary to the new commission of Admiralty and, as such, administrative head of the navy. In order to represent it in Parliament—before whom he had conducted a masterly defense of his office some years before—he became member first for Castle Rising and, later, for Harwich. For the next six years he was engaged in stamping out the corruption that had paralyzed the activities of the navy. His greatest achievement was carrying through Parliament a program that, by laying down 30 new ships of the line, restored the balance of sea power, upset by the gigantic building programs of France and the Netherlands. In his work both at the Admiralty and in Parliament, Pepys's unbending passion for efficiency and honesty (combined with a certain childlike insistence on his own virtue and capacity for being always in the right) made for him powerful and bitter enemies. One of these was Lord Shaftesbury, who in 1678 endeavoured to strike at the succession and at the Catholic successor, the Duke of York, by implicating Pepys in the mysterious murder of the London magistrate Sir Edmund Berry Godfrey, the crime on which the full credulity of the populace in the Popish Plot depended. When Pepys produced an unanswerable alibi, his enemies endeavoured to fasten Godfrey's murder on him indirectly by accusing his confidential clerk, Samuel Atkins. Despite the third-degree methods employed against him, Pepys also proved an alibi for Atkins, who would otherwise almost certainly have perished. Six months later, his enemies brought into England a picturesque scoundrel and blackmailer called John Scott, who had begun his life of crime in what today is Long Island, New York, and whom Pepys had endeavoured to have arrested at the time of Godfrey's death on account of his mysterious activities disguised as a Jesuit. Pepys was flung into the Tower on an absurd charge of treason brought against him by Scott and supported by the Exclusionists in Parliament, as also on a minor and equally unjust charge of popery, brought against him by a dismissed butler whom he had caught in bed with his favourite maid. Had not Charles II almost immediately dissolved Parliament and prevented a new one from meeting for a further year and a half, Pepys would have paid the penalty for his loyalty, efficiency, and incorruptibility with his life. He employed his respite with such energy that by the time Parliament met again he had completely blasted the reputation of his accuser by collecting circumstantial details of his infamies from almost every country.

In 1683, when the King felt strong enough to ignore his opponents, Pepys was taken back into the public service. He had accompanied the Duke of York in the previous year on a voyage to Scotland, and he now sailed as adviser to the Earl of Dartmouth to evacuate the English garrison of Tangier—a voyage that he described in a further journal.

On his return, in the spring of 1684, he was recalled by Charles II to his old post. Entitled secretary of the affairs of the Admiralty of England and remunerated by a salary of £500 per annum, he combined the modern offices of first lord and secretary of the Admiralty, both administering the service and answering for it in Parliament. For the next four and a half years, including the whole of James II's reign, Pepys was one of the greatest men in England, controlling the largest spending department of state. With his habitual courage and industry, he set himself to rebuild the naval edifice that the inefficiency and corruption of his enemies had shattered, securing in 1686 the appointment of a special commission "for the Recovery of the Navy." When, at the beginning of 1689, after James II had been driven from the country, Pepys retired, he had created a navy strong enough to maintain a long ascendancy in the world's seas. Hitherto there had been brief spells when the emergence of naval geniuses like Sir Francis Drake and Robert Blake had given England a temporary advantage over its maritime neighbours, but for long periods the English "sovereignty of the seas" had been an idle boast. When Pepys became associated with the navy in 1660, the line of battle had consisted of 30 battleships of a total burden of approximately 25,000 tons and carrying 1,730 guns. When he laid down his office, he left a battle line of 59 ships of a total burden of 66,000 tons and carrying 4,492 guns. Not only had he doubled the navy's fighting strength, but he had given it what it had never possessed before and what it never again lost—a great administrative tradition of order, discipline, and service.

"To your praises," declared the orator of Oxford University, "the whole ocean bears witness; truly, sir, you have encompassed Britain with wooden walls." Pepys's last 14 years, despite attempts by his political adversaries to molest him, were spent in honourable retirement in his riverside house in York Buildings, amassing and arranging the library that he ultimately left to Magdalene College, Cambridge, corresponding with scholars and artists, and collecting material for a history of the navy that he never lived to complete, though he published a prelude to it in 1690, describing his recent work at the Admiralty, entitled *Memoires relating to the State of the Royal Navy of England for ten years determined December 1688.* He died at the Clapham home of his former servant and lifelong friend William Hewer. His fellow diarist John Evelyn wrote of him: "He was universally belov'd, hospitable, generous, learned in many things, skilled in music, a very greate cherisher of learned men of whom he had the conversation."

The diary. The diary by which Pepys is chiefly known was kept between his 27th and 36th years. Written in Thomas Shelton's system of shorthand, or tachygraphy, with the names in longhand, it extends to 1,250,000 words, filling six quarto volumes in the Pepys Library. It is far more than an ordinary record of its writer's thoughts and actions; it is a supreme work of art, revealing on every page the capacity for selecting the small, as well as the large, essential that conveys the sense of life; and it is probably, after the Bible and James Boswell's *Life of Samuel Johnson,* the best bedside book in the English language. One can open it on any page and lose oneself in the life of Charles II's London, and of this vigorous, curious, hardworking, pleasure-loving man. Pepys wanted to find out about everything because he found everything interesting. He never seemed to have a dull moment; he could not, indeed, understand dullness. One of the more comical entries in his diary refers to a country cousin, named Stankes, who came to stay with him in London. Pepys had been looking forward to showing him the sights of the town—

> But Lord! what a stir Stankes makes, with his being crowded in the streets, and wearied in walking in London, and would not be wooed by my wife and Ashwell to go to a play, nor to White Hall, or to see the lions, though he was carried in a coach. I never could have thought there had been upon earth a man so little curious in the world as he is.

Pepys possessed the journalist's gift of summing up a scene or person in a few brilliant, arresting words. He makes us see what he sees in a flash: his Aunt James, "a poor, religious, well-meaning, good soul, talking of nothing but God Almighty, and that with so much innocence that mightily pleased me"; and his sister Pall, "a pretty, good-bodied woman and not over thick, as I thought she would have been, but full of freckles and not handsome in the face." He could describe with wonderful vividness a great scene: as, for example, the day General George Monck's soldiers unexpectedly marched into a sullen City and proclaimed there should be a free Parliament—"And Bow bells and all the bells in all the churches as we went home were a-ringing; it was past imagination, both the greatness and suddenness of it." He described, too, the Restoration and coronation; the horrors of the Plague; and the Fire of London, writing down his account—so strong was the artist in him—even as his home and its treasures were being threatened with destruction:

> We saw the fire as only one entire arch of fire from this to the other side of the bridge, and in a bow up the hill for an arch of above a mile long: it made me weep to see it. The churches, houses, and all on fire and flaming at once; and a horrid noise the flames made, and the cracking of houses at their ruine.

Above all, Pepys possessed the artist's gift of being able to select the vital moment. He makes his readers share the very life of his time: "I staid up till the bell-man came by with his bell just under my window as I was writing of this very line, and cried, 'Past one of the clock, and a cold, and frosty, windy morning.' " He tells of the guttering candle, "which makes me write thus slobberingly"; of his new watch—"But Lord! to see how much of my old folly and childishness hangs on me still that I cannot forebear carrying my watch in my hand in the coach all the afternoon and seeing what o'clock it is one hundred times"; of being awakened in the night—

> About 3 o'clock this morning I waked with the noise of the rain, having never in my life heard a more violent shower; and then the cat was locked in the chamber and kept a great mewing and leapt upon the bed, which made me I could not sleep a great while.

Pepys excluded nothing from his journal that seemed to him essential, however much it told against himself. He not only recorded his major infidelities and weaknesses; he put down all those little meannesses of thought and conduct of which all men are guilty but few admit, even to themselves. He is frank about his vanity—as, for example, in his account of the day he went to church for the first time in his new periwig: "I found that my coming in a perriwig did not prove so strange to the world as I was afeared it would, for I thought that all the church would presently have cast their eyes upon me, but I found no such thing"; about his meannesses over money, his jealousies, and his injustices—"Home and found all well, only myself somewhat vexed at my wife's neglect in leaving her scarfe, waistcoat and night dressings in the coach today; though I confess she did give them to me to look after." For he possessed in a unique degree the quality of complete honesty. He is both Everyman and the recording angel; his diary paints not only his own infirmities but the frailty of all mankind.

After the successful publication of John Evelyn's diary in 1818, Pepys's diary was transcribed—with great accuracy—by John Smith, later rector of Baldock, Hertfordshire.

A number of volumes of Pepys' correspondence have also been published. (Ar.Br.)

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Pequot, any member of a group of Algonquian-speaking Indians who lived in the Thames valley in what is now Connecticut, U.S.; in the 1600s their population was estimated to be 2,200. Their subsistence was based on the cultivation of maize (corn), hunting, and fishing.

The Mohegan and the Pequot were jointly ruled by the Pequot chief Sassacus until a rebellion of the subchief Uncas that resulted in Mohegan independence. From 1620 the Pequot and British settlers had lived side by side in mutual helpfulness and peaceful trade. Gradually, however, Pequot resentment swelled against new colonists who pushed their way westward frequently in a high-handed manner. The Pequot were especially fearful of British territorial intrusion because they were already squeezed into the region between Narragansett Bay and the Connecticut River. The tribe had also stirred the ire of the British by limiting its trade to the Dutch.

Several incidents had taken place between the Pequots and the settlers before the summer of 1636, when a Boston trader was murdered, presumably by a Pequot, on Block Island. A punitive expedition that was sent by Massachusetts authorities to destroy native villages and crops only succeeded in arousing the tribe to make a more determined defense of its homeland. Puritan clergymen encouraged violence against the Pequots, whom they regarded as infidels, and the British settlers agreed to take up arms.

In a short but vicious war, fought under Captain John Mason with the aid of Mohegans and Narragansets, the main Pequot fort at Mystic, Conn., was surprised and burned, and between 500 and 600 inhabitants were burned alive or slaughtered. Defeated, some Pequot decided to separate into small bands and abandon the area; many who fled were killed or captured by other Indians or the English; many were sold into slavery in New England or the West Indies, and the Mohegan obtained control of Pequot lands. Those who surrendered were distributed among other tribes, but received such harsh treatment that in 1655 they were placed under the direct control of the colonial government and resettled on the Mystic River. Their numbers declined rapidly, and in the late 20th century there were approximately 200 members of the tribe.

Per-Atum (ancient Egyptian city): *see* Pithom.

Per-Month (town, Egypt): *see* Hermonthis.

Per Ramessu, also called PI RAMESSE, biblical RAAMSES, modern QANTÎR, KHATÂ'NA, or TALL AD-DABA'A, ancient Egyptian capital in the 15th, 19th, and 20th dynasties. Situated in the northeastern delta about 62 miles (100 km) northeast of Cairo, the city lay in ancient times on the Bubastite branch of the Nile.

Probably founded in the Old Kingdom, the city was overrun by Palestinian peoples in about 1700 BC and became the Hyksos capital about 1530 BC. Sacked by the victorious pharaoh Ahmose about 1521 BC, it remained obscure until the advent of the 19th dynasty, whose home was nearby. Sometime during this period the Hebrews settled in this area.

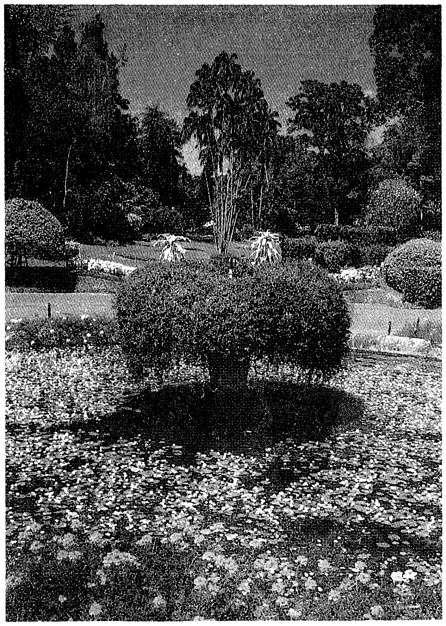
Seti I (1290–79 BC) built a palace on the site and started a faience-manufacturing industry. His successor, Ramses II, decided to move his capital there to utilize the military potential of the site. Early in his reign large temples, residences, storehouses, docks, and military facilities were built (whence the biblical name "treasure cities" stemmed, Exodus 1:11). The city was divided into four quarters, each dedicated to a deity; Amon and Wadjit were the Egyptian gods, Seth and Astarte the Asiatic, as Ramses strove to bind the religions of Syria and Egypt. In the centre of the city, the cult of the king himself was dominant. The city was not only the royal residence but also the administrative capital, as various government bureaucracies were moved here. A rich agricultural and riverine hinterland provided food and recreation for the populace. Oriented toward Egypt's empire in Syria-Palestine, the city began to decline after the loss of the Asiatic territory in the mid-20th dynasty. Toward the end of that dynasty, the town of Tanis, 15 miles (24 km) to the north, superseded Per Ramessu. The final blow was the transfer of the royal residence to Tanis in the 21st dynasty. It was the large-scale plunder and reuse of the stone of Per Ramessu that led to great confusion over the location of the Ramesside capital. Excavations started in the 1940s by Egyptian archaeologists and carried forward by an Austrian expedition since 1975 have firmly located Ramses II's capital here and also have elucidated the Hyksos period of the city.

Per Tum (ancient Egyptian city): *see* Pithom.

peracid (chemistry): *see* peroxy acid.

Peradeniya Botanic Gardens, botanical garden in Peradeniya, near Kandy, Sri Lanka, noted for its rich and varied collections of tropical woody plants. Occupying 59 hectares (146 acres), it has about 4,000 species of plants. The most important specimens of the garden include palms, some of which are planted in impressive avenues. Significant, too, are the collections of orchids, gymnosperms, and flowering trees.

The gardens were founded in 1821 primarily to introduce coffee trees and various other tropical plants of economic importance to the region. Even after it took on a more botanical emphasis in the 1840s, the garden remained a centre for horticultural activities.



Peradeniya Botanic Gardens, in Peradeniya, Sri Lanka
Robert Harding Picture Library

Under the directorship of the botanist George H.K. Thwaites, the garden played a pivotal role in establishing the country's flourishing tea industry in the late 1870s. Thwaites also brought in and cultivated the Brazilian rubber tree, which became a crop producer vital to the nation's economy. The botanical collection has developed into one of the finest in the region.

Perak, traditional region, northwestern West Malaysia (Malaya), bordering Thailand to the north and fronting the Strait of Malacca to the west. Its area includes a large portion of West Malaysia's west-coast plains and centres upon the Perak River, which flows north to south between the Keledang Range to the east and the Bintang Range to the west; both of these mountain ranges lie east of the west-coast plains. The name Perak means "tin."

Chiefly because of its deposits of tin, the region was subject to many foreign and domestic incursions. Malacca fell to the Portuguese in 1511, and it was then that Perak began to emerge as an independent state. The region was particularly harassed by the Achinese, who managed to capture four sultans of Perak and thousands of their subjects between 1575 and 1675 and who were effectively the overlords of Perak. Several Dutch attempts to control tin exports resulted in a 1765 treaty with the sultan of Perak, but the most serious threat to the state was actually from its Bugis neighbours to the south. British influence, which began with an 1818 trade treaty, was extended in 1826, when the Dindings coastal strip and Pangkor Island offshore were ceded to them as bases for pirate suppression. In the Pangkor Engagement (1874), the chiefs accepted a British resident, and Perak became one of the Federated Malay States (1896). The Dindings and Pangkor were returned in 1935 to Perak, which joined the Federation of Malaya after World War II.

Tin mining is still carried on in the region, particularly in Kinta Valley (*q.v.*). Much of the region remains jungle, and the Keledang and Bintang ranges are roadless and sparsely inhabited; there is, however, a good network of roads supported by the Malayan Railway along the foothills of these ranges.

Lake Chenderoh in north-central Perak is the site of a hydroelectric dam on the Perak River that supplies power to the valley. Rubber production, paddy (rice) farming, coconut plantations, and fishing are also important. Tobacco is grown as an off-season cash crop in paddy areas. Iron is mined, and there are coal deposits in the region.

Perak, Tun (d. 1498), *bendahara* (chief minister) of Malacca (now Melaka), who was kingmaker and the effective ruler of that important East Indies trade centre from 1456 until his death in 1498.

A leader in the Malay defeat of a Siamese invasion in 1445–46, Tun Perak was made *bendahara* by Sultan Muzaffar Shah in 1456, when he again led Malacca's forces in a decisive defeat of the Siamese. He proceeded with an aggressive foreign policy that resulted in a loose empire taking in the whole southern half of the Malay Peninsula and a portion of the east coast of Sumatra. Muzaffar Shah died about 1459, and the next three sultans, Mansur Shah, Ala'ud'din, and Mahmud Shah, who were all related to Tun Perak, apparently owed their positions to his influence.

Perak War (*c.* 1874–76), rebellion against the British by a group of dissident Malay chiefs that culminated in the assassination in 1875 of James Birch, the first British resident (adviser) in Perak. Although they succeeded in eliminating Birch, the Malay leaders failed in their ultimate objective—the curbing of British economic and political influence in the area.

Birch arrived in Perak in November 1874 to take up the post of resident (*i.e.,* official British adviser to the sultan), which had been created as part of the Pangkor Engagement, a treaty between the British government and the Malay chiefs. Birch hoped through his influence to have Raja Abdullah accepted as sultan in Upper Perak and to modernize the traditional administrative system, under which government had been based on personal relationships between the sultan and the chiefs. Because of rapid and revolutionary administrative change, especially concerning revenue collection and slavery, the resident soon alienated Abdullah and most local chiefs.

At a meeting in July 1875, the sultan organized a movement to kill Birch and end foreign influence in Perak. When Birch was in Upper Perak posting new tax proclamations, one of the chiefs, Maharaja Lela, and his men assassinated him. An attack on the residency itself failed to materialize. Subsequent British military action crushed weak Malay resistance; the plotters were arrested by mid-1876 and were later tried. Abdullah was deposed as sultan, and the rebel chiefs were severely punished. Subsequent British residents attempted to work through Malay rulers and to avoid drastic changes in traditional institutions.

Peralta, Pedro de (b. *c.* 1584, Spain—d. 1666, Madrid), Spanish colonial official and founder of Santa Fe, N. M.

Peralta arrived in Mexico City during the winter of 1608–09 following his university studies in Spain. In March 1609 the viceroy of Mexico appointed him to the post of governor of New Mexico; and, from April to October of that year, Peralta organized an expedition to that province. He evidently reached the colony's San Gabriel settlement by the following spring. He then founded another settlement at Santa Fe.

Peralta's authority as governor of New Mexico was challenged by the Franciscan missionaries. In 1612 one of the missionaries, Fray Isidrio de Ordoñez, declared Peralta a "schismatic heretic" and proclaimed that he was excommunicated. A short time thereafter, Peralta was arrested and was imprisoned for almost a year, until he sent word of his situation to the viceroy, who forthwith ordered his release.

Peralta continued to serve the Spanish monarchy in the Americas even after he no longer acted as governor of New Mexico. He became lieutenant commander of the Pacific seaport of Acapulco, and he was appointed alcalde of Mexico City's royal warehouse, 1621–22. In 1637 he traveled to Caracas, Venezuela, where he married and entered a commercial enterprise. From 1644 to 1652 he served as auditor and, later, treasurer of the royal treasury in Caracas. He returned to Spain in the latter year, after sustaining injuries from residents who resented his attempts to collect debts owed to the monarchy. He resigned his commission in 1654 and lived in retirement in Madrid until his death.

Peranakan, in Indonesia, a native-born person of mixed Indonesian and foreign ancestry. There are several kinds of Peranakans in Indonesia, namely Peranakan Chinese, Peranakan Arabs, Peranakan Dutch, and Peranakan Indians. The Peranakan Chinese form the largest and the most important group, and for this reason many scholars use Peranakan to refer to the Chinese group.

Until the end of the 19th century, immigration of Chinese was limited because of difficulties in transportation. Most of those who reached Java, mainly from the southern provinces of China, married indigenous women, usually nominal Muslims or non-Muslims.

In time they formed a stable Peranakan Chinese community. Peranakans partly adopted the indigenous way of life and generally spoke the local native tongue rather than Chinese. Along the northern coast of Java, where most of the Chinese lived, a combination of Bazaar Malay and Hokkien dialect was used as a common language, and this language was later known as Bahasa Melaju Tionghoa (Chinese Malay). The Peranakan Chinese community was firmly established by the mid-19th century and had become self-contained with a decline in intermarriage. New immigrants continued to be rapidly assimilated into the Peranakan community because there was no mass immigration.

In the early 20th century a great increase in the number of Chinese immigrants (including women) in Java, the dynamics of Chinese nationalism, and the development of Chinese medium schools contributed to the shaping of a Totok (an Indonesian term for foreign-born people) Chinese community. Unlike the Peranakan Chinese, Totok Chinese were born in China, still spoke a Chinese dialect or Mandarin, and were frequently strongly China-oriented.

Despite the rapid growth of the Totok community, they were overwhelmingly outnumbered by the Peranakan Chinese. In 1930, for example, Indonesia-born Chinese constituted more than 79 percent of all the Chinese in Java, and about 53 percent of the total were at least third generation. But they were by no means a homogeneous political group. Before World War II there were three political streams in the Peranakan Chinese community—the Sin Po group, which was China-oriented; the Chung Hwa Hui, which was Dutch East Indies-oriented; and the Partai Tionghoa Indonesia, which was Indonesia-oriented. These three groups were dissolved during the Japanese occupation (1942–45).

Percé, city, seat of Pabok *municipalité régionale de comté* (regional county), Bas-Saint-

Laurent-Gaspésie region, eastern Quebec province, Canada, on the Gulf of St. Lawrence, at the east end of the Gaspé Peninsula. First visited in 1659 by Bishop François Laval, it has been the site of a Roman Catholic mission since 1670. Percé is now a fishing port and summer resort. Offshore, but connected by a sandbar at low tide, is famed Rocher-Percé (Pierced Rock)—a rocky island 290 feet (88 m) high that is pierced by a 60-foot-(18-metre-) high arch; it and another nearby tourist attraction, Bonaventure Island, are bird sanctuaries. Pop. (1981) 4,839.

perception, the process whereby sensory stimulation is translated into organized or meaningful experience.

A brief treatment of perception follows. For full treatment, *see* MACROPAEDIA: Perception, Human.

The perceptual process is not directly observable, but relations can be found between the various types of stimulation and their associated experiences or percepts. Empirical demonstration of the difference between sensation and perception has been a classical problem, largely because of a lack of agreement about the definition of the two terms. A common distinction is that sensations are simple sensory experiences while percepts are complex constructions of simple elements that have been joined through association. Another distinction is that perceiving is subject to the influence of learning. Percepts have also been characterized as relating to external objects while sensations are more subjective and are internally localized experiences. An anatomical distinction identifies sensation with neural events occurring near the sense organ, while percepts happen at the level of the brain.

Experimental evidence suggests that percepts follow a measurable, developmental time course, and may even change with time or yield more than one percept. Such devices as the tachistoscope, which permit the duration of visual stimuli to be precisely controlled, have indicated that in human beings there is a brief period (100 to 200 milliseconds at most) during which a percept is highly vulnerable to disruption.

Theorists have been divided as to whether perceptual organization is primarily innate or learned. Research has suggested that some basic visual functions, such as pattern and depth perception, are innate, but that visual experience is important to perceptual development.

Structuralist theory states that percepts are structured or synthesized from sensations. To study this concept, Edward Bradford Titchener devised a means of taking percepts apart to reveal their constitutional elements. Through the use of a device that moves the image source along with the eye, it was discovered that stabilized images seem to disappear and that some movement in retinal image is needed to maintain perception over extended periods of time.

Gestalt theorists Max Wertheimer, Kurt Koffka, and Wolfgang Köhler rejected the assumption that perceptual organization was the product of learned relationships. They agreed that simple sensations could comprise organized percepts, but they maintained that percepts were basic to experience and that the human experience is of organized wholes (Gestalten) rather than collections of elements. The mind tends to fill in small gaps in a figure in order to perceive a logical whole. Not only do patterns have properties that are not inherent in the elements themselves, but, according to the principle of Prägnanz, the perceived pattern will be as good as prevailing conditions permit. A good configuration is inferred to have such properties as simplicity, stability, regularity, symmetry, continuity, and unity.

Gestalt theory states that the ground (background) of a figure provides a great deal of perceptual information. The apparent brightness of a stimulus, for example, depends on the surrounding stimulation as well as the figure's own luminance.

Perceptual processes may become fatigued by prolonged visual exposure to an image. Figural aftereffects refer to changes in the perceived shape or location of a figure following its inspection. Most objects tend to appear stable despite continually changing stimulus features. Perceptual constancy prevails, given the appropriate contextual cues, enabling an observer to match an object as it is perceived with the object as it is understood to exist.

Perceptual functioning varies among cultures, among individuals, and even within the same individual. Perceptions may be influenced by expectancies, needs, unconscious ideas, values, and conflicts; people have a tendency to impose order and meaning upon their experiences. *See also* movement perception; space perception; time perception.

perceptual constancy, also called OBJECT CONSTANCY, or CONSTANCY PHENOMENON, the tendency of animals and man to see familiar objects as having standard shape, size, colour, or location regardless of changes in the angle of perspective, distance, or lighting. The impression tends to conform to the object as it is or is assumed to be, rather than to the actual stimulus. Perceptual constancy is responsible for the ability to identify objects under various conditions, which seem to be "taken into account" during a process of mental reconstitution of the known image. For example, snow appears white in the low illumination of moonlight, as well as in sunlight 800,000 times as bright. Perceptual constancy is reduced by limited experience with the object and by decreasing the number of environmental cues that aid in identification of the object.

perceptual learning, the effects of past experience on sensory perceptions.

A brief treatment of perceptual learning follows. For full treatment, *see* MACROPAEDIA: Perception, Human.

An organism's readiness to learn is of primary importance to its survival, and this readiness depends largely on its perceptual skills. Perceptual skills are intimately involved in producing more effective responses to stimuli.

Historically, perceptual learning has been the subject of vigorous debate. Although early Gestalt psychologists denied that learning modifies perceiving, that this occurs is now almost universally accepted. Research continues to examine the extent of modification and how modification occurs. There are two main schools of thought: discovery and enrichment. The discovery theory holds that learning makes one aware of stimuli one had previously overlooked. Enrichment refers to one's increased awareness and heightened response capabilities in the light of a learning experience. It is very possible that discovery and enrichment may simply describe different aspects of perceptual learning.

One aspect of the enrichment thesis holds that learning determines how one interprets common spatial relationships. For example, one learns to assume that a plate remains circular even though it may appear elliptical when viewed from certain angles. In fact, say theorists, these kinds of assumptions are essential in reducing ambiguity for mature perceiving.

In the laboratory, perceptual learning has been tested and measured by observing the effects of practice on perceptual abilities. Subjects are given various auditory, olfactory, and visual acuity tests. With practice, subjects improve their scores, indicating that perceptual abilities are not immutable but are modifiable by learning. Researchers have also discovered through studies with newborn animals and with laboratory subjects adjusting to prism-distorted vision that active, exploratory interaction with the environment greatly enhances perceptual learning.

In studies of animal behaviour, the term perceptual learning is sometimes used to refer to those instances in which an animal learns to identify a complex set of stimuli that can be used to guide subsequent behaviour. Examples of such perceptual learning include imitation and observational learning, song learning in birds, and imprinting in birds and mammals. *See* learning.

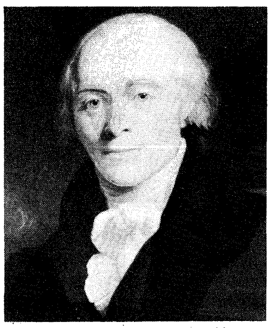
Perceval, hero of Arthurian romance, distinguished by his quality of childlike (often uncouth) innocence, which protected him from worldly temptation and set him apart from other knights in Arthur's fellowship. This quality also links his story with the primitive folktale theme of a great fool or simple hero. In Chrétien de Troyes's poem *Le Conte du Graal* (12th century), Perceval's great adventure was a visit to the castle of the wounded Fisher King, where he saw a mysterious dish (or grail) but, having previously been scolded for asking too many questions, failed to ask the question that would have healed the Fisher King. Afterward, he set off in search of the Grail and gradually learned the true meaning of chivalry and its close connection with the teachings of the church. In later elaborations of the Grail theme, the pure knight Sir Galahad displaced him as Grail hero, though Perceval continued to play an important part in the quest.

The story of Perceval's spiritual development from simpleton to Grail keeper received its finest treatment in Wolfram von Eschenbach's great 13th-century epic, *Parzival.* This poem was the basis of Wagner's last opera, *Parsifal* (1882).

Perceval, John: *see* Egmont, John Perceval, 2nd earl of.

Perceval, Spencer (b. Nov. 1, 1762, London—d. May 11, 1812, London), lawyer, politician, and British prime minister from 1809 until his assassination in 1812.

The second son of the 2nd Earl of Egmont, Perceval was educated at Harrow and at Trinity College, Cambridge; he was called to the bar by Lincoln's Inn in 1786 and became a king's counsel in 1796. In the same year he entered Parliament, where his rise to power was facilitated through his contacts with William Pitt the Younger. On the formation of the government of Henry Addington (1801–04), which succeeded that of Pitt, he was appointed solicitor general. From 1802 and through Pitt's second administration (1804–06) he was attorney general.

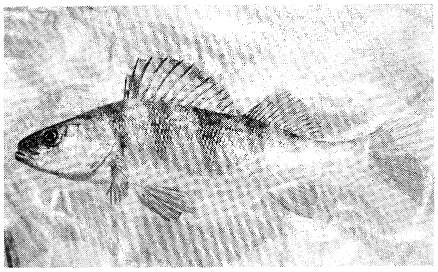


Spencer Perceval, detail of an oil painting by G.F. Joseph, 1812; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

When King George III dismissed William Grenville's ministry in March 1807, Perceval, an ardent opponent of Catholic emancipation, became chancellor of the Exchequer and chancellor of the duchy of Lancaster under the 3rd Duke of Portland, whom he succeeded as prime minister on Oct. 4, 1809. His administration was marked by strong opposition to the tolerant views that had ruined his predecessors; and he is one of the few English statesmen of the period notorious for his extreme religious intolerance. He was a man of a cold, ungenial nature. Perceval was shot and killed in the House of Commons by John Bellingham, a deranged man who had vainly applied to him for redress of a personal complaint against the government.

perch, either of two species of fish, the common and the yellow perch (*Perca fluviatilis* and *P. flavescens,* sometimes considered as single species, *P. fluviatilis*) of the family Percidae (order Perciformes). The name also is widely, and sometimes confusingly, applied to a variety of other fishes.



Yellow perch (*Perca flavescens*)
L.M. Chace from The National Audubon Society Collection/Photo Researchers—EB Inc.

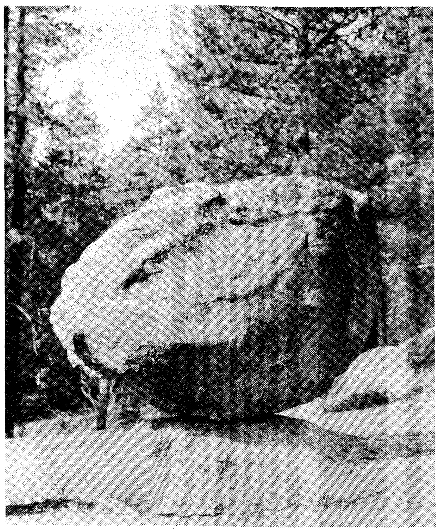
The common and yellow perches are found, respectively, in the fresh waters of Eurasia and North America. Both are well-known and popular as both food and sport fishes. They have two dorsal fins, the first spiny and the second soft-rayed.

Perches are carnivores and inhabit quiet ponds, lakes, streams, and rivers. They spawn in spring, the female at that time laying strings of eggs in the shallows among water plants, branches, and the like. The common, or European, perch is greenish with dark, vertical bars on the sides and reddish or orange colouring in the lower fins. It grows to a maximum weight of about 3 kg (6 pounds), rarely more. The yellow perch, native to eastern North America and introduced on the Pacific coast, is similar to the European perch but yellower in colour. It grows to about 40 cm (15 inches) and 1 kg (2.2 pounds).

Other perchlike and perch-named fishes include the pikeperch (*q.v.*), also of the family Percidae; the surfperch (*q.v.*); and the white perch, a relative of the sea bass (*q.v.*).

Perche, region of northern France on the border of Normandie, mainly in the east of the Orne *département,* with extensions into neighbouring *départements.* Formerly a county, it was united to the French crown in 1525. It is largely hilly country, the Perche Hills having summits as high as 1,000 feet (300 m). Perche is a district of pastoral farming and dairying, famous for its breed of draft horses (Percherons). Mortagne-au-Perche and Nogent-le-Rotrou, the chief market towns, were at different times capitals of Perche county.

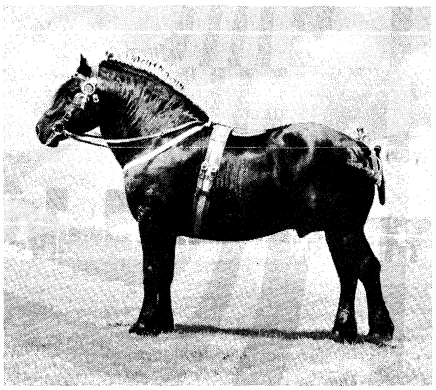
perched rock, also called MUSHROOM ROCK, or PEDESTAL ROCK, boulder balanced on a pinnacle rock, another boulder, or in some other precarious position. Some perched rocks form in place, as where rainwash (and in some cases wind) has removed fine material from around the boulder. Others may be transported by tectonic forces (involved in deformation of the Earth's crust) or by ice (such as erratics, or glacier transports) and let down to an unsettled position. Perched rocks commonly have



Glacial erratic perched on low pedestal of massive granite, Tulare County, California
By courtesy of the U.S. Geological Survey, Washington, D.C.

a hard capping, such as ferruginous duricrust, and they often show crumbling or exudation around their sides.

Percheron, heavy draft-horse breed that originated in the Perche region of France. The breed probably stems from the Flemish "great horse" of the Middle Ages; modified by Oriental blood to develop a coach-horse type, it was changed again in the 19th century by introduction of draft-type blood to produce animals for heavy farm work. Although a few Percherons were imported earlier, they did not



Percheron
Sally Anne Thompson—EB Inc.

become popular draft animals in the United States until after 1851. Before mechanization revolutionized farming, Percherons were widespread and influenced American agriculture more than any other draft breed.

Percherons average 16 to 17 hands (64 to 68 inches, or 163 to 173 cm) high and weigh 1,900 to 2,100 pounds (860 to 950 kg). The head is fairly small and clean cut, the neck long, and the body well muscled. Common colours are black and gray. Percherons are agile and energetic for their size and display a mild disposition. The Percheron Horse Association of America and its predecessor organizations date from 1902.

perching bird: *see* passeriform.

perching duck, any of the species of the tribe Cairinini, family Anatidae (order Anseriformes), waterfowl that typically inhabit wet woodlands, nest in holes in trees, and perch on branches by means of their long-clawed toes. The tribe is widely represented, especially in the tropics. Perching ducks are closely akin to dabbling ducks, which they resemble in feeding habits and, in some species, courtship behaviour; in other respects they are like shelducks. Some possess a bony knob at the wing bend, and most forms show white wing patches and black wing linings. Drakes are larger than hens and, on the whole, more brightly patterned—sometimes in metallic colours.

Best known among the perching ducks are: the North American wood duck (*Aix sponsa*), or Carolina duck, and its Asian relative, the mandarin duck (*A. galericulata*), both exceptionally colourful; and the Muscovy duck (*Cairina moschata*), of Mexico to Peru and Uruguay. The smallest of waterfowl are the little-known perching ducks of tropical forests, the so-called pygmy geese (*Nettapus* species).

perchloroethylene: *see* tetrachloroethylene.

Percier, Charles; and Fontaine, Pierre (-François-Léonard) (respectively b. Aug. 22, 1764, Paris—d. Sept. 5, 1838, Paris; b. Sept. 20, 1762, Pontoise, Fr.—d. Oct. 10, 1853, Paris), pair of French architects and interior designers who carried out many building and decorative projects during the reign of Napoleon I and helped create the influential Empire style (*q.v.*) of interior decoration.

Percier and Fontaine became acquainted with each other while both were studying architecture in Paris. Percier won the Prix de Rome in 1786 and spent the following years studying in Rome with Fontaine, who became his lifelong friend. They returned to Paris in 1790 and set up their own practice; their work eventually attracted the attention of Josephine Bonaparte, Napoleon's wife, and she engaged them to renovate her Château de Malmaison (1800–02). From then on the Bonapartes became their principal patrons.

In their subsequent decorative work Percier and Fontaine virtually invented the severe but elegant Neoclassical blend of Greco-Roman and Egyptian forms and motifs that became known as the Empire style. They redid interiors, walls, and ceilings and designed furniture, accessories, and ornament for the old royal palaces and the new residences of the Bonapartes. Much of their work was done on the Louvre and the Tuileries palaces; they designed the arcades of the rue de Rivoli and the rue de Castiglione along the Louvre and designed the Arc de Triomphe du Carrousel connecting the Louvre and Tuileries (1806–08). They also worked on the Château de Saint-Cloud and the Château de Fontainebleau.

Financing grew scarce in the later years of the Empire, and the return of the Bourbons in 1814 aborted several grandiose Napoleonic building projects and sent Percier into permanent retirement. Fontaine remained active, designing the sombre Neoclassical Chapelle Expiatoire (1815–26) in Paris and continuing to restore the Louvre-Tuileries complex under both Charles X and Louis-Philippe. He retired in 1848.

perciform, any member of the order Perciformes, a group of bony fishes with more than 6,000 species placed in about 150 families. The group includes some of the most important food and game fishes, such as the tunas, mackerels, marlins, perches, and sea basses.

A brief treatment of perciforms follows. For full treatment, *see* MACROPAEDIA: Fishes.

Most perciforms range from 30 to 250 cm (about 1 to 8 feet) in length, but the smallest species, the freshwater goby of the Philippines, measures barely half an inch in length. By contrast, among the largest perciforms are the bluefin tuna and the Indo-Pacific black marlin, which can reach 680 kg (1,500 pounds) in weight.

Perciforms are found all over the world. Among the Antarctic species, which comprise about three-fourths of all Antarctic fishes, the best known is the icefish, noted for its almost transparent appearance. The Indo-West Pacific fishes are also largely made up of perciforms, including the wrasse, goby, and damselfish. Freshwater perciforms include the cichlid, which is found in India, Africa, and North and South America, and the perch and sunfish families found in North America and Europe.

Since the earliest times, perciforms have been an important food source for humans. In Scotland, archaeologists have found evidence of the sea bream being eaten in shell mounds. Nile perches have been found as mummies in Egypt, wrapped up and buried with the dead. Goatfishes (Nullidae) were considered a valuable food by the ancient Romans; in Japan they are eaten raw as *sashimi* or dried in cakes as *kamaboko*. Isinglass, used to make jellies and to clarify wine and beer, is obtained from the drums and the threadfins. Leather is provided by the skin of the wolffish, and artificial pearls are made in Japan with guanin, found in the skin of the Japanese cutlass fish.

Some perciforms have strange habits. A group of blenny lays eggs in the cavity of a living sponge. The young of the black sea bass are mostly born female, but within five years many of them change into males. Eleven species of the sparids are hermaphroditic at some time or even throughout their lifetimes. Most perciform eggs are fertilized in the water, but some species have internal fertilization. Many species are very protective of their young.

Some perciforms form interesting relationships with other marine species. The cleaner fishes, a type of wrasse, remove parasites from inside the mouths of larger predator fishes. The saber-toothed blenny (*Aspidonotus taeniatus*) mimics the cleaner fish but takes a quick bite of fin instead of cleaning. Some fish survive by similar imitations: young tripletails (Lobotidae) turn on their sides and drift like dead leaves. Another blenny mimics a wrasse for both food and protection.

percussion, medical diagnostic procedure that entails striking the body directly or indirectly with short, sharp taps of a finger, or, rarely, a hammer. The procedure was first described in 1761 by the Austrian physician Leopold Auenbrugger von Auenbrugg. Although generally ignored by his contemporaries, it is now routinely employed. The sounds produced by the procedure are helpful in determining the size and position of various internal organs, in revealing the presence of fluid or air in the chest, and in aiding in the diagnosis of pneumonia or pulmonary tuberculosis.

percussion instrument, any musical instrument, among the oldest known, from which sound is produced mainly by striking. There are two main classes of percussion instruments: idiophones, which emit sound when their own substance vibrates (such as bells, cymbals, and castanets), and membranophones, which emit sound when an attached, stretched membrane vibrates (such as drums). Each group contains instruments of both definite and indefinite pitch; timpani, bells, and xylophones are tuned to definite pitches, while snare drums, triangles, clappers, rattles, and cymbals are of indefinite pitch. Both types serve chiefly to delineate rhythm, though the tunable instruments may also be used for melody. Percussion instruments form the third section of the Western orchestra.

A brief treatment of percussion instruments follows. For full treatment, *see* MACROPAEDIA: Musical Instruments.

Idiophones. In the early Stone Age man began to use noisemakers. Notched bones or gourds, which emitted a rasping sound when scraped with a stick, and rattles, which were either gourds filled with pebbles or cords strung with shells, seeds, or teeth, were the first idiophones. Another primitive instrument was the slit-drum, a tree trunk hollowed out in a narrow lengthwise slit, laid over a pit in the ground, and either stamped on or beaten with sticks.

The earliest Greek idiophones were the *krotala* (clappers resembling castanets, made of wood or cane) and the *kymbala*, early cymbals (metal plates made slightly concave, so that only the edges strike each other). The ancient Greek and Roman chorus leaders used a foot-clapper as a timebeating instrument, known in Rome as the *scabellum*, and in Greece as the *kroupalon*. These instruments served a primarily ritual function and from the Stone Age to Greek and Roman times retained a magical significance. Bells were believed capable of warding off evil spirits. Clappers and cymbals were used by women who followed the cult of Dionysus and had a religious as well as a secular function. These ideas carried over into medieval times, when clappers and bells were used in Christian religious ceremonies. *Cymbala*, or bell chimes, may have been taken to Europe from Byzantium. They consisted of a stand with metal cups (hemispherical or tulip-shaped) tuned to the diatonic scale (as represented by the white notes of a modern keyboard) and were quite popular in the Middle Ages. As the bells used became larger these chimes developed into the carillon. This was activated mechanically by a rotating cylinder set with nails (not unlike the modern music box), which caused hammers to strike the bells, playing a tune. In northern Europe they were set in church towers and activated by the tower clock.

Other idiophones that served extra-musical purposes in medieval times were clappers ("bones" or tabulae), carried by lepers as a warning, and jingles (small bells), worn for their magical powers in tournaments and battles. The triangle (a small steel triangle with an open corner, struck with an iron rod) first appeared in the 15th century. It is of indefinite pitch, and has the property of picking up the harmonics (acoustical vibrations) of other instruments.

The rise in importance of instrumental music during the Renaissance had profound influence and effects on the uses of idiophones. Rather than merely being used as an accompaniment to songs or dances, or for their ritual or magical effects, their capacity for melody was gradually exploited. By the 16th century the carillon could be played by a keyboard, increasing its melodic function. The xylophone, an import from Indonesia, consisted of tuned wooden bars struck with hammers. The first xylophones were known as "straw fiddles" as the wooden bars rested on straw rolls.

Cymbals, castanets (small wooden clappers played in pairs), and triangles fell out of favour in the Renaissance, but with the rise in popularity of "Turkish music" (an imitation of Turkish Janissary bands) in the late 18th century, they came back into use, providing "local colour," particularly in opera and military music.

In the early 18th century the Glockenspiel, a development of the carillon, came into favour. In this instrument the bells were replaced by bronze bars. The bell lyre, a portable version, was used in military bands. The celesta, a modern form of Glockenspiel with a keyboard, makes use of metal bars under which hang tuned wooden resonators.

More recently developed, and in common use in today's orchestras, are tubular bells. These are graduated steel tubes suspended from a frame, struck with rawhide hammers. Modern instruments consist of two rows of bells, forming a chromatic scale (all 12 notes of the octave), whereas earlier examples had one row, encompassing a diatonic scale.

A less common idiophone is the Chinese gong (tam-tam), a hammered bronze disk of indeterminate pitch, struck by a hammer. This was imported to Europe about the time of the French Revolution (late 18th century) and is often used in theatrical music. More obscure is the glass harmonica, developed from musical glasses of different sizes that contained water and emitted a pitch when the rims were rubbed by the players' fingers. These attracted the attention of Benjamin Franklin, who in 1763 invented the glass harmonica, enabling the performer to play chords on what had previously been a monophonic (single-voiced) instrument. Both Ludwig van Beethoven and Wolfgang Amadeus Mozart wrote pieces for this instrument, but it was abandoned when it was found that continuous friction of the sensitive fingertips on the glass caused severe nervous disorders.

With the exception of the glass harmonica, most of the instruments mentioned are still used in modern orchestras. The xylophone and its relatives the marimba and vibraphone are popular with jazz musicians. The marimba, a South American adaptation, is a larger version of the xylophone, with tuned metal resonators beneath its bars. The vibraphone uses graduated metal bars, under which are metal resonators that open and close using an electric motor, giving it a unique vibrato effect.

Membranophones. The history and development of membranophones naturally runs parallel to that of idiophones. The earliest drums were struck by hand and later by sticks, the change coming roughly with the change from snake or lizard skin to the use of large animal skins for the membrane. Tubular drums were originally sections of tree trunks, with a skin stretched over the top. Smaller portable drums were developed, made from gourds, clay vessels, or wood. Another type of early drum was the frame drum, a hoop over which was stretched a single skin or two parallel skins. The tympanon, an ancient Greek drum, was of this type.

In the early Middle Ages drums were not in common use in western Europe. In the 12th century the tabor, a small two-headed drum that was fastened to the left arm and played in conjunction with a small pipe, appeared. The tabor often has a snare, consisting of gut strings that create a rasping sound when the drum is beaten. Other instruments of the time were the naker or nacaire (small kettledrums, always in pairs), and the tambourine, a small one-sided frame drum with jingles set into the frame. These were generally used for beating time, an accompaniment to singing and dancing.

By the mid-15th century the kettledrum had grown, now consisting of a large copper caldron with a calf-skin head, and was used in military and ceremonial music (usually with trumpets). The tabor developed into the snare, or side, drum, so-called because it hung at the drummer's side, and was also used by the military. The tenor drum is a large, deeper, unsnared side drum. In the early 17th century kettledrums began to be used in the orchestra in pairs, tuned to the keynote of the piece and a fourth below. Modern kettledrums, or timpani, have a range of approximately five notes and can be tuned according to the tension of the head, either by T-shaped screws or pedals. The bass drum, usually about 34 inches across, was first used in "Turkish music," and is still a member of the modern orchestra.

The most striking development in 20th century Western music has been the expanded use of all types of percussion instruments. As they were previously used for rhythmic impetus, or for melody, they are now exploited for their extreme variety of tone colour, or timbre (the distinctive sound unique to each instrument). Western composers' fascination with Eastern music has led to the use of Asian and African instruments (such as wood blocks, temple blocks, wood and glass chimes, and the slit-drum). The Latin American influence is felt largely in jazz with the use of marimbas and bongo drums. Many avant-garde composers experiment with creating different timbres within an existing framework, such as stroking the edge of a cymbal with a bow or a saw.

Percy FAMILY, English family renowned in history and ballad for its role in medieval, Tudor, and Stuart times.

The family was founded by William de Percy (*c.* 1030–96), a follower of William I the Conqueror, who bestowed on him a great fief in Yorkshire and Lincolnshire. His grandson William (d. 1175) was the last of the house in the direct line, leaving two daughters and coheiresses, Maud, who died childless, and Agnes. Agnes de Percy married Josceline de Louvain, and from this marriage descended the second house of Percy (which name it assumed), until its own extinction in the male line five centuries later (1670).

A descendant of the union of Agnes and Josceline, Henry de Percy (1273–1314) was one of Edward I's most active agents in the subjugation of Scotland until the success of Robert de Bruce made him withdraw into England. Summoned to Parliament as a baron in the time of Edward I, he later, as one of the lords ordainer, supported the baronial opposition to the personal rule of Edward II. Hitherto the family had been mainly connected with Yorkshire, but Henry gave its fortunes a new direction by his purchase of lands in Northumberland. Henceforth the Percys, now the greatest landowners in Northumberland, became the principal guardians of the northeastern border against the Scots, and successive members of the family served regularly as wardens of the Scottish Marches.

Henry de Percy (1341–1408), marshal of England, was created Earl of Northumberland at Richard II's coronation in 1377. He served Richard in numerous capacities but after 1398 supported the Duke of Hereford (afterward Henry IV) and took a prominent part in Richard's abdication. His son, Sir Henry Percy, known as Hotspur, figures prominently in William Shakespeare's history play *1 Henry IV.* Hotspur was killed at the Battle of Shrewsbury (1403) fighting Henry IV; and his father, Northumberland, after being attainted in 1406 for plotting against Henry IV, was slain at Bramham Moore (Feb. 19, 1408). The Percys were Lancastrians and Henry (1393–1455), 2nd Earl of Northumberland and Hotspur's son, was slain at the first battle of St. Albans fighting for Henry VI; while Henry (1421–61), the 3rd earl, fell at the Battle of Towton (1461). The earldom was then briefly given to John Neville but returned to the Percys in 1470 when Henry (*c.* 1449–89), son of the 3rd earl, was restored as the 4th earl by Edward IV. The 4th earl acquiesced in the accession of Richard III and submitted to Henry VII, with whom he found favour. Henry (1478–1527), the 5th earl, known as the Magnificent, was prominent in the early years of Henry VIII. The earldom lapsed in 1537 on the death of Henry (*c.* 1502–37), the 6th earl, whose brother was attainted for his role in the revolt known as the Pilgrimage of Grace (1536).

The earldom of Northumberland was restored to the Percy family in 1557 and continued in the male line until 1670. Thomas (1528–72), the 7th earl, was beheaded for his part in the northern rebellion (1569) which aimed to release Mary Stuart and give toleration to Roman Catholics. Henry (*c.* 1532–85), the 8th earl, also suspected of pro-Catholic plotting, was imprisoned in the Tower of London, where he was found shot in 1585. Henry (1564–1632), the 9th earl, was imprisoned in the Tower from 1605 to 1621 on suspicion of complicity in the Gunpowder Plot, because his cousin, Thomas Percy, was one of the chief conspirators. Algernon (1602–68), the 10th earl, was opposed to the trial of Charles I and took no part in affairs under the Commonwealth and urged moderation after the Restoration. On the death of his son, Joceline (1644–70), the 11th earl, the male line of the Percys of Northumberland became extinct.

Percy, Algernon: *see* Northumberland, Algernon Percy, 10th Earl of.

Percy, Henry: *see* Northumberland, Henry Percy, 1st Earl of; Northumberland, Henry Percy, 8th Earl of; Northumberland, Henry Percy, 9th Earl of.

Percy, Sir Henry, byname HOTSPUR (b. May 20, 1364—d. July 21, 1403, near Shrewsbury, Shropshire, Eng.), English rebel who led the most serious of the uprisings against King Henry IV (reigned 1399–1413). His fame rests to a large extent on his inclusion as a major character in William Shakespeare's *Henry IV.*

The eldest son of Henry Percy, 1st Earl of Northumberland, he was nicknamed Hotspur by his Scottish enemies in recognition of the diligence with which he patrolled the border between England and Scotland. He was captured and held for ransom by Scottish invaders in 1388–89, and in 1399 he and his father played a crucial part in helping Henry Bolingbroke (afterward King Henry IV) overthrow King Richard II. Henry IV rewarded Hotspur with lands and offices in northern England and Wales, but the Percys would not be content until they dominated the king. Their stunning victory over the Scots at Homildon (Humbledon) Hill in Durham, in September 1402, contrasted with Henry's fruitless attempts to suppress the Welsh rebel Owen Glendower. Nevertheless, Henry refused to allow Hotspur to ransom the Scottish captives, and he delayed in paying the expenses of Hotspur's border warfare. Hence in 1403 Hotspur and Northumberland decided to depose the king. Hotspur raised a rebellion in Cheshire in July, but Henry intercepted him near Shrewsbury before he could join forces with his father. In the ensuing battle Hotspur was killed.

Percy, Lucy: *see* Carlisle, Lucy Hay, Countess of.

Percy, Thomas: *see* Northumberland, Thomas Percy, 7th Earl of; Worcester, Thomas Percy, Earl of.

Percy, Thomas (b. April 13, 1729, Bridgnorth, Shropshire, Eng.—d. Sept. 30, 1811, Dromore, County Down, Ire.), English antiquarian and bishop whose collection of ballads, *Reliques of Ancient English Poetry* (1765), awakened widespread interest in English and Scottish traditional songs.

The basis of Percy's collection was a tattered 15th-century manuscript of ballads (known as the Percy folio) found in the house of a friend when it was about to be used to light a fire. To this nucleus Percy added many other ballads, songs, and romances, supplied by his friends who, at his request, rummaged in libraries, attics, and warehouses for old manuscripts. Publication of the *Reliques* inaugurated the "ballad revival," a flood of collections of ancient songs, that proved a source of inspiration to the Romantic poets.

Percy was educated at Christ Church, Oxford, and held livings in Northamptonshire, at Easton Maudit (1753) and Wilby (1756). The *Reliques,* dedicated to the Countess of Northumberland, gained him her patronage, and after editing *The Household Book of the Earl of Northumberland in 1512* (1768), a pioneer work of its kind, he became the earl's chaplain and secretary. In 1778 he acquired the deanery of Carlisle and in 1782 the Irish bishopric of Dromore. Percy's geniality and scholarly interests made him many friends, including Samuel Johnson, who encouraged him to edit the *Reliques* and praised his "minute accuracy of enquiry." Percy's translations from Chinese, Hebrew, Spanish, and Icelandic and his first English version of the

Thomas Percy, detail of an engraving by J. Hawksworth after a painting by Lemuel Abbott

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

Icelandic *Edda* (from Latin, in *Northern Antiquities,* 1770) show his linguistic ability. Above all, his voluminous correspondence confirms his determined pursuit of factual accuracy and places in context the work for which he is principally remembered. His correspondence, edited by Cleanth Brooks in seven volumes, was published 1946–77.

Percy, Walker (b. May 28, 1916, Birmingham, Ala., U.S.—d. May 10, 1990, Covington, La.), American novelist who wrote of the New South transformed by industry and technology.

Orphaned in late childhood, Percy and his brothers went to live with his father's cousin, a bachelor and lawyer, in Greenville, Miss. Percy studied at the University of North Carolina (B.A., 1937) and Columbia University (M.D., 1941) and, while working as a pathologist at Bellevue Hospital, New York City, contracted tuberculosis, compelling him to rest at an upstate New York sanatorium. While recovering, he read widely, was attracted to the works of European existentialists, and decided on a career in writing. He also converted to Roman Catholicism.

During the 1950s, Percy wrote articles for philosophical, literary, and psychiatric journals, and not until 1961 was his first novel published, *The Moviegoer,* which won a National Book Award and which introduced Percy's concept of "Malaise," a disease of despair born of the rootless modern world. Other fiction included *The Last Gentleman* (1966), *Love in the Ruins: The Adventures of a Bad Catholic at a Time near the End of the World* (1971), *Lancelot* (1977), *The Second Coming* (1980), and *The Thanatos Syndrome* (1987). He also wrote such nonfiction as *The Message in the Bottle* (1975), a sophisticated philosophical treatment of semantics.

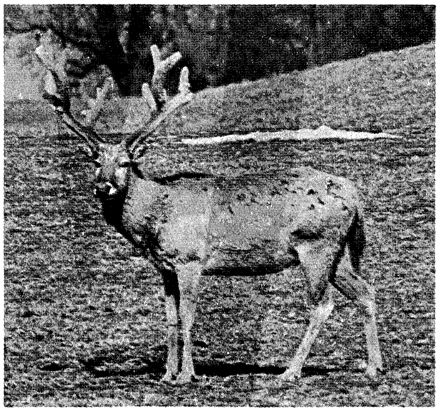
perdesiekte: *see* African horse sickness.

Perdiccas (b. *c.* 365 BC—d. 321), general under Alexander the Great who became regent of the Macedonian empire after Alexander's death (323).

Perdiccas served with distinction in Alexander's campaigns and, upon Alexander's death, led the aristocratic party that supported the claim of the unborn child of Roxana, Alexander's widow, to the succession. After a compromise under which a division of the powers of regency was arranged, Perdiccas exercised a wide authority in Asia as "supreme general" and soon began to act as if he meant to make himself king. This move was resisted by the regional governors, Ptolemy in Egypt, Antigonus in Phrygia, and by Perdiccas' colleagues in the regency, Craterus and Antipater.

In 322 Perdiccas conquered Cappadocia and installed as satrap (provincial governor) his most reliable and efficient subordinate, Eumenes of Cardia. Antigonus fled to Europe, where he persuaded Antipater and Craterus that Perdiccas must be destroyed. Leaving Eumenes to hold Asia Minor against Craterus and Antigonus, Perdiccas marched against Ptolemy, but when he failed to cross the Nile he was murdered by mutinous officers.

Père David's deer (*Elaphurus davidianus*), large, rare Asian deer, family Cervidae (order



Père David's deer (*Elaphurus davidianus*)
P. Morris—W.C.I.

Artiodactyla). The only member of its genus, it is unknown in nature within historic times. Presumably native to northern China, it is now found only in zoos, private animal collections, and game reserves.

The deer is about 1.1 metres (43 inches) tall at the shoulder and is characterized by heavy legs, broad hooves, relatively small ears, and a long, bushy tail. The coat is reddish brown in summer and uniformly grayish brown in winter. The male has long antlers that fork shortly above the base, the front prong branching once and the rear prong extending backward, unbranched.

The only known population of this deer in the 19th century was the herd kept for the emperor of China in a game park near Peking. Observations of the deer were made in 1865 by a French missionary, Armand David, and specimens were classified the following year by the French naturalist Henri Milne-Edwards. From 1869 to 1890, several Père David's deer were brought to European zoos. Most of the Chinese herd died in a flood in 1895, and the remaining deer were killed during the Boxer Rebellion (1900). A breeding population was then established at Woburn Abbey, in England, under the care of the duke of Bedford. The deer bred well in captivity and now survive in zoos and game parks around the world.

Peréal, Jean: *see* Perréal, Jean.

Pereda, José María de (b. Feb. 6, 1833, near Santander, Spain—d. March 1, 1906, Santander), Spanish writer, the acknowledged leader of the modern Spanish regional novelists. Born of a family noted for its fervent Catholicism and its traditionalism, Pereda looked an authentic hidalgo. An older brother provided him with an income that allowed him to become a writer. His first literary effort was the *Escenas montañesas* (1864), starkly realistic sketches of the fisherfolk of Santander and the peasants of the Montaña. There followed other sketches and early novels of pronounced controversial spirit, such as *El buey suelto* (1878; "The Unfettered Ox"); *Don Gonzalo González de la Gonzalera* (1879), a satire on the revolution of 1868 and a eulogy of the old patriarchal system of government; and *De tal palo tal astilla* (1880; "As the Wood, So the Chips"), a protest by a rigid Catholic against the liberal religious tendencies advocated by his friend Benito Pérez Galdós. With the exception of *Pedro Sánchez* (1883) and *La Montálvez* (1888), all his novels have a Montaña background.

Pereda's best work, one of the finest Spanish novels of the 19th century, was *Sotileza* (1884), an epic of the Santander fisherfolk, exemplified by the portrait of the haughty, enigmatic female fisher Sotileza, and a genuine novel of customs.

In his virile realism, tinged with human sympathy, Pereda is thoroughly Castilian. He had the gift of creating human characters, particularly of the humbler variety, and, with his mastery of rich and flexible language, he excels, above all, as a painter of nature, in all its aspects.

Peredvizhniki (Russian: The Wanderers), group of Russian painters who in the second half of the 19th century rejected the restrictive and foreign-inspired classicism of the Russian Academy to form a new realist and nationalist art that would serve the common man. Believing that art should be useful, a vehicle for expressing humanitarian and social ideals, they produced realistic portrayals of inspiring or pathetic subjects from Russian middle-class and peasant life in a literal, easily understood style. Forming a Society of Wandering Exhibitions in 1870, they organized mobile exhibitions of their works in an effort to bring serious art to the people.

The most prominent Russian artists of the 1870s and 1880s, including Ivan Kramskoy,

"The Boyarin Morozova," oil painting by Vasily Surikov, one of the Peredvizhniki, 1887; in the State Tretyakov Gallery, Moscow
Novosti Press Agency

Ilya Repin, Vasily Surikov, Vasily Perov, and Vasily Vereshchagin, belonged to this group. The movement dominated Russian art for nearly 30 years and was the model for the Socialist Realism of the Soviet Union.

Peregrinatio Etheriae, English PILGRIMAGE OF ETHERIA, an anonymous and incomplete account of a western European nun's travels in the Middle East, written for her colleagues at home, near the end of the 4th century. It gives important information about religious life and the observances of the church year in the localities visited, which included the chief holy places of the Old and New Testaments in Egypt, Palestine, and Syria. There is a detailed description of the daily and annual liturgical activities in Jerusalem.

Discovered in 1884 in an 11th-century Latin manuscript at Arezzo, Italy, the account was published in 1887. It was at first attributed to Silvia, a sister of Rufinus (died *c.* 410), a Christian priest, writer, and translator from northern Italy. Later it was determined that the author was probably a Spanish nun called Etheria (Aetheria, Egeria, Eucheria). According to internal evidence, the account was written between 363 and 540, but most scholars agree that the most likely date was the last years of the 4th century.

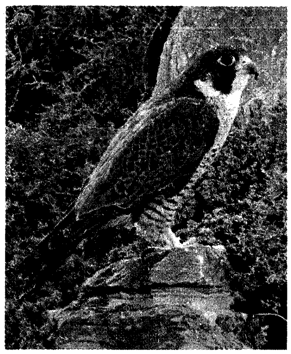
peregrine falcon, also called DUCK HAWK (*Falco peregrinus*), bird of prey of the family Falconidae, which occurs worldwide but has become rare throughout almost all of its range.

Bluish gray above with underparts white to yellowish with black barring, peregrines range from about 33 to 48 centimetres (13 to 19 inches) long. They are strong and fast. They fly high and dive at tremendous speeds, striking with clenched talons and killing by impact. The prey includes ducks and shorebirds. Peregrines inhabit rocky open country near water where birds are plentiful. The usual nest is a mere scrape on a ledge, high on a cliff. The clutch is two to four reddish brown eggs. The young fledge in five or six weeks.

The chief cause of the peregrine falcon's decline has been the buildup of chlorinated hydrocarbons (which are used in such pesticides as DDT) in the bird's food sources. The chemicals become concentrated in the peregrine's tissues and interfere with reproduction, particularly by causing the thinning of eggshells and the resultant loss of eggs. Habitat destruction has also played a role in the falcon's population decline.

The American peregrine falcon (*F. p. anatum*), which once bred from Hudson Bay to the southern United States, is listed as endangered in the *Red Data Book.* It is extinct in the eastern United States and eastern boreal Canada. The Alaskan peregrine is also classified as endangered, and several other subspecies worldwide are listed as threatened or vulnerable.

Peregrine falcons can be bred in captivity, and programs have been instituted to release captive-bred peregrines into areas where the bird has become extinct. The ultimate success of such programs, however, may depend on



Peregrine falcon (*Falco peregrinus*)
Kenneth W. Fink—Root Resources

the elimination of chlorinated hydrocarbons from the peregrine falcon's food chain.

Peregrinus: *see* Vincent of Lérins, Saint.

Peregrinus PROTEUS (b. AD 100, Parium, Mysia, Anatolia—d. 165), Greek Cynic philosopher remembered for his spectacular suicide—he cremated himself on the flames of the Olympic Games in 165.

Suspected of murdering his father, Peregrinus was forced to flee to Palestine, but his influence in the Christian community there led to his arrest. On his release he left Palestine and became estranged from the Christians. He then went to Egypt, where he became a pupil of the Cynic philosopher Agathobulus. Peregrinus next went to Rome but was expelled by the prefect for insulting the emperor Antoninus Pius. After leaving Rome he went to Greece, where he was at first well received, but he compromised his popularity by disparaging the public benefactor Herodes Atticus. He then announced his intention of cremating himself and finally did so on a funeral pyre during the Olympic Games in the presence of many spectators, among whom was Lucian.

Lucian's account of Peregrinus in the letter "On the Death of Peregrinus" depicts him as an opportunist and exhibitionist, but not all ancient authors agreed. Modern scholars tend to think of Peregrinus as sincere, however abnormal, in his enthusiasms.

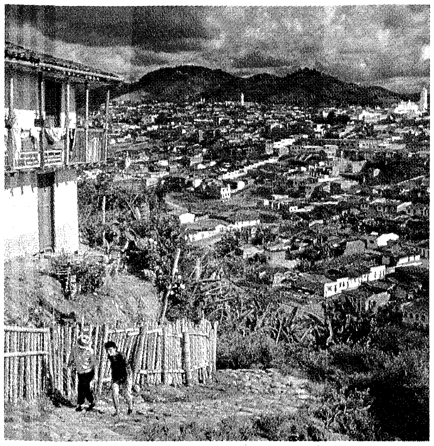
Peregrinus of Maricourt, Peter, French PIERRE PÈLERIN DE MARICOURT, Latin PETRUS PEREGRINUS DE MAHARNCURIA ("Peter the Pilgrim from Maricourt") (fl. 13th century), French crusader and scholar who wrote the first extant treatise describing the properties of magnets.

Almost nothing is known about Peregrinus' life, except that he wrote his famous treatise while serving as an engineer in the army of Charles of Anjou that was besieging Lucera (in Italy) in August 1269 in a "crusade" sanctioned by the pope. Peregrinus's abilities as an experimenter and technician were highly praised by his contemporary Roger Bacon.

Peregrinus' letter on the magnet, *Epistola Petri Peregrini de Maricourt ad Sygerum de Foucaucourt, Militem, De Magnete* ("Letter on the Magnet of Peter Peregrinus of Maricourt to Sygerus of Foucaucourt, Soldier"), commonly known by its short title, *Epistola de magnete,* consists of two parts: the first treats the properties of the lodestone (magnetite, a magnetic iron oxide mineral), and the second describes several instruments that utilize the properties of magnets. In the first part, Peregrinus provides the first extant written account of the polarity of magnets (he was the first to use the word "pole" in this regard), and he provides methods for determining the north and south poles of a magnet. He describes the effects magnets have upon one another, showing that like poles repel each other and unlike poles attract each other. In the second part of his treatise he treats the practical applications of magnets, describing the floating compass as an instrument in common use and proposing a new pivoted compass in some detail.

In his treatise Peregrinus brought together all existing contemporary knowledge of magnets, added his own fundamental observations, and organized the whole into a body of knowledge that formed the basis of the science of magnetism. The *Epistola* is widely regarded as one of the great works of medieval experimental research and a precursor of modern scientific methodology.

Pereira, city, capital of Risaralda *departamento,* west-central Colombia. It lies in the western foothills of the Cordillera Central above the Cauca Valley. It was founded in 1863 on the former site of Cartago by Remigio Antonio Cañarte and named after Francisco Pereira Gamba, who donated lands for the enterprise. Pereira is a centre for coffee and cattle and has some light manufacturing, mainly textiles. A fishing and hunting preserve and a ski resort are nearby. The controversial bronze statue "The Naked Bolivar" (1963), by Rodrigo Arenas Betancourt, stands in its own plaza. The Cathedral of Our Lady of the Poor (1890) and the Technical University of Pereira



Pereira, Colom.
Carl Frank—Photo Researchers/EB Inc.

(1958) are architectural landmarks. Road and rail connect Pereira with Cali and Armenia, and there is an airport. Pop. (1985) 233,271.

Pereira, Nuno Álvares, Nuno Álvares also spelled NUN ÁLVAREZ, original name of BLESSED NUNO DE SANTA MARIA (b. June 24, 1360, Bonjardim, Port.—d. April 1, 1431, Lisbon), outstanding Portuguese military leader, known also as the Holy Constable, whose victory over Castilian forces in the historic Battle of Aljubarrota (Aug. 14, 1385) assured his nation's independence.

Pereira distinguished himself in battle at the age of 13, fighting against the Castilians in their invasion of 1373. On the death of Ferdinand I of Portugal (October 1383), Pereira came forward as a supporter of John of Aviz, the illegitimate son of Ferdinand's father Peter I, against the claims of Ferdinand's daughter Beatriz, whose marriage to John I of Castile posed a threat to Portugal's independence. In January 1384 John I invaded Portugal. Despite the fact that most of his family favoured Castile, Pereira continued to support John of Aviz (later John I, king of Portugal) and defeated the Castilians in the Battle of Atoleiros (April 6, 1384). Further brilliant and heroic actions as a field commander won him appointment to the office of constable of the kingdom in 1385.

Although the Castilians had withdrawn in 1384, they invaded again the following year and moved on Lisbon. To block their advance, Pereira engaged the Castilians at Aljubarrota, where he skillfully prepared the defensive position and displayed courageous and resolute leadership of his greatly outnumbered army in winning a decisive victory. He continued to fight against the Castilians until the final peace of Oct. 30, 1411. He gave all his support to the expedition that captured Portugal's first African possession, Ceuta in northern Morocco, from the Moors in 1415.

John I of Portugal heaped honours on Pereira, giving him titles and extensive lands and properties. Pereira's daughter Beatriz married John I's legitimated son Afonso and thus became ancestor of the house of Bragança, which in 1640 became the ruling house of Portugal. Pereira, who had had a Carmelite house built in Lisbon in fulfillment of a vow, entered it himself as Friar Nuno de Santa Maria in 1423. He was beatified by Pope Benedict XV on Jan. 23, 1918.

Perejasław Agreement: *see* Pereyaslav Agreement.

Perelman, S(idney) J(oseph) (b. Feb. 1, 1904, Brooklyn, N.Y., U.S.—d. Oct. 17, 1979, New York, N.Y.), American humorist who was a master of wordplay in books, movies, plays, and essays.

In 1925 Perelman graduated from Brown University, where he edited the school humour magazine. He began writing for the early, frenetic Marx Brothers films and helped turn out the screenplays for such classics as *Monkey Business* (1931) and *Horse Feathers* (1932). He also regularly contributed essays for *The New Yorker* magazine under such absurd titles as *Beat Me, Post-Impressionist Daddy; No Starch in the Dhoti;* and *Methinks He Doth Protein Too Much.* Perelman collaborated on the theatrical comedies *All Good Americans* (1934) and *One Touch of Venus* (1943), and for his collaboration on the film *Around the World in 80 Days* he shared an Academy Award for best screenwriter for 1956. His magazine pieces were collected in a long series of books, including *Strictly from Hunger* (1937), *Westward Ha!, or, Around the World in Eighty Clichés* (1948), *The Swiss Family Perelman* (1950), and *The Road to Miltown, or, Under the Spreading Atrophy* (1957).

Perelman's humour was characterized by an exquisite sense of cliché and mimicry combined with a varied vocabulary to create effects of comic nihilism and literary parody. The perennial objects of his satire were cultural affectations and what he felt to be the ridiculousness of modern life.

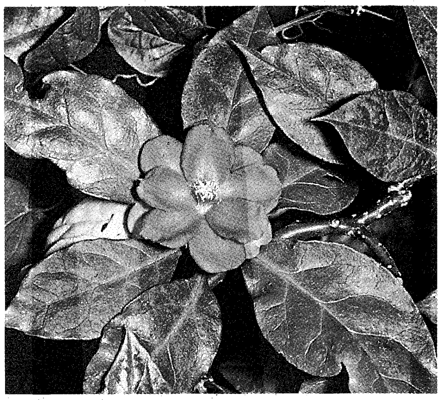
Peres, Shimon, original name SHIMON PERSKI (b. Aug. 16, 1923, Wołożyn, Pol.), Israeli statesman and member (from 1959) of the Knesset (Israeli parliament) who served as prime minister of Israel from 1984 to 1986.

Peres immigrated with his family to Palestine in 1934. While working on a kibbutz, he became involved in politics, and in 1947 he joined the Haganah movement, a Jewish defense organization, under the direction of David Ben-Gurion, who soon became his political mentor. When Israel achieved independence in May 1948, Prime Minister Ben-Gurion appointed Peres, then only 25, head of Israel's navy. In 1952 he was appointed deputy director general of the Defense Ministry, later serving as general director (1953–59) and deputy defense minister (1959–65), during which period he stepped up state weapons production, initiated a nuclear-research program, and established overseas military alliances, most notably with France. Peres resigned in 1965 in order to join Ben-Gurion in founding a new party, Rafi, in opposition to the succeeding prime minister, Levi Eshkol.

The Rafi Party was unsuccessful, however, and in 1967 Peres initiated merger negotiations between the Mapai (Ben-Gurion's former party) and the Ahdut Avodah, a more leftist workers' party, that resulted in the establishment of the Israel Labour Party, of which he became deputy secretary-general. He became defense minister in the Labour Cabinet of Yitzhak Rabin in 1974.

In 1977 Peres became head of the Labour Party and, as such, was twice defeated by Menachem Begin as a candidate for prime minister (1977, 1981) before winning access to the post after the indecisive elections of 1984. In September 1984 Peres and Yitzhak Shamir, head of the Likud party, formed a power-sharing agreement, with Peres as prime minister for the first half of a 50-month term and Shamir as deputy prime minister and foreign minister; the roles were reversed for the second 25-month period. Under Peres' moderate and conciliatory leadership, Israel withdrew its forces in 1985 from their controversial incursion into Lebanon, and the government engineered a comprehensive austerity program drastically reducing the soaring inflation rates that had bedeviled the economy. After similarly indecisive elections in 1988, the Labour and Likud parties formed another coalition government with Peres as finance minister and Shamir as prime minister; this coalition lasted only until 1990, when Likud was able to form a government without Labour support.

Pereskia, genus of about 20 species of trees, shrubs, and vines, family Cactaceae, native to the West Indies, Mexico, and Central and South America, especially coastal areas. Leafy cactus (*P. aculeata*), also known as Barbados, or West Indian, gooseberry, is cultivated extensively for hedges, lumber, and its edible fruit. It has large leaves, unique among cacti.



Pereskia
Werner W. Schulz

P. pititache, the native Mexican species, is treelike, growing to 12 m (about 40 feet) tall.

Peresvetov, Ivan Semenovich (b. Lithuania, fl. 16th century, Russia), early Russian progressive social critic.

Peresvetov was born to a family of the lower nobility in the Grand Duchy of Lithuania and served in the Polish Lithuanian army during the 1520s and 1530s. He arrived in Russia in 1538 or 1539.

In 1549 he presented his *Two Books* (*Dve Knigi*) to Tsar Ivan IV the Terrible. These works were ostensibly an account of the Ottoman conquest of Constantinople by Sultan Mehmed II but actually provided a covert, allegorical denunciation of the privileges still enjoyed by the boyars. Peresvetov's support of the demands of the military class over that of the boyars presumably found favor with Ivan IV, who had to overcome boyar direction of the government to establish himself as the first tsar. Peresvetov advocated strong, autocratic rule coupled with a well-organized army and administration. His advocacy of promotion based on merit and military service was too radical for his time, however, as was his call for the abolition of all indenture.

Peresvetov wrote in an energetic folk Russian that contrasted sharply with the Church Slavonic style of the period.

Peretz, Isaac Leib, also spelled YITSKHEK LEYB PERETS, Leib also spelled LOEB, or LÖB (b. May 18, 1852, or May 20, 1851, Zamość, Pol., Russian Empire—d. April 3, 1915, Warsaw), prolific writer of poems, short stories, drama, humorous sketches, and satire who was instrumental in raising the standard of Yiddish literature to a high level.

Peretz began writing in Hebrew but soon turned to Yiddish. For his tales of Ḥasidic lore, which he introduced into literature (*e.g.,* the *Silent Souls* series), he drew his material from the lives of impoverished Jews of eastern Europe. Critical of their humility and resignation, he urged them to consider their temporal needs while retaining the spiritual grandeur for which he esteemed them. In his drama *Die Goldene Kaite* (1909; "The Golden Chain"), Peretz stressed the timeless chain of Jewish culture. To encourage Jews toward a wider knowledge of secular subjects, Peretz for several years wrote articles on physics, chemistry, economics, and other subjects for *Yiddishe Bibliothek,* which he also edited.

The Peretz home in Warsaw was a gathering place for young Jewish writers, who called him the "father of modern Yiddish literature." During the last 10 years of his life, Peretz became the recognized leader of the Yiddishist movement, whose aim—in opposition to the Zionists—was to create a complete cultural and national life for Jewry within the Diaspora with Yiddish as its language.

Pereyaslav Agreement, Pereyaslav also spelled PEREJASŁAW (Jan. 18 [Jan. 8, Old Style], 1654), act undertaken by the *rada* (council) of the Cossack army in the Ukraine to submit the Ukraine to Russian rule, and the acceptance of this act by emissaries of the Russian tsar Alexis; the agreement precipitated a war between Poland and Russia (1654–67).

The hetman of the Zaporozhian Cossacks, Bohdan Khmelnitsky, had been leading a revolt against Polish rule in the Ukraine since 1648. In 1651, in the face of a growing threat from Poland and forsaken by his Tatar allies, Khmelnitsky asked the tsar to incorporate the Ukraine as an autonomous duchy under Russian protection. The Russians, however, were reluctant to enter into such an agreement, and it was not until October 1653 that a Russian *zemsky sobor* ("assembly of the land") approved the request and Alexis sent a delegation, headed by V.V. Buturlin, to the Cossacks.

Only after the Cossacks had suffered a disastrous military defeat (December 1653), however, did the *rada* receive the Muscovite delegation at Pereyaslav and formally submit to "the tsar's hand." Two months later (March 1654), the details of the union were negotiated in Moscow. The Cossacks were granted a large degree of autonomy, and they, as well as other social groups in the Ukraine, retained all the rights and privileges they had enjoyed under Polish rule. But the unification of the Ukraine with Russia was unacceptable to Poland; a Russo-Polish war (Thirteen Years' War) broke out and ended with the division of the Ukraine between Poland and Russia. *See also* Andrusovo, Truce of.

Pereyaslav-Khmelnitsky, also spelled PEREIASLAV-KHMELNITSKII, or PEREJASLAV-CHMEL'NICKIJ, formerly (until 1943) PEREYASLAV, or PEREIASLAV, city, Kiev *oblast* (province), Ukrainian Soviet Socialist Republic. Pereyaslav-Khmelnitsky has existed since the 10th century, when it was known as Pereyaslav-Russky. It was a border stronghold of the Kievan state but was overrun by Mongol Tatars in 1239. In the 17th century it played a part in Bohdan Khmelnitsky's uprising against Polish domination of the Ukraine. In 1654 Khmelnitsky convened a council at Pereyaslav that submitted the Ukraine to Russian rule. Modern Pereyaslav was occupied by German forces during both world wars.

Archaeological excavations in Pereyaslav-Khmelnitsky have uncovered artifacts and building foundations dating from as early as the 10th century. The modern city has food-processing and clothing industries. Pop. (1974 est.) 24,600.

Pérez, Antonio (b. 1534, Madrid—d. Nov. 3, 1611, Paris), Spanish courtier who was secretary to Philip II of Spain, and later became a fugitive from Philip's court.

Pérez was an illegitimate son of Gonzalo Pérez, secretary of Philip's predecessor, the emperor Charles V. Charming and well-connected, Pérez quickly rose in Philip's service, becoming the king's secretary (1568) and secretary of several of the royal councils.

The upstart secretary was hated by many of the grandees and by his rivals in the Spanish civil service. The king's favour was unstable, and to safeguard himself, Pérez intrigued with all parties: with Philip II's half-brother Don Juan of Austria and his secretary, Juan de Escobedo, against the king; with the king against Don Juan; perhaps even with the Netherlands rebels against both. When Don Juan, then governor-general of the Netherlands, sent Escobedo to Spain in 1577 to plead for his plan to invade England and liberate and marry Mary Stuart, queen of Scots, Pérez feared the exposure of his own intrigues. He persuaded the suspicious king that Escobedo was Don Juan's evil genius and was plotting treason. The king gave his consent to the murder of Escobedo, and Pérez organized his assassination on March 31, 1578.

Philip II never forgave Pérez for having forced his hand. On July 28, 1579, he had Pérez and the Princess of Eboli arrested. Pérez remained in prison for 11 years, but all efforts to extract a full confession and incriminating documents from him failed. In April 1590 he escaped from Madrid to Aragon and placed himself under the protection of the Aragonese courts. Now, for the first time, he accused the king of the murder of Escobedo. Philip thereupon tried to have Pérez handed over to the Inquisition, but the populace of Saragossa twice rioted (May and September 1591) and prevented this move. Philip considered it rebellion and sent a Castilian army into Aragon (October 1591).

Pérez fled to France in November. He spent the remainder of his life at the courts of France and England, carrying on his polemic against Philip II and contributing to the "black legend" about the king. After Philip II's death (1598), Pérez lost what little influence he had had. He failed to obtain a pardon from Philip III and died in exile. His *Relaciones,* of which there are many editions, was published in 1598.

Pérez (Rodríguez), Carlos Andrés (b. Oct. 27, 1922, Rubio, Venezuela), president of Venezuela from 1974 to 1979 and from 1989.

Pérez began his political life as a member of the liberal political party Democratic Action, led by Rómulo Betancourt. When Betancourt took power as president of the junta that overthrew President Isaías Medina Angarita in 1945, Pérez followed as his secretary. A right-wing coup drove Pérez and other party leaders into exile until 1958, when the dictatorship of Marcos Pérez Jiménez was overthrown. Pérez served in the Chamber of Deputies (1959–64 and 1969–72), was minister of the interior (1962–63), and occupied important party posts. Betancourt supported his candidacy in the presidential elections in 1973, which Pérez won by a wide margin. The most important issues facing his administration concerned Venezuela's petroleum production, in particular the question of foreign ownership and how to invest the enormous proceeds received by the government. In 1976 Venezuela nationalized the entire oil industry, while maintaining foreign technical and managerial personnel to ensure efficient operation. Pérez also ordered a production slowdown to conserve resources, passed measures designed to stimulate small business and agriculture, and channeled petroleum income into hydroelectric projects, education programs, and steel mills. While preserving friendly relations with the United States, he underscored his policy of autonomy from it by supporting Panama's demand for control of the Panama Canal and reestablishing diplomatic relations with Cuba (broken in 1961).

As a former president, Pérez was barred by law from seeking reelection for 10 years. Upon that period's termination in 1988, Pérez was again elected to the presidency as the Democratic Action Party's candidate.

Pérez, Manuel Benítez: *see* Cordobés, El.

Pérez de Ayala, Ramón (b. Aug. 9, 1880, Oviedo, Spain—d. Aug. 5, 1962, Madrid), Spanish novelist, poet, and critic who excelled in philosophical satire and the novel of ideas.

Pérez de Ayala studied law at Oviedo University and philosophy and literature at the

University of Madrid. During World War I he covered France, Italy, England, South America, and the United States as a correspondent for the Buenos Aires periodical *La prensa.* He was Spanish ambassador to England (1931–36) and voluntarily exiled himself to South America because of the Spanish Civil War (1936–39). He was elected to the Spanish Academy in 1928.

After writing a volume of poetry, *La paz del sendero* (1903; "The Peace of the Path"), he produced a series of four largely autobiographical novels: *Tinieblas en las cumbres* (1907; "Darkness at the Top"), describing an adolescent's erotic awakening; *AMDG* (1910; *i.e.,* the Jesuit motto "Ad Majorem Dei Gloriam," or "To the Greater Glory of God"), a bitter satire about the author's unhappy education at a Jesuit school; *La pata de la raposa* (1912; *The Fox's Paw*); and *Troteras y danzaderas* (1913; "Trotters and Dancers"), a novel about literary and Bohemian life in Madrid.

Pérez de Ayala's later novels, which are considereed to be his finest works, show a greater mastery of characterization and novelistic technique. *Belarmino y Apolonio* (1921; *Belarmino and Apolonio*) is a symbolic portrayal of the conflict between faith and doubt. *Luna de miel, luna de hiel* (1923; *Moons of Honey and Gall*) and its sequel, *Los trabajos de Urbano y Simona* (1923; "The Labours of Urbano and Simona"), treat the contrast between idealistic innocence and the realities of mature romantic love. In *Tigre Juan* (1926; *Tiger Juan*) and its sequel, *El curandero de su honra* (1926; "The [Quack] Healer of His Honour"), Pérez de Ayala continued to create characters of a universal nature and gave free expression to his delightful and wry humour. Pérez de Ayala also wrote poetry, short stories, and essays.

Pérez de Cuellar, Javier (b. Jan. 19, 1920, Lima, Peru), Peruvian diplomat and fifth secretary-general of the United Nations (UN), from 1982.

After attending the Catholic University in Lima, Pérez de Cuellar joined the foreign ministry in 1940 and the diplomatic service in 1944. After serving in embassies in France, the United Kingdom, Bolivia, and Brazil, he returned in 1961 to the Ministry of Foreign Affairs, where he remained until 1969 (except for a two-year term, 1964–66, as ambassador to Switzerland). After serving as Peru's first ambassador to the Soviet Union (1969–71), he was made Peru's permanent representative to the UN, a post that he held until becoming secretary-general on Jan. 1, 1982, succeeding Kurt Waldheim in that post.

Pérez de Cuellar repeatedly advocated the use of the UN Security Council for keeping the peace and serving as a forum for negotiations. He was reelected to another five-year term as secretary-general in 1986. In August 1988 Pérez de Cuellar personally negotiated the cease-fire that ended active hostilities in the Iran–Iraq War.

Pérez de Cuellar was a skilled, careful diplomat. He was the author of *Manual de Derecho Diplomático* (1964; "Manual of Diplomatic Law").

Pérez de Guzmán, Alonso: *see* Medina-Sidonia, Alonso Pérez de Guzmán, duque de.

Pérez de Guzmán, Fernán (b. *c.* 1378—d. *c.* 1460), Spanish poet, moralist, and historian, author of the first important work of history and historiography in Spanish. His historical portraits of his contemporaries earned him the title of the "Spanish Plutarch."

A member of a distinguished family, Pérez de Guzmán devoted himself to letters after being imprisoned by Alvaro de Luna, a counselor to King John II of Castile. Although his poetry went through many editions, it is not as a poet that he is chiefly remembered. His fame rests on his *Mar de historias* (1512; "Sea of Histories"), a collection of biographies of emperors, philosophers, and saints, and primarily on the third part of this collection, which contains historical portraits of 33 prominent men and one woman from the reigns of Henry III to John II (the period 1390 to 1454). He knew many of the people he described, and, although the portraits are based on rhetorical models, the prose is clear and economical, capturing each personality in a few pages.

Equally important is the preface to the third part of the *Mar,* in which Pérez de Guzmán provided the first examination in Spanish of the theory of history and the responsibility of the historian, concerning himself with the problems of historical accuracy, the proper prose for a historian, and the problem of fame as a moral force in history.

Pérez de Hita, Ginés (b. 1544, Mula, Murcia, Spain—d. 1619), Spanish writer, author of *Historia de los bandos de los Zegríes y Abencerraves . . .* (1595–1619), usually referred to as *Guerras civiles de Granada* ("The Civil Wars of Granada"). The book is considered the first Spanish historical novel and the last important collection of Moorish border ballads, the latter punctuating the book's narrative.

Pérez de Hita fought in the suppression of the revolt of the Moors in the Alpajurras mountains (1568–71), an event that is reflected in the second part of his *Guerras.* The first part deals with Moorish life in Granada before the Christian conquest of that city in 1492. The first part's portrait of the chivalrous Moorish family of the Abencerrages established the stereotype of the romantic Moor in European literature, a type imitated in Madeleine de Scudéry's *Almahide* (1660), Marie-Madeleine de La Fayette's *Zaÿde* (1670), François Chateaubriand's *Aventures du dernier Abencérage* (1826), and Washington Irving's *Chronicle of the Conquest of Granada* (1829).

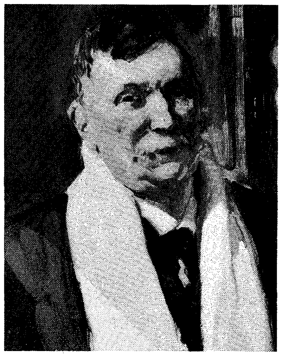
Pérez Esquivel, Adolfo (b. Nov. 26, 1931, Buenos Aires, Arg.), Argentine sculptor and architect who became a champion of human rights and nonviolent reform in Latin America. His work as secretary-general of Peace and Justice (Paz y Justicia), an ecumenical organization established in 1974 to coordinate human-rights activities throughout Latin America, brought him the Nobel Prize for Peace in 1980.

Pérez Esquivel, son of a fisherman, was already well known as a sculptor when he was appointed to a professorship at the Argentine National School of Fine Arts in 1968. He resigned his chair upon being chosen to lead Peace and Justice in 1974. His outspoken advocacy placed him in a precarious situation, for in denouncing the terrorism of both the left and the right that had brought Argentina to the brink of civil war, he brought upon himself the enmity of both sides. He spoke on behalf of the *desaparecidos,* the thousands of people who had simply disappeared during the Argentine military junta's campaign against extremists. He was himself arrested in 1977 and held without charge for 14 months, during which time he was tortured.

Pérez Galdós, Benito (b. May 10, 1843, Las Palmas, Canary Islands, Spain—d. Jan. 4, 1920, Madrid), writer who is regarded as the greatest Spanish novelist since Miguel de Cervantes. His enormous output of short novels chronicling the history and society of 19th-century Spain earned him comparison with such realist writers as Honoré de Balzac and Charles Dickens.

Born into a middle-class family, Pérez Galdós went to Madrid in 1862 to study law but soon abandoned his studies and took up journalism. After the success of his first novel, *La fontana de oro* (1870; "The Fountain of Gold"), he began a series of novels retelling Spain's history from the Battle of Trafalgar (1805) to the restoration of the Bourbons in Spain (1874). The entire cycle of 46 novels would come to be known as the *Episodios nacionales* (1873–1912). In these works Galdós perfected a unique type of historical fiction that was based on meticulous research using memoirs, old newspaper articles, and eyewitness accounts. The resulting novels are vivid, realistic, and accurate accounts of historical events as they must have appeared to those participating in them. The Napoleonic occupation of Spain and the struggles between liberals and absolutists preceding the death of Ferdinand VII 1833 are respectively treated in the first two series of 10 novels each, all of them composed in the 1870s.

In the 1880s and '90s Pérez Galdós wrote a long series of novels dealing with contemporary Spain, beginning with *Doña Perfecta* (1876). Known as the *Novelas españolas contemporáneas,* these books were written at the height of the author's literary maturity and include some of his finest works, notably *La desheredada* (1881; *The Disinherited Lady*) and his masterpiece, the four-volume novel *Fortunata y Jacinta* (1886–87), a study of two unhappily married women from different social classes. Pérez Galdós' earlier novels in the series show a reforming liberal zeal and an intransigent opposition to Spain's ubiquitous and powerful clergy, but after the 1880s he displayed a newly tolerant acceptance of Spain's idiosyncracies and a greater sympathy for his country. He demonstrates a phenomenal knowledge of Madrid, of which he showed himself the supreme chronicler. He also displays a deep understanding of madness and abnormal psychological states. Pérez Galdós gradually came to admit more elements of spirituality into his work, eventually accepting them as an integral part of reality, as evident in the important late novels *Nazarín* (1895) and *Misericordia* (1897; *Compassion*).



Pérez Galdós, detail of an oil painting by Joaquín Sorolla y Bastida

By courtesy of the Hispanic Society of America

Financial difficulties prompted Pérez Galdós in 1898 to begin a third series of novels (covering the Carlist wars of the 1830s) in the *Episodios nacionales,* and he eventually went on to write a fourth series (covering the period from 1845 to 1868) and begin a fifth, so that by 1912 he had brought his history of Spain down to 1877 and retold events of which he himself had been a witness. The books of the fifth series, however, and his last works showed a decline in mental powers compounded by the blindness that overtook him in 1912.

Pérez Galdós also wrote plays, some of which were immensely popular, but their success was largely owing to the political views presented in them rather than to their artistic value.

Pérez Jiménez, Marcos (b. April 25, 1914, Michelena, Venezuela), professional soldier and president of Venezuela whose regime was marked by extravagance, corruption, police oppression, and mounting unemployment.

Pérez Jiménez, 1955

By courtesy of the Library of Congress, Washington, D.C.

A graduate of the Venezuelan Military Academy, Pérez Jiménez began his political career in 1944, participating in the coups d'état of October 1945 and November 1948. After the second coup he served as a member of the military junta that ruled Venezuela. In December 1952 he became provisional president by designation of the armed forces—an appointment confirmed by the constituent assembly of 1953, which, under his control, elected him to a five-year presidential term (1953–58).

Financed by income from oil royalties, Pérez Jiménez began a vast program of public works, including the construction of highways, hotels, office buildings, factories, and dams. Pérez Jiménez and his associates received a commission from every project. The ubiquitous secret police, the closing of the university, the silencing of the press, rampant inflation, and the jailing of five priests led the church to ally itself with the opposition parties, the dissatisfied workers, and younger military men who felt excluded from the rewards of the administration. After being forced out of office in January 1958, Pérez Jiménez fled to the U.S., reportedly taking with him approximately $200,000,000.

In 1963 Pérez Jiménez was extradited by the U.S. to stand trial for embezzlement of government funds. After serving five years in jail, he was released and went to Spain in August 1968. Elected to the Senate in 1969 *in absentia,* his election was annulled on the grounds that he was not a registered voter in Venezuela. In March 1972 in Madrid he announced his candidacy for president in the forthcoming elections. He returned once more to Caracas in May 1972, but his visit prompted riots in the city, and he returned to Spain.

perfect gas, also called IDEAL GAS, a gas that conforms, in physical behaviour, to a particular, idealized relation between pressure, volume, and temperature called the general gas law. This law is a generalization containing both Boyle's law and Charles's law as special cases and states that for a specified quantity of gas, the product of the volume v and pressure p is proportional to the absolute temperature t; *i.e.,* in equation form, $pv = kt$, in which k is a constant. Such a relation for a substance is called its equation of state and is sufficient to describe its gross behaviour.

The general gas law can be derived from the kinetic theory of gases and relies on the assumptions that (1) the gas consists of a large number of molecules, which are in random motion and obey Newton's laws of motion; (2) the volume of the molecules is negligibly small compared to the volume occupied by the gas; and (3) no forces act on the molecules except during elastic collisions of negligible duration.

Although no gas has these properties, the behaviour of real gases is described quite closely by the general gas law at sufficiently high temperatures and low pressures, when relatively large distances between molecules and their high speeds overcome any interaction. A gas does not obey the equation when conditions are such that the gas, or any of the component gases in a mixture, is near its condensation point.

The general gas law may be written in a form applicable to any gas, according to Avogadro's law (*q.v.*), if the constant specifying the quantity of gas is expressed in terms of the number of molecules of gas. This is done by using as the mass unit the gram-mole; *i.e.,* the molecular weight expressed in grams. The equation of state of n gram-moles of a perfect gas can then be written as $pv/t = nR$, in which R is called the universal gas constant. This constant has been measured for various gases under nearly ideal conditions of high temperatures and low pressures, and it is found to have the same value for all gases: $R = 8.314$ joules per gram-mole-kelvin.

Perfectionist (religious group): *see* Oneida Community.

performance, in law, act of doing that which is required by a contract. The effect of successful performance is to discharge the person bound to do the act from any future contractual liability.

Each party to the contract is bound to perform promises according to the stipulated terms. In case of any controversy as to the meaning of a promise, the courts have usually decided that a person must perform it as the other party reasonably understood it to be. Thus, a preference for the rights of the one who is to receive the benefit of the promise is established.

Attempts to establish hard and fast rules about reasonable interpretations of promises are now discouraged. Although at one time a person would be held to the literal meaning of the contract provisions stating a promise, the requirement now is to perform the true meaning and intent of the contract, which may not correspond with the fine print.

perfume, fragrant product that results from the artful blending of certain odoriferous substances in appropriate proportions. The word is derived from the Latin *per fumum,* meaning "through smoke." The art of perfumery was apparently known to the ancient Chinese, Hindus, Egyptians, Israelites, Carthaginians, Arabs, Greeks, and Romans. References to perfumery materials and even perfume formulas are found in the Bible.

Raw materials used in perfumery include natural products, of plant or animal origin, and synthetic materials. Essential oils (*q.v.*) are most often obtained from plant materials by steam distillation. Certain delicate oils may be obtained by solvent extraction, a process also employed to extract waxes and perfume oil, yielding—by removal of the solvent—a solid substance called a concrete. Treatment of the concrete with a second substance, usually alcohol, leaves the waxes undissolved and provides the concentrated flower oil called an absolute. In the extraction method called enfleurage, petals are placed between layers of purified animal fat, which become saturated with flower oil, and alcohol is then used to obtain the absolute. The expression method, used to recover citrus oils from fruit peels, ranges from a traditional procedure of pressing with sponges to mechanical maceration. Individual compounds used in perfumery may be isolated from the essential oils, usually by distillation, and may sometimes be reprocessed to obtain still other perfumery chemicals.

Certain animal secretions contain odoriferous substances that increase the lasting qualities of perfumes. Such substances and some of their constituents act as fixatives, preventing more volatile perfume ingredients from evaporating too rapidly. They are usually employed in the form of alcoholic solutions. The animal products include ambergris from the sperm whale, castor (also called castoreum) from the beaver, civet from the civet cat, and musk from the musk deer.

Odour characteristics ranging from floral effects to odours unknown in nature are available with the use of synthetic, aromatic materials.

Fine perfumes may contain more than 100 ingredients. Each perfume is composed of a top note, the refreshing, volatile odour perceived immediately; a middle note, or modifier, providing full, solid character; and a base note, also called an end note or basic note, which is the most persistent. Perfumes can generally be classified according to one or more identifiable dominant odours. The floral group blends such odours as jasmine, rose, lily of the valley, and gardenia. The spicy blends feature such aromas as carnation, clove, cinnamon, and nutmeg. The woody group is characterized by such odours as vetiver (derived from an aromatic grass called vetiver, or khuskhus), sandalwood, and cedarwood. The mossy family is dominated by an aroma of oak moss. The group known as the Orientals combines woody, mossy, and spicy notes with such sweet odours as vanilla or balsam and is usually accentuated by such animal odours as musk or civet. The herbal group is characterized by such odours as clover and sweet grass. The leather–tobacco group features the aromas of leather, tobacco, and the smokiness of birch tar. The aldehydic group is dominated by odours of aldehydes, usually having a fruity character. Fragrances designed for men are generally classified as citrus, spice, leather, lavender, fern, or woody.

Perfumes are usually alcoholic solutions. The solutions, generally known as perfumes but also called extraits, extracts, or handkerchief perfumes, contain about 10–25 percent perfume concentrates. The terms toilet water and cologne are commonly used interchangeably; such products contain about 2–6 percent perfume concentrate. Originally, eau de cologne was a mixture of citrus oils from such fruits as lemons and oranges, combined with such substances as lavender and neroli (orange-flower oil); toilet waters were less concentrated forms of other types of perfume. Aftershave lotions and splash colognes usually contain about 0.5–2 percent perfume oil. Recent developments include aerosol sprays and highly concentrated bath oils, sometimes called skin perfumes.

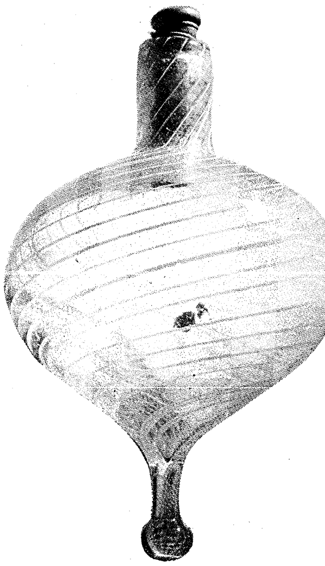
Perfumes employed to scent soaps, talcums, face powders, deodorants and antiperspirants, and other cosmetic products must be formulated to avoid being changed or becoming unstable in the new medium. They must also be formulated so as to avoid unacceptable alterations in the colour or consistency of the product.

Industrial perfumes are employed to cover up undesirable odours, as in paints and cleaning materials, or to impart a distinctive odour, as in the addition of leather odours to plastics used for furniture coverings and the addition of bread odours to wrapping papers used for breads.

perfume bottle, a vessel made to hold scent. The earliest example is Egyptian and dates to around 1000 BC. The Egyptians used scents lavishly, especially in religious rites; as a result, when they invented glass, it was largely used for perfume vessels. The fashion for perfume spread to Greece, where containers, most often terra-cotta or glass, were made in a variety of shapes and forms such as sandalled feet, birds, animals, and human heads. The Romans, who thought perfumes were aphrodisiacs, used not only molded glass bottles but also blown glass, after its invention at the end of the 1st century BC by Syrian glassmakers. The fashion for perfume declined somewhat with the beginning of Christianity, coinciding with the deterioration of glassmaking.

By the 12th century Philippe-Auguste of France had passed a statute forming the first guild of *parfumeurs,* and by the 13th century Venetian glassmaking had become well established. In the 16th, 17th, and particularly the 18th centuries, the scent bottle assumed varied and elaborate forms: they were made in gold, silver, copper, glass, porcelain, enamel, or any combination of these materials; 18th-century porcelain perfume bottles were shaped like cats, birds, clowns, and the like; and the varied subject matter of painted enamel bottles included pastoral scenes, chinoiseries, fruits, and flowers.

By the 19th century classical designs, such as those created by the English pottery ware maker Josiah Wedgwood, came into fashion; but the crafts connected with perfume bottles had deteriorated. In the 1920s, however, René Lalique, a leading French jeweller, revived interest in the bottles with his production of



Venetian glass perfume bottle, 16th–17th century; in the Museo Vetrario di Murano, Murano, Italy
electa editrice—Milano

molded glass examples, characterized by iced surfaces and elaborate relief patterns.

perfume tree: *see* ylang-ylang.

Perga, Greek PERGE, modern MURTINA, or MURTANA, ancient city of Pamphylia, (in modern Antalya *il* [province], Turkey). It was a centre of native culture and was a seat of the worship of "Queen" Artemis, a purely Anatolian nature goddess.

In Perga the apostles Paul and Barnabas began their first mission in Anatolia (Acts of the Apostles 13:13). A difficult mountain route into Phrygia began at Perga, and Alexander the Great used it for his invasion of the interior. Long the chief city of the district of Pamphylia Secunda, Perga was superseded in Byzantine times by its port, Attaleia, which became a metropolis in 1084. The most notable remains at Perga include a theatre, a stadium, two basilicas, and the agora. Pop. (latest census) 491.

Pergamino, city of northern Buenos Aires province, Argentina. Located within the Pampa, it is about 135 mi (220 km) northwest of the ciy of Buenos Aires. It was first mentioned in 1626 as an unpopulated spot where a group of Spaniards lost some parchment documents (*pergaminos*). It was settled and became a municipality in 1784.

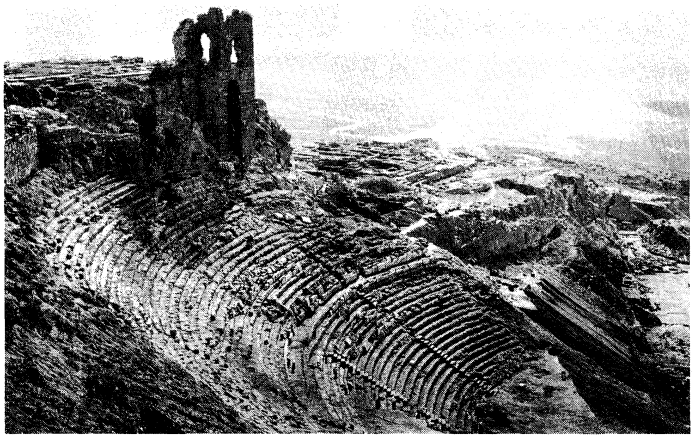
Located at the hub of rail and road networks, the city has developed a diverse economy, including the processing and distribution of agricultural produce and the manufacture of furniture, metals, and textiles. A local museum depicts the history of agriculture in the Pampa. Pop. (1980) 68,989.

Pergamum, Greek PERGAMON, ancient Greek city in Mysia, situated 16 miles from the Aegean Sea on a lofty isolated hill on the northern side of the broad valley of the Caicus (modern Bakir) River. The site is occupied by the modern town of Bergama, in the *il* (province) of Izmir, Turkey. Pergamum existed at least from the 5th century BC, but it became important only in the Hellenistic Age (323–330 BC), when it served as the residence of the Attalid dynasty. Their fortress and palace stood on the peak of the hill, while the town itself occupied the lower slopes. Under the Roman Empire the city was situated on the plain below.

It had formal autonomy under the Attalids, who, however, interfered in most aspects of civic government. Initially they ruled Pergamum as vassals of the Seleucid Kingdom, but Eumenes I declared himself independent of Antiochus I (263 BC); when he died in 241 he was succeeded by his nephew Attalus I, who defeated the Galatians and assumed the royal title; the dynasty received its name from him. The original Attalid territory around Pergamum (Mysia) was greatly expanded by 188 BC with the addition of Lydia (excluding most Greek coastal cities), part of Phrygia, Lycaonia, and Pisidia (from 183 BC), all former Seleucid territories. This expansion was accomplished as the result of Eumenes II's alliance with Rome in its conflict with the Seleucid Antiochus III.

When Eumenes' son and second successor, Attalus III, died without an heir, he bequeathed the kingdom to Rome (133). Rome accepted it and set up the province of Asia (129), which included Ionia and the territory of Pergamum, but left the other regions to neighbouring kings, who were clients of Rome. The kingdom of Pergamum yielded much wealth, especially in agricultural surpluses and silver, first to the Attalid rulers and later to Rome.

The Attalids made the city of Pergamum one of the most important and beautiful of all Greek cities in the Hellenistic Age; it is one of the most outstanding examples of city planning in that period. They built a library excelled only by that at Alexandria. The kings after Attalus I collected many works of art from Greece to adorn the city's temples and courtyards, supplementing the many works of sculpture, painting, and decoration commissioned from resident artists. In Roman times its population was an estimated 200,000. Excavations that were begun in 1878 under the auspices of the Berlin Museum, besides unearthing many artistic treasures, have enabled archaeologists to reconstruct the plan of the most important areas of the Hellenistic city. Its monuments included a theatre; the temple to Athena Nicephorus; and the great altar of Zeus with its richly decorated frieze, a masterpiece of Hellenistic art. A part of the altar and its surviving reliefs, restored and mounted, now stands in the Pergamon Museum in Berlin.



The Greek theatre and part of the terrace in the upper city, Pergamum
By courtesy of Staatliche Museen Preussischer Kulturbesitz, Antikenabteilung, Berlin—Art Resource/EB Inc.

The civic structures of the lower city included a large marketplace, a gymnasium, and temples of Hera and Demeter. Roman remains include an amphitheatre, a theatre, and a racetrack. The early Attalids erected the first structures of the upper (royal) city, but the later kings Eumenes II and Attalus III, by their extensive building and rebuilding, were chiefly responsible for the city's great architectural and artistic reputation. After the fall of Rome, Pergamum was ruled by the Byzantines until it passed into Ottoman hands early in the 14th century.

pergola, garden walk or terrace, roofed with an open framework over which plants are trained. Its purpose is to provide a foundation on which climbing plants can be seen to ad-

Vine covered pergola, wood engraved illustration from Francesco Colonna, the *Hypnerotomachia Poliphili,* Venice, 1499; in the New York Public Library
By courtesy of the New York Public Library, Spencer Collection, Astor, Lennox and Tilden Foundations

vantage and to give shade. It was known in ancient Egypt and was a common feature of early Renaissance gardens in Italy and subsequently throughout Europe.

Pergolas have always been popular in hot climates, and in Mediterranean countries they are frequently covered with vines or ivy. In more northerly countries, where shade is less attractive, they are less common; but they had a marked revival during the Arts and Crafts movement in Great Britain in the early 20th century for the purpose of growing wisteria and were prominent features at the William Randolph Hearst castle at San Simeon, Calif.

Pergolesi, Giovanni Battista (b. Jan. 4, 1710, Jesi, Italy—d. March 16, 1736, Pozzuoli), Italian composer whose intermezzo *La serva padrona* ("The Maid Turned Mistress") was one of the most celebrated stage works of the 18th century.

His family name was Draghi, but, having moved to Jesi from Pergola, the family was called Pergolesi, meaning "of Pergola." From 1726 he attended the Conservatorio dei Poveri at Naples, where he earned a high reputation as a violinist. In 1732 he was appointed *maestro di cappella* to the prince of Stigliano at Naples and produced a Neapolitan opera buffa, *Lo frate 'nnammorato*, and a mass (probably his *Mass in F*). Both were well-received. In 1733, his opera seria *Il prigionier superbo* was produced. But it was the comic intermezzo *La serva padrona,* inserted between the acts of *Il prigionier superbo*, that achieved success. In 1734 Pergolesi was appointed deputy *maestro di cappella* of Naples, and in May he went to Rome to direct the performance of his *Mass in F.* His subsequent operas met with only occasional success. His health began to fail, and in 1736 he left Naples for the Capuchin monastery at Pozzuoli, near Naples, where he finished his last work, the celebrated *Stabat Mater.* He died in extreme poverty at age 26 and was buried at the cathedral at Pozzuoli.

When Pergolesi died, his fame had scarcely spread beyond Rome and Naples, but later in the century it grew enormously. The success of *La serva padrona* was largely posthumous, and it reached its peak after its performance in Paris in 1752. There it led to *la guerre des bouffons* ("the war of the buffoons"), with musical forgers vying to produce spurious works of Pergolesi, leaving some uncertainty about the authenticity of works attributed to him. Some of the works attributed to Pergolesi by Igor Stravinsky in arrangements he made for his ballet *Pulcinella* (1920) are among those of doubtful authenticity.

Pergolesi's serious style is best-illustrated in his *Stabat Mater* and in his masses, which demonstrate his ability to handle large choral and instrumental forces. His gift of comic characterization is best-shown in the classic *La serva padrona.*

Perhimpunan Indonesia, English INDONESIAN UNION, an Indonesian students' organization in The Netherlands, formed in the early 1920s, which provided a source of intellectual leadership for the Indonesian nationalist movement. This association originated in 1908 as the Indische Vereeniging (Indies Association), which changed its name to the Indonesische Vereeniging (Indonesian Association) in 1922 as Indonesian nationalism developed. It became known as the Perhimpunan Indonesia in 1924 and was the vanguard of the Indonesian nationalist movement, advocating national independence from the Dutch.

The Perhimpunan Indonesia was the first political organization to use the term Indonesia in its name. It was influenced by socialist ideas and by Gandhi's principle of nonviolent civil disobedience. When the members of this association returned to Indonesia, they were active in study clubs and eventually in political parties. Two prominent figures were Raden Sutomo and Mohammad Hatta.

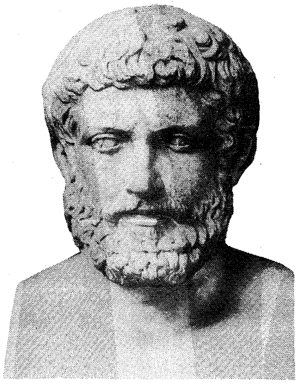
Peri, Jacopo, byname IL ZAZZERINO (b. Aug. 20, 1561, Rome—d. Aug. 12, 1633, Florence), Italian composer noted for his contribution to the development of dramatic vocal style in early Baroque opera.

Under the early sponsorship of the Florentine Cristofano Malvezzi, Peri had published by 1583 both an instrumental work and a madrigal. After early posts as an organist and singer, he was employed in 1588 by the Medici court and, after 1600, was also associated with the court at Mantua. Contemporary testimonials mention his skill as a singer and chitarrone player.

In collaboration with Ottavio Rinuccini, Peri is best-known for composing what was probably the first opera, *Dafne* (1598), and also, in collaboration with Giulio Caccini and Rinuccini, the first opera for which complete music still exists, *Euridice* (1600). The impetus for this new style of dramatic singing, quite different from the traditional Renaissance texture of complex polyphony, was cultivated in Peri's probable association with the Camerata, a group of Florentine poets, musicians, and literati, including Giovanni Bardi and Vincenzo Galilei, who sought to re-create the simplicity of ancient Greek dramatic productions.

periaktos (Greek: "revolving"), plural PERIAKTOI, ancient theatrical device by which a scene or change of scene was indicated. It was described by Vitruvius in his *De architectura* (*c.* 14 BC) as a revolving triangular prism made of wood, bearing on each of its three sides a different pictured scene. While one scene was presented to the audience, the other two could be changed. Although it was once thought to be a feature of Greek classical drama, it is now believed that it did not originate until the Hellenistic age. The periaktos was revived, notably for the Italian theatre in about 1500 and for the 17th-century English stage.

Periander (d. *c.* 588 BC), second tyrant of Corinth (*c.* 628–588), a firm and effective ruler who exploited his city's commercial and cultural potential. Much of the ancient Greek representation of Periander as a cruel despot



Periander, marble bust in the Vatican Museum, Rome
The Mansell Collection

probably derives from the Corinthian nobility, with whom he dealt harshly.

Periander was the son of Cypselus, the founder of the Cypselid dynasty of Corinth. To promote and protect Corinthian trade, Periander established colonies at Potidaea in Chalcidice and at Apollonia in Illyria. He conquered Epidaurus and annexed Corcyra. The *diolkos* ("portage way") across the Isthmus of Corinth was perhaps built during his reign. It appears that the commercial prosperity of Periander's Corinth became so great that the tolls on goods entering its ports accounted for almost all government revenues. Periander cultivated friendly relations with Thrasybulus, tyrant of Miletus, and maintained ties with the kings of Lydia and Egypt. In the cultural sphere he was a patron of art and of literature; by his invitation the poet Arion came to the city from Lesbos. Sometimes reckoned as one of the Seven Wise Men of Greece, Periander was the supposed author of a collection of maxims in 2,000 verses.

periarteritis nodosa (vascular disease): *see* polyarteritis nodosa.

Peribsen, Egyptian king of the 2nd dynasty (*c.* 2775–*c.* 2650 BC), who promoted the cult of the god Seth over that of Horus, the god favoured by his predecessors. His tomb was located in Seth's district in Upper Egypt, at Abydos. According to some scholars, Peribsen's ascendancy was accompanied by a violent reaction against the supporters of Horus, but the supremacy of Horus was restored after his death.

pericarditis, inflammation of the pericardium, the membranous sac that encloses the heart. Acute pericarditis may be associated with any of a number of diseases and conditions, including myocardial infarction (death of a section of heart muscle), uremia (abnormally high levels of urea and other nitrogenous waste products in the blood), allergic disorders, and infections. The pericardial infection may be syphilis, rheumatic heart disease, tuberculosis, or some other bacterial infection. It may be viral or protozoal; the protozoal organism that causes amebic dysentery, for example, may escape from a liver abscess and invade the pericardium. The infection, finally, may be fungal—infection, for example, with *Histoplasma capsulatum.*

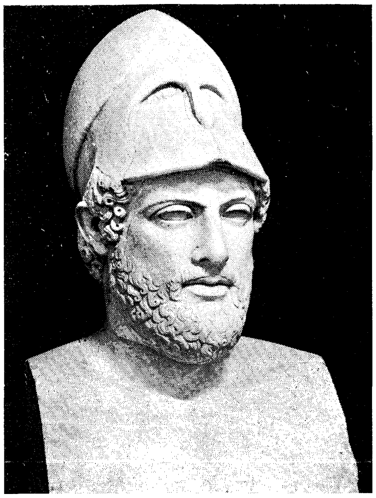
A person with infectious pericarditis experiences pain over the heart, neck, and shoulder. The pain is sometimes increased during breathing and is relieved by leaning forward. Lying down may accentuate the pain, which may radiate to the left arm, the shoulder, and the neck. The affected person may experience difficulty in breathing and may be weak, anxious, and depressed. His skin may be pale or bluish, and he may be feverish and delirious. The tracings of the heart's electrical activity are characteristic, and X rays may show accumulation of fluid in the pericardial sac. A rapid increase of pericardial fluid, called cardiac tamponade, may cause shock. Treatment involves slowly draining the fluid and combating the underlying infection. Acute pericarditis may result in the formation of scar tissue that contracts around the heart and interferes with its operation. This condition, called chronic constrictive pericarditis, is corrected by surgical removal of the pericardium.

periclase, magnesium oxide mineral (MgO) that occurs as colourless to grayish, glassy, rounded grains in marble and in some dolomitic limestones, where it formed by the metamorphosis of dolomite at high temperatures. Rocks containing periclase have been identified at Monte Somma and Predazzo, Italy; Nordmark and Långban, Swed.; and Crestmore, Calif. Periclase may be a major component of the mantle of the Earth. For detailed physical properties, *see* oxide mineral (table).

Pericles (b. *c.* 495 BC, Athens—d. 429, Athens), Athenian statesman largely responsible for the full development, in the later 5th century BC, of both the Athenian democracy and the Athenian empire, making Athens the political and cultural focus of Greece. His achievements included the construction of the Acropolis, begun in 447.

Background and education. Knowledge of the life of Pericles derives largely from two sources. The historian Thucydides admired him profoundly and refused to criticize him.

His account suffers from the fact that, 40 years younger, he had no firsthand knowledge of Pericles' early career; it suffers also from his approach, which concentrates exclusively on Pericles' intellectual capacity and his war leadership, omitting biographical details, which Thucydides thought irrelevant to his theme. The gaps are partly filled by the Greek writer Plutarch, who, 500 years later, began writing the life of Pericles to illustrate a man of unchallengeable virtue and greatness at grips with the fickleness of the mob and finished rather puzzled by the picture he found in his sources of Pericles' responsibility for a needless war. These sources are not all ascertainable, but they certainly preserve an invaluable amount of fact and contemporary gossip, which is sometimes nearly as useful.



Pericles, detail of a marble herm; in the Vatican Museum
Anderson—Alinari from Art Resource/EB Inc.

Pericles was born into the first generation able to use the new weapon of the popular vote against the old power of family politics. His father, Xanthippus, a typical member of this generation, almost certainly of an old family, began his political career by a dynastic marriage into the controversial family of the Alcmaeonids. He soon left their political camp, probably on the question of relations with Persia, and took the then new path of legal prosecution as a political weapon.

Perhaps outbid in his search for popular support, Xanthippus was ostracized in 484 BC, though he returned in 480 to command the Athenian force at Mycale in 479, probably dying soon after. From him Pericles may have inherited a leaning toward the people, along with landed property at Cholargus, just north of Athens, which put him high, though not quite at the highest level, on the Athenian pyramid of wealth.

His Alcmaeonid mother, Agariste, provided him with relationships of sharply diminishing political value and her family curse, a religious defilement that was occasionally used against him by his enemies. A few days before Pericles' birth, according to the Greek historian Herodotus, Agariste dreamed she bore a lion. The symbolism, although ambiguous, is most likely to be unfavourable. That Pericles' skull was of unusual shape seems well attested, but one can hardly speculate about the possible psychological consequences.

The only name associated with his early education is that of the musical theorist Damon, whose influence, it is said, was not just confined to music. The arrival of the Sophist philosophers in Athens occurred during his middle life, and he seems to have taken full advantage of the society of Zeno and particularly Anaxagoras, from whom he is said to have learned impassivity in the face of trouble and insult and skepticism about alleged divine phenomena.

The first known date in his life is 472 BC, when he paid for the production of the playwright Aeschylus' Persian trilogy. Nothing further is known until 463, when he unsuccessfully prosecuted Cimon, the leading general and statesman of the day, on a charge of having neglected a chance to conquer Macedonia; this implies that Pericles advocated an aggressive policy of expansion for Athens. Only rumour associates him directly with the political convulsion of the next two years, which drove Cimon into exile, swung Athens away from its alignment with Sparta, and decisively strengthened the democratic elements in the Athenian constitution; but he probably did support the democratic leader Ephialtes in this period, and his introduction of pay for juries, unfortunately undatable, is a logical consequence of Ephialtes' reforms.

Rise to democratic leadership. That Pericles immediately succeeded the assassinated Ephialtes as head of the democratic party in 461 is an ancient oversimplification; there were other men of considerable weight in Athens in the next 15 years. The outbreak of war among the Greek states in 459 put a premium on military talent, and Pericles' only recorded campaign in the next few years was a naval expedition in the Corinthian Gulf in 454, in which Athens defeated Achaea but failed to win more important objectives. Politically he is credited with some kind of rapprochement with Cimon, who is said to have been recalled and allowed to resume the war with Persia, much preferred to fighting other Greeks, but the date of Cimon's recall is uncertain, and the rumours are hard to disentangle.

In 451 or 450 Pericles carried a law confining Athenian citizenship to those of Athenian parentage on both sides. No source provides any background to this proposal; it is not even clear whether it was retrospective. A correct assessment is vital for understanding Pericles, but explanations vary considerably; some argue that Pericles was merely forging a low-level political weapon for use against Cimon, who had a foreign mother. The upper classes certainly had no prejudice against foreign marriages; the lower classes may well have had more, and, on the whole, it is possible to view Pericles here as championing exclusivist tendencies against immigrants who might break down the fabric of Athenian society.

One hundred years later, an orator argued for firm distinctions of status on the ground that the law provided even the poorest Athenian girl with a dowry in the form of her citizenship. The law also may have passed because of a general wish to restrict access to the benefits of office and public distributions, but there was never any disposition on the part of Athenians to restrict economic opportunities for foreigners—who served in the fleet, worked on public buildings, and had freedom of trade and investment, with the crucial, but normal, exception of land and houses. To speak of this legislation as a move toward creating a "master race" is thus partly misleading, but the demagogic nature of the law seems clear.

Cimon died after 451, during his last campaign against Persia. The policy of war with Persia was abandoned and a formal peace probably made. The Persian War, begun as an ill-considered gesture in 499, could be considered ultimately successful. The city of Athens, however, was physically still much as it had been left by the Persian sack of 480, and its gods were inadequately housed.

Restoring Athens' preeminence. Hostilities among the Greek states had also come to an end in the Five Years' Truce of 451. Pericles now embarked on a policy designed to secure Athens' cultural and political leadership in Greece. It had already dominated the alliance that had continued the Persian War after Sparta's withdrawal in 478, a leadership strengthened by the transfer of the alliance's considerable treasury from Delos to Athens in 454. If peace with Persia did not end the alliance, it may have ended the annual tribute paid to that treasury.

Whether to regain this tribute, or simply to assert Athenian leadership, Pericles summoned a conference of all Greek states to consider the questions of rebuilding the Greek temples destroyed by the Persians, the payment of sacrifices due to the gods for salvation, and the freedom of the seas. Sparta would not cooperate, but Pericles continued on the narrower basis of the Athenian alliance. Tribute was to continue, and Athens would draw heavily on the reserves of the alliance for a magnificent building program centred on the Acropolis. In 447 work started on the temple later known as the Parthenon and on the gold and ivory statue of Athena (by Phidias), which it was to house; the Acropolis project was to include, among other things, a temple to Victory and the Propylaea (started 437), the entrance gateway, far grander and more expensive than any previous Greek secular building.

There was domestic criticism, however. Thucydides, son of Melesias (not the historian) and a relative of Cimon, who had inherited some of his political support, denounced both the extravagance of the project and the immorality of using allied funds to finance it. Pericles argued that the allies were paying for their defense, and, if that was assured, Athens did not have to account for how the money was actually spent. The argument ended in ostracism in 443; Thucydides went into exile for 10 years, leaving Pericles unchallenged. It cannot be determined whether the glamour of the project had completely caught Athenian imagination or whether Pericles was now simply thought to be indispensable. Plutarch attributed to Pericles a desire to stimulate economic activity and employment in Athens, but these motives may be anachronistic and in actuality may not have influenced the voters very much.

Revolts within the empire. There was also some initial allied resentment at the continuation of tribute, and some scattered revolts. Pericles met the situation in part by extending a network of Athenian settlements throughout what may now be called the empire, thus strengthening Athenian control and providing new land for the growing Athenian population. In establishing one of these, Pericles engaged in his most admired campaign, the expulsion of barbarians from the Thracian Chersonese (Gallipoli). A more serious crisis came in 447 or 446, however, when the cities of Boeotia, under Athenian control since 458, beat a small Athenian army and successfully revolted. Euboea, crucial to Athenian control of the sea and food supplies, and Megara soon followed suit. The strategic importance of Megara was immediately demonstrated by the appearance, for the first time in 12 years, of a Spartan army north of the Isthmus in Attica. Pericles thought and acted swiftly. The details were never fully known, but, possibly by bribery and certainly by negotiation, it was arranged that Athens would give up its mainland possessions and confine itself to a largely maritime empire. The Spartan army retired, Euboea was quickly reduced, and the arrangement was ratified by the Thirty Years' Peace (winter 446–445). For Athens, the essential loss was that of Megara, which meant that a Spartan army could appear in Attica at any time. That Pericles doubted the stability of the settlement and saw the need to develop an alternative basic strategy for Athens is shown by his immediate construction of a third Long Wall to improve the defenses of Athens and the port of Piraeus. Henceforth, in effect, Athens could be turned into an island at will.

Political and military achievements. There was a break in tensions for the moment. After Thucydides' ostracism, Pericles had little domestic opposition. His position rested on his continual reelection to the generalship and on his prestige, based, according to the historian Thucydides, on his manifest intelligence and incorruptibility. From his youthful demagogy, he had moved to a more middle ground in politics, and there are traces in his later life of his being outflanked by more radical spokesmen. Athens was, Thucydides says, in name a democracy but, in fact, governed by its first man. Though Athenian democracy never gave more than severely limited powers to the executive, the assembly gave Pericles what he wanted. Thucydides, obsessed with the power of intellect, takes little note of the need of a statesman to work hard, and it is Plutarch who provided the glimpses of a man who took no interest in his own estates, who was never seen on any road but that to the public offices, and who was only recalled to have gone to one social occasion, which he left early.

This picture is softened somewhat by what is known of his personal life. The identity of his wife, however, though certainly of wealth and high birth, is unknown. He married her in his late 20s but, as they were incompatible, divorced her some 10 years later. Close to 50, he took Aspasia of Miletus into his house. By his own law, marriage was impossible, and, after the death of his two legitimate sons, their son Pericles had to be legitimated. Although Aspasia is clouded by scandal and legend, it is easy to believe she possessed great charm and intelligence. There is no reason to doubt that she was free and of good birth in her own city with its great intellectual traditions. It is clear that her own behaviour and Pericles' attitude toward her were surprising phenomena in Athens, where upper class women were kept secluded. That Pericles was known to kiss her on leaving for and returning from work gave rise to speculation about her influence on him and, thus, on Athenian politics.

As the building program continued, Pericles demonstrated Athenian superiority in other ways. In 443 a Panhellenic colony was founded under Athenian auspices at Thurii, in southern Italy, but did not form a continuing centre of Athenian influence in the west, as may have been hoped. At an unknown date, Pericles took a fleet into the Black Sea to demonstrate Athenian power and secure the grain route from the Tauric Chersonese (the Crimean Peninsula in the modern Ukrainian S.S.R.). As the buildings on the Acropolis rose, celebrations of the festival of the Panathenaea grew more and more elaborate, and much was done to enhance the splendour of the Mysteries of Eleusis, symbolic, among other things, of the Athenian claim to have brought corn and civilization to mankind.

Pericles' last major campaign was the one interruption in these years. In 440, Samos, one of Athens' principal allies with a substantial fleet of its own, revolted, and, despite a victory by Pericles against superior numbers, the revolt nearly succeeded. The campaign to recover Samos, although long and costly, was ultimately successful, and it became a model against which later Athenian generals measured their achievements.

The drift toward war. There had been a serious possibility that Sparta and its allies might intervene on this occasion, but they did not, and the Thirty Years' Peace was upheld until the end of the 430s. Tension grew as the decade progressed, particularly with regard to Corinth, Sparta's ally, whose interests conflicted more obviously with those of Athens. By 433 the situation was serious enough for Athens' finances to be put on a war basis, and, thereafter, the drift to war continued.

Pericles' policy was one of firmness, coupled with careful manipulation of the diplomatic position to keep Athens technically in the right. The firmness was a puzzle to contemporaries, particularly his determination to enforce decrees excluding Megarian trade from the Athenian Empire. Was he, it was asked, influenced by some private grievance of Aspasia? Was he trying to divert attention from personal attacks on himself and friends by making war? Thucydides tells just enough to make his own interpretation plausible, that Megara was a small matter in itself but crucial as a symbol of Athenian determination to maintain its position. Consideration of Megara's strategic importance, which Thucydides consistently undervalues, may suggest further the possibility that the Megarian decrees were not the immediate cause of the war but the first blow in a war Pericles thought inevitable and that began in spring 431.

Pericles' main strategic ideas are clear. He was an admiral rather than a general, and Athens' naval resources were immeasurably superior to its land power. He would evacuate the Athenian countryside, bring the population into the Long Walls, decline battle with the Spartan army, and rely on the fleet to assure Athenian food supplies and secure the empire on whose resources the expensive naval policy depended. Expenditure on building had been counterbalanced by annual savings from the tribute, and enough capital had been reserved, he thought, for a long war, though expenditure turned out heavier than he could have calculated. This is essentially Thucydides' analysis, though he failed to explain what end to the war, other than a stalemate, Pericles wanted or expected. There are some indications that Periclean strategy included more aggressive elements, such as the recovery of Megara, which would have considerably improved Athens' position.

Weakness of Pericles' strategy. This strategy, however, had marked political weaknesses. The Athenian population had deep roots in the countryside, and great firmness was required to bring them to abandon their land to Spartan ravages without a fight. The middle-class army suffered in morale, and the living conditions of the lower classes, though they were allowed activity in the fleet, deteriorated in the overcrowded city. The overcrowding had an unforeseeable consequence in a plague, which in the second summer of the war took a quarter of the population. No obvious success counterbalanced the discomforts of war, and Pericles was deposed from office and fined. He was soon reelected, but he took no new initiatives before his death in autumn 429.

After the first campaigning season of the war, he had delivered the funeral speech over the fallen, which Thucydides reports at length. They had fallen, he said, in preserving a way of life that he described in detail. Athenian life often fell short of this Periclean ideal, but he conceived it with clarity and made it generally recognized. He conceived his Athens as "an education to Greece." If the last speech attributed to him by Thucydides is any guide, he cannot be accused of ignoring that the realities of power that made the Periclean age possible might also bring it down.

(D.M.L.)

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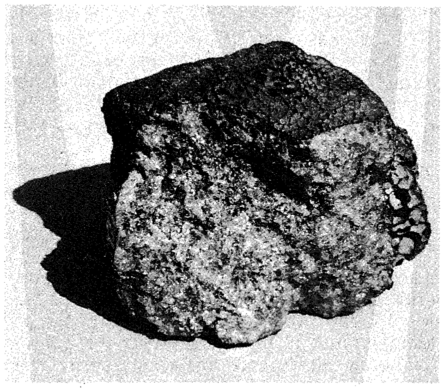
peridot, also called PRECIOUS OLIVINE, gem-quality, transparent green olivine in the forsterite–fayalite series (*q.v.*). Gem-quality olivine has been valued for centuries; the deposit on Jazīrat Zabarjad (Saint Johns Island),



Peridot from Jazīrat Zabarjad, Egypt, in the Red Sea

By courtesy of the American Museum of Natural History, New York City; photograph, Emil Javorsky—EB Inc.

Egypt, in the Red Sea that is mentioned by Pliny in his *Natural History* (AD 70) still produces fine gems. Very large crystals are found in the Mogok district of Burma; peridots from the United States are seldom larger than two carats. Yellow-green peridot has been called chrysolite (Greek: "golden stone"); this term, used for various unrelated minerals, has become less common for the gemstone. Peridot is generally faceted with a step cut.

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

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peridotite, a coarse-grained, dark-coloured, heavy, intrusive igneous rock that contains at least 10 percent olivine, other iron- and magnesia-rich minerals (generally pyroxenes), and not more than 10 percent feldspar. It occurs in four main geologic environments: (1) interlayered with iron-, lime-, and magnesia-rich rocks in the lower parts of tabular-layered igneous complexes or masses; (2) in alpine-type mountain belts as irregular, olivine-rich masses, with or without related gabbro; (3) in volcanic pipes (funnels, more or less oval in cross section, that become narrower with increasing depth) as kimberlite; and (4) as dikes (tabular bodies injected in fissures) and irregular masses with rocks exceptionally rich in potash and soda. The layered complexes are believed to have been formed in place by selective crystallization and crystal settling from a previously intruded fluid or magma; the remaining types seem to have ranged from fluid magmas to semisolid crystal mushes at the time of emplacement. *See also* dunite; kimberlite.

Peridotite is the ultimate source of all chromium ore and naturally occurring diamonds, and of nearly all chrysotile asbestos. It is one of the main host rocks of talc deposits and platinum metals and formerly was a major source of magnesite. Fresh dunite is used in parts of glass furnaces. Nearly all peridotite is more or less altered to serpentine and is cut by many irregular shear surfaces; in warm, humid climates peridotite and serpentine have weathered to soils and related deposits that, though now worked on a relatively small scale, are enormous potential sources of iron, nickel, cobalt, and chromium.

Perier, Casimir(-Pierre) (b. Oct. 21, 1777, Grenoble, Fr.—d. May 16, 1832, Paris), French banker and statesman who exercised a decisive influence on the political orientation of the reign of King Louis-Philippe.

Perier was the son of a manufacturer and financier. After service with the staff of the French army in Italy (1798–1801), he returned to France and together with his brother, Antoine-Scipion, founded a new bank. By 1814 he was one of the most important bankers in Paris. In 1817 he opposed the government's policy of relying on foreign banks to finance France's war indemnity. Elected to the Chamber of Deputies in 1817, he sat with the moderate opposition of the left.

After the Revolution of July 1830 that overthrew Charles X and made Louis-Philippe king of the French, Perier was elected president of the Chamber of Deputies. On March 13, 1831, he became president of the council of ministers (premier) and minister of the interior. He set himself to restore order: the National Guard was brought into action against demonstrators in Paris; and later the army put down the silkworkers' insurrection in Lyon (November–December 1831). In foreign affairs he pursued an active policy: a naval squadron was dispatched to Lisbon to force the Portuguese government to compensate French merchants for damages (July 1831); he sent an army to defend Belgium against the Dutch (August 1831); and he ordered the occupation of the Adriatic port of Ancona to check Austrian predominance in the Papal States (February 1832). He had to face continual attacks from both left and right, and his authoritarian manner sometimes alienated Louis-Philippe also. He died of cholera.

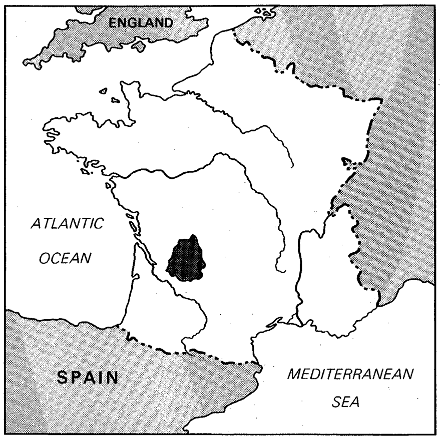
periglaciology, study of the large areas of the Earth that were adjacent to but not covered by ice during the glacial periods. Modern representatives of these areas are the sub-Arctic tundra and permafrost regions located in the Northern Hemisphere. All of the conditions derived from such a paleoenvironment can be observed in the geologic record preserved in many areas now free of ice.

Pérignon, Dominique-Catherine, marquis de (b. May 31, 1754, Grenade, Fr.—d. Dec. 25, 1818, Paris), general and marshal of France, active during the Revolutionary and Napoleonic wars.

A retired officer of the royal army, Pérignon resumed active service in 1792. Operations against the Spaniards won him the rank of general and, in 1794, command of the Army of the Eastern Pyrenees. As ambassador to Madrid he negotiated the Spanish alliance (1796). While fighting in Italy (1799) he was wounded and taken prisoner by the Russians for 18 months, returning to France to become a senator (1801) and a marshal (1804). He was appointed governor general of Parma (1806) and commander in chief at Naples (1808) and became a count of the empire in 1811. After Napoleon's abdication he rallied to Louis XVIII, was made a peer and later a commanding officer at Toulouse (1815) and Paris (1816), and was created marquis in 1817.

Périgord, historic and cultural region encompassing the southern French *département* of Dordogne and part of Lot-et-Garonne and roughly coextensive with the former county of Périgord. The area was originally inhabited by the Gallic tribe of the Petrocorii, or Petragorici, whose capital became Périgueux. The counts of Périgord later played a part in the troubled affairs of Aquitaine, and, beginning in 1259, control of Périgord was disputed by the French and the English. In 1470 the area was transferred to the House of Albret and subsequently was inherited by the crown of Navarre, whereupon Henry IV united it with the French crown (1607). Under the *ancien régime,* Périgord was included in the province of Guyenne and the *intendance,* or *généralité,* of Bordeaux.

Physiographically Périgord is an upland region on the southwestern flanks of the Massif Central, drained westward by the Lot, Dordogne, and other tributaries of the Garonne.



The county of Périgord *c.* 1035

From W. Shepherd, *Historical Atlas,* Harper & Row, Publishers (Barnes & Noble Books), New York; revision Copyright © 1964 by Barnes & Noble, Inc.

The traditional farmstead has two stories linked by an outdoor stairway; houses are often flanked by towers. Architectural features include balconies on the ground floor, oversize portals, carved lintels, and stone arcades. The rural population has been depleted by emigration.

There are numerous immigrants from Alsace and Brittany; repatriates from Algeria settled in Périgord between 1962 and 1964. Roman Catholicism predominates, although there is a sizable Protestant enclave in Bergerac. Three dialects of Occitan are widely spoken in the countryside.

Regional cuisine features truffles, which are unearthed among oak trees by trained pigs and dogs between November and March, and fine pâtés de foie gras. Geese are penned in November and force-fed corn (maize) cooked with fat and salt; geese and ducks are slaughtered by Christmas for foie gras. The wings and thighs are seasoned and canned. Wild boars are occasionally raised for pâté. Phylloxera has destroyed most of the region's vines, though Pécharmant, which is produced outside Bergerac, is a notable dark wine with a slightly earthy flavour.

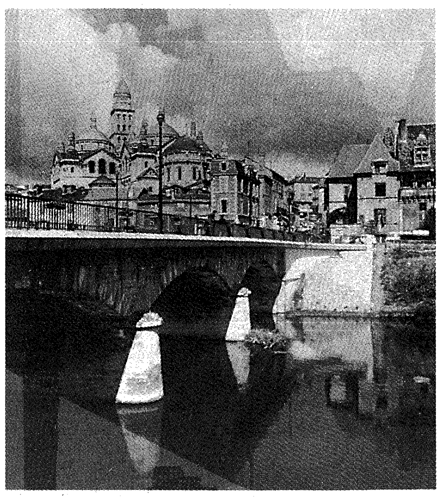
Perigordian industry, tool tradition of prehistoric men in Upper Paleolithic Europe that followed the Mousterian industry, was contemporary in part with the Aurignacian, and was succeeded by the Solutrean. Perigordian tools included denticulate (toothed) tools of the type used earlier in the Mousterian tradition and stone knives with one sharp edge and one flat edge, much like modern metal knives. Other Upper Paleolithic tool types are also found in Perigordian culture, including scrapers, borers, burins (woodworking tools rather like chisels), and composite tools; bone implements are relatively uncommon.

The Perigordian has two main stages. The earlier stage, called Châtelperronian, is concentrated in the Périgord region of France but is believed to have originated in southwestern Asia; it is distinguished from contemporary stone tool culture complexes by the presence of curved-backed knives (knives sharpened both on the cutting edge and the back). The later stage is called Gravettian and is found in France, Italy, and Russia (there termed Eastern Gravettian). Gravettian people in the west hunted horses to the near exclusion of the reindeer and bison that other contemporaries hunted; in Russia Gravettians concentrated on mammoths. Both appear to have hunted communally, using stampedes and pitfalls to kill large numbers of animals at one time. Gravettians in the east used large mammoth bones as part of the building material for winter houses; mammoth fat was used to keep fires burning. Gravettian peoples made rather crude, fat "Venus" figurines, used red ochre as pigment, and fashioned jewelry out of shells, animal teeth, and ivory.

Périgueux, town, *département* of Dordogne, Aquitaine region, southwestern France. An episcopal see, it lies on the right bank of the Isle River, east-northeast of Bordeaux and southwest of Paris. Originally settled by a Gaulish tribe, the Petrocorii, the town fell to the Romans, who called it Vesuna after a local spring, the Vésone, that became their tutelary deity.

The modern town developed from two nuclei, the Cité and Puy-Saint-Front, which vied with one another until they united in 1251. The Cité, in the southwestern part of the town, occupies the site of Vesuna, subsequently reduced by the barbarians to a small encampment, called the Civitas Petrocorium, from which the names Cité and Périgueux are derived. Puy-Saint-Front, on the east, grew between the 5th and 13th centuries around an abbey sanctuary containing the body of St. Front, the Apostle of Périgord, and the first bishop of Périgueux. The contemporary city spreads west and northwest of Puy-Saint-Front.

Périgueux struggled against the English throughout the Hundred Years' War (1337–1453) and suffered severely under Protestant occupation (1575–81) during the 16th-century Wars of Religion. Given amnesty by Louis XIV in 1654 for its part in the Fronde (a series of civil disturbances, 1648–53), the town then experienced an era of peace. At the time of the French Revolution at the end of the 18th century, it continued as the capital of a *département,* covering the same area as the medieval province of Périgord Blanc. From



Périgueux on the Isle River, Fr., with the domes and bell tower of the cathedral of Saint-Front in the background

CAP—Vloo, Paris

the July Monarchy (1830) onward many improvements were made, and the town received new impetus under the Second Empire (1852–70) and the Third Republic (1870–1940).

A chief point of cultural interest is the cathedral of Saint-Front, built in the 12th century on the ruins of the abbey, which burned in 1120. One of the largest in southwestern France, it is built in the shape of a Greek cross, topped by five lofty domes and numerous colonnaded turrets. A Romanesque bell tower and cloisters of the 12th, 13th, and 16th centuries adjoin it on the south. Successive restorations, the last ending in 1901, have altered its original character. The Périgord Museum displays prehistoric and archaeological artifacts of the area, as well as secular and religious art. In the Cité is the 12th-century church of Saint-Étienne, which was the cathedral until 1669. Evidences of early occupation are an arena of the 3rd century AD, a boundary wall of the Roman *civitas* on which is built the Château Barrière (12th–15th century), and the Tour de Vésone, believed to be part of a temple to the goddess Vesuna.

Now one of the most attractive towns in southwestern France, Périgueux is a road and rail junction with connections northeast to Limoges and southwest to Bordeaux. The nearest airport is to the east at Bassilac. Internationally known for its pâté de foie gras, truffles, and wine, Périgueux is also an important hog market. Industries include canneries and plants producing hardware, cutlery, chemicals, textiles, and leather goods. Pop. (1982) 32,632.

Perijá, Mountains of, Spanish SERRANÍA DE PERIJÁ, also called SIERRA DE PERIJÁ, mountain chain, the northward extension of the Andean Cordillera Oriental, forming part of the border between Colombia and Venezuela. The range extends for 190 miles (306 km) from the vicinity of Ocaña, Norte de Santander department, Colombia, northward to the Guajira Peninsula. Its crest line rises to 12,300 feet (3,750 m) above sea level. Included in the range are the Motilones, Valledupar, and Oca mountains. To the west, across the César River, lies the higher Sierra Nevada de Santa Marta, while to the east stretches the Maracaibo Lowland of Venezuela.

perilla oil, drying oil obtained from the seeds of Asiatic mint plants of the genus *Perilla.* Perilla oil is used along with synthetic resins in the production of varnishes. Perilla oil dries in less time than linseed oil and on drying forms a film that is harder and yellows more than that formed by linseed oil. The paint and varnish industry accounts for the largest

Perilla frutescens, the seeds of which are the source of perilla oil
W.H. Hodge

usage. Perilla oil also is important in the manufacture of printing inks and linoleum. In the Orient perilla oil is used as an edible oil.

Perilla has been cultivated in China, Korea, Japan, and northern India and is becoming increasingly important. The seeds contain 35 to 45 percent oil.

Perim Island, Arabic BARĪM, island in el-Mandeb Strait off the coast of Yemen (Aden), to which it belongs. A rocky volcanic island, lying just off the southwestern tip of the Arabian Peninsula, Perim is 5 square miles (13 square km) in area and rises as high as 214 feet (65 m). It has a harbour on the southwestern shore, and an airfield is in the north. Perim was visited by the Portuguese in 1513 and occupied by the French in 1738. The British occupied the island in 1799, but scarcity of water forced them to decamp to Aden; they returned in 1857 and established a coaling station. Perim's population expanded greatly thereafter but declined after the coaling station was abandoned in 1936. The island was incorporated into the British colony of Aden in 1937 and became part of independent Yemen (Aden) in 1967.

period, in geology, the basic unit of the geological time scale; during these spans of time specific systems of rocks were formed. Originally, the sequential nature of defining periods was a relative one, originating from the superposition of corresponding stratigraphic sequences and the evidence derived from paleontological studies. With the advent of radiometric dating methods, absolute ages for various periods can be determined.

period, in music, unit of melodic organization made up of several related consecutive phrases. Often the period has two phrases, typically of 8 or, in some cases, 16 measures each. The first phrase, called the antecedent, ends on a semi- or half-cadence and thus avoids any sense of finality; the second comes to a full cadential stop on the tonic, unless a modulation has occurred, in which case the full cadence confirms the new key.

Periodic structure is primarily a function of homophonic and especially diatonic music, in which the kind of sectionalization associated with the musical period operates at all structural levels. Polyphonic and monophonic textures, on the other hand, thrive on nonperiodicity, or aperiodicity, precisely because the resulting lack of clearly defined intersections generates the continuous flow of melodic energy that is the essence of music thus conceived.

periodic law, in chemistry, the generalization that there is a recurring pattern in the properties of the elements when they are arranged in order of increasing atomic number—*i.e.,* the total number of protons in the atomic nucleus. The periods (horizontal rows) of the periodic table illustrate these relationships.

A brief treatment of periodic law follows. For full treatment, *see* MACROPAEDIA: Chemical Elements. The article also contains a full-colour periodic table.

The elements, arranged in order of their increasing atomic numbers, are divided into seven periods reflecting periodicities in electronic structure and in chemical and physical properties. There are three short periods of 2, 8, and 8 elements; three long periods of 18, 18, and 32 elements, all of which are known; and a further long period predicted to contain 32 elements with atomic numbers from 87 to 118 (successful efforts to prepare elements with atomic numbers as high as 110 had been claimed by the late 1980s).

The progression of elements along a period represents a systematic occupation by electrons of orbitals, or electron shells. A period is completed when all the electron orbitals within a given energy level are filled.

The formulation of the periodic table began during the 1860s, when the Russian chemist Dmitry I. Mendeleyev undertook a detailed investigation of the relationship between the properties of the elements. In 1869, on the basis of an extensive correlation of the properties and the atomic weights of the elements, he proposed the periodic law and devised a tabular arrangement of the elements to show the observed relationships. Lothar Meyer, a German chemist, developed a similar classification of the elements independently of Mendeleyev at about the same time.

Mendeleyev's periodic table made it possible to observe many types of chemical relations hitherto studied only in isolation. It was not, however, widely accepted at first. The new classification system had gaps, but Mendeleyev predicted that they would be filled by elements not yet discovered. The validity of his predictions became apparent with the discovery of three new elements within the next 20 years. During the 1920s it was recognized that the order of elements in the periodic table is that of their atomic numbers. In subsequent years considerable progress was made in explaining the periodic law in terms of the electronic structure of atoms. This clarification greatly increased the value of the law.

periodic motion, in physics, motion repeated in equal intervals of time, the time of each interval being called the period. Periodic motion is performed, for example, by a rocking chair, a bouncing ball, a vibrating tuning fork, a swing in motion, the Earth in its orbit about the Sun, and a water wave. In each case the interval of time for a repetition, or cycle, of the motion is called a period.

In simple harmonic motion (*see* simple harmonic motion), the period is the time required to complete one vibration. One period therefore equals the reciprocal of the frequency, or 1/frequency; *e.g.,* a hummingbird's wing that beats with a frequency of 50 per second has a period of 0.02 second.

When a point moves around a circle with uniform speed, its projection on any line taken as the diameter (*i.e.,* the intersection of a line drawn through the point perpendicular to the diameter) will execute simple harmonic motion. Although the point is moving with constant speed, the projection point will accelerate or decelerate according to whether it is moving toward the centre of the circle or away from it. If the ratio of its displacement distance from the centre to the acceleration is denoted by c, then the period T of a simple harmonic motion is equal to 2π times the square root of c—*i.e.,* $T = 2\pi\sqrt{c}$.

Waves that can be represented by harmonic waves—*i.e.,* sine curves—are periodic. If the wave is propagated with a velocity v and has a wavelength λ, then the period (T) is equal to wavelength divided by velocity, or $T = \lambda/v$. Because frequency (f) is the reciprocal of the period—*i.e.,* $f = 1/T$—this equation may be written $f = v/\lambda$.

periodontal membrane, also called PERIODONTAL LIGAMENT, fleshy tissue between tooth and tooth socket that holds the tooth in place, attaches it to the adjacent teeth, and enables it to resist the stresses of chewing. It develops from the follicular sac that surrounds the embryonic tooth during growth.

The periodontal membrane contains blood vessels and sensory nerve endings for pain, touch, and proprioceptive sensation (sensation arising from stimuli within rather than outside the body), the latter providing the central nervous system with the feedback information necessary for coordinated muscle activity in complex activities such as mastication and swallowing.

periodontics, dental specialty concerned with the prevention, diagnosis, and treatment of functional and structural diseases of the periodontal membrane and related tissues that surround and support the teeth. Degeneration or inflammation of these tissues can be caused by various systemic or local diseases or by poor oral hygiene. In some cases the cause is not established. Most commonly, periodontic diseases are caused by hardened bacteria, called bacterial plaque, which adheres to teeth and destroys periodontal tissue. The most prevalent periodontal disease is periodontitis, inflammation of the periodontium.

periodontitis, inflammation of the soft tissues around the teeth, characterized by swollen, tender gums and eventual loss of teeth. Periodontitis begins with the deposition of bacterial plaque on the teeth below the gum line, irritating and eroding the neighbouring tissues. At this state, the condition is reversible, but left untreated the inflamed margin of the gum begins to recede, exposing the roots of the teeth; eventually the alveolar bone that anchors the teeth becomes involved, loosening the teeth to the point where they may fall out. Removal of all plaque deposits and affected soft tissues can arrest but not reverse alveolar deterioration.

Although the precipitating cause of periodontitis is poor dental hygiene leading to plaque deposition, an inherent susceptibility to osteoporosis and degeneration of connective tissues may also play a role in the more severe consequences of the disease. Familial juvenile periodontitis, an inherited condition resulting in tooth loss in early adulthood, is an extreme manifestation of this systemic susceptibility.

periosteum, dense fibrous membrane covering the surfaces of bones, consisting of an outer, fibrous layer and an inner, cellular layer. The outer layer is composed mostly of collagen and contains nerve fibres that cause pain when the tissue is damaged. It also contains many blood vessels, branches of which penetrate the bone to supply the osteocytes, or bone cells. These branches pass into the bone along channels known as Volkmann's canals to the vessels in the haversian canals, which traverse the length of the bone. Fibres from the inner layer also penetrate the underlying bone, serving, with the blood vessels, to bind the periosteum to the bone.

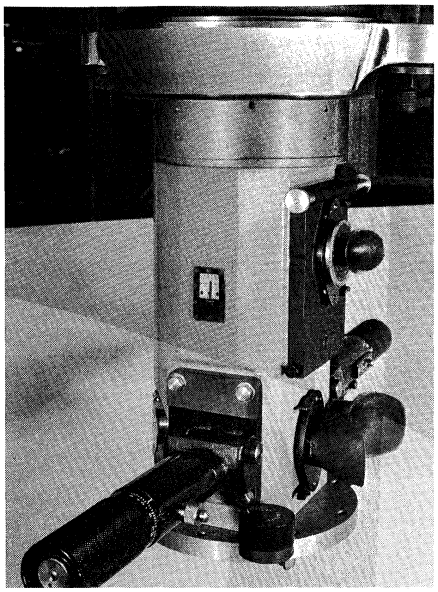
The inner layer of the periosteum contains osteoblasts (bone-producing cells) and is most prominent in fetal life and early childhood, when bone formation is at its peak. In adulthood these cells are less evident, but they retain their functional capacities and are vital to the constant remodeling of bone that goes on throughout life. In the event of bone injury they proliferate greatly to produce new bone in the repair process. Following an injury such as a fracture, the periosteal vessels bleed around the traumatized area and a clot forms around the fragments of bone. Within 48 hours the osteoblasts multiply and the inner layer of the periosteum expands to become many cell layers thick. The cells then begin to differentiate and lay down new bone between the ends of the fracture.

The periosteum covers all surfaces of the bone except for those capped with cartilage, as in the joints, and sites for attachment of ligaments and tendons. Fibrous cartilage often takes the place of the periosteum along grooves where tendons exert pressure against the bone. The periosteum on the inner surface of the skull is also modified to some extent as it joins the membrane protecting the brain, the dura mater.

peripeteia (Greek: "reversal"), the turning point in a drama after which the plot moves steadily to its denouement. It is discussed by Aristotle in the *Poetics* as the shift of the tragic protagonist's fortune from good to bad, which is essential to the plot of a tragedy. It is often an ironic twist, as in Sophocles' *Oedipus Rex* when a messenger brings Oedipus news about his parents that he thinks will cheer him, but the news, instead, slowly brings about the awful recognition that leads to Oedipus' catastrophe. The term is also used to refer to the hero's shift from bad fortune to good in a comedy.

periscope, optical instrument used in land and sea warfare, submarine navigation, and elsewhere to enable an observer to see his surroundings while remaining under cover, behind armour, or submerged.

A periscope includes two mirrors or reflecting prisms to change the direction of the light coming from the scene observed: the first deflects it down through a vertical tube, the second diverts it horizontally so that the scene can be viewed conveniently. Frequently there is a telescopic optical system that provides magnification, gives as wide an arc of vision as possible, and includes a crossline or reticle pattern to establish the line of sight to the object under observation. There may also be devices for estimating the range and course of the target in military applications and for photographing through the periscope.



Periscope, eyepiece box and observer's station; handles control rotation about the axis, twist grips provide control of the line-of-sight elevation

By courtesy of Kollmorgen Corp., Northampton, Mass.

The simplest type of periscope consists of a tube at the ends of which are two mirrors, parallel to each other but at 45° to the axis of the tube. This device produces no magnification and does not give a crossline image. The arc of vision is limited by the simple geometry of the tube: the longer or narrower the tube, the smaller the field of view. Periscopes of this type were widely used in World War II in tanks and other armoured vehicles as observation devices for the driver, gunner, and commander. When fitted with a small, auxiliary gunsight telescope, the tank periscope can also be used in pointing and firing the guns. By employing tubes of rectangular cross section, wide, horizontal fields of view can be obtained.

perissodactyl, member of the mammalian order Perissodactyla, made up of 15 species of herbivorous hoofed mammals divided into 3 families: the horses, asses, and zebras (Equidae), the rhinoceroses (Rhinocerotidae), and the tapirs (Tapiridae). Members of the order are characterized by an odd number of toes on the hind foot, as distinguished from the even-toed ungulates of the Artiodactyla (*e.g.,* cattle, swine).

A brief treatment of perissodactyls follows. For full treatment, *see* MACROPAEDIA: Mammals.

Living perissodactyls are remnants of a large and varied group that flourished in the Tertiary Period (2,500,000 to 65,000,000 years ago). Eight entire families known from the fossil record are extinct, in addition to numerous species from the three families still extant. The fossil history of the order is well-known, especially in the case of Equidae, making their development of great scientific interest and a significant force shaping evolutionary thought. The perissodactyls are large, ranging from the 600-pound (270-kilogram) tapir to the 4,500-pound (2,040-kilogram) rhinoceros. All perissodactyls feed by grazing or browsing, and their teeth have evolved specialized forms adapted to grinding. Various living species have seen their numbers reduced by hunting and human expansion; many are presently protected in game reserves and national parks.

Horses, asses, and zebras adapted to a variety of environments, although not forests or other areas of dense vegetation. They are a highly specialized running form, subsisting almost entirely on grasses. Two races of wild horse (*Equus caballus*), one gray (the tarpan) and one reddish brown (*E. c. przewalskii*), were once widely distributed throughout northern Eurasia. The tarpan became extinct in the Ukraine in the mid-19th century, while Przewalski's horse, thought to have disappeared as a truly wild animal before 1950, may still exist in the remote semidesert lands near the Mongolian–Chinese border. The domestic horse, a descendant of the wild horse, is found throughout the world.

Three species of zebra are found on the African continent, ranging from mountainous terrain to sparsely wooded savanna. Originally very numerous, their numbers have also been severely reduced (one variety now numbers perhaps 100 animals) primarily by competition from domestic livestock for meagre pastureland. A large proportion of zebras are to be found in reserves or enjoying legal protection.

The true ass (*Equus asinus*), found in arid North Africa, is the ancestor of the modern donkey. It is probable that truly wild asses no longer exist, the strain having been diluted by interbreeding with escaped or released domestic donkeys. All races of the half-asses (*E. hemionus*) that are not extinct are rare. The species, which includes the onager, one of which stands only 1 m (3 feet) tall at the shoulder, ranges from Syria through Central Asia to Mongolia.

There are two living species of rhinoceros found in Africa and three in Asia. As with the *Equus* family, all species have been severely reduced in number, some presently being close to extinction, and many are protected in reserves and parks. All are characterized by very large size, extremely thick and mainly hairless hides, and one or, in the case of the Indian rhinoceros, two horns. The African species are the black, or prehensile-lipped, rhinoceros and the white, or square-lipped, rhinoceros. The black rhinoceros, ranging from southern Africa to as far north as the Côte d'Ivoire, is a selective browser and can apparently survive without free water by devouring succulent plants. Its numbers have been reduced mainly by poachers seeking the horns. The much larger white rhinoceros is mainly a grazing animal whose numbers have been reduced to the approximately 1,700 confined to the game reserves of Zululand and an additional population in Zaire.

Less than 1,000 members of the three Asian rhinoceroses survive today in widely separated pockets. The Sumatran rhinoceros, the smallest of the family, standing 1 to 1.5 m (3 to 5 feet) at the shoulder, is thought to number between 100 and 170. Only 25 to 60 Javan rhinoceroses survive, confined to a single reserve in western Java. The most numerous species, the Indian, or one-horned, rhinoceros, is threatened by hunting and by expanding human populations.

The tapirs are rounded, semiamphibious, piglike creatures that inhabit forests and woodlands, subsist by browsing, and are characterized by a trunklike snout and a coat of short, bristly hair. One Asian species (*Tapirus indicus*), the largest tapir, is found in Sumatra and the Malay peninsula, while three species, the mountain (*T. pinchaque*), Baird's (*T. bairdii*), and the Brazilian (*T. terrestris*), range throughout Middle and South America. The mountain tapir is the smallest and most primitive species and is found in Colombia and Ecuador at altitudes up to 15,000 feet. Baird's tapir, the largest, extends from Mexico to coastal Ecuador. Its shyness and difficulty in adjusting to human settlement have greatly reduced its range and numbers.

All ungulates, including the perissodactyls, were probably derived from the order Condylarthra, unspecialized tapir-sized mammals, and emerged 55,000,000 to 40,000,000 years ago, during the Eocene. The earliest horses (formerly *Eohippus*, now known as *Hyracotherium*) were browsing, forest-dwelling creatures, sometimes no larger than a fox terrier, that appeared in Europe and North America. *Pliohippus*, the line from which modern horses are descended, developed in North America during the Pleistocene and then spread throughout most of the world. One group of animals (*e.g.*, *Homogalax*) was the common ancestor of both the tapirs and rhinoceroses. After the separation of the families, some rhinoceros ancestors developed massive horns, and one, *Baluchitherium*, grew to stand 5.5 metres (18 feet) at the shoulder.

The perissodactyls as a rule avoid human contact and play little rôle in the affairs of man. The exceptions, of course, are the equines, particularly the horse and ass, whose importance in the history of mankind as pack, draft, and riding animals, as well as occasionally as food, is very great indeed.

peristalsis, involuntary movements of the longitudinal and circular muscles, primarily in the digestive tract but occasionally in other hollow tubes of the body, that occur in progressive wavelike contractions. Peristaltic waves occur in the esophagus, stomach, and intestines. The waves can be short, local reflexes or long, continuous contractions that travel the whole length of the organ, depending upon their location and what initiates their action.

In the esophagus, peristaltic waves begin at the upper portion of the tube and travel the whole length, pushing food ahead of the wave into the stomach. Particles of food left behind in the esophagus initiate secondary peristaltic waves that remove leftover substances. One wave travels the full length of the tube in about nine seconds. The peristaltic-wave contractions in the esophagus of humans are weak compared with those of most other mammals. In cud-chewing animals, such as cows, reverse peristalsis can occur so that the food is brought back from the stomach to the mouth for rechewing.

When the stomach is filled, peristaltic waves are diminished. The presence of fat in a meal can completely stop these movements for a short period until it is diluted with gastric juices or removed from the stomach. Peristaltic waves start as weak contractions at the beginning of the stomach and progressively become stronger as they near the distal stomach regions. The waves help to mix the stomach contents and propel food to the small intestine. Usually, two to three waves are present at one time in different regions of the stomach, and about three waves occur each minute.

In the small intestine, local stimulation of the intestinal smooth muscle by the presence of food particles causes contractions that tend to travel from the stimulated point in both directions. Under normal circumstances, the progress of the contractions in an oral direction is quickly inhibited, while the contractions travelling away from the mouth tend to persist. If the intestine is paralyzed by applying such drugs as nicotine or cocaine to the intestinal wall, the contractions initiated by local stimulations travel equally well in both directions. Ordinarily, peristaltic waves appear in the small intestine at irregular intervals and travel for varying distances; some travel only a few inches, others a few feet. They serve to expose food to the intestinal wall for absorption and to move it forward.

In the large intestine (or colon), the peristaltic wave, or mass movement, is continuous and progressive; it advances steadily toward the anal end of the tract, pushing waste material in front of the wave. When these movements are vigorous enough to pass fecal masses into the rectum, they are followed by the desire to defecate. If feces are passed to the rectum and not evacuated from the body, they are returned to the last segment of the colon for longer storage by reverse peristaltic waves. Peristaltic waves are particularly important in helping to remove gas from the large intestine and in controlling bacterial growth by mechanically acting as a cleansing agent that dislodges and removes potential colonies of bacteria.

peristerite, iridescent gemstone in the plagioclase (*q.v.*) series of feldspar minerals. The name (from Greek *peristera,* "pigeon") refers to the resemblance of fine specimens such as those from Ontario and Quebec to the commonly iridescent feathers of a pigeon's neck. In peristerite—usually a form of one of the sodium-rich varieties of plagioclase albite or oligoclase—the sodium aluminosilicate and calcium aluminosilicate that make up the mineral separate and form intergrowths of submicroscopic but distinct crystals of the two compounds. The iridescence probably arises from diffusion of light by adjoining areas of different optical properties, or from reflection and diffraction of the separating crystals of the two different substances.

peritoneum, large membrane in the abdominal cavity that connects and supports internal organs. It is composed of many folds that pass between or around the various organs. Two folds are of primary concern: the omentum, which hangs in front of the stomach and intestines; and the mesentery, which attaches the small intestine and much of the large intestine to the posterior abdominal cavity.

The omentum and mesentery contain blood vessels, nerves, lymph nodes, varying amounts of fat, elastic fibres for stretching, and collagen fibres for strength. The omentum is thinner than the mesentery and is lacy in appearance. It contains large quantities of fat that serve to keep the organs warm. The mesentery is fan-shaped and well supplied with blood vessels that radiate to the intestines.

The functions of these membranes are to prevent friction between closely packed organs by secreting serum that acts as a lubricant, to help hold the abdominal organs in their proper positions, to separate and unite organs, and to guard as a barrier against infection.

peritonitis, inflammation of the peritoneum, the membrane that lines the abdominal wall and then folds in to enclose the abdominal organs. The condition is marked by an accumulation of serum, fibrin, cells, and pus in the peritoneal cavity (between the two folds of the peritoneal membrane) and by abdominal pain and distension, vomiting, and fever.

Peritonitis may be acute or chronic, generalized or localized. Acute peritonitis is usually secondary to an inflammatory process elsewhere in the body and may be caused by a variety of agents, such as a bacterial invasion from an infected body structure, or blood or other body fluids from a ruptured organ. A perforated gastrointestinal tract, notably a ruptured appendix, is a common primary cause of peritonitis. Control of the source of inflammation is followed either by remission of the peritoneal inflammation, by the formation of adhesions sealing the two sides of the peritoneal cavity, or by localized abcesses in the peritoneum, which must then be drained. Antibiotic therapy has greatly decreased the incidence of the latter complication.

peritonsillar abscess (disease): *see* quinsy.

peritrich, any ciliated vase-shaped protozoan of the order Peritrichida (more than 1,000 species), found in both fresh and salt water. Usually nonmotile (sessile), they attach themselves to underwater objects, but a few genera, such as *Telotrochidium,* are free-swimming. In most peritrichs a posterior disk, the scopula, secretes a contractile stalk for attachment. Some primitive forms, such as the genus *Scyphidia,* attach directly to an object with the adhesive secreted by the scopula. Peritrichida, lacking uniform ciliation, have conspicuous rows of cilia (short hairlike processes) around the mouth, and there is a posterior ring of cilia in the free-swimming migratory adults and larvae. Reproduction by longitudinal fission differs from the usual ciliate transverse fission. Some sessile genera (for example, *Vorticella*) are solitary; others (*e.g., Zoothamnium*) form branching colonies. Peritrichs are coming to serve a useful role in ecological studies as pollution indicators.

Peritrich (*Zoothamnium* colony)
J.M. Langham

periwig: *see* peruke.

periwinkle, in botany, any of various plants of the genus *Vinca* of the dogbane family (Apocynaceae). The name periwinkle is possibly taken from *pervinka*, the Russian name of the flower, which in turn is derived from *pervi*, "first," as it is one of the first flowers of spring. The lesser periwinkle (*V. Minor*), with lilac-blue flowers, 2 centimetres ($^{3}/_{4}$ inch) across, an evergreen, trailing perennial, is native to Europe and is found in the British Isles. Introduced into North America, it is now widespread over much of the eastern continent. The similar greater periwinkle (*V. major*), with purplish-blue flowers, $2^{1}/_{2}$ to 5 cm across, native to continental Europe, has become naturalized in England.

periwinkle, in zoology, any small marine snail belonging to the family Littorinidae. Peri-

Periwinkles (*Littorina*)
Jane Burton—Bruce Coleman Ltd.

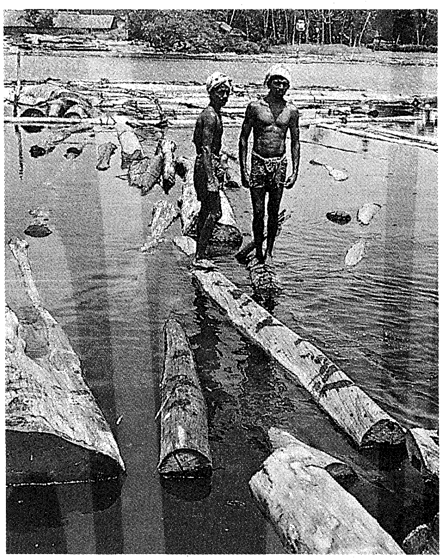
winkles are widely distributed shore (littoral) snails, chiefly herbivorous, usually found on rocks, stones, or pilings between high- and low-tide marks; a few are found on mud flats, and some tropical forms are found on the prop roots or mangrove trees. Of the approximately 80 species in the world, 10 are known from the western Atlantic. The common periwinkle, *Littorina littorea*, is the largest, most common and widespread of the northern species. It may reach a length of 4 centimetres (1 1/2 inches), is usually dark gray, and has a solid spiral (turbinate) shell that readily withstands the buffeting of waves. Widespread along the rocky shores of northern Europe, the common periwinkle was introduced into North America at Halifax, Nova Scotia, in about 1857 and has spread as far south as Maryland. It is very common on the rocky shores of New England and also occurs on shallow muddy bottoms, along the banks of tidal estuaries, and among the roots and blades of marsh grass where the water is only moderately salty.

The breeding habits of periwinkles are quite variable. *Littorina saxatilis*, which lives high up on rocks and is often out of water for long periods of time, holds its eggs in a brood sac until the young are fully developed, at which time they emerge as tiny crawling replicas of the adult.

All species in the Littorinidae are important as a favourite food of many shore birds, particulary ducks.

Certain other marine snails, such as the common northern lacuna (*Lacuna vincta*), are sometimes called periwinkles. In many sections of the southern United States, the term periwinkle, or pennywinkle, is applied to any small freshwater snail.

Periyār, river and lake in southern Kerala state, southwestern India. The river, 140 mi (225 km) long, rises in the Western Ghāts range near the border with Tamil Nādu state and flows north to Periyār Lake in Kottayam



Logging on the Periyār River, Kerala, India
Gilbert Leroy—C.I.R.I.

district. The lake, 12 sq mi (31 sq km) in area, is an artificial reservoir created by damming the river. It lies at an altitude of 2,800 ft (850 m), is ringed by mountain peaks, and is surrounded by a wildlife sanctuary. A tunnel carries water from the lake eastward through the mountains to the Vaigai River in Tamil Nādu, where it is used for irrigation.

From the lake the Periyār River flows in a generally northwest direction through the mountains and onto the coastal plain, past Alwaye, emptying into the Arabian Sea at Parūr. Further development of the river during the late 20th century included construction of a hydroelectric project and another irrigation dam.

Periyār Wild Life Sanctuary, wildlife preserve in Idukkī district, Kerala state, southern India. The sanctuary is noted for herds of elephants, sometimes numbering 50 members. In addition, bonnet monkey, nilgai, langur, porcupine, sloth bear, tiger, leopard, Asian elephant, barking deer, gray jungle fowl, kingfisher, the great Indian hornbill, and the southern grackle are found in the preserve. Extending over an area of 297 sq mi (770 sq km), the sanctuary encompasses Periyār Lake, formed in the early 1900s by impounding the Periyār River, and is located near the Kerala–Tamil Nādu border about 73 mi (118 km) south of Ernākulam and 170 mi northeast of Trivandrum. At an altitude of about 4,600 ft (1,600 m), the hilly topography has produced a lakeshore varied by numerous creeks, bays, and promontories. The vegetal cover is tropical evergreen and deciduous, with patches of dense forest including jackfruit, teak, and kokam trees. Most of the grassland is now planted with eucalyptus.

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perjury, willful, knowing, and corrupt giving under oath of false testimony regarded as material to the issue or point of inquiry. All elements of the crime are essential for conviction. Criminal intent is required; a person who makes a false statement and then later corrects himself has not committed perjury. The testimony must be material to the issue of inquiry, since perjury on a point not material can be no more than a misdemeanour and may not be punished at all.

The giving of false testimony under oath distinguishes perjury from criminal contempt. The latter is an obstruction of the administration of justice, usually in violation of an order of the court. Some perjuries that have the effect of obstructing the adjudication of a case may be given increased punishment for that reason. Generally, however, punishment is directed less against the effect of the perjury than against the disregard of the oath itself. Thus, a man who perjures himself numerous times during the adjudication of one case may be convicted of only a single perjury, though his punishment may be increased.

One who knows of another's perjury and does not make his information known to authorities may be convicted of a separate offense of subornation of perjury. This offense covers anyone who is implicated in the perjury.

Perkin, Sir William Henry (b. March 12, 1838, London—d. July 14, 1907, Sudbury, near Harrow, Middlesex, Eng.), British chemist who discovered aniline dyes.

In 1853 Perkin entered the Royal College of Chemistry, London, where he studied under August Wilhelm von Hofmann. While Perkin was working as Hofmann's laboratory assistant, he undertook the synthesis of quinine. He obtained instead a bluish substance with excellent dyeing properties that later became known as aniline purple, Tyrian purple, or mauve. In 1856 he obtained a patent for manufacturing the dye, and the next year, with the aid of his father and his brother Thomas, he set up an aniline manufacturing plant near Harrow.

In 1858 he and B.F. Duppa synthesized glycine in the first laboratory preparation of an amino acid. They synthesized tartaric acid in 1860. After Graebe and Liebermann announced their synthesis of the red dye alizarin, Perkin developed a cheaper procedure, obtained a patent for his process, and held a monopoly on its manufacture for several years. In 1867 he discovered a chemical process for preparing unsaturated acids. The following year he used this process, which became known as the Perkin reaction, to synthesize coumarin, the first artificial perfume. He also investigated other dyes, salicyl alcohol, and flavourings. About 1874 he abandoned manufacturing and devoted himself to research, not only studying chemical processes but also investigating the optical rotation of various substances. He was knighted in 1906, the 50th anniversary of his discovery of mauve.

Perkins, Frances, original name FANNIE CORALIE PERKINS (b. April 10, 1882, Boston—d. May 14, 1965, New York City), U.S. secretary of labor during the presidency of Franklin D. Roosevelt. Besides being the first woman to be appointed to a Cabinet post, she also served one of the longest terms of any Roosevelt appointee (1933–45).

Perkins' appointment met with some resistance from business and political leaders, and even organized labour greeted her selection coolly. She was regarded as a social reformer, and indeed she had spent most of her life in that capacity. After graduating from Mount Holyoke College (South Hadley, Mass.) in 1902, she taught school and performed church-related social work. For a short time she assisted Jane Addams at Hull House in Chicago, but she soon left for Philadelphia, where she worked with immigrant girls. She did graduate work at the University of Pennsylvania before transferring to Columbia University, where in 1910 she received a master's degree in social economics.

During the next two decades, Perkins dedicated herself to social reform in New York. As executive secretary (1910–12) of the Consumers' League of New York, she lobbied successfully for improved wages and working conditions, especially for women and children. From 1912 to 1917 she held an equivalent position with the New York Committee on Safety, where she became acquainted with Roosevelt while lobbying for a limitation of the workweek for women to 54 hours.

After serving as director of the New York Council of Organization for War Service, Perkins was appointed to the New York State Industrial Commission and later to the Industrial Board. She became chairman of the board in 1926, and in 1929 Roosevelt (then governor of New York) made her state industrial commissioner. With the onset of the Great Depression, Perkins became a prominent advocate for unemployment compensation and governmental involvement in the economy.

As secretary of labor under Roosevelt, Perkins pushed for a minimum wage and maximum workweek, a limit on employment of children under 16, creation of the Civilian Conservation Corps, and unemployment compensation—all of which were enacted. She helped draft the Social Security Act and supervised the Fair Labor Standards Act (1938). When the focus of labour activity shifted in the late 1930s from government to unions, Perkins played a less visible role. Her most important work was now the building up of the Department of Labor, particularly the strengthening of the Bureau of Labor Statistics.

Two months after Roosevelt's death, Perkins resigned from the Cabinet, but she remained in government as a U.S. Civil Service commissioner until 1953. From then until her death, she lectured on the problems of labour and industry. *The Roosevelt I Knew,* a record of her association with the president, was published in 1946.

Perkins, George Walbridge (b. Jan. 31, 1862, Chicago—d. June 18, 1920, Stamford, Conn., U.S.), U.S. insurance executive and financier who organized the health insurance agency system and the corporate structures of several large companies. He also served as chairman of Theodore Roosevelt's Progressive Party, organizing Roosevelt's 1912 presidential campaign.

When Perkins became an office boy for the New York Life Insurance Company in 1877, the company gave charge of territories to general agents who then hired their own salesmen. The salesmen had no company loyalty and often made exaggerated claims for a policy to get the premium. By 1892 Perkins was third vice president in charge of all agencies. Instead of contracting with general agents, he hired local salesmen directly and made them permanent employees. In 1896 he developed a new system of employee benefits based on number of years on the job and policies sold.

In 1900 he was chairman of the Palisades Interstate Park Commission. The following year he became a partner in the banking firm of J.P. Morgan & Company, in which capacity he reorganized corporations such as International Harvester, International Mercantile Marine, and United States Steel. He set up plans for employees of these companies to purchase stock at less than market value and established sick pay and old-age pensions.

In 1910 he retired from business to promote his views about the need for cooperation in business. His published speeches include *National Action and Industrial Growth* (1914), *The Sherman Law* (1915), and *Profit Sharing* (1919).

Perkins, Jacob (b. July 9, 1766, Newburyport, Mass.—d. July 30, 1849, London), American inventor who produced successful innovations in many fields.

In about 1790 Perkins built a machine to cut and head nails in one operation, but the plant he opened to exploit it was ruined by an extended lawsuit over the invention. He subsequently devised a method of bank-note engraving that made counterfeiting extremely difficult. Failing to attract American interest in the process, Perkins and his partner set up a factory in England and in 1819 began printing notes for local banks; after 1840 the factory was also authorized to print Britain's first penny postage stamps.

Perkins also experimented with high-pressure steam boilers and in 1823 devised means to attain working steam pressure of 800–1400 psi. He built a Woolf-type steam engine (1827), designed an improved paddle wheel (1829), and invented a means for the free circulation of water in boilers (1831), which led to the design of modern water-tube boilers. He was awarded a medal by the Society for the Encouragement of the Arts for his method of ventilating ships' holds.

Pērkons (Latvian: "Thunderer"), Lithuanian PERKŪNAS, Old Prussian PERKUNIS, sky deity of Baltic religion, renowned as the guardian of law and order and as a fertility god; the oak, as the tree most often struck by lightning, is sacred to him. Pērkons is related in functions and image to the Slavic Perun, Germanic Thor, and Greek Zeus.

Often depicted as a vigorous, bearded man holding an ax, Pērkons rides across the sky striking fire with his two-wheeled chariot and bringing rain to farmers. In the spring his lightning purifies the earth and stimulates plant growth. Pērkons also directs his thunderbolts against evil spirits and unjust men and even disciplines the gods. Lithuanian legend recounts that when Mēnuo, the moon god and husband of Saule, goddess of the Sun, committed adultery, Perkūnas punished his infidelity by cutting him to pieces.

According to ancient tradition, thunderbolts—"bullets of Pērkons," found buried in the ground as flint or bronze celts—or any object or person struck by lightning could be used by mortals as protection against devils or as cures for toothache, fever, and fright. Probably the most popular of all Baltic gods, Perkūnas is often referred to in Lithuanian as *dievaitis,* an archaic diminutive of *dievas* ("god").

Perlas, Archipiélago de las (Panama): *see* Pearl Islands.

Perlepe (Yugoslavia): *see* Prilep.

Perlis, state (*negeri*), northwestern West Malaysia (Malaya), wedged between Thailand and northwestern Kedah State, with a short coastline on the Andaman Sea (southwest). The smallest (307 sq mi [795 sq km]) and most northerly of the Malayan states, it was part of Kedah until 1821. Given sultanate status by Thailand in 1841, Perlis became one of the Unfederated Malay States under British protection when Thai suzerainty ended (1909). After temporary annexation by Thailand in 1943, it again became a British protectorate in 1945 and later joined the Federation of Malaya.

Mainly occupying a closely cultivated and densely settled plain, formed by short streams (from a steep northeastern range) that combine to form the Sungai (River) Perlis, it is one of the country's most productive paddy-(rice-) growing regions. Regular crops of dry paddy are sown, as the coarse alluvium and erratic streams present problems of water shortage for wet farming. A 20,000 ac (8,100 ha) sugar plantation and refinery are located at Chuping. Rubber and coconuts are minor crops. Kuala Perlis and Sanglang are small fishing villages with houses built on stilts over water. While Malay paddy farmers are an overwhelming majority, some Chinese are engaged in tin mining in the underground caves and crevices of the northern limestone hills (which also are the basis of a cement factory that began production in 1975); they live in small mining settlements such as Kaki Bukit.

Because of its size, Perlis is not divided into administrative districts. Kangar, the state capital, is a dispersed, open settlement, and the sultan resides at nearby Arau. Roads link the main villages, including Bukit Keteri, Simpang Ampat, and Beseri. At Padang Besar ("big field"), a port of entry, the Malayan Railway crosses into Thailand. Bukit Tengku Lembu is the site of a Neolithic burial ground. Pop. (1982 est.) 150,322.

perlite, also called PEARLSTONE, a natural glass with concentric cracks such that the rock breaks into small, pearl-like bodies. It is formed by rapid cooling of viscous lava or magma. Perlite has a waxy to pearly lustre and is commonly gray or greenish but may be brown, blue, or red.

Some perlites are of intrusive origin (dikes), but others constitute major portions of lava flows. These glassy rocks may grade into nearly completely crystalline volcanic types. Like obsidian, they may contain large crystals (phenocrysts) of quartz, alkali feldspar, plagioclase feldspar, and, in some cases, biotite or hornblende; where phenocrysts are abundant the rock passes into vitrophyre.

A rhyolite (*q.v.*), perlite has chemical composition, index of refraction, and specific gravity similar to those of obsidian (*q.v.*). Its water content, however, is considerably higher (generally 3 to 4 percent); much of it is absorbed, subsequent to consolidation, from the sea or wet sediments into which the perlite was intruded.

Devitrification, or conversion of the glass to a microscopically fine crystalline aggregate, is usually initiated spontaneously along cracks or at the surfaces of phenocrysts and crystalline bodies (spherulites). Some minutely crystalline rocks show well-developed perlitic structure and undoubtedly represent completely devitrified perlite. The localization of spherulites along curved and concentric bands in certain glass-free rocks suggests a devitrified perlite with spherulitic growth along the perlitic cracks.

Before about 1950 perlite was virtually unknown in commerce. Since then, however, great deposits have been worked in New Mexico, Nevada, California, and other western states; production outside the United States has increased very slowly, the chief producers being the Soviet Union and Greece. When crushed perlite is rapidly heated, the contained water is converted to steam; tiny bubbles are formed within the softened rock, and the perlite is thus expanded up to 20 times its original volume. Because of its very low density, heat-treated perlite is a substitute for sand in lightweight wall plaster and concrete aggregate. The porous nature of perlite makes the material ideal for heat and sound insulation; other uses include lightweight ceramic products, filters, and fillers.

Perlman, Itzhak (b. Aug. 31, 1945, Tel Aviv, Israel), Israeli-born violinist known for a brilliant virtuoso technique. His refinement of detail led many critics to regard him as one of the finest performers of the major violin repertoire of his time.

At the age of four Perlman was a victim of polio, which left his legs paralyzed. His first public concert was in Tel Aviv, at the age of 10. In 1958 he went to the Juilliard School in New York City to study with Ivan Galamian and Dorothy DeLay. He made his Carnegie Hall debut in 1963 and won the Leventritt Prize a year later, which brought him immediate engagements with major American orchestras. He returned to Israel in 1965 for a successful tour and made his London debut in 1968 but continued to reside in New York City. Thereafter he gave international concert tours, taught and played in numerous major music festivals, and recorded most of the standard violin works.

Perm, *oblast* (administrative region), western Russian Soviet Federated Socialist Republic, occupying an area of 62,000 sq mi (160,600 sq km) on the western flank of the central Urals, extending from the crestline in the east across the broad basin of the middle Kama to the Verkhne (Upper) Kama upland in the west. The northwestern corner is occupied by the Komi-Permyak autonomous *okrug* (area). Almost the entire *oblast* is thickly forested, with swampy forest, or taiga, of spruce, fir, pine, and birch. Extensive floodplain meadows line the rivers. In 1982, 75 percent of the population was urban, reflecting Perm's position as part of the Urals industrial area. It is exceptionally rich in minerals, notably salt and potassium along the Kama; these are the basis of the chemical industry of Berezniki, Solikamsk, and Perm city, the administrative centre. Petroleum is extracted along the Kama, in the Sylva and Iren valleys, and in the south and is refined in Perm and Krasnokamsk. Chusovoy and Lysva have metallurgical plants, and most cities have engineering industries. Coal is mined in the Kizel area. The forests supply paper, pulp, and other timber-working industries. Agriculture has a minor role, except for intensive market gardening around the cities. There are several large power stations, notably the Kama hydroelectric plants. Pop. (1984 est.) 3,027,000.

Perm, formerly (1940–57) MOLOTOV, city and administrative centre of Perm *oblast* (region), western Russian Soviet Federated Socialist Republic, on both banks of the Kama River. In 1723 a copper-smelting works was founded at the village of Yegoshikha (founded 1568), at the junction of the Yegoshikha and Kama rivers. In 1780 the settlement of Yegoshikha became the town of Perm, although another town, Perm Velikaya (Perm the Great; now Cherdyn), had existed 150 mi (240 km) upstream since the 14th century. The city grew in commercial importance through its position on the navigable Kama and on the Great Siberian Highway, established in 1783, and, later, on the Trans-Siberian Railroad, which was completed to Yekaterinburg (now Sverdlovsk) in 1878. Modern Perm is still a major focus of communications and is also one of the chief industrial centres of the Urals region. It has large-scale engineering industries, a major oil refinery, and a large chemical industry, making fertilizers and dyes. The city's institutions of higher education include A.M. Gorky University, founded in 1918. There are several theatres, a notable art gallery, and a school of ballet. Perm gives its name to the Permian Period (from 286 to 245 million years ago), which was first identified in geologic strata in the locality. Pop. (1989 prelim.) 1,091,000.

permafrost, permanently frozen earth, with a temperature below 0° C (32° F) continuously for two or more years. Permafrost is estimated to underlie 20 percent of the Earth's land surface and reaches depths of 1,525 m (5,000 feet) in northern Siberia. It occurs in 85 percent of Alaska, 50 percent of the Soviet Union, and Canada, and probably all of Antarctica. The position of the southern boundary of permafrost in the Northern Hemisphere corresponds approximately to the position of the line connecting points whose mean annual air temperature is 0° C.

A brief treatment of permafrost follows. For full treatment, *see* MACROPAEDIA: Ice and Ice Formations.

Permafrost is overlain by a surface layer which is subject to thawing during the warmer seasons of the year. This zone of seasonal freezing and thawing is termed the active layer, and the maximum depth of thaw penetration delimits the top of the permafrost (permafrost table). The depth to which soil is thawed will vary on an annual basis according to the vagaries of summer temperature. Hence a layer may occur above the permafrost table which may be subject to thaw only in certain years. Such a layer has been termed the pereletok, or supra-permafrost layer. Sporadic bodies of permafrost are often buried by perennially thawed ground that is itself overlain by the seasonally frozen active layer. Such unfrozen layers, as well as islands of thawed ground surrounded by permafrost, are called taliks.

Permafrost is essentially the product of a negative heat balance at the ground surface. Where mean annual ground-surface temperatures are below 0° C, summer thaw depths will be exceeded by winter freezing depths, resulting in permafrost growth. If the condition is maintained, the progressive downward extension of the permafrost will ultimately be counterbalanced by the geothermal heat flow from the Earth's interior. The resultant equilibrium depth will determine the permafrost's base. Thus, the lower the mean surface temperature, the greater the depth at which the equilibrium position will lie.

Although permafrost may exist without any ice content, it is usually associated with the presence of ground ice. Ice occurs in many forms and variable amounts in ground permafrost and often exceeds all other materials in quantity. It is present as crystals of diverse size and shape, as grains, films, veins and lenses, and as large masses. Annual surface-temperature fluctuations affect the ice in the uppermost part of the permafrost where it lies within about 10–20 m (30–65 feet) of the surface. Rapid cooling in the winter may cause thermal contraction cracks to propagate down from the permafrost table and also up to the surface. These become infilled by snow and hoarfrost or by fine mineral particles. Repeated cracking and ice growth results in the growth of ice wedges in vertical section and polygons in horizontal form, two of the most widespread geomorphic features associated with permafrost. Complex stress forces operating within permafrost layers may produce such surface features as mud spots, frost blisters, ice mounds, and pingos. Pingos, which are hills composed largely of ice, originate in swampy lowlands and may attain heights exceeding 200 feet (60 m) and diameters of several hundred feet.

Most authorities recognize a geographic subdivision of permafrost into two zones, continuous and discontinuous, with some recognizing an outer fringe to the latter that is called a sporadic zone. Within the continuous zone, permafrost everywhere underlies the ground surface and is usually continuous in depth down to its lower limit. Within the discontinuous zone, the lateral continuity of the permafrost is broken to create alternating frozen and talik areas. As the sporadic zone is approached, the amount and thickness of the residual permafrost decreases. Beyond the main permafrost belt, limited areas of permafrost are present where elevation reduces the mean annual temperature regime, with the permafrost lying as cores to the mountain massifs. Permafrost is essentially continuous in polar regions, becomes increasingly discontinuous at lower latitudes, and occurs only sporadically towards its geographic limits.

Permafrost and the geomorphic processes associated with it have a significant effect on the development and distribution of plant and animal life where it occurs. Its practical importance to human affairs is that it presents special problems in essentially all engineering projects. The buildup of ground ice is a response to a long and complex thermal history, and its preservation is dependent upon the insulatory properties of the overlying active layer. Because of this factor, land use in permafrost environments must take account of the special geomorphic sensitivity of the terrain. Where permafrost occurs, waste disposal, mining activities, well drilling, and road, airstrip, and building construction all pose critical problems. The delicate thermal balance within the active layer must be maintained; otherwise, extensive permafrost degradation may be induced and cause a loss in the weight-bearing strength of the permafrost.

An interesting aspect of permafrost is the preservation in it of the carcasses of extinct Ice Age mammals; one or two almost complete, frozen mammoths dating from at least 10,000 years ago have been reported from Siberia.

Permalloy, trademark of the Western Electric Company for nickel-iron alloys having much higher magnetic permeability than iron alone. It is widely used for fabricating the thin pieces that are laminated to form transformer cores. The proportion of nickel may range from 35 to 90 percent, depending on the properties desired, and is about 78 percent for low-power transformers. Hipernik (trademark of the Westinghouse Electric Company) is an alloy of 50 percent nickel useful for high-power transformers. Heating Permalloy containing 5 percent molybdenum in pure hydrogen yields Supermalloy, with even higher permeability.

permeability, capacity of a porous material for transmitting a fluid; it is expressed as the velocity with which a fluid of specified viscosity, under the influence of a given pressure, passes through a sample having a certain cross section and thickness. Permeability is largely dependent on the size and shape of the pores in the substance and, in granular materials such as sedimentary rocks, by the size, shape, and packing arrangement of the grains.

The standard unit of permeability is the darcy, equivalent to the passage of one cubic centimetre of fluid (having a viscosity of one centipoise) per second through a sample one square centimetre in cross-sectional area under a pressure of one atmosphere per centimetre of thickness.

permeability, magnetic: *see* magnetic permeability.

Permeke, Constant (b. July 31, 1886, Antwerp, Belg.—d. Jan. 4, 1952, Ostend), painter and sculptor who was significant in the development of Expressionism in Belgium.

Permeke studied at art academies in Bruges and Ghent. He came to know fellow Belgian artists Frits van den Berghe and Gustave and Léon de Smet and from 1909 to 1912 joined them at a popular artists' colony at Laethem-Saint-Martin, Belg. In England during World War I, Permeke composed some of his most profound paintings. His thick brushwork, sombre, earthy colours, and depictions of massive human figures helped usher Belgian painting into a new era. Although his subjects and themes were grounded in the Flemish tradition—farmers, fishermen, and everyday life—Permeke's personal vision gave powerful expression to the ordinary, as in "The Oarsmen" (1921). In 1935 he began sculpting torsos and nudes that were marked by the same solid, weighty, and often brutal style.

Permian Basin, also called WEST TEXAS BASIN, large sedimentary basin in western Texas and southeastern New Mexico that is noted for its rich petroleum and natural-gas deposits. It originated as a marine basin bordered by extensive deltas during the Permian and Triassic periods (between 286 and 208 million years ago). The Permian Basin consists of three connected but distinct areas of subsidence, which are, from east to west, the Midland Basin, Central Basin, and Delaware Basin. These smaller basins are separated from one another by platforms, areas of relatively thin sedimentary strata. Great subsidence during the Permian Period, coupled with limited access to the ocean, resulted in the deposition of salts (from which evaporite minerals later precipitated) in the basins and the formation of large barrier reefs that abounded with diverse marine fauna around them. The occurrence of large quantities of oil and natural gas in the Permian Basin is attributable to subsurface remnants of Permian reefs; these reefs were rich in plant and animal remains that developed into petroleum and collected in the porous formations. Numerous oil fields also occur in the geologic remnants of the lagoonal deposits that formed behind the reefs.

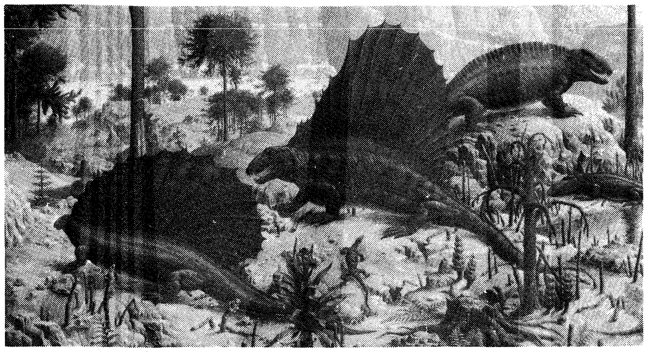
Permian languages: *see* Permic languages.

Permian Period, interval of geologic time from 286 to 245 million years ago. The Permian is the last of the six periods of the Paleozoic Era; it follows the Carboniferous and precedes the Triassic of the subsequent Mesozoic Era. The Permian is often divided into the Early Permian Epoch (286 to 258 million years ago) and the Late Permian Epoch (258 to 245 million years ago). The rocks that originated during the period make up the Permian System.

A brief treatment of the Permian Period follows. For full treatment, *see* MACROPAEDIA: Geochronology.

The Permian was named by the early British geologist Sir Roderick I. Murchison in 1841 after the Perm region of the Russian Urals, whose rocks became a standard reference for the Permian System. The rocks of the system are characterized by an abundance of red land-laid sediments and evaporites (salts formed by a sequence of chemical precipitation in an acid environment).

Massive movements of crustal plates continued from the preceding Carboniferous Period into the Permian. The northern hemispheric continent of Laurasia (composed essentially of present-day North America, Greenland, Europe, and Asia) became linked to the southern hemispheric landmass of Gondwana



Landscape of characteristic Permian animals and plants, detail of the mural "The Age of Reptiles" by Rudolph F. Zallinger; in the Peabody Museum of Natural History, Yale University

Peabody Museum of Natural History, Yale University, New Haven, Conn.

(composed of what is now South America, Africa, India, Australia, and Antarctica), forming one single supercontinent by the mid-Permian. This immense assembly of landmasses, known as Pangaea, stretched across all the climatic temperature zones virtually uninterrupted from pole to pole. The extensive glaciation that had begun in the Carboniferous continued into the Permian, mainly in the southern portion of Gondwana that was located around the south paleopole. Hot, dry conditions prevailed almost everywhere else on Pangaea, and by the Late Permian deserts became widespread in several tropical and subtropical areas on the supercontinent.

Laurasia and Gondwana remained separated at their eastern extent by the Tethys Sea, and the rest of the Earth's surface was covered by a vast ocean known as Panthalassa. Orogenies (mountain-building episodes) associated with the formation of Pangaea by the collision of these continents continued into the Permian, further forming the Appalachian mountain chain of North America and the Hercynian mountain chains of Europe and Asia.

In eastern Europe the stable Russian Platform in the east flanked a deep-sea trough, the Ural Geosyncline, which was compressed, folded, and uplifted to form the Ural Mountains when the Angaran segment of western Siberia collided with eastern Laurasia.

In western Europe continental and restricted basin deposits, such as red sandstone, conglomerate, shale, dolomitic limestone, and evaporites, predominated. Permian deposits are widespread in North America, particularly in Texas, New Mexico, Nevada, and Utah, where marine and continental deposits accumulated in great thicknesses. North American Permian deposits are principally sandstones, shales, limestones, and evaporites. Deposits of limestone, sandstone, shale, cherts, and basalt pillow lavas were also formed in the shallow and deepwater environments of the Tethys Sea. The Permian deposits on the landmasses that made up Gondwana exhibit similar characteristics; they contain tillites (consolidated sedimentary rocks formed by the lithification of glacial till) and sediments deposited by glacial meltwater, as well as sandstones, shales, and coal. This rock sequence indicates that the world climate in the Permian became milder through alternating warm and cool stages. Late Permian deposits in Pangaea are characterized by dune sands, evaporites, and red beds (*e.g.,* shale and sandstone of reddish colour), indicating the onset of desert conditions at the close of the period.

Economically important mineral deposits of Permian age consist of evaporite minerals (such as halite, sylvite, and gypsum), coal, petroleum, and copper ore. Significant evaporite deposits of rock salt and potash minerals are found in the southwestern United States, the Soviet Union, Poland, The Netherlands, Denmark, and England. Important Permian coals are found in northern Siberia, China, Korea, India, Australia, and southern Africa. Permian rocks also hold significant oil and natural-gas deposits in the southwestern United States (western Texas, Oklahoma, and New Mexico) and in the Soviet Union.

The fossil record indicates that life evolved from the preceding Carboniferous into the Permian as a continuation of established faunas. The marine invertebrates, mainly brachiopods, ammonoids, bryozoans, bivalves, and foraminiferans, evolved into several lineages during the period. The rapid evolutionary rate of the ammonoids and fusulinid foraminiferans make them extremely useful for geologic dating in the Permian. Marine and freshwater fish lineages and the amphibians thrived in the Permian. Of the vertebrates, the reptiles evolved into three markedly distinct groups: the cotylosaurs, the pelycosaurs, and the therapsids (mammallike reptiles). Land plants evolved from the Carboniferous ferns and seed ferns to the conifers and adapted to drier and well-drained land conditions. An abrupt change occurred in Gondwana with the widespread development of the Glossopteris flora, which were tongue ferns adapted to the colder climates of the Southern Hemisphere.

Toward the close of the Permian, however, many forms of life suffered mass extinction. In Gondwana the Glossopteris flora disappeared, but the coniferous flora of the Northern Hemisphere survived into the Triassic. Many animal groups did not survive the Permian. Trilobites and fusulinids became extinct, and the brachiopods, ammonoids, and bryozoans were severely reduced. Uncertainty still exists over the events that led to these extinctions at the close of the period.

Permic languages, also called PERMYAK, or PERMIAN, division of the Finno-Ugric branch of the Uralic language family, consisting of the Udmurt (Votyak) and Komi (Zyryan) languages. The Permic languages are spoken along the northern and western reaches of the Ural Mountains in the Soviet Union in and around the Udmurt A.S.S.R. and the Komi A.S.S.R. Udmurt has little dialectal variation, but Komi has many distinctive dialects divided into three major groups: Northern (Zyryan) Komi, Western (Permyak) Komi, and Eastern (Yazva) Komi. Komi has two literary languages, one based on Zyryan and the other on Permyak.

Both Udmurt and Komi have flourishing literatures that have developed primarily since the second half of the 19th century, although written records of Komi exist from the 14th century. The Permic languages are of note for their contrast of voiced and voiceless consonants (voiceless *p* contrasts with voiced *b*) generally lacking in the Uralic languages. *See also* Finno-Ugric languages.

permission to elect (English royal church prerogative): *see* congé d'élire.

permit, marine fish, a species of pompano (*q.v.*).

permittivity, a universal electric constant appearing in the mathematical formulation of two fundamental phenomena, the existence of a physical force between two separated electric charges (*see* Coulomb force), and the modification of the properties of an electric field attending the introduction into it of a dielectric (*see* displacement, electric). Permittivity is a generalized, or large-scale, description of electric behaviour that does not specify detailed features on the atomic dimension.

The permittivity of an insulating, or dielectric, material is commonly symbolized by the Greek letter epsilon, ε; the permittivity of a vacuum, or free space, is symbolized ε_0; and their ratio $\varepsilon/\varepsilon_0$, called the dielectric constant (*q.v.*), is symbolized by the Greek letter kappa, κ.

In the rationalized metre-kilogram-second (mks) and SI systems, the magnitude of the permittivity of a vacuum ε_0 is 8.854×10^{-12}. Its units and those of permittivity ε are square coulombs per newton square metre. In the mks system, permittivity ε and the dimensionless dielectric constant κ are formally distinct and related by the permittivity of free space ε_0; $\varepsilon = \kappa\varepsilon_0$. The magnitude and units of the permittivity of free space in the mks system are a necessary consequence of the laws of physics and of the decision to make the practical electrical units in use, such as volt and ampere, compatible with the mechanical units, such as metre and kilogram. In the centimetre-gram-second (cgs) system, the value of the permittivity of free space ε_0 is chosen arbitrarily to be one. Thus, the permittivity ε and the dielectric constant κ in the cgs system are identical; both of them are dimensionless numbers.

Permon, Laure (French author): *see* Junot, Laure.

permutations and combinations, different ways in which a subset of objects can be selected from a given set of objects, with or without regard to the order in which the objects are selected, respectively. The development of the theory of permutations and combinations, and of procedures for counting the numbers of them possible in a given situation, played an important part in the development of probability theory in the 17th century. This is because probability theory evolved from the consideration of the possible outcomes of gambling situations such as playing cards and rolling dice, and these outcomes can frequently be expressed in terms of permutations and combinations.

To illustrate permutations and combinations, consider five distinguishable objects, such as the letters A, B, C, D, and E, and look at all the different ways in which two of these five objects can be selected. If both the letters selected and the order of selection are considered, then the following 20 outcomes are possible:

AB	BA	AC	CA	AD
DA	AE	EA	BC	CB
BD	DB	BE	EB	CD
DC	CE	EC	DE	ED

Each of these 20 different possible selections is called a permutation. In particular, they are called the permutations of five objects taken two at a time, and the number of such permutations possible is denoted by the symbol ${}_5P_2$. In general, if there are n objects available from which to select, and permutations are to be formed using k of the objects at a time, the number of different permutations possible is denoted by the symbol ${}_nP_k$. A formula for evaluation ${}_nP_k$ is

$${}_nP_k = \frac{n!}{(n-k)!},$$

where the symbol ! indicates that all the consecutive positive integers from 1 up to and including the preceding quantity—n or $(n-k)$—are to be multiplied together. For example, using this formula, the number of permutations of five objects taken two at a time is

$$ {}_5P_2 = \frac{5!}{(5-2)!} = \frac{5!}{3!} = \frac{(1)(2)(3)(4)(5)}{(1)(2)(3)} = \frac{120}{6} = 20. $$

Suppose now that only the letters selected are important, not their order of selection. In this case AB and BA, for example, are really a single selection. In fact, if the order in which the two letters are selected is unimportant, then there are only 10 different possible results. These 10 different possible selections, in which only the letters selected are important and not the order in which they are selected, are called "combinations" of five objects taken two at a time, and the number of such combinations possible is denoted by the symbol ${}_5C_2$. In general, if there are n objects available from which to select, and combinations are to be formed using k of the objects at a time, the number of different combinations possible is denoted by the symbol ${}_nC_k$:

$$ {}_nC_k = \frac{n!}{(k)!\,(n-k)!}. $$

For example, the number of combinations of five objects taken two at a time is

$$ {}_5C_2 = \frac{5!}{(2)!\,(5-2)!} = \frac{5!}{(2)!\,(3)!} = \frac{(1)(2)(3)(4)(5)}{(1)(2)(1)(2)(3)} = \frac{120}{12} = 10. $$

The formulas for ${}_nP_k$ and ${}_nC_k$ are called counting formulas since they can be used to count the number of possible permutations or combinations in a given situation without having to list them all.

Permyak languages: *see* Permic languages.

Pernambuco, *estado* ("state") of northeastern Brazil, situated near the eastern tip of the South American coastline's bulge into the Atlantic. It is bounded on the east by the Atlantic Ocean, on the south by the states of Alagoas and Bahia, on the west by Piauí, and on the north by Ceará and Paraíba. The area of the state is 37,947 square miles (98,282 square km). The state capital is Recife.

Although Cristóvão Jacques founded a trading post on the mainland near the Iguaraçú River in 1526, the first permanent settlement of Pernambuco was at Olinda in 1535 by Duarte Coelho, who had been granted a captaincy extending from the mouth of the São Francisco River northward to that of the Iguaraçú.

During the Dutch occupation (1630–54), a well-planned town was built where present-day Recife is located. This became, under the name Mauritzstad, the administrative capital. Pernambuco was ably governed by the Dutch and prospered with the production of sugar in the plantations located in the rich alluvial soil along the coast. Portuguese rule replaced that of the Dutch in Pernambuco in 1654.

In the early 18th century a bitter rivalry developed between Olinda, the administrative capital of the captaincy and residence of the rich aristocratic plantation owners, and Recife, inhabited by traders, ship chandlers, and warehouse workers, mostly Portuguese. Recife continued to prosper, however, while Olinda declined, and in 1823 Recife was elevated to the category of city (*cidade*). In 1827 it was made the capital of the *província.*

In 1817 Pernambuco was the scene of a local armed rebellion against Portuguese rule. Pernambuco remained for years a hotbed of republicanism and revolutionary agitation. It was the site of unsuccessful insurrections against Portuguese rule in 1821–22, 1824, 1831, and 1848. Pernambuco became a state of the Brazilian Republic in 1891.

Pernambuco's Atlantic coastline, which extends approximately 116 miles (187 km) from south to north, is relatively short when compared to the state's east–west extent of 447 miles (720 km). The coastal zone is comparatively narrow and is separated from the high inland plateau by an intermediate zone formed by the terraces and slopes between the two. The coastal zone is low, well-wooded, and fertile and has a hot, humid climate, relieved to some extent by the southeast trade winds. The middle zone, called the *agreste* region, has a drier climate and lighter vegetation. The inland plateau is called the *sertão;* it is high, stony, and dry and frequently is devastated by prolonged droughts (*sêcas*). The climate of the *sertão* is characterized by hot days and cool nights. For the state as a whole there are two clearly defined seasons, rainy from March to July and dry for the remainder.

The rivers of the state include a number of small plateau streams (dry for much of the year) flowing southward to the São Francisco River and several large streams in the eastern part flowing eastward to the Atlantic. The largest of the coastal rivers are the Goiana, which drains a rich agricultural region in the northeast part of the state; the Capibaribe and the Beberibe, which flow eastward to the Atlantic at Recife; the Ipojuca, which reaches the coast south of Recife; the Sirinhaém; and the Una. A large tributary of the Una—the Jacuípe River—forms part of the boundary with Alagoas.

Beginning in the 16th century and continuing through the colonial period, large numbers of black slaves were brought by the Portuguese from Africa to work the sugar plantations in Pernambuco. Thus the population of the state includes a high percentage of blacks and mulattoes, especially in the coastal region. The majority of Pernambuco's population lives within 200 miles (322 km) or less of the coast. Living conditions in general are better in the coastal region than they are in the interior, as are public health and education. Higher education is available in Recife at the Federal University of Pernambuco, the Catholic University of Pernambuco, and the Rural University of Pernambuco.

Agriculture is the leading activity in Pernambuco, although grazing, commerce, manufacturing, and mining also contribute to the economy. Since the 16th century the coastal plain has been devoted to the production of sugarcane, largely for export abroad and to other areas of the state and nation. Tropical and semitropical fruits (bananas, oranges, coconuts) and food crops (sweet potatoes, corn [maize], cassava, rice) are also grown commercially in the coastal zone. The principal crops of the *agreste* region are cotton, coffee, beans, cassava, onions, tomatoes, corn, and tobacco. Livestock raising is the chief activity in the *sertão,* but in areas of adequate rainfall or irrigation, cotton, sisal, castor beans, and food crops are also produced. Pernambuco's large herds of cattle and goats are the source of meat, hides, skins, and leather.

The traditional manufactures are refined sugar, cotton cloth, and cigars. Sugar processing continues to be the major industry, although there is today a broad range of other industries, such as steel manufacture and the processing of nonferrous metals.

Pernambuco's port of Recife is one of the country's most important because of its location on the South American coastline's bulge into the Atlantic. The railways of the area converge on the port, as does the system of surfaced roads. Recife also is the site of an international airport.

The state's cultural life and institutions also are concentrated in Recife, and Olinda, a national monument, is of considerable touristic interest because of the old colonial churches and houses located in that city. Pop. (1988 est.) 7,105,000.

pernicious anemia, also called ADDISON'S ANEMIA, severe, slow-developing disease, characterized by a deficiency of red blood cells and often white cells and platelets in the circulation, by associated jaundice from the accelerated destruction of red cells in the bone marrow, by a lack of gastric juice (achylia gastrica), and by progressive gastrointestinal and neurologic problems.

Pernicious anemia is caused by a deficiency of vitamin B_{12}. This deficiency in turn is usually due to the underproduction of a substance called intrinsic factor, which is made by parietal cells in the stomach fundus and is necessary for the absorption of vitamin B_{12} from food. The lack of vitamin B_{12} leads to a disordered production of deoxyribonucleic acid (DNA). In the bone marrow, red-cell production becomes abnormal—the nuclei remain immature, while the surrounding cytoplasm matures normally, eventually becoming overabundant and containing much hemoglobin. Such cells, called megaloblasts, are for the most part destroyed in the bone marrow without being freed to the circulation. Some megaloblasts mature to become large red cells, called macrocytes; these reach the circulation but function abnormally and have a reduced life span. A deficiency of white blood cells (leukopenia) and of platelets (thrombocytopenia) also develops in the circulation.

Pernicious anemia may develop as a result of cancer or of surgical removal of the stomach; in many cases, however, the reason for the atrophy of the parietal cells of the stomach fundus, which is the most common cause of pernicious anemia, is not known, although an autoimmune mechanism has been suggested. Most patients display antibodies against the parietal cells; more than 50 percent also show antibodies against intrinsic factor. These latter antibodies probably bind to the intrinsic factor molecules, preventing them from combining with the vitamin B_{12} and being absorbed by the intestine.

Pernicious anemia affects males and females equally, is uncommon under age 35, and is more common in persons with blood group A and in blue-eyed, bulky-framed, light-skinned northern Europeans. Symptoms and signs include waxy pallor; fatigue; weakness; shortness of breath; jaundice; smooth, shiny tongue; deficiency of constituents of gastric juice; and progressive neurological problems, such as a loss of sensation in fingers and toes, stiffness, incoordination, apathy, and irritability. The administration of vitamin B_{12} by injection produces quick improvement in the anemia; the neurological damage is seldom fully reversible.

Pernik, formerly (1949–62) DIMITROVO, town, west-central Bulgaria. The town is located on the banks of the Struma River, 19 miles (30 km) southwest of Sofia. Originally a Bulgarian fortress whose function it was to contain the assaults of the Byzantine armies, Pernik was for five centuries (1396–1878) under Turkish rule. Pernik was originally a small agricultural village; from 1891 on, however, it was a centre of Bulgarian industrial growth because of the mining of considerable quantities of coal in the area. It is a leading industrial town in Bulgaria in terms of the tonnage of goods produced and in the proportion of its working population employed in industry. The town's cultural centre, the Georgi Dimitrov Palace of Culture, is one of the finest in Bulgaria. The town also has a mining school, a large sports complex with a stadium, a national theatre, a symphony orchestra, a museum, and an attractive park (Municipal Gardens). Pop. (1981 est.) town, 93,483; (1982 est.) *okrüg*, 175,042.

pernio: *see* chilblains.

Pernov (Estonian S.S.R.): *see* Pärnu.

Perobolinggo (Indonesia): *see* Probolinggo.

peromelia, congenital absence or malformation of the extremities, of rare occurrence until the thalidomide tragedy in the early 1960s. Peromelia is caused by errors in the formation and development of the limb bud from about the fourth to the eighth week of intrauterine life.

In amelia, one of the rarest of malformations of the extremities, limbs are completely absent. Ectromelia is the absence of one or more extremities. In phocomelia ("seal extremity") the upper part of the limb is extremely underdeveloped or missing, and the lower part is attached directly to the trunk, resembling the flipper of a seal. Hemimelia is a condition in which the upper part of the limb is well formed but the lower part is rudimentary or absent. Sirenomelia ("mermaid extremity") is a severe abnormality in which the legs are fused to a greater or lesser degree and contain malformed bones, the anal and urinary orifices are absent, and the genitals and parts of the intestinal and urinary tracts malformed.

Treatment of major limb malformations involves the fitting of prostheses and special training in their use. Surgery is used with success in relieving minor malformations.

Perón, Eva (Duarte de), *née* MARÍA EVA DUARTE, byname EVITA (b. May 7, 1919, Los Toldos, Arg.—d. July 26, 1952, Buenos Aires), second wife of Argentine president Juan Perón, who, during her husband's first term as president (1946–52), became a powerful though unofficial political leader, revered by the lower economic classes.

One of five illegitimate children of Juan Duarte and Juana Ibarguren, Eva Duarte married Col. Juan Perón, a widower, in 1945 after an undistinguished career as a stage and radio actress. She participated in her husband's 1945–46 presidential campaign, winning the adulation of the masses, whom she addressed as *los descamisados* (Spanish: "the shirtless ones").

Although she never held any government post, Evita acted as de facto minister of health and labour, awarding generous wage increases to the unions, who responded with political support for Perón. After cutting off government subsidies to the traditional *Sociedad de Beneficencia* (Spanish: "Aid Society"), thereby making more enemies among the traditional elite, she replaced it with her own Eva Perón Foundation, which was supported by "voluntary" union and business contributions plus a substantial cut of the national lottery and other funds. These resources were used to establish thousands of hospitals, schools, orphanages, homes for the aged, and other charitable institutions. Evita was largely responsible for the passage of the women's suffrage law and formed the Peronista Feminist Party in 1949. She also introduced compulsory religious education into all Argentine schools. In 1951, although she knew herself to be dying of cancer, she obtained the nomination for vice president, but the Army forced her to withdraw her candidacy.

After her death, Evita remained a formidable figure in Argentine politics. Her working-class followers tried unsuccessfully to have her canonized, and her enemies, in an effort to exorcise her as a national symbol of Peronism, stole her body in 1955 after Perón was overthrown and secreted it in Italy for 16 years. In 1971 the military government, bowing to Peronist demands, turned over her remains to her exiled widower in Madrid. After Juan Perón died in office in 1974, Isabel Perón, hoping to gain favour among the populace, repatriated the remains and installed them next to the deceased leader in a crypt in the presidential palace. Two years later a new military junta hostile to Peronism removed the bodies; Evita's remains were finally interred in the Duarte family crypt in Recoleta cemetery.

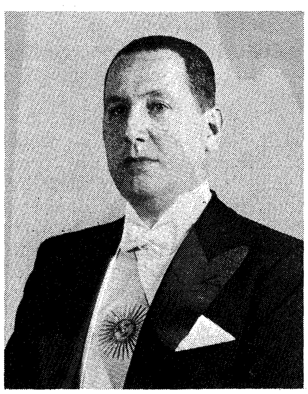
Perón, Isabel (Martínez de), *née* MARÍA ESTRELA MARTÍNEZ CARTAS (b. Feb. 4, 1931, La Rioja, Arg.), president of Argentina 1974–76, third wife of Pres. Juan Perón.

She was born to a lower-middle-class family, acquired the name Isabel (her saint's name) on her Roman Catholic confirmation, and adopted the name when she became a dancer. She met Perón in either 1955 or 1956 and, giving up her career in show business, became his personal secretary, accompanying him in exile to Madrid, where they were married in 1961. She visited Argentina several times in the 1960s and early 1970s, building support for Perón. When Perón finally returned to Argentina to run for president in 1973, Isabel was chosen as his running mate on the suggestion of Perón's close adviser José López Rega. Perón's illness several times elevated her to the position of acting president, and when he died on July 1, 1974, she succeeded him in office.

Her regime inherited problems of inflation, labour unrest, and political violence. She attempted to solve the problems by appointing new Cabinet ministers, printing money to pay foreign debts, and imposing a state of siege in November 1974 as the country was on the brink of anarchy. The controversy surrounding her social welfare minister López Rega, who was forced into exile for graft and terrorist activities, did not help her situation. Moderate military officers urged her to resign, but she stubbornly refused; the economic and political situation continued to worsen, and on March 24, 1976, she was seized by Air Force officers and held under house arrest for five years. In 1981 she was convicted of corrupt practices, but she was paroled in the summer of that year and went into exile in Spain. Pardoned in late 1983, she submitted her "irrevocable" resignation as head of the Partido Justicialista, the Peronist party, from her home in Madrid in 1985.

Perón, Juan (Domingo) (b. Oct. 8, 1895, Buenos Aires province, Argentina—d. July 1, 1974, Buenos Aires), army colonel who became president of Argentina (1946–55, 1973–74), founder and leader of the Peronista movement.

Early life and career. Born in 1895 in a town on the Pampas of the province of Buenos Aires, Perón had a typical Argentine inheritance. He was a creole—a descendant of families that have been settled in Argentina for several generations—yet he also had non-Spanish European ancestors (Italian and French) as do most Argentines, for they live in a land dominated by immigrants and their descendants.



Juan Perón, 1954
By courtesy of the OAS (Columbus Memorial Library)

His early career was in many ways typical of the upwardly mobile, lower-middle-class, male youth. He entered military school at 16 and made somewhat better than average progress through the officer ranks. But he had superior attributes. A strongly built six-foot-tall youth, Perón was the champion fencer of the army and a fine skier and boxer. He served in Italy during the late 1930s as a military attaché and observed the successes of the Fascists and Nazis. He had a bent for history and political philosophy and published in those fields.

In 1943 he joined a clique of military plotters that overthrew the ineffective civilian government of Argentina, a government that had failed to solve the pressing problems of social and economic justice for a people ideologically split by the issues of World War II.

The military regimes of the following three years came increasingly under the influence of Perón, who had shrewdly requested for himself only the minor post of secretary of labour and social welfare. By 1945 he had also become vice president and minister of war. Clearly, he was bidding for undisputed power, based on the support of the underprivileged labourers (the *descamisados,* or "shirtless ones") and on his popularity and authority in the army.

Marriage to Eva Duarte. In early October 1945, Perón was ousted from his positions by a coup of constitutionally minded civilians and officers. But his beautiful and dynamic mistress, Eva Duarte, and associates in the labour unions rallied the workers of greater Buenos Aires, and Perón was released from custody on Oct. 17, 1945. That night, from the balcony of the presidential palace, he addressed 300,000 people, and his address was broadcast to the nation on radio. He promised to lead the people to victory in the pending presidential election and to build with them a strong and just nation. A few days later he married Eva, or Evita, as she was popularly called, who would help him rule Argentina in the years ahead.

After a campaign marked by repression of the liberal opposition by the federal police and by strong-arm squads, Perón was elected president in February 1946 with 56 percent of the popular vote.

Perón set Argentina on a course of industrialization and state intervention in the economy, calculated to provide greater economic and social benefits for the working class. He also adopted a strong anti-United States and anti-British position, preaching the virtues of his Third Position—between Communism and capitalism—both domestically and in international relations. He extended Argentina's influence widely in Latin America and particularly sought to establish its political and ideological hegemony over South America.

If he did not structurally revolutionize Argentina, he did reshape the nation. Basing his government on a foggy doctrine he called Justicialismo, the President showered needed benefits upon the labourers, in the form of wage increases and fringe benefits. He nationalized the railroads and other utilities and financed public works on a large scale. The funds for those costly innovations—and for the graft that early began to corrode his regime—came from the foreign exchange accumulated by Argentine exports during World War II and from the profits of the state agency that set the prices for agricultural products. Perón dictated the political life of the nation by his command of the armed forces. He severely restricted and in some areas eliminated constitutional liberties.

Dictator in exile. Reelected by a somewhat larger margin in 1951, Perón modified some of his policies. But he was overthrown and fled to Paraguay on Sept. 19, 1955, after an army–navy revolt led by democratically inspired officers who reflected growing popular discontent with inflation, corruption, demagoguery, and oppression.

Perón finally settled in Madrid. There in 1961 he married for the third time (his first wife had died of cancer, as had Evita in 1952); his new wife was the former María Estela (called Isabel) Martínez, an Argentine dancer whom he met in 1956. In Spain, Perón worked to ensure, if not his return to Argentina, at least the eventual assumption of power by the millions of Peronist followers, whose memory of his regime improved with time and with the incapacity of the Argentine governments following Perón's decade of power.

In election after election the Peronists emerged as a large, indigestible mass in the Argentine body politic. Neither the civilian nor the military regimes that precariously ruled in Argentina after 1955 were able to solve the relatively rich nation's condition of "dynamic stagnation," in part because they refused to give political office to the Peronists.

The military regime of General Alejandro Lanusse, which took power in March 1971, proclaimed its intention to restore constitutional democracy by the end of 1973 and allowed the reestablishment of political parties, including the Peronist party. Upon invitation from the military government, Perón returned to Argentina for a short time in November 1972. In the elections of March 1973, Peronist candidates captured the presidency and majorities in the legislature, and, in June, Perón was welcomed back to Argentina with wild excitement. In October, in a special election, he was elected president and, at his insistence, his wife—whom the Argentines disliked and resented—became vice president.

A legacy of turmoil. While in exile Perón had wooed the left-wing Peronists and had supported the most belligerent labour unions. Once returned to power, however, he formed close links with the armed forces and other previously opposition right-wing groups. When he died in 1974, he left to his widow and successor as president an untenable situation. Isabel Perón failed to obtain the firm support of any power group, not even the labour unions. Terrorist activity and political violence increased. On March 24, 1976, the armed forces took power, removed Isabel Perón from office, and set up a military junta. (T.F.McG./Ed.)

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Peronist, member of the JUSTICIALIST NATIONALIST MOVEMENT, Spanish PERONISTA, or MOVIMIENTO NACIONALISTA JUSTICIALISTA, in Argentine politics, a supporter of Juan Perón, or an adherent of the populist and nationalistic policies that Perón espoused. Peronism has played an important part in Argentina's history from the mid-1940s. The movement arose as the personal following of Colonel Juan Perón, who, after participating in a successful military coup in 1943, became Argentina's minister of labour. In this position he enacted various social measures to help the country's growing class of urban industrial workers. Perón was elected to the presidency in 1946 with the strong support of these workers and their labour unions; he also gained the support of many lower-middle-class citizens and of the nation's industrialists. After Perón was overthrown and exiled in 1955 by the military, the leaderless Peronist movement was weakened by factional conflicts, since it was composed of many divergent elements, from left-wing trade unionists to right-wing authoritarian nationalists. The movement remained the main civilian contender for power in Argentina, however.

Under the new name of the Justicialist Nationalist Movement, the Peronists swept back into power in 1973 when the military permitted the first general elections in 10 years. Perón returned from exile and became president. But deep dissension between right-wing and left-wing Peronists erupted into terrorism and violence after Perón's death in 1974, and the military overthrew Perón's widow and successor as president, Isabel, in 1976. The Peronists lost the presidential election of 1983, but in 1989 their candidate, Carlos Saúl Menem, was elected to the presidency.

Pérotin, Latin PEROTINUS (d. 1238?, Paris?), French composer of sacred polyphonic music, who is believed to have introduced the composition of polyphony in four parts into Western music.

Nothing is known of Pérotin's life, and his identity is not clearly established. He worked probably at the Cathedral of Notre-Dame in Paris, and his compositions are considered to belong to the Notre-Dame, or Parisian, school, of which he and Léonin are the only members known by name.

Pérotin's four-part works were revolutionary, since religious music of the 12th century was almost entirely in the form of two-part organum (polyphony in which a plainchant melody is sung against another line of music). In Pérotin's organa the liturgical chant of the tenor is heard against not one voice but two or three voices that provide highly decorative vocalizations. He is known to have composed two four-part works, "Viderunt" and "Sederunt"; another four-part composition, "Mors," is believed to be his. He also enlarged upon the *Magnus liber organi,* a collection of organa by his predecessor, Léonin, and made innovations in the use of rhythm. "Viderunt" and "Sederunt," musical creations comparable in scope to the cathedrals of Gothic architecture, have both been recorded in modern performance.

perovskite, calcium titanate mineral (formulated $CaTiO_3$) found as brilliant black cubes in many basic igneous rocks, in their associated pegmatites, and in metamorphic contact zones. It also occurs in chlorite or talc schists. For detailed physical properties, *see* oxide mineral (table).

peroxide, any of a class of chemical compounds in which two oxygen atoms are linked together by a single covalent bond. Several organic and inorganic peroxides are useful as bleaching agents, as initiators of polymerization reactions, and in the preparation of hydrogen peroxide (*q.v.*) and other oxygen compounds. The negatively charged peroxide ion (O_2^{2-}) is present in inorganic compounds that may be regarded as salts of the very weak acid hydrogen peroxide; examples are sodium peroxide (Na_2O_2), a bleaching agent, and barium peroxide (BaO_2), formerly used as a source of hydrogen peroxide.

Two categories of peroxides exist in which one or both of the oxygen atoms are covalently linked to atoms other than hydrogen. One category is represented by cumene hydroperoxide, an organic compound used as a polymerization initiator and as a source of phenol and acetone, and peroxysulfuric acid, an inorganic compound used as an oxidizing agent. The other category includes di-*tert*-butyl peroxide and ammonium peroxydisulfate, both used as initiators.

peroxy acid, also called PERACID, any of a class of chemical compounds in which the atomic group $-O-O-H$ replaces the $-O-H$ group of an oxy acid (a compound in which a hydrogen atom is attached to an oxygen atom by a covalent bond that is easily broken, producing an anion and a hydrogen ion). Examples of peroxy acids are peroxyacetic acid ($CH_3CO-OOH$, related to acetic acid, CH_3CO-OH) and peroxysulfuric acid ($HOSO_2-OOH$, or H_2SO_5, analogous to sulfuric acid, $HOSO_2-OH$, or H_2SO_4).

Peroxy acids usually are prepared by reaction of the oxy acid with hydrogen peroxide; small amounts of sulfuric or other strong acids often are used to accelerate the reaction of weak oxy acids. The peroxy acids are used primarily as oxidizing agents; they readily add oxygen to alkenes to give epoxides and are used to convert ketones to esters and amines to nitro compounds, amine oxides, or nitroso compounds.

perpetual calendar, type of dating system that makes it possible to find the correct day of the week for any date over a wide range of years. Aspects of the perpetual calendar can be found in the Jewish religious and the Julian calendars, and some form of it has appeared in proposed calendar reforms. The 19th-century French philosopher Auguste Comte, for example, proposed a calendar of 13 months of 28 days each, with an extra day (Year Day) inserted between December 28 and January 1 each year and with an additional leap-year day periodically. More recently, reformers promoted the World Calendar, consisting of 12 months divided into 30 and 31 days, with an annual "year-end" day and a periodic leap-year day.

To find the day of the week for any Gregorian or Julian date in the perpetual calendar provided in the Table, first find the proper dominical letter (one of the letters A through G) for the year in the upper Table. Leap years have two dominical letters, the first applicable to dates in January and February, the second to dates in the remaining months. Then find the same dominical letter in the lower table, in whichever column it appears opposite the month in question. The days then fall as given in the lowest section of the column.

perpetual motion, the action of a device that, once set in motion, would continue in motion forever, with no additional energy required to maintain it. Such devices are impossible on grounds stated by the first and second laws of thermodynamics.

A brief treatment of perpetual motion follows. For full treatment, *see* MACROPAEDIA: Energy, Concept of.

Perpetual motion, although impossible to produce, has fascinated both inventors and the general public for hundreds of years. The enormous appeal of perpetual motion resides in the promise of a virtually free and limitless source of power. That perpetual-motion machines cannot work because they violate the laws of thermodynamics has not discouraged inventors and hucksters from attempting to break, circumvent, or ignore those laws, and the history of such attempts is long and colourful.

Basically there are three kinds of perpetual-motion devices. The first kind includes those devices that purport to deliver more energy from a falling or turning body than is required to restore those devices to their original state. The most common of these, and the oldest, is the overbalanced wheel. In a typical version, flexible arms are attached to the outer rim of a vertically mounted wheel. An inclined trough is arranged to transfer rolling weights from folded arms on one side of the wheel to fully extended arms on the other. The implicit assumption is that the weights exert more downward force at the ends of extended arms than is required to raise them on the other side, where they are kept closer to the axis of rotation by the folding of the arms. This assumption violates the first law of thermodynamics, also called the law of

Perpetual calendar

year				century											
				Julian calendar							Gregorian calendar				
				0 700 1400	100 800 1500*	200 900	300 1000	400 1100	500 1200	600 1300	1500†	1600 2000	1700 2100	1800 2200	1900 2300
0				DC	ED	FE	GF	AG	BA	CB	...	BA	C	E	G
1	29	57	85	B	C	D	E	F	G	A	F	G	B	D	F
2	30	58	86	A	B	C	D	E	F	G	E	F	A	C	E
3	31	59	87	G	A	B	C	D	E	F	D	E	G	B	D
4	32	60	88	FE	GF	AG	BA	CB	DC	ED	CB	DC	FE	AG	CB
5	33	61	89	D	E	F	G	A	B	C	A	B	D	F	A
6	34	62	90	C	D	E	F	G	A	B	G	A	C	E	G
7	35	63	91	B	C	D	E	F	G	A	F	G	B	D	F
8	36	64	92	AG	BA	CB	DC	ED	FE	GF	ED	FE	AG	CB	ED
9	37	65	93	F	G	A	B	C	D	E	C	D	F	A	C
10	38	66	94	E	F	G	A	B	C	D	B	C	E	G	B
11	39	67	95	D	E	F	G	A	B	C	A	B	D	F	A
12	40	68	96	CB	DC	ED	FE	GF	AG	BA	GF	AG	CB	ED	GF
13	41	69	97	A	B	C	D	E	F	G	E	F	A	C	E
14	42	70	98	G	A	B	C	D	E	F	D	E	G	B	D
15	43	71	99	F	G	A	B	C	D	E	C	D	F	A	C
16	44	72		ED	FE	GF	AG	BA	CB	DC	...	CB	ED	GF	BA
17	45	73		C	D	E	F	G	A	B	...	A	C	E	G
18	46	74		B	C	D	E	F	G	A	...	G	B	D	F
19	47	75		A	B	C	D	E	F	G	...	F	A	C	E
20	48	76		GF	AG	BA	CB	DC	ED	FE	...	ED	GF	BA	DC
21	49	77		E	F	G	A	B	C	D	...	C	E	G	B
22	50	78		D	E	F	G	A	B	C	...	B	D	F	A
23	51	79		C	D	E	F	G	A	B	...	A	C	E	G
24	52	80		BA	CB	DC	ED	FE	GF	AG	...	GF	BA	DC	FE
25	53	81		G	A	B	C	D	E	F	...	E	G	B	D
26	54	82		F	G	A	B	C	D	E	C	D	F	A	C
27	55	83		E	F	G	A	B	C	D	B	C	E	G	B
28	56	84		DC	ED	FE	GF	AG	BA	CB	AG	BA	DC	FE	AG

month	dominical letter						
January, October	A	B	C	D	E	F	G
February, March, November	D	E	F	G	A	B	C
April, July	G	A	B	C	D	E	F
May	B	C	D	E	F	G	A
June	E	F	G	A	B	C	D
August	C	D	E	F	G	A	B
September, December	F	G	A	B	C	D	E
1 8 15 22 29	Sunday	Saturday	Friday	Thursday	Wednesday	Tuesday	Monday
2 9 16 23 30	Monday	Sunday	Saturday	Friday	Thursday	Wednesday	Tuesday
3 10 17 24 31	Tuesday	Monday	Sunday	Saturday	Friday	Thursday	Wednesday
4 11 18 25	Wednesday	Tuesday	Monday	Sunday	Saturday	Friday	Thursday
5 12 19 26	Thursday	Wednesday	Tuesday	Monday	Sunday	Saturday	Friday
6 13 20 27	Friday	Thursday	Wednesday	Tuesday	Monday	Sunday	Saturday
7 14 21 28	Saturday	Friday	Thursday	Wednesday	Tuesday	Monday	Sunday

*On and before 1582, October 4 only. †On and after 1582, October 15 only.
Source: *Smithsonian Physical Tables*, 9th edition, rev. 1956.

conservation of energy, which states that the total energy of a system is always constant. The first such device was suggested by Vilard de Honnecourt, a 13th-century French architect, and actual devices were built by Edward Somerset, 2nd marquis of Worcester (1601–67), and Jean Ernest Elie Bessler, known as Orffyreus (1680–1745). Both machines gave impressive demonstrations by virtue of their ability to operate for long periods of time, but they could not run indefinitely.

Another unsuccessful attempt to create perpetual motion by violating the first law of thermodynamics was the closed-cycle water mill, such as one proposed by the English physician Robert Fludd in 1618. Fludd erred in thinking that the energy created by water passing over a mill wheel would exceed the energy required to get the water back up again by means of an Archimedes screw.

Perpetual motion machines of the second kind attempt to violate the second law of thermodynamics—namely, that some energy is always lost in converting heat into work. One of the more notable failures in this category was the ammonia-filled "zeromotor" developed in the 1880s by John Gamgee in Washington, D.C.

Perpetual motion machines of the third kind are those associated with a continuous motion that would supposedly be possible if hindrances like mechanical friction and electrical resistivity could be eliminated. In fact, such forces can be greatly reduced, but they can never be completely eliminated without expending additional energy. A prime example is the superconductive metals, whose electrical resistance disappears completely at low temperature, usually somewhere around 20 K. Unfortunately, the energy required to maintain the low temperature exceeds the work that results from the superconductive flow.

Other types of perpetual motion machines have been proposed based on misunderstandings of the nature of certain energy sources. An example is the self-winding clock that derives energy from changes in the temperature or pressure of the atmosphere. It depends upon the energy delivered to the Earth by the Sun and is not, therefore, a perpetual motion machine.

Scientific and governmental sanctioning bodies have looked askance at perpetual motion claims for many years. Since 1775 the French Academy of Science has refused to correspond with anyone claiming to have invented a perpetual motion machine. The British and U.S. patent offices have long refused to expend time or energy on such claims.

Perpignan, city, capital of Pyrénées-Orientales *département*, Languedoc-Roussillon region, southern France, on the Têt River, 8 mi (13 km) west of the Mediterranean Sea, and 19 mi (31 km) north of the Spanish frontier. Formerly a stronghold town, and once the capital of the old province of Roussillon, it is today a flourishing market centre for the wines, fruit, and vegetables of the rich plain in which it is located. The town walls were dismantled toward the end of the 19th century, but the picturesque Castillet—a 14th- and 15th-century crenellated fort that defended the principal gate—still stands and is now a museum. Nearby are the ancient Loge de Mer, which housed the maritime tribunal, and the 14th- and 15th-century cathedral of Saint-Jean. In the south of the town, the bastions of the great 17th- and 18th-century citadel surround the partially restored medieval palace of the kings of Majorca. Paintings by Catalan primitive artists and by Hyacinthe Rigaud, a native of Perpignan, are in the Rigaud Museum.

After serving as the capital of the counts of Roussillon, Perpignan in 1172 passed to the House of Aragon. James I of Aragon divided his realm between his sons, leaving Roussillon and Majorca to the younger, James, the first of three hereditary kings of Majorca who made the city their capital (1276–1344). Perpignan was heavily fortified during and after the struggle between France and Spain for the province of Roussillon. It became French in 1659, by the Treaty of the Pyrenees. Perpignan has been a city of refuge in the 20th century—after 1936, for refugees from the Spanish Civil War, and for returning North African emigrants after 1960. Pop. (1982) 107,812.

Perrault, Charles (b. Jan. 12, 1628, Paris—d. May 15/16, 1703, Paris), French poet, prose writer, and storyteller, a leading member of the Académie Française, who played a prominent part in a literary controversy known as the "quarrel of the ancients and the moderns." He is best remembered for his collection of fairy stories for children, *Contes de ma mère l'oye* (1697; *Tales of Mother Goose*).

A lawyer by training, Perrault first worked as an official in charge of royal buildings. He began to win a literary reputation in about 1660 with some light verse and love poetry and spent the rest of his life in promoting the study of literature and the arts. In 1671 he was elected to the Académie Française, which soon was sharply divided by the so-called quarrel between the ancients and the moderns. Perrault supported the modern view that as civilization progresses, literature evolves with it and that therefore ancient literature is inevitably more

Charles Perrault, detail of an oil painting by an unknown French artist, 17th century; in the Musée National de Versailles et des Trianons, Versailles, Fr.

Cliche Musees Nationaux, Paris

coarse and barbarous than modern literature. His poem *Le Siècle de Louis le Grand* (1687; "The Age of Louis the Great") set such modern writers as Molière and François de Malherbe above the classical authors of Greece and Rome. His chief opponent in this controversy was Nicolas Boileau-Despréaux, who on the whole had the better of the argument. Nevertheless, Perrault's stand was a landmark in the eventually successful revolt against the confines of the prevailing tradition.

Perrault's charming fairy stories in *Mother Goose* were written to amuse his children. They include "Little Red Riding Hood," "The Sleeping Beauty," "Puss in Boots," and "Bluebeard," modern versions of half-forgotten folk tales, which Perrault retold in a style that is simple and free from affectation.

Perrault, Claude (b. Sept. 25, 1613, Paris, Fr.—d. Oct. 9, 1688, Paris), French physician and amateur architect who, together with Louis Le Vau, Charles Le Brun, and François d'Orbay, designed the eastern facade of the Louvre.

Perrault's training was in mathematics and medicine, and he was a practicing physician. He was elected a member of the newly founded Academy of Sciences in 1666, and in 1673 he produced a renowned French annotated translation of Vitruvius' architectural treatise. Claude's brother, Charles, was assistant to J.-B. Colbert, the superintendent of works under Louis XIV, and Charles saw to it that Claude, who had little practical experience, was appointed to the three-man commission responsible for the rebuilding of the Louvre.

Claude collaborated in the final design of the Colonnade, a massive row of paired columns that rises above the unadorned first story and dominates the majestic east facade of the Louvre. Perrault claimed responsibility for this design, but it is now thought that he collaborated on it with Le Vau and d'Orbay and helped solve the engineering problems associated with the Colonnade's construction. Perrault was probably the designer of the Paris Observatory, which still stands.

Perrault's foremost scientific pursuit was as a director of a team that performed dissections on various animals; his death is attributed to a disease contracted while dissecting a camel.

Perrault, Pierre (b. 1611?, Paris, Fr.—d. 1680, Paris), French hydrologist whose investigation of the origin of springs was instrumental in establishing the science of hydrology on a quantitative basis. He showed conclusively that precipitation was more than adequate to sustain the flow of rivers; thus he refuted theories traceable as far back as the writings of Plato and Aristotle that invoked some variety of subterranean condensation or return flow of seawater to account for the discharge of water in springs and rivers.

Perrault was not a scientist by profession but had been, in succession, a lawyer, a government administrator, and a writer. In his most significant scientific work, *De l'origine des fontaines* (1674; *On the Origin of Springs*), he presented a study of a substantial section of the Seine River, beginning at its source, northwest of the city of Dijon. His numerical estimates demonstrated that the annual river runoff was only one-sixth of the amount of water falling as rain or snow over the drainage basin in a year.

Perréal, Jean, Perréal also spelled PERÉAL, also called JOHANNES PARISIENSUS, or JEAN DE PARIS (b. *c.* 1460, Paris?, Fr.—d. June/July, 1530, Paris/Lyon), painter, architect, and sculptor, the most important portrait painter in France at the beginning of the 16th century.

Perréal was a court painter to the Bourbons and later worked for Charles VIII, Louis XII, and Francis I of France. He traveled to Italy several times between 1492 and 1530 and in 1514 visited London, where he painted a portrait of the princess Mary Tudor. Perréal designed tombs, medals, and public ceremonials. A painting of Charles VIII of France and a miniature, "Pierre Sala," are probably the most important works now attributed to him. Perréal was a superb craftsman who in his portraits grafted a French elegance of design and presentation onto conventional Flemish realism.

Perrers, Alice, also called ALICE DE WINDSOR (d. 1400), mistress of King Edward III of England. She exercised great influence at the aging monarch's court from about 1369 until 1376.

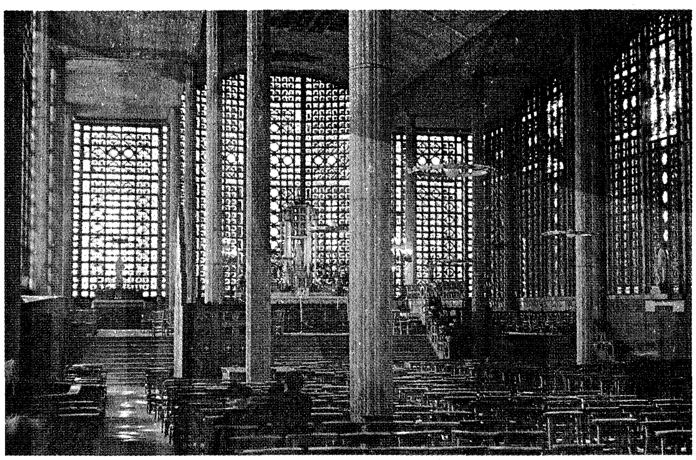
She belonged probably to the Hertfordshire family of Perrers, although it is also stated that she was of more humble birth. Before 1366 she had entered the service of Edward's queen, Philippa, and she appears later as the wife of Sir William de Windsor, deputy of Ireland (d. 1384). Her intimacy with the king began about 1366, and during the next few years she received from him several grants of land and gifts of jewels.

Not content with the great influence that she obtained over Edward III, Alice interfered in the proceedings of the courts of law to secure sentences in favour of her friends or of those who had purchased her favour—actions which induced the Parliament of 1376 to forbid all women from practicing in the law courts. Alice was banished, but John of Gaunt, Duke of Lancaster, allowed her to return to court after the death of Edward the Black Prince in June 1376; and the Parliament of 1377 reversed the sentence against her. Again attempting to pervert the course of justice, she was tried by the peers and banished after the death of Edward III in June 1377; but this sentence was annulled two years later, and Alice regained some influence at court. Her time, however, was mainly spent in lawsuits.

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

Perret, Auguste (b. Feb. 12, 1874, near Brussels, Belg.—d. Feb. 25, 1954, Paris, Fr.), French architect notable for his pioneering contributions to the vocabulary of reinforced-concrete construction.

He was the son of Claude-Marie Perret, a stonemason who, after 1881, had a flourishing business as a building contractor in Paris. Auguste studied architecture at the École des Beaux-Arts, Paris, but left before receiving his diploma to enter his father's business. With his brothers, Gustave and Claude, he built (1903) at 25 rue Franklin, Paris, what was probably the first apartment block designed for reinforced-concrete construction. His garage on the rue de Ponthieu (1905) demonstrates how light and open an interior can be when the use of reinforced concrete has minimized the need for structural supports. Through its exposed frame, the garage exhibits Perret's concern for structural honesty. A visible framework was also a notable characteristic of the interior of his Paris Théâtre des Champs-Élysées (1913). He used thin shell roof vaulting for his warehouses in Casablanca (1915) and elegant concrete arches for a clothing factory in Paris (1919). Publicity resulting from Perret's Church of Notre-Dame at Le Raincy (1922–23), near Paris, probably fully established the novel and progressive character of his ideas and the immense structural possibilities of reinforced concrete.



Church of Notre-Dame, Le Raincy, Fr., by Auguste and Gustave Perret, 1923, with stained glass by Maurice Denis

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Among Perret's many notable buildings of the 1920s and 1930s was the École Normale de Musique in Paris (1929), considered by many to be an acoustical masterpiece. After World War II he was appointed chief architect for the reconstruction of Le Havre. Notable Perret buildings there are the Hôtel de Ville and the church of St. Joseph, both designed in 1950 and completed before his death. By that time his ideals were in sharp conflict with those of many of the younger architects who were less interested in the expression of structural systems than in the variety of spatial and sculptural effects made possible by reinforced concrete.

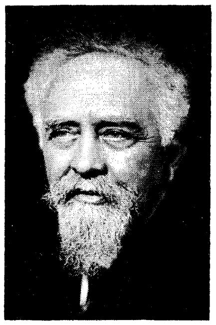
Perrin, Ami (d. 1561), Swiss opponent of the religious Reformer John Calvin at Geneva and leader of the anti-Calvinist Libertines.

A member of a prominent Genevese family, Perrin was associated with the city's anti-Savoyard party (Eidguenots) and commanded a company outfitted against the Duke of Savoy in 1529. Between 1544 and 1555 he stood as one of the most powerful figures in Geneva, serving many times as the city's intercantonal and foreign emissary.

Perrin early embraced the Reformation and championed the cause of Geneva's seminal Reformer, Guillaume Farel. Consequently, he opposed the growth of the Calvinist theocracy, siding with and eventually leading an established party of moderation, the Libertines. In May 1555 an armed rising of his Libertines was resisted by the city's government, and he was condemned to death. He managed to escape to Bern, where, with a few supporters (Fugitifs), he continued a futile opposition in exile.

Perrin, Claude: *see* Victor-Perrin, Claude.

Perrin, Jean(-Baptiste) (b. Sept. 30, 1870, Lille, Fr.—d. April, 17, 1942, New York City), French physicist who studied the Brownian motion of minute particles suspended in liquids and thereby confirmed the atomic nature of matter. For this achievement he was



Jean Perrin
H. Roger-Viollet

honoured with the Nobel Prize for Physics in 1926.

Educated at the École Normale Supérieure, Paris, Perrin joined the faculty of the University of Paris (1898) where he became professor of physical chemistry (1910–40). In 1895 he established that cathode rays are negatively charged particles (electrons). Around 1908 he addressed himself to determining the way in which colloidal particles remained suspended in a liquid in defiance of gravity. Through observations of the manner of sedimentation of these particles, he confirmed Einstein's equation concerning the phenomenon, and was also able to estimate the size of atoms and molecules as well as their quantity in a given volume.

Perrine, Charles Dillon (b. July 28, 1867, Steubenville, Ohio, U.S.—d. June 21, 1951, Villa General Mitre, Arg.), U.S. astronomer who discovered the sixth and seventh moons of Jupiter in 1904 and 1905, respectively. In 1904 he published a calculation of the solar parallax (a measure of the Earth-Sun distance) based on observations of the minor planet Eros during one of its close approaches to the Earth.

Perrine worked at the Lick Observatory in California from 1893 to 1909 and then until his retirement in 1936 was director of the Argentine National Observatory in Córdoba. His work included counts of extragalactic nebulae and the discovery of 13 comets.

Perron, (Charles) Edgar du (b. Nov. 2, 1899, Meester Cornelis, Java—d. May 14, 1940, Bergen, Neth.), writer and critic, cofounder with Menno ter Braak of the influential Dutch literary journal *Forum* (1932–35), which aimed to replace superficial elegance of literary style with greater sincerity of literary content. The *Forum* writers resisted National Socialism and the German occupation of The Netherlands.

The son of a Dutch East Indian planter, du Perron went to Europe in 1921 and lived on the Left Bank in Paris, an experience that provided the background of his novel *Een voorbereiding* (1927; "A Preparation"). Cosmopolitan in outlook, he did much to counteract Dutch provincialism by publicizing the works of the French writers André Gide and André Malraux. He translated into Dutch Malraux's *La Condition humaine*, which had been dedicated to him. His collected essays, *De smalle mens* (1934), deal with the precarious position of the individual in the face of the collective attitudes of left and right. His poems, collected in *Parlando* (1941), are characterized by everyday words and a conversational tone. Shortly before World War II, du Perron spent a few more years in the Dutch East Indies collecting materials for *De man van Lebak* (1937), a critical biography of the great Dutch novelist Multatuli.

Perronet, Jean(-Rodolphe) (b. Oct. 8, 1708, Suresnes, Fr.—d. Feb. 27, 1794, Paris), French civil engineer renowned for his stone-arch bridges, especially the Pont de la Concorde, Paris.

The son of an army officer, Perronet entered the newly formed Corps des Ponts et Chaussées (Bridges and Highways Corps) and so distinguished himself that on the founding, in 1747, of the École des Ponts et Chaussées, the world's first engineering school, he was appointed director.

During construction of a bridge at Mantes in 1763, Perronet made the discovery that the horizontal thrust of a series of elliptical arches was passed along to the abutments at the ends of the bridge. Armed with this knowledge, he carried the stone-arch bridge to its ultimate design form with extremely flat arches that were supported during construction by timbering (falsework) and mounted on very slender piers, which widened the waterway for navigation and reduced scour from the current.

The result was also aesthetically pleasing; Perronet's Pont de Neuilly has been called the most graceful stone bridge ever built. He was 80 years old when he began the Pont de la Concorde, originally called the Pont Louis XV, in 1787. Despite the outbreak of the French Revolution, he kept the work going, completing it in 1791. His memoirs, published in 1782, give a complete account of his career to that date.

Perrot, Sir John (b. *c.* 1527, Harroldston, Pembrokeshire, Wales—d. September 1592, London), lord deputy of Ireland from 1584 to 1588, who established an English colony in Munster in southwestern Ireland.

Perrot was reputed to be the son of King Henry VIII of England and Mary Berkley, who later married Thomas Perrot of Pembrokeshire. Knighted in 1547, he was appointed president of Munster by Queen Elizabeth I in 1570. After suppressing the Munster rebellion of James (Fitzmaurice) Fitzgerald, he pardoned the rebels and returned to England (1573). In 1584 he was sent back to Ireland as lord deputy. He confiscated vast lands in Munster for plantation by English settlers, but the colonization was poorly organized and ex-

Sir John Perrot, engraving by U. Green, 1584
By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

ecuted. He did succeed, however, in bringing the native landowners of Connaught under English law by having them pay the crown a fixed money rent. In return, they avoided losing lands to plantations.

Meanwhile, Perrot's tolerance toward Roman Catholics and his plan to convert St. Patrick's Cathedral in Dublin into a university had earned him the enmity of Adam Loftus, Anglican archbishop of Dublin. In 1588 Loftus had Perrot recalled to England on trumped-up charges of treasonable negotiations with Spain. Perrot was found guilty, but he died in prison before he could be executed.

Perrot, Jules (Joseph) (b. Aug. 18, 1810, Lyon—d. Aug. 24, 1892, Paramé, Fr.), French virtuoso dancer and choreographer whose mas-

Jules Perrot, engraving after a drawing
By courtesy of the Bibliotheque de l'Opera, Paris; photograph, Pic

terpieces of Romantic ballet include *Pas de Quatre* (1845), composed for four of the 19th century's leading ballerinas and frequently revived in the 20th century; Perrot is usually credited with choreographing Giselle's dances in *Giselle* (1841).

He studied with Auguste Vestris and Salvatore Viganò, two of the principal exponents of expressive ballet (as opposed to pure or formal ballet). He made his debut in 1830 at the Paris Opéra, where, despite the period's prejudice against male dancers, he was highly applauded for both his classical and his mime dancing. A combination of knee trouble and the professional jealousy of his partner Marie Taglioni led to his resignation in 1835. He then toured Europe (1835–40) as a dancer and choreographer and in Naples was joined by the young ballerina Carlotta Grisi, whom he trained and later married. Perrot again danced in Paris in 1840, but only Grisi was hired to perform at the Opéra. Since he frequently arranged her solos, his choreography is now believed to include that of her title role in *Giselle,* still considered a consummate challenge to a ballerina's artistry; Jean Coralli, however, received all official credit for choreographing Giselle.

From 1842 to 1848 Perrot worked in London, making it an important ballet centre by choreographing such ballets as *Ondine* (1843), *Esmeralda* (1844), and the *Pas de Quatre,* staged for Marie Taglioni, Carlotta Grisi, Lucile Grahn, and Fanny Cerrito. In 1848 Perrot became premier danseur at the Imperial Theatre in St. Petersburg, where he created eight more ballets and revived many others. Some of his ballets, such as *Esmeralda* and *Giselle,* remained in the Russian repertoire long after his departure from St. Petersburg (1859) and eventually became part of the post-Revolution Soviet ballet. On his return to France, Perrot attempted to revive his major works but was unsuccessful, since technical virtuosity had become more popular in western Europe than the expressive and dramatic elements that characterized his ballets.

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Perrot, Nicolas (b. *c.* 1644, France—d. Aug. 13, 1717, Lower Canada), French fur trader, North American colonial official, and explorer.

Perrot immigrated to New France (Canada) as a youth, and his services there under the Jesuits and Sulpicians enabled him to learn Indian languages and native cultures. He entered the fur trade about 1663, working in the Great Lakes region, and in 1668 he was among the first French traders who dealt with the Algonkin tribes around Green Bay. Governor Frontenac sent Perrot in 1670 as interpreter on an expedition that claimed the Upper Mississippi area for France in June 1671. He returned to New France that autumn, married, and settled on an estate at Bancour. For the next 12 years, he evidently worked his lands but also engaged in some fur trading, as he was awarded a license for that purpose in 1674.

In 1683 Governor Le Fevre La Barre authorized Perrot to undertake a Great Lakes trading expedition, and the next year, the governor directed him to obtain the support of western tribes in his campaign against the Iroquois. In 1685 Perrot was made commandant of the Green Bay region, and, with his commission, he journeyed to the junction of the Wisconsin and Mississippi rivers, where he built Ft. St. Nicolas. In 1686 he constructed Ft. St. Antoine on Lake Pepin and initiated trade with the Sioux and other local tribes. The following year, Perrot was ordered to assist another campaign against the Iroquois. He ousted British fur-tradering expeditions from the Great Lakes region, and, on May 8, 1689, he officially renewed France's claim to the Upper Mississippi.

Perrot continued to work among the western tribes until 1696, when all trading licenses were revoked. He then returned to Lower Canada. Perrot subsequently worked as an interpreter and served in the militia, although he devoted his final years to writing his memoirs.

Perry, Bliss (b. Nov. 25, 1860, Williamstown, Mass., U.S.—d. Feb. 13, 1954, Exeter, N.H.), U.S. scholar and editor, especially noted for his work in American literature.

Perry was educated at Williams College, Williamstown, and the universities of Berlin and Strassburg (then in Germany). He taught at Williams (1886–93), Princeton University (1893–1900), and Harvard University (1907–30) and was Harvard lecturer at the University of Paris (1909–10). From 1899 to 1909 he edited *The Atlantic Monthly.* The French government awarded him the Legion of Honour. He edited many volumes, including the works of Edmund Burke, Sir Walter Scott, and Ralph Waldo Emerson, and was general editor (1905–09) of the Cambridge edition of the major American poets. He wrote a number of books, including works on Walt Whitman, John Greenleaf Whittier, Thomas Carlyle, Emerson, and others, as well as novels, short fiction, essays, an autobiography, studies of poetry, and collections of fiction and essays.

Perry, Matthew C(albraith) (b. April 10, 1794, South Kingston, R.I., U.S.—d. March 4, 1858, New York City), U.S. naval officer who headed an expedition that forced Japan in 1853–54 to enter into trade and diplomatic relations with the West after more than two centuries of isolation. Through his efforts the United States became an equal power with Britain, France, and Russia in the economic exploitation of East Asia.

Earlier, Perry had served as commanding officer (1837–40) of the first U.S. steamship, the "Fulton"; led a naval squadron to Africa to help suppress the slave trade (1843); and successfully commanded naval forces during the Mexican War (1846–48). In March 1852 Pres. Millard Fillmore placed Perry—who was called by his honorary rank of commodore—in charge of a naval expedition to induce the Japanese government to establish diplomatic relations with the United States. After studying the situation, Perry concluded that Japan's traditional policy of isolation would be altered only if superior naval forces were displayed and if Japanese officials were approached with a "resolute attitude." With two frigates and two sailing vessels, he entered the fortified harbour of Uraga on July 8, 1853—an act widely publicized throughout the world. Calling himself an "admiral," he refused to obey Japanese orders to leave and sent word that if the government did not delegate a suitable person to receive the documents in his possession, he would deliver them by force if necessary. The Japanese defenses were inadequate to resist him, and after a few days of diplomatic sparring they accepted his letter from the President of the United States requesting a treaty.

In the interim, the Japanese, who were aware of China's recent defeat by the technologically superior Western powers in the Opium War (1839–42), decided to agree to Perry's terms as a way of stalling for time while they improved their defenses. In February 1854 he reappeared in Edo (modern Tokyo) Bay—this time with nine ships—and on March 31 concluded the first treaty between the two countries. The pact assured better treatment of shipwrecked seamen, permitted U.S. ships to obtain fuel and supplies at two minor ports, arranged for a U.S. consul to reside at Shimoda, and opened the way for further U.S. trading privileges. Perry's success demonstrated the inability of the Shogun, Japan's hereditary military dictator, to enforce his country's traditional isolationist policy; the Japanese were soon forced to sign similar treaties with other Western nations. These events contributed to the collapse of the shogunate and ultimately to the modernization of Japan.

Matthew Perry, detail of a Japanese watercolour, *c.* 1853; in Norfolk Museum of Arts and Sciences, Virginia
Collection Norfolk Museum of Arts and Sciences, Virginia

Considered thereafter an authority on the Far East, Perry stressed the danger of British and Russian expansion and urged a more active U.S. role in the Orient. He specifically recommended the acquisition of island bases in the Pacific to assure U.S. military and commercial superiority in the area, but the government was not ready to act on these proposals for roughly half a century.

Perry, Oliver Hazard (b. Aug. 20, 1785, South Kingston, R.I., U.S.—d. Aug. 23, 1819, at sea), U.S. naval officer who became a national hero when he defeated a British squadron in the Battle of Lake Erie in the War of 1812.

Appointed a midshipman at 14, Perry served in both the West Indies and the Mediterranean until February 1813, when he was sent to Erie, Pa., to complete the building of a U.S. squadron to challenge British control of the Great Lakes.

Oliver Hazard Perry, detail from a portrait by an unknown artist
By courtesy of the U.S. Navy

By early autumn he had assembled a fleet of 10 small vessels and was ready to engage the enemy. When the battle was joined on September 10, Perry's fleet was greatly superior in short-range firepower but only slightly superior at long range; a light wind prevented him from closing in quickly on the six British warships commanded by R.H. Barclay. When Perry's flagship, the "Lawrence," was disabled, he transferred to the "Niagara," winning the battle within the next 15 minutes by sailing directly into the British line, firing broadside. In his official report of the British surrender he said, "We have met the enemy and they are ours."

Perry's successful action at Lake Erie helped ensure U.S. control of the Northwest; it also raised him to a position of national eminence and earned him promotion to the rank of captain. He commanded the "Java" in the Mediterranean (1816–17) and a small U.S. fleet sent to the South Atlantic (1819) to bring under control certain vessels that were preying on U.S. shipping out of Buenos Aires and Venezuela. On the return trip he contracted yellow fever and died.

Perry, Ralph Barton (b. July 3, 1876, Poultney, Vt., U.S.—d. Jan. 22, 1957, Cambridge, Mass.), U.S. educator and philosopher noted as the founder of the school of new Realism in American Pragmatic philosophy.

Educated at a private school in Philadelphia and at Princeton (A.B., 1896) and Harvard (M.A., 1897; Ph.D., 1899), Perry began a teaching career that spanned nearly half a century when, in 1899, he became a philosophy instructor at Williams College in Williamstown, Mass.; he then taught philosophy briefly at Smith College in Northampton, Mass. In 1902 he went to Harvard in the same role and remained there until his retirement in 1946. By 1913 he had become a full professor and in 1930 was made Edgar Pierce professor of philosophy. After his retirement from Harvard, he was Gifford lecturer at the University of Glasgow (1946–48).

Heavily influenced by William James, Perry was founder of the school of new Realism, which sought to refine and develop James's pragmatism. He edited James's works and wrote a biography—*The Thought and Character of William James*—that earned him a Pulitzer Prize (1936). Among his other books are *The Approach to Philosophy* (1905), *The Present Conflict of Ideals* (1918), *General Theory of Value* (1926), *Shall Not Perish From the Earth* (1940), *Puritanism and Democracy* (1944), *One World in the Making* (1945), *The Citizen Decides* (1951), and *Realms of Value* (1954).

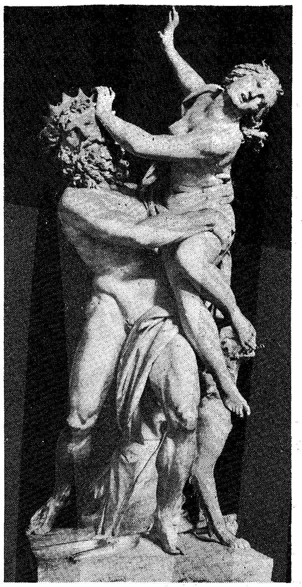
Perry, W(illiam) J(ames) (b. 1868—d. 1949), British geographer and anthropologist noted for his diffusionist theory of cultural development. Perry believed that Egypt of 4000 BC was the original and sole source of agriculture, pottery, basketry, domestic animals, houses, and towns and that these then spread throughout the world. He explained all cultural differences and similarities by migrations and additions, losses, and combinations of complexes of cultural traits, views that are considered naive by contemporary anthropologists.

Perry Convention (Japanese history): *see* Kanagawa, Treaty of.

Perryville, Battle of (Oct. 8, 1862), in the American Civil War, engagement of Union and Confederate troops as Gen. Braxton Bragg was leading the Confederates in an advance on Louisville, Ky., from Chattanooga, Tenn. Union troops, under Gen. Don Carlos Buell, were marching from Louisville when they unexpectedly encountered the Confederate Army. A bloody but indecisive battle ensued at Perryville, near Danville, Ky. Bragg's forces, though, held the field and continued to control the area until forced to withdraw three months later following the Battle of Stones River.

Perse, Saint-John: *see* Saint-John Perse.

Persephone, Latin PROSERPINA, or PROSERPINE, in Greek religion, daughter of Zeus, the chief god, and Demeter, the goddess of agriculture; she was the wife of Hades, king of the underworld. In the Homeric "Hymn to Demeter," the story is told of how Persephone was gathering flowers in the Vale of Nysa when she was seized by Hades and removed to the underworld. Upon learning of the abduction, her mother, Demeter, in her misery, became unconcerned with the harvest or the fruitfulness of the Earth, so that widespread famine ensued. Zeus therefore intervened,



Persephone abducted by Hades, marble sculpture by Gian Lorenzo Bernini, 1621–22; in the Borghese Gallery, Rome

Anderson—Alinari from Art Resource/EB Inc.

commanding Hades to release Persephone to her mother. Because Persephone had eaten a single pomegranate seed in the underworld, she could not be completely freed but had to remain one-third of the year with Hades, spending the other two-thirds with her mother.

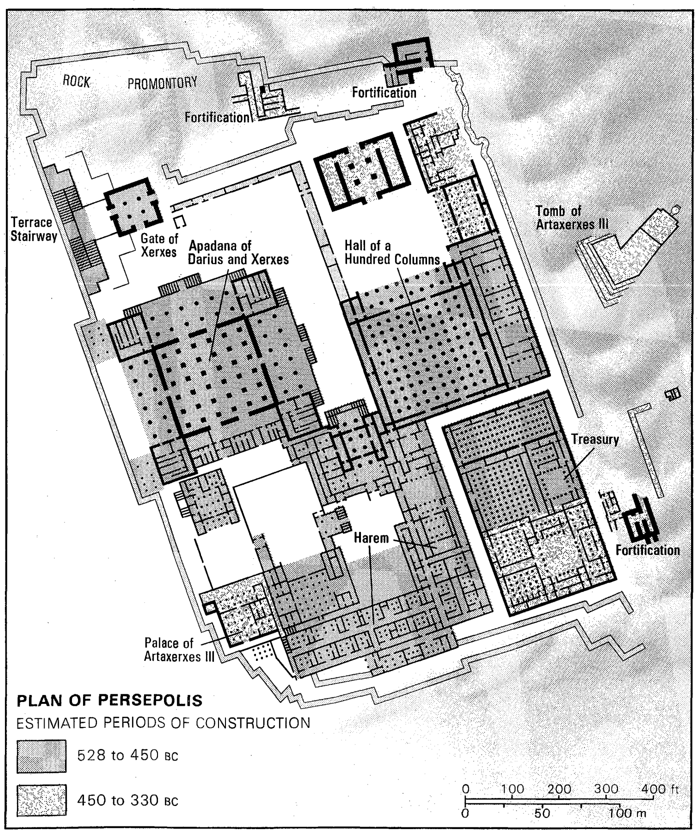
One of the variants of the name Persephone is Persephassa, which suggests that she was originally a pre-Hellenic goddess of the dead and that her connection with Demeter came later, when she was identified with Kore (Core; Greek: Maiden), the young grain goddess and daughter of Demeter. The story that Persephone/Kore spent four months of each year in the underworld was no doubt meant to account for the barren appearance of Greek fields in full summer (after harvest), before their revival in the autumn rains, when they are plowed and sown.

Persephone also appears in the Orphic myth of Zagreus, her son by Zeus, who, as a child, was torn apart by Titans.

Persepolis, Old Persian PARSA, modern TAKHT-E JAMSHĪD, or TAKHT-I JAMSHĪD (Persian: Throne of Jamshīd), an ancient capital of the Achaemenian kings of Iran (Persia), located about 32 miles (51 kilometres) northeast of Shīrāz in the *ostān* (province) of Fars, southwest Iran, near the confluence of the small river Pulvār (Rūdkhāneh-ye Sīvand) with the Rūd-e Kor.

Though archaeologists have discovered evidence of prehistoric settlement, inscriptions indicate that the construction of the city began under Darius I the Great (reigned 522–486 BC), who, as a member of a new branch of the royal house, made Persepolis the capital of Persia proper, replacing Pasargadae, the burial place of Cyrus the Great. Built in a remote and mountainous region, Persepolis was an inconvenient royal residence and was visited mainly in the spring. Effective administration of the Achaemenian Empire was carried on from Susa, Babylon, or Ecbatana. This accounts for the fact that the Greeks were not acquainted with Persepolis until Alexander the Great's invasion of Asia. In 330 BC Alexander plundered the city and burned the palace of Xerxes, probably to symbolize the end of his Panhellenic war of revenge. In 316 BC Persepolis was still the capital of Persis as a province of the Macedonian Empire. The city gradually declined in the Seleucid period and after, its ruins attesting its ancient glory. In the 3rd century AD the nearby city of Istakhr became the centre of the Sāsānian Empire.

The site is marked by a large terrace with



City of Persepolis

Adapted from *Westermann Grosser Atlas zur Weltgeschichte,* Georg Westermann Verlag, Braunschweig its east side leaning on Kūh-e Raḥmat (the Mount of Mercy). The other three sides are formed by a retaining wall, varying in height with the slope of the ground from 13 to 41 feet (4 to 12 metres); on the west side a magnificent double stair in two flights of 111 easy stone steps leads to the top. On this terrace are the ruins of a number of colossal buildings, all constructed of a dark gray stone, often polished to the consistency of marble, from the adjacent mountain. The stones, of great size, cut with the utmost precision, were laid without mortar, and many of them are still in place. Especially striking are the huge columns, 13 of which still stand in Darius the Great's audience hall, known as the apadana, the name given to a similar hall built by Darius at Susa. There are two more columns still standing in the entrance hall of the Gate of Xerxes, and a third has been assembled there from its broken pieces.

In 1933 two sets of gold and silver plates recording in the three forms of cuneiform, Ancient Persian, Elamite, and Babylonian, the boundaries of the Persian Empire were discovered in the foundations of Darius' hall of audience. A number of inscriptions, cut in stone, of Darius I, Xerxes I, and Artaxerxes III indicate to which monarch the various buildings are to be attributed. The oldest of these on the south retaining wall gives Darius' famous prayer for his people: "God protect this country from foe, famine and falsehood." There are numerous reliefs of Persian, Median, and Elamite officials, and 23 scenes separated by cypress trees depict representatives from the remote parts of the empire who, led by a Persian or a Mede, made appropriate offerings to the king at the national festival of the vernal equinox.

Behind Takht-e Jamshīd are three sepulchres hewn out of the mountainside; the facades, of which one is incomplete, are richly ornamented with reliefs. About eight miles north by northeast, on the opposite side of the Pulvār, rises a perpendicular wall of rock in which four similar tombs are cut at a considerable height from the bottom of the valley. This place is called Naqsh-e Rostam (the Picture of Rostam) from the Sāsānian carvings below the tombs, which were thought to represent the mythical hero Rostam. That the occupants of these seven tombs were Achaemenian kings might be inferred from the sculptures, and one of those at Naqsh-e Rostam is expressly declared in its inscriptions to be the tomb of Darius I, son of Hystaspes, whose grave, according to the Greek historian Ctesias, was in a cliff face that could be reached only by means of an apparatus of ropes. An inscription beside the entrance to Darius' tomb describes his character and states that God had given him two special qualities, wisdom and activity. The three other tombs at Naqsh-e Rostam, besides that of Darius I, are probably those of Xerxes I, Artaxerxes I, and Darius II. Xerxes II, who preceded Darius II, reigned for a very short time and could not have obtained so splendid a monument; still less could Sogdianus (Secydianus), who usurped his brother's throne and reigned for less than a year. The two completed graves behind Takht-e Jamshīd probably belong to Artaxerxes II and Artaxerxes III. The unfinished one might be that of Arses, who reigned at the longest two years, but is more likely that of Darius III, last of the Achaemenian line, who was overthrown by Alexander the Great. (R.N.S.)

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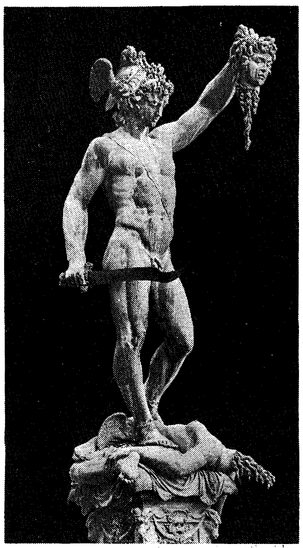
Perseus, in Greek mythology, the slayer of the Gorgon Medusa and the rescuer of Andromeda from a sea monster. Perseus was the son of Zeus and Danaë, the daughter of Acrisius of Argos. As an infant he was cast into the sea in a chest with his mother by Acrisius, to whom it had been prophesied that he would be killed by his grandson. After Perseus had grown up on the island of Seriphus, where



"Perseus," bronze sculpture by Benvenuto Cellini, 1545–54; in the Loggia dei Lanzi, Florence
Alinari—Art Resource/EB Inc.

the chest had grounded, King Polydectes of Seriphus, desiring Danaë, tricked Perseus into promising to obtain the head of Medusa, the only mortal among the Gorgon (*q.v.*).

Aided by Hermes and Athena, Perseus pressed the Graiae, sisters of the Gorgons, into helping him by seizing the one eye and one tooth that the sisters shared and not returning them until they provided him with winged sandals (which enabled him to fly), the helmet of Hades (which conferred invisibility), a curved sword, or sickle, to decapitate Medusa, and a bag in which to conceal the head. (According to another version, the Graiae merely directed him to the Stygian Nymphs, who told him where to find the Gorgons and gave him the bag, sandals, and helmet; Hermes gave him the sword.) Because the gaze of Medusa turned all who looked at her to stone, Perseus guided himself by her reflection in a shield given him by Athena and beheaded Medusa as she slept. He then returned to Seriphus and rescued his mother by turning Polydectes and his supporters to stone at the sight of Medusa's head.

A further deed attributed to Perseus was his rescue of the Ethiopian princess Andromeda when he was on his way home with Medusa's head. Andromeda's mother, Cassiopeia, had claimed to be more beautiful than the sea nymphs, or Nereid (*q.v.*); so Poseidon had punished Ethiopia by flooding it and plaguing it with a sea monster. An oracle informed Andromeda's father, King Cepheus, that the ills would cease if he exposed Andromeda to the monster, which he did. Perseus, passing by, saw the princess and fell in love with her. He turned the monster to stone by showing it Medusa's head and afterward married Andromeda.

Later Perseus gave the Gorgon's head to Athena, who placed it on her shield, and gave his other accoutrements to Hermes. He accompanied his mother back to her native Argos, where he accidentally struck her father, Acrisius, dead when throwing the discus, thus fulfilling the prophecy that he would kill his grandfather. He consequently left Argos and founded Mycenae as his capital, becoming the ancestor of the Perseids, including Heracles.

The Perseus legend was a favourite subject in painting and sculpture, both ancient and Renaissance. Sigmund Freud reinterpreted the Gorgon's head in terms of castration, and the English novelist Iris Murdoch used it for modern symbolism in *A Severed Head* (1961).

Perseus (b. *c.* 212 BC—d. *c.* 165, Alba Fucens, near Rome), the last king of Macedonia (179–168), whose attempts to dominate Greece brought on the final defeat of Macedonia by the Romans, leading to annexation of the region.

The elder son of King Philip V of Macedonia, Perseus commanded troops in his father's wars against Rome (199) and Aetolia (189). After three years of intriguing against his brother Demetrius, accusing him of coveting the succession, Perseus in 181 persuaded the King to have Demetrius executed. On succeeding to the throne, he extended his influence in Thrace and Illyria but made special efforts to win over the Greek world. To this end he resumed control of the Delphic Amphictyony, established excellent relations with Rhodes, and encouraged revolution in Aetolia and Thessaly. After subduing a revolt in Dolopia, he aroused widespread alarm in Greece by visiting Delphi with his army. Eumenes II of Pergamum incited Rome against Perseus' allegedly aggressive designs, thus precipitating the Third Macedonian War (171–168). Perseus held off the Romans for three years but in 168 lost the support of Genthius of Illyria, thus exposing his western flank. A Roman army forced him to fight at Pydna (in southern Macedonia), where he was defeated by Lucius Aemilius Paulus. He spent the rest of his life in captivity.

Pershing, John J(oseph), byname BLACK JACK (b. Sept. 13, 1860, Laclede, Mo., U.S.—d. July 15, 1948, Washington, D.C.), U.S. Army general who commanded the American Expeditionary Force (AEF) in Europe during World War I.

Pershing, 1917
By courtesy of the Library of Congress, Washington, D.C.

Graduating from the U.S. Military Academy at West Point, N.Y., in 1886, Pershing served in several Indian wars, in the Spanish-American War (1898), as brigadier general in the Philippine Islands (1906–13), and as commander of a punitive raid against the Mexican revolutionary Pancho Villa (1916). He also was a military instructor at the University of Nebraska, Lincoln, and at West Point.

After the United States declared war on Germany (April 1917), Pres. Woodrow Wilson selected Pershing to command the American troops being sent to Europe. In June he submitted a "General Organization Report" recommending an army of 1,000,000 men by 1918 and 3,000,000 by 1919. Though early U.S. planning had not included such a large force, Pershing's recommendations prevailed.

Pershing was determined to maintain the integrity of the AEF as an independent army, despite pressure from the Allied high command to use U.S. troops as replacement units in European divisions, many of which were exhausted from the setbacks of 1917. Pershing largely resisted these pressures, although during the March–June 1918 German offensive threatening Paris, he was finally persuaded to release his troops temporarily to inter-Allied commander Marshal Ferdinand Foch.

Pershing's army never became entirely self-sufficient, but it conducted two significant operations. In September 1918 the AEF assaulted the Saint-Mihiel salient successfully. Then, at Foch's request, later that month Pershing quickly regrouped his forces for the Meuse-Argonne offensive, despite his original plans to advance toward Metz. Though incomplete preparations and inexperience slowed the operations, the inter-Allied offensive in France destroyed German resistance in early October and led to the Armistice the next month.

Pershing was criticized for operational and logistic errors, but his creation of the AEF was a remarkable achievement; he returned home with a sound reputation and in 1919 was given the rank of general of the armies of the United States. Pershing's nickname, Black Jack, derived from his service with a black regiment early in his career; it came to signify his stern bearing and rigid discipline. Eschewing politics, Pershing remained in the army and served as chief of staff from 1921 until his retirement three years later.

Pershing's memoirs were published as *My Experiences in the World War,* 2 vol. (1931).

Persia, the kingdom of Iran in southwestern Asia. The term was used for centuries, chiefly in the West, and originated from a region of southern Iran formerly known as Persis, alternatively as Pārs, or Parsa, modern Fārs. Parsa was the name of an Indo-European nomadic people who migrated into the region about 1000 BC. The first mention of the Parsa occurs in the annals of Shalmanesar III, an Assyrian king, in 844. During the rule of the Persian Achaemenid dynasty (559–330 BC) the ancient Greeks first encountered the inhabitants of Persis on the Iranian Plateau, when the Achaemenid kingdom was expanding. The use of the name was gradually extended by the ancient Greeks and other Western peoples to apply to the whole Iranian Plateau. The people of Iran have always called their country Iran, "Land of the Aryans."

In 1935 the government of Iran requested that the name Iran be used instead of Persia.

Persian (cat): *see* longhair.

Persian deer, fallow deer (*q.v.; Dama mesopotamica*) of western Asia. The maral, an Asiatic red deer, also is often called Persian deer.

Persian Gulf, also called ARABIAN GULF, Arabic BAḤR FĀRIS, Persian KHALĪJ-E FĀRS, shallow marginal sea of the Indian Ocean covering a surface area of 92,500 square miles (240,000 square km) between the Arabian Peninsula and southwestern Iran.

A brief treatment of the Persian Gulf follows. For full treatment, *see* MACROPAEDIA: Asia.

The Persian Gulf extends 615 miles (990 km) from the al-ʿArab River (mouth of the Tigris and Euphrates rivers) in the northwest to its outlets, the Strait of Hormuz and the Gulf of Oman, on the southeast; its width ranges from 35 to 210 miles (55 to 340 km). The gulf contains the island state of Bahrain and is bordered by Iran to the north and east, the United Arab Emirates and Oman to the south, Saudi Arabia and Qatar to the west, and Kuwait and Iraq to the northwest.

The seafloor is very shallow, rarely deeper than 300 feet (90 m), although depths exceeding 360 feet are found near its outlet and at isolated localities in its southeastern part. The deepest waters occur along the Iranian coast, while a broad shallow area, averaging less than 120 feet deep, borders the Arabian coast. The small freshwater inflow into the gulf is mostly from the Tigris–Euphrates–Kārūn rivers; there are some ephemeral streams on the Iranian coast south of Būshehr, but virtually no fresh water flows into the gulf on its southwest side. This condition, together with high water temperatures, results in evaporation in excess of freshwater inflow and high salinity.

The economy of the Persian Gulf region is dominated by the production of petroleum. The gulf and surrounding countries produce nearly one-fourth of the world's total petroleum and have more than one-half of the world's proved reserves. Large commercial-fishing industries have also developed on the gulf coasts in Kuwait, Qatar, and Bahrain.

Persian language, also called FĀRSĪ, member of the Iranian branch of the Indo-Iranian language family; it is the official language of Iran. Written in Arabic characters, modern Persian also has many Arabic loanwords and an extensive literature.

Old Persian, spoken until approximately the 3rd century BC, is attested by numerous inscriptions written in cuneiform, most notable of which is the great monument of Darius I at Bīsitūn, Iran. The inscriptions at Bīsitūn were generally trilingual—in Old Persian, Elamite, and Akkadian.

Middle Persian, spoken from the 3rd century BC to the 9th century AD, is represented by numerous epigraphic texts of Sāsānian kings, written in Aramaic script; there is also a varied literature in Middle Persian embracing both the Zoroastrian and the Manichaean religious traditions. Pahlavi was the name of the official Middle Persian language of the Sāsānian Empire.

Modern Persian grammar is in many ways much simpler than its ancestral forms, having lost most of the inflectional systems of the older varieties of Persian. Other than markers to indicate that nouns and pronouns are direct objects, Modern Persian has no system of case inflections. Possession is shown by addition of a special suffix (called the *ezāfeh*) to the possessed noun. Verbs retain a set of personal endings related to those of other Indo-European languages, but a series of prefixes and infixes (word elements inserted within a word), as well as auxiliary verbs, are used instead of a single complex inflectional system to mark tense, mood, voice, and the negative.

Persian literature, body of writings in Modern Persian (Fārsī), the form of the Persian language written with the Arabic alphabet and with many Arabic loanwords, that emerged by the 9th century, especially in northeast Iran, and became established as the literary form of the Persian language in Iran and northern India.

A brief treatment of Persian literature follows. For full treatment, see MACROPAEDIA: Islāmic Arts.

After the Arab conquest of Iran in the 7th century, Islām replaced orthodox Zoroastrianism and its related heterodoxies as the dominant religion and also eclipsed the minority religions, Buddhism, Nestorian Christianity, and Manichaeism (all of which had some discernible influence on later literary subject matter and imagery), and Arabic became the language of law and culture. In the 9th century, however, the Persian political revival was accompanied by the emergence of a Persian literary medium, expecially in northeast Iran, where the dialect known as Modern, or New, Persian began to be used for literary expression and so became established as the literary form of the Persian language in Iran and in northern India. Mid-20th-century research, by study of an indigenous spoken dialect preserved among the Iranian people and of the learned language of Arabic (with its greater vocabulary), has revealed examples of the early form of this language. The first writings in Modern Persian were in verse, the medium of praise and pleasure, and Arabic elements were few. As prose translations from Arabic began to be made, rhetorical refinements based on Arab literary conventions and more Arabic words and literary devices were introduced.

The earliest major genres of Persian poetry were the panegyric and elegy, both written in the form of the qasida (a formal ode), and their first great exponent was Rūdakī, who flourished under the Sāmānid Naṣr II (913–943). Another form soon to develop was the shorter lyric, or ghazel (ghazal), used for bacchic odes and later for love poetry. Both the qasida and the ghazel were monorhymed. The introduction of the rhyming couplet, *maṡnavī,* effected the release from the limitations of monorhyme and led to the composition of epic and long didactic poems. Like the robāʿī, or quatrain, the *maṡnavī* was a purely Persian development; and the robāʿī, unlike most other poetic forms, was unknown in Arabic.

The foundations of Persian prose, as of poetry, were laid in the time of the Sāmānid dynasty. In 963 Balʿami, vizier of al-Manṣūr I, published an abridged translation of the famous annals of aṭ-Ṭabarī. About the same time, a band of theologians from Transoxania made a Persian version of aṭ-Ṭabarī's other great work, his commentary on the Qurʾān, thus demonstrating that Persian also was suitable for sacred texts. Al-Manṣūr I also commissioned the first Persian book on medicine, the pharmacopoeia of Abū Manṣūr Muvaffaq of Herat. The application of Persian to philosophy and science, which involved the coining of an extensive and subtle technical vocabulary, ranks among the outstanding achievements of Avicenna, whose formative years were passed at the Sāmānid court.

Persian lynx: *see* caracal.

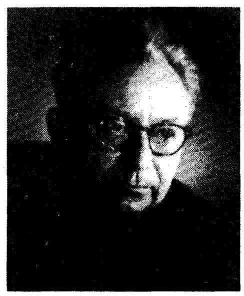
Persian melon: *see* muskmelon.

Persian Royal Road, ancient road running from Susa, the ancient capital of Persia, across Anatolia to the Aegean Sea, a distance of more than 1,500 miles (2,400 km). Royal messengers, who, according to the Greek historian Herodotus, were stopped by "neither snow, nor rain, nor heat, nor gloom of night," traversed the entire road in nine days, thanks to a system of relays. Normal travel time was about three months. Alexander the Great made use of the Royal Road in his invasion and conquest of the Persian Empire.

Persian Wars: *see* Greco-Persian Wars.

Persian wheel (in irrigation): *see* sakia.

Persichetti, Vincent (b. June 6, 1915, Philadelphia—d. Aug. 14, 1987, Philadelphia), American composer noted for his succinct polyphonic style (based on interwoven melodic lines), forceful rhythms, and generally diatonic (moving stepwise; not atonal or highly chromatic) melodies.



Persichetti

By courtesy of the Juilliard School, New York; photograph, Clarence E. Premo

Persichetti began piano lessons at the age of 5, studied theory at 8, and produced his first two works at 14. Among his later teachers were the composer Roy Harris and the conductor Fritz Reiner, the latter at the Curtis Institute in Philadelphia. In 1942 Persichetti began teaching at the Philadelphia Conservatory, and from 1947 he taught at the Juilliard School in New York City. He also was music editor for the Elkan-Vogel Company in Philadelphia.

Among his many published works are several for band and various chamber combinations and the highly regarded *Piano Quintet* (1955). He also wrote nine symphonies and many piano concerti, as well as songs, solo sonatas (including one for harpsichord), ballet music, and a large group of serenades. Skilled in the composition of simple, elegant pieces as well as more complex and virtuosic works, Persichetti was credited with having produced a distinctive blend of Classical, Romantic, and Modernist elements.

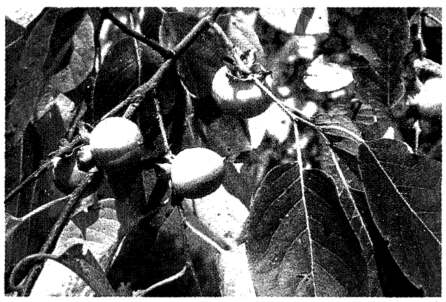
He wrote the book *Twentieth-Century Harmony: Creative Aspects and Practice* (1961).

Persigny, Jean-Gilbert-Victor Fialin, duc de (duke of) (b. Jan. 11, 1808, Saint-Germain-Lespinasse, Fr.—d. Jan. 12, 1872, Nice), French statesman, an ardent Bonapartist, who helped pave the way for Louis-Napoléon's rise to power as the emperor Napoleon III.

Of a petty noble family, he served in the hussars from 1825 to 1831, when he was dismissed for participation in a political rebellion. Thereafter he devoted himself to the restoration of the empire and to the cause of Louis-Napoléon Bonaparte: he played an active part in the latter's attempted coups in 1836 and 1840 and in his eventual election to the presidency in 1848. He was then appointed aide-de-camp to Louis-Napoléon and was simultaneously deputy for Loire (1849–51), enjoying an important backstairs influence.

As minister of the interior (1852–54) he accelerated the proclamation of the empire and worked energetically to organize a Bonapartist party; as French ambassador in London (1855–58 and 1859–60) he sought to strengthen Anglo-French relations. He was minister of the interior again (1860–63), but his conduct at the elections in 1863 gave rise to criticism, and he was dismissed. Napoleon III gave him the ducal title (1863) and was grateful to him but now looked upon his views as being too extreme and disregarded the advice that Persigny, frustrated by inactivity, continued to send. Gradually their relations deteriorated, particularly as Persigny and the empress Eugénie were bitter enemies. Persigny's *Mémoires* appeared in 1896.

persimmon, tree of the genus *Diospyros* (family Ebenaceae) and its globular, edible fruit. The Oriental persimmon (*D. kaki*), an important and extensively grown fruit in China and Japan, where it is known as *kaki,* was introduced into France and other Mediterranean



American persimmon (*Diospyros virginiana*)
H.R. Hungerford

countries in the 19th century and grown to a limited extent there. Introduced into the United States a little later, it is now grown commercially on a small scale in California and in the Gulf states, mainly in home gardens. The fruit, 5 to 8 cm (2 to 3 inches) or more in diameter, yellow to red in colour, somewhat resembles a tomato in appearance and contains vitamin A, with lesser amounts of vitamin C. Except for such varieties as Fuyu, the fruit tends to be highly astringent until soft-ripe or, as in Japan, until treated with certain gases. The trees will tolerate temperatures to about −18° C (0° F).

The native American persimmon (*D. virginiana*) is a small tree, occasionally up to 10 m (33 feet) in height, and grows from the Gulf states north to central Pennsylvania and central Illinois. The fruit is 3 to 5 cm (1 to 2 inches) in diameter, usually rather flattened, and dark red to maroon in colour. Most fruits contain several rather large, flattened seeds. It is generally considered more flavourful in its softened state than the Oriental species. Considerable quantities are gathered from the wild. A number of superior kinds have been named and propagated to a limited extent but are not grown commercially. Persimmons are eaten fresh as a dessert fruit, often with sugar or liqueur, stewed, or cooked as jam.

Persis, Persian PARSA, ancient country in the southwestern part of Iran, roughly coextensive with the modern *ostān* (province) of Fārs. Its name was derived from the Iranian tribe of the Parsua (Parsuash; Parsumash; Persians), who settled there in the 7th century BC. Herodotus lists the leading Persian tribes as the Pasargadae, to which the Achaemenians, the royal family of Persia, belonged; the Maraphii; and the Maspii. It was these three that Cyrus II the Great assembled to approve his plans for his revolt against Astyages, his Median overlord, in 550 BC.

The inhabitants of Persis were considered to be the rulers of the Achaemenian Empire and were exempt from taxation. As the homeland of the Achaemenian dynasty, Persis was closely associated with the monarchy. Cyrus built his capital at Pasargadae, and about 30 miles (48 km) to the southwest Darius I founded his new capital of Parsa, known to the Greeks as Persepolis, the Persian City.

The history of Persis after the fall of the Achaemenian Empire in 330 BC is obscure. Lying apart from the main strategic and economic highways of Iran, it preserved its ancient culture, language, and religion under the Seleucids and enjoyed considerable autonomy during the Parthian period. In the 3rd century AD its rulers, heirs of the Achaemenian tradition, founded the Sāsānian Empire.

Persius, in full AULUS PERSIUS FLACCUS (b. AD 34, Volaterrae [now in Italy]—d. 62, Campania), Stoic poet whose Latin satires reached a higher moral tone than those of other classical Latin poets (excepting Juvenal).

A pupil and friend of the Stoic philosopher Lucius Annaeus Cornutus and a fellow student of the poet Lucan, who admired all he wrote, Persius discovered his vocation as a satirist through reading the 10th book of Lucilius. He wrote painstakingly, and his book of satires was still incomplete at his premature death. The book, edited by his friends Cornutus and Caesius Bassus, was an immediate success. The six satires, amounting to 650 lines, are in hexameters; but what appears as a prologue, in which Persius (an extremely wealthy man) ironically asserts that he writes to earn his bread, not because he is inspired, is in choliambics. The first satire censures literary tastes of the day, reflecting the decadence of national morals. The remaining books are philosophical discussions on themes often treated by Seneca, such as what may rightly be asked of the gods, the necessity of self-knowledge for public men, and the Stoic doctrine of freedom.

Persius is said to have been gentle in disposition, girlishly modest, good-looking, and devoted to his mother, sister, and aunt. To his mother and sister he left a considerable fortune.

persona, in literature, the person who is understood to be speaking (or thinking or writing) a particular work. The persona is almost invariably distinct from the author; it is the voice chosen by the author for a particular artistic purpose. The persona may be a character in the work in question or merely an unnamed narrator; but, insofar as the manner and style of expression in the work exhibit taste, prejudice, emotion, or other characteristics of a human personality, the work may be said to be in the voice of a persona.

The term derives from the Latin *persona,* meaning an actor's mask, and is thus etymologically related to the term *dramatis personae,* designating the characters in a drama.

persona, in psychology, the personality that an individual projects to others, as differentiated from the authentic self. The term, coined by Carl Jung, is derived from the Latin *persona,* referring to the masks worn by Etruscan mimes. According to Jung, the persona enables an individual to interrelate with the world around him by reflecting the role in life that the individual is playing. In this way one can arrive at a compromise between one's innate psychological constitution and society. Thus the persona enables the individual to adapt to society's demands.

personal income tax, a tax imposed by public authorities on the incomes of individuals or family units. *See* income tax.

personal-liberty laws, pre-U.S. Civil War laws passed by Northern state governments to counteract the provisions of the Fugitive Slave Acts and to protect escaped slaves and free blacks settled in the North.

Contravening the Fugitive Slave Act of 1793, which did not provide for trial by jury, Indiana (1824) and Connecticut (1828) enacted laws making jury trials possible upon appeal. In 1840 Vermont and New York granted fugitives the right of jury trial and provided them with attorneys. After 1842, when the Supreme Court ruled that enforcement of the Fugitive Slave Act was a federal function, some Northern state governments passed laws forbidding state authorities to cooperate in the capture and return of fugitives. In the reaction to the Fugitive Slave Act contained in the Compromise of 1850, most Northern states provided further guarantees of jury trial, authorized severe punishment for illegal seizure and perjury against alleged fugitives, and forbade state authorities to recognize claims to fugitives. These laws were among the many assaults on states' rights cited as a justification for secession by South Carolina in 1860.

personal property (law): *see* real and personal property.

personalism, a school of philosophy, usually idealist, which asserts that the real is the personal, *i.e.,* that the basic features of personality—consciousness, free self-determination, directedness toward ends, self-identity through time, and value retentiveness—make it the pattern of all reality. In the theistic form that it has often assumed, personalism has sometimes become specifically Christian, holding that not merely the person but the highest individual instance of personhood—Jesus Christ—is the pattern.

Personalism is thus in the tradition of the *cogito, ergo sum* ("I think, therefore I am") of René Descartes in holding that, in the subjective flow of lived-through experience, one makes more direct soundings of the real than in anything arriving through the tortuous paths of perceptual processes. The word *person* comes from the Latin *persona,* which referred to the mask worn by an actor and thus to his role. Eventually, it came to mean the dignity of a man among men. The person is thus supreme both in reality (as substance) and in value (as dignity).

There are various kinds of personalism. Though most personalists are idealists, believing that reality is either of, in, or for consciousness, there are also realistic personalists, who hold that the natural order, though created by God, is not as such spiritual; and, again, though most personalists are theists, there are also atheistic personalists. Among the idealists there are absolutistic personalists (*see* absolute idealism), panpsychistic personalists (*see* panpsychism), ethical personalists, and personal idealists, for whom reality comprises a society of finite persons or an ultimate person, God.

Though elements of personalistic thought can be discerned in many of the greatest philosophers of the Western tradition and even in the Orient—as, for example, in Rāmānuja, a 12th-century Hindu theist—Gottfried Wilhelm Leibniz, a famous 17th–18th-century German philosopher and mathematician, is usually singled out as the founder of the movement and George Berkeley, the 18th-century Anglo-Irish churchman and epistemologist, as another of its seminal sources.

Personalism has been strongly represented in France, usually under the name of spiritualism. Inspired by Maine de Biran, an 18th–19th-century thinker who had taken as primordial the inner experience of acting against a resisting world, Félix Ravaisson-Mollien, a 19th-century philosopher and archaeologist, drew a radical distinction between the spatial world of static necessary law and the world of living individuals, spontaneous, active, and developing. This led in turn to the personalism of Henri Bergson, a 19th–20th-century intuitionist, who stressed duration as a nonspatial experience in which subjective states both present and past intimately interpenetrate to form the free life of the spiritual person and who posited the élan vital as a cosmic force expressing this life philosophy.

Personalism in the United States matured among 19th–20th-century philosophers of religion, often of the Methodist Church, several of whom had studied in Germany under Rudolf Hermann Lotze, an erudite metaphysician and graduate in medicine. George Holmes Howison, for example, stressed the autonomy of the free moral person to the point of making him uncreated and eternal and hence free from an infinite person. Borden Parker Bowne, who made Boston University the citadel of personalism, was explicitly theistic, holding that men are creatures of God with many dimensions—moral, religious, emotional, logical—each worthy of consideration in its own right and each reflecting the rationality of the creator. Nature, too, for him, displays the energy and rational purpose of a God who is immanent in it as well as transcendent over it.

Through Bowne's disciples Edgar Brightman and Ralph Tyler Flewelling and many others, personalism was influential through the mid-20th century, and its impact upon existentialism and phenomenology has perpetuated its spirit and many of its insights.

personalismo, in Latin America, the practice of glorifying a single leader, with the resulting subordination of the interests of political parties and ideologies and of constitutional government.

Latin-American political parties have often been constituted by the personal following of a leader rather than by adherents of certain political beliefs or proponents of certain issues. Thus the popular term for such parties or their members has been often derived from their leaders—*e.g.,* Peronistas (the followers of Juan Perón, Argentine president in 1946–55, 1973–74) or Fidelistas (the followers of Fidel Castro, Cuban leader who came to power in 1959). The archetypical demagogue and focus of *personalismo* in Mexico was General Antonio López de Santa Anna, who dominated Mexican political life between 1821 and 1855. The Dominican Republic and Ecuador in particular have suffered from *personalismo,* but the phenomenon has been rather pervasive throughout Latin-American history.

Personalismo is related to the phenomenon in Latin America called *caudillismo,* by which a government is controlled by dictatorial leaders (caudillos). During and immediately after the Latin-American independence movement in the early 19th century, politically unstable conditions led to the widespread emergence of such leaders; thus the period is often referred to as the "age of the caudillos." The flamboyant leader of the independence movement, Simón Bolívar, was the first such ruler (of Gran Colombia, his ephemeral political creation). Although some nations, such as Argentina and Chile, developed more regular forms of constitutional government in the latter 19th century, *caudillismo* remained into the 20th century a common feature of Latin-American states and prevailed in such countries as Argentina, during Perón's regime—as a form of political bossism—and in others as outright and brutal military dictatorship, as with the regime of Juan Vicente Gómez in Venezuela (ruled 1908–35). The latter was a ruler in the Venezuelan tradition, following the pattern of such dictators as José Antonio Páez, who controlled the country in 1830–46 and again in 1860–63. Among other well-known caudillos of the 19th century were Juan Manuel de Rosas of Argentina, Francisco Solano López of Paraguay, and Andrés Santa Cruz of Bolivia. In such countries as Argentina and Mexico, during periods of weak central government, regional caudillos operated in their own localities in much the same way as did those on a national scale.

personality, the characteristic way in which a particular individual thinks, feels, and behaves. Personality embraces a person's moods, attitudes, and opinions and is most clearly expressed in his interactions with other people. Personality is those behavioral characteristics, both inherent and acquired, that distinguish each individual and are observable in his relations to the environment and to the social group.

A brief treatment of personality and its measurement follows. For full treatment, *see* MACROPAEDIA: Personality.

Personality theories. Theories of personality have been offered in an attempt to understand how a given person is similar to others, how he is different, and what organizes a particular set of similarities and differences into an overall pattern. The ancient Greeks used their ideas about physiology to account for differences and similarities in temperament. They believed emotional and physical health depended on a balance of four fluids, called humours. Each humour was identified with a personality trait: blood with enthusiasm, black bile with melancholy, yellow bile (choler) with anger, and phlegm with apathy. Each mood or disposition was seen as a result of a combination of these fluids.

In the 20th century, the German psychiatrist Ernst Kretschmer developed a personality-classification scheme based on three basic bodily structures (somatotypes) and their accompanying psychological characteristics. However, this and other "constitutional" theories of personality have been found to have only limited validity, if any at all.

The most influential personality theory of the modern era has been Sigmund Freud's psychoanalytic one. Freud concentrated on understanding the forces at work in a personality and the internal structures which channel and direct them. In Freud's view, the human personality has three components: the id, the ego, and the superego. The id is the original structure of the personality and contains primitive, inherited drives or instincts; these biologically mediated factors supply the driving force, or psychic energy, to the personality through the id. The id is associated with the inborn tendency of a person to satisfy his drives and thus release tension, or, in other words, to achieve pleasure and avoid pain. In infancy and childhood the ego develops from the id so that the individual can interact realistically with the objective world in his quest to satisfy his instinctual needs. The ego controls the higher intellectual, logical, and perceptual functions involved in the control of behaviour. The chief expression of the ego is realistic, logical thinking. The superego was theorized by Freud to represent the person's adoption of social and moral values. The conscience is part of the superego. Freud theorized that the overall orientation of the human personality is directed toward satisfying a person's inborn drives or instincts. The individual personality structure develops out of the struggle between drives (which originate in the id) and the processes to control and at the same time satisfy these drives (which processes are centred in the ego).

Freud's psychoanalytic concepts have had a profound influence on personality theory in the 20th century. He turned scientific attention from mere descriptions of personality "types" to an interest in how people become what they are. Psychoanalysis was especially influential in its insistence that personality is affected by both biological and psychosocial forces that operate principally within the family, and in its claim that the major foundations of individual personality are laid early in life. Psychoanalytic theory has provided a workable preliminary framework for much personality research involving motivations and development.

Those of Freud's followers who broke away to found psychotherapeutic schools of their own failed to develop followings comparable to Freud's. Like Freud, Carl Jung (*q.v.*) emphasized unconscious motives. He separated himself from Freud's emphasis on sexuality, however, and formulated a typal theory that distinguished people according to whether they were extroverted (outward-looking) or introverted (inward-looking). Jung also posited a storehouse of inherited racial memories called the "collective unconscious." An individual personality is a persona (mask) drawn from this repository. For Alfred Adler (*q.v.*), the motive force of personality was a "drive to power" which led individuals to compensate for feelings of inferiority. Freud's personality theories were further refined by Erik H. Erikson (*q.v.*), who integrated biological, psychological, and social factors into a comprehensive theory of personality development and change covering the full span of the human lifetime.

Contemporary personality studies generally tend to be empirical and based on experiments and, perforce, have a narrower scope than the sweeping theories of psychoanalysis. One major area of study is personality traits; traits refer to persistent (though not unvarying) behaviours or behaviour patterns that imply a disposition to respond in a particular, predictable way. Pyschological traits are more or less stable over time and across different situations, and they contribute much to the consistency of a person's behaviour. Traits are the product of both genetic predisposition and experience.

There is considerable evidence to suggest that personality is actively shaped by external influences, chiefly the other members of one's family and the larger sociocultural context common to all members of a family. But there has also been an accumulation of experimental evidence suggesting that genetic factors play a prominent role in the formation of personality. Systematic observations of human infants have shown clearly observable differences in their activity, passivity, fussiness, cuddliness, and responsiveness. It appears that these patterns, which can be considered expressions of personality, are at least partially genetically determined. In general, evidence is emerging that personality traits such as sociability, impulsiveness, altruism, aggression, and truthfulness have at least some inherited biological basis.

Measurement. Contemporary academic investigation of personality makes little attempt to sustain a consistent, generally applicable view of personality, preferring an eclectic use of existing theories to assemble masses of heterogenous data, which are then scrutinized for patterns. The measurement or assessment of personality is an attempt to define human characteristics, measure them objectively, and relate them to social behaviour. Following the example of intelligence testing, tests have been devised that allow for the measurement of specific "factors" of the personality such as sociability or introversion, which can be viewed as dimensions of traits. Despite the problems which have plagued this approach, the intellectual inclination it embodies—its attention to empirical, quantitative data collection and distrust of general-theory building—appears well-rooted.

The most common techniques for measuring and assessing personality are interviews, behavioral observation, and personality tests.

In an interview the individual under assessment "tells his story" to the interviewer and answers questions about himself. In clinical (diagnostic) interviews the aim is not only to collect information about a person but to be able to use it toward making an appropriate referral or designing a psychotherapeutic program for that individual. Shortcomings to the interview technique include interviewer bias and changed subject behaviour to match the perceived expectations of the interviewer.

Behavioral observation techniques attempt to assess the individual's behaviour without the distorting lenses of one's self-image and experimenter expectation. An individual may be observed in a natural or simulated setting and the frequency of a certain behaviour noted. The collection of biographical information from indirect sources such as medical records or relatives may also be useful for personality assessment.

Personality tests tend to be of two main types, personality inventories and projective tests. Personality inventories usually consist of a large number of questions to which the subject must respond true or false—*e.g.,* "I am afraid to be alone," "I consider myself a happy person." Such tests are easy to administer and score, produce objective results, and allow the comparison of profiles from individual to individual. Probably the most widely used test of this type is the Minnesota Multiphasic Personality Inventory. The respondent receives a score for each of nine clinical subscales, for instance, depression, schizophrenia, and paranoia. The higher the score on any of the scales, the more likely the person is to have that mental disorder. Another well-known personality inventory is the California Psychological Inventory.

Projective tests present the examinee with an ambiguous stimulus and ask him to comment on it. Such tests are called projective because the subject is thought to project his personality onto the stimulus. One of the more well known of these is the Rorschach test, in which a person must make verbal associations to a series of 10 inkblots. The subject's responses are scored according to location of the percept (association) in the inkblot; the kind of stimulus characteristic (*e.g.,* form or colour) emphasized; content of the percept; perception of movement; and number of percepts. Another is the Thematic Apperception Test, which requires the subject to invent and tell a story about a series of ambiguous drawings that are shown to him. *See also* developmental psychology; humanistic psychology.

personality disorder, also called CHARACTER DISORDER, mental disorder that is marked by deeply ingrained and lasting patterns of inflexible, maladaptive, or antisocial behaviour. A personality disorder is an accentuation of one or more personality traits to the point that the trait significantly impairs an individual's social or occupational functioning. Personality disorders are not, strictly speaking, illnesses, since they need not involve the disruption of emotional, intellectual, or perceptual functioning. In many cases, an individual with a personality disorder does not seek psychiatric treatment for such unless he is pressured to by his relations or by a court.

There are many different types of personality disorders; they are classified according to the particular personality traits that are accentuated. Persons who have a paranoid personality disorder show a pervasive and unjustified mistrust and suspiciousness of others. They may be secretive or aggressive and are excessively sensitive to implied slights or criticism. Persons with schizoid personality disorder appear aloof, withdrawn, unresponsive, humourless, and dull and are solitary to an abnormal degree. Persons with explosive personality disorder exhibit extreme emotional instability characterized by explosive outbursts of rage upon minor provocation. Persons with histrionic personality disorder persistently display overly dramatic, highly excitable, and intensely expressed behaviour, *i.e.,* histrionics. Persons with dependent personality disorder lack energy and initiative and passively let others assume responsibility for major aspects of their lives. Persons with passive-aggressive personality disorder express their hostility through such indirect means as stubbornness, procrastination, inefficiency, and forgetfulness.

One of the most important disorders is the antisocial, sociopathic, or psychopathic personality disorder. This disorder is chiefly characterized by a personal history of chronic and continuous antisocial behaviour in which the rights of others are violated. Poor or nonexistent job performance is another major indicator. Persons with antisocial personality disorder make up a significant portion of the criminal and delinquent elements of society. Besides persistent criminality, the symptoms may also include sexual promiscuity or sexual aggression and drug addiction or alcoholism. Sociopaths generally accept their behaviour as natural, feel no guilt when they hurt others, see little reason for or possibility of change, and resist therapy.

The causes of personality disorders are unknown, though there is undoubtedly a hereditary element involved. Personality traits are, by definition, virtually permanent, and so personality disorders are only partially amenable to treatment, if at all. The most effective treatment combines various behavioral and psychotherapeutic therapies. Medication may be helpful in alleviating periodic anxiety, depression, emotional instability, or paranoid tendencies in some cases.

personification, figure of speech in which human characteristics are attributed to an abstract quality, animal, or inanimate object. An example is "The Moon doth with delight / Look round her when the heavens are bare" (Wordsworth, "Ode: Intimations of Immortality from Recollections of Early Childhood," 1807). Personification has been used in European poetry since Homer and is particularly common in allegory; for example, the medieval morality play *Everyman* (*c.* 1500) and the Christian prose allegory *Pilgrim's Progress* (1678) by John Bunyan contain characters such as Death, Fellowship, Knowledge, Giant Despair, Sloth, Hypocrisy, and Piety. Personification became almost an automatic mannerism in 18th-century Neoclassical poetry, as exemplified by these lines from Thomas Gray's "Elegy Written in a Country Church Yard":

> Here rests his head upon the lap of earth
> A youth to Fortune and to Fame unknown:
> Fair science frowned not on his humble birth,
> And Melancholy marked him for her own.

personnel administration, the management of the people in working organizations. It is also frequently called personnel management, industrial relations, employee relations, and manpower management. It represents a major subsystem in the general management system, in which it refers to the management of human resources, as distinguished from financial or material resources. The term may be used to refer to selected specific functions or activities assigned to specialized personnel officers or departments. It is also used to identify the entire scope of management policies and programs in the recruitment, allocation, leadership, and direction of manpower.

Personnel administration begins with the definition of the required quantities of particular personal capabilities. Thereafter, people must be found, recruited, selected, trained or retrained, negotiated with, counseled, led, directed, committed, rewarded, transferred, promoted, and finally released or retired. In many of these relations, managers deal with their associates as individuals (the field takes its name in part from this type of relationship). In some working organizations, however, employees are represented by unions, and managers bargain with these associations. Such collective-bargaining relationships are generally described as labour relations.

Current practice shows wide variation in the range of responsibilities assigned to personnel or industrial-relations departments. Major areas of personnel department responsibilities include: (1) organizing—devising and revising organizational structures of authority and functional responsibility and facilitating two-way, reciprocal, vertical, and horizontal communication; (2) planning—forecasting personnel requirements in terms of numbers and special qualifications, scheduling inputs, and anticipating the need for appropriate managerial policies and programs; (3) staffing, or manning—analyzing jobs, developing job descriptions and specifications, appraising and maintaining an inventory of available capabilities, recruiting, selecting, placing, transferring, demoting, promoting, and thus assuring qualified manpower when and where it is needed; (4) training and development—assisting team members in their continuing personal growth, from pre-employment, preparatory job training to executive development programs; (5) collective bargaining—negotiating agreements and following through in day-to-day administration; (6) rewarding—providing financial and nonfinancial incentives for individual commitment and contribution; (7) general administration—developing appropriate styles and patterns of leadership throughout the organization; (8) audit, review, and research—evaluating current performance and procedures in order to facilitate control and improve future practice.

Individual personnel departments may be assigned varying degrees of responsibility in a few, many, or all of these areas. In areas assigned to them, personnel departments exercise various levels of authority. Some officers and departments create policies and make major decisions and determinations. Some study and recommend policies and create and direct appropriate programs. The personnel vice president may be a member of the executive cabinet; he may be expected to assume leadership in and responsibility for all manpower management policy and programs. Other personnel departments are essentially "staff" or advisory; their activities are restricted to recommending, consulting, and providing such specified technical and professional services as are requested by operating managers. Among the most common examples, the personnel staff (when, as, and if requested and authorized by operating managers) analyzes jobs and prepares job specifications, visits sources of potential employees, conducts preliminary screening interviews, administers tests, supervises rating or appraisal programs, counsels employees, conducts training and development programs, negotiates agreements, monitors grievance settlements, maintains safety and accident control programs, administers employee benefits and services, prepares forecasts of future manpower requirements, recommends changes in organizational structures, supervises formal in-house communication, conducts employee attitude and morale surveys, and supplies other related services, sometimes including public relations.

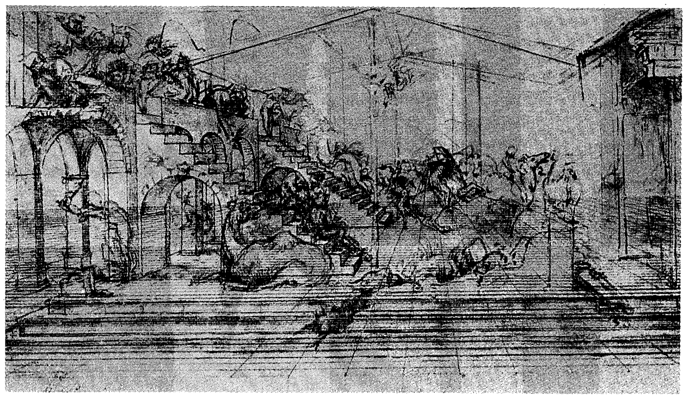
Persons, Robert: *see* Parsons, Robert.

perspective, method of graphically depicting three-dimensional objects and spatial relationships on a two-dimensional plane or on a plane that is shallower than the original (for example, in flat relief). Perceptual methods of representing space and volume, which render them as seen at a particular time and from a fixed position and which are characteristic of Chinese and most Western painting since the Renaissance, are in contrast to conceptual methods. The pictures of young children and primitives (untrained artists), many of the paintings of cultures such as ancient Egypt and Crete, India, Islām, and pre-Renaissance Europe, as well as the paintings of many modern artists, depict objects and surroundings independently of one another, as they are known to be rather than as they are seen to be, and from the views that best present their most characteristic features; in many Egyptian and Cretan paintings, for example, the head and legs of a figure are shown in profile, while the eye and torso are shown frontally. This system produces not the illusion of depth but the sense that objects and their surroundings have been compressed within a shallow space behind the picture plane.

In Western art, illusions of perceptual volume and space are generally created by use of the linear perspectival system, based on the observations that objects appear to the eye to shrink and parallel lines and planes to converge to infinitely distant vanishing points as they recede in space from the viewer. Parallel lines in spatial recession will appear to converge on a single vanishing point, called one-point perspective. Perceptual space and volume may be simulated on the picture plane by variations on this basic principle, differing according to the number and location of the vanishing points. Instead of one-point (or central) perspective, the artist may use, for instance, angular (or oblique) perspective, which employs two vanishing points.

Another kind of system—parallel perspective combined with a viewpoint from above—is traditional in Chinese painting. When buildings rather than natural contours are painted and it is necessary to show the parallel horizontal lines of the construction, parallel lines are drawn parallel instead of converging, as in linear perspective. Often foliage is used to crop these lines before they extend far enough to cause a building to appear warped.

The early European artist used a perspective that was an individual interpretation of what he saw rather than a fixed mechanical method. At the beginning of the Italian Renaissance, early in the 15th century, the mathematical laws of perspective were discovered by the architect Filippo Brunelleschi, who worked out some of the fundamental principles, including the concept of the vanishing point, which had been known to the Greeks and Romans but had been lost. These principles were applied in painting by Masaccio (for example, in his "Trinity" fresco in Sta. Maria Novella, Florence; *c.* 1427), who within a short period brought about an entirely new approach in painting. A style was soon developed using configurations of architectural exteriors and interiors as the background for religious paintings, which thereby acquired the illusion of great spatial depth. In his seminal *Della pittura* (1436; *On Painting*, 1956), Leon Battista Alberti codified, especially for painters, much of the practical work on the subject that had been carried out by earlier artists; he formulated, for example, the idea that "vision makes a triangle, and from this it is clear that a very distant quantity seems no larger than a point."



Linear perspective study for "The Adoration of the Magi," silverpoint, pen, and bistre heightened with white on prepared ground by Leonardo da Vinci, *c.* 1481; in the Uffizi, Florence
Alinari—Art Resource/EB Inc.

Linear perspective dominated Western painting until the end of the 19th century, when Paul Cézanne flattened the conventional Renaissance picture space. Linear perspective also plays an important part in presentations of ideas for works by architects, engineers, landscape architects, and industrial designers, furnishing an opportunity to view the finished product before it is begun. Differing in principle from linear perspective and used by both Chinese and European painters, aerial perspective (*q.v.*) is a method of creating the illusion of depth by a modulation of colour and tone.

perspective scenery, in theatre, scenery and the scene design technique that represents 3-dimensional space on a flat surface, so as to create an illusion of reality and an impression of distance. Developed during the Italian Renaissance by Baldassarre Peruzzi and his student Sebastiano Serlio, perspective scenery applied the newly mastered science of optical perspective and brought the craft of illusion to the Italian stage. An initial motivation may have been to allow theatre to move from outdoors into closed rooms, where perspective painting could make small spaces appear larger.

Influenced by the perspective painting of Renaissance artists, particularly Florentine artist Filippo Brunelleschi, who formalized principles of perspective, and by the 15th-century revival of Vitruvius' writings on architecture, Peruzzi applied the laws of perspective to scene design. His work provided a basis for Sebastiano Serlio's *De Archittetura* (1545), which outlined methods of constructing perspective scenery and the raked, or angled, stage—from which the terms upstage and downstage derive. Angle perspective, which created an illusory, offstage vanishing point where painted vistas disappeared, was an 18th-century refinement of the Renaissance techniques of perspective scenery.

Perspex (acrylic plastic): *see* Lucite.

perspiration, in most mammals, water given off by the intact skin, either as vapour by simple evaporation from the epidermis (insensible perspiration) or as sweat, a form of cooling in which liquid actively secreted from sweat glands (*q.v.*) evaporates from the body surface. Sweat glands, although found in the majority of mammals, constitute the primary means of heat dissipation only in certain hoofed animals (orders Artiodactyla and Perissodactyla) and in primates, including man. Their secretion is largely water (usually about 99 percent), with small amounts of dissolved salts and amino acids.

When the body temperature rises, the sympathetic nervous system stimulates the eccrine sweat glands to secrete water to the skin surface, where it cools the body by evaporation. Thus, eccrine sweat is an important mechanism for temperature control. In extreme conditions, human beings may excrete several litres of such sweat in an hour.

Human eccrine sweat is essentially a dilute sodium chloride solution with trace amounts of other plasma electrolytes. In some cases a reddish pigment may also be present. In a person unused to heavy sweating, the loss of sodium chloride during a period of heavy labour or high temperatures may be great (*see* sodium deficiency), but the efficiency of the gland increases with use, and in acclimatized persons the salt loss is decreased.

The apocrine sweat glands, associated with the presence of hair in human beings (as on the scalp, the armpit, and the genital region), continuously secrete a concentrated fatty sweat into the gland tube. Emotional stress stimulates contraction of the gland, expelling its contents. Skin bacteria break down the fats into unsaturated fatty acids that possess a pungent odour.

persuasion, the process by which a person's attitudes or behaviour are, without duress, influenced by communications from other people. One's attitudes and behaviour are affected by other factors (for example, verbal threats, physical coercion, one's physiological states). Not all communication is intended to be persuasive; some of it has such purposes as informing or entertaining. Persuasion often involves manipulating other people, and for this reason many find the exercise distasteful. Others might argue that without some degree of social control and mutual accommodation, the human community becomes disordered and that persuasion indeed gains moral accept-ability when the alternatives are considered. To paraphrase Winston Churchill's evaluation of democracy as a form of government, persuasion is the worst method of social control except for all the others.

In European universities of the Middle Ages, persuasion was one of the basic liberal arts to be mastered by any educated man; and, from the days of imperial Rome through the Reformation, it was raised to a fine art by preachers who used the spoken word to move men to virtue and the Holy Land. In the modern era, persuasion, in the form of advertising, supports a major industry; only education and the military command a greater share of the gross national product.

The process of persuasion can be conveniently analyzed in a preliminary way by distinguishing verbal communication (as cause, or stimulus) from the associated changes in attitudes (as effect, or response).

Analysis has led to the delineation of a series of successive steps that a person undergoes in being persuaded. The communication first is presented; the person pays attention to it, and he comprehends its contents (including the basic conclusion being urged and perhaps also the evidence offered in its support). For persuasion to be effected, the individual must yield to, or agree with, the point being urged; and, unless only the most immediate impact is of interest, he must retain this new position until opportunity arises to act on it. Finally, if the fruits of the persuasive process are to be reaped, he must carry out the behaviour implied by his new attitudinal position; *e.g.*, he enlists in the army or becomes a Buddhist monk or begins to eat cornflakes for breakfast.

Some, but by no means all, theorists emphasize a similarity between education and persuasion. They hold that persuasion closely resembles the learning of new information through informative communication. Thus, since repetition in communication will modify learning, they infer that it will have persuasive impact as well; that, for example, principles of verbal learning and conditioning are widely and profitably applied by persuaders (as in the judicious repetition of television advertisements). The learning approach tends to emphasize attention, comprehension, and retention of the message.

One's reaction to persuasive communication depends in part on the message and to a considerable extent on the way in which the receiver perceives or interprets it. Words in a newspaper advertisement may take on different persuasive qualities if they are printed in red instead of in black. Perceptual theorists regard persuasion as altering the person's perception of any object of his attitudes. Perceptual approaches also rest on evidence that the receiver's preconceptions are at least as important as the message content in determining what will be understood. The approach stresses attention and comprehension.

While learning and perceptual theorists may stress objective intellectual steps involved in the process of being persuaded, another, functional, approach emphasizes more subjective motivational aspects. It views humans as essentially ego-defensive—that is, as organisms with beliefs that function to satisfy conscious and unconscious personal needs and that may have little to do with the objects toward which those attitudes and actions are directed. Functional theorists say, for example, that ethnic prejudice and other forms of social hostility derive more from individual personality structure than from information about the nature of these groups.

Other theories view the person confronted with persuasive communication as being in the harassed role of trying to find some reasonable compromise among many conflicting forces acting on him—*e.g.*, his own desires, his information, and the social pressures put upon him, including this new communication. Those (frequently called congruity, balance, consistency, or dissonance theorists) who stress this conflict-resolution model focus on how people weigh these forces in adjusting their attitudes. Some theorists who take this point of departure stress the intellectual aspects of persuasion, while others emphasize emotional considerations.

Each of the approaches considered above tends to neglect one or more steps in the process of being persuaded and thus serves to supplement rather than supplant the others. Another, more eclectic and inclusive approach, growing out of information-processing theory, is oriented to a consideration of all of the options implied by the communication aspects of source, message, channel (or medium), receiver, and destination (behaviour to be influenced); and each option is appraised for its persuasive efficacy in terms of presentation, attention, comprehension, yielding, retention, and overt behaviour.

Perth, capital, Western Australia, situated on Melville and Perth waters, on the estuary of the Swan River, 12 miles (19 km) above its mouth, which forms the inner harbour of Fremantle. The city, fifth largest in the nation, is the centre of a metropolitan area in which about three-fourths of the state's population is concentrated. In the early 19th century, the British, suspicious of French and U.S. interest in the Australian west coast, decided to expand settlement and to claim the entire continent. In 1827 Captain (later Sir) James Stirling arrived to choose a townsite. The following year, Captain Sir Charles Fremantle took possession of the area, and in 1829 a colony, with private financial backing, was declared. It was named after the county of Perth in Scotland, birthplace of Sir George Murray, then secretary of state for the colonies. Proclaimed a city in 1856, it was linked to Adelaide (in South Australia) by telegraph in 1877 and received strong impetus for growth from the discovery (1890) of gold at Coolgardie-Kalgoorlie (374 miles [602 km] east), from the opening of an improved Fremantle harbour (1901), and from the completion of the transcontinental railway in 1917. It became a lord mayoralty in 1929.

Perth and the Swan River estuary, Western Australia
R. Archibald—Shostal/EB Inc.

Perth is a major industrial centre, with heavy industries concentrated in the suburban zones of Kwinana, Fremantle (*qq.v.*), and Welshpool. Diversified manufactures include paint, plaster, printed materials, sheet metal, cement, rubber, tractors, steel, aluminum, and nickel; there are also petroleum refineries and food-processing plants.

The city has a moderate climate for eight months of the year, but January and February are quite hot, and both June and July are cool and damp. The city is accessible via several highways, the transcontinental railway, the port of Fremantle, and the international airport. It was the site of the Commonwealth and Empire Games in 1962. Perth has Anglican and Roman Catholic cathedrals and two universities: the University of Western Australia (1911) and Murdoch University (1975). Many Italian immigrants live in northern Perth and in Fremantle. Pop. (1986) urban centre, 895,710; (1987 est.) Perth Statistical Division, 1,083,400.

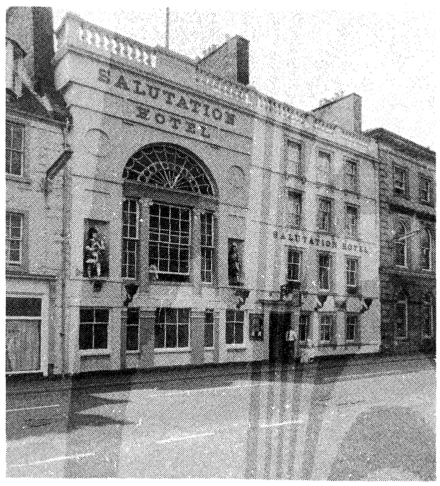
Perth, town, seat of Lanark county, southeastern Ontario, Canada, on the Tay River, 45 miles (70 km) southwest of Ottawa. Named after the town in Scotland, it was founded in 1816 by Scottish immigrants who were later joined by British-Canadian veterans of the War of 1812. The town became an important commercial and administrative centre after the construction of the Tay Canal in the 1830s linked it with Montreal and Ottawa (via the Rideau Canal and Ottawa River). The canal is now used only by pleasure craft. Located in the centre of the Rideau Lakes region, Perth also serves as a summer resort. Inc. village, 1850. Pop. (1986) 5,673.

Perth, city, royal burgh, and seat of the administrative authority of Perth and Kinross district, Tayside region, Scotland, on the right bank of the River Tay. The name is probably Celtic. Following the conversion of the Britons to Christianity and the dedication of the first church to St. John the Baptist, Perth also became known as St. John's Town; both names were used until the 17th century.

Perth was well established by the 12th century, a burgh in 1106 and a royal burgh in 1210. Until about 1452 it served as the capital of Scotland and was therefore both a frequent royal residence and a centre of government. During the Scottish Wars of Independence, Perth was taken by Edward I of England, who strengthened its fortifications in 1298. It was retaken by Robert de Bruce in 1313 during the fourth of the town's seven sieges. The English held it again from 1335 to 1339. Perth was a Jacobite city during the Scottish uprisings of 1715 and 1745, and the insurgent James, the Old Pretender, was proclaimed king at its market cross.

Few buildings remain from this eventful past, apart from the Church of St. John the Baptist, which was built about 1440. The Salutation Hotel, built in 1699, is said to be the oldest hotel building in Scotland. The town's friaries have disappeared, as have the castle, palace, and fortress. Notable modern public buildings include St. Ninian's Episcopal Cathedral (1850–90) and Perth prison, originally erected in 1812 to house French prisoners of the Napoleonic Wars.

During the European Middle Ages, Perth was a significant river port at the head of the Tay estuary, but it gradually declined. Fertilizers are still imported in quantity, and seed



Salutation Hotel at Perth, Scot.
V. Mortimer from Barnaby's Picture Library, London

potatoes are exported. Perth has long been a centre for dyeing industries, whisky blending and distilling, and the manufacture of twine, jute, and glass. Although the city has always maintained a wide range of industries, it is primarily the centre for its agricultural hinterland. Its livestock sales are famous in Great Britain. Pop. (1981) 43,009.

Perth Amboy, city and port of entry, Middlesex county, central New Jersey, U.S., at the mouth of the Raritan River, on Raritan Bay at the southern end of Arthur Kill (channel), there bridged to Tottenville, Staten Island, N.Y. Settled in the late 17th century, it was the capital of the East Jersey colony from 1686 to 1702, and, after East and West Jersey were united to form New Jersey province, it served with Burlington from about 1738 to 1790 as the alternate provincial capital. The last royal governor of the colony was Benjamin Franklin's son William. Perth Amboy was occupied by the British in 1776–77 and was later evacuated when General George Washington seized northern New Jersey. Industry is now well diversified and includes oil refining, electrolytic copper refining, shipbuilding, and the manufacture of chemicals, paint, and ceramics. The city's original name, Amboy, is of Indian origin. Later, Perth was added in honour of an early proprietor, the Earl of Perth. Perth Amboy is usually regarded as the place where the first black person (Thomas Mundt Peterson) voted (March 31, 1870) in the United States. Inc. 1718. Pop. (1988 est.) 38,205.

Perth and Kinross, district, Tayside region, north-central Scotland; created by the reorganization of 1975, it includes the former county of Kinross and most of the former county of Perth. The district has an area of 2,021 square miles (5,235 square km). Perth is the seat of the district authority.

The Highland Boundary Fault runs across Perth from northeast to southwest, forming a rough boundary between lowland Perth in the southeast and The Grampians in the northwest. Highland Perth, a plateau about 3,000 feet (915 m) high, rises to Ben More (3,852 feet [1,174 m]), Ben Lawers (3,984 feet [1,214 m]), and Schiehallion (3,547 feet [1,081 m]); it is much dissected by intensely glaciated valleys often occupied by glacial ribbon lakes (*e.g.,* Lochs Rannock, Tummel, Tay, and Earn). Much of lowland Perth lies within the central valley of Scotland; it includes the Ochil and Sidlaw hills (1,500–2,000 feet [450 to 600 m]), and the vale of Strathmore, which forms a drift-covered, lowland corridor.

Perth's fertile lowlands produce good crops of wheat, sugar beets, and fodder, as well as high-quality seed potatoes. Fruits, particularly raspberries, are intensively cultivated on the low, fertile, riverine lands called carses. Sheep farming predominates on the hills and beef cattle on the foothills. The rivers and lochs abound with salmon and trout. The Forestry Commission controls large acreages of woodland, including Rannock Forest. There is a forestry school at Pitlochry. The Tummel-Garry Hydro-Electric Scheme of 10 power stations is the largest in Scotland; others include the Breadalbane and Lawers schemes.

Industries include widespread whisky distilling in Pitlochry, Aberfeldy, and Perth. Pop. (1987 est.) 123,607.

Perthes, Jacques Boucher (de Crèvecoeur) de (French archaeologist): *see* Boucher (de Crèvecoeur) de Perthes, Jacques.

perthite, any member of a class of alkali feldspars in which tiny crystals of sodium-rich feldspar (albite; $NaAlSi_3O_8$) are intimately intergrown with, but distinct from, tiny crystals of potassium-rich feldspar (orthoclase or, less commonly, microcline; $KAlSi_3O_8$). Slow cooling of a homogeneous, molten mixture of sodium and potassium feldspar induces instabilities and results in the separation of tiny crystals of the two phases. In perthite, they sometimes may be seen by the unaided eye; in microperthite, however, they are distinguishable only microscopically, and in cryptoperthite the crystals are so small that the separation can be detected only by X-ray diffraction. Perthite was originally thought to be a single mineral, described at a locality near Perth, Ontario, from which its name is derived.

Perthshire, also called PERTH, former county and historic region, north-central Scotland. It was bounded north by the counties of Inverness-shire and Aberdeenshire, east by Angus (formerly Forfarshire), and southeast by Clackmannanshire and Stirlingshire; and its area was 2,493 square miles (6,457 square km). Since the reorganization of 1975 the region that made up Perthshire lies mostly in Perth and Kinross district of Tayside (*q.v.*) region, with the remainder in Stirling district of Central region.

In AD 83 the Roman general Gnaeus Julius Agricola explored the lands beyond the Firth of Forth and in the following year penetrated to the Grampians. The growing lawlessness of the southern Picts and their frequent raids in the more settled country in the south later compelled the attention of the Roman emperor Severus. But though he led a strong army to the shores of the Moray Firth, he was unable to subdue the tribesmen. There were several Roman forts in the county, such as those at Bochastle, Dalginross, Bertha, Fendoch, and Gourdie, as well as a legionary fortress at Inchtuthil; along the Earn there were many signal stations.

When the Romans finally withdrew from Britain, the Picts established their capital first at Abernethy and then at Forteviot. Abernethy was the centre of the Celtic church after the conversion of the natives by St. Ninian, Palladius (deacon of the Roman church), and other missionaries in the 5th and 6th centuries. On the burning of Forteviot by the Norsemen in the 8th century, the seat of Pictish government was removed to Scone. In the latter half of the 9th century, Dunkeld—to which Kenneth I MacAlpin had brought some of the relics of St. Columba from Iona—became the scene of monastic activity.

The Danes periodically harried the land but suffered a crushing defeat at Luncarty in 961. In 1054 Macbeth was defeated at Dunsinane by Siward, Earl of Northumbria, who had invaded Scotland in the interest of his kinsman, Duncan's son, who, on the death of the usurper three years later, ascended the throne as Malcolm III. With Malcolm's accession the Celtic rule of the monarch of Scone came to an end. The royal burgh of Perth (*q.v.*) became the capital of Scotland at the beginning of the 12th century and remained the capital until 1452; from that time the history of the county is merged in that of the county town, with the exception of such isolated incidents as the removal of the coronation stone from Scone to Westminster in 1296, the defeat of Robert de Bruce at Methven in 1306, and the Battle of Dupplin Moor (*q.v.*) in 1332.

Doune Castle, belonging to Thomas Randolph, Earl of Moray, was built in the 14th century and was a royal palace. It was restored in 1883. Blair Castle, home of the Duke of Atholl, is in Scottish baronial style, with a 13th-century tower.

Among non-Roman archaeological remains are the hill fort on Dunsinane; the ship barrow of the Vikings at Rattray; weems (or earth houses) in the parishes of Monzie, Alyth, and Bendochy; standing stones near Pitlochry; and an extraordinary assemblage of sculptured stones now housed in the museum at Meigle.

Pertinax, Publius Helvius (b. Aug. 1, 126, Liguria [now in Italy]—d. March 28, 193), Roman emperor from January to March 193.

The son of a freed slave, Pertinax taught school, then entered the army, commanding units in Syria, in Britain, and on the Danube

Pertinax, detail of marble bust; in the Vatican Museum, Rome

Anderson—Mansell from Art Resource/EB Inc.

and the Rhine. He earned distinction during the great invasion by German tribes in 169. Given senatorial rank and command of a legion, he was soon promoted to the consular commands of Moesia, Dacia, and Syria, but under the emperor Commodus (reigned 180–192) he fell from favour, together with the future emperor Septimius Severus, during the ascendancy of the praetorian prefect Perennis. In the last years of Commodus' life, Pertinax became prefect of the city of Rome, while Severus commanded the armies of the upper Danube. When Commodus was murdered on Dec. 31, 192, the Senate met before dawn and proclaimed Pertinax (then senior marshal of the empire) emperor. He tried to enforce unpopular economies in both civilian and military expenditure and was murdered by a small group of soldiers after less than three months in power. When Severus became emperor later in the year, he decreed divine honours for the slain ruler and took the name Pertinax.

perturbation, in astronomy, deviation in the motion of a celestial object caused either by the gravitational force of a passing object or by a collision with it. For example, predicting the Earth's orbit around the Sun would be rather straightforward were it not for the slight perturbations in its orbital motion caused by the gravitational influence of the other planets. The search for a 10th planet continues because some astronomers believe that the known outer planets are being gravitationally perturbed by something beyond Pluto.

perturbation, in mathematics, method for solving a problem by comparing it with a similar one for which the solution is known. Usually the solution found in this way is only approximate.

Perturbation is used to find the roots of an algebraic equation that differs slightly from one for which the roots are known. Other examples occur in differential equations. In a physical situation, an unknown quantity is required to satisfy a given differential equation and certain auxiliary conditions that define the values of the unknown quantity at specified times or positions. If the equation or auxiliary conditions are varied slightly, the solution to the problem will also vary slightly.

The process of iteration is one way in which a solution of a perturbed equation can be obtained. Let D represent an operation, such as differentiation, performed on a function, and let $D + \varepsilon P$ represent a new operation differing slightly from the first, in which ε represents a small constant. Then, if f is a solution of the common type of problem $Df = cf$, in which c is a constant, the perturbed problem is that of determining a function g such that $(D + \varepsilon P)g = cg$. This last equation can also be written as $(D - c)g = -\varepsilon Pg$. Then the function g_1 that satisfies the equation $(D - c)g_1 = -\varepsilon Pf$ is called a first approximation to g. The function g_2 that satisfies the equation $(D - c)g_2 = -\varepsilon Pg_1$ is called a second approximation to g, and so on, with the nth approximation g_n satisfying $(D - c)g_n = -\varepsilon Pg_{n-1}$. If the sequence $g_1, g_2, g_3, \ldots, g_n, \ldots$ converges to a specific function, that function will be the required solution of the problem. The largest value of ε for which the sequence converges is called the radius of convergence of the solution.

Another perturbation method is to assume that there is a solution to the perturbed equation of the form $f + \varepsilon g_1 + \varepsilon^2 g_2 + \ldots$ etc., in which the $g_1, g_2, \ldots$ etc., are unknown, and then to substitute this series into the equation, resulting in a collection of equations to solve corresponding to each power of ε.

pertussis: *see* whooping cough.

Peru, officially REPUBLIC OF PERU, Spanish REPÚBLICA DEL PERÚ, third largest nation in South America, covering an area of 496,225 square miles (1,285,216 square km). Its capital is Lima. The country lies between latitudes 0° and 19° S (about 1,325 miles [2,132 km] from northwest to southeast) and longitudes 68° and 82° W (about 570 miles [917 km] at its widest extent from west to east); it is bounded on the northwest by Ecuador, on the northeast by Colombia, on the east by Brazil and Bolivia, on the south by Chile, and on the west by the Pacific Ocean. The population in 1990 was estimated at 22,332,000.

A brief summary of Peru follows. For full treatment, *see* MACROPAEDIA: Peru.

Peru

For current history and for statistics on society and economy, *see* BRITANNICA WORLD DATA ANNUAL.

The land. Peru can be divided into three geographical regions from west to east: the Costa (coast), the Sierra (highlands), and the Montaña, or *selva* (the vast, forested eastern plains). The Costa is a long narrow belt of arid lowlands, rising to about 1,500 feet (460 m) above sea level, and contains most of the chief cities of Peru. The Sierra consists of the Andean mountain ranges of the Cordillera Occidental ("western range"), Cordillera Central, and Cordillera Oriental ("eastern range"), which have average elevations of between 9,000 and 19,000 feet (2,750 and 5,800 m). Mount Huascarán (22,205 feet [6,768 m]), in the west-central part of the country, is the highest point in Peru. The Sierra region varies in width from about 60 miles (95 km) in the north to 200 miles (320 km) in the south. The Montaña is a humid lowland region less than 3,000 feet (915 m) above sea level and consists principally of the tropical rain forests of the Amazon basin. The Amazon's chief headstreams in Peru are the Marañón and Ucayali rivers. Lake Titicaca in the south, with an area of 3,200 square miles (8,288 square km), lies at an elevation of 12,500 feet (3,810 m) and is the world's highest navigable body of water. Peru is subject to considerable seismic activity; the last volcanic eruption was recorded in 1869, but earthquakes are more frequent.

The climatic regions of Peru are diverse and are defined by elevation or by the blockage of weather patterns by the Andes. Average annual temperatures vary from 66° to 72° F (19° to 22° C) on the coast, to 34° to 57° F (1° to 14° C) in the Andes, and to 75° to 95° F (24° to 35° C) in the eastern forests. Precipitation is heaviest in the east (75 to 125 inches [1,900 to 3,175 mm]) and very low (about 2 inches [50 mm]) in the arid western coasts. The snow line varies from 14,700 to 16,400 feet (4,480 to 5,000 m).

The western coastal region has sparse vegetation (cactus and algarroba); the vegetation of the Sierra consists of perennial shrubs, cacti, pepper trees, and tall grasses; and the Montaña is characterized by wild rubber, mahogany, cinchona, cocoa, vanilla, and curare trees and is the most densely vegetated region of Peru. Peru is famous for its camellike species—the llama, the alpaca, the wild vicuña, and the guanaco—all grazing animals of the highlands; in the Amazon basin are found the parrot, monkey, sloth, jaguar, capybara, and alligator. Piranha are found in the streams.

Peru has extraordinarily rich mineral resources, including gold, silver, copper, iron ore, phosphates, and manganese. The northern desert, the Amazon basin, and the narrow continental shelf have large petroleum and natural-gas deposits. Peru's exploitable hydroelectric potential is great.

The people. Quechua Indians are the largest ethnic group in Peru, encompassing almost half of the total population; mestizos and whites are the other major ethnic groups. There are minority populations of blacks and Asians (particularly Japanese). Both the Spanish and Quechua languages have official status; Aymara is spoken by a large segment of the Indian population. About 70 percent of the people speak Spanish. More than nine-tenths of the people are Roman Catholic.

The population density is moderate, and the large-scale migration to coastal urban areas has restricted the development of second- and third-order urban centres. Lima, the capital, has the largest population, followed by Arequipa and Callao. About 70 percent of the population is urban.

Two-fifths of Peru's population is younger than 15 years of age. The extraordinarily high birth rate maintained by Peru's young population applies great pressure on all of the nation's existing resources and reduces gains made in social or economic areas. In an effort to reduce this high population growth, measures were introduced in 1976 to bring greater numbers of women into the labour force. Both general and infant mortality rates are high, especially in rural areas. Life expectancy is a relatively low 58 years for men and 62 years for women.

The economy. Peru has a developing mixed economy largely based on manufacturing, services, agriculture, and mining. The petroleum industry and most other industries were nationalized between the late 1960s and early 1970s, and the government's insistence that workers participate in management has discouraged investment by foreign firms. Unemployment and underemployment are widespread. The gross national product (GNP) has not grown as rapidly as the population, and the GNP per capita is about average for a developing country.

Agriculture accounts for approximately one-tenth of the GNP and employs more than one-third of the work force. Subsistence farming predominates in the Andes mountains; farms, located in the irrigated valleys, or oases, along the coast have generally high yields and tend to raise crops for export. Only 3 percent of the country's total land area is arable; Peru is not agriculturally self-sufficient. Droughts are frequent and irrigation is inadequate. The land-reform law of 1969, which expropriated 25,900,000 acres (10,500,000 hectares), has benefited only a limited number of peasants. Smallholdings have been consolidated into cooperative farms. Sugarcane, cotton, coffee, potatoes, corn (maize), rice, and plantains are major crops. Coca is primarily cultivated for cocaine, which is smuggled to Colombia and from there to the United States and Europe. Sheep, llamas, alpacas, and vicuñas are raised for wool.

Prior to 1972 Peru had been the world's leading fishing nation, with anchovies the main catch. The El Niño (a severe, irregularly occuring variation in weather patterns) of that year, however, caused great damage to the fishing grounds, and the catch plummeted, although Peru remained among the world leaders. Through conservation measures, the fishing industry gradually recovered.

Mining accounts for approximately one-tenth of the GNP and employs about 2 percent of the work force. The government controls most mining through the Empresa Minera del Perú, Empresa Minera del Centro del Perú, and Petróleos del Perú; marketing is controlled by the Minero Perú Comercial.

Peru is an important producer of petroleum, and the value of petroleum exports is roughly comparable to that of copper. A pipeline across the Andes links oil fields in the northeastern jungles to the coast. Rich deposits of uranium have been discovered north of Lake Titicaca. Peru is a leading producer of iron, zinc, copper, bismuth, lead, and silver. Minerals regularly account for almost two-thirds of the total value of the country's exports.

Industries are heavily concentrated around Lima and neighbouring Callao. Manufacturing accounts for approximately one-third of the GNP and employs more than one-tenth of the work force. Major manufactures include cement, textiles, steel, televisions, processed foods, refined petroleum, tires, and motor vehicles.

Production of electricity is controlled by the government. Electricity is chiefly generated from waterpower and reaches only about one-fourth of the population.

All but one-tenth of Peru's roads are unpaved. Public railways were nationalized in 1972. Callao is the largest of the country's numerous ports and is the site of Peru's most important international airport.

Exports include mineral products, agricultural products, fish products, and petroleum; imports consist of foodstuffs, consumer goods, and component parts for Peruvian industries. The United States, Japan, and Germany are Peru's major trading partners.

Taxes on exports have been prohibitively high and are being reduced in favour of higher indirect taxes. Quotas on imports have been replaced by higher tariffs. Low world prices for commodities on which the country depended for foreign-exchange earnings made it increasingly difficult for Peru to meet debt repayments in the 1980s. Loans from the International Monetary Fund were restricted after the country drastically reduced its payment schedule for foreign loans. In 1987 Peru nationalized the nation's financial system.

Government and social conditions. Civilian government was fully restored in 1980, following more than a decade of military rule. The constitution, promulgated in 1979, vests executive power in the president, directly elected to a five-year term. The president governs with the assistance of a Council of Ministers, appointed by the president. Legislative power is held by the bicameral Congress, composed of the 180-member Chamber of Deputies and the 60-member Senate, members of which are directly elected to five-year terms. Senators are elected on a regional basis, while deputies are elected by a system of proportional representation. The major political party is the centrist Alianza Popular Revolucionaria Americana (APRA). The judicial system is headed by the Supreme Court and includes higher courts and the courts of first instance.

Peru's social-welfare system provides cash benefits or medical care for sickness, maternity, and disability and pensions for old age, invalidism, disability, and loss of support. Conditions of employment are guaranteed by labour laws. Infectious diseases such as typhoid, tuberculosis, gastrointestinal diseases, whooping cough, malaria, and influenza are widespread despite government programs to bring them under control. Dietary deficiency is most serious among children. Medical facilities are inadequate in the rural areas. Most housing, both urban and rural, lacks water and sewerage. Squatter settlements on the outskirts of cities and inner-city tenements house the growing population of urban poor.

Peru's relatively high literacy rate is comparable to most South American countries. Education is compulsory, where possible, and free for children between the ages of 6 and 15. Adult-literacy programs and technical education have high government priority. Peru has more than 30 universities, including the oldest in South America, the National University of San Marcos in Lima (founded 1551).

Peru's press is one of the oldest on the continent; its first newspaper was founded in 1791. Censorship laws introduced during military rule have been repealed, effectively restoring freedom of the press. Radio and television facilities are either fully or partially owned by the government.

Cultural life. The ancient culture of Peru is best known not only in its Spanish–Inca cities but also in the remains of Machu Picchu, a "lost city" of the Incas on an 8,000-foot-(2,450-kilometre-) high mountain 50 miles (80 km) from Cuzco. Peruvian folk culture is rich in elements from pre-Hispanic and mestizo traditions.

The ancient Peruvians were great builders, adapting their architecture to the landscape. The oldest colonial work is the Cathedral of Lima, and the most important is the Convent and Church of San Francisco of Lima.

Peru's most prominent writers since the late 19th century include César Vallejo, José María Argüedas, and Mario Vargas Llosa. Valle-Riestra's *Ollanta* and Vincente Stea's *Sinfonía autóctona* (*Aboriginal Symphony*) were the major musical works of 19th-century Peru. Painting reached its zenith with the famous Cuzco school during the 17th and 18th centuries.

History. Human habitation in Peru dates back to at least 8000 BC. Several advanced cultures developed in different parts of Peru by the middle of the 13th century AD. About AD 1438 the Incas set out on a 50-year period of conquest, ultimately controlling present-day Peru, Bolivia, Chile, Ecuador, and northern Argentina.

The Spanish explorer Francisco Pizarro landed in Peru in 1527. Returning in 1532 with a small army, he conquered the Inca empire and in the next year killed Atahuallpa, the Inca king.

Spain consolidated its control over Peru, and it remained under Spanish domination for almost 300 years. During the independence movements of the early 19th century, Peru remained loyal to the Spanish crown. Peruvian independence came about as a virtual by-product of the successes of other Spanish colonies in their wars of independence. Following the Argentine liberator General José de San Martín's capture of Lima in 1821, Peru's independence was proclaimed.

In 1836 General Andrés Santa Cruz united Peru with Bolivia to create the Peru-Bolivia confederation, which, however, was broken up in 1839 following a military defeat at the hands of Chile. From 1844 to 1862 General Ramón Castilla ruled Peru, providing much-needed political stability. Castilla helped develop public education, abolished slavery, and strengthened the military. In the 1870s the Civilian Party was formed; it successfully wrested control of the country from the military but was unable to cope with a severe economic depression. Peru's economic dislocation was aggravated by the effects of an unsuccessful war with Chile (1879–84). Rising public debt led to the formation of the Peruvian Corporation (1889), established by the country's creditors to help in economic recovery.

In 1895 the Democratic Party was formed and elected Nicolás de Piérola president. After a period of orderly political and economic development, Augusto Leguía y Salcedo of the Civilian Party won a single term as president (1908–12). Leguía was elected again in 1919 and embarked on a U.S.-financed public-works program. Although he was re-elected, his popularity was declining, and in 1930 a military coup ousted Leguía. Colonel Luis Sánchez Cerro, leader of the coup, was elected president in 1931 but was assassinated in 1933. His successor, General Oscar Benavides, restored confidence in the economy. Manuel Prado was elected to the presidency in 1939 and immediately aligned Peru with U.S. policies during World War II.

Following the war, General Manuel Odría seized control of the government (1948) and remained in power until 1956. Prado was elected to his second term as president that same year. He was succeeded by Fernando Belaúnde Terry in 1963. Belaúnde initiated more effective agricultural land use, organized community development projects, and tried to eradicate illiteracy.

A military junta seized power in 1969. It nationalized many foreign commercial holdings and encouraged expropriation of landed estates by the peasants. In August 1975 another military coup replaced the ruling junta and paved the way for a return to civilian rule in 1980. The popularly elected civilian governments in the 1980s and '90s, however, were beset with skyrocketing inflation and unemployment, a gigantic foreign debt, and violence by guerrilla groups using terrorist tactics, such as the neo-Maoist Shining Path (Sendero Luminoso) and the Tupac Amaru Revolutionary Movement. Drug trafficking and widespread coca farming also hampered economic reform.

Peru, city, seat (1834) of Miami county, north-central Indiana, U.S. The city lies on the Wabash River near its juncture with the Mississinewa, midway between South Bend (70 miles [110 km] north) and Indianapolis. Founded in 1826 as Miamisport on the site of a Miami Indian village and apparently renamed for the South American country, Peru is now a transportation, industrial, and agricultural trading centre. Manufactures include electrical and heating equipment; plastics; and paper, wood, and fabricated metal products. Pioneer, circus, and Indian relics are displayed in the Miami County Historical and Puterbaugh museums. Songwriter Cole Porter was born in Peru and is buried there. The annual Circus City Festival commemorates Peru's former fame as one of the nation's foremost circus winter quarters. Grissom Air Force Base and the Mississinewa Reservoir are nearby. Inc. town, 1848; city, 1867. Pop. (1988 est.) 13,030.

Peru, Viceroyalty of, Spanish VIRREINATO DE PERU, the second of the four viceroyalties that Spain created to govern its domains in the Americas. Established in 1543, the viceroyalty initially included all of South America under Spanish control except for the coast of what is now Venezuela. It later lost jurisdiction (with the creation of the Viceroyalty of New Granada in 1739) over the areas that now constitute the nations of Colombia, Ecuador, Panama, and Venezuela and, later still (with the establishment of the Viceroyalty of the Río de la Plata in 1776), over what is now Argentina, Uruguay, Paraguay, and much of Bolivia.

Until nearly the end of the colonial era, Peru was considered the most valuable Spanish possession in the Americas. It produced vast quantities of silver bullion for shipment to Europe, especially from the mines at Potosí. Thriving on the labour of enslaved Indians, an exploitative society of mine operators and merchant princes lived in splendour in the coastal city of Lima. Access to easy wealth, however, was one of the major contributing factors to political instability in the region. Geography was another; Lima's position along the western coast of South America limited effective communication with Spain. And the rigours of the terrain—especially the Andes Mountains—made Peru very difficult to govern.

From 1569 to 1581, the Viceroyalty of Peru received some much-needed stable leadership from the viceroy Francisco de Toledo. Considered the best of Peru's viceroys, Toledo revamped the administration, granted certain rights of autonomy to the Indians, and modernized mining operations. His successors—most notably the Marqués de Montes Claros (1607–15), Francisco de Borja y Aragón, Prince de Esquilache (1615–21), Don Pedro Antonio Fernández de Castro, 10th Count de Lemos (1667–72), and Melchor Portocarrero Lasso de la Vega, Count de la Monclova (1689–1705)—were for the most part impressive men and capable administrators.

By the late 18th century, however, the Viceroyalty of Peru was badly in need of reform. Exploitation of the Indians had led in 1780 to the brief but bloody rebellion of José Gabriel Condorcanqui (or Tupac Amaru, as he wished to call himself, after his Inca ancestor). This revolt spread throughout Peru, and, although Tupac was captured and executed in 1781, the Indians continued to wage war against the Spaniards until 1783, causing the disruption of the viceroyalty's economic life. The area was unable to mount a vigorous defense when General José de San Martín entered Lima and declared Peru's independence from Spain in July 1821. Then, on Dec. 9, 1824, the Spanish royal army—despite an advantage in manpower and arms—lost the Battle of Ayacucho to a revolutionary army under Antonio José de Sucre. The viceroy of Peru and his generals were taken prisoner, and what was left of the territory that had been the Viceroyalty of Peru became part of the independent nations of Peru and Chile.

Peru–Chile Trench, also called ATACAMA TRENCH, submarine trench in the eastern Pacific Ocean, about 100 miles (160 km) off the coast of Peru and Chile. It reaches a maximum depth of 26,457 feet (8,064 m) below sea level in Richards Deep and is 3,666 miles (5,899 km) long; its mean width is 40 miles (64 km) and it covers an expanse of some 228,000 square miles (590,000 square km). It lies offshore from an area of active volcanism. The trench sediments are alternate layers of turbidites and oceanic deposits, mainly clays, volcanic ash, and siliceous oozes, with some carbonates and, possibly, primary dolomites.

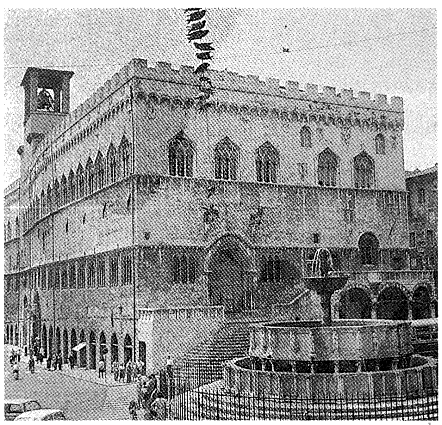
Studies of these sediments indicate the presence of metals initially disseminated in newly erupted underwater volcanic rocks.

Peru Current, also called HUMBOLDT CURRENT, cold-water current of the southeast Pacific Ocean, with a width of about 900 km (550 mi). Relatively slow and shallow, it transports only 350,000,000–700,000,000 cu ft (10,000,000–20,000,000 cu m) of water per second. It is an eastern boundary current similar to the California Current of the North Pacific. The West Wind Drift flows east toward South America south of latitude 40° S, and while most of it continues through the Drake Passage around the southern tip of South America to the Atlantic, a shallow stream turns north to parallel the continent as far as latitude 4° S, where it turns west to join the Pacific South Equatorial Current.

As it is a cold current, except at times of the phenomenon known as El Niño Current (*q.v.*), the Peru Current brings fog to the nearby coast but also helps to keep the coast one of the most intensely arid areas in the world. The cold flow is intensified by upwelling of deep water caused by the combined effects of the drag of surface winds of the Southeast Trades and the Earth's rotation. Upwelling brings abundant nutrients close to the surface, and the beneficial effects of sunlight, which allow for rich plankton growth, make the waters off Peru, Chile, and Ecuador one of the world's greatest fishing grounds for anchovies and the larger fish (*e.g.,* tuna) that feed upon them. Another economic benefit is the guano, used for fertilizer, deposited by the flocks of birds that feed on the anchovies.

The current's alternative name is taken from that of the German scientist Alexander von Humboldt, who in 1802 took measurements that showed the coldness of the flow in relation to the air above it and the sea around it.

Perugia, Latin PERUSIA, city, seat of an archbishopric and capital of Perugia province and Umbria region, in central Italy, north of Rome; it lies on an irregular cluster of hills overlooking the Umbrian and central



Palazzo dei Priori, Perugia, Italy
Mildred Bernhaut—Photo Researchers

Tiber valleys and Lake Trasimeno. Founded by the Umbrians, it became one of the 12 strongholds of the Etruscan Confederation and belonged to Rome from 310 BC. In AD 592 it became a Lombard duchy; subsequently, it was embroiled in many petty conflicts with neighbouring towns in which it usually took the Guelf, or pro-papal, side. The condottiere Braccio Fortebraccio captured it in 1416, and later the rival Oddi and Baglioni families fought there for power before the town became a papal possession in 1540.

Perugia was the centre of the great Umbrian school of painting, which reached its height in the 15th century. It played an active part in the Italian Risorgimento in 1859 and in the following year became part of united Italy.

There are considerable remains of Etruscan walls with three gateways, as well as the Etruscan nucleus of the well-preserved medieval city enclosed by 13th-century walls, and, on the outskirts, the Etruscan *hypogea* (underground burial chambers) of San Manno and of the Volumnii (2nd century BC). In the centre of the city the magnificent Piazza Quattro Novembre contains the Palazzo dei Priori, or Palazzo Comunale (1293–97; extended 1443), housing the National Gallery of Umbria's remarkable collection of paintings and sculpture; the cathedral of S. Lorenzo (1345–1430), in which is the supposed white onyx espousal ring of the Virgin; and the splendid Maggiore Fountain (1278) by Fra Bevignate. Other landmarks include the Collegio del Cambio (1452–57), with a dazzling series of frescoes by Pietro Perugino and his pupils. Particularly notable among the many fine churches are S. Angelo (5th and 6th centuries; on a circular plan); S. Domenico (1305; rebuilt 1632), containing the monumental tomb of Pope Benedict XI; S. Pietro (originally 10th century, often remodelled); S. Severo (15th–18th centuries), with a fresco by Raphael; and S. Bernardino (1457–61). In the former convent of S. Domenico are the state archives and the Etrusco-Roman museum, with an important archaeological collection. The former convent of the Olivetans is the central seat of the university (founded 1307), and the Palazzo Gallenga is the seat of the Italian university for foreigners.

Perugia is an agricultural trade centre noted for its chocolate; its chief economic activities are the food, textile, machine, and pharmaceutical industries. Pop. (1983 est.) mun., 143,089.

Perugia, Lake of (Italy): *see* Trasimeno, Lake.

Perugia, University of, Italian UNIVERSITÀ DEGLI STUDI DI PERUGIA, coeducational state institution of higher learning at Perugia, Italy. The university was founded in 1200 by a group of students seceding from the University of Bologna. It was recognized by Pope Clement V in 1308 as a *studium generale,* a place of study accepting scholars from all over Europe and conferring a generally recognized degree. After the annexation of the papal territories by the Kingdom of Italy in 1860, the university became autonomous. Among its modern faculties are law, medicine, letters and philosophy, political science, economics, veterinary medicine, agriculture, pharmacy, and the physical and biological sciences.

Perugino, byname of PIETRO DI CRISTOFORO VANNUCCI (b. *c.* 1450, Città della Pieve, near Perugia, Romagna—d. February/March 1523, Fontignano, near Perugia), Italian early Renaissance painter of the Umbria school, the teacher of Raphael. His work (*e.g.,* "Giving of the Keys to St. Peter," 1481–82, a fresco in the Sistine Chapel, Rome) anticipated High Renaissance ideals in its compositional clarity, sense of spaciousness, and economy of formal elements.

Early work. Nothing is known for certain of Perugino's early training, but he may have been a pupil of Fiorenzo di Lorenzo (*c.* 1440–1525), a minor painter in Perugia, and of the renowned Umbrian Piero della Francesca (*c.* 1420–92) in Arezzo, in which case he would have been a fellow pupil of one of his most famous contemporaries, Luca Signorelli. The two men were acquainted, and an occasional influence from Signorelli is visible in Perugino's work, notably in the direction of an increased hardness of drawing (*e.g.,* "Crucifixion and Saints," *c.* 1480–1500; Uffizi, Florence). In Florence, where he is first recorded in 1472, he almost certainly worked in the shop

"Vision of St. Bernard," wood panel by Perugino, *c.* 1491–94; in the Alte Pinakothek, Munich
By courtesy of the Alte Pinakothek, Munich

of the important painter and sculptor Andrea del Verrocchio, where the young Leonardo da Vinci was apprenticed.

The first certain work by Perugino is a "Saint Sebastian," at Cerqueto, near Perugia. This fresco, or mural painted on plaster with water-dissolved pigments, dates from 1478 and is typical of Perugino's style. He must have attained a considerable reputation by this time, since he probably worked for Pope Sixtus IV in Rome, 1478–79, on frescoes now lost. Sixtus IV also employed him to paint a number of the frescoes in the Sistine Chapel in the Vatican Palace. Completed between 1481 and 1482, three narrative scenes behind the altar were destroyed by Michelangelo in 1535–36 in order to use the space for his fresco of the "Last Judgment." Of the scenes completely by Perugino's own hand, only the fresco "Giving of the Keys to St. Peter" has survived. The simple and lucid arrangement of the composition reveals the centre of narrative action, unlike the frescoes in the same series by the Florentine painter Sandro Botticelli, which, in comparison, appear overcrowded and confused in their narrative focus. After completing his work in the Sistine Chapel, Perugino returned to Florence, where he was commissioned to work in the Palazzo della Signoria. In 1491 he was invited to sit on the committee concerned with finishing the Florence cathedral.

Mature work. From approximately 1490 to 1500 Perugino was at his most productive and at the artistic summit of his career. Among the finest of his works executed during this time are the "Vision of St. Bernard," the "Madonna and Saints," the "Pietà," and the fresco of the "Crucifixion" for the Florentine convent of Sta. Maria Maddalena dei Pazzi. These works are characterized by ample sculpturesque figures gracefully posed in simple Renaissance architectural settings, which act as a frame to the images and the narrative. The harmonious space is tightly controlled in the foreground and middle ground, while the background effect is conversely one of infinite space. During this period he painted his best known portrait, a likeness of "Francesco delle Opere." Perugino must have been well acquainted with the late 15th-century portraiture of Flanders, since the influence of the Flemish painter Hans Memling is unmistakable.

Commissioned by the guild of bankers of Perugia, Perugino painted a fresco cycle in their Sala dell'Udienza that is believed to have been completed during or shortly after 1500, the date that appears opposite Perugino's self-portrait in one of the scenes. The importance of these frescoes lies less in their artistic merit than in the fact that the young Raphael, Perugino's pupil around 1500, probably was an assistant learning the technique of fresco painting. An allegorical figure of Fortitude from this series is often attributed to Raphael.

Late work. After 1500, Perugino's art began to decline, and he frequently repeated his earlier compositions in a routine manner. Giorgio Vasari, a 16th-century biographer and artist, wrote that the critical Florentines began to lampoon him, and Perugino replied that they had once praised his work, and, if he now gave the same designs, they had no right to blame him. It is certainly true that the "Combat of Love and Chastity" (Louvre, Paris) was commissioned in 1503 by Isabella d'Este and was delivered only in 1505, after a great many letters had passed between all concerned, at which time Isabella expressed herself as satisfied but only moderately so. In fact, Perugino left Florence about 1505 and began to work principally for the less critical public of Umbria.

In 1508 he made a temporary comeback by painting roundels on the ceiling of the Stanza dell'Incendio in the Vatican. The commission for the frescoes on the walls of the room went to his pupil Raphael, who, in the few years after leaving Perugino's studio, proved himself the greater artist.

One of Perugino's last commissions was the completion in 1521 of some frescoes in S. Severo, Perugia, which had been begun by Raphael. He was still painting in February or March 1523 when he died of the plague. The fresco of the "Nativity," in the National Gallery, London, comes from Fontignano and is generally supposed to be Perugino's last work. (P.J.Mu.)

MAJOR WORKS. "St. Sebastian" (1478; Cerqueto, Italy); "Giving of the Keys to St. Peter" (1481–82; Vatican, Sistine Chapel); "Crucifixion" (*c.* 1485; National Gallery, Washington, D.C.); "Vision of St. Bernard" (*c.* 1491–94; Alte Pinakothek, Munich); "Adoration of the Child, Crucifixion, and Saints" (1491; Villa Torlonia, formerly Albani, Rome); "Madonna and Saints" (1493; Uffizi, Florence); "Madonna and Saints" (1493; Kunsthistorisches Museum, Vienna); "Crucifixion" (1493–96; convent of Sta. Maria Maddalena dei Pazzi, Florence); "Francesco delle Opere" (1494; Uffizi); "Pietà" (*c.* 1494–95; Uffizi); "Virgin in Glory with Saints" (*c.* 1495–96; Pinacoteca Nazionale, Bologna, Italy); "Agony in the Garden" (1495; Galleria Palatina, Florence); Altarpiece (1497; church of Sta. Maria Nuova, Fano, Italy); "Ascension" (1496–98; Musée Municipal des Beaux-Arts, Lyon), panels belonging to this painting in museums at Nantes and Rouen in France; "Annunciation" (1498; church of Sta. Maria Nuova); "Archangel Michael, the Virgin Adoring the Child, Archangel Raphael with Tobias" (*c.* 1499; National Gallery, London); "Biagio Milanesi" (1500; Uffizi); "The Monk Baldassare" (1500; Uffizi); "Prophets, Heroes, Sibyls, and Sages, the Transfiguration and the Adoration of the Shepherds" (*c.* 1497–1500; Sala dell'Udienza, Collegio del Cambio, Perugia, Italy); "St. Sebastian" (1500–08; Hermitage, Leningrad); "Resurrection" (*c.* 1501; Vatican Gallery); "Adoration of the Shepherds" (1501; Galleria Nazionale dell'Umbria, Perugia); "Crucifixion and Saints" (1502–06; church of S. Agostino, Siena, Italy); "Marriage of the Virgin" (1503–04; Musée de l'Hôtel de Ville, Caen, Fr.); "Combat of Love and Chastity" (1505; Louvre, Paris); "Deposition" (1505–07; Uffizi); "Assumption" (1506; Uffizi); "Ascension" (*c.* 1509; Cathedral, Sansepolcro, Italy); Altarpiece (before 1517; Galleria Nazionale dell'Umbria); "Adoration of the Magi" (1521; church of Sta. Maria delle Lacrime, Trevi, Italy); "Nativity" (1522; National Gallery, London).

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peruke, also called PERIWIG, man's wig, especially the type popular from the 17th to the early 19th century. It was made of long hair, often with curls on the sides, and drawn back on the nape of the neck.

Use of the word peruke probably became widespread in the 16th century, when the

Back view of a squared peruke worn by an effigy of William II, 1725; in the Victoria and Albert Museum, London

wearing of wigs became popular. Toward the end of the 16th century and the beginning of the 17th, the peruke was no longer worn as an adornment or to correct nature's defects but rather as a distinctive feature of costume, especially after Louis XIII of France set the fashion in 1624. *See also* wig.

Perun, the thunder-god of the ancient pagan Slavs, a fructifier, purifier, and overseer of right and order. His actions are perceived by the senses: seen in the thunderbolt, heard in the rattle of stones or the bellow of the bull or the bleat of the he-goat (thunder), and felt in the touch of an ax blade. The word for Thursday (Thor's day) in the Polabian language was *peründan.* Polish *piorun* and Slovak *parom* denote "thunder" or "lightning."

The "Lightning-god" and his cult among the Slavs is attested by the Byzantine historian Procopius in the 6th century. In the *Primary Russian Chronicle,* compiled *c.* 1111, Perun is mentioned as having been invoked in the treaties of 945 and 971, and his name is the first in the list of gods of St. Vladimir's pantheon of 980. He was worshipped in oak groves by western Slavs, who called him Prone, which name appears in Helmold's *Chronica Slavorum* (*c.* 1172). Porenut, Perun's son, is mentioned by the Danish historian Saxo Grammaticus in the early 13th century.

In the Christian period the worship of Perun was gradually transferred to St. Elijah (Russian Iliya), but in folk beliefs, his fructifying, life-stimulating, and purifying functions are still performed by his vehicles: the ax, the bull, the he-goat, the dove, and the cuckoo. Sacrifices and communal feasts on July 20 in honour of Perun or Iliya continued in Russia until modern times.

Perusia (Italy): *see* Perugia.

Perutz, Max Ferdinand (b. May 19, 1914, Vienna), Austrian-born British biochemist, co-recipient of the 1962 Nobel Prize for Chemistry for his X-ray diffraction analysis of the structure of hemoglobin, the protein that transports oxygen from the lungs to the tissues via blood cells.

Perutz was educated at the University of Vienna and at the University of Cambridge, where he received his Ph.D. in 1940. While at Cambridge he began research at the Cavendish Laboratory (1937), taking the first X-ray diffraction pictures of hemoglobin crystals and working with the most powerful tool for examining the structure of hemoglobin—X-ray crystallography.

In 1947, along with the British biochemist John C. Kendrew—with whom he was later to share the Nobel Prize—Perutz founded the Medical Research Council Unit for Molecular Biology at Cambridge. There the two men continued their investigation of hemoproteins, Kendrew specializing in the molecular structure of myoglobin (muscular hemoglobin), Perutz concentrating on the hemoglobin molecule itself. By 1959 Perutz had shown that hemoglobin was composed of four separate polypeptide chains that formed a tetrahedral structure, with four heme groups near the molecule's surface. Perutz subsequently showed that in oxygenated hemoglobin the four chains are rearranged, a discovery that led to the full determination of the molecular mechanism of respiratory transport by hemoglobin. Perutz served as director of the Unit for Molecular Biology from its inception until 1962. From 1962 until his retirement in 1979, he served as chairman of the Medical Research Council molecular biology laboratory (at the School of Clinical Medicine, Cambridge).

Perutz also investigated the flow of glaciers, making a crystallographic study of the transformation of snow into glacial ice (1938). Measuring for the first time the velocity distribution of a glacier, he proved that the fastest flow occurs at the surface and the slowest near the bed of the glacier.

Peruvian–Bolivian Confederation, transitory union of Peru and Bolivia (1836–39). Bolivia's dictator, Andrés Santa Cruz, conquered Peru after helping to quell an army rebellion against Peruvian president Luís José de Orbegoso in 1835. Santa Cruz then divided Peru into a northern and a southern part, with Orbegoso as president in the north and Gen. Ramón Herrera in the south. These states were then joined to Bolivia, of which Gen. José Miguel de Velasco was made president. Santa Cruz assumed the office of "protector" of the confederation, a lifetime and hereditary office. Since he had already proved himself an able administrator in Bolivia, influential Peruvians welcomed his rule.

Great Britain, France, and the United States recognized the confederation, but its South American neighbours feared and opposed the powerful new state. In 1836 fighting broke out between the confederation and Chile, whose relations with independent Peru had already been strained by economic problems centring on rivalry between their ports of Callao (near Lima) and Valparaíso, Chile. In 1837 Santa Cruz's forces defeated an Argentine army sent to topple him.

The Chileans, joined by Peruvians opposed to Santa Cruz, persisted in their fight until, under the command of Gen. Manuel Bulnes, they finally defeated the forces of the confederation at the Battle of Yungay (department of Ancash, Peru) on Jan. 20, 1839. This defeat caused the immediate dissolution of the confederation; Santa Cruz went into exile. Agustín Gamarra assumed the presidency of Peru and tried to subjugate Bolivia to Peru; this attempt ended abruptly with his death on the battlefield in 1841. Both Peru and Bolivia then entered a period of internal conflict and disorder.

Peruzzi FAMILY, leading family of medieval Italian financiers whose bankruptcy in the 14th century contributed to the economic depression of the late Middle Ages.

An old Florentine family belonging to the "popular" (democratic) party, the Peruzzi contributed 10 gonfaloniers (chief executives) and 54 priors (members of the governing body) to the republic. Coming to prominence as bankers *c.* 1275, the Peruzzi soon had branches in most of the important centres of Europe and were second in importance only to the Bardi company. The Florentine chronicler Giovanni Villani was a Peruzzi partner. At the beginning of the Hundred Years' War between England and France, they were especially active in Naples, Paris, and London. Beginning in the 1330s, the Peruzzi made large loans to Edward III of England, first in concert with the Bardi company, later by themselves, financing his wars in Scotland and France in return for grants of wool, money, and assignment of customs and taxes. Loans in 1338–39 for the mounting expenses of Edward's wars exhausted both Peruzzi and Bardi resources. From 1342 to 1345 members of both companies were arrested for bankruptcy and released only on renunciation of all claims to interest, and the English crown canceled massive debts to the Peruzzi. At the same time, the king of Naples defaulted on his debts to the two companies, and the king of France exiled them and confiscated their goods.

The disasters abroad brought on panic at home, resulting in 1342 in a movement by the Bardi and Peruzzi and other great banking companies to set up Walter of Brienne, duke of Athens, as ruler of Florence, hoping to control his foreign and financial policies to save their firms from bankruptcy. In 1343, disappointed in their hopes, the bankers ousted the soldier of fortune. When a revolution put the *popolo minuto* (lesser guilds and merchants) in power, the Peruzzi company's bankruptcy followed, heralding a great economic crisis.

Peruzzi, Baldassarre (Tommaso) (b. 1481, Siena?, Republic of Siena [now in Italy]—d. Jan. 6, 1536, Rome), Sienese architect and painter, one of the earliest artists to attempt illusionist architectural painting (*quadratura*), the extension of real architecture into imaginary space.

A contemporary of Raphael and Donato Bramante, Peruzzi began his career as a painter of frescoes in the Cappella San Giovanni in

"Head of the Goddess Ceres," oil painting by Baldassarre Peruzzi; in the Galleria Nazionale, Rome
Photo SASKIA, North Amherst, Mass.

Siena Cathedral. His first architectural work was the Villa Farnesina in Rome (1509–21), and he also assisted in the fresco decoration of this palace. On Raphael's death, in 1520, Peruzzi was appointed one of the architects for St. Peter's in Rome. Among the many edifices attributed to him, the most significant is probably the Palazzo Massimo alle Colonne (*c.* 1535) in Rome.

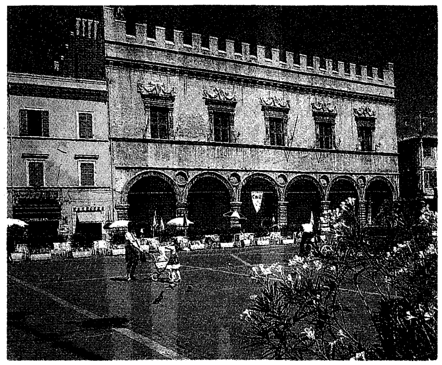
Pervomaysk, also spelled PERVOMAISK, or PERVOMAJSK, city, Nikolayev *oblast* (province), Ukrainian Soviet Socialist Republic, at the confluence of the Sinyukha and Yuzhny Bug rivers. The city, formerly known as Olviopol, was incorporated in 1773 and renamed, literally, First of May, after the international (Communist) holiday, in 1919. The city is divided by the rivers into three separate parts. It is now an industrial centre, with machine, engineering, food, and furniture industries. Pop. (1987 est.) 79,000.

Pervomaysk, also spelled PERVOMAISK, or PERVOMAJSK, mining town, Voroshilovgrad *oblast* (province), Ukrainian Soviet Socialist Republic, on the Donets Coal Basin. The town, the name of which means First of May, after the international (Communist) holiday, was incorporated in 1938, before which it was known as Petromaryevka. Besides mining, Pervomaysk has electrical-engineering and light industries. Pop. (1974 est.) 45,400.

Pervouralsk, city, Sverdlovsk *oblast* (province), western Russian Soviet Federated Socialist Republic, located on the upper Chusovaya River and on the railway from Sverdlovsk to Perm. Founded in 1732 as an ironworks, the modern city of Pervouralsk has several large steel-pipe factories. It also produces mining machinery, pipes, chemicals, clothing, and foodstuffs. Iron ore containing vanadium is mined in the vicinity. Pop. (1989 prelim.) 142,000.

Pesaḥ, also spelled PESACH (Judaism): *see* Passover.

Pesaro, Latin PISAURUM, city, capital of Pesaro e Urbino *provincia,* Marche *regione,* northern Italy, a seaport on the Adriatic Sea at the mouth of the Foglia (Pisaurum) River. Destroyed by Witigis the Ostrogoth in 536, the town was rebuilt and fortified by the Byzantine general Belisarius and was one of the five cities of the Maritime Pentapolis under the exarchate of Ravenna. Later disputed between the popes and the Holy Roman emperors, Pesaro came into the hands of the Malatesta family of Rimini about 1285. It was sold in 1445 to the Sforza family, and in 1512, through the influence of Pope Julius II, it went to the pope's nephew Francesco Maria I della Rovere, duke di Urbino. It reverted to the Papal States in 1631. A main point at the Adriatic end of the so-called Gothic line in World War II, Pesaro suffered heavily in the Allied advance of 1944, but many of its old buildings escaped with minor damage. Notable landmarks include the fortress of Rocca Constanza (built 1474–1505 for Constanzo Sforza); the Palazzo Ducale (1450–1510); the cathedral, with a 14th-century facade; and the nearby Villa Imperiale, built (1469–72) for Alessandro Sforza and noted for its fine stucco ceilings, wall paintings, and pavements of majolica plates. A new palace, begun in 1530 by Girolamo Genga and his son for Eleonora Gonzaga, was never completed.



The Palazzo Ducale, Pesaro, Italy, 1450–1510
Shostal/Superstock

The civic museums house the picture gallery and the museum of majolica, with the richest collection in Italy. (Pesaro has been famous for its majolica since 1462.) The Oliveriano Archaeological Museum is important for students of Italian antiquities. The composer Gioacchino Antonio Rossini, a native of Pesaro, left his fortune to found a music school there.

Pesaro is a pleasant seaside resort and serves a rich agricultural area; its industries include sulfur refining, boatbuilding, and the manufacture of motorcycles. Pop. (1988 est.) mun., 90,375.

Pescadores: *see* Penghu Islands.

Pescara, Latin ATERNUM, city, capital of Pescara *provincia,* Abruzzi *regione,* central Italy, on the Adriatic Sea at the mouth of the Pescara River, east-northeast of Rome.

Government palace and the Pescara River in Pescara, Italy
Marzari—SCALA from Art Resource/EB Inc.

The Roman Aternum, the city was almost destroyed in the barbarian invasions and arose again in the early European Middle Ages as Piscaria (*i.e.,* "abounding with fish"). The scene of much fighting throughout its history, it suffered heavy damage in World War II. Since 1927, Castellammare Adriatico, on the north bank of the river, has been part of Pescara. The birthplace (1863) of the poet Gabriele D'Annunzio has been preserved.

Pescara is a seaside resort and tourist centre that lies on the railway and main road from Bologna to Bari and Brindisi. Fishing and electrical, mechanical, textile, and food-processing industries are economically important, and there are naval shipyards. Pop. (1988 est.) mun., 130,525.

Pescara, Fernando Francesco de Avalos, marchese di (marquess of) (b. 1490, Naples [Italy]—d. Dec. 2, 1525, Milan), Italian leader of the forces of Holy Roman emperor Charles V against the French king Francis I.

A pupil of the soldier of fortune Prospero Colonna, Pescara commanded Spanish forces in Italy in the struggles from 1512 to 1525 between the French on one side and the Spanish and Germans on the other. In 1512 he was wounded at Ravenna, became a prisoner of the French, and was released on the promise not to fight against them again, a promise that was to be broken many times. In subsequent engagements he defeated the Venetians at Vicenza, occupied Padua in 1514, and, once more fighting against the French, took Milan in 1521 and Genoa in 1522. After Prospero Colonna's death in 1523, Pescara became virtual commander of Charles V's troops in Italy, winning a victory at Romagnano (northwest of Milan) in 1524 and, the following year, his greatest battle, at Pavia (south of Milan). There, by a combination of patience and tact, he successfully led his unpaid, ill-fed, and demoralized troops against the French.

After the victory Girolamo Morone, the Milanese chancellor, tried to enlist Pescara in a plot to ally Italy with France against Charles V, offering him the crown of Naples. Pescara at first appeared to give the plan serious consideration—to learn details of the conspiracy, he later claimed. But on Oct. 14, 1525, he arrested Morone, marched on Milan, and forced the Milanese to swear allegiance to the emperor, demanding the surrender of the citadels of Milan and Cremona (southeast of Milan). The duke of Milan, Francesco Sforza, refused, whereupon Pescara besieged the Castello Sforzesco. He died, however, before the duke yielded, and on his deathbed he recommended clemency for Morone.

Pescennius Niger Justus, Gaius: *see* Niger, Pescennius.

Peschiera del Garda, formerly PESCHIERA SUL GARDA, port village, Verona *provincia,* Veneto *regione,* northern Italy. Situated on the southeast end of Garda Lake at the efflux of the Mincio River, Peschiera lies about 14 miles (23 km) west of Verona. It is a rail junction. The village also has a fish hatchery. During Austrian rule, Peschiera was one of the four fortified towns, the site of the northwest fortress of the Quadrilateral. Pop. (1988 est.) mun., 8,729.

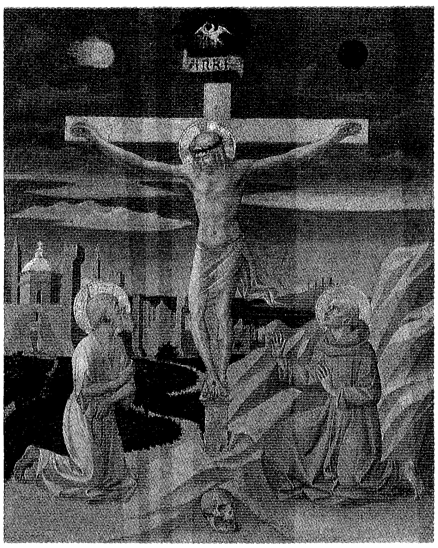
Pescia, town, Pistoia *provincia,* Toscana *regione,* central Italy, at the base of the Etruscan Apennines and at the western end of the Nievole River. Its cathedral is notable for an ancient tower, and in the 14th-century Church of St. Francis is a picture of St. Francis of Assisi, painted in 1235 by Bonaventura Berlinghieri. There are also several notable paintings in the civic museum.

The town has diverse industries, particularly paper manufacture, which dates from the 15th century. An important distribution centre for local produce, Pescia has an agricultural school and is a busy market in asparagus and flowers. Pop. (1988 est.) mun., 18,089.

Pescium (Yugoslavia): *see* Peć.

Pesellino, original name FRANCESCO DI STEFANO, also called GIUOCHI (b. 1422, Florence [Italy]—d. July 29, 1457, Florence), Italian artist of the early Renaissance who excelled in the execution of small-scale paintings.

Pesellino was raised by his grandfather, the painter Giuliano il Pesello, and worked as his assistant until Giuliano's death. He then became associated with Fra Filippo Lippi. In 1453 he went into partnership with Piero di Lorenzo di Pratese, and during this period he began, for the Church of the Trinità at Pistoia, the altarpiece now in the National Gallery, London. It was left unfinished at his death.



"The Crucifixion with Saint Jerome and Saint Francis," tempera on wood by Pesellino, probably *c.* 1440–45; in the National Gallery of Art, Washington, D.C.

By courtesy of the National Gallery of Art, Washington; Samuel H. Kress Collection

Pesellino is famous for his *cassone* pictures, which were intended for the decoration of marriage chests and in which he illustrated old legends or tales in tapestry-like designs. Several of these are in the Gardner Museum, Boston. A number of works by Pesellino may be seen in the National Gallery of Art, Washington, D.C.; the Metropolitan Museum of Art, New York City; and the Museum of Art of Toledo, Ohio.

peshaṭ (Hebrew: "spread out"), in Jewish hermeneutics, the simple, obvious, literal meaning of a biblical text. In the interpretation of the Halakha (the "Proper Way"; *i.e.,* the Oral Law that was essentially an interpretation of the Written Law), *peshaṭ* was preferred. Other interpretive principles, however, could be used simultaneously in any given text: *remez* (meaning "hint," in reference to typological or allegorical interpretations), *derash* (meaning "search," in reference to biblical study according to the *middot,* or rules), and *sod* (meaning "secret," or mystical interpretation). The first letters (PRDS) of these four words were first used in medieval Spain as an acronym forming the word PaRaDiSe to designate a theory of four basic interpretive principles: literal, philosophical, inferred, and mystical.

Depending on the needs or preferences of a particular historical period, one of the four principles generally gained a dominant position. During the early scribal and rabbinical period (*c.* 4th century BC–*c.* 2nd century AD), *peshaṭ* was preferred. Later, in the Talmudic period (*c.* 3rd–6th century AD), the inferred sense (*derash*) was viewed as more adequately communicating the intent of the divine author of the text—*i.e.,* making the text more relevant by seeking in it ethical and religious implications. Both *remez* and *sod,* which allowed for greater speculation, became favourite interpretive methods of the Kabbalists, Jewish mystics who flourished in Europe and Palestine during the Middle Ages and the early modern period.

Peshāwar, city, central North-West Frontier province, Pakistan. The city (capital of the province) lies just west of the Bāra River, a tributary of the Kābul River, near the Khyber Pass. The Shāhjī-kī Dhērī mounds, situated to the east, cover ruins of the largest Buddhist stupa in the subcontinent (2nd century AD), which attest the lengthy association of the town with Buddha and the religion founded about him. Once the capital of the ancient Buddhist kingdom of Gandhāra, the city was known variously as Paraṣawara and Puruṣapura (town, or abode, of Puruṣa). Also called Begrām, the present name, Peshāwar (*pēsh āwar,* "frontier town"), is ascribed to Akbar, the Mughal emperor of India (1556–1605). A great historic centre of transit-caravan trade with Afghanistan and Central Asia, Peshāwar is today connected by the Grand Trunk Road and rail with Lahore, Rāwalpindi, Hyderābād, and Karāchi and by air with Rāwalpindi, Chitrāl, and Kābul, Afg.

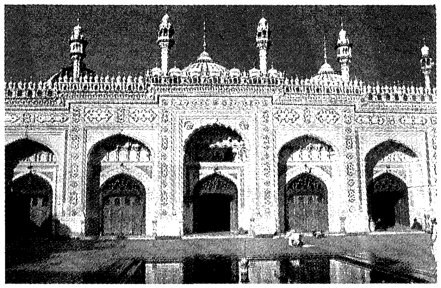
Industries include textile and sugar mills, fruit canning, and the manufacture of *chappal*s (sandals), shoes, leatherwork, glazed pottery, wax and embroidery work, copper utensils, *lungī*s (loincloths), turbans, carpets, ornamental woodwork and furniture, ivory work, knives, and small arms. The ancient Qiṣṣah (Kissa) Khwānī Bāzār ("Street of Storytellers") is the meeting place for foreign merchants who deal in dried fruits, woolen products, rugs, carpets, *pūstīn*s (sheepskin coats), karakul (lambskin) caps, and Chitrālī cloaks.

Peshāwar's historic buildings include Bālā Ḥissār, a fort built by the Sikhs on the ruins of the state residence of the Durrānīs, which was destroyed by them after the battle of Nowshera; Gor Khatri, once a Buddhist monastery and later a sacred Hindu temple, which stands on an eminence in the east and affords a panoramic view of the entire city; the pure white mosque of Mahābat Khān (1630), a remarkable monument of Mughal architecture; Victoria memorial hall; and Government House. There are many parks, and the Chowk Yadgar and the town hall are other places of social and public assembly. Coffeehouses also are popular. Gardens and suburbs are outside the old city wall.

Constituted a municipality in 1867, the city has three hospitals, a museum (with a large collection of Gandhāran Buddhist relics), an agricultural college, and the University of Peshāwar (founded 1950), with several constituent and affiliated colleges.

The surrounding region consists of highly irrigated plains, part of a huge basin drained and irrigated by the Kābul River, and a tract covered by low hills at Cherāt in the southeast. The chief crops are wheat, corn (maize), sugarcane, barley, cotton, and fruit (apples, pears, peaches, pomegranates, and quinces). The inhabitants are mostly Pashtuns.

References to the Peshāwar area occur in early Sanskrit literature and the writings of the classical historians Strabo and Arrian and the geographer Ptolemy. The Vale of Peshāwar was annexed by the Greco-Bactrian king Eucratides (2nd century BC), and Kaniṣka made Puruṣapura the capital of his Kushān (Kuṣāna) empire (1st century AD). Buddhism was still dominant in the 5th century AD when Fa-hsien, the Chinese Buddhist monk and traveler, passed through the area. Captured by the Muslims in AD 988, it was by the 16th century in the possession of the Afghans, who were nominally dependent on the Mughals. Sikh authority was firmly established by 1834, and the area was under British control from 1849 to 1947. Pop. (1981) town, 566,248; metropolitan area, 1,084,347.



Mahābat Khān Mosque, Peshāwar, Pak.

Frederic Ohringer from the Nancy Palmer Agency—EB Inc.

Peshitta (Syriac: "simple," or "common"), Syriac version of the Bible, the accepted Bible of Syrian Christian churches from the end of the 3rd century AD. The name Peshitta was first employed by Moses bar Kepha in the 9th century to suggest (as does the name of the Latin Vulgate) that the text was in common use. The name also may have been employed in contradistinction to the more complex Syro-Hexaplar version.

Of the vernacular versions of the Bible, the Old Testament Peshitta is second only to the Greek Septuagint in antiquity, dating from probably the 1st and 2nd centuries AD. The earliest parts in Old Syriac are thought to have been translated from Hebrew or Aramaic texts by Jewish Christians at Edessa, although the Old Testament Peshitta was later revised according to Greek textual principles. The earliest extant versions of the New Testament Peshitta date to the 5th century AD and exclude The Second Letter of Peter, The Second Letter of John, the Third Letter of John, The Letter of Jude, and The Revelation to John, which were not canonical in the Syrian church.

Peshtigo, city, Marinette county, northeastern Wisconsin, U.S. It is situated on the Peshtigo River, 49 miles (79 km) north-northeast of Green Bay. On Oct. 8, 1871, the date of the more famous but less deadly Chicago fire, winds whipped Wisconsin forest fires that had been burning for several days, destroying 1,200,000 acres (500,000 hectares); in a few hours Peshtigo was burned to the ground, with 1,152 known deaths. A monument commemorating those who died is in Peshtigo Fire Cemetery. Peshtigo is a manufacturing community; its chief products are lumber, paper and paper products, and boats. Dairying supplements the economy. Inc. 1903. Pop. (1986 est.) 2,930.

peshwa, the office of chief minister among the Marāthā people of India. The peshwa, also known as the *mukhya pradhan,* originally headed the advisory council of the raja Śivājī (reigned *c.* 1659–80). After Śivājī's death, the council broke up and the office lost its primacy, but it was revived when Śivājī's grandson Shāhū appointed Bālājī Visvanāth Bhat, a Chitpavan Brahman, as peshwa in 1714. Bālājī's son Bājī Rāo I secured the hereditary succession to the peshwaship.

From Shāhū's death, in 1749, the peshwa Bālājī Bājī Rāo was the virtual ruler of Mahārāshtra. He hoped to succeed the Mughals in Delhi, but, after a disastrous defeat of his army at Pānīpat (1761), he became the head of a confederacy of himself and four northern chiefs. Succession disputes from 1772 weakened the peshwa's authority. Defeat by Holkars—the Marāthā rulers of Indore—led Bājī Rāo II to seek British protection by the Treaty of Bassein (1802). Bājī Rāo was deposed after attacking the British in 1818; he died in 1853.

Pesne, Antoine (b. May 23, 1683, Paris, Fr.—d. Aug. 5, 1757, Berlin, Prussia [Germany]), French-born Rococo painter of historical subjects and portraits who was the most important artist in Prussia in the first half of the 18th century.

His father, the painter Thomas Pesne, and his maternal great-uncle, Charles de La Fosse, were probably his first teachers. While studying in Paris, he was influenced by the leading French portraitists, Hyacinthe Rigaud and Nicolas de Largillière. In Rome and Naples and particularly in Venice, where he studied with Andrea Celesti, Pesne developed a marked talent as a colourist.

In 1707 Pesne's full-length portrait of the Prussian ambassador to Venice, Baron von Knyphausen, attracted the attention of Frederick I of Prussia, who appointed him court portraitist. When Frederick II came of age, Pesne was able to give full scope to his colouristic gifts in mythological and allegorical ceiling paintings and murals, executed for the interiors of the palaces of Rheinsberg, Charlottenburg, Berlin, Potsdam, and Sanssouci. He continued to paint portraits, some of which achieve by their brushwork and brilliant colouring an almost impressionistic effect anticipating Pierre-Auguste Renoir. Of special interest are the various representations, in the style of Antoine Watteau, of Italian and French dancers and actresses whom Frederick II engaged for the Berlin Opera. These portraits are often cited for their perceptive characterizations.

peso, the monetary unit of several Latin-American countries and the Philippines; it is divided into 100 centavos. The peso was introduced into Spain by the monarchs Ferdinand and Isabella, who reformed the Spanish coinage system in 1497; it did not come into common use, though, until the time of Charles I (the emperor Charles V).

Originally divided into eight reales, the peso subsequently became the basis of the silver coinage of the Spanish empire after the monetary reform of 1772–86. In the Americas it was called "piece of eight," or "Spanish milled dollar," and was, in fact, equivalent to the U.S. silver dollar. It was retained as the basic coin by most of the Spanish colonies in the Americas when they gained their independence. When these countries adopted the decimal system for their coinage, a local name was in several cases substituted for the term peso. Thus it was renamed sol in Peru, bolivar in Venezuela, sucre in Ecuador, colón in El Salvador and Costa Rica, balboa in Panama, lempira in Honduras, quetzal in Guatemala, córdoba in Nicaragua, and boliviano in Bolivia. Other countries, such as Argentina, Chile, Colombia, Cuba, Mexico, and Uruguay, continued to use the term peso. Even where the name was officially changed, peso often continued to be used in popular speech. Spain first adopted the peseta as a monetary unit in 1859 and, except briefly from 1864 to 1868, has retained the peseta as the basic unit.

Pessac, town, southwestern suburb of Bordeaux, Gironde *département,* southwestern France. It was the site of a Gallo-Roman villa of the patrician Pesus. Located in the Graves vineyard district, it is noted for its red wines (Haut-Brion, Pape Clément). The 17th-century château of Haut-Brion, with its famous vineyard, is located there. It is also the site of a housing project designed by Le Corbusier. Pessac has some diversified manufacturing. Pop. (1982) 49,019.

Pessanha, Camilo (b. Sept. 7, 1867, Coimbra, Port.—d. 1926, Macao), Portuguese poet whose work is the representative in Portuguese poetry of Symbolism in its purest and most genuine form and the chief precursor of Modernist poetry.

After studying law at the university at Coimbra in 1891, Pessanha became a high-school teacher in the Portuguese colony of Macao in China. Pessanha began to practice various Oriental customs, including the opium habit, and learned Cantonese, from which he translated some elegies, *Oito Elegias Chinesas* ("Eight Chinese Elegies"). He also collected Chinese objets d'art, which he bequeathed to the Machado de Castro Museum in Coimbra. His writings on China, in particular the *Introdução a um Estudo sobre a Civilização Chinesa* and the *Elegias,* were collected in *China* (1943).

Although he had begun to write verse in Coimbra, Pessanha was virtually unknown until 1916, when his innovative Symbolist poetry was published in the progressive review *Centauro.* Later collected in *Clépsidra* (1920), it became a breviary for the Modernist poets. Pessanha is one of the most lyrical of Portuguese poets.

Pessoa, Fernando Antônio Nogueira (b. June 13, 1888, Lisbon, Port.—d. Nov. 30, 1935, Lisbon), poet whose part in Modernism gave Portuguese literature European significance.

From the age of seven Pessoa lived in Durban, S.Af., where his stepfather was Portuguese consul. He became fluent in English and wrote his early verse in English. In 1905 he returned to Lisbon, where he remained, working as a commercial translator while contributing to avant-garde reviews, especially *Orpheu* (1915), the organ of the Modernist movement, of which Pessoa was a leading aesthetician. He began publishing books of English poetry in 1918, but it was not until 1934 that his first book in Portuguese, *Mensagem,* appeared. It attracted little attention. Fame came after his death in 1935, when his extraordinarily rich dream world, peopled with alter egos whose poetry he produced along with his own, became generally known. Though the works of the imaginary poets differ in outlook and style from the work done under Pessoa's own name, taken together they express different personalities that he felt to exist within himself. The most important of his works are *Poesias de Fernando Pessoa* (1942), *Poesias de Álvaro de Campos* (1944), *Poemas de Alberto Caeiro* (1946), and *Odes de Ricardo Reis* (1946).

Included among English translations of some of his work are *Selected Poems,* 2nd ed. (1982), edited by Jonathan Griffin, and *Always Astonished: Selected Prose* (1988), edited by Edwin Honig.

Pest, *megye* (county), north-central Hungary, extending southward from the Budapest area to near the Tisza River and with an area of 2,469 square miles (6,394 square km). The *megye* is very much oriented toward Budapest, the national capital and *megye* seat, which is a county in its own right. Pest is by far the most populous and industrialized *megye* in Hungary.

The principal industrial centres of the *megye* have varied industries, including a cement factory at Vác, a prefabricated-house factory at Dunakeszi, and food canneries at Cegléd and Nagykőrös. Százhalombatta is a rapidly developing industrial centre with a power station and oil refinery based on a pipeline from the Soviet Union. Szentendre, founded by Serbs, has many Baroque buildings, several museums, and an artists' colony. The Danube Bend is a popular resort area with Visegrád at its centre. Visegrád has a medieval fortress and ruins of a Renaissance castle. In Gödöllő there is an agricultural university.

Market garden vegetables, fruits, pigs, and poultry are the main farm products, and there is a high crop value yield per acre and per

The Danube Bend, seen from Visegrád, with Pest *megye* (county), Hung., in the distance
Jean S. Buldain/Berg & Assoc.

capita, especially in sugar peas and tomatoes. Pop. (1983 est.) 983,000.

pest, any organism judged as a threat to human beings or to their interests. When early man hunted animals and foraged for food, he shared the natural resources with other organisms in the community. As human culture developed and population rose, people made ever-increasing demands on these resources. One result of changing the environment has been a great increase in the number of species that are now recognized as competitors of humans. These competitors are usually referred to as pests. The definition of pest is, of course, subjective. An ecologist would not necessarily consider several leaf-eating caterpillars on a plant as pests, whereas a gardener who cultivated the plant might very well do so. And only one bat, rat, or mouse is enough to qualify as a household pest.

Natural communities have always contained organisms that were economically significant; locusts, for example, have plagued humans throughout history, and grain from Stone Age locations has been found infected with bunt and ergot diseases. Most species that became pests, however, did so because of environmental modification, occasionally from natural causes but usually from human activities.

In order to appreciate some of the methods devised to combat pests, one should consider how advancing technology has increased the number of harmful insect species. The change from natural vegetation to large areas of single-crop (monoculture) agriculture has three consequences. First, given a more uniform food source, some plant-eating species increase to large populations. Second, the uniform plant cover is easily invaded by attacking pests. Third, the introduction of new crops over large areas results in the transfer of previously harmless insects from scattered native plants to the new and abundant sources of food. Cultural practices such as fertilization, irrigation, and the use of modern harvesting equipment (which often leaves large amounts of plant litter in the field) enhance still further the ability of pest species to increase rapidly. In addition, the elimination of species that compete with or prey upon pests—an unintended effect in some pest control programs—has also exacerbated certain pest problems. Also, the ease with which people and goods can be transported around the world has resulted in the introduction of exotic pests in many places.

Pests are found throughout the animal kingdom. Microorganisms such as fungi, bacteria, and viruses are here considered with the pests even though they are usually thought of as agents of disease. Most animal pests are invertebrates, among them protozoa, flatworms, nematodes, snails, slugs, insects, and mites. Among the vertebrates, rabbits, elk, deer, and many kinds of rodents are sometimes injurious to crops.

Insects are also serious pests because some of them play an essential role in the transmission of disease. Each year millions of lives, particularly in the tropics, are threatened by insect-borne diseases. Malaria and yellow fever are transmitted by mosquitoes, plague by fleas, typhus by the human louse, sleeping sickness by tsetse flies, Chagas' disease by blood-sucking bugs, and leishmaniasis by sandflies. Other diseases may be spread by insects accidentally as a result of their habits.

Pest control began to receive attention in the 18th century, and it has become increasingly important since then. As control programs were developed, they tended to fall primarily into two somewhat mutually exclusive categories: chemical and biological. Physical or mechanical methods, including sticky barriers, heat killing (for storage pests), and flooding (for ground pests), were also developed. Because of their limited utility and short-term effectiveness, they have been superseded largely by chemical and biological methods.

The chemical, or pesticide, approach probably began with the use of poisonous plant compounds—ground tobacco was used in France to kill aphids about 1763. Other natural products such as nicotine, rotenone, petroleum, kerosene, creosote, and turpentine were used in the 19th century. Inorganic compounds such as Paris green, lime sulfur, Bordeaux mixture, hydrogen cyanide, and lead arsenate were also introduced in the 1800s.

With the appearance of the synthetic organic compounds during World War II, a dramatic change occurred in pest control. Some organic compounds, such as the dinitrophenols, had been used earlier, but the discovery of the insecticidal properties of DDT (dichloro-diphenyl-trichloroethane) and of BHC (benzene hexachloride) made the concept of pest-free crops possible. Research in the 1930s on plant hormones and related compounds led to the development of the selective herbicide 2,4-D (2,4-dichlorophenoxyacetic acid), and this became commercially available about the same time as DDT. Following the appearance of these new synthetic organic compounds, a whole new series of pesticides—insecticides, fungicides, herbicides, and plant growth regulators—was introduced.

Although the ancient Chinese used predacious ants to control foliage-feeding insects, the control of pests by biological means appears to have been initiated in the Western world with the importation of the Indian Mynah bird into Mauritius in 1762 to control the red locust. Control of bedbugs by predatory agents was recommended in 1776. A number of other projects in biological control were carried out in the 1800s, but the modern era in this phase of pest control began in 1888 with the importation into California of the vedalia beetle (*Rodolia cardinalis*) to control the cottony-cushion scale (*Icerya purchasi*). This beetle, imported from Australia, saved the citrus-fruit industry.

The use of plants resistant to insects was suggested about 1788 as a means of controlling the Hessian fly, a pest of wheat. The classic example of this approach was the control of phylloxera, aphid-like insects that atacked the root stocks of the European wine grape and almost ruined the European wine industry. The solution lay in grafting the European wine grape onto resistant American stocks. The effort, about 1900, to control the lantana shrub in Hawaii by introducing an insect appears to have been the first attempt to control weeds biologically. The use of microorganisms to destroy insect pests began in the late 1800s and early 1900s.

With the appearance of the synthetic organic insecticides, however, emphasis was placed on chemical control, and biological means fell into neglect. The extensive use of powerful chemical agents soon resulted in a number of serious ecological problems. Consequently, current pest control practice minimizes the use of pesticides and combines them with biological methods in an approach called integrated control. The integrated control of an insect that attacks crops may, for example, involve the breeding of pest-resistant crop varieties; the development of crop culture methods that inhibit pest proliferation; the release of organisms that are predators or parasites of the pest species; the placement of traps baited with the pest's own sex attractants (pheromones); the disruption of the pest's reproduction by the release of sterilized pests; and, often as a last resort, the application of chemical insecticides. Other important tools of modern pest control or importation and quarantine regulations, which are designed to prevent the introduction of exotic pests.

Pestalozzi, Johann Heinrich (b. Jan. 12, 1746, Zürich—d. Feb. 17, 1827, Brugg, Switz.), Swiss educational reformer, who advocated education of the poor and emphasized teaching methods designed to strengthen the student's own abilities. Pestalozzi's method became widely accepted, and most of his principles have been absorbed into modern elementary education.

Pestalozzi's pedagogical doctrines stressed that instructions should proceed from the familiar to the new, incorporate the performance of concrete arts and the experience of actual emotional responses, and be paced to follow the gradual unfolding of the child's development. His ideas flow from the same stream of thought that includes Johann Friedrich Herbart, Maria Montessori, John Dewey, and more recently Jean Piaget and advocates of the language experience approach such as R.V. Allen.

Pestalozzi, lithograph after a drawing by G.A. Hippius, 1818; in the Pestalozzianum, Zürich
By courtesy of the Bibliotheque Nationale Suisse

Pestalozzi's curriculum, which was modelled after Jean-Jacques Rousseau's plan in *Émile,* emphasized group rather than individual recitation and focussed on such participatory activities as drawing, writing, singing, physical exercise, model making, collecting, map making, and field trips. Among his ideas, considered radically innovative at the time, were making allowances for individual differences, grouping students by ability rather than age, and encouraging formal teacher training as part of a scientific approach to education.

Pestalozzi was influenced by the political conditions of his country and by the educational ideas of Rousseau; as a young man he abandoned the study of theology to go "back to Nature." In 1769 he took up agriculture on neglected land near the River Aare—the Neuhof. When this enterprise collapsed in 1774, he took poor children into his house, having them work by spinning and weaving and learn simultaneously to become self-supporting. This project also failed materially, although Pestalozzi had gained valuable experience. He also took an active interest in Swiss politics.

As practical realization of his ideas was denied him, he turned to writing. *Die Abendstunde eines Linsiedlers* (1780; "The Evening Hour of a Hermit") outlines his fundamental theory that education must be "according to nature" and that security in the home is the foundation of man's happiness. His novel *Lienhard und Gertrud* (1781–87; *Leonard and Gertrude,* 1801), written for "the people," was a literary success as the first realistic representation of rural life in German. It describes how an ideal woman exposes corrupt practices and, by her well-ordered homelife, sets a model for the village school and the larger community.

The important role of the mother in early education is a recurrent theme in Pestalozzi's writings.

For 30 years Pestalozzi lived in isolation on his Neuhof estate, writing profusely on educational, political, and economic topics, indicating ways of improving the lot of the poor. His proposals were ignored by his own countrymen, and he became increasingly despondent. He would have accepted the post of educational adviser anywhere in Europe had it been forthcoming. His main philosophical treatise, *Meine Nachforschungen über den Gang der Natur in der Entwicklung des Menschengeschlechts* (1797; "My Inquiries into the Course of Nature in the Development of Mankind"), reflects his personal disappointment but expresses his firm belief in the resources of human nature and his conviction that people are responsible for their moral and intellectual state. Thus, Pestalozzi was convinced, education should develop the individual's faculties to think for himself.

Pestalozzi's chance to act came after the French Revolution, when he was more than 50 years old. The French-imposed Helvetic Republic in Switzerland invited him to organize higher education, but he preferred to begin at the beginning. He collected scores of destitute war orphans and cared for them almost single-handedly, attempting to create a family atmosphere and to restore their moral qualities. These few exhausting months in Stans (1799) were, according to Pestalozzi's own account, the happiest days of his life.

From 1800 to 1804 he directed an educational establishment in Burgdorf and from 1805 until 1825 a boarding school at Yverdon, near Neuchâtel. Both schools relied for funds on fee-paying pupils, though some poor children were taken in, and these institutes served as experimental bases for proving his method in its three branches—intellectual, moral, and physical, the latter including vocational and civic training. They also were to finance his life's "dream," an industrial (*i.e.,* poor) school. The Yverdon Institute became world famous, drawing pupils from all over Europe as well as many foreign visitors. Some visiting educators—*e.g.,* Friedrich Froebel, J.F. Herbart, and Carl Ritter—were so impressed that they stayed on to study the method and later introduced it into their own teaching.

While dedicated assistants carried on the teaching, Pestalozzi remained the institute's heart and soul and continued to work out his method. *Wie Gertrud ihre Kinder lehrt* (1801; *How Gertrude Teaches Her Children*) contains the main principles of intellectual education: that the child's innate faculties should be evolved and that he should learn how to think, proceeding gradually from observation to comprehension to the formation of clear ideas. Although the teaching method is treated in greater detail, Pestalozzi considered moral education preeminent.

The family spirit prevailing at Yverdon was shattered in later years by a progressively severe dispute among the teachers for first place by Pestalozzi's side. The longed-for poor school, established by means of the proceeds from publication of his collected works, existed for only two years. To Pestalozzi's great distress, the Yverdon Institute lost its fame and its pupils. His efforts at reconciliation were in vain. With a few pupils he retreated to Neuhof in 1825, sad but convinced that his ideas would prevail in the end. His *Schwanengesang* (1826; "Swan Song") culminated in the maxim "Life itself educates."

Pestalozzi was an impressive personality, highly esteemed by his contemporaries. His concept of education embraced politics, economics, and philosophy, and the influence of his "method" was immense. (K.Si./Ed.)

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Pestel, Pavel Ivanovich (b. July 5 [June 24, Old Style], 1793, Moscow, Russia—d. July 25 [July 13], 1826, St. Petersburg), Russian military officer and a radical leader of the Decembrist revolutionaries.

The son of a government official, Pestel attended school in Dresden, Saxony, from 1805 to 1809. He entered the elite Corps of Pages in St. Petersburg in 1810 and, upon graduation in 1811, was commissioned as an ensign in the Lithuanian Regiment of Guards. After fighting in the Napoleonic Wars, he returned to St. Petersburg with a sense of Russia's backwardness in comparison with western and central Europe. In 1816 Pestel joined the Union of Salvation to discuss ideas for Russian reforms and the institution of a constitutional monarchy. In 1818 he organized a branch of the Union of Welfare at Tulchin, and in 1821 he organized the more radical Southern Society of Decembrists. His plan for the socioeconomic and political transformation of Russia, titled *Russkaya Pravda* (1824; "Russian Truth"), called for the execution of the imperial family, the emancipation of the serfs, the replacement of the tsarist autocracy by a republican form of government, and the allotment of land to the freed serfs.

During the succession crisis following the death of Alexander I and on the day before the Decembrists' planned uprising took place in St. Petersburg, Pestel was arrested in Tulchin (Dec. 25 [Dec. 13, Old Style], 1825), having been betrayed by an officer newly recruited into the Southern Society. He was executed a few months later in Petropavlovsk fortress with four other Decembrists.

pesticide, any toxic substance used to kill animals or plants that cause economic damage to crop or ornamental plants or are hazardous to the health of domestic animals or humans. All pesticides interfere with normal metabolic processes in the pest organism and often are classified according to the type of organism they are intended to control. *See* herbicide; insecticide; fungicide; fumigant.

pet, any animal kept by human beings as a source of companionship and pleasure.

While a pet is generally kept for the pleasure that it can give to its owner, often, especially with horses, dogs, and cats, as well as with some other animals, this pleasure appears to be mutual. Thus, pet keeping can be described as a symbiotic relationship, one that benefits both animals and human beings. As the keeping of pets has been practiced from prehistoric times to the present and as pets are found in nearly every culture and society, pet keeping apparently satisfies a deep, universal human need.

The history of pets is intertwined with the process of animal domestication, and it is likely that the dog, as the first domesticated species, was also the first pet. Perhaps the initial steps toward domestication were taken largely through the widespread human practice of making pets of captured young wild animals. Eventually, a working relationship developed between the dogs and their human captors. The dog was swifter, had stronger jaws, and was better at tracking prey; therefore, it could be of great use in hunting and guarding duties. From human beings, on the other hand, the dogs were assured of a constant supply of food as well as warmth from the fire. There is indirect evidence that the dog may have been domesticated and kept as a pet since Paleolithic times, as can be surmised from the paintings and carvings that archaeologists have found in ancient campsites and tombs. In Mesopotamia, dogs that look remarkably like the present-day mastiff were shown participating in a lion hunt. Domestic pets were often depicted in the scenes of family life in ancient Egypt; hunting dogs of the greyhound or saluki type accompany their master to the chase, and lap dogs frequently sit under the chair of their master or mistress.

Next to the dog, horses and cats are the animals most intimately associated with human beings. Surprisingly, both these animal groups were domesticated rather late in human history. There is no evidence that horses were domesticated in Paleolithic or Mesolithic times, but by about 2000 BC horses used in chariot battles were an established phenomenon throughout the Middle East. It seems that riding astride horses was a practice developed a few centuries later (*see* horsemanship). The cat, too, does not seem to have been domesticated as a pet until the New Kingdom period (about the 16th century BC) in Egypt. This is all the more strange as the ancient Egyptians had tamed many types of animals, such as lions, hyenas, monkeys, the Nile goose, and dogs, since the Old Kingdom period. But once cats were finally domesticated, their popularity was enormous. Gradually, the cat became one of the most universally worshiped animals.

As has been noted, the primary bond distinguishing a pet-and-owner relationship is affection. As useful as many of these animals are, what differentiates a pet from other economically useful livestock is the degree of contact between the animals and human beings. Often, this relationship has been unabashedly sentimentalized in myth, art, and literature. The affection between Alexander the Great and his favourite horse, Bucephalus, has become legendary, while in the modern age the popularity of such canine motion-picture stars as Rin Tin Tin and Lassie is further evidence of the importance placed on the relationship between owner and pet.

The pet-and-owner relationship, however, is not only founded on companionship; since the earliest period of domestication, pets have fulfilled practical, economic ends. Catching other animals to feed their human masters is one of the most fundamental uses of pets, and not only dogs have served in this capacity but cats, hyenas, and lions have also been used for hunting. The aristocratic, rather arcane sport of falconry made use of the natural talent of hawks to aid in hunting game birds. Pets have also been used for the purpose of guarding—either other livestock, the home or territory of their owners, or the owners themselves. Any pet that has a sharp sense of smell or hearing and that makes a loud noise when aroused can be used as a guard, although dogs are the best-known examples. It is thought that the Nile goose, a favourite household pet of the ancient Egyptians, may have served such a purpose. The herding and guarding of livestock is another practical use of pets, in particular the dog. Over the centuries, many specialized breeds of dog have been developed to suit this purpose.

Often, pets have been used as a source of food when other sources become scarce. This has been the case with dogs throughout their history of domestication in both the Old World and the New World. Guinea pigs, domesticated as pets in the New World, also assured a stable food supply.

Pets have also been used to eliminate animal pests. The rat-catching ability of cats is celebrated in fairy tales such as "Puss 'n Boots" and "Dick Whittington," as is the snake-catching talent of the mongoose in Rudyard Kipling's "Rikki-tikki-tavi."

Finally, pets themselves have become a self-perpetuating industry, bred for a variety of purposes, including their value as breeding animals. Pets that are bred for aesthetic purposes may have full-fledged show careers. Other pets may be bred for racing or other competitive sports, around which sizable industries have been built.

Animals kept as pets can be classified according to the type of premises or habitat they usually occupy. Dogs, cats, and birds such as canaries and parakeets are kept as household pets. Other birds, such as jays, magpies, and members of the crow family, are kept in aviaries. When kept as pets, reptiles and amphibians frequently require special conditions of heat and moisture. For this reason, they are best kept in glassed enclosures called vivaria. The most common vivarium pets are snakes, lizards, turtles, frogs, and toads. Many people keep fish as aquarium pets. Fishes constitute a completely separate section of the pet world, and an international industry exists for catching, breeding, transporting, and supplying stock. Hutch, or cage, pets can be kept indoors or outdoors under protected conditions. These pets include rabbits, guinea pigs, rats, mice, hamsters, gerbils, and, recently, chinchillas. Paddock pets are those that must be stabled outdoors and include such animals as horses, ponies, donkeys, and mules. Several kinds of insects are also kept as pets. These include walking-stick insects (kept in simple containers at room temperature) and ants (kept in artificial nests).

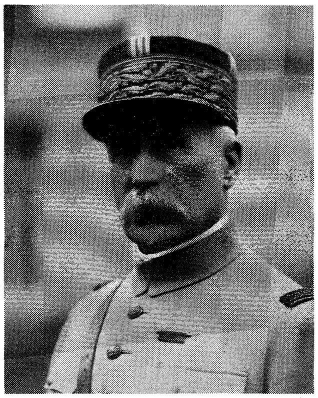
Of increasing concern is the sale of exotic pets (*e.g.,* jaguars, alligators, ocelots, monkeys, apes, kinkajous, etc.). Rarely are the owners of such pets able to provide the basic nutritional or habitat needs of these animals; most of the animals soon die or are sent to a zoo. Furthermore, in order to obtain the young, which are considered most desirable as pets, many adults of the wild species are killed, seriously depleting populations already endangered. Several countries have passed laws to prohibit the importation of endangered species as pets, but an active black market flourishes.

Petaḥ Tiqwa, city, west-central Israel, on the Plain of Sharon, east-northeast of Tel Aviv-Yafo and part of that city's metropolitan area. Situated in the valley of Achor near the Yarqon River, the city takes its name (meaning "Door of Hope") from the biblical allusion in Hosea 2:15: ". . . and make the valley of Achor a door of hope." Petaḥ Tiqwa was the first village (founded 1878) in the modern Jewish settlement of Palestine and is known as Em ha-Moshavot (Hebrew: "Mother of Villages"). Because the village was founded in a swampy, malarial area, the first years of settlement were unstable and dangerous. Settlers first planted eucalyptus trees for drainage, then turned to truck and citrus farming; the first orange groves in modern Palestine were also planted in the village. With the growth of Tel Aviv, much of the agricultural land was converted to suburban residential and industrial use. Petaḥ Tiqwa was incorporated as a city in 1939. Industries include the production of canned fruits, oils and soaps, textiles, and agricultural machinery.

About 5 miles (8 km) east-northeast of Petaḥ Tiqwa is the tell (mound) of Aphek, an ancient Canaanite city, mentioned in Egyptian texts as early as the 18th century BC. In the Bible, Aphek was the site of the rout of the Israelites by the Philistines (I Samuel 4). Later Herod the Great, king of Judaea, built the city of Antipatris on the site (*c.* 20 BC). Pop. (1988 est.) 132,100.

Pétain, (Henri-)Philippe (b. April 24, 1856, Cauchy-à-la-Tour, Fr.—d. July 23, 1951, Île d'Yeu), French general who was a national hero for his victory at the Battle of Verdun in World War I but was discredited as chief of state of the French government at Vichy in World War II. He died under sentence in a prison fortress.

Born into a family of farmers in northern France, Pétain, after attending the local village school and a religious secondary school, was admitted to Saint-Cyr, France's principal military academy. As a young second lieutenant in an Alpine regiment, sharing the rough outdoor life of his men, he came to understand the ordinary soldier. The extraordinary popularity he was later to enjoy with the rank and file in World War I is believed to have had its origin there.



Pétain
EB Inc.

His advancement until the outbreak of World War I in 1914—he was 58 when he finally became a general—was slow because as a professor at the War College he had propounded tactical theories opposed to those held by the high command. While the latter favoured the offensive at all costs, Pétain held that a well-organized defensive was sometimes called for and that before any attack the commander must be sure of the superiority of his fire power.

After successively commanding a brigade, a corps, and an army, Pétain in 1916 was charged with stopping the German attack on the fortress city of Verdun. Though the situation was practically hopeless, he masterfully reorganized both the front and the transport systems, made prudent use of the artillery, and was able to inspire in his troops a heroism that became historic. He became a popular hero, and, when serious mutinies erupted in the French army following the ill-considered offensives of General Robert-Georges Nivelle, then French commander in chief, Pétain was named his successor.

He reestablished discipline with a minimum of repression by personally explaining his intentions to the soldiers and improving their living conditions. Under him the French armies participated in the victorious offensive of 1918, led by Marshal Ferdinand Foch, generalissimo of the Allied armies. Pétain was made a marshal of France in November 1918 and was subsequently appointed to the highest military offices (vice president of the Supreme War Council and inspector general of the army).

Following the German attack of May 1940 in World War II, Paul Reynaud, who was then head of the government, named Pétain vice premier, and on June 16, at the age of 84, Marshal Pétain was asked to form a new ministry. Seeing the French army defeated, the "hero of Verdun" asked for an armistice. After it was concluded, the Chamber of Deputies and the Senate, meeting in Vichy, conferred upon him almost absolute powers as "chief of state."

With the German army occupying two-thirds of the country, Pétain believed he could repair the ruin caused by the invasion and obtain the release of the numerous prisoners of war only by cooperating with the Germans. In the southern part of France, left free by the armistice agreement, he set up a paternalistic regime the motto of which was "Work, Family, and Fatherland." Reactionary by temperament and education, he allowed his government to promulgate a law dissolving the Masonic lodges and excluding Jews from certain professions.

He was, however, opposed to the policy of close Franco-German collaboration advocated by his vice premier Pierre Laval, whom he dismissed in December 1940, replacing him with Admiral François Darlan. Pétain then attempted to practice a foreign policy of neutrality and delay. He secretly sent an emissary to London, met with the Spanish dictator Francisco Franco, whom he urged to refuse free passage of Adolf Hitler's army to North Africa, and maintained a cordial relationship with Admiral William Leahy, the U.S. ambassador to Vichy until 1942.

When, in April 1942, the Germans forced Pétain to take Laval back as premier, he himself withdrew into a purely nominal role. Yet he balked at resigning, convinced that, if he did, Hitler would place all of France directly under German rule. After Allied landings in November 1942 in North Africa, Pétain secretly ordered Admiral Darlan, then in Algeria, to merge the French forces in Africa with those of the Allies. But, at the same time, he published official messages protesting the landing. His double-dealing was to prove his undoing.

In August 1944, after the liberation of Paris by General Charles de Gaulle, Pétain dispatched an emissary to arrange for a peaceful transfer of power. De Gaulle refused to receive the envoy. At the end of August the Germans transferred Pétain from Vichy to Germany. Brought to trial in France for his behaviour after 1940, he was condemned to death in August 1945. His sentence was immediately commuted to solitary confinement for life. He was imprisoned in a fortress on the Île d'Yeu off the Atlantic coast, where he died at the age of 95. (G.Bl.)

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Consult the INDEX *first*

Petaling Jaya, city, West Malaysia (Malaya), about 7 miles (11 km) southwest of Kuala Lumpur, the national capital. Established (1953) originally as a satellite settlement for squatters of Kuala Lumpur, Petaling Jaya is among the most industrialized and prosperous cities in Malaysia. Local industries include the processing of food, rubber, and wood and the manufacture of paper, chemicals, pharmaceuticals, fertilizers, and beverages. A vocational institute provides training in automobile engineering, refrigeration, welding, and electronics. There is also a film production studio and a teaching hospital. Cultural resources include the Malaysian branch of the Royal Asiatic Society, the national archives of Malaysia, and the Cooperative College of Malaysia, founded 1956. Pop. (1980) 207,805.

Petaluma, city, Sonoma County, western California, U.S., at the head of navigation on the Petaluma River, 38 mi (61 km) north of San Francisco. Founded in 1852, it derived its name from the Rancho Petaluma (Miwok Indian *pe'ta*, "flat"; *lu'ma*, "back"). The poultry and egg industry, dairying, and wine making are foremost commercial activities, supplemented by light manufactures (notably processing machinery and fishing tackle). Nearby is the Petaluma Adobe State Historical Park (the restored home of Mexican general Mariano Guadalupe Vallejo, built about 1836). Inc. town, 1858; city, 1884. Pop. (1980) 33,834.

Petar (Serbo-Croatian, Montenegrin, etc., personal name): *see under* Peter.

Petare, city, northwestern Miranda state, in the central highlands of northern Venezuela. Formerly a commercial centre in a fertile agricultural area producing coffee, cacao, and sugarcane, the city has become a residential suburb of the national capital and a part of the Caracas metropolitan area. Cardboard is manufactured in the city. Expressways lead from Petare to downtown Caracas, approximately 10 mi (16 km) to the west-northwest. Pop. (1981 est.) 334,800.

petasos, also spelled PETASUS, wide-brimmed hat with a conical crown worn in ancient Greece. The petasos worn by men had a rather low crown, while that worn by women had a tall one.

Man wearing a petasos, terra-cotta sculpture from Tanagra, Greece, early 5th century BC; in the British Museum
By courtesy of the trustees of the British Museum

A hat used for travelling, the petasos was made of felt or straw and had a chin strap, so that when not in use it could be hung down the back. The winged hat of the god Hermes was also called a petasos.

Petchabun (Thailand): *see* Phetchabun.

Petchaburi (Thailand): *see* Phetchaburi.

Petén, department, northern Guatemala, bounded on the north and west by Mexico and on the east by Belize. The department's 13,843 sq mi (35,854 sq km) make up over one-third of the national territory. Petén is a low limestone plateau, varying in altitude between 500 and 700 ft (150 and 210 m) above sea level at the base of the Yucatán Peninsula. Except for areas of savanna vegetation, the region is covered by dense tropical rain forests. Few rivers penetrate Petén, for most of the heavy rainfall is drained underground.

Because of its vegetation and unsuitability for agriculture, Petén long has been isolated. The centre of the Mayan Old Empire, it contains ruins of many Mayan cities, most notably Tikal, where in the 1970s the government established a large park with tourist facilities, and Uaxactún (*qq.v.*). The Maya Itzá Indians, whose centre was around Lake Petén Itzá, were not subdued by the Spanish until 1697. The major resources of Petén lie in its forests, which yield mahogany, tropical cedar, rubber, and chicle. Some oil has been found in the area. Sugarcane, cacao, fruits, and grains are cultivated around Flores (*q.v.*), the departmental capital, which lies on Lake Petén Itzá. Thousands of people have migrated from the overworked lands to the south and through slash-and-burn agriculture have attempted to turn the forests into farmland. Flores is accessible by highway from Belize; other roads radiate to the Mexican border and to navigable rivers. The first road connecting the central part of the country with northern Petén was completed in 1970, but much transportation in Petén is by air. Pop. (1982 est.) 102,803.

Petén Itzá, Lake, Spanish LAGO PETÉN ITZÁ, central Petén department, northern Guatemala, 160 mi (260 km) northeast of Guatemala City. A depression in the low limestone plateau at an elevation of 262 ft (80 m) above sea level, it measures about 22 mi from east to west and 10 mi from north to south and is 165 ft deep; its area is 40 sq mi (100 sq km). It has no visible outlet, because its drainage is underground. Once the stronghold of the Maya Itzá Indians, who were not conquered by the Spanish until 1697, the shores of the lake are now dotted with modern towns: Flores, the departmental capital, which lies on an island in the southwestern portion of the lake; San Benito, in the southwest; and San Andrés, on the northwestern shore. Much of the surrounding land is covered by dense tropical rain forest, but there is some cultivation of cacao, sugarcane, grains, and tropical fruits around Flores.

Peter: *see* Peter the Apostle, Saint.

Peter, name of rulers grouped below by country and indicated by the symbol •.

Foreign-language equivalents:

French	Pierre
Italian	Pietro, or Piero
Latin	Petrus
Montenegrin	Petar
Portuguese	Pedro
Russian	Pyotr, or Pëtr
Serbo-Croation	Petar
Spanish	Pedro

BRAZIL

• Peter I: *see* Pedro I.

• Peter II: *see* Pedro II.

BRITTANY

• Peter I, also called PETER OF DREUX, byname PETER MAUCLERC, French PIERRE DE DREUX, or PIERRE MAUCLERC (b. 1190—d. 1250, at sea en route to France), duke or count of Brittany from 1213 to 1237, French prince of the Capetian dynasty, founder of a line of French dukes of Brittany who ruled until the mid-14th century.

Married by his cousin King Philip II Augustus of France to Alix, heiress to Brittany, Peter did homage for the province in 1213 and assumed the title of duke, though he was considered merely a count by the French. He energetically asserted his authority over the Breton lands, annexing new fiefs to the ducal domain, granting privileges to the towns, and regularizing the administration.

As guardian for his son, John I the Red, after Alix's death in 1221, Peter attempted to build up his own power against the day of his son's majority; he extorted concessions from the French regency in 1227 by means of rebellion. He transferred his allegiance from the French to the English king from 1229 until 1234, despite the fact that his predecessor, Arthur I, had been murdered by the English. But when John came of age (1237), Peter had to renounce Brittany and henceforth was merely count of Braine.

Called Mauclerc (Bad Clerk) either because his early training for the church was abortive or because he quarreled continually with the episcopate, Peter spent much of his life under excommunication and was persuaded to go on a crusade (1239–40) in penance. In 1248 he went to Egypt on another crusade. Wounded in battle, he died on his way home.

• Peter II (d. Sept. 22, 1457, Nantes, Fr.), duke of Brittany (from 1450), son of John V (or VI) and brother of his predecessor Francis I. He made an important innovation in limiting the right of asylum in churches and monasteries, enabling him to pursue his enemies at will. To preserve the family line, he adhered to the testament of Francis I and made his uncle Arthur, constable de Richemont (*q.v.*), his successor, as Arthur III.

CONSTANTINOPLE

• Peter, also called PETER OF COURTENAY, French PIERRE DE COURTENAY (d. 1219?), briefly Latin emperor of Constantinople from 1217 to 1219.

The son of Peter of Courtenay (d. 1183) and a grandson of the French king Louis VI, he obtained the counties of Auxerre and Tonnerre by his first marriage. He later married Yolande (d. 1219), sister of Baldwin I and Henry of Flanders, first and second Latin emperors of Constantinople; she brought him the marquessate of Nevers.

Chosen successor to Henry of Flanders when Henry died without sons in 1216, Peter was consecrated emperor in S. Lorenzo Fuori le Mura, Rome, by Pope Honorius III on April 9, 1217. Accompanied by an army and a papal legate, he subsequently embarked at Brindisi on ships furnished by the Venetians, for whom he tried to conquer Durazzo from Theodore Ducas, Greek despot of Epirus. Failing in that enterprise, Peter set out overland toward Thessalonica. In the mountains near Elbasan he was taken by Theodore and died, probably by assassination, after an imprisonment of at least two years.

MONTENEGRO

• Peter I, Montenegrin in full PETAR PETROVIĆ NJEGOŠ (b. *c.* 1747, Njegoš, Montenegro—d. Oct. 30 [Oct. 18, old style], 1830, Cetinje), the great *vladika*, or prince-bishop, of Montenegro from 1782 to 1830, who won full independence of his country from the Turks.

As successor to his saintly but inept uncle Sava, Peter became the reigning prince in theocratic Montenegro in 1782 and was consecrated bishop two years later. To cement relations with Russia, always a potential ally against the Turks, he visited Russia that same year. On his return he found his land was being overrun by the forces of the Pasha of Scutari. Uniting his warlike clans, he drove the invaders out. War with the Turks flared up periodically, sometimes with, and sometimes without, a powerful ally such as Russia or Austria. In 1796 a second invasion by the Pasha of Scutari led to a series of brilliant victories over the Turks, with Peter leading his men. The Pasha was captured and beheaded, and by a treaty in 1799 Sultan Selim III was forced to recognize the independence of Montenegro. New territories were added, including Brda, recently settled by Serbs from Hercegovina, which was to double the size of Montenegro during Peter's reign.

During the Napoleonic Wars, Montenegro became involved in the struggle between the Great Powers. When by the Treaty of Pressburg with Austria (1804) the French took over Dalmatia, Peter allied himself first with the Russians until 1807 and then with the British in 1813 to maintain Montenegrin occupation of the town and Gulf of Kotor. After the French left in 1813, the territory was annexed by Peter (October 1813), and Kotor became his capital for a year. At the Congress of Vienna (1815), however, the land was returned to Austria. In Peter's last years as ruler he was involved in more wars with the Turks (1819 and 1821) and in settling blood feuds among his mountaineers; his efforts further enhanced his reputation as a just prince.

• **Peter II,** Montenegrin in full PETAR PETROVIĆ NJEGOŠ (b. Nov. 13 [Nov. 1, old style], 1813, Njegoš, Montenegro—d. Oct. 31 [Oct. 19, O.S.], 1851, Cetinje), the *vladika* or prince-bishop of Montenegro from 1830 to 1851, renowned as an enlightened ruler, an intrepid warrior, and especially as a poet. His principal works were "The Ray of the Microcosm," "The False Tsar Stephen the Small," and "The Mountain Garland."

On succeeding his uncle Peter I, he took the title of Peter II rather than his own Christian name of Rado. As part of the tradition of theocratic Montenegro, Peter was consecrated bishop in 1833 (the practice was discontinued by his successor). While maintaining his lands in wars against the traditional enemy, the Turks, Peter II conducted reforms that were financed in part by an annual subsidy from Tsar Nicholas I of Russia. Schools were founded, and the first printing press was installed at Cetinje, the capital. Peter strengthened his government by eliminating the office of civil governor, which had been held on a hereditary basis by the Radonić family, and by transferring the power of local chieftains to a senate of 12 leading chiefs, meeting in Cetinje under his supervision.

NAPLES

• **Peter I:** *see* Peter III (Spain: Aragon).

PORTUGAL

• **Peter I,** byname PETER THE JUST, or THE CRUEL, Portuguese PEDRO O JUSTICEIRO, or O CRUEL (b. April 8, 1320, Coimbra, Port.—d. Jan. 18, 1367), king of Portugal from 1357 to 1367.

The son of Afonso IV and his consort Beatriz of Castile, Peter was married in 1336 to Constanza of Castile; but she died in 1345, and Peter is chiefly remembered for his tragic amour with Inês de Castro (*q.v.*), whose death he savagely avenged after his accession to the throne. Even so, some of his acts, designed to curb abuses and to enhance the royal power, were of great importance: he reformed the administration of justice (1361) and did much to make the Portuguese church a national one by insisting on the *beneplácito régio*, that is, the royal approbation of all papal bulls or letters before they could be published in the kingdom.

Although before he became king of Portugal he had advanced a claim to the Castilian throne (1354), he later helped Castile against Aragon (1358 and 1360). From 1363, however, he pursued a neutral policy. On his death he was succeeded by his son Ferdinand I.

Articles are alphabetized word by word, not letter by letter

• **Peter II** (b. April 26, 1648, Lisbon—d. Dec. 9, 1706, Lisbon), king of Portugal whose reign as prince regent (1668–83) and as king (1683–1706) was marked by the consolidation of royal absolutism and the reduction of the significance of the Cortes (National Assembly); at the same time he encouraged economic development and guided his nation through a troubled period in Europe.

After the death of his father, John IV, in 1656, Peter's feebleminded and profligate elder brother Afonso VI brought Portugal to a very low condition. In November 1667 Afonso was sent into confinement in the Azores, and Peter became regent. Shortly thereafter, his brother's marriage (1666) to Marie Françoise Elisabeth of Savoy-Nemours was annulled, and Peter married her. He quickly made peace with Spain (Feb. 13, 1668), forgoing advantages that might have been expected from the Portuguese victories of 1663–65. When Afonso died on Sept. 12, 1683, Peter became king.

In the last years of the 17th century, the goldfields of Brazil provided Peter with great wealth and enabled him to govern without seeking revenue from the Cortes, which was not convoked after 1697. To stimulate Portuguese industry and commerce, Peter concluded the Methuen Treaty (1703) with England, which agreed to reduce customs duties on Portuguese wines in return for favourable treatment of English woollen goods. The treaty largely resulted from Peter's having finally adhered (May 1703) to the Anglo-Austrian side in the War of the Spanish Succession, though at first he had allied himself with France. Peter died in the midst of the war, leaving his throne to John V, his son by his second wife, Maria Sophia of Palatinate-Neuburg, whom he had married in 1687, four years after the death of his first wife.

• **Peter III** (b. July 5, 1717, Lisbon—d. May 25, 1786, Ajuda, Port.), king consort of Portugal from 1777, with Queen Maria I. The younger son of John V of Portugal, he was married in July 1760 to the daughter of his elder brother, King Joseph. When she became queen as Maria I (February 1777), Peter became nominally king. He devoted himself entirely to religious practices.

• **Peter IV:** *see* Pedro I.

• **Peter V** (b. Sept. 16, 1837, Lisbon—d. Nov. 11, 1861, Lisbon), king of Portugal who conscientiously and intelligently devoted himself to the problems of his country during his short reign (1853–61).

Peter succeeded his mother, Maria II, on Nov. 15, 1853; and while his father, Ferdinand II of Saxe-Coburg-Gotha, acted as regent for two years, Peter travelled (1854–55) to the more industrialized European nations.

He wished to convert the Duque de Saldanha's Regeneration movement into a two-party system and inclined toward the liberalism of the Duque de Loulé (his mother's uncle). He carefully studied internal problems, from the railways to military organization, and left the politicians in no doubt as to his views. He personally patronized the foundation of the Curso Superior de Letras, the forerunner of the University of Lisbon. In the spring of 1858 he married Stephanie of Hohenzollern-Sigmaringen and never recovered from her death in the following year.

Epidemics of cholera and yellow fever recurred in Portugal, and he worked assiduously to provide relief. In October 1861 he fell ill with typhoid fever, and he and a younger brother died in November. He was succeeded by his second brother, Louis (Luís).

RUSSIA

• **Peter I,** Russian in full PYOTR ALEKSEYEVICH, byname PETER THE GREAT, Russian PYOTR VELIKY (b. June 9 [May 30, old style], 1672, Moscow—d. Feb. 8 [Jan. 28, O.S.], 1725, St. Petersburg), tsar of Russia, who reigned jointly with his half-brother Ivan V (1682–96) and alone thereafter (1696–1725) and who in 1721 was proclaimed emperor (*imperator*). He was one of the most outstanding rulers and reformers in Russian history.

A brief account of the life and works of Peter I follows; for a full biography, *see* MACROPAEDIA: Peter the Great.

Peter—the son of Tsar Alexis by his second wife, Natalia Kirillovna Naryshkina, who had been reared in an atmosphere open to progressive influences from the West—was a healthy, lively, and inquisitive child. He loved military games and enjoyed carpentry, joinery, blacksmithing, and printing. At the age of 17 a marriage was arranged with the beautiful Eudoxia but within a decade she was relegated to a convent. After becoming sole ruler in 1696, Peter's most far-reaching accomplishment was to draw Russia further into the European sphere. After touring western Europe himself (1697–98), he transferred the capital to St. Petersburg on the Baltic coast, introduced Western technology, and completely overhauled the Russian government and military system, further increasing the power of the monarchy at the expense of the nobles and the Orthodox Church.

Peter pursued foreign policies aimed at giving Russia access to the Baltic and Black Seas, engaging in a war with Ottoman Turkey (1695–96) and in the Great Northern War with Sweden (1700–21). His campaign against Persia in 1722–23 secured the southern and western shores of the Caspian Sea for Russia. At his death, Russia was a far more secure and advanced nation than it had been before his reign.

• **Peter II,** Russian in full PYOTR ALEKSEYEVICH (b. Oct. 23 [Oct. 12, old style], 1715, St. Petersburg—d. Jan. 29 [Jan. 18, O.S.], 1730, Moscow), emperor of Russia from 1727 to 1730. Grandson of Peter I the Great (ruled 1682–1725), Peter II was named heir to the Russian throne by Catherine I (ruled 1725–27) and was crowned at the age of 11 (May 18 [May 7, O.S.], 1727).

Because Catherine had named the Supreme Privy Council to act as regent for the youth, Aleksandr D. Menshikov, who had been a close adviser to both Peter I and Catherine I and had become the most prominent member of the council, dominated the first months of Peter's reign. Menshikov installed the young emperor in his own household and arranged for his daughter and Peter to become betrothed. Peter, however, did not welcome the domineering kindness of his guardian and turned to the Dolgorukys, an old aristocratic family. In September 1727 the Dolgoruky family arrested Menshikov, exiled him to Siberia, and replaced him as the dominant political figures in Russia. They subsequently moved Peter's capital from St. Petersburg (now Leningrad) to Moscow (1728) and prepared for Peter's marriage to Princess Yekaterina Alekseyevna Dolgorukaya (1729). On the day set for the wedding, however, Peter II died of smallpox.

• **Peter III,** Russian in full PYOTR FYODOROVICH, original name KARL PETER ULRICH, HERZOG (duke) VON HOLSTEIN-GOTTORP (b. Feb. 21 [Feb. 10, old style], 1728, Kiel, Holstein-Gottorp—d. July 18 [July 7, O.S.], 1762, Ropsha, near St. Petersburg), emperor of Russia from Jan. 5, 1762 (Dec. 25, 1761, O.S.), to July 9 (June 28, O.S.), 1762.

Son of Anna, one of Peter I the Great's daughters, and Charles Frederick, duke of Holstein-Gottorp, the young duke was brought to Russia by his aunt Elizabeth shortly after she became empress of Russia (Dec. 5–6, 1741). Renamed Peter (Pyotr Fyodorovich), he was received into the Russian Orthodox Church (Nov. 18 [Nov. 7, O.S.], 1742) and proclaimed the heir to the Russian throne. On Aug. 21, 1745, he married Sophie Frederike Auguste, a princess from Anhalt-Zerbst, in Germany, who took the name Catherine (Yekaterina Alekseyevna).

Peter, who was mentally feeble and extremely pro-Prussian, not only alienated the affections of his wife soon after their marriage but also failed to gain the favour of politically powerful court cliques. His popularity diminished further after he succeeded Elizabeth and, reversing her foreign policy, made peace with Prussia and withdrew from the Seven Years' War (1756–63), formed an alliance with Prussia, and prepared to engage Russia in a war against Denmark to help his native Holstein gain control of Schleswig. Even when he relieved the gentry of their obligation to serve the state (March 1, 1762), he did not gain supporters. When he offended the Russian Orthodox Church by trying to force it to adopt Lutheran religious practices and also alienated the imperial guards by making their service requirements more severe and threatening to disband them, Catherine, who suspected that he was planning to divorce her, conspired with her lover Grigory Grigoryevich Orlov and other members of the guard to overthrow him.

Peter III, detail of an engraving by Johann Stenglin after a painting by G.C. Grooth; in the collection of Mrs. Merriweather Post, Hillwood, Washington, D.C.

By courtesy of Hillwood; Washington, D.C.

On July 9 (June 28, O.S.), 1762, Catherine, with the approval of the guard, the senate, and the church, became Catherine II, empress of Russia. Peter, who was at his residence at Oranienbaum, near St. Petersburg, formally abdicated on July 10 (June 29, O.S.); he was arrested and taken to the village of Ropsha, where, while in the custody of one of the conspirators, Aleksey Grigoryevich Orlov, he was killed.

Serbia

• *see* Peter I (Yugoslavia).

Sicily

• **Peter I:** *see* Peter III (Spain: Aragon).

Spain: Aragon

• **Peter I** (b. *c.* 1068–74—d. Sept. 28, 1104), king of Aragon from June 1094. The son of Sancho Ramírez, the third in order of the historic kings of Aragon, Peter belonged to times anterior to the authentic written history of his kingdom; and little is known of him save that he conquered Huesca (1096) and Barbastro (1100) from the Moors of Saragossa. He was twice married but left no children and was succeeded by his brother Alfonso I.

• **Peter II,** byname PETER THE CATHOLIC, Spanish PEDRO EL CATÓLICO (b. 1174—d. Sept. 12, 1213, Muret, Fr.), king of Aragon from 1196 to 1213, the eldest son and successor of Alfonso II.

Peter married (1204) Mary, lady of Montpellier, and thus greatly extended Aragonese power in southern France. Despite the violent objections of his subjects, he had himself crowned by Pope Innocent III in Rome and declared his kingdom a feudatory of the Holy See (1204). Peter, with other Spanish kings, took a prominent part in the victory over the Moors at Las Navas de Tolosa (July 16, 1212); but he then went to support his brother-in-law Raymond VI of Toulouse against the crusader Simon de Montfort in Languedoc. There he was killed in the Battle of Muret. His son James I succeeded him.

• **Peter III,** byname PETER THE GREAT, Spanish PEDRO EL GRANDE (b. 1239—d. Nov. 11, 1285, Villafranca del Panades, Catalonia), king of Aragon from July 1276, on the death of his father, James I, and king of Sicily (as Peter I) from 1282.

In 1262 he had married Constance, heiress of Manfred, the Hohenstaufen king of Sicily; and after the revolt of the Sicilians in 1282 he invaded the island and was proclaimed king at Palermo, despite strong Guelph and papal opposition (*see* Sicilian Vespers). His Sicilian enterprise was unpopular in Aragon, where an association of nobles and some municipalities, the Unión Aragonesa, forced him to grant a privilege not only confirming the Aragonese *fueros* (legal rights) but diminishing some of the crown's rights. In 1285 Philip III of France invaded Aragon to dethrone Peter but was disastrously defeated. Peter, however, soon died. His great stature and physical strength were famous. Among his children were Alfonso III of Aragon, James I of Sicily (II of Aragon), and Frederick III of Sicily.

• **Peter IV,** byname PETER THE CEREMONIOUS, or THE CRUEL, Spanish PEDRO EL CEREMONIOSO, or EL CRUEL, or EL DEL PUÑAL (He of the Dagger) (b. Sept. 5, 1319, or Sept. 15, 1317, Balaguer, Catalonia—d. Jan. 5, 1387, Barcelona), king of Aragon from January 1336, son of Alfonso IV.

Peter was the most cultivated of Spanish 14th-century kings but was also an inveterate political intriguer whose ability to dissemble was notorious. Through his voluminous correspondence, the workings of his mind are far better known than those of any contemporary Spanish ruler. Having picked a quarrel with James III of Majorca, he reincorporated the possessions of the Majorcan crown, namely the Balearic Islands and Roussillon, by force into his own dominions (1343–44). He next crushed the long-standing pretensions of the Aragonese nobles by defeating the armies of the Unión Aragonesa at Epila (1348), thereafter displaying the extreme vindictiveness that he always showed when his authority was challenged. Peter had to contend with revolt in Sardinia throughout his reign; but he succeeded, by political and military means, in preparing the future reunion of Sicily to the Aragonese crown and was recognized by the Catalan Almogávares as duke of Athens and Neopatras in 1380.

The chief event of his reign, however, was the intermittent war (1356–66) against King Peter of Castile. Urged on by France and by his own ambitions, Peter IV underwrote Henry of Trastámara's claims to the Castilian throne in exchange for a promised cession of one-sixth of Castile. The war was disastrous to Aragon, which was saved only by the intervention of the mercenary companies brought from France by Bertrand du Guesclin. Although the mercenaries succeeded in briefly installing Henry of Trastámara on the Castilian throne, Henry failed to honour any of his promises to Peter, and after 1369 Charles V of France took no trouble to conceal that he preferred his alliance with Castile to that with Aragon. As a result, Peter now pursued a complicatedly neutral approach to the Hundred Years' War, with some bias in favour of the English. His last years were clouded by a quarrel with his heir, the future John I, who let himself become the tool of French intrigues against Aragonese neutrality.

Spain: Castile

• **Peter,** byname PETER THE CRUEL, or THE JUST, Spanish PEDRO EL CRUEL, or EL JUSTICIERO (b. Aug. 30, 1334, Burgos, Castile—d. March 23, 1369, Montiel, Fr.), celebrated king of Castile and Leon from 1350 to 1369, charged by his contemporary enemies with monstrous cruelty but viewed by later writers as a strong executor of justice.

He succeeded his father, Alfonso XI, at the age of 15, and John II of France saw the chance to force Castile into a military alliance against England. The alliance was concluded (1352), and Peter was forced to marry (1353) Blanche, daughter of Pierre, duc de Bourbon, though he was already passionately in love with the beautiful María de Padilla—who was to remain his mistress, and perhaps his legal wife, until her death (1361). He abandoned Blanche immediately after the marriage. This act ruptured the Franco-Castilian alliance.

At home Peter was at once confronted by a row of bastard half brothers, led by Henry of Trastámara (later Henry II), who, to win support for his undefined ambitions, proclaimed himself defender of the magnates' privileges against the growing power of the crown. After leading several revolts which Peter crushed with energy, Henry, who failed to win any popular sympathy, escaped to France (1356) and offered to serve the French crown against his brother. From 1356 to 1366 Peter was engaged in a bitter war with Aragon, whose king, Peter IV, supported Henry's cause. During the war Peter won many successes against Aragon while Trastamaran propaganda failed to undermine Castilian loyalty toward him. In 1365, therefore, the French king Charles V, Pope Urban V, and Peter IV—to save Aragon from being overrun—paid veteran French mercenaries, led by Bertrand du Guesclin, to go to Spain and overthrow Peter, replacing him by Henry. Peter fled to Gascony and requested English help under the Anglo-Castilian alliance, concluded on June 22, 1362. The Trastamarans and their French allies were routed at Nájera (April 3, 1367) by Edward the Black Prince, and Peter resumed his reign.

Charles V sent Henry back to Spain with more French troops and a long civil war ensued. Eventually Peter was defeated at Montiel and assassinated there by his brother's own hand.

Yugoslavia

• **Peter I** (b. July 11 [June 29, old style], 1844, Belgrade—d. Aug. 16, 1921, Topčider, near Belgrade), king of Serbia from 1903, the first strictly constitutional monarch of his country. In 1918 he became the first king of the Kingdom of Serbs, Croats, and Slovenes (later called Yugoslavia).

Born the third son of the reigning prince Alexander Karageorgević (1842–58), Peter became heir to the throne on the death of his brother Svetozar (1847). After his father was forced to abdicate (1858), Peter lived in exile for the next 45 years. Educated in France, mainly at military schools, such as the prestigious Saint-Cyr, he served as a lieutenant in the French Army during the Franco-German War and was decorated with the Cross of the Legion of Honour for heroism. When the Serbs of Hercegovina revolted against the Turks in 1875, Peter organized a party of volunteers to assist them. Afterward he became an honorary senator in Montenegro (1883) and improved his dynastic ties by marrying Zorka, the first child of Prince Nicholas of Montenegro (1883).

In 1903 the Serbian king Alexander Obrenović (1889–1903) was assassinated, ending the Obrenović dynasty, and Peter was elected king of Serbia. His reputation as a liberal (he translated John Stuart Mill's essay *On Liberty* into Serbian in 1868) and his strong advocacy of constitutional government helped improve the political situation at home and win recognition abroad. Incapacitated by age and poor health, Peter named his heir, Prince Alexander, to be regent on June 24, 1914. During World War I, after the defeat of Serbia by the Central Powers (Germany and Austria) in 1915, he took part in the retreat to the Adriatic, being carried in a litter. At the end of World War I he returned to Belgrade, where he was proclaimed king of the Serbs, Croats, and Slovenes (Dec. 1, 1918).

• **Peter II,** Serbo-Croatian in full PETAR KARAĐORĐEVIĆ (b. Sept. 6, 1923, Belgrade—d. Nov. 3, 1970, Los Angeles), the last king of Yugoslavia.

The son of Alexander I, who was assassinated during a visit to France on Oct. 9, 1934, Peter became titular king at 11, but the actual rule was in the hands of a regent, his uncle Prince Paul. After Paul was deposed by a coup of officers led by Gen. Dušan Simović on March 27, 1941, Peter ruled for a few weeks until Axis troops invaded. He then fled into exile in London, where he led an émigré government. In 1944 he married Princess Alexandra of Greece, and, after the Yugoslav monarchy was abolished by Tito in 1945, he settled in the U.S. He wrote *A King's Heritage* (1955) and worked in public relations in New York.

Peter (b. Volhynia Grand Duchy of Lithuania—d. 1326, Moscow), Russian Orthodox metropolitan of Kiev and Moscow (1308–26) and the first metropolitan to reside in Moscow.

Until Peter's tenure as metropolitan, the centre of the Russian Orthodox Church had for many years been in Kiev, the ancient capital of Rus, with a brief interlude in Vladimir. When Peter became metropolitan, he, like his predecessors, lived in no fixed place but rather travelled throughout Russia to promote unity among rival principalities.

His allegiance leaned toward Moscow and its prince, Ivan, whom he believed capable of liberating Russia from Mongol oppression. Ivan began to turn his obscure principality into a religious centre by building a cathedral to the archangel Michael and, following Peter's suggestion, a cathedral dedicated to the Assumption. Under Ivan's and Peter's influence, Moscow became the religious capital of Russia; and its position as the permanent home of the metropolitan was strengthened by Peter's direction that he be buried in the Cathedral of the Assumption there.

Peter CHRYSOLOGUS, SAINT (b. *c.* 400/406, Imola, near Ravenna—d. *c.* 450, Imola; feast day July 30), archbishop of Ravenna, whose orthodox discourses earned him the status of doctor of the church. The title Chrysologus (Golden Orator) was added to his name at a later date, probably to create a Western counterpart to the Eastern patriarch St. John Chrysostom.

About 433 he became archbishop of Ravenna, where, with the aid of Galla Placidia, the mother of the Roman emperor Valentinian III, he promoted the construction of church buildings. He was a close friend of Pope St. Leo I the Great and was highly respected by the Western and Eastern churches for his orthodoxy. In 448 when the Eastern monk Eutyches was condemned for founding Eutychianism, an extreme form of Monophysitism teaching that Christ's nature was only human and not also divine, he appealed to Peter, whose reply withheld judgment but instructed Eutyches to be obedient to Leo.

Many of Peter's homilies survive, including the letter to Eutyches. In the standard collection of 176 sermons made in the 8th century, however, several are not authentic. His short sermons stress the fundamental Christian doctrines and the duties of Christian life in keeping with the needs and ideals of the times. Peter was declared a doctor of the church by Pope Benedict XIII in 1729. G. Gann's *Saint Peter Chrysologus: Selected Sermons* appeared in 1953.

Peter CLAVER, SAINT, Spanish SAN PEDRO CLAVER (b. 1581, Verdu, Spain—d. Sept. 4, 1654, Cartagena, Colom.; canonized 1888; feast day September 9), Jesuit missionary to South America who, in dedicating his life to the aid of Negro slaves, earned the title of apostle of the Negroes.

Peter entered the Society of Jesus in 1602 and eight years later was sent to Cartagena, where he was ordained in 1616. The miserable condition of the slaves aboard ship and in the pens of Cartagena, South America's chief slave market, caused Peter to declare himself "the slave of the Negroes forever." Accompanied by interpreters and carrying food and medicines, he boarded every incoming slave ship and visited the pens, where he nursed the sick and taught religion. Despite strong official opposition, Peter persevered for 38 years, baptizing an estimated 300,000 slaves. He was canonized by Pope Leo XIII, who in 1896 proclaimed him patron of all Roman Catholic missions to Negroes. Arnold Lunn's *Saint in the Slave Trade* appeared in 1935.

Peter DES RIVAUX (b. *c.* 1190, Poitou, Fr.—d. 1262), one of the Poitevin administrators who dominated the government of young King Henry III of England from 1232 to 1234; Peter failed in his efforts to create an all-powerful central administration.

His father (or uncle), Peter des Roches (bishop of Winchester, 1205–38), became tutor to Henry upon the King's accession. Peter des Rivaux served as a king's clerk from 1218 to 1223 but was exiled from England when Henry threw off Peter des Roches's tutelage in 1227. Returning to England under Henry's protection in 1230, Peter des Rivaux was appointed treasurer of the household in June 1232.

After Henry stripped the powerful Hubert de Burgh, the last of the great justiciars, of his authority (July–November 1232), Peter des Rivaux took over the machinery of government. He immediately initiated a drastic overhaul of the financial and administrative system. These innovations, if fully executed, would have made Henry the richest and most powerful monarch in Europe, but the English barons, led by Edmund Rich, archbishop of Canterbury, forced Henry to dismiss Peter des Rivaux and the other Poitevins in 1234. Peter served as baron of the exchequer again in 1253 and keeper of the wardrobe in 1257–58, but he never regained his former power.

Peter DES ROCHES (d. June 1238, Farnham, Hampshire, Eng.), Poitevin diplomat, soldier, and administrator, one of the ablest statesmen of his time, who enjoyed a brilliant but checkered career, largely in England in the service of kings John and Henry III.

As bishop of Winchester from 1205 to 1238, he organized and added to the financial resources of his see. He held ecclesiastical appointments in Touraine and Poitou and afterward went to England, where King John influenced his election to the see of Winchester. He remained in England and retained his see throughout the interdict (1208–13), filling several administrative and military roles. He became chief justiciar in 1214 but was unpopular and was replaced in June 1215. He supported John loyally during the war with the barons and was one of his executors. Peter crowned Henry III and was his tutor until 1227. As the most influential Poitevin in the country, he headed that group of alien officials and soldiers who suffered political defeat at the hands of the justiciar, Hubert de Burgh, in 1223–24. He accompanied the emperor Frederick II's crusade (1228–29) and reached Jerusalem. In 1230 he helped to reconcile Frederick with the Pope and in 1231 negotiated a truce between Henry III and the French. On his return to England in 1231, he influenced Henry III to promote his son (or nephew) Peter des Rivaux to numerous posts and brought about Hubert's fall in 1232. The administrative methods he advocated, however, led to baronial opposition in 1233, and in 1234 Henry III dismissed Peter des Roches from favour and Peter des Rivaux from office.

Peter LOMBARD, French PIERRE LOMBARD, Latin PETRUS LOMBARDUS (b. *c.* 1100, Novara, Lombardy—d. Aug. 21/22, 1160, Paris), bishop of Paris whose *Four Books of Sentences* (*Sententiarum libri IV*) was the standard theological text of the Middle Ages.

After early schooling at Bologna, he went to France to study at Reims and then at Paris. From 1136 to 1150 he taught theology in the school of Notre Dame, Paris, where in 1144–45 he became a canon—*i.e.,* staff clergyman. Lombard was present at the Council of Reims (1148) that assembled to examine the writings of the French theologian Gilbert de La Porrée. In June 1159 he was consecrated bishop of Paris and died the following year.

Although he wrote sermons, letters, and commentaries on Holy Scripture, Lombard's *Four Books of Sentences* (1148–51) established his reputation and subsequent fame, earning him the title of *magister sententiarum* ("master of the sentences"). The *Sentences,* a collection of teachings of the Church Fathers and opinions of medieval masters arranged as a systematic treatise, marked the culmination of a long tradition of theological pedagogy, and until the 16th century it was the official textbook in the universities. Hundreds of scholars wrote commentaries on it, including the celebrated philosopher St. Thomas Aquinas.

Book I of the *Sentences* discusses God, the Trinity, divine guidance, evil, predestination; Book II, angels, demons, the Fall of man, grace, sin; Book III, the Incarnation of Jesus Christ, the redemption of sins, virtues, the Ten Commandments; Book IV, the sacraments and the four last things—death, judgment, hell, and heaven. While Lombard showed originality in choosing and arranging his texts, in utilizing different currents of thought, and in avoiding extremes, of special importance to medieval theologians was his clarification of the theology of the sacraments. He asserted that there are seven sacraments and that a sacrament is not merely a "visible sign of invisible grace" (after Augustine of Hippo) but also the "cause of the grace it signifies." In ethical matters, he decreed that a man's actions are judged good or bad according to their cause and intention, except those acts that are evil by nature.

Lombard's teachings were opposed during his lifetime and after his death. Later theologians rejected a number of his views, but he was never regarded as unorthodox, and efforts to have his works condemned were unsuccessful. The fourth Lateran Council (1215) approved his teaching on the Trinity and prefaced a profession of faith with the words, "We believe with Peter Lombard . . . ." His collected works are in J.-P. Migne, *Patrologia Latina,* vol. 191–192. The best edition of the *Four Books of Sentences* (no English translation) is considered to be that of the Franciscans of the College of St. Bonaventura (near Florence), *Libri quattuor sententiarum* (2 vol., 1916). E.F. Rogers' *Peter Lombard and the Sacramental System* appeared in 1917.

Peter MARTYR, name commonly used in English for (1) St. Peter Martyr, who was killed in 1252 by the Cathari, a heretical Christian sect; (2) Peter Martyr d'Anghiera, who was an Italian historian; and (3) Peter Martyr Vermigli, who was one of the greatest Italian Reformers and a leading exponent of the Reformed doctrine of the sacraments.

Peter MARTYR D'ANGHIERA, Italian PIETRO MARTIRE D'ANGHIERA, Spanish PEDRO MÁRTIR DE ANGHIERA (b. Feb. 2, 1457, Arona, Milan—d. October 1526, Granada, Spain), chaplain to the court of King Ferdinand II of Aragon and Queen Isabella I of Castile, and historian of Spanish explorations, who became a member of Emperor Charles V's Council of the Indies (1518). He collected unidentified documents from the various discoverers, including Christopher Columbus, and wrote *De Orbe Novo* (published 1530; "On the New World"), in which the first European reference to India rubber appears in the description of an Aztec game. His collection of 812 letters is valuable source material for the period.

Peter MARTYR, SAINT, also called PETER OF VERONA, Italian SAN PIETRO MARTIRE or SAN PIETRO DA VERONA (b. 1205?, Verona—d. April 6, 1252, near Milan; canonized 1253; feast day April 29), inquisitor, vigorous preacher, and religious founder who, for his militant reformation, was assassinated by the neo-Manichaean sect, the Cathari (heretical Christians who held unorthodox views on the nature of good and evil).

Peter's parents were members of the Cathari, and there was some family opposition to Peter's studying at the University of Bologna. There he befriended Dominic (Domingo de Guzmán), whose religious order, the Order of Friars Preachers, he entered about 1221.

Peter gained his initial reputation as preacher in Lombardy, where eventually he was forbidden to preach because of spurious moral charges made against him. After receiving what he regarded as divine inspiration, he resumed his evangelization with such fervour that Pope Gregory IX appointed him general inquisitor about 1232. In this capacity he preached against the Cathari throughout northern and central Italy, and his success provoked powerful enemies among them

According to a 14th-century work ascribed to Peter of Todi, who was prior general of the Servite order from 1314 to 1344, Peter Martyr helped the Seven Holy Founders to establish the Servites in Florence during the 1240s. Peter himself influenced and founded various confraternities to combat heresies. He served as prior of the Italian Dominican centres of Asti in 1240, of Piacenza in 1241, and of Como in 1251, the year that Pope Innocent IV named him papal inquisitor.

While returning to Milan from a preaching mission at Como, Peter and his companion, the friar Dominic, were attacked by Cathari, who bludgeoned Peter with an ax. According to pious tradition, he wrote on the ground *Credo in Deum* ("I believe in God") with his own blood before being fatally stabbed in the heart. Dominic died a few days later. Peter was buried in the church of Sant' Eustorgio, Milan. He was subsequently named patron of inquisitors. In 1952 appeared two biographies (in Italian), by R. Francisco and by G. Ederle.

Peter MARTYR VERMIGLI: *see* Vermigli, Peter Martyr.

Peter MAUCLERC: *see* Peter I *under* Peter (Brittany).

Peter NOLASCO, SAINT, French SAINT PIERRE NOLASQUE (b. *c.* 1182, probably Barcelona—d. Dec. 25?, 1249/56, Barcelona; canonized 1628; feast day January 28), founder of the order of Our Lady of Ransom (Mercedarians, or Nolascans), a religious institute originally designed to ransom Christian captives from the Moors; today, the Mercedarians, whose numbers have declined, are engaged mostly in hospital work.

Peter dedicated himself to helping the poor. In Spain, where the Moors held many Christian slaves gained from struggles between the Moorish and the Christian kingdoms there, he ransomed them with funds from his inheritance and from contributions. Between 1218 and 1234, he founded his order at Barcelona. Peter is said to have gone twice to Africa to redeem Christian slaves there. He resigned his offices of master general and ransomer some years before his death.

When his cause for canonization was being considered in Rome, there was presented a notarial act, the *documento de los sellos* ("document of the seals"), declaring that the Blessed Virgin Mary came to Peter and instructed him to found his order. The *documento* has since been proved to be a forgery. P.N. Pérez' *San Pedro Nolasco, fundador de la orden de la Merced* appeared in 1915.

Peter OF ALCÁNTARA, SAINT, Spanish SAN PEDRO DE ALCÁNTARA, original name PEDRO GARAVITO (b. 1499, Alcántara, Spain—d. Oct. 18, 1562, Arenas; canonized 1669; feast day October 18), Franciscan mystic who founded an austere form of Franciscan life known as the Alcantarines or Discalced (*i.e.*, barefooted) Friars Minor. He is the patron saint of Brazil.

Of noble birth, he entered the Franciscan Order at Alcántara in 1515 and was ordained priest in 1524. As a friar, Peter emphasized the penitential aspects of the life of St. Francis of Assisi, founder of the Franciscans. He then wrote special instructions for his disciples and in Spain and Portugal founded convents that were unique for their isolation and discomfort. From his first friary at El Pedroso, Spain, his friars spread to Italy, Germany, and France.

Peter had spirited correspondence with SS. Francis Borgia, Louis of Granada, and especially with the mystical writer Teresa of Avila, whom he aided in her reform of the Carmelite nuns and whose autobiography is one of the best sources on his life. Peter's *Tratado de la oración y meditación* (*Treatise on Prayer and Meditation*) has been translated into numerous languages (Eng. trans., 1926).

Peter OF CANDIA: *see* Alexander (V) *under* Alexander (Papacy).

Peter OF CASTELNAU, French PIERRE DE CASTELNAU (b. Château-Neuf, Montpellier, Fr.—d. Jan. 14, 1208, near Saint-Gilles, Fr.), Cistercian martyr, apostolic legate, and inquisitor against the Albigenses, most particularly the Cathari (heretical Christians who held unorthodox views on the nature of good and evil), whose assassination led to the Albigensian Crusade.

Peter became an archdeacon in 1199 and in 1202 joined the Cistercian order. In 1207 Pope Innocent III appointed Peter as apostolic legate and inquisitor to lead an expedition against the Albigenses and particularly to obtain the recantation of Count Raymond VI (*q.v.*) of Toulouse, who was allowing the heresy to spread throughout his domain. Having urged him from 1205 to stamp out the heretics, Peter now excommunicated Raymond, placing the Languedoc region under interdict, which aroused grave opposition. Peter's campaign on behalf of Innocent ended in disaster. He was assassinated, supposedly at Raymond's instigation, and in response to this act Innocent launched the Albigensian Crusade, a holy war in which Toulouse was ravaged and its inhabitants, Cathar and non-Cathar alike, were massacred. Peter's relics were enshrined in the church of Saint-Gilles. He is venerated as a martyr in the dioceses of the Midi, in France.

Peter OF COURTENAY: *see* Peter *under* Peter (Constantinople).

Peter OF DREUX: *see* Peter I *under* Peter (Brittany).

Peter OF MONTBOISSIER, BLESSED: *see* Peter the Venerable.

Peter OF VERONA, SAINT: *see* Peter Martyr, Saint.

Peter THE APOSTLE, SAINT, original name SIMEON, or SIMŌN (d. *c.* AD 64, Rome), disciple of Jesus Christ, recognized in the early Christian Church as the leader of the disciples and by the Roman Catholic Church as the first of its unbroken succession of popes. Peter, a fisherman, was called to be a disciple of Jesus at the beginning of his ministery. He received from Jesus the name Cephas (*i.e.*, Rock, hence Peter, from the Latin *petra*).

St. Peter, detail of a tempera painting on wood by Nardo di Cione, second half of the 14th century; in the Yale University Art Gallery

By courtesy of the Yale University Art Gallery, James Jackson Jarves Collection

The man and his position among the disciples. The sources of information concerning the life of Peter are limited to the New Testament: the four Gospels, Acts, the letters of Paul, and the two letters that bear the name of Peter. He probably was known originally by the Hebrew name Simeon or the Greek form of that name, Simōn. The former appears only twice in the New Testament; the latter, 49 times. At solemn moments (Gospel According to John 21:15) he was called "Simon, son of John." The Gospel According to John prefers Simon (17 times) or the compound, rarely found elsewhere, of Simon Peter. Though Paul has a distinct preference (8 times out of 10) for the Greek transliteration Kēphas (Latinized as Cephas) of the Aramaic name or title Kepha, meaning "rock," the Gospels and Acts use the Greek translation Petros approximately 150 times. From the Synoptic Gospels (Gospel According to Matthew 8:14) and Paul (First Letter of Paul to the Corinthians 9:5), there is indirect evidence that Peter was the son of John and was married. His family originally came from Bethsaida (John 1:44), but during the period of Jesus' ministry he lived in Capernaum, at the northwest end of the Sea of Galilee, where he and his brother Andrew were in partnership as fishermen with James and John, the sons of Zebedee (Gospel According to Luke 5:10).

Much can be learned about Peter from the New Testament—either explicitly from the statements made by and about Peter or indirectly from his actions and reactions as revealed in a number of episodes in which he figures prominently. He was at times vacillating and unsure, as in his relations with the church of Antioch when he at first ate with the Gentiles and later refused to do so (Letter of Paul to the Galatians 2:11–14); he could also be resolute (Acts of the Apostles 4:10; 5:1–10). Occasionally he is depicted as rash and hasty (Luke 22:33, etc.) or irritable and capable of great anger (John 18:10). Often he is pictured as gentle but firm and, as in his professions of love to Jesus, capable of great loyalty and love (John 21:15–17).

The New Testament reports that Peter was unlearned in the sense that he was untrained in the Mosaic Law (Acts 4:13), and it is doubtful that he knew Greek. He apparently learned slowly and erred time and time again, but later, when entrusted with responsibility, he demonstrated that he was mature and capable.

The Gospels agree that Peter was called to be a disciple of Jesus at the beginning of his ministry, but when and where the event took place is recorded differently in the several Gospels. Luke (5:1–11) scarcely mentions James and John and omits Andrew while emphasizing the call of Peter. Matthew (4:18–22) and Mark (Gospel According to Mark 1:16–20) note the call of the four men and—with Luke—agree that the event took place at the Sea of Galilee. The Gospel According to John places the call in Judaea (1:28) and states that Andrew—who had been a follower of John the Baptist (1:35) and had heard John indicate that Jesus was the Lamb of God—left John and introduced Peter to "the Messiah," who at that time gave him the name (or title) Cephas (*i.e.*, Peter, or Rock).

The Synoptic Gospels (Matthew, Mark, and Luke) are probably correct in recording that the call to Peter was extended in Galilee when Jesus first began his work in that area. The Gospel According to John is here, as elsewhere, perhaps more theologically than historically motivated; the author of John wishes to stress that Peter recognized Jesus' Messiahship from the beginning and that Jesus had seen Simon as the rock from their first meeting.

The Synoptic Gospels largely agree in the amount of emphasis each gives to the leadership of Peter among the Twelve Apostles, but there are differences also. For example, in one case Matthew and Luke note that Peter was the speaker in questioning Jesus about a parable, but Mark has attributed these words to the group of disciples (see Matt. 15:15; Luke 8:45; and Mark 7:17). With differing degrees of emphasis, the Synoptic Gospels agree that Peter served as spokesman, the outstanding member of the group, and enjoyed a certain precedence over the other disciples. Whenever the disciples are listed, Peter is invariably mentioned first (Matt. 10:2–4; Mark 3:16–19; Luke 6:14–16; Acts 1:13; *cf.* only Gal. 2:9). Although it is not certain whether or not this priority is due primarily to reading back into the Gospel narrative Peter's importance in the apostolic church, his forceful personality was surely a factor.

Those not belonging to the immediate followers of Jesus also recognized the authority of Peter, such as when the collectors of the temple tax approached him for information (Matt. 17:24). Again, with characteristic quickness he sought a clarification from Jesus on behalf of the disciples concerning the meaning of a parable (Matt. 15:15) or of a saying (Matt. 18:21). As both an individual and representative of the Twelve Apostles, he made a plea for personal preference in the Kingdom of Heaven as a reward for faithful service (Matt. 19:27, 28).

On several occasions Peter alone is mentioned by name, and others are indicated as merely accompanying him (Mark 1:36; Luke 8:45). Even when the three disciples closest to Jesus (the "pillars"—Peter, James, and John) figure in a particular incident, it is frequently Peter alone who is named. When the three are named, Peter's name invariably appears first (as in Matt. 17:1, 26:37). It was his home in Capernaum that Jesus visited, when he cured Peter's mother-in-law (Matt. 8:14); it was Peter's boat that Jesus used when he instructed the crowd (Luke 5:3). It was Peter who possessed remarkable insight and displayed his depth of faith in the confession of Christ as the Son of God (Matt. 16:15–18; Mark 8:29; Luke 9:20); and it was Peter who rebuked and in turn was rebuked by Jesus when the Master prophesied that he would suffer and die (Mark 8:32, 33). It was also Peter who manifested the momentary weakness of even the strongest in the denial of his Lord (Matt. 26:69–75; Mark 14:66–72; Luke 22:54–61). Later, however, with greater maturity, he discovered strength and, as he was charged by Jesus (Luke 22:31, 32), effected the strengthening of others. Finally, Peter, who survived his denial, was permitted to be the first witness of the Resurrection (Luke 24:34).

In the Fourth Gospel, the prominence of Peter is challenged in the person of John, the "Beloved Disciple." Though Peter receives mention in John 37 times (out of a total of 109 times in the four Gospels), one-third of the references are found in the appendix (chapter 21), and he appears in only 9 incidents. The Gospel According to John attempts to show the close relationship between John and Jesus while still reserving to Peter the role of representative and spokesman. The fact that Peter is emphasized in John and charged by Jesus to "tend my sheep" and "feed my lambs" (John 21:15,16) at the same time that the role of the disciples as a whole is being deemphasized attests to the prestige of Peter in the apostolic church. But throughout the Fourth Gospel Peter shares his prominence with John (13:24; 18:15; 19:26, 27, etc.). Among the purposes of chapter 21 in emphasizing Peter may well be an attempt to restore the disciple who denied his Lord to the position he enjoyed in the Synoptic Gospels.

Incidents important in interpretations of Peter. Out of the many incidents in which Peter figures prominently in the Gospels, three should be separately considered; for each is important, contains problems of interpretation, and is controversial.

In Mark (8:29) and Luke (9:20), to a question of Jesus concerning his essential identity, about which he pressed the disciples for an opinion, Peter answered for them all that Jesus is the "Messiah" or "God's Messiah." In adjuring them to be silent, Jesus rejected the response as perhaps too partial, too political. In the Matthean version (16:13), expanding upon the narrative in Mark, Peter answered for himself and presumably for the other disciples, "You are the Christ, the Son of the living God." A new dimension of understanding was thus reached, and this heightened awareness of Jesus' divinity was approved by Jesus and occasioned Peter's "ordination."

In what may be a grouping of Petrine material (Matt. 16:18, 19)—the confession, naming, and receiving of authority—Jesus gave to Simon the title of Cephas, or Peter (Rock). Though in the past some authorities have considered that the term rock refers to Jesus himself or to Peter's faith, the consensus of the great majority of scholars today is that the most obvious and traditional understanding should be construed, namely, that rock refers to the person of Peter. In John the title was granted at what may have been their first meeting (1:42). Thus *when* the name was given is open to question, but *that* the name was given by Jesus to Peter seems fairly certain. Matthew continues that upon this rock—that is, upon Peter—the church will be built. The word church in the 1st-century Gospel According to Matthew is to be understood as referring to the community of the faithful rather than to a definite ecclesiastical organization.

The authenticity of the uniquely Matthean material (Matt. 16:16–19) of this narrative has been and is widely discussed and has been challenged on the bases (1) that verses 16–19 are found only in Matthew, or (2) that the inclusion of the word church suggests a level of organization acquired only at a later period. Though these and other arguments against authenticity are given most careful consideration, the general consensus is that at some time—and more likely at the end of his career—these words were spoken by Jesus.

If Peter's confession demonstrates his faith and insight, his denial that he knew Jesus demonstrates a weakness of will (even if momentary), capability of inaction, and a tendency toward vacillation, but not a loss of faith. Prior to the denial, out of his deep love for Jesus and his overestimation of his own capabilities, he had sought to overrule Jesus' prophecy of his denial and declared that, even if the other disciples deserted Jesus, he would suffer death rather than disown his Lord (Matt. 26:33–35; Mark 14:29–31; Luke 22:31–34; John 13:37–38). As the drama unfolded, Peter fled when Jesus was arrested but did find his way to the palace of the high priest where Jesus had been taken. When confronted in the courtyard with the danger of admitting association with Jesus, he chose to deny (Matt. 26:69–75; Mark 14:66–72; Luke 22:54–61; John 18:15–18, 25–27). The degree of his shame and the depth of his love were revealed when he later realized that the prophecy had been fulfilled, and he wept bitterly (Matt. 26:75; Mark 14:72).

The fact of Peter's denial did not destroy the love and trust that Jesus felt for him. It was to Peter—who had confessed the Sonship of Jesus (Matt. 16:16), who had been commissioned earlier to "lend strength" to his brothers (Luke 22:32), who had hesitated in his resolution at one crucial point (Mark 14:66–72), and who on the morning of the Resurrection "ran to the tomb" (Luke 24:12)—that the Resurrected Christ first appeared. The earliest report of Peter's priority as a witness to the Resurrection is found in the letters of Paul (I Cor. 15:5), and this most probably is the intent of Luke (24:34). The initial appearance to Peter in Galilee may have been included in the original ending of Mark.

The silence concerning this important matter of priority in Matthew and John is remarkable. It may be, however, that Matt. 14:27, 28 represents a misplaced post-Resurrection narrative, and John 21 may contain an echo of the tradition preserved by Paul (I Cor. 15:5). Whether or not Jesus appeared *first* to Peter after the Resurrection, he was a witness, which Peter declared to be a criterion of apostleship (Acts 1:22).

The position of Peter in the Apostolic Church. Given the information supplied by the Gospels, it is not unexpected that Peter should emerge immediately after Jesus' death as the leader of the earliest church. For approximately 15 years after the Resurrection, the figure of Peter dominated the community. He presided over the appointment of Matthias as an Apostle (Acts 1:23–26) to take the place of Judas, who had betrayed Christ and later died. It was Peter who first "raised his voice" and preached at Pentecost, the day when the church came into being (Acts 1:14–39). It was Peter who served as an advocate for the Apostles before the Jewish religious court in Jerusalem (Acts 4:5–22). And it was he who exercised the role of judge in the disciplining of those who erred within the church (Acts 5:1–10).

Peter led the Twelve Apostles in extending the church "here and there among them all" (Acts 9:32). He went first to the Samaritans

(Acts 8:4–17), "who received the Holy Spirit"; in Samaria he encountered the magician and faith healer Simon Magus; then he went to Lydda, in the plain of Sharon (Acts 9:32–35), where he healed the paralyzed Aeneas; and then at the Mediterranean coastal town of Joppa (Acts 9:36–43) he effected the cure of Tabitha (Dorcas) in the name of Christ.

He went farther north on the Mediterranean coast to Caesarea (Acts 10:1–11:18), where, through the conversion of Cornelius, "a centurion of what was known as the Italian Cohort" (Acts 10:1), Peter introduced Gentiles into the church. According to Jewish requirements, a Gentile convert must first become a Jew through the rite of circumcision and be acceptable as a proselyte. In accepting Cornelius and the others—who may have had some informal connection with the synagogue (Acts 10:1)—and ordering "them to be baptized in the name of Jesus Christ" (Acts 10:48) without submission to the prior rite of circumcision, Peter introduced an innovation that insured the opposition of the Jewish Christians and others. This independent course set by Peter with the blessing of "the Spirit" (Acts 10:10–15) was possibly a factor in Herod's beheading of James (the brother of John) and in the arrest of Peter (Acts 12:2, 3). In prison (*c.* AD 44) Peter was visited by an "angel of the Lord. . . . And the chains fell off his hands," and he made his escape (Acts 12:1–8). He went immediately to "the house of Mary, the mother of John whose other name was Mark" (Acts 12:12). After asking them to report his escape "to James and to the brethren," he "went to another place" (Acts 12:17).

At this point the unchallenged leadership of Peter in Jerusalem came to an end. It is not at all clear where Peter went, but it is not probable that the words to another place refer to a different home in the same general area that would provide temporary refuge.

The later work of Peter is not covered in Acts, perhaps because the author of Luke–Acts had planned a third book that would have included such a discussion, but the book was never written or was written and later lost. Perhaps the events would have included unedifying material such as the internal jealousy within the church alluded to in the *First Letter of Clement* 4–6, or perhaps the author died before completion of his work. Whatever momentary glimpses into the period of the later ministry of Peter remain can only be noted in a discussion of his relationship with the two other outstanding Apostles of the time, James and Paul.

Peter was the most prominent figure in the Jerusalem Church up to the time of his departure from Jerusalem after his imprisonment by King Herod and his subsequent release in the New Testament account (Acts 12:1–17). For example, Paul went up to Jerusalem to consult with Peter three years after he had been converted and remained with him for two weeks (Gal. 1:18, 19). When Peter left Jerusalem, however, it appears clear to many New Testament scholars (although unconvincing to others) that he assumed a missionary role while the actual leadership of the church devolved upon James, "the brother of the Lord." This sequence of authority is suggested by Peter's obedience to the wishes of "certain persons who came from James" and hence his ceasing to eat with Gentile Christians at Antioch (Gal. 2:11–14); by a final "summing up" of decisions made in the so-called apostolic Council of Jerusalem (Acts 15:7) by James; and later, when Peter made his departure from the home of the mother of John whose other name was Mark, by the word of explanation or "report" of his whereabouts left primarily for James (Acts 12:17).

Paul first met with Peter at Jerusalem three years after his conversion. In the record of this meeting the name of Cephas (Peter) precedes that of James, although Galatians notes that in another meeting 14 years later the name of James precedes that of Cephas (Gal. 2:9). Paul also emphasized an incident involving himself and Peter at Antioch. Apparently, Paul had achieved some success in the difficult matter of welding the Jewish and Gentile Christians of Antioch into one congregation. The Jewish Christians saw the sharing of food with Gentiles as quite alien to their tradition. In the absence of Paul, Peter, perhaps in his capacity as missionary, visited Antioch and ate with the united group. Later, "certain persons came from James" and opposed the united congregation's custom of eating together. In apparent deference to James, Peter "drew back and began to hold aloof," and the Jewish Christians did likewise. The unity of the group had been destroyed. When Paul returned, he upbraided Peter for what he may have considered Peter's vacillation or perhaps even purposeful disruption (Gal. 2:11–14). This incident may have occasioned the Jerusalem Council (AD 49 or 50), in which it was settled that hereafter Paul should be "entrusted with the gospel to the uncircumcised" (Gal. 2:7) and Peter "for the mission to the circumcised" (Gal. 2:8).

In passing, Paul refers to a party of Cephas (Peter) in I Corinthians 1:12 that suggests that a group in the church of Corinth was especially devoted to Peter (leading some to assume a residence of Peter in Corinth) and in I Corinthians 9:5 to Peter as carrying on missionary activity accompanied by his wife. A missionary journey to Asia Minor may be suggested in the First Letter of Peter 1:1.

Tradition of Peter in Rome. The problems surrounding the residence, martyrdom, and burial of Peter are among the most complicated of all those encountered in the study of the New Testament and the early church. The absence of any reference in Acts or Romans to a residence of Peter in Rome gives pause but is not conclusive. If Peter did write I Peter, the mention of "Babylon" in 5:13 is fairly reliable evidence that Peter resided at some time in the capital city. If Peter was not the author of the first epistle that bears his name, the presence of this cryptic reference witnesses at least to a tradition of the late 1st or early 2nd century. "Babylon" is a cryptic term indicating Rome, and it is the understanding utilized in Revelation 14:8; 16:19; 17:5, 6 and in the works of various Jewish seers.

It may be said that by the end of the 1st century there existed a tradition that Peter had lived in Rome. Further early evidence for the tradition is found in the *Letter to the Romans* by Ignatius, the early 2nd-century bishop of Antioch. It is probable that the tradition of a 25-year episcopate of Peter in Rome is not earlier than the beginning or the middle of the 3rd century. The claims that the church of Rome was founded by Peter or that he served as its first bishop are in dispute and rest on evidence that is not earlier than the middle or late 2nd century.

Words of John 21:18, 19 clearly allude to the death of Peter and are cast into the literary form of prophecy. The author of this chapter is aware of a tradition concerning the martyrdom of Peter when the Apostle was an old man. And there is a possible reference here to crucifixion as the manner of his death. But as to when or where the death took place there is not so much as a hint.

The strongest evidence to support the thesis that Peter was martyred in Rome is to be found in the *Letter to the Corinthians* (*c.* AD 96; 5:1–6:4) of Clement of Rome:

> Peter, who by reason of wicked jealousy, not only once or twice but frequently endured suffering and thus, bearing his witness, went to the glorious place which he merited (5:4). . . . To these men [Peter and Paul] who lived such holy lives there was joined a great multitude of the elect who by reason of rivalry were victims of many outrages and tortures and who became outstanding examples among us (6:1).

These sources, plus the suggestions and implications of later works, combine to lead many scholars to accept Rome as the location of the martyrdom and the reign of Nero as the time.

As part of the general question of Peter's residence and martyrdom in Rome, debated since the appearance of the *Defensor pacis* of Marsilius of Padua (*c.* 1275–*c.* 1342), the particular question of where Peter was buried has been argued. There is not the slightest hint at a solution in the New Testament. The earliest evidence (*c.* AD 200) is found in a fragment of a work by Gaius (or Caius) witnessing to a tradition at least a generation earlier (*c.* AD 165) that the "trophy" (*i.e., tropaion,* or monument) of Peter was located at the Vatican. Though difficult to interpret, the use of the word trophy indicates that in this period the Vatican area was associated with either the tomb of the Apostle or simply a monument erected in the area of Peter's victory (*i.e.,* his martyrdom).

Some scholars find support for a tradition that the Apostle was buried "Ad Catacumbas" ("at the catacombs" of San Sebastiano) on the Via Appia in an inscription of Damasus (pope, 366–384), composed in such ambiguous terms that it was certain to foster such misinterpretations as are found in the letter of Gregory the Great to Empress Constantina and the notice of Cornelius in the *Liber Pontificalis.* Apart from the aforementioned, later literary tradition is unanimous in indicating the Vatican Hill as the place of burial. See *Peristephanon,* XII, of Prudentius, various notices in the *Liber Pontificalis,* and *The Salzburg Itinerary.* Liturgical sources such as the *Depositio Martyrum, Martyrologium Hieronymianum,* though interesting, add nothing to the literary evidence.

Excavations were begun in the late 19th century in order to substantiate the theory that the burial of Peter and Paul was "Ad Catacumbas." After a half century of investigation, it now seems reasonable to concede that a cult of the Apostles existed there about AD 260, though Christian influence may have been exerted as early as AD 200. None of the excavations, however, in all of the areas indicated at various times as the resting place of the apostolic relics, have produced any evidence whatsoever that the bodies of Peter and Paul were either buried there originally or brought there at a later time after earlier burials elsewhere.

In the early 4th century, the emperor Constantine (died AD 337) with considerable difficulty erected a basilica on the Vatican Hill. The difficulty of the task, combined with the comparative ease with which this great church might have been built on level ground only a slight distance to the south, may support the contention that the Emperor was convinced that the relics of Peter rested beneath the small Aedicula (shrine for a small statue) over which he had erected the basilica. The task before the excavators was to determine whether or not the belief of Constantine accorded with the facts or was based merely upon a misunderstanding.

The excavation of this site, which lies far beneath the high altar of the present Church of St. Peter, was begun in 1939. The problems encountered in excavation and interpretation of what has been discovered are extremely complex. There are some scholars who are convinced that a box found in one of the fairly late sidewalls of the Aedicula contains fragments of the remains of the Apostle, fragments which at an earlier time may have rested in the earth beneath the Aedicula. Others are most definitely not convinced. If a grave of the Apostle did exist in the area of the base of the Aedicula, nothing identifiable of that grave remains today. Furthermore, the remains discovered in the box that until comparatively recently rested in the sidewall do not lead necessarily to a more positive conclusion. Archaeological investigation has not solved with any great degree of certainty the question of the location of the tomb of Peter. If it was not in the area of the Aedicula, perhaps the grave rested elsewhere in the immediate vicinity, or perhaps the body was never recovered for burial at all.

The feast of St. Peter. Five festivals in the calendar of the Roman Catholic Church involve honour paid to Peter. And in each, the name of Paul is also associated. First chronologically, on January 18 is celebrated the festival of the "Cathedra Petri" at Rome, and on February 22 at Antioch. June 29 marks the festival of Peter and Paul, ranking among the 12 most important celebrations of the Roman Catholic Church. The escape of Peter from his chains is noted in the feast of August 1. Last, the dedications of the basilicas of Peter and Paul, commemorating their construction by the emperor Constantine, are celebrated in the festival of November 18.

(D.W.O'C./Ed.)

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Peter THE GREAT: *see* Peter I *under* Peter (Russia); Peter III *under* Peter (Spain: Aragon).

Peter THE HERMIT, French PIERRE L'ERMITE (b. *c.* 1050, probably Amiens, Fr.—d. July 8, 1115, Neufmoustier, near Huy, Flanders), ascetic, monastic founder, considered one of the chief stimulators in the launching of the First Crusade.

Peter reputedly visited the Holy Land *c.* 1093. When Pope Urban II proclaimed the Crusade at the Council of Clermont in November 1095, Peter began his preaching, travelling from Berry (in central France) across Champagne and down the Meuse Valley to Cologne, and thence (May 1096) leading his enthusiastic followers across Europe to Constantinople. On August 5–6 the crusaders advanced to Nicomedia (modern Izmir, Tur.). Unable to maintain discipline, Peter soon returned to Constantinople to seek help from the Byzantine emperor, Alexius I. In his absence most of his army was annihilated (October 21) by the Turks. He waited in Constantinople until the princely expeditions from western Europe were finally assembled there (May 1097) and accompanied them southeastward across Anatolia. In Antioch he became discouraged by the hardships attending the crusaders' siege in October and was dissuaded only with difficulty from abandoning the enterprise (January 1098).

At last having reached Jerusalem, Peter was appointed almoner of the Christian army in spring 1099. He preached a sermon on the Mount of Olives shortly before the storming of Jerusalem in July, and he conducted processions there in August. He returned to Europe in 1100, becoming prior of the Augustinian monastery of Neufmoustier, at Huy, which he founded, and died there. Y. Le Febvre's *Pierre l'Ermite et la croisade* appeared in 1946.

Peter THE JUST: *see* Peter I *under* Peter (Portugal); Peter *under* Peter (Spain: Castile).

Peter THE VENERABLE, also called BLESSED PETER OF MONTBOISSIER, French PIERRE LE VÉNÉRABLE, or BIENHEUREUX PIERRE DE MONTBOISSIER (b. *c.* 1092, Montboissier, Auvergne, Arles—d. Dec. 25, 1156, Cluny, Burgundy), outstanding French abbot of Cluny whose spiritual, intellectual, and financial reforms restored Cluny to its high place among the religious establishments of Europe.

Peter joined Bernard of Clairvaux in supporting Pope Innocent II, thereby weakening the position of the antipope, Anacletus II. After Peter Abelard's teachings had been condemned at the Council of Sens (1140), Peter received him at Cluny and reconciled him with Bernard and with the Pope. He also tried to convert the Crusades into nonviolent missionary ventures; ordered the first Latin translation of the Qur'ān so that it might be refuted; and was papal ambassador to Aquitaine, Italy, and England. He wrote hymns and poems in addition to theological tracts and left about 200 letters of considerable historiographical interest. Although Peter has not been canonized, his cult received papal approval in 1862.

Peter, Apocalypse of, also called REVELATION TO PETER, pseudepigraphal (noncanonical and unauthentic) Christian writing dating from the first half of the 2nd century AD. The unknown author, who claimed to be Peter the Apostle, relied on the canonical Gospels and on Revelation to John to construct a conversation between himself and Jesus regarding events at the end of the world. Unlike Revelation to John, however, the *Apocalypse of Peter* dwells on eternal rewards and punishments. The graphic account of the torments to be borne by sinful men was apparently borrowed from Orphic and Pythagorean religious texts, thereby introducing pagan ideas of heaven and hell into Christian literature. The most complete extant version (in Ethiopic) was discovered in 1910.

Peter, Gospel of, pseudepigraphal (noncanonical and unauthentic) Christian writing of the mid-2nd century AD, the extant portion of which covers the condemnation, Crucifixion, and Resurrection of Jesus. Because the work reflects the view that Christ's body had only the appearance of reality, Serapion, bishop of Antioch *c.* AD 190, believed it was written by a member of the heretical Docetist sect. Modern scholars are more inclined to attribute it to a Syrian Christian Gnostic because the Gospel does not view the Crucifixion as an act of atonement. But it lacks the mythological or cosmological speculations characteristic of most Gnostic sects. Possibly to convince non-Christians of the truth of the Resurrection, the *Gospel of Peter* goes beyond the canonical Gospels in claiming that Roman soldiers and Jewish officials witnessed the event.

Peter, Hugh, Peter also spelled PETERS (b. 1598, Fowey, Cornwall, Eng.—d. Oct. 16, 1660, London), English Independent minister, army preacher, and propagandist during the Civil War and Commonwealth.

Educated at Trinity College, Cambridge, he was ordained a priest in the Anglican Church in 1623. He went to London in 1626 and was appointed preacher at St. Sepulchre's, but his unorthodox views led to the suspension of his preaching license in 1627. He was in Holland from 1628 to 1635; he returned to England and then sailed to Massachusetts, where he succeeded Roger Williams as preacher at Salem in December 1636. He played a leading part in the colony's affairs and helped in the founding of Connecticut. Peter returned to England in 1641 as an agent for Massachusetts, but after the Irish Insurrection (October 1641) he went to Ireland as chaplain to a company of adventurers under Alexander, Lord Forbes, which fought against the Irish rebels (June–September 1642). As chaplain to the New Model Army, Peter preached during the campaigns of 1645 and 1646.

He accompanied Oliver Cromwell to Ireland in 1649 and was present at the fall of Wexford. Appointed chaplain to the Council of State (1650), he preached at Whitehall continually during the Commonwealth and Protectorate, but his protests against the Dutch War (1652–54) brought him a reprimand from Parliament. He also advocated reform of the universities, banking, and poor relief.

During the later years of the Protectorate, his part in civil and military affairs was less prominent. At the Restoration in 1660 he was specially exempted from the Act of Indemnity and at his trial in October 1660 was found guilty of abetting the execution of Charles I. He was executed at Charing Cross.

Peter's works included sermons, accounts of battles and sieges, and tracts on legal, economic, and social reforms. See R.A. Stearns, *The Strenuous Puritan* (1954).

Peter, letters of, two New Testament writings attributed to the foremost of Jesus' 12 Apostles but perhaps written during the early 2nd century.

The first letter, addressed to persecuted Christians living in five regions of Asia Minor, exhorts the readers to emulate the suffering Christ in their distress, remembering that after his Passion and death Jesus rose from the dead and is now in glory. The Christians are urged to repay evil with goodness and to love one another and are cautioned to safeguard their reputation as good citizens of high morality, thereby removing all doubt about the injustice of their sufferings. The question of authorship has not been solved to the satisfaction of scholars. Whereas the fluent Greek style and certain historical references seem to argue against Petrine authorship, the description of a primitive church organization, for example, seems to indicate an early composition, with the actual writing perhaps done by a secretary of or spokesman for Peter.

The second letter is principally concerned with the Second Coming of Christ. The author attributes the apparent delay to God's patience in allowing time for universal redemption and notes that in the sight of God 1,000 years are like one day. The writer also warns against false teachers, whose conduct is as immoral as their words are deceptive. They, and those who follow them, says the writer, will be destroyed in a great conflagration that will precede "new heavens and a new earth in which righteousness dwells" (3:13). Though the author explicitly identifies himself as Peter, numerous textual difficulties created doubts as early as the 3rd century about the actual authorship, which have been reinforced by subsequent scholarship.

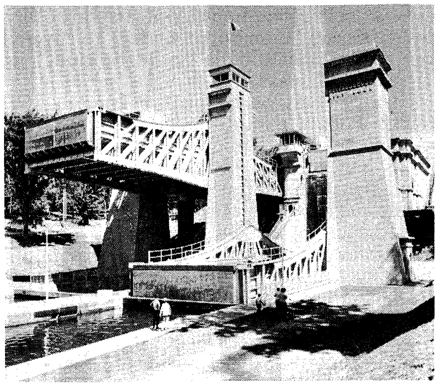
Peter Damian, SAINT, Italian SAN PIER DAMIANI (b. 1007, Ravenna [Italy]—d. Feb. 22, 1072, Faenza; feast day February 23), cardinal and doctor of the church, an original leader and a most forceful figure in the 11th-century reform movement.

Educated at the Italian universities of Ravenna, Faenza, and Parma, he abandoned his teaching career (1035) to enter the hermitage of Fonte Avellana in the Apennines, where he was chosen prior in 1043. Peter's zeal for reform, particularly his advocacy of clerical celibacy and his attacks on simony (the buying or selling of church office), attracted attention. Created cardinal in 1057, he served Popes Stephen IX (X), Nicholas II, and Alexander II, whom he defended during the schism of the antipope Honorius II. Even in semiretirement at Fonte Avellana (after 1067), he was active in the cause of reform. He died after reconciling Ravenna with Alexander, who excommunicated Henry, archbishop of Ravenna. He was declared a doctor of the church in 1828.

A conservative in political and theological controversies, he often used strong language, thus reminding his contemporaries of St. Jerome. As an apostle of voluntary poverty, he may be considered a forerunner of St. Francis of Assisi. His prolific works are collected in J.P. Migne's *Patrologia Latina* (vol. 144–145, 1853). *Selected Writings on the Spiritual Life,* translated and with an introduction by P. McNulty, was published in 1959.

Peter the Great Bay, Russian ZALIV PETRA VELIKOGO, inlet, Sea of Japan, northwestern Pacific Ocean, in the Maritime Territory of the Soviet Union. Extending 115 miles (185 km) from the mouth of the Tumen River (on the Soviet-Chinese border) northeast across to Cape Povorotny, the bay is 55 miles (88 km) long. In the north, the port of Vladivostok is situated on the Muravyov-Amursky Peninsula between Amur and Ussuri bays. The town of Posyet is on Posyeta Bay (southwest). The functioning of these harbours is severely limited by the freezing of the bay from early December to mid-April. Formerly (from 1855) known as Victoria Bay, the inlet was renamed (1859) to honour Peter I the Great.

Peterborough, city, seat of Peterborough county, southeastern Ontario, Canada, on the Otonabee River, 70 miles (115 km) east-northeast of Toronto. In 1821 Adam Scott founded a sawmill and gristmill at the site, which became known as Scott's Plains. In 1825 almost 2,000 Irish immigrants settled there, and the town and county were renamed for the group's director, Peter Robinson. Peterborough became a commercial and manufacturing centre of the surrounding area and a tourist centre for the Kawartha Lakes region. Canalization of the Otonabee as part of the Trent Canal system provided a direct link with Lake Ontario and Georgian Bay by means of the world's highest hydraulic lift lock (1904), 65 feet (20



Lift lock on the canalized Otonabee River at Peterborough, Ont.
Shostal—EB Inc.

m). Manufactures include electrical appliances and machinery, boats and marine equipment, hardware, lumber, watches, and food products. The city is the site of Trent University (founded 1963) and of Sir Sandford Fleming College of Applied Arts and Technology. Inc. 1905. Pop. (1986) 61,049.

Peterborough, city ("district"), county of Cambridgeshire, England. The city stands on the River Nen, which is navigable for small vessels to and from the North Sea. It lies on the margin, or "shoreline," of the Fens, a low-lying area of peat and silt, which was for many centuries intermediate between land and sea but which was drained and reclaimed between the 17th and 19th century. Today the Fens is an area of great fertility and massive agricultural output, and a number of the region's products are processed in Peterborough's factories.

The flat city site is dominated by St. Peter's Cathedral, a structure begun in 1118 and consecrated in 1238. It is in part a good example of Late Norman style; but it was added to in virtually every succeeding architectural period, and the total effect is discordant. The cathedral contains the Hedda Stone, an Anglo-Saxon sculpture some 1,200 years old, and the tomb of Catherine of Aragon, Henry VIII's first wife. Apart from the cathedral, gatehouses, and the Church of St. John (1407), there are few buildings of interest.

The draining of the Fens, the coming of the railway, and the development of some of England's largest brickworks on the south bank of the Nen contributed to Peterborough's 19th-century growth. In the mid-20th century its designation as an expanded town has led to further substantial growth. Situated on the main London–Edinburgh railway at a point of junction with cross-country routes, it is a choice location, particularly for warehousing and distributing trades.

Under the expanded town plan, the formerly concentrated city has been surrounded by a ring of dispersed suburban communities, linked by fast motor routes. The district stretches 20 miles (32 km) from east to west, and some 8 miles (13 km) from north to south. Pop. (1981) city, 115,544; (1986 est.) district, 148,200.

Peterborough, also spelled PETERBORO, town ("township"), Hillsborough county, southern New Hampshire, U.S., at the confluence of the Contoocook and Nubanusit rivers. The site, granted in 1737 and named after Charles Mordaunt, 3rd Earl of Peterborough, was permanently settled in 1749 and incorporated in 1760. The town became famous after the establishment of the MacDowell Colony there by Marian Nevins, the wife of composer Edward MacDowell, following his death in 1908. The colony attracted numerous composers and writers, including Stephen Vincent Benét, Willa Cather, and Thornton Wilder. Tourism and some light manufacturing (textiles, baskets) are the economic mainstays. The Sharon Arts Center in the town is run by the League of New Hampshire Arts and Crafts. Popular summer and winter resorts are at nearby Miller and Greenfield state parks; Temple and Crotched mountains have ski slopes. Pop. (1986 est.) 5,190.

Peterborough, Soke of, former administrative county (1884–1965) within Northamptonshire, Eng. From 1965 to 1974 it was part of Huntingdon, and it is now part of Cambridgeshire.

The Soke of Peterborough stretched from Market Deeping, Lincolnshire, in the north to Peterborough in the south and comprised the rural districts of Barnack and Peterborough as well as the city of Peterborough. The part of the Soke north of the River Nene is known as the Liberty of Peterborough, an area originally under the jurisdiction of the abbot of the monastery.

Peterhead, most easterly town in Scotland, burgh, fishing port, and seat of the Banff and Buchan district of Grampian region. Founded in 1593, Peterhead developed as a port and functioned briefly as a fashionable 18th-century spa. By the early 19th century it had become the chief British whaling centre. Fishing for herring later assumed primary importance but declined in favour of whitefish to supply local fish-processing plants. Food processing and light engineering were the town's main industries until the 1970s, when exploitation of the North Sea oil fields revived the town. Pop. (1981) 17,085.

Peterhof (Russian S.F.S.R.): *see* Petrodvorets.

Peterloo Massacre (Aug. 16, 1819), in English history, the brutal dispersal by cavalry of a radical meeting held on St. Peter's Fields in Manchester. The "massacre" (likened to Waterloo) attests to the profound fears of the privileged classes of the imminence of violent Jacobin revolution in England in the years after the Napoleonic Wars. To radicals and reformers Peterloo came to symbolize Tory callousness and tyranny.

The August meeting was the culmination of a series of political rallies held in 1819, a year of industrial depression and high food prices. Presided over by the radical leader Henry Hunt, the meeting was intended to be a great demonstration of discontent, and its political object was parliamentary reform. About 60,000 persons attended the rally, including a high proportion of women and children. None was armed, and their behaviour was wholly peaceable. The magistrates, who had been nervous before the event, were alarmed by the size and mood of the crowd, and ordered the Manchester yeomenry to arrest the speakers immediately after the meeting had begun. The untrained yeomenry did not confine themselves to seizing the leaders but, wielding sabres, made a general attack on the crowd. The chairman of the bench of magistrates thereupon ordered the 15th Hussars and the Cheshire Volunteers to join the attack; in ten minutes the place was cleared except for bodies. The numbers of killed and wounded were disputed; probably about 500 people were injured and 11 killed. Hunt and the other radical leaders were arrested, tried, and convicted—Hunt being sent to prison for two years.

Petermann Ranges, low mountains extending for 200 miles (320 km) from east-central Western Australia southeast to the southwest corner of Northern Territory. A continuation of the granite and gneiss formations in the Musgrave Ranges to the southeast, the Petermanns rise to a height of 3,800 feet (1,158 m). Visited (1874) by Ernest Giles, the mountains were named after August Petermann, a German geographer. The eastern section lies within the Petermann Reserve. To the east is the Ayers Rock–Mount Olga National Park.

Peters, Carl (b. Sept. 27, 1856, Neuhaus an der Elbe, Hanover [Germany]—d. Sept. 10, 1918, Bad Harzburg, Ger.), German explorer who advanced the establishment of the German East African protectorate of Tanganyika, now a part of Tanzania.

Carl Peters, oil painting by Herbert Sidney, 1912
Historia-Photo

After visiting London to study British principles of colonization, Peters founded the Society for German Colonization in 1884 and later that year, in the Usambara Mountains area of present-day northeastern Tanzania, made a number of contracts with chiefs who surrendered their territories to him. He later helped to extend the German sphere of influence and established the German East Africa Company, which obtained an imperial charter in 1885. He reached Uganda in 1890 and concluded a treaty with the king, but without the support of the German government. This treaty was declared void, for an agreement had been reached between Germany and Great Britain by which Uganda was left in the British sphere. He became imperial high commissioner for Kilimanjaro in 1891 but was deprived of his commission in 1897 for misuse of official power in his treatment of the Africans. From 1899 to 1901 he explored regions along the Zambezi River with a view to commercial exploitation and described his discovery of ancient cities and gold mines in *Im Goldland des Altertums* (1902; *The Eldorado of the Ancients*). He also published *Die deutsche Emin-Pascha Expedition* (1891; *New Light on Dark Africa*), among other works.

Peters, Curtis Arnoux: *see* Arno, Peter.

Peters, Hugh: *see* Peter, Hugh.

Peters, Lenrie (b. 1932, Bathurst, Gambia [now Banjul, The Gambia]), physician, novelist, and one of western Africa's most important poets.

Peters was educated at Bathurst, Freetown (Sierra Leone), and at Trinity College, Cambridge, where he earned a medical degree in 1959, with further studies in surgery. He broadcast on several British Broadcasting Corporation programs (and chaired its *Africa Forum*) before returning to Gambia.

His novel *The Second Round* (1965) is semi-autobiographical in its story of the disillusionment and alienation of a young doctor returning from England to Freetown after completing his medical studies and finding his home unsettled and unsettling, the people there having rejected all traditional values without substituting anything positive. The doctor drifts among acquaintances for a time but finally seeks some meaning by working in an isolated up-country hospital.

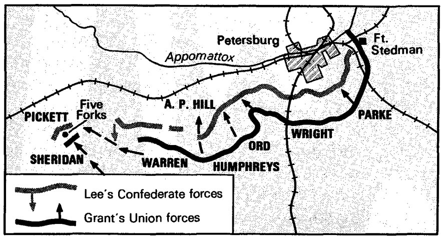
Peters' poetry (*Poems*, 1964; *Satellites*, 1967; and in several anthologies) is less pessimistic, characterized by a hope that good will prevail and by a sense of discovery. Some of his poems, however, tell of an estrangement similar to that in *The Second Round*. In style he usually follows European conventions, although he concentrates upon African themes and images.

Petersburg, city, seat (1839) of Menard county, central Illinois, U.S., on the Sangamon River. The area was settled about 1820, and in 1826 a plat for Petersburg (named for Peter Lukins, who owned land on the site) was surveyed by Abraham Lincoln. In a hillside cemetery near the city, which is on the Lincoln Heritage Trail, is the grave of Lincoln's fiancée, Ann Rutledge, whose headstone is inscribed with an epitaph written by the poet and novelist Edgar Lee Masters, a native son. The boyhood home of Masters, who is buried in the same cemetery, is maintained as a museum. The county courthouse has a display of Lincoln papers. Lincoln's New Salem Historic Site is just to the south. The city's economy is basically agricultural, with corn (maize), wheat, and soybeans being the chief crops. Inc. 1841. Pop. (1986 est.) 2,390.

Petersburg, city, in, but independent of, Dinwiddie and Prince George counties, southeast Virginia, U.S., on the Appomattox River (bridged), adjacent to Colonial Heights and Hopewell, 23 miles (37 km) south of Richmond. In 1645 Fort Henry was built at the falls of the Appomattox, the site of the present city. The name (earlier, Peter's Point and Peter's Town) reputedly honours Major Peter Jones, who became commander of the fort in 1675. In 1733 Colonel William Byrd II surveyed the site, but it was not until 1748 that an act of the colonial legislature established the town. During the American Revolution it was captured by British troops under William Phillips and Benedict Arnold (April 25, 1781). On May 20, Lord Cornwallis arrived with his army to prepare for the campaign that was to end with his surrender at Yorktown. In 1784 the towns of Petersburg, Blandford, Pocahontas, and Ravenscroft were combined and incorporated as Petersburg. It was the scene of bitter fighting in the American Civil War.

The city's manufactures include cigarettes, textiles, chemicals, luggage, and furniture. It is the seat of Richard Bland College (1961) and Virginia State University (1882). Historic sites include Petersburg National Battlefield (scene of the "Battle of the Crater"), Old Blandford Church (1737) and Cemetery (with 30,000 Confederate graves), and Center Hill Mansion Museum (1823). Fort Lee, with its Quartermaster Museum, is nearby. Inc. city, 1850. Pop. (1988 est.) city, 41,944; Richmond–Petersburg MSA, 844,300.

Petersburg Campaign (1864–65), series of military operations in southern Virginia during the final months of the American Civil War, culminating in the defeat of the South. Petersburg, an important rail centre 23 miles (37 km) south of Richmond, was a strategic point for the defense of the Confederate capital. In June 1864 the Union army began a siege of the two cities, with both sides rapidly constructing fortifications 35 miles (56 km) long. In a series of battles that summer, Union losses were heavy, but, by the end of August, General Ulysses S. Grant had crossed the Petersburg–Weldon Railroad; he captured Fort Harrison on September 29. By year's end, however, General Robert E. Lee still held Richmond and Petersburg. But mostly due to mismanagement and inefficiency, Southern railroads had broken down or been destroyed. Thus the Confederates were ill-fed to the point of physical exhaustion, and the lack of draft animals and cavalry mounts nearly immobilized the troops. Hunger, exposure, and the apparent hopelessness of further resistance led to increasing desertion, especially among recent conscripts. In March 1865 the Confederates were driven back at the Battle of Fort Stedman, leaving Lee with 50,000 troops as opposed to Grant's 120,000. Soon after, Grant crushed a main Southern force under General George E. Pickett and General Fitzhugh Lee at the Battle of Five Forks (April 1);



The Petersburg Campaign, Union attacks on April 1–2, 1865
From *A Dictionary of Battles* by David Eggenberger, Copyright © 1967 by David Eggenberger, reprinted with permission of the publisher, Thomas Y. Crowell Company Inc.

the next day the defenders were driven back within the Petersburg inner defenses. Lee immediately informed President Jefferson Davis that the two cities could no longer be held, and the evacuation was carried out that night. After Lee's plan to join with General Joseph E. Johnston was thwarted, he surrendered to General Grant on April 9 at Appomattox Court House.

Petersfield, Louise-Renée de Kéroualle, Baroness: *see* Portsmouth, Louise-Renée de Kéroualle, Duchess of.

Peterson, Oscar (b. Aug. 15, 1925, Montreal, Can.), Canadian jazz pianist best known for his dazzling solo technique.

After playing with a popular Canadian orchestra, Peterson went to the United States in 1949, where he appeared in one of jazz promoter Norman Granz's concerts at Carnegie Hall. He toured with Granz's Jazz at the Philharmonic group throughout the 1950s, leading a trio with Ray Brown (bass) and Irving Ashby (guitar), later succeeded by Barney Kessel and Herb Ellis. In the late 1950s, after Ellis left the trio, Peterson substituted a drummer (Ed Thigpen) for the guitarist and continued to develop his own personal style in the tradition of swing and bebop (having been at first influenced by Art Tatum and Earl Hines, among others). In the mid-1960s Louis Hayes replaced Thigpen, and Sam Jones replaced Ray Brown.

Peterson gained a wide audience after making several extensive European tours and recording with such jazz greats as Billie Holiday, Roy Eldridge, Dizzy Gillespie, Count Basie, and Ella Fitzgerald. He also won acclaim through his solo performances and recordings. Peterson received three Grammy Awards (1974, 1975, and 1977) and the Order of Canada service medal, and he was frequently named number one jazz pianist in numerous critics' and readers' polls. He was author of *Jazz Exercises and Pieces* (1965) and *Oscar Peterson New Piano Solos* (1965).

Peterson, Roger Tory (b. Aug. 28, 1908, Jamestown, N.Y., U.S.), American ornithologist, author, conservationist, and wildlife artist whose field books on birds, beginning with *A Field Guide to the Birds* (1934), did much in the United States and Europe to stimulate public interest in bird study.

The "Peterson Field Guide Series" includes Peterson's own books on birds of western North America (1954), eastern and central North America (1980), Britain and Europe (with British ornithologists Guy Mountfort and P.A.D. Hollum; 1954), and Mexico (1973), as well as his own volume on the wild flowers of eastern North America (with

Margaret McHenney; 1968). The series also includes a number of guides by other authors.

Peterson started drawing birds while in high school. He studied at the Art Student's League, New York (1927–29), and the National Academy of Design, New York (1929–31). In painting for the field guides, he stressed those features of each species that would aid the reader in identifying it in the field. In addition to the field guides, he wrote many popular books of a more general nature, among them *Birds Over America* (1948), *Wildlife in Color* (1951), *Wild America* (1955), *The Birds* (1963), and *The World of Birds* (with James Fisher; 1964). He received many awards, including the Brewster Medal of the American Ornithologists' Union (1944), the New York Zoological Society Gold Medal (1961), the World Wildlife Fund Gold Medal (1972), the Linné Gold Medal from the Royal Swedish Academy of Sciences (1976), and the U.S. Medal of Freedom (1980).

Peterson was an officer of many ornithological and conservation organizations, including the American Ornithologists' Union, National Audubon Society, and International Committee for Bird Preservation.

Petersson, Lars: *see* Petri, Laurentius.

Petersson, Olof: *see* Petri, Olaus.

Petherick, John (b. 1813, Glamorgan, Wales—d. July 15, 1882, London), British trader and explorer who investigated the western tributaries of the Nile River and made zoological and ethnological discoveries in the Sudan and Central Africa. He was the first European to encounter the Azande of northeastern Congo (now Zaire).

Petherick went to Africa in 1845 on a fruitless search for coal deposits in the interior of Egypt and the Sudan and remained in the Sudan as a trader. He later transferred his energies to the investigation of the tributaries of the Nile that run through the southern Sudan, notably the Baḥr-al-Ghazāl (Gazelle River). In 1853 he reached the borders of the Azande nation. Following the publication of his accounts of his travels, *Egypt, the Soudan and Central Africa* (1861), the Royal Geographical Society appointed him to meet John H. Speke and James A. Grant on their return from discovering the source of the Nile, but while carrying out further investigations in the Azande country, Petherick misjudged Speke's arrival and missed him.

Pethick-Lawrence (of Peaslake), Frederick William Pethick-Lawrence, Baron, original name FREDERICK WILLIAM LAWRENCE (b. Dec. 28, 1871, London—d. Sept. 10, 1961, London), British politician who was a leader of the woman suffrage movement in Great Britain during the first two decades of the 20th century; he later served (1945–47) as secretary of state for India and Burma.

In 1901 Lawrence married Emmeline Pethick, a fellow social worker in the East End of London, and added her family name to his own. Together they assailed their nation's prosecution of the South African War (1899–1902) and then became leaders in the agitation for woman suffrage. Pethick-Lawrence spent nearly all his considerable inheritance paying suffragettes' fines; and in 1912, after a demonstration in London, he served a few months in jail.

A Socialist and Labour Party member, he defeated Winston Churchill, at that time a Liberal, in the 1923 election to the House of Commons from West Leicester. In Ramsay MacDonald's second Labour ministry (1929–31) he was financial secretary to the Treasury. As secretary of state for India and Burma (August 1945–April 1947) in the Labour government of Clement Richard (afterward 1st Earl) Attlee, he was unable to reconcile Jawaharlal Nehru and Mohammed Ali Jinnah, respectively leaders of the Hindus and Muslims in India. He was created a baron in 1945. His autobiography, *Fate Has Been Kind,* was published in 1943 and *Pethick-Lawrence,* by Vera Mary Brittain, in 1963.

Pethick-Lawrence's two marriages were childless, and the barony became extinct upon his death.

Pétion, Alexandre Sabès (b. April 2, 1770, Port-au-Prince, Haiti—d. March 29, 1818, Port-au-Prince), Haitian liberator and president remembered by the Haitian people for his liberal rule and by South Americans for his support of Simón Bolívar during the struggle for independence from Spain.

The son of a wealthy French colonist and a mulatto, Pétion served in the French Colonial Army before the French Revolution and then joined the revolutionary troops of Toussaint-Louverture and, later, those of the mulatto general André Rigaud. Fleeing to France after Toussaint defeated Rigaud, who had set up a mulatto state in the southern provinces, Pétion returned in 1802 with the French Army sent to reconquer the colony but then became one of the first Haitian officers to revolt against France. In 1806 he was a leader in the revolt against the rule of Jean-Jacques Dessalines, who had played a principal role in 1803 in ousting the French. When, after Dessalines' death, Henry Christophe set up a separate state in northern Haiti, Pétion was elected president of southern Haiti in 1807. He was re-elected in 1811 and made president for life in 1816.

Influenced by ideals of French liberalism, Pétion divided the large plantations into small lots, giving one to each of his soldiers. Freed from the burden of producing a surplus for the plantation owners, the people produced only enough for their own needs, and the resulting slowdown in the economy led to galloping inflation. Pétion's regime was also marked by continual struggles with Christophe and with dissident generals in his own country.

Pétion de Villeneuve, Jérôme (b. Jan. 3, 1756, Chartres, Fr.—d. 1794, near Saint-Émilion), politician of the French Revolution who was at first a close associate, and later a bitter enemy, of the Jacobin leader Robespierre.

The son of a lawyer of Chartres, Pétion practiced as an advocate before accepting a seat with the bourgeois Third Estate at the States General of 1789. When the Third Estate obtained control of the States General (which became the National Assembly) and set about abolishing France's feudal institutions, Pétion and Robespierre led the small minority of deputies who pressed for enfranchisement of the lower classes and other far-reaching democratic reforms. The National Assembly dissolved itself on Sept. 30, 1791, and in November Pétion was elected mayor of Paris. Without breaking with Robespierre, he formed ties with the Girondins, the moderate bourgeois-democrats who opposed Robespierre in the newly formed Legislative Assembly.

When the Girondins organized a popular demonstration against King Louis XVI in Paris on June 20, 1792, Pétion made only half-hearted efforts to preserve order. Louis retaliated by suspending him from office on July 12, but the Legislative Assembly reinstated the mayor on August 3. Nevertheless, during the Paris insurrection that overthrew the monarchy on August 10, Pétion avoided committing himself to the Revolutionary cause.

In September 1792, Pétion was elected the first president of the National Convention, which succeeded the Legislative Assembly. Jealous of Robespierre's preeminence among the Montagnards (as the Jacobins of the Convention were called), Pétion joined the Girondins, and on June 2, 1793, he, together with 28 other Girondin leaders, was expelled from the Convention in a Montagnard coup d'état. Escaping arrest, Pétion made his way to the vicinity of Saint-Émilion, where he and another prominent Girondin, François Buzot, committed suicide. Their bodies were discovered on June 18, 1794.

Pétionville, eastern suburb of Port-au-Prince, Ouest *département,* southern Haiti, on the cool northern hills of the Massif de la Selle. Named for Alexandre Sabès Pétion, who fought in Haiti's wars for independence in the early 19th century and was later president of the southern kingdom, it is primarily a residential and resort area. It is linked to Port-au-Prince, the national capital, by a winding toll road, the proceeds of which were intended to finance Duvalierville, a model city, now defunct. Pop. (1982 prelim.) 35,333.

Petipa, Marius (b. March 11, 1819, Marseille—d. July 14 [July 1, old style], 1910, Gurzuf, Russia), dancer and choreographer who worked for nearly 60 years at the Mariinsky Theatre in St. Petersburg and had a profound influence on modern classical Russian ballet. He directed many of the greatest artists in Russian ballet and developed ballets that retain an important position in Soviet dance repertoire.

Petipa, 1869
Novosti Press Agency

Petipa and his brother Lucien (later principal dancer at the Paris Opéra) received their early training from their father, Jean, a ballet master long active in Brussels. After Marius' debut in Nantes, Fr., in 1838, he danced in Belgium, France, and the United States (he appeared in New York in 1839) before accepting an engagement in Spain, where he gathered material for ballets later produced in Russia. He established a reputation as a talented pantomime artist and one of the outstanding dancers of his day.

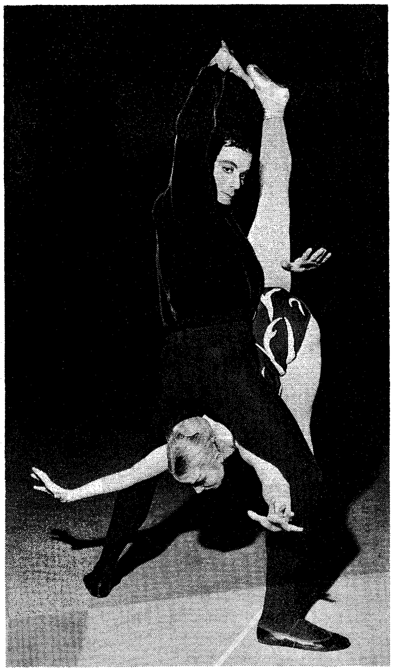
He made his initial appearance at the St. Petersburg Mariinsky Theatre in 1847 in *Paquita* and staged his first original ballet, *Un Mariage sous la régence* ("A Regency Marriage") there in 1858. For his wife, the ballerina Mariya Surovshchikova, he created *Le Marché des innocents* (1859; "The Children's March"). His first outstanding success was *La fille du pharaon* (1862; "The Pharaoh's Daughter"). Later, after becoming choreographer in 1862 and chief choreographer in 1869, he produced more than 60 ballets, working from carefully detailed plans that became the basis of modern classical ballet in Russia. He collaborated with Tchaikovsky on *The Nutcracker* (*Casse Noisette,* choreographed by his assistant Lev Ivanov) and *The Sleeping Beauty* and presented versions of *Swan Lake, Raymonda,* and *Giselle* that have been revived frequently. Among other major ballets are his *Don Quixote* (1869), *La Bayadère* (1877), and *Le Corsaire* (1899). After the death of his first wife, Petipa married another dancer, Lyubov Leonidovna.

Petit, Roland (b. Jan. 13, 1924, Villemomble, Fr.), French dancer and choreographer whose dramatic ballets combined fantasy with elements of contemporary realism.

Trained at the Paris Opéra Ballet school, he joined the company in 1940 but left in 1944 to create and perform his own works at the Théâtre Sarah Bernhardt, in Paris. In 1945 Petit was instrumental in creating Les Ballets des Champs-Elysées, where he remained as principal dancer, ballet master, and choreographer until 1947. In 1948 he formed the Ballets de Paris de Roland Petit (1948–50, 1953–54, 1955, and 1958), which made several tours of Europe and the United States Dancers who rose to prominence in his companies include Jean Babilée, Colette Marchand, Leslie Caron, and Renée ("Zizi") Jeanmaire, whom he married in 1954.

His choreography was often angular or acrobatic and was considered theatrical in its use of mime dance, occasional singing, and props such as cigarettes and telephones. His works included the realistic ballet *Les Forains* (1945; "The Strolling Players"), a study of indigent circus performers; the imaginative creation *La Croqueuse de diamants* (1950; "The Diamond Cruncher"), whose heroine eats the gems her associates steal; and *L'Oeuf à la coque* (1949; "The Soft-Boiled Egg"), in which the leading female dancer hatches from an egg in hell. *Carmen* (1949) was one of Petit's most popular ballets; the choreography was passionate and erotic, and Jeanmaire became famous for her interpretation of the title role. *Le Jeune Homme et la mort* (1946; "The Young Man and Death") and *Les Demoiselles de la nuit* (1948; "The Ladies of the Night") were among his other popular ballets.

Petit staged several music hall revues for his wife and choreographed the dances for the films *Hans Christian Andersen* (1952), *The Glass Slipper* (1955), *Daddy Long Legs* (1955),



Petit and Danielle Jossy in *Maldoror*
Serge Lido

Anything Goes (1956), and others. The ballet film *Black Tights* (1962) consisted of Petit's works *La Croqueuse de diamants, Cyrano de Bergerac, A Merry Mourning* (originally presented in 1953 as *Deuil en 24 heures,* "A 24-Hour Mourning"), and *Carmen.* Petit also staged several of his ballets for Sadler's Wells Ballet (now the Royal Ballet), for the Royal Danish Ballet, and for other troupes. From 1970 to 1975 he owned and operated the Casino de Paris, producing revues starring Jeanmaire. In 1973 he became director of the Ballet de Marseille. He choreographed a modern version of *Coppélia* in 1975 and a new *Phantom of the Opera* for the Paris Opéra Ballet in 1980.

petit jury, also called TRIAL JURY, COMMON JURY, or TRAVERSE JURY, a group chosen from the citizenry of a district to try a question of fact. It is the standard jury used in civil and criminal trials—at the request of either party to a civil action and only at the defendant's request in a criminal action. It is distinguished from the grand jury (*q.v.*), which formulates accusations, whereas the petit jury tests the accuracy of such accusations by standards of proof.

Generally, the petit jury's function is to deliberate questions of fact, questions of law being left to the trial judge; however, the distinction is often blurred. The petit jury has less discretion than is often imagined. The trial judge supervises it, rules on what evidence it may view and on what laws are applicable, and sometimes directs its verdict. If the judge deems that the jury has grossly ignored the weight of the evidence, he or she can set aside their verdict.

Although petit juries in England and the United States have historically contained 12 members, there is no uniform number. Numerical requirements for a valid verdict vary (*e.g.,* unanimity in the U.S., a majority in Scotland and Italy, two-thirds in Portugal), as do subject areas of operation. In the United States, for example, juvenile defendants may not request a jury, and in England juries have been eliminated from civil cases. Outside England and the United States the petit jury is declining. In nations having civil rather than common law, the jury, where found, is used only for criminal trials. Germany and France have a mixed tribunal of judges and jurors, and Japan abolished its petit jury in 1943 after a brief experimental period for civil cases.

Scholars disagree on the time and place of the trial jury's birth. Some suggest that King Alfred the Great of England initiated the institution in the 9th century. Others trace it to the Norman Conquest of England (1066). The petit jury emerged as a distinct form when the Articles of Visitation in England (1194) separated accusatory and trial juries—the grand and petit juries of today.

The future of the petit jury is uncertain. Even in England and the United States it is hotly debated. Proponents argue that the trial jury is a bulwark against tyranny, being drawn from the populace at large. Detractors insist the system is inconvenient and clumsy and that modern legal complexities are beyond the competence of most petit jurors. Court backlogs continue to underscore the need for greater efficiency in the administration of justice. *See also* voir dire.

petit mal (French: "little sickness"), type of epilepsy characterized by episodes of brief unresponsiveness. They generally last less than 15 seconds each and usually occur many times in a day—sometimes several hundred times. No involuntary movement or falling occurs (as in grand mal). After the short interruption of consciousness, the individual is mentally clear and able to continue what he was doing before. Petit mal occurs mainly in children and does not appear initially after age 20; it tends to disappear before or during early adult life. Each short absence is accompanied by an electroencephalogram pattern in which "spike and wave" discharges recur three times a second. At times petit mal can be nearly continuous, and the person may continue his activities in a clouded, partially responsive state for minutes or hours. *See also* epilepsy.

petit point, form of canvas embroidery similar to cross-stitch embroidery (*q.v.*), but even finer because of its small scale. The squareness and regularity of the outlines of the forms represented is less apparent at ordinary viewing distance. The stitch used—also called petit point or tent stitch—is worked either in diagonal or horizontal rows across the intersection of the canvas threads. The thread is carried back from stitch to stitch in a uniform

Petit point embroidered box, English, *c.* 1670; in the Royal Scottish Museum, Edinburgh
By courtesy of the Royal Scottish Museum, Edinburgh; photograph, Tom Scott

manner to ensure that the pull of the thread at the front is consistent.

Petit point was widely used in France in the 17th and early 18th centuries, particularly for pole screens and upholstery covering.

Petit porcelain, French hard-paste porcelain produced by Jacob Petit (b. 1796). Petit worked at the porcelain factory at Sèvres as a painter. With his brother Mardochée he bought a porcelain factory in Fontainebleau

Petit porcelain tea jar from Jacob Petit's factory at Fontainebleau, Fr., *c.* 1840; in the Victoria and Albert Museum, London
By courtesy of the Victoria and Albert Museum, London

in 1830, finally settling in Paris in 1863. The wares he made were of a purely ornamental character; *e.g.,* vases, statuettes, clocks. The high-quality porcelain may have been fired in Limoges. The usual colours are pale pink, light green, mauve, black, and gold. The shapes are idiosyncratic interpretations of the 18th-century rocaille style typical of the taste of the Louis-Philippe period for Rococo. Impressed or in blue, the mark for Petit porcelain is JP.

Petit-Quevilly, Le, town, southwest suburb of Rouen, Seine-Maritime *département,* Haute-Normandie region, northern France, on the Seine River. The name Quevilly comes from the Latin Quevillicium—in ancient French Chivilly, or Chevilli—meaning "a row of spikes" that enclosed a park where the Norman dukes once hunted. It was designated "Petit" in 1030 to distinguish it from Le Grand-Quevilly. Historic buildings include the Chapel of Saint-Julien, formerly part of the leprosarium founded by Henry II of England in 1183. Louis IX (St. Louis) was baptized in the chapel, which is decorated with 12th- and 13th-century paintings. Pop. (1982) 22,861.

Petit-Saint-Bernard, Col du (France–Italy): *see* Little Saint Bernard Pass.

petition, written instrument directed to some individual, official, legislative body, or court in order to redress a grievance or to request the granting of a favour. Petitions are also used to collect signatures to enable a candidate to get on a ballot or to put an issue before the electorate. They are also used to pressure representatives and deputies to vote in a certain way.

Most governments allow citizens to petition in some form for redress of grievances, and, indeed, in many countries it is an established right. The history of its growth has been wide and varied. In England the right of petitioning the crown was recognized indirectly as early as Magna Carta (1215) and reaffirmed in the Bill of Rights of 1689. At first, petitions to the crown appear to have been for the redress of private and local grievances. Moreover, in Parliament many statutes were drawn up from the petitions from the House of Commons to the crown and the latter's answers. Although the right to petition Parliament itself is not mentioned in the Bill of Rights, it is a convention of the constitution. In modern times the presentation of public petitions plays little effective part in parliamentary affairs because most fail to conform to very strict tests of technical validity.

In the United States the right to petition was recognized during the American Revolution and formalized in the First Amendment of the Constitution. Now both Congress and the various state legislatures have well-defined procedures for receiving and acting upon materials of this kind. Although the rules are not as stringent as those in England, individual officials often have wide discretion in interpreting the validity of petitions.

In France the petitions of the people and the National Assembly played a significant role throughout the Revolution.

petition of ———: *see under* substantive word (*e.g.,* right, petition of).

Petitot, Jean (b. July 12, 1607, Geneva, Switz.—d. April 3, 1691, Vevey), Swiss painter who was the first great miniature portraitist in enamel.

The son of sculptor Faulle Petitot, he was apprenticed to a Swiss jeweler from 1622 to 1626. About 1633 he went to France, where he probably became the pupil of Jean and Henri Toutin, the originators of the art of painting miniature portraits in enamel. By 1637 Petitot had arrived in England, where he was patronized by Charles I and his court. Only a few miniatures are known from this period, and all are copies of portraits by the court painter Sir Anthony Van Dyck (1599–1641).

Portrait of an unknown lady, painted enamel miniature by Jean Petitot; in the Musée Condé, Chantilly, Fr.

Giraudon—Art Resource/EB Inc.

Petitot had high expectations of his stay in England, but, after the outbreak of the first of the English Civil Wars, he returned to France. For many years he enjoyed the patronage of Louis XIV (1638–1715) and his courtiers. He executed many portraits of the king, his family, and the most celebrated figures in the king's entourage; most were based upon paintings by fashionable artists. Petitot worked in partnership with Jacques Bordier until the latter's death in 1684. When the Edict of Nantes, a document of religious freedom, was revoked in 1685, Petitot, as a Protestant, was imprisoned. Worn out by fever and old age, he signed a recantation and was freed. In 1687 he was allowed to return to Geneva and was received back into the Reformed Church.

Although priority in the discovery of the art of painting enamel miniature portraits belongs to the Toutins, it was Petitot who raised the art to a level never surpassed. While relying primarily on original portraits by others, he was able to preserve to a remarkable degree the character of the work he was transforming into a small, jewellike roundel. The most important collections of his works are in the Victoria and Albert Museum, London, and the Louvre, Paris. His style, much imitated in his own time, provoked a vast number of 18th- and 19th-century copies or imitations.

His son Jean-Louis Petitot (1653–after 1699) painted portrait enamels in a style closely resembling that of his father.

Petlyura, Symon Vasilyevich (b. May 17 [May 5, Old Style], 1879, Poltava, Ukraine, Russian Empire [now in Ukrainian S.S.R.]—d. May 26, 1926, Paris, Fr.), Socialist leader of the Ukraine's unsuccessful fight for independence after the Russian revolutions of 1917.

One of the founders of the Ukrainian Social-Democratic Workers' Party in 1905, Petlyura published two socialist weekly newspapers before the onset of World War I, when he became an officer in the Russian army (1914). After the imperial government of Russia was overthrown by the February Revolution (1917), he joined the Ukrainian Central Rada ("council"), which proclaimed the Ukraine to be an autonomous republic (June 1917); and in July he was appointed minister of war of the newly formed government.

Soon thereafter, however, the Germans occupied the Ukraine and established a puppet government. When the Germans withdrew at the end of the war, he assumed a leading role in the Ukraine's movement for independence, heading the five-member directorate of the Rada, becoming ataman ("commander in chief") of the Ukrainian army, and seizing power from the German regime.

Petlyura's government then had to confront hostile Soviet Russian armies as well as forces of the anti-Bolshevik White Russians. When the White armies, which had occupied the Ukraine and replaced Petlyura's government at the end of 1918, withdrew in the autumn of 1919, the Ukraine fell under Soviet authority.

To overthrow the Soviet regime, Petlyura concluded a treaty of alliance with Józef Piłsudski, head of the Polish state, in April 1920 and supported the Poles in their war against Soviet Russia (Russo-Polish War of 1919–20). Although the Poles repulsed the Soviet army, they were unable to secure independence for the Ukraine when they concluded the Treaty of Riga with the Bolsheviks (March 18, 1921).

The Ukraine subsequently remained under Soviet control, and Petlyura, after spending some months in Warsaw, moved with his government to Paris, where, several years later, he was fatally shot by Shalom Shvartsbard, in revenge for the deaths of Jews during pogroms staged by members of Petlyura's army.

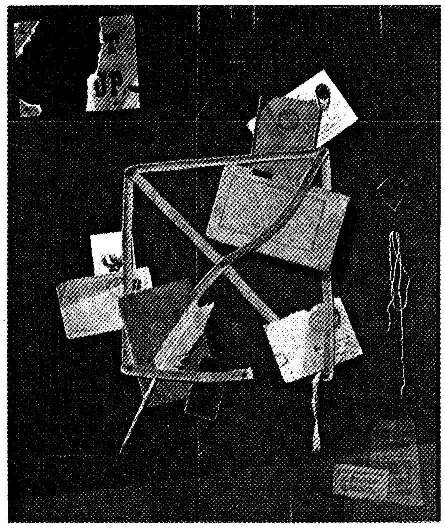
PETN, abbreviation of PENTAERYTHRITOL TETRANITRATE, a highly explosive organic compound belonging to the same chemical family as nitroglycerin—*i.e.,* the nitric acid esters of polyalcohols.

PETN was introduced as an explosive after World War I. It is used by itself in detonators and detonating fuses (Primacord) and in a mixture, called pentolite, with an equal amount of trinitrotoluene (TNT), developed during World War II, in grenades and projectiles.

PETN is a colourless, crystalline material that is generally stored and shipped as a mixture with water. It is less sensitive than nitroglycerin but is easily detonated. Valued for its shattering force and efficiency, PETN is the least stable of the common military explosives but retains its properties in storage for longer periods than nitroglycerin or cellulose nitrate (nitrocellulose) does. PETN is also used in medicine as a heart stimulant.

Peto, John Frederick (b. May 21, 1854, Philadelphia, Pa., U.S.—d. Nov. 23, 1907, Island Heights, N.J.), American still-life painter who, though influenced by the style and subject matter of the better-known trompe l'oeil ("fool-the-eye") still-life painter William Harnett, developed a distinctive mode of expression.

Biographical information on Peto is meagre, and few of his works were signed or dated. He may have been a student at the Philadelphia Academy of Fine Arts. From 1879 to 1886



"Old Time Letter Rack," oil on canvas by John Frederick Peto, 1894; in the Museum of Modern Art, New York City

By courtesy of the Museum of Modern Art, New York, gift of Nelson A. Rockefeller

he contributed irregularly to academy exhibitions. He knew Harnett, and possibly they were close friends. Peto and Harnett painted many of the same subjects—money, books, violins, and guns. A favourite subject of both, but particularly of Peto, was the letter rack in which a group of tapes tacked to a vertical surface held letters and other objects. Such pictures were done both early and late in Peto's career, the late ones, such as "Old Reminiscences," being stronger in abstract composition. Characteristically, Peto chose common, everyday objects as his subjects.

From 1875 to 1889 Peto worked in Philadelphia and, from 1889 to his death, in the village of Island Heights. Most of his works date from the second period. Because he was unknown and away from the world of art, his works were often represented as Harnett's. His works differ from Harnett's, however, in their softer, more luminous colour and gentler, almost poetic atmosphere.

Petőfi, Sándor (b. Jan. 1, 1823, Kiskőrös, Hung.—d. probably 1856, Siberia), one of the greatest Hungarian poets and a revolutionary who symbolized the Hungarian desire for freedom.

Petőfi had an eventful youth; he studied at eight different schools, joined for a short time a group of strolling players, and enlisted as a private soldier, but because of ill health was soon dismissed from the army. He traveled extensively in Hungary, mostly on foot. As a schoolboy he displayed a keen interest in the stage and in literature, and his first poem was published in 1842. After years of vicissitudes, in 1844, on the recommendation of Mihály Vörösmarty, then the leading Hungarian poet, he became an assistant editor of the literary periodical *Pesti Divatlap*. His first volume of poetry, *Versek,* appeared in the same year and made him famous at once, though the tone of his poems scandalized many. In 1847 he married Julia Szendrey, who inspired his best love poems.

Petőfi played a leading role in the literary life of the period preceding the outbreak of the Hungarian Revolution of 1848. After 1847, together with Mór Jókai, he edited the magazine *Életképek*. A fervent partisan of the French Revolution, he castigated the social conditions of his country, attacking the privileges of the nobles and the monarchy. Politically he was an extreme radical and an inspired agitator, but he was lacking in experience and failed to obtain a seat in the Diet. His poems glowed with political passion, and one of them, "Talpra magyar" ("Rise, Hungarian"), written on the eve of the revolution, became its anthem. During the revolution he became the aide-de-camp of General Jozef Bem, then head of the Transylvanian army, who had great affection for the somewhat unsoldierly but enthusiastic poet. Petőfi disappeared during the Battle of Segesvár, July 31, 1849. Though for many years his death at Segesvár had been assumed, in the late 1980s Soviet investigators found archives that revealed that he was one of some 1,800 Hungarian prisoners of war who were marched to Siberia. It is believed that he died of tuberculosis in 1856.

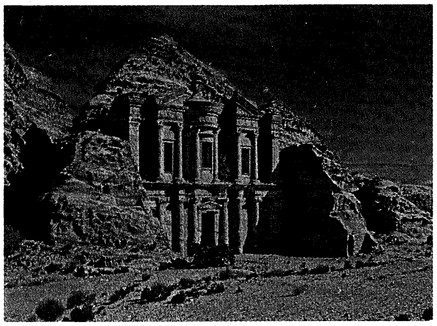
Petőfi's poetry is characterized by realism, humour, and descriptive power and imbued with a peculiar vigour. He introduced a direct, unpretentious style and a clear, unornamented construction adapted from national folk songs. This simplicity was the more arresting as it was used to reveal subtle emotions and political or philosophical ideas. Of his epic poems the *János vitéz* (1845), an entrancing fairy tale, is the most popular. Petőfi's popularity has never diminished in Hungary.

A critical edition of Petőfi's works by B. Varjas Béla was published in six volumes, 1948–56.

Petoskey, resort city, seat (1853) of Emmet county, northwestern Michigan, U.S., on Little Traverse Bay of Lake Michigan, 67 miles (108 km) northeast of Traverse City. Settled in 1852 and named for the Ottawa chief Pet-o-sega, it was the site of St. Francis Solanus Indian Mission (1859), which still stands. Originally a lumber town, it has turned to tourism and small manufacturing. Fine ski areas are nearby. The local beaches and gravel pits are searched by rock hounds for colourful and unusual fossilized stones, one of which—the Petoskey Stone—was adopted in 1965 as the official state stone. North Central Michigan (junior) College (1958) is located in the city. Inc. village, 1879; city, 1896. Pop. (1986 est.) 6,160.

Pëtr (Russian personal name): *see under* Peter.

Petra, Arabic BAṬRĀ, ancient city, centre of an Arab kingdom in Hellenistic and Roman times; its ruins are in southwest Jordan. The city was built on a terrace, pierced from east to west by the Wadi Mūsā (the Valley of Moses)—one of the places where, according to tradition, the Israelite leader Moses struck a rock and water gushed forth. The valley is enclosed by sandstone cliffs veined with shades of red and purple varying to pale yellow; and for this reason Petra is often called the "rose-red city."



The Nabataean rock-cut monument of ad-Dayr at Petra
Brian Brake—Rapho/Photo Researchers—EB Inc.

The Greek name Petra ("Rock") probably replaced the biblical name Sela. The site is usually approached from the east by a narrow gorge known as the Sik (or Siq; Wadi as-Sīk). Remains from the Paleolithic and the Neolithic periods have been discovered at Petra, and "Edomites" are known to have occupied the area in about 1200 BC; but little is known about the site up to about 312 BC, when the Nabataeans, an Arab tribe, occupied it and made it the capital of their kingdom. Under their rule, the city prospered as a centre of the spice trade.

When the Nabataeans were defeated by the Romans in AD 106, Petra became part of the Roman province of Arabia but continued to flourish until changing trade routes caused its gradual commercial decline. After an earthquake (not the first) damaged the city in AD 551, significant habitation seems to have ceased. The Islāmic invasion occurred in the 7th century, and a Crusader outpost is evidence of activity there in the 12th century. After the Crusades, the city disappeared from history until it was rediscovered by the Swiss traveler Johann Ludwig Burckhardt in 1812.

Excavations from 1958 on behalf of the British School of Archaeology in Jerusalem and the American School of Oriental Research added greatly to knowledge of Petra. Ad-Dayr ("The Monastery"; *c.* 3rd century AD) is one of Petra's best-known rock-cut monuments; it is an unfinished tomb facade that during Byzantine times was used as a church. The most noteworthy features of Petra are the tombs, many of which have elaborate facades and are now used as dwellings.

Petracha (Siamese king): *see* Phetracha.

Petralona skull, hominid fossil dating from possibly 70,000 years ago found in a cave near Thessaloníki, in eastern Greece, by two Greek archaeologists in 1960. The skull was found attached to a stalactitic column. The jaw was missing, but the cranium was almost complete.

The skull has a large brow and a slanting forehead, and, from the structure of the face, the jaw is estimated to have been larger than the known Neanderthal man. Nevertheless, the skull is considered to belong to an early Neanderthal type that is comparable to that of Kabwe man (found in Africa) and also related to certain European equivalents.

Petrarch, Italian in full FRANCESCO PETRARCA (b. July 20, 1304, Arezzo, Tuscany [Italy]—d. July 18/19, 1374, Arqua, near Padua, Carrara), Italian scholar, poet, and Humanist whose poems addressed to Laura, an idealized beloved, contributed to the Renaissance flowering of lyric poetry. Petrarch's inquiring mind and love of classical authors led him to travel, visiting men of learning and searching monastic libraries for classical manuscripts. He was regarded as the greatest scholar of his age.

Education and early poems. Petrarch's father, a lawyer, had been obliged to leave Florence in 1302 and had moved to Arezzo, where Petrarch was born. The family eventually moved to Avignon (1312), in the Provence region of southern France, the home of the exiled papal court, at which an Italian lawyer might hope to find employment. Petrarch's first studies were at Carpentras, Fr., and at his father's insistence he was sent to study law at Montpellier, Fr. (1316). From there he returned to Italy with his younger brother Gherardo to continue these studies at Bologna (1320). But already he was developing what, in a later letter, he described as "an unquenchable thirst for literature."

Petrarch's earliest surviving poems, on the death of his mother, date from the Montpellier and Bologna period, though like all Petrarch's work they were heavily revised later. Meanwhile, his knowledge and love of the classical authors increasing, he made his acquaintance with the new vernacular poetry that was being written. After his father's death, in 1326, Petrarch was free to abandon his law studies and pursue his own interests. Returning to Avignon, he took minor ecclesiastical orders and entered the household of the influential cardinal Giovanni Colonna. Petrarch enjoyed

Petrarch, portrait miniature within the illuminated initial *a* from *De remediis utriusque fortunae* by Petrarch, completed 1366; in the Biblioteca Nazionale Marciana, Venice (Cod. Marc. Lat. VI, 86)
By courtesy of the Biblioteca Nazionale, Venice

life in Avignon, and there is a famous description of him and his brother as dandies in its polished courtly world; but he was also making a name there for his scholarship and the elegance of his culture.

As well as a love of literature, Petrarch also had during his early youth a deep religious faith, a love of virtue, and an unusually deep perception of the transitory nature of human affairs. There now followed the reaction—a period of dissipation—which also coincided with the beginning of his famous chaste love for a woman known now only as Laura. Vain attempts have been made to identify her, but Petrarch himself kept silent about everything concerning her civil status, as though he thought it unimportant. He first saw her in the Church of St. Clare at Avignon on April 6, 1327, and loved her, although she was outside his reach, almost until his death. From this love there springs the work for which he is most celebrated, the Italian poems (*Rime*), which he affected to despise as mere trifles in the vulgar tongue but which he collected and revised throughout his life.

Classical studies and career (1330–40). He spent the summer of 1330 at Lombez, Fr., the bishop of which was an old friend from Bologna, Giacomo Colonna. In 1335 he received a canonry there but continued to reside at Avignon in the service of the Cardinal, with whom he stayed until 1337. Quite apart from his love for Laura, this period was an important one for Petrarch. These were years of ambition and unremitting study (notably in the field of classical Latin). They were also years of travel. In 1333 his journeying took him through France, Flanders, Brabant, and the Rhineland, where he visited men of learning and searched monastic libraries for "lost" classical manuscripts (in Liège he discovered copies of two speeches by Cicero). In Paris he was given a copy of the *Confessions* of St. Augustine by a friend and spiritual confidant, the Augustinian monk Dionigi of Sansepolcro, and he was to use this more and more as the breviary of his spiritual life.

These experiences bring Petrarch's mission as a stubborn advocate of the continuity between classical culture and the Christian message more sharply into focus. By making a synthesis of the two seemingly conflicting ideals—regarding the one as the rich promise and the other as its divine fulfillment—he can claim to be the founder and great representative of the movement known as European Humanism. He rejected the sterile argumentation and endless dialectical subtleties to which medieval Scholasticism had become prey and turned back for values and illumination to the moral weight of the classical world. In 1337 he visited Rome for the first time, to be stirred among its ruins by the evident grandeur of its past. On returning to Avignon he sought a refuge from its corrupt life—the papacy at this time was wholly absorbed in secular matters—and a few miles to the east found his "fair transalpine solitude" of Vaucluse, which was afterward to become a much-loved place of retreat.

The chronology of Petrarch's writings is somewhat complicated by his habit of revising, often extensively. By the time he discovered Vaucluse, however, he had written a good many of the individual poems that he was to include in the *Epistolae metricae* (66 "letters" in Latin hexameter verses) and some of the vernacular *Rime* inspired by his love for Laura. At Vaucluse he began to work on *Africa,* an epic poem on the subject of the Second Punic War. He also began work on *De viris illustribus,* intended as a series of biographies of heroes from Roman history (later modified to include famous men of all time, beginning with Adam, as Petrarch's desire to emphasize the continuity among ideals of the Old Testament, of the classical world, and of Christianity increased).

Moral and literary evolution (1340–46). Meanwhile, his reputation as a scholar was spreading; in September 1340 he received invitations from Paris and Rome to be crowned as poet. He had perhaps sought out this honour, partly from ambition but mainly in order that the rebirth of the cult of poetry after more than 1,000 years might be fittingly celebrated. He had no hesitation in choosing Rome, and accordingly he was crowned on the Capitoline Hill on April 8, 1341, afterward placing his laurel wreath on the tomb of the Apostle in St. Peter's Basilica: again, the symbolic gesture linking the classical tradition with the Christian message.

From Rome he went to Parma and the nearby solitude of Selvapiana, returning to Avignon in the autumn of 1343. It is generally believed that he went through some kind of moral crisis at this time, rooted in his inability to make his life conform to his religious faith and possibly heightened by his brother's decision to enter a Carthusian monastery. At any rate, this is a common reading of the *Secretum meum* (1342–43). It is an autobiographical treatise consisting of three dialogues between Petrarch and St. Augustine in the presence of Truth. In it he maintains hope that, even amidst worldly preoccupations and error, even while absorbed in himself and his own affairs, a man might still find a way to God. Thus, Petrarch's spiritual "problem" found a coherent solution, one that can be said to express the Petrarchan vision and the Humanist's religious and moral outlook.

It was therefore an evolution—both moral and literary—rather than a "crisis" that made Petrarch decide his love for Laura was love for the creature rather than for the Creator and therefore wrong—proof of his attachment to the world. It was an evolution in his thinking that led him to break through the barriers of his too-exclusive admiration for antiquity and to admit other authoritative voices. It was now, for example, that *De viris* was enlarged to include material from sacred as well as secular history, while in the *De vita solitaria* (1346) he developed the theoretical basis and description of the "solitary life" whereby man enjoys the consolations of nature and study together with those of prayer.

Break with his past (1346–53). The events of the next few years are fundamental to his biography, both as a man and as a writer. In the first place, he became enthusiastic for the efforts of Cola di Rienzo to revive the Roman republic and restore popular government in Rome—a sympathy that divided him still more sharply from the Avignon court and in 1346 even led to the loss of Cardinal Colonna's friendship. The Plague of 1348, known as the Black Death, saw many friends fall victim, including Laura, who died on April 6, the anniversary of Petrarch's first seeing her. Finally, in the jubilee year of 1350 he made a pilgrimage to Rome and later assigned to this year his renunciation of sensual pleasures.

These are the landmarks of Petrarch's career, but the time in between was filled with diplomatic missions, study, and immense literary activity. In Verona in 1345 he made his great discovery of the letters of Cicero to Atticus, Brutus, and Quintus, which allowed him to penetrate the surface of the great orator and see the man himself. The letters spurred him on to write epistles to the ancient authors whom he loved and to make a collection of his own letters that he had scattered among his friends. These great collections record not only Petrarch's genius for friendship but also all those shifts in attitude by which he left behind the Middle Ages and prepared for the Renaissance. Toward the end of 1345 he returned again to the peace of Vaucluse and spent two years there, chiefly revising *De vita solitaria* but also developing the theme of solitude in a specifically monastic context, in *De otio religioso.* Between November 1347 and his pilgrimage to Rome in 1350 he was also in Verona, Parma, and Padua. Much of the time was spent in advancing his career in the church; the manoeuvring and animosities this involved resulted in an intense longing for the peace of Vaucluse; not even a visit from his lifelong friend the poet Boccaccio, who offered him a chair to be established under his guidance in the University of Florence, could deflect him. He left Rome in May 1351 for Vaucluse.

Here he worked on a new plan for the *Rime.* The project was divided into two parts: the *Rime in vita di Laura* ("Poems During Laura's Life") and the *Rime in morte di Laura* ("Poems After Laura's Death"), which he now selected and arranged to illustrate the story of his own spiritual growth. The choice of poems was further governed by an exquisite aesthetic taste and by a preference for an approximately chronological arrangement, from the description of his falling in love to his final invocation to the Virgin; from his "youthful errors" to his realization that "all worldly pleasure is a fleeting dream"; from his love for this world to his final trust in God. The theme of his *Canzoniere* (as the poems are usually known) therefore goes beyond the apparent subject matter, his love for Laura. For the first time in the history of the new poetry, lyrics are held together in a marvellous new tapestry, possessing its own unity. By selecting all that was most polished and at the same time most vigorous in the lyric tradition of the preceding two centuries and filtering it through his new appreciation of the classics, he not only bequeathed to humanity the most limpid and yet passionate, precise yet suggestive, expression of love and grief, of the ecstasies and sorrows of man, but also created with his marvellous sensibility the form and language of the modern lyric, to provide a common stock for lyric poets of the whole of Europe.

He also continued work on the *Metricae,* begun in 1350; he embarked on a polemic against the conservative enemies of his new conception of education, which rejected the prevailing Aristotelianism of the schools and restored the spiritual worth of classical writers—the new studies to be called *litterae humanae,* "humane letters." He also began work on his poem *Trionfi,* a more generalized version of the story of the human soul in its progress from earthly passion toward fulfillment in God.

Later years (1353–74). But the death of his closest friends, dislike of the newly elected pope, Innocent VI, increasingly bitter relations with the Avignon court, all finally determined Petrarch to leave Provence. He found rooms in Milan and stayed there for most of the next eight years. During these eight years he also completed the first proper edition of the *Rime,* continued assiduously with the *Familiares,* worked on the *Trionfi,* and set in order many of his earlier writings.

Early in 1361 he went to Padua, hoping to escape the Plague. He remained there until September 1362, when, again a fugitive from the Black Death, he sought shelter in Venice. He was given a house, and in return Petrarch promised to bequeath all his books to the republic. He was joined by his daughter Francesca, and the tranquil happiness of her little family gave him great pleasure. He was visited by his dearest and most famous friends (including the great chancellor Benintendi de' Ravegnani and Boccaccio, who presented him with a long-desired Latin translation of Homer's poems); he was invited to play an honourable part in the life and politics of the city; he worked peacefully but with great concentration at the definitive versions of his various writings. Nevertheless, after receiving an insult from four young men who followed the Arab "naturalist" interpretation of Aristotle's work, Petrarch was induced to move back to Padua in 1367. He remained there until his death, dividing his time from 1370 between Padua and Arquà, in the neighbouring Euganean hills, where he had a little house. There he wrote the defense of his Humanism against the critical attack from Venice, *De sui ipsius et multorum ignorantia.* He was still in great demand as a diplomat; in 1370 he was called to Rome by Urban V, and he set off eager to see the fulfillment of his great dream of a new Roman papacy, but at Ferrara he was seized by a stroke. Yet he did not stop working; in addition to revision he composed more minor works and added new sections to his *Posteritati,* an autobiographical letter to posterity that was to have formed the conclusion to his *Seniles*; he also composed the final sections of the *Trionfi.* Petrarch died in 1374 while working in his study at Arquà and was found the next morning, his head resting on a manuscript of Virgil.

The hallmark of Petrarch's thought was a deep consciousness of the past as the nutriment of the present. His abiding achievement was to recognize that, if there is a Providence that guides the world, then it has set man at the centre. Petrarch provided a theoretical basis for the enrichment of man's life. But, even more important, the Humanist attitudes of the Italian 15th century that led into the Renaissance would not have been possible without him. (J.H.W./Ed.)

MAJOR WORKS. The chronology of Petrarch's works is difficult to ascertain because the poet habitually and heavily revised everything he wrote. His collected works (*Opera*) were published in 1554 and 1581. *Epistolae metricae* (he worked on the collection in three phases: 1350, 1357, and 1363; ed. by D. Rossetti, *Poesie minori del Petrarca,* 1831); *Africa* (begun 1338 or 1339; published posthumously 1396; critical edition by N. Festa, 1926); *De viris illustribus* (begun 1338–39; revised 1341–43, and again 1351–53; later replanned with the title *Quorundam virorum illustrium epithoma,* preface by Petrarch, completed by his disciple Lombardo della Seta; ed. by L. Razzolini, 1874–79); *Secretum meum* (1342–43, revised 1353–58; ed. by E. Carrara in *Prose,* 1955); *De vita solitaria* (1346 and later—one addition of 1371; ed. by G. Martellotti in *Prose,* 1955); *De otio religioso* (1347, revised and enlarged 1357; ed. by G. Rotondi, 1958); *Familiarium rerum libri xxiv* (arrangement of the letters begun 1351–53, i–viii; 1359–60, ix–xix; 1363–64, xx–xxiii; 1366, xxiv; critical edition by V. Rossi and U. Bosco, 1933–42); *De remediis utriusque fortunae* (begun 1354; published 1366; Petrarch probably returned to it later); *Senilium rerum libri* (after 1361 to 1374); *Posteritati* (first draft before 1367; additions 1370–72; ed. by E. Carrara and P.G. Ricci in *Prose,* 1955); *De sui ipsius et multorum ignorantia* (written 1367, published 1371; ed. by L.M. Cappelli, 1906).

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Petrassi, Goffredo (b. July 16, 1904, Zagarolo, near Rome), one of the foremost Italian composers of the 20th century.

After completing his musical studies he was appointed to the faculty of St. Cecilia Academy in Rome as professor of composition; in 1956 he taught composition classes at the Berkshire Music Center in Tanglewood, Mass., and throughout his career he toured widely as a conductor. Petrassi composed in a variety of styles. His early music shows the influence of Casella and Hindemith; his later, that of Stravinsky and Schoenberg. Choral composition, as in *Coro di morti* (1940–41), the cantata *Noche oscura* (1950–51), and *Orationes Christi* (1974–75), played a major role in his development. In his later compositions he displayed an interest in twelve-tone procedures, and several of his eight concerti for orchestra (1931–72) feature liberal doses of atonality. Petrassi's other works include operas, ballets, chamber and keyboard music, and songs.

Petre, Sir Edward, 2ND BARONET, byname FATHER PETRE (b. 1631, London—d. May 15, 1699, Watten, Flanders), English Jesuit, favourite of King James II of Great Britain.

Educated in France, he entered the Society of Jesus in 1652 and took orders in 1671,

Petre, engraving

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

when he returned to England. In 1679 he succeeded to the family baronetcy and estates and was appointed vice provincial of the English Jesuits but was imprisoned for suspected complicity in the Popish Plot (an alleged conspiracy to massacre Protestants, murder the King, and burn London). Released in 1680 by the influence of James (then duke of York), he was later blamed for the King's more extreme policies. James made Petre clerk to the closet (1686) and a member of the Privy Council (1687), but the King was unsuccessful in his attempt to persuade the Pope to make Petre a cardinal. Late in 1688 Petre fled abroad.

petrel, any of a number of seabirds of the order Procellariiformes, particularly certain members of the family Procellariidae, which also includes the fulmars and the shearwaters. Members of the family Hydrobatidae are increasingly called storm petrels; those of the Pelecanoididae are usually called diving petrels (*see* diving petrel; storm petrel).

Among the procellariid petrels, some two dozen species of the genera *Pterodroma* and *Bulweria* are called gadfly petrels because their flight is more fluttering than that of the related shearwaters (*see* shearwater). Certain heavy-bodied petrels are known as fulmars, and one, *Macronectes giganteus,* is called both giant fulmar and giant petrel (*see* fulmar).

Gadfly petrels nest in loose colonies on islands in the tropical and subtropical regions of the major oceans. A single egg (rarely two) is laid on the soil surface or in a burrow or crevice. The chick is tended by both parents and deserted about a week before it is fully fledged; it completes its development on stored fat. During the nonbreeding season, these birds roam the open ocean, feeding on squid and small fish. Most gadfly petrels are dark above and light beneath, with long wings and short, wedge-shaped tails. Because they are quite similar in appearance, the species are difficult to distinguish.

Some of the better known gadfly petrels are the endangered Bermuda petrel, or cahow (*Pterodroma cahow,* sometimes considered a race of *P. hasitata*); the dark-rumped petrel, also called the Hawaiian petrel (*P. phaeopygia*), another endangered species, now concentrated almost entirely on the island of Maui; the phoenix petrel (*P. alba*), which breeds on several tropical archipelagos; and the black-capped petrel, or diablotin (*P. hasitata*), formerly found throughout the West Indies but now known only in Haiti. Several other species, including the Chatham Island (or magenta) petrel, the Galápagos dark-rumped petrel, and the Réunion petrel, are also on the endangered list.

Several other procellariids are also called petrels. Among them are the pintado petrel, or Cape pigeon (*Daption capensis*), a sub-Antarctic species about 40 centimetres (16 inches) long, marked with bold patches of black and white. The snow petrel (*Pagodroma nivea*), 35 cm, a pure white species, and the Antarctic petrel (*Thalassoica antarctica*), 42 cm, a brown-and-white-pied species, are rarely seen outside Antarctic waters.

Petri, Laurentius, Swedish LARS PETERSSON (b. 1499, Örebro, Swed.—d. Oct. 26, 1573, Uppsala), Lutheran churchman, a leader of the Protestant Reformation in Sweden and the first Protestant archbishop of Uppsala (1531–73).

His influence was very great, although he was less dynamic and forceful than his brother Olaus. The Swedish Bible of 1541, for which he was principally responsible, was as important for Swedish life and literature as Luther's German translation was for the German-speaking peoples. His *kyrkoordning* (church order) of 1571 defined the practice of the church, particularly its relation to government. It went far toward establishing the independence of the church from the crown, which has been characteristic of most of the history of the Swedish Lutheran Church.

Petri, Olaus, Swedish OLOF PETERSSON (b. Jan. 6?, 1493, Örebro, Swed.—d. April 19, 1552, Stockholm), Lutheran churchman who, with his brother Laurentius, played a decisive role in the reformation of the Swedish church.

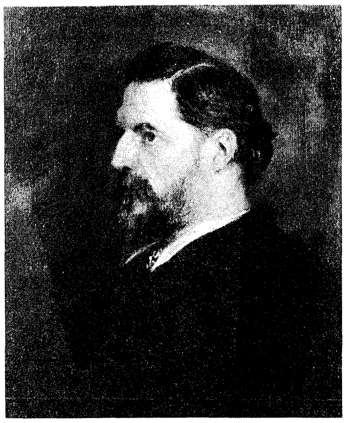
He studied at Wittenberg (1516–18) and absorbed the reformed teaching of Martin Luther and Philipp Melanchthon. When Gustavus Vasa was crowned king in 1523, Olaus had already attracted attention and criticism by his preaching. The Roman Catholic hierarchy was hostile to the King, who became a supporter of the reformed teaching. During the reign of Gustavus Vasa, Olaus rose in prominence and served briefly as chancellor (1531). Later, because he opposed the autocratic policy of the King, he fell from favour and was condemned to death in 1540, the sentence being remitted for a heavy fine. He regained favour, however, and was appointed pastor of Storkyrkan (the Cathedral of St. Nicholas) in Stockholm. Olaus provided most of the literature for the Swedish Reformation movement, including a Swedish New Testament, hymnbook, church manual, the Swedish liturgy, and many homiletical and polemical writings. His *Chronicle* is an important historical document.

Petrie, Sir (William Matthew) Flinders (b. June 3, 1853, Charlton, near Greenwich, London—d. July 28, 1942, Jerusalem), British archaeologist and Egyptologist who made valuable contributions to the techniques and methods of field excavation and invented a sequence dating method that made possible the reconstruction of history from the remains of ancient cultures. He was knighted in 1923.

Petrie was named for his maternal grandfather, Matthew Flinders, British navigator, pioneer hydrographer, and explorer of Australia and Tasmania. A frail child, Petrie was privately educated, early developing archaeological and ethnological interests, particularly in the area of ancient weights and measures, and in Egyptology.

At the age of 24, Petrie wrote *Inductive Metrology, or the Recovery of Ancient Measures from the Monuments,* a work that represented a new approach to archaeological study. Fieldwork done at various locations in Britain, including Stonehenge, enabled him to determine by mathematical computations the unit of measurement for the construction of the monument. His *Stonehenge: Plans, Description, and Theories* was published in 1880, and in that same year he began the surveys and excavation of the Great Pyramid at Giza, which initiated his four decades of exploration in the Middle East.

During the 1884 excavation of the Temple of Tanis, Petrie discovered fragments of a colossal statue of Ramses II. In 1885 and 1886, at Naukratis and Daphnae in the Nile delta, he uncovered painted pottery by which he proved that those sites had been trading colonies for the ancient Greeks. It was this discovery that caused him to believe that history could be



Petrie, detail of an oil painting by G.F. Watts; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

reconstructed by a comparison of potsherds (pottery fragments) at various levels of an excavation.

He first applied his principle of sequence dating in Palestine, at Tel Ḫasi, south of Jerusalem. In 1890, in a period of only six weeks, the indefatigable excavator found a series of occupations for which he supplied tentative dates of habitation. His work at the hill site marked the second stratigraphic study in archaeological history—the first was carried out at Troy by Heinrich Schliemann. The excavations of these two men marked the beginning of the examination of successive levels of a site, rather than the previously practiced method of haphazard digging, which had produced only a jumble of unrelated artifacts. Most of Petrie's contemporaries in archaeology questioned his hypothesis that chronology could be established by potsherds, whether painted or undecorated. But, with the progressive sophistication of the science of archaeology, examination and classification of broken pottery became, as it is now, routine procedure.

He made other important discoveries in the Fayyūm region of Egypt. At Gurob he found numerous papyri and Aegean pottery that substantiated dates of ancient Greek civilizations, including the Mycenaean. At the Pyramid of Hawara he searched through the tomb of Pharaoh Amenemhet III to discover how grave robbers could have found the tomb's opening and made their way through the labyrinth surrounding the two sarcophagi (stone coffins) that they emptied. He concluded that they must have been given the master plan by an informer. At al-Fayyūm also he made a rich find of 12th-dynasty jewelry (housed at the Metropolitan Museum in New York City since 1919). He was delighted by his discovery of the earliest-known Egyptian reference to Israel on the stela (a stone slab monument) of Merneptah, pharaoh of ancient Egypt from 1213 to 1204 BC.

In 1892 Petrie was made Edwards professor of Egyptology at University College, London, and he served in the position until 1933, when he became professor emeritus. In 1894 he founded the Egyptian Research Account, which in 1905 became the British School of Archaeology.

Petrie added to the knowledge of the pyramid builders during his exploration of the necropolis of Abydos, holy city of the cult of Osiris, god of the dead. At Tell el-Amarna he excavated the city of Akhenaten, or Amenhotep IV, ruler of Egypt from 1353 to 1336 BC, revealing the now-famous painted pavement and other artistic wonders of the Amarna age (14th century BC). Three thousand graves found by Petrie at Naqādah, northeast of Thebes, were identified as those of primitive ancient Egyptians.

In 1904 Petrie published *Methods and Aims in Archaeology,* the definitive work of his time, in which he lucidly defined the goals and methodology of his profession along with the more practical aspects of archaeology—details of excavation, including the use of cameras in the field. With uncommon insight, he noted that research results were dependent on the personality of the archaeologist, who, in addition to possessing broad knowledge, had to have insatiable curiosity. His own abundance of that characteristic was never questioned.

Inscriptions Petrie found on the Sinai Peninsula represented an intermediate stage (not later than 1500 BC) of written communication between Egyptian hieroglyphics and the Semitic alphabet. Although he wrote *The Formation of the Alphabet* (1912), language was not Petrie's forte, and he depended on a sixth sense for free translation of inscriptions and for establishing dates through the study of the forms of hieroglyphs.

Under the auspices of the American School of Research, he excavated in Palestine from 1927 until 1938, when he was 85. In those years, again at Tel Ḫasi, he uncovered the ruins of 10 cities. His scientific methods provided the guidelines for all subsequent Palestinian excavations. He died at Jerusalem at the age of 89. (G.J.P.)

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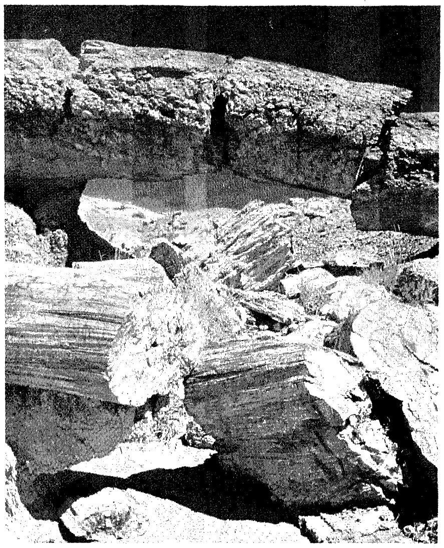
Petrified Forest National Park, national park in eastern Arizona, U.S., 18 miles (29 km) east of Holbrook. Established as a national monument in 1906 and as a national park in 1962, it occupies an area of 146 square miles (378 square km). The park features extensive exhibits of petrified wood in several "forest" areas. The park includes the inaccessible Black Forest in the Painted Desert (*q.v.*), a badlands region of colourful wind-eroded hills near the north entrance, where Pilot Rock (6,235 feet [1,900 m]), the park's highest point, is located. Other sections (Blue Mesa, Jasper, Crystal, and Rainbow forests) of the park are mostly filled with fossilized leaves, plants, and broken logs. Other features include petroglyphs (such as Newspaper Rock) and ancient Indian Pueblo ruins, notably the Puerco Indian Ruin (just south of the Painted Desert) and the Rainbow Forest Museum near the south entrance.

The park's elevation, which ranges from 5,300 feet (1,600 m) to Pilot Rock's 6,235 feet (1,900 m), and annual precipitation, which is less than 10 inches (250 mm), are the primary factors in determining the type of plant and animal life. Many of the plants are small and

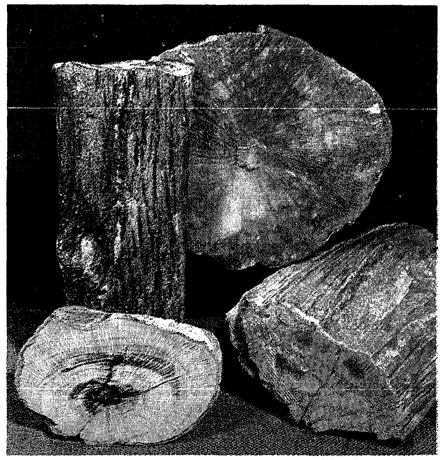


Natural bridge in the Blue Mesa section of the Petrified Forest National Park, Arizona

David Muench—EB Inc.

inconspicuous, but they include some that blossom in spring—yuccas, mariposa lilies, and cacti—and others that provide summer flowers—asters, rabbit brush, and sunflowers. Wildlife includes coyotes, bobcats, antelopes, rattlesnakes, lizards, and a variety of birds, notably the horned lark, rock wren, and phoebe.

petrified wood, fossil formed by the invasion of minerals into cavities between and within cells of natural wood, usually by silica (silicon dioxide, SiO_2) or calcite (calcium carbonate, $CaCO_3$). The petrified forests of the western United States are silicified wood, the tree



Petrified wood from (top left) Coal City, Ill.; (top right) Holbrook, Ariz.; (bottom left) Clover Creek, Lincoln City, Idaho; (bottom right) Arizona

By courtesy of the Field Museum of Natural History, Chicago, and Joseph and Helen Guetterman collection; photograph, John H. Gerard—EB Inc.

tissues having been replaced by chalcedony (cryptocrystalline quartz). Often this replacement is so accurate that the internal structure as well as the external shape is faithfully represented; sometimes even the cell structure may be determined.

Petrillo, James C(aesar) (b. March 16, 1892, Chicago—d. Oct. 23, 1984, Chicago), American labour leader who served as president of the American Federation of Musicians (AFM) from 1940 to 1958.

Petrillo grew up on Chicago's west side and, after a brief period as a trumpet player and band leader, became active in an independent musicians' union and served as its president for three years. Defeated for reelection, he joined the local chapter of the American Federation of Musicians in Chicago in 1918. In

1922 he became president of the Chicago local. Active in Democratic political circles, Petrillo used a position on Chicago's Park Board to initiate free summer concerts in Grant Park—a practice that has continued since 1936.

In 1940 Petrillo was elected national president of the AFM; and from that date until his retirement in 1958 he fought on many different fronts to protect his membership from changes wrought by technological change in the entertainment and recording industry.

Petrine theory, the basis of Roman Catholic doctrine on papal primacy, resting partly on Christ's bestowing the "keys of the Kingdom" on Peter (the first pope, according to Catholic tradition), and partly on Christ's words: "And I tell you, you are Peter [Greek: *Petros*], and on this rock [Greek: *petra*] I will build my church" (Matt. 16:18). *See also* pope.

Petrobrás, abbreviation of PETRÓLEO BRASILEIRO SA, Brazilian, largely government-owned monopoly formed on Oct. 3, 1953, to prospect and extract crude oil, natural gas, and related hydrocarbons; to refine domestic and imported petroleum; and to transport oil and gas and their derivatives. The largest joint-stock, limited-liability company in Brazil, it is an operating company, whereas the National Petroleum Council (Conselho Nacional do Petróleo), a government agency, establishes policies and oversees the overall development of the petrochemical industry. Headquarters are in Rio de Janeiro.

Although largely devoted to developing petroleum sources in Brazil, on land and offshore, Petrobrás also has interests in oil fields in such areas as the Middle East, North Africa, and Colombia. A subsidiary, Interbrás (Petrobrás Comércio Internacional SA) is an export-import company trading in a variety of products, such as foods, fertilizers, metals, tractors, clothing, and textiles. Other subsidiaries and associated companies produce or develop fertilizers, minerals, and other industrial products.

petrochemical, any of a large group of chemicals (as distinct from fuels) derived from petroleum and natural gas and used for a variety of commercial purposes. Petrochemical production is highly automated, typically using large-scale continuous processes. The largest outlets for petrochemical raw materials are the manufacture of plastics, fibres, synthetic rubbers, detergents, fertilizers, insecticides, and solvents; such diverse industries as automobile, aviation, textile, explosives, and paint manufacturing, food processing, agriculture, and construction use petrochemicals.

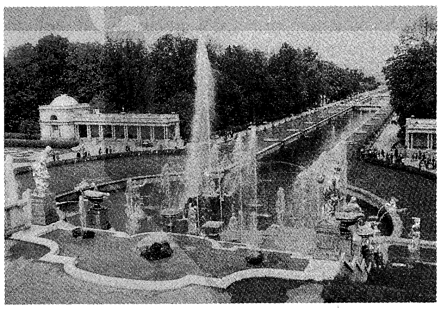
The petrochemical industry received its chief impetus in 1913 from the development of the thermal cracking process by which crude petroleum was refined. The process yielded gaseous by-products that were at first used only as illuminating gas or as fuel, but were found useful as chemical raw materials in the 1920s and 1930s. The introduction of catalytic cracking in 1937 and increased supplies of natural gas brought further expansion of the industry.

Hydrocarbons produced by petroleum refining methods are converted by polymerization to plastics, synthetic rubbers, and synthetic fibres of superior hardness, flexibility, or strength.

Ethylene and propylene, produced by thermal cracking since 1913, provide raw materials for many chemicals. From ethylene are manufactured ethylene glycol, used in polyester fibres and resins and in antifreezes; ethyl alcohol, a solvent and chemical reagent; polyethylene, for film and plastics; styrene, for resins, synthetic rubber, plastics, and polyesters; ethylene dichloride, for vinyl chloride, used in plastics and fibres; and ethyl chloride, for tetraethyllead, an anti-knock additive in gasoline. Propylene is processed into isopropyl alcohol, used as a solvent and convertible to acetone, also a solvent; acrylonitrile, for acrylics, resins, and synthetic rubber; cumene, for phenol, used in resins, adhesives, plastics, and detergents and convertible to the components of nylon-6,6; polypropylene, for plastics, fibres, and film; propylene oxide, for propylene glycol and polyurethane; epichlorohydrin for glycerol and epoxy resins; and polyisoprene for synthetic rubber. From the butanes and butylenes come butadiene, for synthetic rubber and plastics; isobutylene, for synthetic rubber; and polybutene, for oil additives, sealants, caulking compounds, and adhesives.

The aromatic compounds benzene, toluene, the xylenes, and naphthalene yield a variety of products. Benzene is processed into alkylbenzenes, used in surfactants, and cyclohexane, from which nylon is manufactured; toluene is used for solvents, gasoline, and explosives; xylene for solvents and gasoline; naphthalene for insecticides. Chemicals derived from methane, a major constituent of natural gas, include carbon black, a pigment and strengthening agent for rubber; methyl alcohol for formaldehyde, synthetic resins, and solvents; chloromethanes, for refrigerants, solvents, aerosol propellants, and cleaning fluids; and acetylene, for vinyl acetate, used in adhesives, water-based paints, textiles, and paper manufacturing.

Petrodvorets, also spelled PETRODVOREC, formerly (until 1944) PETERHOF, Russian PETERGOF, city, Leningrad *oblast* (administrative region), northwestern Russian Soviet Federated Socialist Republic, on the southern shore of the Gulf of Finland, 18 mi (29 km) southwest of the city of Leningrad. Peter I the Great founded Peterhof in 1709 as a country estate. After visiting the French court in 1717, he decided to make Peterhof into an imperial residence that would rival Versailles. The Baroque Grand Palace (completed 1721) was designed by Domenico Trezzini and the palace's gardens by Alexandre Le Blond; Bartolomeo Rastrelli enlarged the structure in 1752. Peterhof subsequently became the most lavish and popular of the Russian royal summer residences. Nicholas II spent much time in Peterhof and the last tsarevich (heir apparent of a Russian tsar) in the Romanov line, Aleksey Nikolayevich, was born there in 1904.



The Grand Cascade in the gardens of the Baroque Grand Palace, Petrodvorets, Russian S.F.S.R.
Valerie J. Edessis—EB Inc.

The modern city of Petrodvorets is a rail terminus, port, and resort centre. The products of the surrounding agricultural area consist of lumber, dairy cattle, pigs, vegetables, and potatoes. Industries in the city include watch factories and lapidary works. Many workers commute to Leningrad by way of a suburban train line. The Grand Palace (now a museum); the 39 mi of canals that connect the intricate system of fountains, as well as pavilions, small palaces, and gardens; and the noted statue of Samson Rending the Lion's Jaws (sculpted by Mikhail Kozlovsky in 1802) are today part of the 2,500-ac (1,000-ha) area known as the Palace-Museums and Parks of the City of Petrodvorets. Pop. (1983 est.) 76,000.

Petrofina SA, major Belgian petroleum conglomerate, engaged in the exploration for and production of crude oil, oil refining, and petrochemical production. Headquarters are in Brussels.

The company was organized in 1920 as the Compagnie Financière Belge des Pétroles, with its initial interest in the development of Romanian oil fields and of Belgian interests in Africa. It assumed its present name in 1957.

Until 1962 the company's main efforts were directed toward petroleum distribution and refining, and to establishing associated companies in the United States and Canada. Since 1962 Petrofina has shown increasing interest in manufacturing petrochemicals, and the company has become one of the world's largest ethylene producers. It also produces polypropylene, polystyrene, and related products. Other products include paints and varnishes, fatty acids, emulsifiers and detergents, plastics, and materials for road construction. The company has petrochemical manufacturing facilities in Belgium and the United States.

As an integrated petroleum company, Petrofina engages in exploration, production of crude oil, refining, and distribution. Its exploration activities have become concentrated primarily in the North Sea and North America. It has refineries in Europe, America, and Angola, and sells much of its petroleum output through its own retail outlets.

Petrograd (Russian S.F.S.R.): *see* Leningrad.

Petrokrepost, formerly (until 1611) ORESHEK, (1611–1702) NOTEBURG, and (1702–1944) SHLISSELBURG, town, Leningrad *oblast* (administrative region), northwestern Russian Soviet Federated Socialist Republic, on the Neva River where it flows out of Lake Ladoga, east of Leningrad city. Founded as Oreshek in 1323 by the Republic of Novgorod, it was captured in the early 17th century by the Swedes, who built the fortress of Noteburg. Taken by Peter I the Great in 1702, it was renamed Shlisselburg and became a key fortress protecting St. Petersburg. Later used as a prison, Shlisselburg again played a fortress role in the defense of Leningrad in World War II. Renamed Petrokrepost in 1944, it is a shipbuilding and repair centre on the White Sea–Baltic Canal. Pop. (latest census) 7,100.

petrol: *see* gasoline.

petrolatum: *see* petroleum jelly.

Petróleo Brasileiro SA (Brazilian company): *see* Petrobrás.

Petróleos de Venezuela, SA, state-owned Venezuelan company created through the nationalization of the petroleum industry on Jan. 1, 1976. It earns the largest share of Venezuela's foreign exchange, and its revenues support about three-fourths of the national budget. Headquarters are in Caracas.

By 1971 Venezuela had begun to take steps to curb the control and influence of the foreign concessionaires who, since their arrival soon after World War I, had been exploiting the nation's oil fields. The state barred the sale of additional concessions, nationalized concessions already sold but not yet exploited, and set a timetable for expropriation of ongoing operations.

Since the nationalization of the industry, Petróleos de Venezuela has been engaged in the exploration, refining, and marketing of oil, petrochemicals, and natural gas, including the export of petroleum and petroleum products. The company is also responsible for supervising and planning the controlled use of Venezuela's proven oil reserves. A member of the Organization of Petroleum Exporting Countries, the company tends to be a voice of moderation within that group.

Petróleos Mexicanos, byname PEMEX, state-owned Mexican company, a producer, refiner, and distributor of oil, natural gas, and petroleum derivatives. Pemex is the largest Latin-American oil company. Headquarters are in Mexico City.

Commercial production of crude oil in Mexico began in 1901 at Ebano, near Tampico, and, during the first quarter of the 20th century, Mexico produced nearly one-fourth of the world's oil annually. The development of huge oil fields in Texas and the Middle East and the rapid exhaustion of some of Mexico's oil reservoirs, however, diminished Mexico's share of total world production. Following prolonged controversy, the government expropriated all foreign oil interests in 1938 and set up Pemex to manage the consolidated industry.

Since its formation, Pemex has carried on a vigorous exploration program, sinking hundreds of exploration and development wells per year. Under Mexican president José López Portillo, Pemex in the 1970s began the exploitation of huge, newly discovered oil reserves in Tabasco and Chiapas states. His government's ambitious expansion of Pemex's extraction and processing capabilities led to the tripling of Mexico's crude oil production in the years from 1976 to 1982.

The company is an integrated petroleum company, engaging in oil and gas exploration, production, refining, transportation, storage, distribution, and sales. Most of the production comes from the state of Veracruz and the rest from Tabasco, which also produces almost half the country's natural gas. Additional large reserves have been exploited in the Gulf of Mexico. The company has been a major world exporter of fossil fuel since Mexico became self-sufficient in crude oil in 1974.

petroleum, complex mixture of hydrocarbons that occurs in the Earth in liquid, gaseous, or solid forms; the term is usually restricted to the liquid form, commonly called crude oil. Both liquid and gaseous phases of petroleum occur naturally underground and, taken together, constitute the most important of the primary fossil fuels.

A brief treatment of petroleum follows. For full treatment, *see* MACROPAEDIA: Fuels, Fossil; Industries, Extraction and Processing. For statistical data on production, reserves, and trade, *see* MICROPAEDIA: mining (table).

Petroleum was known to many ancient peoples through surface seepages. Excavations in Iran, Iraq, and elsewhere show that bitumen, or asphalt, a form of petroleum, was used to caulk ships, to build roads, and for other purposes. Europeans of the age of exploration found similar seepages of the black liquid in the Americas and in Indonesia.

The first important modern use of petroleum was as an illuminating fuel to replace whale oil in lamps. The first well drilled specifically for oil was that of E.L. Drake at Titusville, Pa., in 1859; within a few decades oil drilling was widespread in the United States, Europe, the Middle East, and East Asia. The development of the automobile gave petroleum a new and swiftly expanding role as the primary source of gasoline. Petroleum also is the source of kerosene, gas oil, lubricating oil, and residual fuel oil. It is refined and processed into numerous other products, such as solvents, paints, asphalt, plastics, synthetic rubber, fibres, soaps and cleansing agents, waxes and jellies, medicines, explosives, and fertilizers.

Petroleum is derived from aquatic plants and animals that lived and died hundreds of millions of years ago. Their remains mixed with mud and sand in layered deposits that, over the millennia, were geologically transformed into sedimentary rock. Gradual decomposition of the organic matter contributed to the production of petroleum in the rock structures. Since the Paleozoic era (from about 570 million to 245 million years ago), the organic matter has been slowly moving from the original compacting clays to more porous and permeable rocks, such as sandstones and siltstones, where it finally became entrapped. Such entrapped accumulations of oil are called pools. A series of pools within a common reservoir rock structure or a series of pools in separate but neighbouring reservoir rock formations is commonly referred to as an oil field. A group of oil fields in similar geologic environments is known as a petroleum province.

Crude petroleum, pumped from the Earth through drilled wells, is costly to locate, recover, and process, but it is the world's largest energy source, accounting for approximately 39 percent of all energy consumed. The Middle East, the Soviet Union, and the United States are the world's leading petroleum producers; the United States is the largest consumer, and the Soviet Union is second.

Crude oils vary considerably in their compositions, but the major components are hydrocarbons (compounds of hydrogen and carbon). Despite the variations in the molecular structure of the compounds, most crude oils contain from 82 to 87 percent carbon by weight and from 12 to 15 percent hydrogen. Most crude oils contain a mixture of three series of compounds—paraffin, naphthene, and aromatic. The paraffin series is the broadest, extending from methane, which forms natural gas, through the liquids that are refined into ordinary gasoline, to crystalline waxes. The naphthene series ranges from volatile liquids to tarry asphalts. The chief member of the aromatic series is benzene. Petroleums also vary in their physical properties, such as volatility, colour, and specific gravity.

Almost all crude oil comes from beneath the Earth's surface, but a few petroleum lakes, or tar pits, are known (a good example is the La Brea Tar Pits in Los Angeles). The extraction of petroleum and natural gas from the Earth involves three basic steps: prospecting, drilling, and recovery. About four-fifths of the world's proved petroleum reserves in land areas have now been developed, and development of offshore deposits has assumed increasing importance since 1960.

In oil exploration, geologic techniques can determine only the existence of rock formations that are favourable for oil deposits, not whether oil is actually there. Drilling is the only sure way to ascertain the presence of oil. With modern rotary equipment, wells can be drilled to depths of more than 7,600 m (25,000 feet). Once oil is found, it may be recovered (brought to the surface) by various methods. Underground pressure created by natural gas or water within the reservoir can force the oil up; if the natural pressure is not great enough, it can be raised by artificially injecting water or steam into the reservoir through a well. Enhanced recovery processes may be utilized to increase production. These processes involve injecting such substances as carbon dioxide, polymers, and solvents into a reservoir to reduce oil viscosity and capillarity. Thermal recovery methods are frequently used to enhance the production of heavy crude oils, whose extraction is impeded by viscous resistance to flow at reservoir temperatures.

Petroleum is transported to refineries by pipelines, which can often carry more than 500,000 barrels per day, or by oceangoing tankers. The basic refinery process is distillation, which separates the crude oil into fractions of differing volatility. After the distillation, other physical methods are employed to separate the mixtures, including absorption, stripping, solvent extraction, and crystallization.

After physical separation into such constituents as gasoline, kerosene, and lubricating oils, selected petroleum fractions may be subjected to chemical conversion processes, such as cracking and reforming. In the most general terms, cracking breaks the large molecules of hard-to-use heavy oils into the smaller molecules that form their lighter, more valuable fractions. Reforming changes the structure of a molecule without breaking it to pieces; the process is widely used to raise the octane number of gasolines obtained by distillation of paraffinic crude oils. Both cracking and reforming can be brought about by simply heating the petroleum fraction to high temperatures (thermal processes) or by bringing them into contact with certain reagents (catalytic processes).

petroleum engineering, field of engineering that involves the optimized development and exploitation of crude oil and natural gas fields, as well as the technical analysis and forecasting of these fields' future performance. In general, petroleum engineers are not involved in the exploration for new fields, but they may contribute to a joint effort of geologists, geophysicists, and engineers in such endeavours. Petroleum engineers are responsible for the development and production of oil reservoirs after discovery.

A brief treatment of petroleum engineering follows. For full treatment, *see* MACROPAEDIA: Engineering; Industries, Extraction and Processing.

Petroleum engineering as a discipline may be said to have started with the drilling of the first oil well in Titusville, Pa., in 1859. For many years the United States, relying more on petroleum than other industrialized nations, contributed the most to the development of this profession. The first college department of petroleum engineering in the United States was established in 1914, and many more petroleum engineering programs began in the 1920s and '30s. By the mid-1980s more than two dozen colleges offered degrees in petroleum engineering in the United States, and similar programs existed in other oil-producing countries.

The first topics of concern to the original colleges were the areas of operations and machinery. As progress in petroleum recovery was made, more importance was placed on ways to maximize the amount of oil recovered from a given reservoir; such topics of study as reservoir characterization, reservoir behaviour, and mathematical simulation using computers began to be emphasized. Major areas of current attention and future importance are tied to computer simulation of drilling, fluid flow in pipe and reservoir rocks, and recovery processes.

There are many areas of specialization in petroleum engineering. The drilling of exploratory wells requires engineers to design, plan, and supervise drilling operations. After a new reservoir has been discovered, drilling engineers are responsible for drilling development wells and preparing them for production. Engineering efforts during this stage concentrate on keeping drilling costs to a minimum while ensuring that the completed well is capable of efficient production of oil and gas from the reservoir.

After wells are completed and ready for production, production engineers design the equipment needed to pump fluids to the surface; to separate oil, gas, and water; and to store or transport the oil and gas. Production engineers are responsible for the efficient operation of producing wells and for the redesign of any well equipment or surface facilities.

Another type of petroleum engineer specialist is called a log analyst, whose reponsibilities include evaluating data gathered on wells immediately after drilling. The log analyst determines reservoir properties such as thickness, areal extent, and the saturations of oil, gas, and water. These parameters are needed for calculating the amount of oil and gas in the reservoir.

Reservoir engineers are responsible for the overall recovery of petroleum from a reservoir. They study the reservoir's past behaviour in order to forecast the future and ultimate recovery. The reservoir engineer determines if the use of secondary recovery or enhanced oil recovery techniques would be profitable.

All petroleum engineers, regardless of their area of specialization, must do economic evaluations to determine which of several options or choices will yield optimum results. These conclusions are then presented to company management. The analytical methods used by petroleum engineers are similar to most other types of engineering, the major difference being that the petroleum reservoir exists far underground—frequently several thousand to 20,000 feet deep. This remoteness means that most petroleum-engineering calculations are based on indirect and imperfect measurements of underground phenomena.

Equipment and analytical procedures have been developed for measuring properties of the reservoir rock and fluids, flow rates and pressures, downhole pump operation, and wellbore measurements while drilling. All these and other data are analyzed to assist the petroleum engineer. Computers have assumed increased importance in analyzing data.

Petroleum Exporting Countries, Organization of (OPEC), multinational organization established to coordinate the petroleum policies of its members and to provide the member states with technical and economic aid. The organization was established in September 1960 and formally constituted in January 1961 by Iran, Iraq, Kuwait, Saudi Arabia, and Venezuela. Members admitted since OPEC was founded include Qatar (1961), Indonesia and Libya (1962), Abu Dhabi (1967; membership transferred to the United Arab Emirates in 1974), Algeria (1969), Nigeria (1971), Ecuador (1973), and Gabon (1975). The headquarters of OPEC, initially in Geneva, were moved to Vienna in 1965. Policy is formulated at conferences of delegates from member countries, which meet at least twice a year. Conference decisions are made on the principle of unanimity.

OPEC decisions began to be of major importance in the world oil market at its 35th conference in Vienna in September–October 1973, when it raised oil prices by 70 percent. The dominant Middle Eastern members of OPEC used succeeding price increases as a political weapon aimed at Western nations in retaliation for their support of Israel against its Arab neighbours in the so-called Yom Kippur War of October 1973. Prices were accordingly raised another 130 percent at the Tehrān conference of December 1973, and a temporary embargo was placed on oil shipments to the United States and The Netherlands at the same time. Other price increases followed in 1975, 1977, 1979, and 1980, which ultimately raised the price of a barrel of crude oil from US $3.00 in 1973 to $30.00 in 1980.

The oil price increases brought a great upsurge in the government revenues of the OPEC countries. They spent part of these revenues on the development of their economies and also invested large sums in the industrialized countries, particularly the United States. A significant amount was also placed with U.S. banks to finance loans to developed and developing countries. Other sums went to the European currency market. OPEC also established the OPEC Fund for International Development in 1976 to aid developing countries.

By the early 1980s, however, the influence of OPEC on world oil prices was declining; Western industrialized countries were responding to increased oil prices by exploiting alternative sources of energy (most notably coal and nuclear energy), by locating and drilling more of their own oil resources, by turning to other emerging oil-exporting countries to meet their fossil-fuel needs (particularly Mexico and the Soviet Union), and by encouraging conservation programs to decrease their overall demands for energy. These efforts by the West significantly reduced dependence on OPEC oil and by 1982 had forced the OPEC countries to lower prices and cut back production. Decreasing Western demand for OPEC oil was a severe blow to the organization's unity, which had already been damaged by internal conflicts and by the Iraq–Iran war that had broken out in 1980.

The member countries of OPEC differ in their oil endowment, as well as in their economic and political interests. Four of the members—Kuwait, Qatar, Saudi Arabia, and the United Arab Emirates—have very large oil reserves in relation to their populations. They are also financially strong and can thus afford more flexibility in adjusting their output to serve long-term interests. Saudi Arabia, having the largest reserves, has traditionally played a decisive role in determining prices, although its influence has diminished.

OPEC has a Board of Governors, appointed by the member countries, with a chairman elected by the conference. There is a secretariat for administration and research, located in Vienna.

petroleum jelly, also called PETROLATUM, translucent, yellowish to amber or white, unctuous substance having almost no odour or taste, derived from petroleum and used principally in medicine and pharmacy as a protective dressing and as a substitute for fats in ointments and cosmetics. It is also used in many types of polishes and in lubricating greases, rust preventives, and modeling clay.

Petrolatum is obtained by dewaxing heavy lubricating-oil stocks. It has a melting-point range from 38° to 54° C (100° to 130° F). Chemically, petrolatum is a mixture of hydrocarbons, chiefly of the paraffin series.

petroleum trap, subsurface reservoir of petroleum. The oil is always accompanied by water and often by natural gas; all are confined in porous rock, usually such sedimentary rocks as sands, sandstones, arkoses, and fissured limestones and dolomites. The natural gas, being lightest, occupies the top of the trap and is underlain by the oil and then the water. A layer of impervious rock, called the roof rock, prevents the upward or lateral escape of the petroleum. That part of the trap actually occupied by the oil and gas is called the petroleum reservoir.

Many systems have been proposed for the classification of traps; one simple system divides them into structural traps, stratigraphic traps, and combinations of the two. A structural trap has a concave (viewed from below) roof caused by the local deformation (by faulting or folding) of the reservoir rock and the impervious roof rock. In this case, the intersection of the oil–water contact with the roof rock determines the edges of the reservoir. In a stratigraphic trap, variations in the rock strata themselves (*e.g.,* a change in the local porosity and permeability of the reservoir rock, a change in the kinds of rocks laid down, or a termination of the reservoir rock) play the important role. The stratigraphic variations associated with the reservoir rocks are the main influence on the areal extent of the reservoirs in these traps. A complete gradation between the two varieties is possible.

The oil and gas pool will rise to the top of the trap if the underlying water is stationary, and the resulting oil–water contact will be level. When the water is moving, however, the pool is displaced down the trap's side in the direction of flow because of hydrodynamic pressure. In some traps the pool may be displaced great distances or may even be completely flushed out. *See also* salt dome.

petroleum wax, any wax obtained from petroleum, including paraffin wax, microcrystalline wax, and petroleum jelly (*qq.v.*). By comparison, animal and vegetable waxes are generally higher in cost, of varying chemical constitution, and of uncertain availability and have thus been largely displaced by petroleum waxes.

Petrolina, city, southwestern Pernambuco *estado* ("state"), northeastern Brazil. It lies on the left (north) bank of the São Francisco River, just across from Juàzeiro, in Bahia state, with which it is linked by ferry and railroad bridge (completed in 1951). Petrolina is the southern terminus of a railroad running northwestward for approximately 100 miles (160 km) to Paulistana, in Piauí state. The principal goods shipped from Petrolina are cotton, textiles, chemicals, perfume, tobacco, and sugar. The city is also accessible by highway and by air. Pop. (1980 prelim.) 73,436.

petrology, scientific study of rocks that deals with their composition, texture, and structure; their occurrence and distribution; and their origin in relation to physicochemical conditions and geologic processes. It is concerned with all three major types of rocks—igneous, metamorphic, and sedimentary. Petrology includes the subdisciplines of experimental petrology and petrography. Experimental petrology involves the laboratory synthesis of rocks for the purpose of ascertaining the physical and chemical conditions under which rock formation occurs. Petrography is the study of rocks in thin section by means of a petrographic microscope (*i.e.,* an instrument that employs polarized light that vibrates in a single plane). Petrography is primarily concerned with the systematic classification and precise description of rocks.

Petrology relies heavily on the principles and methods of mineralogy because most rocks consist of minerals and are formed under the same conditions. Also essential to petrological research is the careful mapping and sampling of rock units, which provide data on regional gradations of rock types and on associations unavailable by other means.

Petronius Arbiter, Gaius, original name TITUS PETRONIUS NIGER (d. AD 66), reputed author of the *Satyricon,* a literary portrait of Roman society of the 1st century AD.

Life. The most complete and the most authentic account of Petronius' life appears in Tacitus' *Annals,* an account that may be supplemented, with caution, from other sources. It is probable that Petronius' correct name was Titus Petronius Niger. From his high position in Roman society, it may be assumed that he was wealthy; he belonged to a noble family and was therefore, by Roman standards, a man from whom solid achievements might have been expected. Tacitus' account, however, shows that he belonged to a class of pleasure-seekers attacked by the Stoic philosopher Seneca, men who "turned night into day"; where others won reputation by effort, Petronius did so by idleness. On the rare occasions, however, when he was appointed to official positions, he showed himself energetic and fully equal to public responsibilities. He served as governor of the Asian province of Bithynia and later in his career, probably in AD 62 or 63, held the high office of consul, or first magistrate of Rome.

After his term as consul, Petronius was received by Nero into his most intimate circle as his "director of elegance" (*arbiter elegantiae*), whose word on all matters of taste was law. It is from this title that the epithet "Arbiter" was attached to his name. Petronius' association with Nero fell within the emperor's later years, when he had embarked on a career of reckless extravagance that shocked public opinion almost more than the actual crimes of which he was guilty. What Petronius thought of his imperial patron may be indicated by his treatment of the rich vulgarian Trimalchio in the *Satyricon.* Trimalchio is a composite figure, but there are detailed correspondences between him and Nero that cannot, given the contemporary nature of the work, be accidental and that strongly suggest that Petronius was sneering at the emperor.

Tacitus records that Nero's friendship ultimately brought on Petronius the enmity of the commander of the emperor's guard, Tigellinus, who in AD 66 denounced him as having been implicated in a conspiracy of the previous year to assassinate Nero and place a rival on the imperial throne. Petronius, though innocent, was arrested at Cumae in southern Italy; he did not wait for the inevitable sentence but made his own preparations for death. Slitting his veins and then bandaging them again in order to delay his death, he passed the remaining hours of his life conversing with his friends on trivial topics, listening to light music and poetry, rewarding or punishing his slaves, feasting, and finally sleeping "so that his death, though forced upon him, should seem natural."

The Satyricon. The *Satyricon,* or *Satyricon liber* ("Book of Satyrlike Adventures"), is a comic, picaresque novel that is related to several ancient literary genres. In style it ranges between the highly realistic and the self-consciously literary, and its form is episodic. It relates the wanderings and escapades of a disreputable trio of adventurers, the narrator Encolpius ("Embracer"), his friend Ascyltos ("Scot-free"), and the boy Giton ("Neighbour"). The surviving portions of the *Satyricon* (parts of Books XV and XVI) probably represent about one-tenth of the complete work, which was evidently very long. The loose narrative framework encloses a number of independent tales, a classic instance being the famous "Widow of Ephesus" (*Satyricon,* ch. 111–112). Other features, however, recall the "Menippean" satire; these features include the mixture of prose and verse in which the work is composed; and the digressions in which the author airs his own views on various topics having no connection with the plot.

The longest and the best episode in the surviving portions of the *Satyricon* is the *Cena Trimalchionis,* or "Banquet of Trimalchio" (ch. 26–78). This is a description of a dinner party given by Trimalchio, an immensely rich and vulgar freedman (former slave), to a group of friends and hangers-on. This episode's length appears disproportionate even to the presumed original size of the *Satyricon,* and it has little or no apparent connection with the plot. The scene is a Greco-Roman town in Campania, and the guests, mostly freedmen like their host, are drawn from what corresponded to the petit bourgeois class. Trimalchio is the quintessence of the parvenu, a figure familiar enough in ancient satirical literature, but especially so in the 1st century AD, when freedmen as a class were at their most influential.

Two features distinguish Petronius' "Banquet" from other ancient examples: its extraordinary realism and the figure of Trimalchio. It is obvious that the table talk of the guests in the "Banquet" is based on the author's personal observation of provincial societies. The speakers are beautifully and exactly characterized and their dialogue, quite apart from the invaluable evidence for colloquial Latin afforded by the vulgarisms and solecisms in which it abounds, is a humorous masterpiece. Trimalchio himself, with his vast wealth, his tasteless ostentation, his affectation of culture, his superstition, and his maudlin lapses into his natural vulgarity, is more than a typical satirist's figure. As depicted by Petronius he is one of the great comic figures of literature and is fit company for Shakespeare's Falstaff. The development of character for its own sake was hardly known in ancient literature: the emphasis was always on the typical, and the classical rules laid down that character was secondary to more important considerations such as plot. Petronius, in his treatment of Trimalchio, transcended this almost universal limitation in a way that irresistibly recalls Dickens, and much else in the "Banquet" is Dickensian—its exuberance, its boisterous humour (rare in ancient literature, where wit predominates), and its loving profusion of detail.

The rest of the *Satyricon* is hardly to be compared to the "Banquet." Insofar as any moral attitude at all is perceptible in the work as a whole, it is a trivial and debased brand of hedonism. The aim of the *Satyricon* was evidently above all to entertain by portraying certain aspects of contemporary society, and when considered as such, the book is of immense value: superficial details of the speech, behaviour, appearance, and surroundings of the characters are exactly observed and vividly communicated. The wealth of specific allusions to persons and events of Nero's time shows that the work was aimed at a contemporary audience, and certain features suggest that the audience in fact consisted of Nero and his courtiers. The realistic descriptions of low life recall the emperor's relish for slumming expeditions; and the combination of literary sophistication with polished obscenity is consistent with the wish to titillate the jaded palates of a debauched court.

If Petronius' book has a message, it is aesthetic rather than moral. The emphasis throughout the account of Trimalchio's dinner party is on the contrast between taste and tastelessness. Stylistically, too, the *Satyricon* is what Tacitus' account of the author would lead one to expect. The language of the narrative and the educated speakers is pure, easy, and elegant, and the wit of the best comic passages is brilliant; but the general impression, even when allowance is made for the fragmentary state of the text, is that of a book written quickly and somewhat carelessly by a writer who would not take the necessary trouble to discipline his astonishing powers of invention. In his book, as in his life, Petronius achieved fame by indolence. (E.J.Ke./Ed.)

MAJOR WORKS. The *Satyricon* (1st century AD; *The Satyricon of Titus Petronius Arbiter,* "Loeb Series," 1913; "Penguin Classics Series," 1965, the former with both Latin text and English translation, and the latter in English translation), containing the episode of the "Cena Trimalchionis" (*Dinner at Trimalchio's,* 1925 and 1950) and the anecdote known as the *Widow of Ephesus.* The Martin S. Smith edition, *Cena Trimalchionis* (*i.e., Satyricon,* 1976), includes a bibliography of scholarship from 1909.

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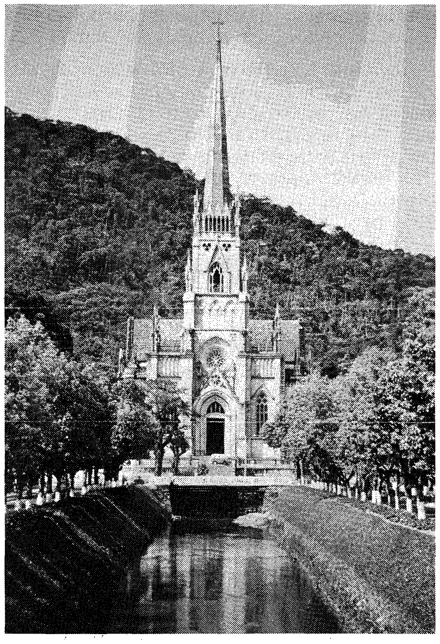
Petronius Maximus: *see* Maximus, Petronius.

Petropavlovsk, city and capital of Severo (North) Kazakhstan *oblast* (province), Kazakh Soviet Socialist Republic. It lies along the Ishim River in the centre of the Ishim Steppe. The second oldest *oblast* centre in northern Kazakhstan after Pavlodar, it was founded as a Russian fort in 1752 and soon became an important centre of trade between Russia and Central Asia and the Kazakh steppes. The Trans-Siberian Railroad reached Petropavlovsk in 1896, and by 1917 the population was nearly 50,000. Petropavlovsk now has some notable industrial undertakings and accounts for about nine-tenths of the industrial output of the *oblast.* It is also important as the junction of the Trans-Siberian and Trans-Kazakhstan railroads. The city has a theatre, a television station, and a teacher-training institute. Pop. (1987 est.) 233,000.

Petropavlovsk-Kamchatsky, also spelled PETROPAVLOVSK-KAMČATSKIJ, port and administrative centre of Kamchatka *oblast* (province), far eastern Russian Soviet Federated Socialist Republic. It lies along the landlocked Avachinskaya Gulf, on the Pacific coast of the Kamchatka Peninsula. The city was founded in 1740 during V.J. Bering's Second Kamchatka Expedition. In 1854, during the Crimean War, an Anglo-French attack on Petropavlovsk was repulsed. The modern city is a fishing centre and has fish-processing, can-making, net-making, and ship-repairing industries. Pop. (1987 est.) 252,000.

Petrópolis, city, north of the city of Rio de Janeiro, in Rio de Janeiro *estado* ("state"), Brazil. It is situated in a valley at 2,667 feet (813 m) above sea level, in the Órgãos Mountains. The city was founded in 1845 by



The cathedral at Petrópolis, Braz.
Walter Aguiar—EB Inc.

Bavarian immigrants under the sponsorship of Dom Pedro II, the Brazilian emperor for whom it was named. The emperor was attracted by the site's relatively cool climate and held court there during the warmer months. His possessions, along with those of Dom Pedro I and João VI of Portugal, remain in the ornate royal palace, now the Museum of the Empire. Petrópolis served as the state capital from 1894 until 1903. A treaty with Bolivia was signed there in 1903 for an exchange of lands and a Brazilian commitment to construct the Madeira–Mamoré Railway. The city has diversified industries and is the seat of the Catholic University of Petrópolis (1961). Pop. (1980) 150,249.

Petros PHILARGOS (antipope): *see* Alexander (V) (Papacy).

Petroşani, city, Hunedoara *judeţ* (county), west-central Romania, situated on a tributary of the Jiu River. Founded in the 17th century, it is the principal city and cultural centre for the upper Jiu Valley coalfield. It has a theatre and a museum of mining. The city is the headquarters for a group of nearby mining centres, including Lupeni, Petrila, Vulcan, and the new town of Uricani at the foot of Mount Retezat. Output from the area averages several million tons of low-grade bituminous coal annually. Petroşani manufactures coal by-products and is the site of a state mining institute. Jules Verne, the fiction writer, wrote about Petroşani and its environs in his book *Le Château des Carpates,* after his visit to Romania in 1892. Highways and a railway connection extend through Petroşani. Pop. (1982 est.) 44,268.

Petrosyan, Tigran V(artanovich), Petrosyan also spelled PETROSIAN (b. June 17, 1929, Tbilisi, Georgian S.S.R.—death reported Aug. 14, 1984, Moscow), Soviet Chess master who won the world championship from Mikhail Botvinnik in 1963, defended it successfully against Boris Spassky in 1966, and was defeated by Spassky in 1969. Petrosyan's play, subtle and tirelessly patient, was designed to weaken an opponent's position gradually rather than to crush it at a single blow. Against masters of comparable strength he played a great many drawn games.

Petrosyan was made a Chess master in 1947. He was educated at Yerevan Teachers' College in the Armenian S.S.R. and continued postgraduate study in philosophy there after becoming world Chess champion. He received a number of decorations for his achievements, and he remained an active member in the Presidium of the Chess Federation of the U.S.S.R. In 1968 Petrosyan published *Chess and Philosophy.*

Petrov, Yevgeny: *see* Ilf, Ilya; and Petrov, Yevgeny.

Petrović, George, Serbo-Croatian ĐORĐE PETROVIĆ: *see* Karageorge.

Petrozavodsk, city and capital of the Karelian Autonomous Soviet Socialist Republic, northwestern Russian S.F.S.R., situated on the western shore of Lake Onega, south of the Shuya River outflow. The city was founded in 1703 by Peter I the Great as an ironworks to supply ordnance to his new capital of St. Petersburg. Its modern industries include engineering and timber working. The many scientific and educational establishments include a university, a teacher-training institute, and a branch of the Academy of Sciences of the U.S.S.R. Pop. (1983 est.) 247,000.

Petrucci, Ottaviano dei (b. 1466, Fossombrone, near Ancona, Papal States—d. 1539, Venice), Italian music printer whose collection of chansons, *Harmonice Musices Odhecaton A* (1501), was the first polyphonic music printed from movable type.

Petrucci went to Venice in 1490, holding music printing monopolies there from 1498 to 1511 and later at Fossombrone. In 1536, at the request of the Venetian Senate, he returned to Venice. His 61 music publications contain masses, motets, chansons, and *frottole* by the foremost composers of the 15th and early 16th centuries, among them Josquin des Prez, Jean d'Okeghem, and Loyset Compère. He also published the first book of printed lute music, Francesco Spinaccino's *Intabolatura de Lauto* (1507).

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

Petrucci, Pandolfo (b. *c.* 1452, Siena, Republic of Siena—d. May 21, 1512, San Quirico d'Orcia), Italian merchant and politician who succeeded in gaining supreme power over Siena. Although an absolute and tyrannical ruler, he did a great deal to augment the artistic splendour of his native city.

Exiled from Siena as a partisan of the Nove (New Ones), Petrucci returned in 1487 and began to take advantage of the struggles among various political factions. Having married Aurella Borghese, daughter of one of the most powerful men in the city, Petrucci entered public office, acquiring so much authority and wealth that he became the actual despot of Siena with the title of *signore* (lord). Petrucci's ambition, however, alienated even Niccolò Borghese, whom Petrucci later assassinated (July 1500). This crime frightened his adversaries, leaving him in complete control.

As head of state, Petrucci consolidated his power by surrounding himself with supporters whose loyalty was guaranteed by the income they received from certain public lands. Yet the authoritarian and arbitrary Petrucci stopped the sale of public offices, secured economic advantages for the city, reformed the monetary system, and protected arts and letters.

Involved in the political struggle between France and Spain on the Italian peninsula, Petrucci was implicated in a plot against the powerful Cesare Borgia. He fled from Siena in January 1503 but was returned in March through the intervention of Louis XII of France. After the death of Cesare in 1507, Petrucci became more powerful than ever. By secret accords he allied with the Spanish and Pope Julius II against the French shortly before his death.

Petrus (Latin personal name): *see under* Peter, except as below.

Petrus AUREOLI, Aureoli also spelled AUREOLUS, English PETER AUREOL, French PIERRE AURIOL, ORIOL, or D'ORIOL (b. *c.* 1280, near Gourdon, Guyenne—d. 1322, Aix-en-Provence/Avignon, Provence), French churchman, philosopher, and critical thinker, called *Doctor facundus* ("eloquent teacher"), who was important as a forerunner to William of Ockham.

Petrus may have become a Franciscan at Gourdon before 1300; he was in Paris (1304) to study, possibly under John Duns Scotus. He became lector at Bologna (1312), Toulouse (1314–15), and Paris (1316–18). Provincial of his order for Aquitaine *c.* 1320, he was nominated archbishop of Aix-en-Provence and consecrated in 1321 by Pope John XXII, to whom he had dedicated *c.* 1316 his *Commentariorum in primum librum sententiarum,* 2 vol. (1596–1605; "Commentary on the First Book of Sentences").

Criticizing Duns Scotus' and St. Thomas Aquinas' theory of knowledge, Petrus promoted an individualistic empiricism (emphasizing the part played by experience in knowledge against that played by reasoning), supported by a doctrine of universals, or general words that can be applied to more than one particular thing; this doctrine is partly Nominalistic (denying the reality of universal essences) and partly conceptualistic (acknowledging universals as existing only in the mind). According to Petrus, knowledge is appearance of objects: man knows what exists by direct impressions, more or less clearly, but without intermediaries; forms, essences, and universals are fictions. Although some of his philosophical theories are individual, he generally conforms to the dictum subsequently known as "Ockham's razor"—*i.e.,* that entities are not to be multiplied beyond necessity. Essentially, Petrus anticipated the Nominalism that Ockham developed more fully.

Petrus' works include *Tractatus de paupertate* (1311; "Treatise on Poverty"), the unfinished *Tractatus de principiis naturae,* 4 vol. ("Treatise on the Principles of Nature"), and *Tractatus de conceptione beatae Mariae Virginis* (1314/15; "Treatise on the Conception of the Blessed Mary the Virgin"). In 1319 he wrote his popular *Compendium . . . totius Scripturae* ("Compendium . . . of the Whole Scripture").

Petrus DE VINEA: *see* Pietro della Vigna.

Petrus HISPANUS: *see* John XXI *under* John (Papacy).

Pétrus Ky, also called TRUONG VINH KY, or JEAN-BAPTISTE PÉTRUS (b. Dec. 6, 1837, Vinh Long province, Vietnam—d. Sept. 1, 1898), Vietnamese scholar whose literary works served as a bridge between his civilization and that of the West. He helped popularize the romanized script of the Vietnamese language, Quoc-ngu.

Pétrus Ky was born into a Roman Catholic family, and in 1848 he attended a mission college in Cambodia; three years later he studied at the Catholic college in Penang (now Pinang, Malaysia), established by French missionaries, and decided to enter the priesthood. Having studied French, Latin, and Greek, Pétrus Ky was designated by the missionaries as their most competent interpreter, and so his future was redirected. In 1863 he went with the statesman Phan Thanh Gian as an interpreter on a diplomatic mission to France. Pétrus Ky saw the great cultural differences between the Vietnamese and the French, and he stayed in Europe until 1865, visiting England, Spain, Italy, and Egypt, while compiling a Vietnamese–French dictionary.

In 1867–74 Pétrus Ky taught Oriental languages in Saigon and wrote prolifically in the French-sponsored Vietnamese language newspaper *Gia-Dinh Bao.* In 1876 he visited northern Vietnam (Tonkin in French usage) and prepared a confidential report on political conditions there, urging a French advance into this still uncolonized region. In 1886 Gov. Gen. Paul Bert designated Pétrus Ky as the teacher of French to the emperor Dong Kanh at the court of Hue.

Pétrus Ky assumed responsibility for translating not only the French language but also Western attitudes and philosophies for the Vietnamese. He was a prolific writer on many diverse subjects; among his publications are *Thanh suy bi tho'i phu* (1883; "Whims of Destiny"), *Phong hoa dieu hanh* (1885; "Morals and Deeds"), *Grammaire de la langue annamite* (1867; "Grammar of the Vietnamese Language"), *Petit cours de géographie de la Basse-Cochinchine* (1875; "Handbook of the Geography of Lower Cochinchina"), *Cours d'histoire annamite* (1875–77; "Course of Vietnamese History"), and *Histoire d'Annam* ("History of Vietnam"), the first significant history of Vietnam written in a European language and following European historiographic models.

Petsamo (Russian S.F.S.R.): *see* Pechenga.

Pettazzoni, Raffaele (b. Feb. 3, 1883, Persiceto, Italy—d. Dec. 8, 1959, Rome), Italian historian of religions and educator, a founder and president (1950–59) of the International Association for the Study of History of Religions. His original comparative method is shown in many works, among them his studies *Dio, formazione e sviluppo del monoteismo nella storia delle religioni* (1922; "God, the Formation and Development of Monotheism in the History of Religions"), *La confessione dei peccati,* 3 vol. (1929–35; "The Confession of Sins"), and *L'essere supremo nelle religioni primitive* (1957; "The Supreme Being in Primitive Religions").

petticoat, in modern usage, an underskirt worn by women. The *petycote* (probably derived from the Old French *petite cote,* "little coat") appeared in literature in the 15th century in reference to a kind of padded waistcoat, or undercoat, worn for warmth over the shirt by men. The petticoat developed as a piece of women's apparel—a skirt worn under an overgown—at the end of the Middle Ages. By the beginning of the 16th century, the overgown had an inverted V opening, and the petticoat, now visible, was brocaded or embroidered.

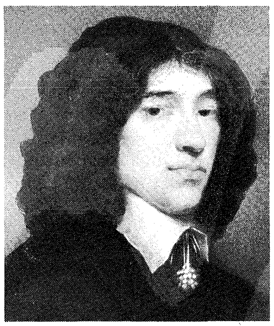
In the 17th century the outer skirt was looped up prominently, showing the petticoat underneath, and in the 18th century the petticoat figured prominently with the inverted V opening of the popular polonaise. In the early 19th century, women wore many petticoats, bound together, to show the great fullness of the skirt. By the 1850s, however, these voluminous petticoats had been abandoned for the more comfortable crinoline (*q.v.*). In about 1900, when skirts became less full, the petticoat was visible only when a woman lifted her dress—as when crossing the street. Thereafter, petticoats became increasingly less important and were worn only as undergarments.

Pettit, Bob, byname of ROBERT E. LEE PETTIT (b. Dec. 2, 1932, Baton Rouge, La., U.S.), American professional basketball player, first to score 20,000 points in the National Basketball Association (NBA). A graceful 6-foot 9-inch athlete, he was considered to be the first really agile player of extraordinary height in professional basketball.

After graduating from Louisiana State University, Baton Rouge, Pettit played NBA basketball for 11 seasons (1954–65) with the Milwaukee (after 1954–55, the St. Louis) Hawks. In each season but his last, he led the Hawks in scoring and rebounding. Twice (1955–56 and 1958–59) he was the NBA scoring champion and was voted the league's most valuable player. On Nov. 22, 1961, he set an NBA single-game record by scoring 19 free throws without missing. In 792 NBA regular season games, Pettit scored 20,880 points (average 26.4 points a game) and captured 12,851 rebounds. He retired in 1965 and was elected to the Basketball Hall of Fame in 1970.

Petty, Sir William (b. May 26, 1623, Romsey, Hampshire, Eng.—d. Dec. 16, 1687, London), English political economist and statistician whose main contribution to political economy, *Treatise of Taxes and Contributions* (1662), considered the role of the state in the economy and touched on the labour theory of value.

As a young man, Petty abandoned a life at sea to take up the study of medicine at the universities of Leiden, Paris, and Oxford. He was successively a physician, professor of



William Petty, detail of a portrait attributed to Isaac Fuller, *c.* 1649–51; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

anatomy at Oxford, professor of music in London, inventor, surveyor and landowner in Ireland, and member of Parliament.

A protagonist of the empirical scientific doctrines of the newly established Royal Society, of which he was a founder, Petty was one of the originators of political arithmetic, which he defined as the art of reasoning by figures upon things relating to government. His *Essays in Political Arithmetick and Political Survey or Anatomy of Ireland* (1672) presented population estimates and rough calculations of social income. His ideas on monetary theory and policy were developed in *Verbum Sapienti* (1665) and in *Quantulumcunque Concerning Money, 1682* (1695).

His most significant work, however, is his *Treatise on Taxes.* Petty favoured giving free rein to the natural forces of individual self-interest. Unlike liberals after Adam Smith, however, Petty considered the maintenance of a high level of employment by monetary and fiscal policies and by public works to be a duty of the state. In the *Treatise,* he also argued that the labour necessary for production was the main determinant of exchange value.

Petty-Fitzmaurice, Henry Charles Keith: *see* Lansdowne, Henry Charles Keith Petty-Fitzmaurice, 5th marquess of.

Petty-Fitzmaurice, William: *see* Lansdowne, William Petty-Fitzmaurice, 1st marquess of.

petty morrel (plant): *see* spikenard.

petunia, flowering plant whose showy, trumpet-shaped flowers make it immensely popular for summer beds and window boxes. It is a genus of the nightshade family (Solanaceae), originating in South America, and it is related to the deadly nightshade, potato, and tobacco plants.

The genus *Petunia* comprises many species, but the common garden petunia, *P. hybrida,* is a cross of two species native to Argentina—*P. axillaris* and *P. violacea.* The innumerable varieties of *P. hybrida* fall into two types: the compact, erect type, reaching 6 to 10 inches (15 to 25 centimetres) and adapted for summer garden beds, and the sprawling, long-stemmed balcony petunia, which grows to about 18 in. and is often potted in hanging baskets and window boxes. Flowers are funnel-shaped; are crisped, fringed, or ruffled; and are of spectacular hue, ranging from pure white to deep crimson or purple and often speckled or veined in contrasting colours. There are single- and double-bloom varieties. Leaves are soft, flabby, and covered with fine, sticky hairs.

Although technically a perennial, the petunia is most often grown as an annual. They do well in almost any ordinary garden soil in any temperate locale, provided they are well watered and well drained. They grow poorly in shade. Flowers bloom profusely from early summer until frost.

Pétursson, Hallgrímur (b. 1614, Hólar, Ice.—d. Oct. 27, 1674, Ferstikla), poet, one of the greatest religious poets of Iceland.

Though he came from a good family, Hallgrímur lived an errant life; as a boy he ran away to Copenhagen and became a blacksmith's apprentice. Through the influence of Bishop Brynjólfur Sveinsson he was later enrolled in the Danish Frúar Skóli ("Our Lady's School"), where he received a Latin humanist education. In 1636 he was entrusted with the re-Christianizing of a party of Icelanders who had been held captive by Algerian pirates for nine years. Among them was a 38-year-old woman, Gudridur Símonardóttir, who bore a child by Hallgrímur and later married him. Returning to Iceland, Hallgrímur worked as a labourer and a fisherman but eventually became a parson at Saurbær (1651–69). He contracted leprosy and out of this misery produced his *Passiusálmar* (1666; *The Passion Hymns of Iceland*), which ranks among the best religious poetry of the world. In each hymn the poet merges his personal suffering with that of Jesus. The effect of the Passion Hymns in bolstering the morale of a desperate people was attested to by the immediate widespread popularity of the hymns. First printed in 1666 and for the 64th time in 1957, they remain the most cherished devotional songs of the Icelanders. The Hallgrímskirkja, a memorial church built in the poet's honour at Saurbær, is one of the largest and finest churches in Iceland.

Petworth, parish, Chichester district, county of West Sussex, England. The parish adjoins the great park of Petworth House (now owned by the National Trust). The mansion itself was largely rebuilt (1688–96) by Charles Seymour, the 6th duke of Somerset, and contains a noted art collection; its deer park was landscaped in the 18th century by Lancelot ("Capability") Brown. Pop. (1971) 2,506.

Peugeot SA, major French automotive manufacturer and holding company, incorporated in France in 1896 as Société Anonyme des Automobiles Peugeot. The company merged with another large French automobile producer, Citroën SA, in 1976, the combination assuming the name Peugeot–Citroën SA. The present name was adopted in 1979. Headquarters are in Paris.

Peugeot was founded in 1890 by Armand Peugeot (1849–1915), one of a large family of industrialists and engineers. The first Peugeot automobile had been designed in a family-owned shop set up in 1885 to build velocipedes and quadricycles.

In 1914 Citroën's founder, André Citroën, formed his own company to produce munitions during World War I. The company proved so successful that by the end of the war Citroën was able to buy out the Mors Company, an automobile manufacturer for which Citroën had previously served as president. In the 1920s the company, which was established as Citroën SA in 1924, emerged as a major producer of low-priced, mass-produced cars. By 1933 it had built 90 percent of the taxicabs operating in Paris.

During the Great Depression, Citroën fell into financial trouble and was sold to the Michelin Tire Company in 1936. During the 1960s Citroën was merged with several other automakers. In 1975, to avert another potential bankruptcy, the French government funded Citroën's sale to a group that included Peugeot, which increased its holdings in the company the following year.

In 1978–79 Peugeot acquired the European car- and truck-making units and related finance operations of Chrysler Corporation of the United States, changing the names of these Peugeot subsidiaries to Talbot. In addition to manufacturing cars and trucks, Peugeot is a major producer of bicycles and motorcycles. The holding company owns and operates several bank and finance companies throughout Europe.

Peul (people): *see* Fulani.

Peutinger Table, copy of a Roman map, made in 1265 by a monk of Colmar (Alsace) on 12 sheets of parchment. Eleven of the sheets are now in the Nationalbibliothek in Vienna. The dimensions are 268 by 13⅓ inches (6.82 by 0.34 metres). The copy was found by Conradus Celtis in 1494 and was bequeathed by him to his friend Konrad Peutinger (1465–1547) of Augsburg.

The shape of the map, an elongated rectangle, causes a grave deformation of the Roman world, the distances from north to south being compressed and those from east to west being unduly extended. The map is in six colours—black, red, green, yellow, blue, and rose. Opinions have differed as to how closely the lost original depended on Roman itineraries and world maps. The table depicts an area beyond the frontiers of the Roman Empire to the east. *See also* itinerarium.

Pevensey, locality, Wealden district, county of East Sussex, England. Once an English Channel port, it now lies a mile inland along a narrow waterway; from the 13th century on, silting of the waterway brought about Pevensey's economic decline. The remains of the walls and towers of a Roman fort, Anderida

Ruins of the castle at Pevensey, in East Sussex
A.F. Kersting

(*c.* 250), rank among the best extant examples of Roman building in England. After the Norman Conquest (1066) a castle was built within the Roman walls. Pop. (1981) 2,668.

Pevensey, Spencer Compton, Viscount: *see* Wilmington, Spencer Compton, Earl of.

Pevsner, Antoine (b. Jan. 18, 1886, Oryol, Russia—d. April 12, 1962, Paris), Russian-born French sculptor and painter who—like his brother, Naum Gabo (*q.v.*)—advanced the Constructivist style, which employs such materials as metal, glass, and wire and eschews mass in favour of space intervals and a sense of movement.

Pevsner studied art in Kiev, went to Paris in 1911 and 1913, and in 1915 joined his brother Naum in Oslo, where they experimented in art that was "capable of utilizing emptiness and liberating us from the compact mass." The brothers returned to Russia after the Russian Revolution of 1917, and Pevsner became a professor at Moscow's school of fine arts. In 1920 they issued the "Realist Manifesto" of Constructivism, championing their form of art, which they exhibited that year. In 1923 Pevsner left Russia and settled in Paris. A naturalized Frenchman by 1930, he was cofounder and later honorary president of the Réalités Nouvelles group of exhibiting artists.

Pevsner produced primarily sculpture after 1923. His early sculptures used zinc, brass, copper, and celluloid, but later he relied mainly on parallel arrays of bronze wire soldered together to form plates. These plates are joined together to form intricate and convoluted shapes using both straight and curved lines. Pevsner was the finest Constructivist sculptor, and he succeeded in infusing that somewhat impersonal geometric style with his own feeling for form.

Pevsner, Naum Neemia: *see* Gabo, Naum.

pew, originally a raised and enclosed place in a church designed for an ecclesiastical dignitary or officer; the meaning was later extended to include special seating in the body of the church for distinguished laity and, finally, to include all church seating. In its early stages, the pew was meant for standing in and was close in conception to a pulpit; but in its second phase of development, it became an elaborate wooden structure, shut off from the main body of the nave, with seats, prayer benches, and other accessories. Such pews were owned by individuals or institutions and appeared both in wills and in legal actions.

In its final and more generalized context, a pew consisted of a long, backed, oak or pine bench with a fixed kneeling board. The upright ends were squared off or terminated in a finial or other carved ornament. The use of this type of seating in modern churches is almost universal.

Pew, J(ohn) Howard and Joseph N(ewton), Jr. (respectively b. Jan. 27, 1882, Bradford, Pa., U.S.—d. Nov. 27, 1971, Ardmore, Pa; b. Nov. 12, 1886, Pittsburgh—d. Apr. 9, 1963, Philadelphia), American industrialist brothers who expanded the Sun Oil Company (which their father had founded) by introducing new refining, marketing, and distribution techniques.

The Sun Oil Company was founded by Joseph Newton Pew, Sr. (1848–1912). Beginning in 1886, Pew, Sr., piped and refined oil in Pennsylvania and Ohio. When oil was discovered near Beaumont, Texas, in 1901, he bought some wells and built a pipeline to the tidewater area of the nearby Neches River, whence the oil could be shipped to his huge new refinery at Marcus Hook, Pa., for processing. He consolidated his oil-producing holdings in Ohio, Illinois, West Virginia, and Texas in the new Sun Oil Company and was its president from 1901 until his death.

His son, J. Howard Pew, joined the company in 1901, was president in 1912–47, and thereafter was a director. He developed a way of making lubricants out of asphaltic Texas oil. Under his leadership, Sun was the first (in 1927) to use pipes heated with mercury vapour rather than with fire to separate lubricants and the first (in 1937) to use Eugene Houdry's catalytic-cracking process, instead of thermal cracking, to make its gasoline.

Joseph N. Pew, Jr., joined the company in 1908 and became vice president four years later upon his father's death. He persuaded the company to lay gasoline pipelines from the Marcus Hook refinery to distribution points in Ohio, New York, and New Jersey. He then negotiated with 1,000 landholders in four states for permission to cross their property.

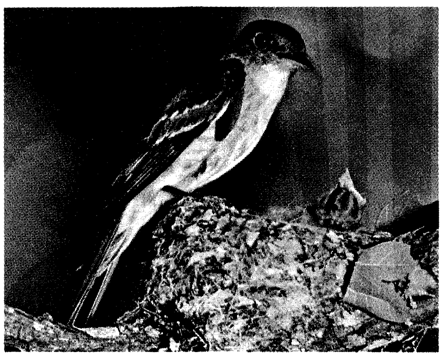
In 1916 the brothers founded a shipbuilding company that produced oil tankers for Sun and its competitors. Sun's shipyard used welding instead of riveting to build ships, thereby saving substantially on the amount of steel required per ship.

During World War II, Sun pioneered in developing and refining aviation fuels and lubricants. In 1942 the company also adapted the Houdry process to the production of synthetic rubber.

In 1933–34 Joseph, Jr., went to Washington to fight the New Deal petroleum code, which he believed would lead to price-fixing. The experience was the beginning of his involvement with the Republican Party. Besides contributing large sums of money to the party, he purchased trade publications and magazines, like *Farm Journal,* to sway the public to his way of thinking. He also wielded considerable influence in shaping several Republican Party platforms.

The Sun Oil Company became the Sun Company, Inc., in 1971, the year of J. Howard Pew's death.

pewee, also spelled PEEWEE, any of eight species of birds of the genus *Contopus* (family Tyrannidae); it is named for its call, which is monotonously repeated from an open perch. In North America a sad, clear "pee-oo-wee" announces the presence of the eastern wood pewee (*C. virens*), while a blurry "peeurrr" is the call of the western wood pewee (*C. sordidulus*). Some authorities consider the western form to be a race of *C. virens*. Both forms are plain birds, about 14 cm (6 inches) long, that resemble the eastern phoebe; the two forms differ from the eastern phoebe, however, in being browner and more slender and in having two distinct whitish wing bars.



Eastern wood pewee (*Contopus virens*)
Thase Daniel

Wood pewees winter chiefly in northern South America. Other pewees are found in Central and South America.

pewter, tin-based alloy used as a material from which domestic utensils were fashioned. The use of pewter dates back at least 2,000 years to Roman times. Ancient pewter contained about 70 percent tin and 30 percent lead. Such pewter, also called black metal, darkened greatly with age, and the lead readily leached out in contact with acidic foods.

Pewter with little or no lead is of finer quality, and alloys that include antimony and bismuth are more durable and brighter of sheen. Modern pewter is about 91 percent tin, 7.5 percent antimony, and 1.5 percent copper; the absence of lead makes it safe to use for dishes and drinking vessels. The surface of modern pewter is bluish-white with either a crisp, bright finish or a soft, satin sheen. It resists tarnish, retaining its colour and finish indefinitely.

Pewter work is usually cast, then further finished by hammering, turning on a lathe, burnishing, and sometimes engraving. Some items, such as snuffboxes, were constructed from separate pewter pieces and then soldered together. Some modern pewter work is formed by stamping presses. Most pewter alloys are quite ductile and easily worked. Cold-working does not cause the metal to harden sufficiently to require annealing.

Manufacture of pewter ware developed in various European countries from the 14th century. Pewter was widely used for dishes, church vessels, and decorative items. Being a common alloy, pewter has been primarily utilitarian and only secondarily ornamental, being used where the precious metals were too expensive. Pewter work often emulated designs in silver, and some unscrupulous pewterers even endeavoured from time to time to pass off pewter as silver or something almost like silver. Most pewter work was unornamented, but some items (usually for display only) were painted, enameled, gilded, and even inlaid with other metals, such as brass.

Peyer's patch, any of the nodules of lymphatic cells that aggregate to form bundles or patches and occur usually only in the lowest portion (ileum) of the small intestine; they are named for the 17th-century Swiss anatomist Hans Conrad Peyer.

Peyer's patches are round or oval and are located in the mucous membrane lining of the intestine. They can be seen by the naked eye as elongated thickened areas, and their surface is free of the projections (villi) and depressions (Lieberkühn glands) that characterize the intestinal wall. Usually there are only 30 to 40 patches in each individual. In young adults, however, they may be more numerous, and as an individual ages they tend to become less prominent. Their function is not known exactly; they may serve an immunological function like that of peripheral lymph nodes.

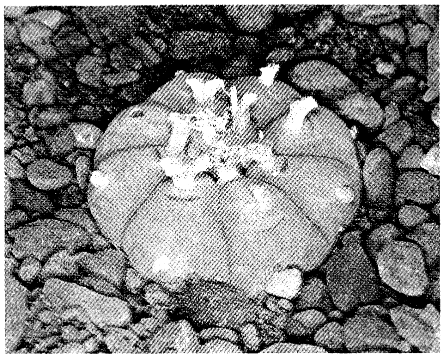
In typhoid fever, these patches may become sites of inflammation, in which case they may develop into ulcerations, hemorrhages, or perforations.

peyote, also called MESCAL-BUTTON, two species of the cactus genus *Lophophora,* family Cactaceae, native to North America, almost exclusively to Mexico.

Peyote, well known for its hallucinogenic effects, contains at least 28 alkaloids, the principal one of which is mescaline (*q.v.*). Peyote figures prominently in old religious rituals of certain North American Indian peoples and in the ritual of the Native American Church (*q.v.*). The sale, use, or possession of dried mescal buttons or live plants is prohibited by law in some places.

Peyote is found only on limestone soils of the Chihuahuan desert of southern Texas and northern Mexico. Averaging about eight centimetres (three inches) wide and five centimetres (two inches) tall, the body of the peyote cactus is spineless, soft, and in most cases, blue green in colour.

The more common species, *L. williamsii,* has pink to white flowers in summer, the fruit ripening the following year. *L. diffusa,* more



Peyote (*Lophophora williamsii*)
Dennis E. Anderson

primitive, grows in a small area in central Mexico. Its flowers are white to yellow, and the body is yellow green.

peyotism: *see* Native American Church.

Pezza, Michele: *see* Diavolo, Fra.

Pfaff, Johann Friedrich (b. Dec. 22, 1765, Stuttgart, Württemberg—d. April 21, 1825, Halle, Saxony), German mathematician who proposed the first general method of integrating partial differential equations of the first order.

Pfaff was professor of mathematics at the University of Helmstedt from 1788 until 1810, when he was appointed professor of mathematics at the University of Halle. He made notable contributions to calculus, the theory of series, and the solution of differential equations. He completed his work on the general method of partial differential equation integration in 1814–15. The term Pfaffian problem was originated in his honour. Among his published works are *Disquisitiones analyticae* (1797; "Analytic Works") and *Observationes ad Euleri institutiones calculi integralis* ("Observations of Eulerian Methods of the Integral Calculus").

Pfahlbauten (anthropology): *see* Lake Dwellings.

Pfalz (Germany): *see* Palatinate.

Pfälzer Wald (Germany): *see* Haardt Mountains.

Pfeffer, Wilhelm (Friedrich Philipp) (b. March 9, 1845, Grebenstein, near Kassel, Ger.—d. Jan. 31, 1920, Leipzig), German botanist whose work on osmotic pressure made him a pioneer in the study of plant physiology.

After earning his Ph.D. from the University of Göttingen in 1865 Pfeffer continued his studies at the universities of Marburg and Bonn. He then held teaching positions at Bonn (1873), Basel (1877), Tübingen (1878), and Leipzig (1877), where he remained until his death. Pfeffer's work on cell metabolism led to his work in 1877 in devising a semi-

Pfeffer
Archiv fur Kunst und Geschichte, Berlin

permeable membrane that he used to study osmosis. He developed a method for measuring osmotic pressure and showed that pressure depended on the size of the molecules too large to pass through the membrane. Pfeffer was then able to measure the size of giant molecules. His findings were published in *Osmotische Untersuchungen, Studien sur Zellmechanik* (1877; "Osmotic Research Studies on Cell Mechanics"). His best publication is *Pflanzenphysiologie. Ein Handbuch des Stoffwechsels und Kraftwechsels in der Pflanze* (1881; *The Physiology of Plants; A Treatise upon the Metabolism and Sources of Energy in Plants,* 1900–06), which was for long a standard handbook.

Pfefferkorn, Johannes (Joseph) (b. 1469, Nürnberg?—d. 1522/23, Cologne), German controversialist—a Christianized Jew—and opponent of Jewish literature, whose dispute with the Humanist and Hebraist Johannes Reuchlin (*q.v.*) was a European *cause célèbre* in the early 16th century.

Pfefferkorn began a campaign to rid Germany of Jewish writings that were suspected of being subversive of Christianity. The Dominicans of Cologne supported him, and in 1509 he succeeded in persuading Emperor Maximilian I to issue a mandate permitting the confiscation and destruction of Hebrew books. Strong protests, however, forced the Emperor to seek the advice of theologians and scholars, including Reuchlin. Reuchlin's defense of many Jewish writings provoked fanatical recriminations from Pfefferkorn, resulting in a war of pamphlets and culminating in a widespread controversy between conservative scholars and the Humanists, who often caricatured Pfefferkorn in their popular writings.

Pfitzner, Hans (Erich) (b. May 5, 1869, Moscow—d. May 22, 1949, Salzburg, Austria), German composer who upheld traditional ideals during the post-Wagnerian era.

Pfitzner was a pupil at Frankfurt of Iwan Knorr. Between 1892 and 1934 he held posts as teacher and conductor in several German towns, including Strassburg, where he was director of the conservatory and of the opera. His operas include *Der arme Heinrich* (Mainz, 1895), *Die Rose vom Liebesgarten* (Eberfeld, 1901), and *Palestrina* (Munich, 1917), the last being his best known work. His works were widely played in Germany but made little impression in other countries.

PFNA: *see* Pentecostal Fellowship of North America.

Pforzheim, city, Baden-Württemberg *Land* (state), southwestern Germany, on the northern edge of the Schwarzwald (Black Forest), where the Nagold and Würm rivers join the Enz, on the French border. Originally the site of a Roman settlement (Porta Hercyniae), it was chartered *c.* 1195. The city was at times the residence of the margraves of Baden-Baden and Baden-Durlach. The Humanist Johann Reuchlin was born there (1455), and its medieval Latin school was famous. The city was sacked during the Thirty Years' War (1618–48) and the War of the Grand Alliance (1689–97) and was virtually destroyed during World War II. It has been rebuilt with broad thoroughfares and open spaces along the rivers. Notable buildings include the castle-church of St. Michael (13th–15th century), the Franciscan Barfüsserkirche ("church of barefoot friars"; 13th century), and the modern Reuchlin House (containing both history and jewelry museums). Pforzheim has been the centre of the German jewelry and watch industry since the 18th century and has schools for precious metalworking and watchmaking. Other manufactures include machinery, electrical equipment, and paper. Pop. (1989 est.) 108,887.

Pfyffer, Ludwig, byname KING OF THE SWISS, German SCHWEIZERKÖNIG (b. 1524—d. March 17, 1594, Luzern, Switz.), Swiss military leader, spokesman for Roman Catholic interests in the cantons, and probably the most important Swiss political figure in the latter half of the 16th century.

For many years an active and intrepid warrior in the service of France, Pfyffer won fame by safely leading the royal family of Charles IX from Meaux to Paris while under Huguenot attack (1567). Elected chief magistrate for Luzern in 1571—which office he continued to occupy until his death—he made that city the centre of Catholic Counter-Reformation activity in Switzerland. His Golden (or Borromean) League (1586)—the alliance of the seven Catholic cantons for furtherance of religious interests—nearly led to the destruction of the Swiss Confederation and precipitated the division of the canton of Appenzell along religious lines. Pfyffer established close relations with the Holy League of Philip II of Spain and Henri, duc de Guise, and concluded a Swiss alliance with Spain (1587) against the accession of Henry of Navarre (Henry IV) to the French throne. He also acquired a substantial fortune from foreign pensions and as a supplier of mercenaries to the pope.

PGA: *see* Professional Golfers' Association of America.

PGR: *see* psychogalvanic reflex.

pH, quantitative measure of the acidity or basicity of aqueous or other liquid solutions. The term, widely used in chemistry, biology, and agronomy, translates the values of the concentration of the hydrogen ion—which ordinarily ranges between about 1 and 10^{-14} gram-equivalents per litre—into numbers between 0 and 14. In pure water, which is neutral (neither acidic nor alkaline), the concentration of the hydrogen ion is 10^{-7} gram-equivalents per litre, which corresponds to a pH of 7. A solution with a pH less than 7 is considered acidic; a solution with a pH greater than 7 is considered basic, or alkaline.

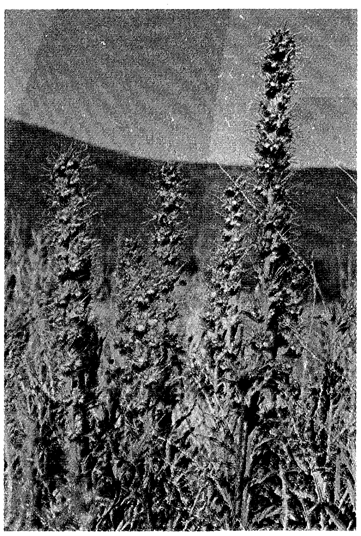
The measurement was originally used by the Danish biochemist S.P.L. Sørensen to represent the hydrogen ion concentration, expressed in equivalents per litre, of an aqueous solution: $pH = -\log[H^+]$ (in expressions of this kind, enclosure of a chemical symbol within square brackets denotes that the concentration of the symbolized species is the quantity being considered).

Because of uncertainty about the physical significance of the hydrogen ion concentration, the definition of the pH is an operational one—*i.e.*, it is based on a method of measurement. The U.S. National Bureau of Standards has defined pH values in terms of the electromotive force existing between certain standard electrodes in specified solutions.

In agriculture, the pH is probably the most important single property of the moisture associated with a soil, since that indication reveals what crops will grow readily in the soil and what adjustments must be made to adapt it for growing any other crops. Acidic soils are often considered infertile, and so they are for most conventional agricultural crops, although conifers and many species of shrub will not thrive in alkaline soil. Acidic soil can be "sweetened" or neutralized by treating it with lime. As soil acidity increases so does the solubility of aluminum and manganese in the soil, and many plants (including agricultural crops) will tolerate only slight quantities of those metals. Acid content of soil is heightened by the decomposition of organic material by microbial action, by fertilizer salts that hydrolyze or nitrify, by oxidation of sulfur compounds when salt marshes are drained for use as farmland, and by other causes.

The pH is usually measured with a pH-meter, which translates into pH readings the difference in electromotive force (electrical potential or voltage) between suitable electrodes placed in the solution to be tested. Fundamentally, a pH meter consists of a voltmeter attached to a pH-responsive electrode and a reference (unvarying) electrode. The pH-responsive electrode is usually glass, and the reference is usually a mercury-mercurous chloride (calomel) electrode, although a silver-silver chloride electrode is sometimes used. When the two electrodes are immersed in a solution, they act as a battery. The glass electrode develops an electric potential (charge) that is directly related to the hydrogen-ion activity in the solution, and the voltmeter measures the potential difference between the glass and reference electrodes. The meter may have either a digital or analogue (scale and deflected needle) readout. Digital readouts have the advantage of exactness, while analogue readouts give better indications of rates of change. Battery-powered portable pH-meters are widely used for field tests of the pH of soils; such tests may also be performed, less accurately, by mixing indicator dyes in soil suspensions and matching the resulting colours against a colour chart calibrated in pH.

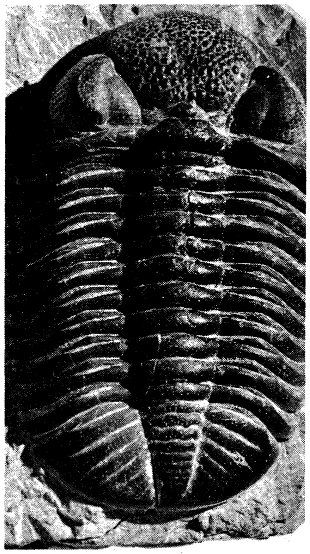
Phacelia, genus of about 200 species of blue- or white-flowering herbs, native to North America and Andean South America and including several species of garden flowers. It belongs to the family Hydrophyllaceae.



Phacelia
F.K. Anderson—EB Inc.

P. campanularia, native to dry slopes of southern California, bears blue, five-lobed blooms in loose sprays over the dark-green, toothed, oval leaves, on plants about 23 centimetres (9 inches) tall. From similar areas the closely related California bluebell, or wild Canterbury bell (*P. whitlavia*), has urn-shaped blooms.

Phacops, genus of trilobites (an extinct group of aquatic arthropods) found as fossils in



Phacops rana milleri, collected in Sylvania, Ohio
By courtesy of the Buffalo Museum of Science, Buffalo, N.Y.

Silurian and Devonian rocks (between 345,000,000 and 430,000,000 years old) in Europe and North America. *Phacops* is a common and easily recognizable form, with its rounded rather than angular outline, globose head region, and large compound eyes. A common form is the species *Phacops rana.*

Phaedo, also spelled PHAEDON (b. *c.* 417 BC, Elis, in the Peloponnesus), philosopher, founder of a Socratic school of philosophy at Elis on the Peloponnese, and author of works on dialectics and ethics.

Born of an aristocratic family, Phaedo was made a prisoner in the war with Sparta (400–399 BC) and was sold as a slave. Bought and freed by an Athenian who was a friend of Socrates, Phaedo became Socrates' disciple. Plato named one of his dialogues after him. After Socrates' death, Phaedo returned to Elis and established his school.

Many dialogues were attributed to Phaedo, but only the *Zopyrus* and *Simon* have survived.

Phaedrus (b. *c.* 15 BC, Thrace—d. *c.* AD 50, Italy), Roman fabulist, the first writer to Latinize whole books of fables, producing free versions in iambic metre of Greek prose fables then circulating under the name of Aesop.

A slave by birth, Phaedrus went to Italy early in life, became a freedman in the emperor Augustus' household, and received the usual education in Greek and Latin authors.

The poets Ennius, Lucilius, and Horace had introduced fables into their poems, but Phaedrus considered himself a genuine, pioneering artist whose poems, combining charm with a serious didactic purpose, were assured of immortality. He also prided himself on his brevity. The fables of Phaedrus include such favourites as "The Fox and the Sour Grapes," "The Wolf and the Lamb," "The Lion's Share," "The Two Wallets," and "The Pearl in the Dung-Heap." His work became extremely popular in the Middle Ages. Numerous prose and poetic versions of his tales appeared in Europe and Britain. A collection called *Romulus,* was the basis of most of them; Phaedrus' identity having been lost, some scholars assumed that Romulus was the author.

In the early 18th century a manuscript was discovered at Parma that contained 64 fables of Phaedrus, of which 30 were new. Another manuscript was later found in the Vatican and published in 1831. Later research identified 30 more fables as written in the iambics of Phaedrus.

Phaenias (Greek philosopher): *see* Phanias.

Phaeophyta, division or phylum of algae the members of which are commonly known as brown algae (*q.v.*).

Phaestus, Greek PHAESTOS, ancient city on the western end of the southern plain of Crete, about 3½ miles (5.6 kilometres) from the sea. The site was occupied from the 4th millennium BC, and its importance grew in the Early and Middle Bronze ages (*c.* 3000–*c.* 1600 BC). In the latter period its palace was first built and later remodelled. In the Late Bronze Age, about 1400, it was destroyed in the same earthquake that destroyed Knossos and other sites on Crete. It was reoccupied in the final phase of the Late Bronze Age (13th century BC) and was widely known in classical and Hellenistic times (*c.* 6th–1st centuries BC) until neighbouring Gortyn eclipsed it under the Roman Empire.

Phaethon (Greek: Shining, or Radiant), in Greek mythology, the son of Helios, the sun god, and a woman or nymph variously identified as Clymene, Prote, or Rhode. Taunted with illegitimacy, Phaethon appealed to his father, who swore to prove his paternity by giving him whatever he wanted. Phaethon asked to be allowed to drive the chariot of the sun through the heavens for a single day. Helios, bound by his oath, had to let him make the attempt. Phaethon set off but was entirely unable to control the horses of the sun chariot, which came too near to the earth and began to scorch it. To prevent further damage, Zeus hurled a thunderbolt at Phaethon, who fell to the earth at the mouth of the Eridanus, a river later identified as the Po.

phaeton, open, four-wheeled, doorless carriage, popular in the 18th and 19th centuries. It contained one or two seats, usually had a folding, or falling, top, and was owner-driven (*i.e.,* it had no outside driver's seat). The most spectacular phaeton was the English four-wheeled high-flyer, the body of which consisted of a light seat for two, resting atop two sets of springs and reached by ladder.

Much more reasonably constructed and graceful phaetons were the mail and the spider phaetons. The mail phaeton, used chiefly to convey passengers with luggage and as a travelling and posting carriage, was so named because it was constructed with mail-springs originally designed for mail coaches. The spi-

Phaeton, *c.* 1770; in the Science Museum, London
By courtesy of the Science Museum, London, lent by Sir John Lionel Armytage

der phaeton, of U.S. origin, was a light vehicle made for gentlemen drivers. The Stanhope and Tilbury phaetons were also fashionable carriages, both used at horse shows. Double phaetons had two seats, and extension-top phaetons resembled better surreys and simpler cabriolets.

Phag-mo-gru FAMILY, Tibetan family that in the 14th century liberated Tibet from Mongol control. The Phag-mo-gru had begun to extend its power over the surrounding countryside in the 13th century at a time when the country was being governed by a series of lamas from the Sa-skya monastery, residing at the Mongol (Yüan) court in China. The death of the emperor Kublai Khan in 1294 marked the beginning of the decline of Mongol power; the Phag-mo-gru, under its great leader Byang-chub rgyal-mtshan (1302–64), moved in and soon began to actively dispute the Sa-skya Lama's authority. By 1358 Byang-chub rgyal-mtshan had liberated all of central Tibet, eradicating Mongol control over the country. Byang-chub rgyal-mtshan and the Phag-mo-gru leaders who succeeded him assumed the title of Gong-ma, restored the Tibetan ethos as the ruling ideology, and divided the nation into districts governed by centrally appointed officials. During the next 100 years in which the Phag-mo-gru was dominant, a semblance of central authority was reestablished in the country. In the middle of the 15th century, however, the Phag-mo-gru rule was gradually usurped by the powerful Rin-spung family, who had previously been ministers to the Gong-ma.

phage (virus): *see* bacteriophage.

phagocytosis, process by which living cells (phagocytes) ingest or engulf other cells or particles. The phagocytic cell may be a free-living one-celled organism, such as an amoeba, or one of the body cells, such as a leukocyte (white blood cell). The particles commonly phagocytized by leukocytes include bacteria, dead tissue cells, protozoa, various dust particles, pigments, and other minute foreign bodies. In the simpler forms of animal life, such as amoebae and sponges, phagocytosis is a means of feeding; in higher animals phagocytosis is chiefly a defensive reaction against infection and invasion of the body by foreign substances (antigens).

In humans and in vertebrates generally, the most effective phagocytic cells are the macrophages (large phagocytic cells) and the granular leukocytes, or granulocytes (small phagocytic cells). The macrophages occur especially in the liver, spleen, and lymph nodes, in which their function is to free the blood and lymph of bacteria and other particles. Macrophages are also found in all tissues as wandering amoeboid cells, and the monocyte, a precursor of the macrophage, is found in the blood. The smaller granulocytes are white blood cells, chiefly neutrophils, that are carried along by the circulating blood until they reach an area of infected tissue, where they pass through the blood vessel wall and lodge in that tissue. Both macrophages and granulocytes are drawn toward an area of infection or inflammation by means of substances given off by the bacteria and the infected tissue, or by a chemical interaction between the bacteria and complement, which is a blood plasma protein.

Before phagocytosis is accomplished, the phagocyte and the particle must adhere to each other, and whether this is possible depends largely on the chemical nature of the surface of the particle. Ordinary proteins from the blood can form a surface film on less virulent bacteria to which leukocytes adhere, and phagocytosis follows. Virulent bacteria are ingested with more difficulty. Leukocytes, instead of adhering to them, succeed only in pushing them away. If, however, the leukocytes succeed in pushing them against a firm surface, such as the lining of a blood vessel, the bacteria may not be able to slip away and are ingested. This process is known as surface phagocytosis. Other virulent bacteria may not be phagocytized until their surfaces are coated with special antibodies formed by the body in response to the presence of that particular kind of bacterium. Such antibodies are of great importance in establishing immunity to diseases.

The manner in which a phagocytic cell ingests a particle varies somewhat with the size of the particle. Small particles, such as bacteria or minute grains of charcoal, seem to be ingested in an instant. At one moment they appear through the microscope to be adherent to the surface of the phagocyte; at the next moment they are inside it. Larger objects, such as clumps of bacteria or tissue cells, are phagocytized by a more prolonged response of the leukocyte. The cell flows around the object until it has been completely engulfed.

The results of phagocytosis are digestion and destruction of the particle by means of enzymes inside the phagocyte. The engulfed object is contained within a membrane-bound vacuole. Poisons contained in ingested bacteria cannot harm the phagocyte so long as the bacteria remain in the vacuole; phagocytic enzymes are secreted into the vacuole in which digestion takes place. If the particle is indigestible, however, as is a grain of carbon, it eventually may be ejected by the phagocyte.

'Phags-pa (b. 1235—d. 1280), Tibetan scholar-monk who set up a Buddhist theocracy in Tibet.

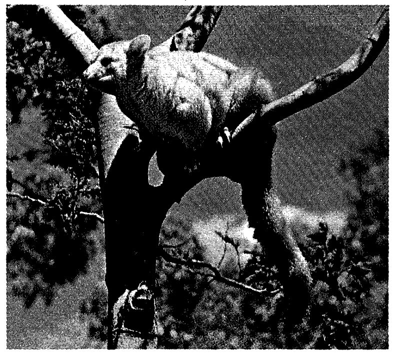
'Phags-pa was a member of the Sa-skya-pa school of Buddhism, which was based at the Sa-skya monastery and which was noted for its emphasis on scholarship. After the Mongols had established suzerainty over his country, 'Phags-pa accompanied his uncle, the Sa-skya lama, on a visit to Mongolia in 1247. 'Phags-pa later succeeded his uncle as lama and came to have great influence with Kublai Khan, founder (1279) of the Yüan dynasty of China, to whom he became adviser. With Kublai he worked out the relation of Tibet to China as a personal bond between the lama as priest and the emperor as patron (*yon-mchod*). He also developed with Kublai the "dual principle" of the parity of power and dignity of church and state in political matters. 'Phags-pa also invented an alphabet for the Mongol language.

phala (Sanskrit: "fruit"), in Indian philosophy, the fruit or consequence of a particular action (*karma*). The almost universally held conviction among Indian philosophers that this life is but one in a chain of lives and that social class and personal character are the result of deeds in a previous life underlies the significance of both *phala* and *karma*. The moral energy of man's past deeds is conserved and automatically fructifies in the circumstances of a future life. *See also* karma.

Phalaborwa, also spelled PALABORA, mining town, northeastern Transvaal, South Africa, located east of the Drakensberg mountains and north of the Olifants River near Kruger National Park. It is built on top of an old black African mining centre of iron and copper ore; traces of their workings and clay smelting ovens have been found in the nearby granite hills. A name of tribal origin, Phalaborwa ("Better than the South") means the area was healthier than fever-ridden areas to the south. Copper mining by Europeans was first undertaken there in 1904 but was soon suspended because of the high cost of transport. The discovery of phosphates there led to the formation of the Phosphate Development Corporation (Foskor) in 1951 and the establishment of the town of Phalaborwa in 1957. Phosphate deposits now mined there supply South Africa's requirements. Copper and iron ore are extracted once again, and uranium is recovered as a by-product. Pop. (1984 est.) mun., 12,000.

phalanger, any of several species of Australasian marsupial mammals of the family Phalangeridae. They are called possums in Australia and Tasmania. The cuscus (*q.v.*) belongs to this family.

Phalangers are tree-dwelling animals: the clawless innermost hind digit and, sometimes, the first and second digits of the forefoot are opposable, making it possible for the animal to grasp branches. The second and third digits of the hind foot are united. The tail is long and often prehensile. The pouch opens forward; there are usually two to four teats. The first incisor tooth is long and stout; the side teeth are tiny. The coat is often woolly, and many species are striped. Total length ranges from 12 to 120 centimetres (5 to 47 inches).



Golden brush-tailed possum (*Trichosurus*)
Warren Garst—Tom Stack and Associates

Phalangers are native to the forests of Australia, Tasmania, New Guinea, and islands west to Celebes and east to the Solomons. All are herbivorous, feeding on fruits, leaves, and blossoms. Some species also eat insects and small vertebrates. Phalangers are active chiefly at night. Most bear their young—usually two or three—in tree hollows and unused birds' nests; a few build leafy nests of their own.

Several species are endangered: they are the prey of snakes and cats or have been trapped for their fur, though in Australia they are now protected. The brush-tailed possum (*Trichosurus vulpecula*) is the most widely distributed Australian and Tasmanian marsupial. It looks rather like a squirrel.

Ring-tailed possums—the 17 species of the genus *Pseudocheirus*—usually carry their tails in a circle at the tip. The three dormouse possums, or mundardas (*Cercartetus*), and the three pygmy possums (*Eudromicia*) store fat in the tail and become torpid at times. Striped phalangers, also called striped possums (*Dactylonax palpator* and the three species of *Dactylopsila*), are chiefly New Guinean; they have the fourth digit of the front foot elongated to serve as a probe for grubs in rotten wood. The long-snouted phalanger, or honey possum (*Tarsipes spenserae*), has an extended muzzle and only 22 teeth—the fewest among marsupials. It uses its bristle-tipped tongue to take nectar from flowers. Several phalanger species are arboreal gliders who use flaps of skin along their flanks as sails with which to ride from tree to tree. *See* glider.

phalanx, tactical formation consisting of heavily armed infantry standing shoulder to shoulder in files normally eight men deep. The use of the formation, developed by the ancient Greeks and maintained throughout their history, apparently spread throughout Greece during the 7th century BC. The Greek hoplite (heavy-armed infantryman) who manned the phalanx was equipped with a round shield, a heavy corselet of leather and metal, greaves (shin armour), an 8- to 21-foot pike for thrusting, and a 2-foot double-edged sword. The pikes formed a barrier to cavalry attack, although the phalanx was somewhat vulnerable to archers, either mounted or on foot.

Since the phalanx held in solid ranks and was divided only into the centre and wings, there was generally little need for an officer corps; the whole line advanced in step to the sound of the flute. The Spartans, however, did train officers to manoeuvre the phalanx.

Consult the INDEX *first*

Phalaris (d. *c.* 554 BC), tyrant of Acragas (modern Agrigento), Sicily, notorious for his cruelty. He is alleged to have roasted his victims alive in a bronze bull, their shrieks representing the animal's bellowing. A statue of a bull of some kind seems to have existed, but the facts surrounding its use have been embellished. For example, the supposed designer of the bull, Perilaus, or Perillus, was said to have been the first man executed in it.

After assuming the responsibility for building the temple of Zeus Atabyrios, in the citadel at Acragas, Phalaris armed his workers and seized power. Under his rule Acragas seems to have prospered and to have expanded its territory. The splendid layout of the city probably belongs to his time. Eventually Phalaris was overthrown by Telemachus, the ancestor of Theron (tyrant 488–472). It is said that the deposed tyrant was burned to death in his own bronze bull.

Contrary to the legends that stress the cruelty of Phalaris, he was represented by the sophists of the Roman Empire as a humane and cultured man. The famous 148 *Letters of Phalaris* were proved by the great English Classical scholar Richard Bentley, in his *Dissertation on the Letters of Phalaris* (1699), to have been written much later by a sophist or rhetorician, possibly Adrianus of Tyre (died *c.* AD 193).

phalarope (Greek: "coot-foot"), any of three species of shorebirds that constitute the family Phalaropodidae (order Charadriiformes). They are lightly built, slim-necked birds, about 20 to 25 centimetres (8 to 10 inches) long, and have

Wilson's phalarope (*Steganopus tricolor*)
Alice B. Kessler

lobed toes, adapted to swimming. Phalaropes are noted among birds for complete reversal of sex roles. Females, larger and more brightly coloured than males, fight for nesting territories and do the courting; males undertake all nesting duties and lead the young southward in autumn after the females have departed.

Phalaropes are marked with red and soft gray in summer; in winter they are gray and white. Two species that breed around the Arctic Circle are the red phalarope (*Phalaropus fulicarius*), called gray phalarope in Britain, and the northern phalarope (*Lobipes lobatus*), called red-necked phalarope in Britain. Both species winter on tropical oceans, where they are known as sea snipe. Wilson's phalarope (*Steganopus tricolor*) breeds in interior western North America and migrates chiefly to the Argentine pampas.

phallicism, worship of the generative principle as symbolized by the sexual organs or the act of sexual intercourse. Although religious activities that involve sexuality or the symbolism of the male or female sexual organs are sometimes called phallic cults, there is no evidence that any cult is preeminently phallic.

The most important forms of sexual rituals are those in which intercourse is believed to promote fertility, those that release a flood of creative energy by breaking boundaries and by returning a culture to the state of primeval and powerful chaos (*e.g.,* the orgy during New Year festivals), or those in which sexual intercourse symbolizes the bringing together of opposites (*e.g.,* alchemy or Tantrism, a Hindu esoteric meditation system).

In other traditions objects of adoration are representations of the sexual organs (*e.g.,* the phallus borne in Dionysiac processions in Greece and Rome; the male *liṅga* and female *yoni* in India) or deities with prominent genitals (*e.g.,* Priapus in Greece). In these instances, the powers of creativity that the sexual organ represents, rather than the organ itself, are worshipped.

Phalodi, town, Rājasthān state, northwestern India. Located in the Great Indian (Thar) Desert, Phalodi is an old caravan centre, believed to have been founded in the 15th century. Architectural monuments include a fort and palaces. The town is connected by road and rail with Jodhpur and is a trade centre for camels, sheep, hides, and salt. Local manufactures include metal utensils, camel's-hair mats, and pottery. Just north lies the Phalodi salt source, a large saline depression of the desert. Camels are bred nearby. Pop. (1981) 28,539.

Phan Boi Chau, also called PHAN GIAI SAN, PHAN SAO NAM, PHAN THI HAN, or HAI THU, original name PHAN VAN SAN (b. 1867, Nghe An province, northern Vietnam—d. Sept. 29, 1940, Hue), dominant personality of early Vietnamese resistance movements, whose impassioned writings and tireless schemes for independence earned him the reverence of his people as one of Vietnam's greatest patriots.

Phan Boi Chau was the son of a poor scholar, who stressed education and preparation for the mandarin examinations, the only means to success in the traditional bureaucracy. By the time he received his doctorate in 1900 Phan Boi Chau had become a firm nationalist.

In 1903 he wrote *Luu cau huyet le tan thu* ("Ryukyu's Bitter Tears"), an allegory equating Japan's bitterness at the loss of the Ryukyu Islands with the Vietnamese loss of independence. With fellow revolutionaries he formed the Duy Tan Hoi (Reformation Society; *see* Duy Tan) in 1904 and secured the active support of Prince Cuong De (*q.v.*), thus presenting to the people an alliance of royalty and resistance.

In 1905 Phan Boi Chau moved his resistance movement to Japan, and in 1906 he met the Chinese revolutionary Sun Yat-sen. His plans to place Cuong De on the throne of Vietnam resulted in a meeting in 1906 with the Prince and the Vietnamese reformer Phan Chau Trinh (*q.v.*). A Franco-Japanese understanding forced Phan Boi Chau, the Vietnamese students he had brought to Japan, and Cuong De to leave Japan in 1908–09. By 1912 Phan Boi Chau had reluctantly given up his monarchist scheme. He reorganized the resistance movement in Canton, China, under the name Viet Nam Quang Phuc Hoi (Vietnam Restoration Society). The organization launched a plan to assassinate the French governor general of Indochina, but the plan failed. Phan Boi Chau was imprisoned in Canton from 1914 to 1917; during his confinement he wrote *Nguc trung thu* ("Prison Notes"), a short autobiography.

Upon his release, Phan Boi Chau studied Marxist doctrine and resumed his resistance to the French. In June 1925 he was seized and taken to Hanoi, but hundreds of Vietnamese protested against his arrest. The French pardoned him and offered him a civil service position that he refused.

Phan Boi Chau lived out his later years in quiet retirement at Hue, under French surveillance. He wrote a second autobiography, replete with directives for future revolutionaries, and several volumes of poetry. Among his notable works are *Viet Nam vong quoc su* (1906; "History of the Loss of Vietnam"), renowned as Vietnam's first revolutionary history book, and *Hau Tran dat su* ("Strange Story of the Latter Tran"), a historical novel with political implications.

Phan Chau Trinh, also spelled PHAN CHU TRINH (b. 1872, Tay Loc, Quang Nam province, Vietnam—d. March 24, 1926, Saigon), nationalist leader and reformer who played a vital role in the movement for Vietnamese independence and who was the leading proponent of a reformist program that joined the aims of expelling the French and of restructuring Vietnamese society.

Trained in military skills by his father, Phan Chau Trinh fought in 1885 against French forces that were searching for the fugitive rebel king Ham Nghi, the symbol of the resistance. In an encounter with the French, his father was killed, possibly by a member of a nationalist–royalist organization who thought him a traitor. Thereafter, Phan Chau Trinh would not associate with any plans to oppose the French that involved a monarchist symbol.

Phan Chau Trinh resumed his education in 1887, studying the Chinese classics in preparation for the mandarin examinations, which he passed in 1900. By 1906 he had come to view the mandarin bureaucracy and the Vietnamese monarchy as symbols of a backwardness that would forever prevent technological progress and the development of an autonomous state. That year he went to Japan, where he discussed plans for overthrowing the French regime with another Vietnamese nationalist, Phan Boi Chau (*q.v.*). Phan Chau Trinh argued for the gradual development of an autonomous state by laying firm foundations in economic and industrial development. His primary goal was modernization, from which he believed a Vietnamese democratic republic would follow.

Returning to Vietnam, Phan Chau Trinh started small business enterprises and spread propaganda encouraging the development of local industries and a modern education for all Vietnamese. Gaining a large following, he tried to persuade the French to undertake major reforms, and he urged replacing the mandarin civil service system with vocational schools and commercial firms. He asked wealthy Vietnamese to develop national commerce through personal investments.

Greatly influenced by the writings of Jean-Jacques Rousseau and Montesquieu, Phan Chau Trinh began by appealing in vain to French colonialists in terms of their own revolutionary tradition. In 1908 he was seized in Hanoi during a series of arrests of anticolonialist agitators. He maintained a silent protest through a hunger strike while awaiting trial at Hue. After a trial in a joint mandarin and French court, he was sentenced in May 1908 to life imprisonment on Poulo Condore (now Con Son). He was pardoned and released in 1911, however, apparently to work with the colonial regime for modernization. Subsidized by the French, he went to Paris; he was again imprisoned early in World War I, this time for draft evasion and pro-German leanings. He was released in 1915 but received no more subsidies from the French. Phan Chau Trinh returned to Vietnam in 1924 and died of tuberculosis in 1926. He was mourned by Vietnamese of all classes in a national funeral ceremony that lasted a week.

BIBLIOGRAPHY. An excellent critical assessment of Phan Chau Trinh's writings and his influence on Vietnam's historical development is given in David G. Marr, *Vietnamese Anticolonialism, 1885–1925* (1971).

Phan Dinh Phung (b. 1847, Ha Tinh province, Vietnam—d. Dec. 28, 1895, Nghe Tinh province), Vietnamese government official who opposed French expansion in Vietnam and became a leader of the nationalist resistance movement.

Phan was a mandarin at the court of the Vietnamese emperor Tu Duc. After Tu Duc's death in 1883, Phan opposed the succession of the emperor's nephew Ham Nghi. Ham Nghi ascended the throne in 1884, however, and Phan was condemned to death by his enemies at the court; the sentence was later commuted to banishment. Ham Nghi became the youthful figurehead leader of an unsuccessful rebellion against the French in 1885.

By 1894 Phan led another rebellion that failed because of inadequate support. Phan and his fellow revolutionaries were forced to retreat to the mountains of Nghe Tinh province. In July 1895 the French sent 3,000 troops to Nghe Tinh, but Phan's resistance movement held out for several months. At the end of the year, Phan died of dysentery, and the remainder of his followers were caught and executed.

Phan Khoi (b. 1888?, Quang Nam province, Annam [now in Vietnam]—d. 1958, Hanoi, North Vietnam), intellectual leader who inspired a North Vietnamese variety of the Chinese Hundred Flowers Campaign, in which scholars were permitted to criticize the communist regime, but for which he himself was ultimately persecuted by the Communist Party of Vietnam.

Phan Khoi was a dedicated nationalist who in his youth followed the patriot Phan Chau Trinh in working for social and political reforms in Vietnam. When Vietnam was divided in 1954, Phan Khoi chose to remain under the communist government in the north, becoming North Vietnam's most illustrious intellectual. He was the editor of *Nhan Van* ("Humanism") and *Giai Pham Mua Xuan* ("Beautiful Flowers of the Spring"), two radical literary reviews that took advantage of the liberalizing proclamation of Mao Zedong, of China, to offer stringent criticisms of the Hanoi regime. Phan Khoi accused the Communist Party of corruption, attacked alleged anti-intellectualism of the Vietnam People's Army, and voiced other complaints.

"Art is a private sphere," he wrote, "Politics should not encroach upon it." The criticisms, however, were more than the government could endure. The liberalization policy ended, and Phan Khoi was imprisoned on charges of "deviationism."

Phan Thanh Gian, also spelled PHAN THANG GIANG (b. 1796, Ben Tre province, Cochinchina [now in Vietnam]—d. Aug. 4, 1867, Vinh Long), Vietnamese government official and diplomat whose conservatism and strict adherence to the political and ethical tenets of Confucianism may have contributed to the French conquest of Vietnam.

The son of a low-ranking administrative employee, Phan Thanh Gian was outstanding in state examinations and won a doctoral degree—the first awarded in Cochinchina (southern Vietnam)—and a position close to Emperor Minh Mang. At the imperial court he progressed rapidly through the scholarly ranks, becoming a mandarin of the second order and a counselor of the emperor. Following Confucian principles strictly, he informed his sovereign of errors and shortcomings in imperial edicts and practices, thus incurring imperial displeasure. Minh Mang deprived him of his titles and demoted him to fight as a common soldier in the region of Quang Nam, in central Vietnam.

On the battlefield, Phan Thanh Gian marched in the front lines and provided an example of courage and discipline. His behaviour won him the respect and admiration of officers as well as his fellows, and Minh Mang recalled him to court. Under succeeding rulers he was named to the highest governmental positions.

When the Vietnamese sovereigns began the active persecution of Christian missionaries, France invaded southern Vietnam and by 1862 had captured Saigon (now Ho Chi Minh City), Bien Hoa, and Vinh Long. By treaty Phan Thanh Gian ceded Gia Dinh and Dinh Thong (present-day My Tho), in the hope that the French would stay out of the remainder of Vietnam. The French thus controlled the richest parts of southern Vietnam, its three easternmost provinces.

In 1863 Phan Thanh Gian proposed a treaty by which France would halt colonization efforts in Vietnam and return the three provinces in exchange for commercial settlements and land around Saigon, My Tho, and Mui Vung Tau (Cap Saint-Jacques), the promise of yearly tribute, and the provision that all of southern Vietnam would be declared a French protectorate. The terms were approved by France, and, although the emperor Tu Duc reneged on some points and added modifications that favoured the Vietnamese, the treaty was signed in 1864. The following year, however, France declared that it would respect only the terms of the original treaty. Phan Thanh Gian was dismayed, feeling that he had failed and had betrayed his people. He feared the influence of Western civilization and distrusted European technology. When the French seized lands that were under his personal protection in 1867, he committed suicide in protest of the use of force by the French in a cause for which they lacked any moral justification.

Phan Thiet, seaport, southern Vietnam. On the South China Sea, it is at the head of a broad crescent bay, 112 miles (180 km) east-northeast of Ho Chi Minh City (formerly Saigon). Originally a fishing village, it had resort facilities under the French colonial administration. It is one of Vietnam's most important fishing ports and centres for fish processing and marketing; it is also headquarters of the Vietnamese fishing cooperatives. There is a considerable brick- and tile-making industry. An important activity is the manufacture of *nuoc mam,* the national condiment derived from certain types of fermented fish. There are hospitals and a commercial airport located there. Pop. (latest est.) 76,652.

Phanariote, member of one of the principal Greek families of the Phanar, the Greek quarter of Constantinople (Istanbul), who, as administrators in the civil bureaucracy, exercised great influence in the Ottoman Empire in the 18th century. Some members of these families, which had acquired great wealth and influence during the 17th century, abandoned their traditional careers in commerce to enter the bureaucracy of the Ottoman Empire. From 1669 until 1821 Phanariotes served as dragomans (interpreters who also acted as foreign-affairs advisers) to the Sublime Porte (the Ottoman government) and to foreign embassies. They were also appointed hospodars (rulers) of the Danubian principalities, Moldavia and Walachia, which were vassal states of the Ottoman Empire during the period 1711–1821, which is, therefore, known as the Phanariote period in Romanian history. Phanariotes also dominated the administration of the Eastern Orthodox church and frequently intervened in the selection of prelates, including the patriarch of Constantinople. Leading Phanariote families were the Argyropoulos, Cantacuzino, Mavrokordátos, and Ypsilantis.

Phanerozoic Eon, the span of geologic time extending about 570 million years from the end of the Proterozoic Eon to the present. The Phanerozoic, the eon of visible life, is divided into three major spans of time largely on the basis of characteristic assemblages of life-forms: the Paleozoic, Mesozoic, and Cenozoic eras. Although life clearly originated at some time, probably quite early, in the Proterozoic Eon, not until the Phanerozoic did a rapid expansion and evolution of forms occur and fill the various ecological niches available. The key to this great Phanerozoic expansion appears to lie in the development of plants able to carry out the photosynthetic process and thus release free oxygen into the atmosphere. Before this time, the Earth's atmosphere contained negligible amounts of free oxygen, and animals, in which energy transfers involving the process of respiration are critical, were unable to develop. During the Phanerozoic, the Earth gradually assumed its present configuration and physical features through such processes as continental drift, mountain building, and continental glaciation. Thus, although the Phanerozoic Eon represents only about the last one-eighth of time since the Earth's crust formed, its importance far exceeds its relatively short duration.

Phang Xi Pang (peak, Vietnam): *see* Fan Si Pan.

Phangnga, town, southern Thailand, on the hilly western side of the Malay Peninsula. It lies on the coastal road and is a centre for mining, trade, and tourism inspired by the mountain caves and coastal scenery. The surrounding area has a coastline on the Indian Ocean and embraces a number of offshore islands. Tin and tungsten are mined in the region, and rubber, fruit, and rice are produced. Pop. (1986 est.) 8,897.

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Phanias, also spelled PHAENIAS, or PHAINIAS (fl. *c.* 300 BC), Greek philosopher of Eresus on the island of Lesbos, a pupil of Aristotle and a friend of Theophrastus, whom he joined in the Peripatetic school. He is mentioned as the author of works on logic, in which he probably followed Aristotle's doctrine; he also wrote, as Theophrastus did, on botany; and there are remains of works by him on poets, on the Socratic philosophers, and on history. His *Prytaneis of Eresus* was a history in which events in the Greek world in general were included, the chronology being determined by the series of the successive magistrates of his native place. In his *Tyrants of Sicily* he seems to have dealt with Western history against a pan-Hellenic background.

phantom midge (subfamily Chaoboridae), any of a group of insects (order Diptera) similar in appearance to the mosquito. The common name is derived from the fact that the larvae are almost transparent. Their antennae are modified into grasping organs. The larvae, found in pools, often destroy mosquito larvae. The adults do not bite.

Phao Sriyanond (b. March 1, 1910, Siam [now Thailand]—d. Nov. 21, 1960, Geneva, Switz.), director general of the Thai government's national police, who as one of a powerful triumvirate, with Luang Phibunsongkhram and Sarit Thanarat, built a formidable armed force in an unsuccessful attempt to assert his individual authority.

Phao, of Thai-Burmese ancestry, joined in the coup of 1947 that restored Phibunsongkhram to power; he held various ministries in the new regime and was given command of the national police force. In a purge of Thailand's Communists in 1952–53 he directed a harsh anti-Chinese policy. His reputation was marred by charges of widespread corruption among police officials, who were accused of smuggling opium and profiteering in national commercial enterprises, and by the mysterious deaths of the regime's political opponents. In the early 1950s Phao and Sarit became more powerful than Phibunsongkhram, and the rivalry between Phao and Sarit led in 1957 to a bloodless coup that forced Phao and Phibun into exile.

pharaoh (from Egyptian *per ʿaa,* "great house"), originally, the royal palace in ancient Egypt; the word came to be used as a synonym for the Egyptian king under the New Kingdom (starting in the 18th dynasty, 1539–1292 BC), and by the 22nd dynasty (*c.* 945–*c.* 730 BC) it had been adopted as an epithet of respect. The term has since evolved into a generic name for all ancient Egyptian kings, although it was never formally the king's title. In official documents, the full title of the Egyptian king consisted of five names, each preceded by one of the following titles: Horus; Two Ladies; Golden Horus; King of Upper and Lower Egypt and Lord of the Double Land; and Son of Re and Lord of the Diadems. The last name was given him at birth, the others at coronation.

The Egyptians believed their pharaoh to be a god, identifying him with the sky god Horus and with the sun gods Re, Amon, and Aton. Even after death the pharaoh remained divine, becoming transformed into Osiris, the father of Horus and god of the dead, and passing on his sacred powers and position to the new pharaoh, his son. The pharaoh's divine status was believed to endow him with magical powers: his uraeus (the snake on his crown) spat flames at his enemies, he was able to trample thousands of the enemy on the battlefield, and he was all-powerful, knowing everything and controlling nature and fertility.

As a divine ruler, the pharaoh was the preserver of the god-given order, called *ma'at.* He owned a large portion of Egypt's land and directed its use, was responsible for his people's economic and spiritual welfare, and dispensed justice to his subjects. His will was supreme, and he governed by royal decree. To govern fairly, though, the pharaoh had to delegate responsibility; his chief assistant was the vizier, who, among other duties, was chief justice, head of the treasury, and overseer of all records. Below this central authority, the royal will of the pharaoh was administered through the nomes, or provinces, into which Upper and Lower Egypt were divided.

Since he was considered a god, the pharaoh lived apart from other men, and his subjects subscribed to rituals that exalted him as a divine king. All those approaching him, for example, had to prostrate themselves on the ground. When the pharaoh died, Egyptian funerary rituals were performed that were thought to guarantee that he survive in the afterlife as a god, apart from other men.

Evidence suggests, however, that the Egyptians knew that their divine ruler was only a human being, if a supreme one; they judged him according to his deeds, criticizing pharaohs, plotting against them, and deposing or murdering ineffectual ones. Each succeeding pharaoh, however, ascended the throne under the aegis of the rituals and traditions that recognized him as divine ruler.

Pharisee, member of a Jewish religious party that flourished in Palestine during the latter part of the Second Temple period (515 BC–AD 70). Their insistence on the binding force of oral tradition ("the unwritten Torah") still remains a basic tenet of Jewish theological thought. When the Mishna (the first constituent part of the Talmud) was compiled about AD 200, it incorporated the teachings of the Pharisees on Jewish law.

The Pharisees (Hebrew: Perushim) emerged as a distinct group shortly after the Maccabaean revolt, around 165–160 BC; they were, it is generally believed, spiritual descendants of the Hasideans (*q.v.*). The Pharisees emerged as a party of laymen and scribes in contradistinction to the Sadducees, *i.e.,* the party of the high priesthood that had traditionally provided the sole leadership of the Jewish people. The basic difference that led to the split between the Pharisees and the Sadducees lay in their respective attitudes toward the Torah (the first five books of the Old Testament) and the problem of finding in it answers to questions and bases for decisions about contemporary legal and religious matters arising under circumstances far different from those of the time of Moses. In their response to this problem, the Sadducees, on the one hand, refused to accept any precept as binding unless it was based directly on the Torah, *i.e.,* the Written Law. The Pharisees, on the other hand, believed that the Law that God gave to Moses was twofold, consisting of the Written Law and the Oral Law, *i.e.,* the teachings of the prophets and the oral traditions of the Jewish people. Whereas the priestly Sadducees taught that the written Torah was the only source of revelation, the Pharisees admitted the principle of evolution in the Law; men must use their reason in interpreting the Torah and applying it to contemporary problems. Rather than blindly follow the letter of the Law even if it conflicted with reason or conscience, the Pharisees harmonized the teachings of the Torah with their own ideas or found their own ideas suggested or implied in it. They interpreted the Law according to its spirit; when in the course of time a law had been outgrown or superseded by changing conditions, they gave it a new and more acceptable meaning, seeking scriptural support for their actions through a ramified system of hermeneutics. It was due to this progressive tendency of the Pharisees that their interpretation of the Torah continued to develop and has remained a living force in Judaism.

The Pharisees were not primarily a political party but a society of scholars and pietists. They enjoyed a large popular following, and in the New Testament they appear as spokesmen for the majority of the population. Around 100 BC a long struggle ensued as the Pharisees tried to democratize the Jewish religion and remove it from the control of the Temple priests. The Pharisees asserted that God could and should be worshiped even away from the Temple and outside Jerusalem. To the Pharisees, worship consisted not in bloody sacrifices—the practice of the Temple priests—but in prayer and in the study of God's law. Hence the Pharisees fostered the synagogue as an institution of religious worship, outside and separate from the Temple. The synagogue may thus be considered a Pharasaic institution since the Pharisees developed it, raised it to high eminence, and gave it a central place in Jewish religious life.

The active period of Pharasaism, the most influential movement in the development of Orthodox Judaism, extended well into the 2nd and 3rd centuries AD. The Pharisees preserved and transmitted Judaism through the flexibility they gave to Jewish scriptural interpretation in the face of changing historical circumstances. The efforts they devoted to education also had a seminal importance in subsequent Jewish history; after the destruction of the Second Temple and the fall of Jerusalem in AD 70, it was the synagogue and the schools of the Pharisees that continued to function and to promote Judaism in the long centuries following the Diaspora.

pharmaceutical, substance used in the diagnosis, treatment, or prevention of disease and for restoring, correcting, or modifying organic functions.

A brief treatment of pharmaceuticals follows. For full treatment, *see* MACROPAEDIA: Industries, Chemical Process.

Records of medicinal plants and minerals date to ancient Chinese, Hindu, and Mediterranean civilizations. Ancient Greek physicians such as Galen used a variety of drugs in their profession. During the 16th century AD, after Western medicine began to recover from its long sleep during the Dark and Middle Ages, pharmaceutical practice began to develop rapidly. In 1546 the first pharmacopoeia (list of drugs and their preparation) appeared in Germany, and the profession of pharmacy is considered to have begun in 1617 with the founding of the Society of Apothecaries in London. Among the earliest modern pharmaceuticals were the anesthetics; morphine was first used in 1806, ether in 1842, chloroform in 1847, and cocaine in 1860. Other substances isolated in the 19th century included strychnine (1817), quinine (1820), and nicotine (1828). Joseph Lister first used phenol (carbolic acid) to prevent infection in 1865.

Pharmaceuticals are generally classified by chemical group, by the way they work in the body (pharmacological effect), and by therapeutic use. Alkaloids were the first pure pharmaceuticals derived from natural substances (plants); they include quinine, nicotine, cocaine, atropine, and morphine. Drugs of animal origin include glandular extracts containing hormones, such as insulin for use in treating diabetes.

Antibiotics, vaccines, human blood-plasma fractions, and steroid hormones are other important pharmaceuticals manufactured from natural substances. Vitamins, which were formerly obtained from natural sources, are now often made in the laboratory.

In the preparation of dosages, many pharmaceuticals are ground to varying degrees of fineness. Many medicinal substances are added to water, alcohol, or another solvent so that they can be used in solution form. These may include spirits, elixirs, and tinctures. Ointments are one of many semisolid preparations, which also include creams, pastes, and jellies. Solid pharmaceuticals include pills, tablets, lozenges, and suppositories. In this form the compounds are more stable, with less risk of chemical reaction, and the dosage is easier to determine. Storage and packaging also is made simpler, and solid forms are more efficient to produce.

pharmacology, branch of medicine that deals with the interaction of drugs with the systems and processes of living animals, in particular, the mechanisms of drug action as well as the therapeutic and other uses of the drug.

The first Western pharmacological treatise, a listing of herbal plants used in classical medicine, was made in the 1st century AD by the Greek physician Dioscorides. The medical discipline of pharmacology derives from the medieval apothecaries, who both prepared and prescribed drugs. In the early 19th century a split developed between apothecaries who treated patients and those whose interest was primarily in the preparation of medicinal compounds; the latter formed the basis of the developing specialty of pharmacology. A truly scientific pharmacology developed only after advances in chemistry and biology in the late 18th century enabled drugs to be standardized and purified. By the early 19th century, French and German chemists had isolated many active substances—morphine, strychnine, atropine, quinine, and many others—from their crude plant sources. Pharmacology was firmly established in the later 19th century by the German Oswald Schmeiderberg (1838–1921). He defined its purpose, wrote a textbook of pharmacology, helped to found the first pharmacological journal, and, most importantly, headed a school at Strasbourg that became the nucleus from which independent departments of pharmacology were established in universities throughout the world. In the 20th century, and particularly in the years since World War II, pharmacological research has developed a vast array of new drugs, including antibiotics, such as penicillin, and many hormonal drugs, such as insulin and cortisone. Pharmacology is presently involved in the development of more effective versions of these and a vast array of other drugs through chemical synthesis in the laboratory. Pharmacology also seeks more efficient and effective ways of administering drugs through clinical research on large numbers of patients.

During the early 20th century, pharmacologists became aware that a relation exists between the chemical structure of a compound and the effects it produces in the body. Since that time, increasing emphasis has been placed on this aspect of pharmacology, and studies routinely describe the changes in drug action resulting from small changes in the chemical structure of the drug. Because most medical compounds are organic chemicals, pharmacologists who engage in such studies must necessarily have an understanding of organic chemistry.

Important basic pharmacological research is carried out in the research laboratories of pharmaceutical and chemical companies. After 1930 this area of pharmacological research underwent a vast and rapid expansion, particularly in the United States and Europe.

The work of pharmacologists in industry deals also with the exhaustive tests that must be made before promising new drugs can be introduced into medical use. Detailed observations of a drug's effects on all systems and organs of laboratory animals are necessary before the physician can accurately predict both the effects of the drug on patients and their potential toxicity to humans in general. The pharmacologist does not himself test the effects of drugs in patients; this is done only after exhaustive tests on animals and is usually conducted by physicians to determine the clinical effectiveness of new drugs. Constant testing is also required for the routine control and standardization of drug products and their potency and purity.

pharmacopoeia, also spelled PHARMACOPEIA, a book published by a government, or otherwise under official sanction, to provide standards of identity, quality, and strength for the medicinals representing the best practice and teaching of medicine. The primary function of a pharmacopoeia is to describe each drug on the selected list and to specify methods for determining its identity, quality, and strength. The provisions of the pharmacopoeia are binding upon all who produce drugs and who dispense them.

The task of compiling most pharmacopoeias is carried out by experts in the professions of medicine, chemistry, and pharmacy at the request of the agency undertaking the compilation. Most programs are financed from government funds, but the *British Pharmacopoeia* and the *United States Pharmacopeia* are written by private, nonprofit organizations with the sanction of their respective governments. The proceeds of their sale support the revision. Most countries not having a national pharmacopoeia have adopted one of another nation (or nations) or, in some cases, the international pharmacopoeia.

The *Pharmacopoea Internationalis* was put forward by the World Health Organization in 1951 as a recommendation aimed at minimizing or eliminating variations among national pharmacopoeial standards.

pharmacy, the science that deals with the collection, preparation, and standardization of drugs and medicines. Pharmacists prepare and dispense the medications prescribed by physicians, dentists, and veterinarians.

A brief treatment of pharmacy follows. For full treatment, *see* MACROPAEDIA: Medicine.

References to pharmacy have been found throughout history. Special groups of physician-priests in ancient Egypt prepared remedies in the temples, and in Greece and Rome and sometimes in Europe (during the Middle Ages), the role of the pharmacist was filled by an herbalist, who supplied the physician with the raw materials for the medicines.

The Philadelphia College of Pharmacy and Science, founded in 1821, was the first college of pharmacy in the United States. Similar schools were soon organized in Europe, but universities began to include pharmacy courses in their curricula. The course of instruction for pharmacy was increased from four to five years in 1960; it includes two years of basic training in the arts and sciences, followed by advanced and specialized courses and some business classes. In the United States, pharmacy graduates must be examined and licensed by the state government.

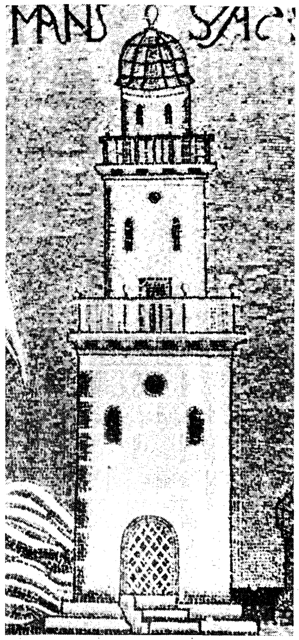
The growth of the pharmaceutical industry has meant that pharmacists themselves are no longer required to prepare many of the prescriptions called for by the physician. They do continue to have responsibility for formulating, storing, and providing correct dosages of the prescribed medicines.

The laws of the pharmaceutical industry are based on the national pharmacopoeia, a treatise that outlines the purity and dosages of numerous medicinal products. Most countries have their own treatise, but an international pharmacopoeia was published beginning in the 1950s by the World Health Organization (WHO) of the United Nations. A number of organizations specialize in pharmacy. Among them are the Pharmaceutical Society of Great Britain and the American Pharmaceutical Association, both founded in the mid-19th century.

Pharnabazus (fl. late 5th and early 4th centuries BC), Persian soldier and statesman who was the hereditary satrap (provincial governor) of Dascylium under Darius II and Artaxerxes II. Pharnabazus was an outstanding military and naval commander in Persia's wars against Athens and Sparta. In the war with Athens, beginning in 413 BC, he supported Spartan operations in the Hellespont. When war broke out with Sparta in 400 BC, he persuaded Artaxerxes to organize a naval counterstroke, and in 394 the Persian navy, jointly commanded by Pharnabazus and the Athenian admiral Conon, completely destroyed the Spartan fleet off Cnidus and gained the mastery of the Aegean. When in 388 the revival of Athenian imperialist ambitions led Artaxerxes to enter into an alliance with Sparta, Pharnabazus, as the chief opponent of Sparta, was recalled with honour from his command. In 385 and 373 he commanded unsuccessful invasions of Egypt.

Pharos OF ALEXANDRIA, one of the Seven Wonders of the World and the most famous lighthouse in antiquity. It was a technological triumph and is the archetype of all lighthouses since. Built by Sostratus of Cnidus for Ptolemy II of Egypt in about 280 BC on the island of Pharos in the harbour of Alexandria, it is said to have been more than 440 feet (135 m) high. The lighthouse was built in three stages, all sloping slightly inward; the lowest was square, the next octagonal, and the top cylindrical. A broad spiral ramp led to the top, where a fire burned at night.

The lighthouse was surmounted by a huge statue, probably representing either Alexander the Great or Ptolemy I Soter in the form of the sun god Helios. Though it was well-known earlier, the Pharos does not appear in any list of wonders until the 6th century AD (the earliest list gives the walls of Babylon instead). In the Middle Ages the Arabs replaced the beacon with a small mosque. The Pharos was still standing in the 12th century, although by 1477 the Mamlūk sultan Qā'it Bāy was able to build a fort from its ruins.



Pharos of Alexandria, Egypt, detail of a mosaic in St. Mark's church, Venice, late 13th century

Douglas B. Hague

Pharsalus, Battle of (48 BC), the decisive engagement in the ancient Roman civil war between Julius Caesar and Pompey. After Caesar had been defeated by Pompey at Dyrrhachium in 48 BC, both armies departed and again made contact somewhere near what is today Fârsala, Greece. After several days of maneuvering, Pompey finally offered Caesar battle (August 9 by the uncorrected Roman calendar; June 6, Julian). Caesar had approximately 22,000 men; Pompey possibly had as many as 45,000.

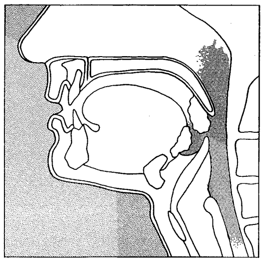
Pompey massed the main force of his cavalry on his left infantry wing, hoping to outflank and overpower Caesar's right wing, which was made up of a mixed band of cavalry and infantry. Caesar, however, foresaw the defeat of his right wing and had stationed behind it about 2,000 of his best legionnaires. In the ensuing battle, Pompey's cavalry drove back Caesar's cavalry, only to find itself faced by the advancing corps of select men using their *pila* as stabbing spears rather than as javelins. Confused by the unusual infantry attack, Pompey's cavalry turned and fled. The victorious legionnaires then began to outflank the left wing of Pompey's infantry; at the same time, Caesar's third division, which had been held in reserve, was ordered to attack. Pompey's legions broke, and he himself fled to Larissa. About 24,000 of Pompey's troops surrendered; the rest were dead or in flight. When Caesar, whose casualties were less than 250, surveyed the stricken field and Pompey's dead supporters he exclaimed, "They would have it so" ("Hoc voluerunt").

pharyngitis, inflammation and infection of the pharynx (throat), usually as a result of infections with bacteria or viruses. A streptococcal infection of the throat may be a complication arising from a common cold. Many viral infections closely mimic the symptoms of a streptococcal infection. The symptoms of pharyngitis caused by streptococci are generally redness and swelling of the throat, a pustulant fluid on the tonsils or discharged from the mouth, extreme soreness of the throat that is felt during swallowing, swelling of lymph nodes, and a slight fever; sometimes in children there are abdominal pain, nausea, headache, and irritability. Within approximately three days the fever leaves; the other symptoms may persist for another two to three days. Treatment is with antibiotics.

Viral pharyngitis infections also occur. They can produce raised whitish to yellow lesions in the pharynx that are surrounded by reddened tissue. They cause fever, headache, and sore throat that lasts for 4 to 14 days. Lymphatic tissue in the pharynx may also become involved.

A number of other infectious diseases may cause pharyngitis, including tuberculosis, syphilis, diphtheria, and meningitis.

pharynx (Greek: "throat"), a cone-shaped passageway leading from the oral and nasal cavities in the head to the esophagus and larynx. The pharynx chamber serves both respiratory and digestive functions. Thick fibres of muscle and connective tissue attach the pharynx to the base of the skull and surrounding structures. Both circular and longitudinal muscles occur in the walls of this organ; the circular muscles form constrictions that help push food to the esophagus and prevent air



Pharynx
Drawing by Charles Joslin

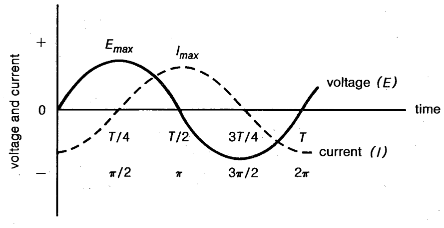
from being swallowed, while the longitudinal fibres lift the walls of the pharynx during swallowing.

The pharynx consists of three main divisions. The anterior portion is the nasal pharynx, the back section of the nasal cavity. The nasal pharynx connects to the second region, the oral pharynx, by means of a passage called an isthmus. The oral pharynx begins at the back of the mouth cavity and continues down the throat to the epiglottis, a flap of tissue that covers the air passage to the lungs and that channels food to the esophagus. Triangular-shaped recesses in the walls of this region house the palatine tonsils (*see* tonsils), two masses of lymphatic tissue prone to infection. The isthmus connecting the oral and nasal regions is extremely beneficial in humans. It allows them to breathe through either the nose or the mouth and, when medically necessary, allows food to be passed to the esophagus by nasal tubes. The third region is the laryngeal pharynx, which begins at the epiglottis and leads down to the esophagus. Its function is to regulate the passage of air to the lungs and food to the esophagus.

Two small tubes (eustachian tubes) connect the middle ears to the pharynx and allow air pressure on the eardrum to be equalized. Head colds sometimes inflame these tubes, causing earaches and hearing difficulties. Other medical afflictions associated with the pharynx include tonsillitis, cancer, and various types of throat paralyses caused by polio, diphtheria, rabies, or nervous-system injuries. *See also* swallowing.

phase, in astronomy, any of the varying appearances of a celestial body as different amounts of its disk are seen (from the Earth, ordinarily) to be illuminated by the Sun. The Moon displays four main phases: new, first quarter, full, and last quarter. Earth, as seen from the Moon, shows the same phases in opposite order; *e.g.,* Earth is full when the Moon is new. Planets more distant than the Earth from the Sun display only full or gibbous (more than half but not entirely full) phases to an observer on the Earth; *i.e.,* they are always seen with more than half of their apparent disks in sunlight. Mercury and Venus, closer to the Sun than Earth is, show full cycles of phases like the Moon's.

phase, in mechanics, the fraction of a period (*i.e.,* the time required to complete a full cycle) that a point completes after last passing through the reference, or zero, position. For example, the reference position for the hands



Phase

of a clock is at the numeral 12, and the minute hand has a period of one hour. At a quarter past the hour the minute hand has a phase of one-quarter period, having passed through a phase angle of 90°, or $\pi/2$ radians. In this example the motion of the minute hand is a uniform circular motion, but the concept of phase also applies to simple harmonic motion such as that experienced by waves and vibrating bodies.

If the position y of a point or particle changes according to a simple harmonic law, then it will change in time t according to the product of the amplitude, or maximum displacement, r, of the particle and a sine or cosine function composed of its angular speed, symbolized by the Greek letter omega (ω), the time t, and what is called the epoch angle, symbolized by the Greek letter epsilon (ε): $y = r \sin(\omega t + \varepsilon)$. The angle $(\omega t + \varepsilon)$ is called the phase angle at time t, which at zero time is equal to ε. Phase itself is a fractional value—the ratio of elapsed time t to the period T, or t/T—and is equal to the ratio of the phase angle to the angle of the complete cycle, 360°, or 2π radians. Thus, phase for uniform circular or harmonic motion has the value $(\omega t + \varepsilon)/2\pi$. Applying this expression to the example of the moving minute hand cited above, ε is zero (zero phase angle at zero time), angular speed is 2π radians per hour, and time t is ¼ hour, giving a phase of ¼.

When comparing the phases of two or more periodic motions, such as waves, the motions are said to be in phase when corresponding points reach maximum or minimum displacements simultaneously. If the crests of two waves pass the same point or line at the same time, then they are in phase for that position; however, if the crest of one and the trough of the other pass at the same time, the phase angles differ by 180°, or π radians, and the waves are said to be of opposite phase. Two periodic motions represented by the equations $y_1 = r_1 \sin(\omega_1 t + \varepsilon_1)$ and $y_2 = r_2 \sin(\omega_2 t + \varepsilon_2)$ have a phase-angle difference $(\omega_2 t + \varepsilon_2) - (\omega_1 t + \varepsilon_1)$, or $(\omega_2 - \omega_1)t + (\varepsilon_2 - \varepsilon_1)$. At zero time, or if the angular speeds ω_1 and ω_2 are identical, the phase-angle difference is $(\varepsilon_2 - \varepsilon_1)$ and the phase difference is $(\varepsilon_2 - \varepsilon_1)/2\pi$.

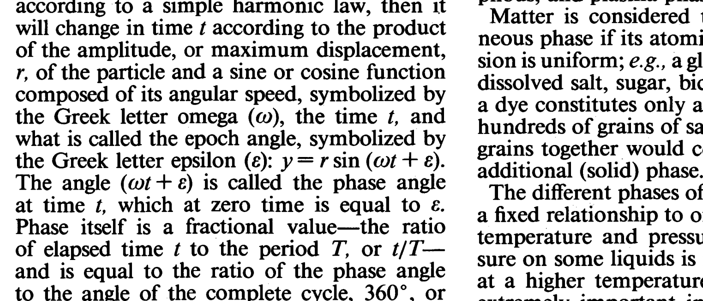
The measurement of phase difference is of central importance in alternating-current technology. In the diagram, two waves represent the voltage (E) and the current (I) in an alternating-current (ac) circuit with pure inductance. The difference in phase angle $(\varepsilon_E - \varepsilon_I)$ is 90°, and the phase difference is 90°/360° = ¼; the current is said to lag one-quarter cycle in phase. This lag may also be seen from the diagram: the voltage has already completed one-quarter cycle by the time the current has reached zero. In ac power transmission, the terms multiphase and polyphase are applied to currents that are out of phase with one another. In a two-phase system, there are two currents with a phase difference of 90°; in a three-phase system, the currents differ in phase by 120°.

phase, in thermodynamics, chemically and physically uniform or homogeneous quantity of matter that can be separated mechanically from a nonhomogeneous mixture and that may consist of a single substance or of a mixture of substances. The three fundamental phases of matter are solid, liquid, and gas (vapour), but others are considered to exist, including crystalline, colloidal, glassy, amorphous, and plasma phases.

Matter is considered to form one homogeneous phase if its atomic or molecular dispersion is uniform; *e.g.,* a glass of water containing dissolved salt, sugar, bicarbonate of soda, and a dye constitutes only a single liquid phase. If hundreds of grains of sand were added, all the grains together would constitute only a single additional (solid) phase.

The different phases of a pure substance bear a fixed relationship to one another in terms of temperature and pressure. Thus, if the pressure on some liquids is raised, they will freeze at a higher temperature. This relationship is extremely important in industrial as well as scientific work (*see* phase diagram).

phase diagram, graph showing the limiting conditions for solid, liquid, and gaseous phases of a single substance or of a mixture of substances while undergoing changes in pressure and temperature or in some other combination of variables, such as solubility and temperature. The Figure shows a typical phase diagram for a one-component system (*i.e.,* one consisting of a single pure substance), the curves having been obtained from measurements made at various pressures and temperatures. At any point in the areas separated by the curves, the pressure and temperature allow only one phase (solid, liquid, or gas) to exist,



Phase equilibria for the solid, liquid, and vapour states of a substance and changes in temperature and pressure, up to the points on the curves, will not alter this phase. At any point on the curves, the temperature and pressure allow two phases to exist in equilibrium: solid–liquid, solid–vapour, or liquid–vapour. For example, the line drawn for the variation with temperature of vapour pressure for the liquid is the boundary between liquid and vapour; only vapour can exist on the low-pressure, high-temperature side of the line, while the substance must be liquid on the high-pressure, low-temperature side; liquid and vapour exist together at temperatures and pressures corresponding to points on the line; at the place where this line vanishes, called the critical point, the liquid and its vapour become indistinguishable. Along the line between liquid and solid, the melting temperatures for different pressures can be found. The junction of the three curves, called the triple point, represents the unique conditions under which all three phases exist in equilibrium together. A phase diagram for two components usually shows melting curves on a temperature–composition diagram.

Phase diagrams are specific for each substance and mixture. Complex mixtures may require three-dimensional phase diagrams, which can be represented in two dimensions through use of perspective. Phase diagrams are widely used in studies of mineral equilibria in connection with the conditions of formation of rocks and minerals within the Earth. They also are invaluable when designing industrial equipment and seeking optimum conditions for manufacturing processes, and in determining the purity of substances.

phase rule, law relating variables of a system in thermodynamic equilibrium, deduced by the U.S. physicist J. Willard Gibbs in his papers on thermodynamics (1875–78). Systems in thermodynamic equilibrium are generally considered to be isolated from their environment in some kind of closed container, but many geological systems can be considered to obey the phase rule. The variables are: the number of phases P (forms of matter; *i.e.,* solid, liquid, and gas not necessarily of a single chemical component), the number of chemical components C (pure compounds or elements), and the number of degrees of freedom F of intensive variables, such as temperature, pressure, and percentage composition. The phase rule states that $F = C - P + 2$. Thus, for a one-component system with one phase, the number of degrees of freedom is two, and any temperature and pressure, within limits, can be attained. With one component and two phases—liquid and vapour, for example—only one degree of freedom exists, and there is one pressure for each temperature. For one component and three phases (*e.g.,* ice floating in water with water vapour above it, in a closed container), there is no degree of freedom, and temperature and pressure are both fixed at what is called the triple point (*see* phase diagram).

In multicomponent systems the number of components to be counted may be less than the total number if some are in chemical equilibrium with one another. For example, a monomer (simple molecule) in equilibrium with its dimer (two molecules chemically bonded) would count as a single component.

Phasi, Isaac ben Jacob al-: *see* Alfasi, Isaac ben Jacob.

Phasianidae, the pheasant family, a bird family (order Galliformes) that includes among its members the jungle fowl, partridge, peacock, pheasant, and quail (*qq.v.*).

Phat Song (Vietnamese philosopher): *see* Huynh Phu So.

Phatthalung, also spelled PHATALUNG, or PHETTALUNG, *changwat* (province), in the Southern region of Thailand. Phatthalung town, the provincial capital, lies on the Bangkok–Singapore rail line. The province, with an area of 1,322 sq mi (3,425 sq km), occupies a fertile plain planted largely in rice and coconuts. Fishing is a major activity on Thale (lake or lagoon) Luang. Pop. (1980) town, 19,611; (1982 est.) province, 418,405.

Phaulkon, Constantine (b. 1647, Cephalonia, Greece—d. June 5, 1688, Ayutthaya, Siam), Greek adventurer who became one of the most audacious and prominent figures in the history of 17th-century European relations with Southeast Asia.

Phaulkon signed on an English merchant ship in Greece at 12 years of age and sailed to Siam. He learned Siamese quickly, and this ability—combined with his knowledge of Portuguese, Malay, French, and English—rendered him invaluable as an interpreter, in which capacity he served with the English East India Company in the years 1670–78. He cultivated a friendship with King Narai and offered his services to the Siamese court. He rose quickly to become acting minister of finance and foreign affairs (*phrakhlang*), and by 1685, as virtual prime minister, he took the leading role in shaping Narai's foreign policy.

In collaboration with French Roman Catholic missionaries, Phaulkon schemed to establish French power in Siam. He encouraged diplomatic exchanges between Narai and King Louis XIV. His ambitions and his rapid rise to power were viewed with suspicion by Siamese court officials, and they became alarmed when a major French expedition in 1687 was allowed to occupy the city of Bangkok. In 1688 King Narai became seriously ill and was unable to protect Phaulkon. With France threatening to seize the country, a court faction led by Phetracha, Narai's foster brother, obtained Phaulkon's arrest and execution. This episode demonstrated to the Siamese the dangers of close alliance with a single European power, and Siamese foreign policy thereafter was much more cautious. Indeed, the architects of Siamese foreign policy in the 19th century carefully studied the Phaulkon affair.

Phaulkon–Tachard conspiracy (1685–88), in Siamese history, an unsuccessful attempt to establish French control over Thailand (Siam), an attempt in which Constantine Phaulkon, a high-level royal adviser to Thailand's King Narai, cooperated with Gui Tachard, a French Jesuit missionary.

A Greek by birth, Phaulkon had worked with the British East India Company in Java, and then entered the service of the Siamese king, rising to the position of virtual prime minister. Tachard, who arrived at Ayutthaya, the Siamese capital, in 1685, hoped to convert the Thais to Christianity and to extend French influence, and he enlisted Phaulkon's aid for these purposes.

After negotiations between the two men, a treaty was drafted in December 1685, granting France numerous trading privileges and allowing troops to be stationed in the town of Singora (Songkhla). The French king, Louis XIV, presented additional demands, however, and in 1687 sent an armed French expedition to Thailand to secure acceptance of his terms, which included French garrisons at the strategic cities of Bangkok and Mergui. Narai became suspicious of French designs, and to placate him Phaulkon engaged the French garrison troops as mercenaries in the service of Thailand. The final treaty was then ratified by Narai, who hoped that closer relations with France would help to balance the strong Dutch economic influence in Ayutthaya.

In March 1688 King Narai became seriously ill. Phaulkon, isolated without the King's support, was overthrown and executed by an anti-French faction at the Siamese court led by Narai's foster brother Phetracha (Bedraja); the French garrisons were expelled from the country.

The effect of the Phaulkon–Tachard conspiracy was to reverse a policy of openness to foreigners encouraged by previous Siamese kings. When Phetracha succeeded Narai, he took steps to discourage European settlers and to limit foreign influence in Siam.

Phayao, also spelled PAYAO, town and *changwat* (province) in the Northern region of Thailand. The provincial capital, Phayao town, lies on a scenic mountain lake that empties into the Nam Mae (river) Ing, a Mekong tributary. The town was the capital of a principality in the 13th and 14th centuries. It is on the main road between Lampang and Chiang Rai. The province, with an area of 2,446 sq mi (6,335 sq km), was created in 1977 from several southern districts of Chiang Rai province, in extreme northern Thailand on the Laotian border. Phayao province is a mountainous region on the watershed between the Mekong and Chao Phraya river systems. Pop. (1980) town, 21,853; province, 418,228.

Phayre, Sir Arthur Purves (b. May 7, 1812, Shrewsbury, Shropshire, Eng.—d. Dec. 14, 1885, Bray, County Wicklow, Ire.), British commissioner in Burma, who made a novel attempt to spread European education through traditional Burmese institutions.

Educated at the Shrewsbury School in England, Phayre joined the army in India in 1828. He was an army officer in Moulmein in the province of Tenasserim, Burma; in 1846 he was appointed assistant to the commissioner of the province. In 1849 he was made commissioner of Arakan, where he learned to speak fluent Burmese.

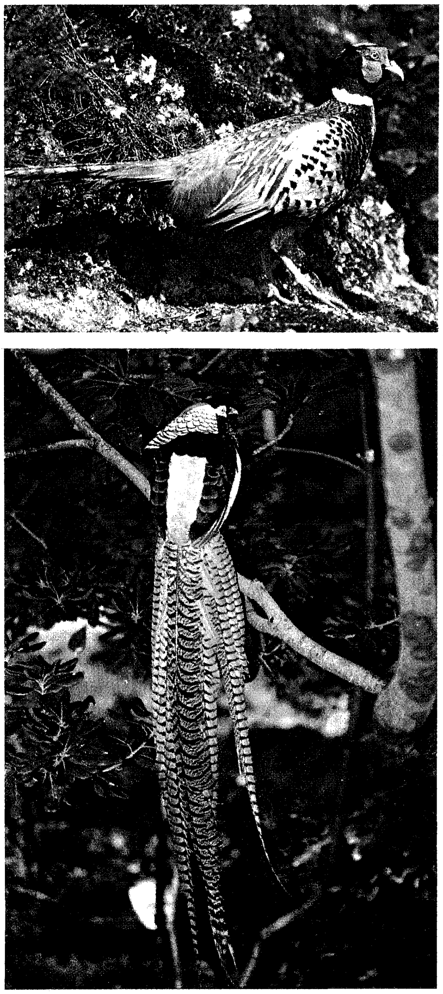
After the Second Anglo-Burmese War (1852), Phayre became commissioner of Pegu and played a major role in the relations between the government of India and the new king Mindon. He served as interpreter for the Burmese mission to Calcutta in 1854 and the following year headed a return mission to the Burmese capital, Amarapura. Although no treaty was signed, Phayre and the Burmese king came to an understanding that prevented the outbreak of further war. In 1862, when Phayre was made commissioner for the entire province of British Burma (including Arakan, Tenasserim, and Pegu), he concluded a commercial treaty with Mindon to facilitate trade between Lower and Upper Burma and to establish a British representative at the capital. Five years later Phayre left Burma; after serving for a few years (1874–78) as governor of Mauritius, he retired to Bray and was knighted (1878).

Phayre was a renowned scholar of Burmese culture and history; he wrote the first standard *History of Burma* (1883). His effort to introduce modern education into Burma using Buddhist monastic schools as a foundation was ultimately unsuccessful.

Phazania (Africa): *see* Fezzan.

pheasant, any bird of the family Phasianidae (order Galliformes) that is larger than a quail or partridge. Most pheasants—some 50 species in about 16 genera of the subfamily Phasianinae—are long-tailed birds of open woodlands and fields, where they feed in small flocks. All have hoarse calls and a variety of other notes. The males of most species are strikingly coloured. A male pheasant—pugnacious in breeding season—has one or more leg spurs and may have fleshy ornaments on the face. Courting males sometimes fight to the death in the presence of hens, who seem utterly indifferent to the commotion.

Centre of distribution of pheasants is China to Malaysia. Several species have been naturalized elsewhere, and many are prized as



(Top) common pheasant (*Phasianus colchicus*) and (bottom) Lady Amherst's ruffed pheasant (*Chrysolophus amherstiae*)

(Top) H. Reinhard—Bruce Coleman Inc., (bottom) K.W. Fink—Bruce Coleman Inc.

ornamentals in zoos and private collections. Some species have been brought to the verge of extinction by hunting.

The common pheasant (*Phasianus colchicus*) has 20–30 races ranging across Asia. Birds naturalized elsewhere are mixtures of races, with the gray-rumped ringneck (or Chinese) strain usually dominating.

The pheasant prefers grain fields near brushy cover. The male, about 90 centimetres (35 inches) long, with streaming, narrow, cross-barred tail, has a brown back and coppery breast, purplish-green neck, and two small ear tufts; his entire body is speckled and barred. He collects a harem of about three brownish, relatively short-tailed hens. The grassy nest contains about 10 eggs, which hatch in three to four weeks.

The green pheasant, or *kiji* (*P. versicolor*), of Japan, is mainly metallic green. It is sensitive to earth tremors unfelt by man and calls in concert when a quake impends.

The argus pheasants, of southeastern Asia, carry long feathers covered with "eyes." Two distinct types are known: the crested argus, or ocellated pheasants (*Rheinardia*), and the great argus (*Argusianus*). The great argus of Malaya, Sumatra, and Borneo (*A. argus*) can attain a length of 2 metres (6½ feet). During display the large "eyes" seem to revolve as the bird quivers.

Ornamental pheasants have been kept for centuries and are represented in collections throughout the world. Best known ornamentals in the west are two species of ruffed pheasants: Lady Amherst's (*Chrysolophus amherstiae*) and the golden pheasant (*C. pictus*).

Several pheasants are of exceptional coloration. Such are the monals, or Impeyan pheasants, of south central Asia. The male Himalayan Impeyan (*Lophophorus impejanus*) has metallic green head and throat, coppery nape and neck, green-gold mantle, purplish wings, white back, orangish tail, and black underparts; the hen is streaked brown. The Chinese monal (*L. lhuysii*), now found only in western China, is an endangered species.

The male tragopans, or horned pheasants (*Tragopan* species), of Asia also, are among the world's most colourful birds. They show a bright apron of flesh under the bill during courtship and short fleshy horns. The white-spotted plumage may be mainly red, yellow, or gray.

pheasant's-eye (*Adonis annua*), annual herbaceous plant of the buttercup family (Ranunculaceae) native to Eurasia and grown in garden borders and as cut flowers. It is 20 to 40 centimetres (8 to 16 inches) tall and is noted for its small, red flowers with prominent dark centres.

Pheidias: *see* Phidias.

Pheidon (fl. probably early 7th century BC), king of Argos, Argolis, who made his city an important power in the Peloponnese.

Herodotus implies that Pheidon flourished about 600 BC, but at this time Corinth and Sicyon, not the Argives, were in the ascendance. Although some later writers assigned Pheidon to the 8th century BC, most modern scholars place him in the early 7th century. He was said to have been the 10th successor to Temenus, the founder of Argos, and ruler of the whole Argolid peninsula in the northeast Peloponnese. Pheidon united this region (the "lot of Temenus"), marched across the Peloponnese, and seized Olympia (perhaps in 672 or 668).

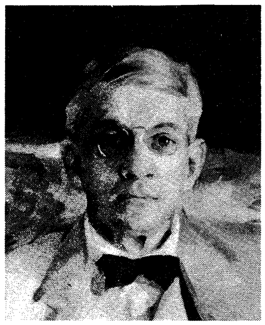
The system of standard measures instituted by Pheidon remained in effect in the Peloponnese long after his death; it was also employed in Athens before the reforms of Solon (6th century BC). The statement of the 4th-century Greek historian Ephorus that Pheidon was the first to coin silver money cannot be correct, for the beginning of coinage in mainland Greece is now generally ascribed to the late 7th century. In general the King used his royal power more effectively than was usual in an age when the aristocracy was in control. The Argive recovery that he instigated did not last long against the alliance of Sparta and Elis, and the northeastern cities were soon independent under their own tyrants.

Phek, town, administrative headquarters of Phek district, Nāgāland state, northeastern India, 75 mi (121 km) east of Kohīma town. It was a subdivisional headquarters before the bifurcation of Kohīma district in 1973. It is a rural town whose inhabitants practice shifting cultivation. Weaving is the important cottage industry. Phek district (about 770 sq mi [2,000 sq km]) is in the southeastern part of the state and extends over most of the southern hilly region. It is bounded by Manipur state on the south, Burma on the east, Zonheboto and Tuensang districts on the north, and Kohīma district on the west. Phek district is hilly and rugged with north–south-aligned ranges defined by narrow valleys. The Naga Hills form the eastern frontier and are cut by the Tizu River, which drains eastward. The natural vegetation ranges from tropical evergreen to temperate evergreen. Agriculture is the principal occupation; oranges, grapes, and mangoes are grown. Cottage industries include weaving, dyeing, cane working and woodworking, blacksmithing, pottery making, and timber seasoning. The people belong to different ethnic groups of Mongolian descent; they are referred to as Kirāts in the Hindu epic the *Mahābhārata*. They live in villages on the crests of hills and along roads traversing the valleys. Pop. (1981) town, 13,609; district, 70,618.

phellem (botany): *see* cork.

Phelps, William Lyon (b. Jan. 2, 1865, New Haven, Conn., U.S.—d. Aug. 21, 1943, New Haven), U.S. scholar and critic who did much to popularize the teaching of contemporary literature.

Phelps attended Yale (B.A. 1887, Ph.D. 1891) and Harvard (M.A. 1891), taught at Harvard for a year, and then returned to Yale, where he was for 41 years a member of the English department and Lampson professor from 1901 until his retirement in 1933. For years his students voted him Yale's most inspiring professor. In 1895 he taught the first U.S. college course in the modern novel. Both in this course and in his *Essays on Russian Novelists* (1911), Phelps was influential in introducing Russian novelists to U.S. readers. He was a popular lecturer and critic, and his literary essays in *Scribner's Magazine* and other periodicals and his syndicated newspaper column, "A Daily Thought," brought him an audience estimated in the millions. His *Autobiography with Letters* was published in 1939.



Phelps, detail of an oil painting by Jere Raymond Wickwire, 1926; in the Yale University Art Gallery

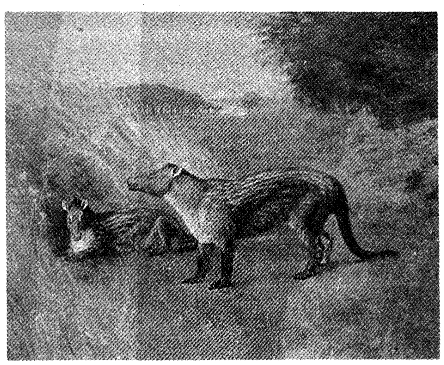
By courtesy of the Yale University Art Gallery, bequest of William Lyon Phelps

Phélypeaux, Jean-Frédéric: *see* Maurepas, Jean-Frédéric Phélypeaux, comte de.

Pheme (Greek mythology): *see* Fama.

phenacetin (drug): *see* acetophenetidin.

Phenacodus, extinct genus of primitive mammals known from fossils in early Eocene deposits (the Eocene Epoch began 54,000,000 years ago and lasted 16,000,000 years).

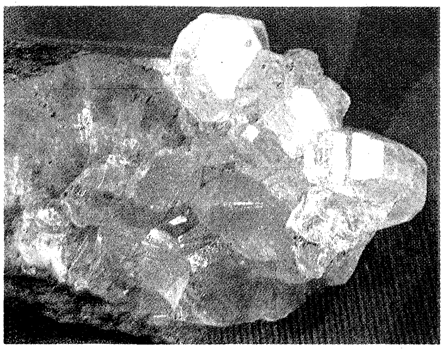


Phenacodus, restoration painting by Charles R. Knight, 1898

By courtesy of the American Museum of Natural History, New York

Though too late in time to have been the ancestral form from which the hoofed mammals evolved, *Phenacodus* represents a late-surviving form that retained many of the primitive traits that a common ancestor must have possessed. In structure and dentition, *Phenacodus* appears to be intermediate between the early carnivores and the early herbivores. Though the canine teeth are large and well developed, the cheek teeth were at least partly adapted to a plant diet.

phenakite, rare mineral, beryllium silicate, $BeSiO_4$, used as a gemstone. Phenakite has long been known from the emerald and chrysoberyl mine on the Takovaya River,



Phenakite on feldspar from Minas Gerais state, Brazil

By courtesy of the Field Museum of Natural History, Chicago; photograph, John H. Gerard—EB Inc.

near Sverdlovsk, in the Urals, U.S.S.R., where large crystals occur in mica schist. It also occurs in the granite of the Ilmen Mountains in the Urals and of the Pikes Peak region in Colorado. Other notable localities include Kragerø, Nor., and San Miguel de Piricicaba, Braz. For detailed physical properties, *see* silicate mineral (table).

For gem purposes the stone is brilliant cut; *i.e.,* with numerous facets. It is often colourless and glassy but may be wine yellow, pale rose, or brown. Its indices of refraction are higher than those of quartz, beryl, or topaz; it is consequently rather brilliant and may sometimes be mistaken for diamond. Nevertheless, it is not in general use, and fine examples are seldom seen outside private or museum collections.

phenazocine, synthetic narcotic drug and the first analgesic of a new structural type introduced in the 1960s. Phenazocine belongs to the benzomorphan series, a group of organic compounds with similarities to both morphine and the narcotic antagonists. Investigated during a search for a potent, nonaddicting analgesic, phenazocine is about four times as potent as morphine, and addiction appears to develop more slowly than does addiction to morphine.

Phenazocine, administered by intramuscular injection in the form of the hydrobromide salt, is available in solution and sometimes marketed under the trade name Prinadol.

phenbenzamine, also called DIMETHYLAMINOETHYLBENZANILIDE, the first specific antihistaminic drug to be used therapeutically to counteract the histamine reaction, as it occurs in allergies. Antergan was the trade name for the drug. Introduced in France in 1942, phenbenzamine has been replaced by newer, more effective, and less toxic drugs.

phencyclidine (drug): *see* PCP.

phenelzine, synthetic drug of the monoamine-oxidase inhibitor type, used to treat mental depression. Like other monoamine-oxidase inhibitor drugs, phenelzine prevents the enzymatic breakdown of norepinephrine, the brain-neurotransmitter substance concerned with emotional stimulation. Phenelzine is administered orally. The onset of action is delayed, the effects of the drug developing slowly over the first two weeks of therapy. As with other monoamine-oxidase inhibitor drugs, liver damage is a possible side effect.

Phenix City, city, Lee and Russell counties, seat (1935) of Russell County, eastern Alabama, U.S., and a port on the Chattahoochee River, opposite Columbus, Ga. Incorporated in 1883 as Brownville, it was renamed in 1889 for the old Phoenix Mills in Columbus. In 1923 it annexed Girard (settled 1820, inc. 1890). Manufactures include paperboard, bricks, and textiles. The last Civil War battle east of the Mississippi was fought there (April 16, 1865). Nearby in Georgia is Ft. Benning (a military reservation), and the remains of Ft. Mitchell (erected in 1813 during the Creek War) are south of Phenix City. In the early 1950s Phenix City had the reputation of being a "sin city." After the assassination of anti-vice crusader Albert L. Patterson (a nominee for district attorney) in 1954, there was a successful movement to clean up the community led by his son, John, who became the governor of Alabama (1959–63). Pop. (1980) 26,928.

phenobarbital, barbiturate drug that became available in 1912, used in medicine as a sedative, hypnotic, and anticonvulsant. *See* barbiturate.

phenol, any of a family of organic compounds characterized by a hydroxyl (OH) group attached to a carbon atom, which forms part of the benzene ring or any ring of carbon atoms that comprise what is called the aromatic series. Besides serving as the generic name for the entire family, the term phenol is also the specific name for its simplest member, monohydroxybenzene (C_6H_5OH), commonly known as carbolic acid.

A brief treatment of phenols follows. For full treatment, *see* MACROPAEDIA: Chemical Compounds.

Phenols are similar to alcohols but form stronger bonds with hydrogen. Thus, they are more soluble in water than are alcohols and have higher boiling points. Most phenols are acidic.

Phenols occur either as colourless liquids or white solids at room temperature. Many phenols have a sharp, spicy odour, but monohydroxybenzene smells bland and sweetish. It is, however, highly toxic and caustic.

So-called natural monohydroxybenzene can be made from wood tar or from the destructive distillation of coal. It can also be obtained from petroleum and from the organic matter of plants. Other phenols of truly natural origin are found in essential oils, which are derived from seeds or leaves of plants. Coal tar has been a prime source of synthetic phenols, but today most varieties are produced by methods using benzene as a starting material.

Because of their acidity, phenols react with strong bases to form alkali-metal salts known as phenoxides, phenolates, or phenates. The most important reaction of monohydroxybenzene is its condensation (which produces water as a side effect) with formaldehyde. This forms synthetic polymers, called phenol-formaldehyde (phenolic) resins, that are widely used in making plastics. In dilute solutions, monohydroxybenzene combats itching of the skin. Owing to its irritating effect, however, it has largely been discontinued as a medicinal antiseptic. Members of the phenol series with higher molecular weight, and derivatives of monohydroxybenzene, have supplanted it as an industrial antiseptic (*e.g.,* for germicidal cleaning) as well. Chlorophenols are used in various products, including fungicides, bacteriocides, and herbicides. Alkylphenols are used in synthetic detergents and to produce oxygen inhibitors.

phenol coefficient, number representing the disinfectant quality of an antiseptic or germicide in relation to that of phenol, which is used as a standard. The phenol coefficient of a chemical is found by adding microorganisms to several samples of various concentrations of the chemical and to samples of phenol for a known period of time. The action of the chemicals is stopped before samples are removed from each solution and added to a suitable liquid growth medium. The sample in which no visible microbial growth occurs is considered the end-point sample for the chemical. An end-point concentration is recorded for phenol as well. A ratio is then determined by comparing the concentrations of the two end-point samples.

phenol–formaldehyde resin (plastic): *see* Bakelite.

phenolphthalein, an organic compound of the phthalein family widely employed as an acid–base indicator and as a laxative.

The colourless form of phenolphthalein that exists in acidic solution is converted by alkali to an anionic form (with a negative charge) that also is colourless. Further alkali produces the bluish-red form, which is a doubly charged anion. In very strongly alkaline solutions, formation of the triply-charged anion disrupts the chromophoric (colour-producing) system; this anion is colourless.

Phenolphthalein, which is closely related to the triphenylmethane dyes, was discovered in 1871 by the German chemist Adolf von Baeyer, who prepared it by fusing phenol and phthalic anhydride in the presence of sulfuric acid or zinc chloride, the procedure still employed.

phenolsulfonphthalein test, also called PSP TEST, clinical procedure for the estimation of overall blood flow through the kidney. A specific dose of the PSP dye is injected intravenously, and its recovery in the urine is measured at successive time intervals. The recovery value at 15 minutes after injection (normally about 35 percent) is the most significant diagnostically, since even a damaged kidney may be able to remove the PSP dye from circulation after a longer time. PSP excretion is decreased in most chronic kidney diseases and may be increased in some liver disorders. *See also* kidney function test.

phenomenalism, a philosophical theory of perception and the external world. Its essential tenet is that propositions about material objects are reducible to propositions about actual and possible sensations, or sense data, or appearances. According to the phenomenalists, a material object is not a mysterious something "behind" the appearances that men experience in sensation. If it were, the material world would be unknowable; indeed, the term matter itself would be unintelligible unless it somehow could be defined by reference to sense experiences. In speaking about a material object, then, reference must be made to a very large group or system of many different possibilities of sensation. Whether actualized or not, these possibilities continue during a certain period of time. When the object is observed, some of these possibilities are actualized, though not all of them. So long as the material object is unobserved, none of them is actualized. In this way, the phenomenalist claims, an "empirical cash value" can be given to the concept of matter by analyzing it in terms of sensations.

Some philosophers have raised the objection against phenomenalism that, if these hypothetical propositions play such an important role in the phenomenalist analysis—analyzing all material-object expressions in terms of actual and possible sense experiences—it nonetheless remains difficult to avoid using material-object expressions in "if . . . then" clauses, which would render any analysis circular. A second and even more important objection is that it is very difficult to believe that categorical propositions about material objects (*e.g.,* "There is a fire in the next room") can be analyzed without remainder into sets of hypotheticals or "if . . . then" clauses; *i.e.,* that a statement about what there actually is can be reduced to a set of statements about what there would be if certain (nonexistent) conditions were to be fulfilled.

phenomenology, a school of philosophy that arose at the turn of the 20th century with the work of Edmund Husserl. Its primary objective has been to take a fresh approach to concretely experienced phenomena through the direct investigation of the data of consciousness—without theories about their causal explanation and as free as possible from unexamined presuppositions—and to attempt to describe them as faithfully as possible. By carefully exploring examples, one can thus fathom the essential structures and relationships of phenomena.

A brief treatment of phenomenology follows. For full treatment, *see* MACROPAEDIA: Philosophical Schools and Doctrines, Western.

Phenomenology developed gradually through many reformulations by Husserl, but its central features may be enumerated as follows: The first step in the phenomenological method is the so-called phenomenological reduction, or epoche, by which is meant the description of mental acts in a way that is free of theories and presuppositions, either about those acts themselves or about the existence of objects in the world. In contrast to the psychologist, the phenomenologist disregards the causes, consequences, and physical accompaniments of mental acts. Objects, however, do not disappear altogether in such a process; for Husserl inherited from the German philosopher of psychology Franz Brentano the doctrine that every mental act is intentional, that it is "of" or "about" an object. The object need not actually exist; one can believe in dragons or see pink rats whether or not such things exist in the conventional sense. The object may also be an "irreal" one, such as a number. The description of mental acts thus involves a description of their objects, but only as phenomena and without assuming their existence.

The second step in phenomenological analysis is the eidetic reduction, through which by reflecting on a particular act (*e.g.,* seeing a tree) and by imaginatively varying certain of its features, the essence, or eidos, not merely of this particular act but of any comparable one (*e.g.,* of seeing as such) may be intuited. Any object of vision must, for example, have colour, extension, and shape. Eidetic reduction may be used in examining not only sensory perception and its objects but also mathematical objects, as well as values, moods, and desires.

Finally, the phenomenological view takes into account the process by which objects are constituted or built up in the cognition of them. Seeing a tree entails a diversity of visual experiences as the tree is seen at different times, from different angles, and at different distances, yet what is seen continues to be apprehended as a single persistent object.

In his earlier writings, Husserl did not seriously doubt that objects exist independently of mental acts. The reduction is simply a device for focusing on them as phenomena. Later, however, he introduced the problematic notion of a transcendental phenomenological reduction, by which is discovered the transcendental ego, which is distinct from the phenomenal ego of ordinary awareness. At this stage Husserl moves away from his earlier realism toward a form of Kantian idealism, in which objects are regarded as not merely accessible to the ego but rather that their perceived nature is constituted by and dependent upon it. Husserl continually grappled with the problems thus presented for the common belief—itself a phenomenon—that objects exist independently of one's consciousness of them and that there are several distinct selves of equal status (intersubjectivity). In doing so, he came to regard the world as existing not for a single ego, but for a community of egos; in this light, the task of phenomenology is thus to reflect upon and describe this communal experience and its essential structures. Husserl's early concern with scientific knowledge gives way to the idea of the *Lebenswelt* ("life-world"), the world of lived experience, from which the world of science is seen ultimately to derive.

While the interpretation and value of Husserl's doctrines are controversial, his influence has been extensive and diverse, particularly, but not exclusively, in continental Europe. He has influenced not only philosophers but also psychologists and sociologists. His existentialist followers—notably Martin Heidegger, Jean-Paul Sartre, and Maurice Merleau-Ponty—have called themselves phenomenologists, while discarding such Husserlian features of phenomenology as the view of philosophy as a rigorous science, the concern with epistemology, the epoche, and the transcendental ego. They are in general less concerned with cognition than with action, though Husserl's seminal notion of the *Lebenswelt* brings him closer to them.

phenomenon, in philosophy, any object, fact, or occurrence perceived or observed. In general, phenomena are the objects of the senses (*e.g.,* sights and sounds) as contrasted with what is apprehended by the intellect. The Greek verb *phainesthai* ("to seem," or "to appear") does not indicate whether the thing perceived is other than what it appears to be. Thus in Aristotle's ethics "the apparent good" is what seems good to a man, whether or not it really is good. Later Greek philosophers distinguished observed facts (phenomena) from theories devised to explain them. This usage, widely adopted in the 17th century by scientists who sought to explain phenomena of natural science (*e.g.,* magnetism), is still current.

In modern philosophy the word is sometimes used for what is immediately apprehended by the senses before any judgment is made; it has, however, never become a technical term, many philosophers preferring sense-datum or some such expression—though they commonly accept the cognate forms phenomenalism and phenomenology. In English translations of Immanuel Kant, "phenomenon" is often used to translate *Erscheinung* ("appearance"), Kant's term for the immediate object of sensory intuition, the bare datum that becomes an object only when interpreted through the categories of substance and cause. Kant contrasted it to the noumenon, or thing-in-itself, to which the categories do not apply.

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

phenothiazine, widely used anthelmintic (worming agent) in veterinary medicine. Phenothiazine is an organic compound effective against a broad range of parasites in cattle, horses, poultry, sheep, and swine. A highly toxic drug, it is not recommended for human use and is not effective in dogs or cats. Many antianxiety drugs, including chlorpromazine and trifluoperazine, are derivatives of phenothiazine.

phenotype, all the observable characteristics of an organism, such as shape, size, colour, and behaviour, that result from the interaction of its genotype (total genetic inheritance) with the environment. The common type of a group of physically similar organisms is sometimes also known as the phenotype. Environmental conditions may favour the expression of certain potentials common to all the individuals. The phenotype may change constantly throughout the life of an individual because of environmental changes and the physiological and morphological changes associated with aging.

Different biological and physical backgrounds influence development of inherited traits (as size, for example, is affected by available food supply) and alter expression by similar genotypes (for example, twins maturing in dissimilar families). All inherited possibilities in the genotype are not expressed in the phenotype, because some are the result of latent, recessive, or inhibited genes. *See also* genotype.

phenylalanine, an amino acid present in the mixture obtained upon hydrolysis of common proteins. Human hemoglobin (the oxygen-carrying pigment of red blood cells) is one of the richest sources of phenylalanine, yielding 9.6 percent by weight. First isolated in 1881 from lupine seedlings, phenylalanine is one of several essential amino acids for fowls and mammals; *i.e.,* they cannot synthesize it and require dietary sources. Microorganisms synthesize it from glucose and pyruvic acid (products of the breakdown of carbohydrates).

phenylketonuria (PKU), also called PHENYLPYRUVIC OLIGOPHRENIA, hereditary inability of the body to normally metabolize the amino acid phenylalanine. Phenylalanine is normally converted in the human body to tyrosine, another amino acid, by a specific organic catalyst, or enzyme, called phenylalanine hydroxylase. This enzyme is not active in individuals who have phenylketonuria. As a result of this metabolic block, a high level of phenylalanine is observed in blood plasma, cerebrospinal fluid, and urine. Abnormal products of phenylalanine breakdown can also be detected in the urine. In the tissues, the excess amino acid and its abnormal metabolites interfere with various metabolic processes. The central nervous system, notably, is affected; impairment of some facet of nerve cell function manifests itself by mental retardation, epileptic seizures, and abnormal brain wave patterns, but the mechanism of injury is not known. The first behavioral signs of nerve cell damage are usually evident in an affected child from four to six months old. The retention of phenylalanine in body tissues also inhibits the course of tyrosine metabolism and leads specifically to a decrease in the formation of a product of tyrosine—melanin, the pigment found in the skin, hair, and eye. This may explain why persons with phenylketonuria generally have blond hair, blue eyes, and a fair skin.

Phenylketonuria is transmitted by an autosomal recessive gene. Statistically, two unaffected carriers of the trait can expect a 25 percent chance of having a child who is phenylketonuric, a 50 percent chance of having a child who is unaffected but is a carrier, and a 25 percent chance of having a completely normal child. Reliable tests are available to detect carriers of phenylketonuria, as well as infants who have the disorder. Approximately one in 10,000 newborn infants will show abnormally high plasma phenylalanine levels; out of these, about two-thirds will have the classic form of phenylketonuria, which, if untreated, will cause severe mental retardation. In the treatment of phenylketonuria, a lifelong diet low in phenylalanine is effective in controlling the body level of this amino acid.

phenylpyruvic oligophrenia (metabolic disorder): *see* phenylketonuria.

phenylthiocarbamide tasting, also called PTC TASTING, a genetically controlled ability to taste phenylthiocarbamide (PTC) and a number of related substances, all of which have some antithyroid activity. PTC-tasting ability is a simple genetic trait governed by a pair of alleles, dominant *T* for tasting and recessive *t* for nontasting. Persons with genotypes *TT* and *Tt* are tasters, and persons with genotype *tt* are nontasters; there appears to be hormonal mediation of the tasting ability, however, since women are more often taste sensitive in this regard than are men. It has been suggested that PTC tasting may be related to the genetically determined level of dithiotyrosine in the saliva.

PTC-tasting ability is not particularly useful, it would seem, since PTC does not occur in food, but some substances related to PTC do occur in food items. As for the utility of being able to taste PTC, it appears that nontasters of PTC may have a higher than average rate of goitre, a disease of the thyroid gland sometimes associated with lack of iodine; since PTC and related compounds contain iodine, there may be a selective advantage of some kind for tasters or nontasters in different environments. It has also been suggested that tasters may have more food aversions than nontasters, a disadvantage in situations of food scarcity.

The chief reason for interest in tasting ability, however, is that the frequency of tasters varies from population to population and from race to race. Difference in PTC-taster frequency is of use to the physical anthropologist in the determination of relationships between population groupings.

pheochromocytoma, also called CHROMAFFINOMA, tumour, most often nonmalignant, that causes abnormally high blood pressure because of hypersecretion of the hormones epinephrine and norepinephrine. Usually the tumour is in the medullary cells of the adrenal gland but may occur elsewhere; *e.g.,* in the chromaffin tissues of the ganglions of the nervous system.

The hypertension may be persistent or paroxysmal (periodic). Patients with persistent hypertension usually are afflicted with a constant headache, are thin and nervous, and have high blood sugar and an elevated basal metabolic rate. In paroxysmal attacks of hypertension, which last from one-half to three-quarters of an hour, the headache is much more intense and is accompanied by sweating, pallor, and tremor. Surgical removal of the tumour is the most effective treatment of the disorder. Pheochromocytoma is an uncommon cause of hypertension, perhaps causing only one out of every 1,000 cases of that disorder.

Pherecydes OF SYROS (fl. *c.* 550 BC), Greek mythographer and cosmogonist traditionally associated with the Seven Wise Men of Greece (especially Thales).

Pherecydes is credited with originating metempsychosis, a doctrine that holds the human soul to be immortal, passing into another body, either human or animal, after death. He is also known as the author of *Heptamychos,* a work, extant in fragments only, describing the origin of the world. Pherecydes was characterized by Aristotle as a theologian who mixed philosophy and myth. Tradition says that he was the teacher of Pythagoras. He is not to be confused with Pherecydes of Athens, a genealogist who lived about a century later.

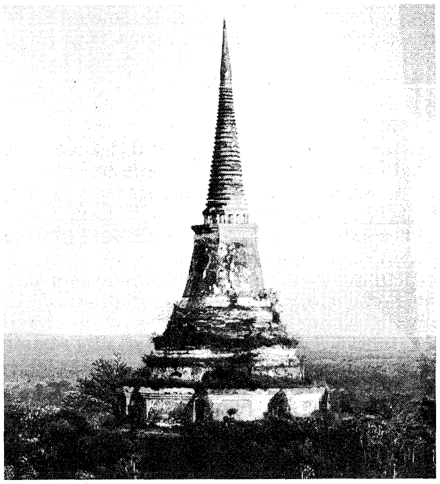
Pherenice (queens and princesses of Egypt): *see under* Berenice.

pheromone, any endogenous chemical secreted in minute amounts by an organism in order to elicit a particular reaction from another organism of the same species. Pheromones are widespread among insects and vertebrates but are unknown among birds. The chemicals may be secreted by special glands or incorporated in other substances, such as urine. They may be shed freely into the environment or deposited in carefully chosen locations. Pheromones are also used by some fungi, slime molds, and algae as attractants in reproduction; organisms of complementary reproductive cell types grow or move toward each other.

Pheromones are widely used to promote aggregation. Among social insects such as termites and ants, several different pheromones may transmit the various messages needed to coordinate the complex activities of a colony. Some ants lay scent pheromones along a trail leading to a food source so that other members of the colony can find the food. Pheromones are also used to signal the presence of danger. A wounded minnow has been shown to release a chemical from specialized epidermal cells that elicits a dispersal response from the school. Pheromones play a role in sexual attraction and copulatory behaviour, and they have been shown to influence the sexual development of many mammals as well as of insects such as termites and grasshoppers. Such pheromones tend to last relatively longer and extend farther distances than alarm pheromones. Aspects of vertebrate parent-young responses are often elicited by chemical stimuli. Entomologists use particular sex-attractant pheromones to lure and trap harmful insects.

Pheromones may be involved in human sexual response. In testing human vaginal secretions, scientists have identified fatty acids identical to several that are presumed to act as sex pheromones in other primates. The human female's sensitivity to musklike odours is greatest around the time of ovulation, which some researchers interpret as proof of the ancestral presence of a musky pheromone in the male.

Phetchaburi, also called PETCHABURI, or PHET BURI, town, south-central Thailand, located in the northern portion of the Malay Peninsula. It lies 65 miles (105 km) southwest of Bangkok. Phetchaburi is located near the mouth of the Phet Buri River and lies along the southern railway and highway. Before the sea route around the Malay Peninsula was developed, the town was on an overland trade route from Europe and India to continental Southeast Asia. Near the town are the ruins of old Brahmin and Buddhist temples and caves; Khao Luang cave is a Buddhist shrine. Both King Mongkut and his son, Chulalongkorn, built palaces in Phetchaburi. Haad Chao Samran, a popular beach, is nearby. Rice is grown on irrigated land in the surrounding area, and there are coconut, melon, and palm-sugar plantations. Pop. (1985 est.) town, 33,984.



Stupa, Phetchaburi, Thailand
Rene Burri—Magnum

Phetracha, also spelled BEDRAJA, or PETRACHA, also called P'RA P'ETRAJA (b. 1633?—d. 1703, Ayutthaya, Siam [now Thailand]), king of Siam (1688–1703) whose policies reduced European trade and influence in Siam and helped preserve its independence.

Phetracha was the foster brother of King Narai, whose patronage helped him rise to become head of the Elephant Department and a leading general in the kingdom. He led the coup that toppled the Greek adventurer Constantine Phaulkon from ministerial office and expelled a French expeditionary force from Siam in 1688. In that year he seized the throne himself and determined to drastically reduce foreign power and influence. To this end he persecuted Christians and harassed western traders, while encouraging Asian traders who were more easily controlled.

Phetracha's 15-year reign was frequently interrupted by revolts. Although he reorganized his country's civil and military administration, these achievements were overshadowed by the authoritarianism with which he ruled and by the intemperance, cruelty, and depravity that reportedly characterized his military ventures. His equally tyrannical son, King Sua, "Tiger," succeeded him.

Phetsarath Ratanavongsa, Prince (b. Jan. 19, 1890, Luang Prabang, Laos—d. 1959, Vientiane), Lao nationalist and political leader, who is regarded as the founder of Lao independence.

Phetsarath was the eldest son of Viceroy Boun Khong of the Kingdom of Luang Prabang and the elder brother to Souvanna Phouma and Souphanouvong. He studied in Saigon and in France, and on his return to Laos in 1913 joined the civil service of Luang Prabang under the French Protectorate. By 1919 he had become head of the indigenous branch of the civil service, and for the next two decades he worked to unify Laos by creating a bureaucracy that would transcend the principalities and provinces into which it had been divided by the French.

Following the Franco-Thai Indochina War of 1940–41, the French ceded additional provinces (including Vientiane) to the Luang Prabang kingdom and granted executive powers to a Lao cabinet in which Viceroy Phetsarath served as premier. When the Japanese surrendered at the end of World War II, Phetsarath sought to prevent the return of the French and proclaimed the unification of Laos as a single, independent kingdom. When King Sisavangvong dismissed him from office, he joined the opposition Lao Issara (Free Laos) government in Vientiane, and on the French reoccupation of Laos in 1946 he fled to Thailand. Phetsarath took the lead in forming the Free Laos government-in-exile and became its head in December 1946.

As the French began making concessions to Lao nationalism, Phetsarath's brothers withdrew their support from him and his government-in-exile. Souphanouvong joined with the Viet Minh to form the Communist Pathet Lao and continue armed opposition, and Souvanna Phouma decided to cooperate with the French and participate in French-sponsored Lao governments. Phetsarath refused to return to Laos until assured that efforts would be made to end civil war that had developed between rightist and leftist factions; but his hopes for such a reconciliation soon were dashed after his return to Laos in 1956. Phetsarath's autobiography, *Iron Man of Laos,* was published in 1978.

Phettalung (Thailand): *see* Phatthalung.

Phialia (ancient city): *see* Phigalia.

Phibunsongkhram, Luang, also called PIBUL SONGGRAM, original name PLAEK KHITTASANGKHA (b. July 14, 1897, near Bangkok—d. June 12, 1964, Tokyo), field marshal and premier of Thailand in 1938–44 and 1948–57 and associated with the rise of authoritarian military governments in Thailand.

He was educated at the royal military academy, and in 1914 he entered the Siamese artillery corps. In 1924–27 he took advanced military training in France, where he became involved with Thai students who were plotting the overthrow of the absolute monarchy. On returning to Bangkok, he served as a major on the army general staff, and in 1928 he received the title by which he was known thereafter, Luang Phibunsongkhram, which he later took as his family name.

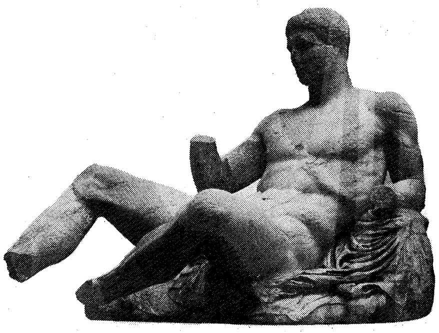
After helping organize the bloodless revolution of 1932 that forced King Prajadhipok to grant a constitution, Phibunsongkhram rose rapidly in the new, military-dominated government and came to public prominence by suppressing the 1933 rebellion of Prince Boworadet. In 1934 he became minister of defense and worked both to strengthen the army and to popularize military values in the fashion of contemporary Italy and Germany. On becoming premier in December 1938, he worked to mobilize the country (whose name he changed from Siam to Thailand in 1939), espousing ultranationalist and irredentist views. After the fall of France he provoked war with French Indochina (1940–41) to regain territories in Laos and Cambodia lost by treaty at the beginning of the century. Already pro-Japanese, when Japan invaded Thailand on Dec. 8, 1941, he quickly concluded an alliance with Japan and declared war on the United States and Great Britain on Jan. 25,

Phibunsongkhram, 1957
Popperfoto

1942. As field marshal during the war he promoted such modern habits as wearing shoes and hats and exhorted the Thai to follow their "Leader" in a highly authoritarian fashion. Though technically an ally of Japan, Thailand increasingly was treated as an occupied state. A strong, anti-Japanese Free Thai Movement developed, and, when the war began to turn against Japan, Phibunsongkhram's government collapsed (July 1944) and a civilian government took power, controlled from behind the scenes by Pridi Phanomyong.

Postwar civilian governments lacked sufficient public support to maintain public order and economic stability, and they were discredited by the suspicious death of King Ananda Mahidol in 1946. The army seized the government in 1947, and Phibunsongkhram returned as premier in 1948. Almost immediately he commenced efforts to contain the spread of communism in Thailand. He suppressed the economic development of Chinese immigrants in Thailand in an attempt to restrict those who were members of the Chinese Communist Party, and he cooperated with the British-Malay campaigns against communist guerrillas in Thailand-Malaya border areas. During the Korean War he supported UN action by dispatching an expeditionary force of 4,000 troops. In 1954 he further allied Thailand to the West in the Cold War by helping establish the Southeast Asia Treaty Organization (SEATO), with its headquarters in Bangkok. After a brief experiment with democracy in 1956–57, when political parties were allowed and free speech encouraged, he was ousted by military colleagues who had tired of the corruption and inefficiency of his government. He then fled to Tokyo, where he lived until his death.

Phidias, also spelled PHEIDIAS (fl. *c.* 490–430 BC), Athenian sculptor, the artistic director of the construction of the Parthenon, who created its most important religious images and supervised and probably designed its overall



"Heracles," marble statue produced in the workshop of Phidias, from the eastern pediment of the Parthenon, the Acropolis, Athens, *c.* 5th century BC; in the British Museum
By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

sculptural decoration. It is said of Phidias that he alone had seen the exact image of the gods and that he revealed it to man. He established forever general conceptions of Zeus and Athena.

Little is known about Phidias' life. When Pericles rose to power in 449, he initiated a great building program in Athens and placed Phidias in charge of all artistic undertakings. Among works for which Phidias is famous are three monuments to Athena on the Athenian Acropolis (the Athena Promachos, the Lemnian Athena, and the colossal Athena Parthenos for the Parthenon) and the colossal seated Zeus for the Temple of Zeus at Olympia; none of these survives in the original.

The first of Phidias' monuments to Athena, the bronze Athena Promachos, was one of his earliest works. It was placed on the Athenian Acropolis in about 456. According to the preserved inscription, it measured about 30 feet (9 m) high. At the time, it was the largest statue yet erected in Athens.

The so-called Lemnian Athena was dedicated as an offering by Athenian colonists who were sent to Lemnos between 451 and 448. A head of Athena in Bologna and two statues of Athena in Dresden are thought to be copies, in marble, of Phidias' original work in bronze.

The colossal statue of the Athena Parthenos, which Phidias made for the Parthenon, was completed and dedicated in 438. The original work was made of gold and ivory and stood some 38 feet (12 m) high. The goddess stood erect, wearing a tunic, aegis, and helmet and holding a Nike (goddess of victory) in her extended right hand and a spear in her left. A decorated shield and a serpent were by her side. Several copies have been identified from this description; among them are the Varakion, a Roman copy of about AD 130 (now in the National Archaeological Museum of Athens), and a Hellenistic copy, from about 160 BC, made for the main hall of the royal library at Pergamum (now in the Staatliche Museen Preussischer Kulturbesitz in Berlin).

The ancient writers considered Phidias' Zeus, completed about 430, for the Temple of Zeus at Olympia to be his masterpiece; this colossal statue is now considered to be one of the Seven Wonders of the Ancient World. Zeus was seated on a throne, holding a Nike in his right hand and a sceptre in his left. His flesh was of ivory, his drapery of gold. The throneback rose above his head. Everything surrounding the figure, including the statues and paintings (by Panaenos), was richly decorated. The Olympian Zeus was about seven times life size (or 42 feet [13 m]) and occupied the full height of the temple.

Phidias' last years remain a mystery. Pericles' enemies accused Phidias of stealing gold from the statue of the Athena Parthenos in 432, but he was able to disprove the charge. They then accused him of impiety (for including portraits of Pericles and himself on the shield of Athena on the Athena Parthenos), and he was thrown into prison. Until recently, it was thought that Phidias died in prison shortly thereafter; now it is believed that he was exiled to Elis, where he worked on the Olympian Zeus. A "workroom," thought to be Phidias', has been found in Olympia. It contains a number of terra-cotta molds believed to have been used for the drapery of the Olympian Zeus.

Phidias and his assistants were also responsible for the marble sculptures that adorned the Parthenon. Most of these remains (the Elgin Marbles) are now in the British Museum. Several of these sculptures have been attributed to Phidias, but none with certainty.

From these works one can gain some idea of Phidias' style. Even when movement is represented in some of his reliefs, a monumental quality is imparted. Though the construction of the human body is perfectly understood, its rendering is restrained and harmonized. In other words, Phidias may be called the initiator of the idealistic, classical style that distinguishes Greek art in the later 5th and the 4th centuries.

Philadelphia (Jordan): *see* Amman.

Philadelphia, city, seat (1833) of Neshoba county, east-central Mississippi, U.S., and headquarters of the Choctaw Indian Agency, 80 miles (130 km) east-northeast of Jackson. It was settled on an old Indian site, Aloon Looanshaw, following the Treaty of Dancing Rabbit Creek (1830) and named for Philadelphia, Pa. The Indian Agency was established in 1918, and the majority of the state's few thousand Choctaw (*q.v.*) live in the vicinity. A large Indian school is in the city. In 1964 the city received national attention when three civil-rights workers, murdered during a voter-registration drive, were found buried nearby. The city is an agricultural-trade centre (cattle, cotton, corn) with some light manufactures (textiles, electric motors, lumber products). The Choctaw Indian Fair is an annual summer event. Inc. 1904. Pop. (1986 est.) 7,010.

Philadelphia, city and port, coextensive with Philadelphia county, southeastern Pennsylvania, U.S. Situated at the confluence of the Delaware and Schuylkill rivers, it is the largest city in the state of Pennsylvania. From its founding in 1681 as a Quaker settlement, through its central roles in the American Revolution, the early federal government, and the Industrial Revolution, to the 20th century, Philadelphia has been an intellectual, economic, and humanitarian centre.

A brief treatment of Philadelphia follows. For full treatment, *see* MACROPAEDIA: Philadelphia.

Much of Philadelphia occupies the fertile Atlantic Coastal Plain, but in the city's western extremity the hills of the Piedmont plateau reach elevations of about 440 feet (134 m). Its continental climate is characterized by hot, humid summers and mild winters.

Philadelphia's harbour, one of the largest freshwater ports in the world, is the major element in the official agglomeration of Delaware River ports known as Ameriport, collectively one of the busiest shipping centres in the world. The area is a centre for research, and the development of new technologies and products has stimulated the growth of its industries. Apparel, food and food products, printing and publishing, and electrical machinery are leading manufacturing industries, and employment in nonmanufacturing and service industries is substantial. The city is also a major banking centre, and it has the oldest stock exchange (1790) in the United States, as well as three other exchange services.

The gridiron of streets in central Philadelphia, which is known as Center City, follows the original plan of the city's founder, William Penn. Penn Square, midway between the two rivers and occupied by City Hall, marks the centre, and four shady and fountained squares—Logan, Franklin, Washington, and Rittenhouse—dot the quadrants. Benjamin Franklin Parkway offers a splendid vista as it cuts northwestward from near Penn Square to the shaded and elegant Fairmount Park, the nation's largest landscaped municipal park. Southwark, Society Hill, and the Independence Hall area, located southeast and east of City Hall, are the city's oldest sections and contain some of its finest old houses, taverns, and churches. Independence National Historical Park houses Independence Hall, where the Declaration of Independence and the Constitution were signed and the historic Liberty Bell is displayed. Nearby, Carpenters' Hall was the site of the meeting of the First Continental Congress. Elfreth's Alley, just west of the Delaware River, is the oldest continuously inhabited street in the country. Throughout these areas and elsewhere, two- and three-story red-brick buildings fronting directly on the sidewalks and containing impressive examples of colonial design outside and inside are characteristic of the domestic architecture. The areas of Philadelphia north, south, and west of the city centre contain many distinctive ethnic or racial sections. The Germantown section in the northwest was settled by Germans in Penn's time; black and Puerto Rican communities are located in North Philadelphia; Italian and other European sections are located in South Philadelphia. In the late 20th century Asians (Chinese, Filipinos, Koreans, and Indians) settled in West and South Philadelphia.

Philadelphia has a vigorous cultural life, with its many prominent museums, galleries, orchestras, and theatres. The world-renowned Philadelphia Museum of Art, which houses priceless collections of art from the Western Middle Ages onward and from the Orient, heads a great diversity of museums. The Philadelphia Orchestra and the Walnut Street Theatre, the oldest playhouse in active use in the English-speaking world, are representative of the rich musical and theatrical traditions of the city. Philadelphia is a centre for medical education, and the University of Pennsylvania heads an array of universities and colleges.

Local transportation is provided by buses, subways, streetcars, and trolley cars, and both the Delaware and the Schuylkill are bridged at several points. Philadelphia is well served by roads, railways, and waterways, and there are two airports, one international, making it an important transportation centre of the Atlantic Seaboard. Area city, 136 square miles (352 square km); metropolitan area, 5,351 square miles (13,859 square km). Pop. (1988 est.) city, 1,657,285; Philadelphia-Wilmington-Trenton metropolitan area (CMSA), 5,963,300.

Philadelphia Centennial Exposition (1876), international trade fair, the first exposition of its kind in the United States, held in celebration of the 100th anniversary of the Declaration of Independence.

Ten years in the planning, the Centennial Exposition cost more than $11 million and covered more than 450 acres (180 hectares) of Philadelphia's Fairmount Park. President Ulysses S. Grant opened the exposition on May 10, 1876, and for the next six months more than 10,000,000 people viewed the works of 30,000 exhibitors.

Unquestionably the focal point of the exposition was Machinery Hall, where viewers marveled at the working models of steam engines and dynamos and celebrated the advent of the United States as an internationally important industrial power. Although some critics were offended by the ornate and grandiose symptoms of the "Gilded Age" and by the wild confusion of architectural styles found among the more than 200 buildings, the Centennial Exposition gave a decided boost to the American spirit and signaled the coming of age of a modern nation.

Philadelphia Inquirer, The, morning daily newspaper published in Philadelphia, long one of the most influential dailies in the eastern United States.

It was founded in 1847 as the *Pennsylvania Inquirer* but adopted "Philadelphia" into its name about 1860. When the American Civil War began, it voiced strong support for the North, and it was frequently delivered to Union troops in the field. The *Inquirer* was involved in circulation wars through the latter half of the 19th century and the early years of the 20th. It survived by giving its readers broad coverage of the news and by constantly modernizing its plant and equipment. In 1863 the *Inquirer* became one of the first daily newspapers to use a web-fed rotary press that could print on both sides of the paper at once.

There were several changes of ownership in the early 20th century, but the *Inquirer* largely retained its character as an aggressive paper. Moses L. Annenberg bought it in 1936 and managed within four years to boost its Sunday circulation to more than 1,000,000 copies. The paper stayed in his family's hands after his death in 1942. It was acquired in 1969 by John S. Knight, along with the afternoon tabloid *Philadelphia Daily News.* Both newspapers were included in the merger of the Knight and Ridder groups in 1974; each one, however, maintained editorial independence.

Philadelphia Zoological Gardens, first zoo in the United States, opened in Philadelphia in 1874 with an animal inventory of several hundred native and exotic specimens. It was begun and continues to be operated by the Zoological Society of Philadelphia, founded in 1859. After the American Civil War had ended in 1865, a 42-acre (17-hectare) site was selected in Fairmount Park, an architect was sent to study the London Zoo, and the collection was begun. The Philadelphia Zoo developed the first zoo laboratory (1901) and the first children's zoo (1938) in the United States. It was the first zoo to formulate specific diets for its animals (1930s), and one of these, monkey cake, is still used today by many zoos. Modern developments include an elaborate hummingbird exhibit (1970) and a reptile house (1972) with naturally planted displays. Also during the 1970s, three major outdoor exhibits were constructed: Wolf Wood, Bear Country, and the multispecies African Plains. The Philadelphia Zoo maintains excellent cat and waterfowl collections and is famous for the longevity records of its animals. It has about 2,000 specimens representing more than 500 species.

Philadelphus, genus of deciduous shrubs of the family Hydrangeaceae, including the popular garden forms commonly known as mock orange (from its characteristic orange-blossom fragrance) and sweet syringa. *Philadelphus,* comprising about 75 species, is native to northern Asia and Japan, the western United States, the southern Atlantic coast of the United States, and Mexico. These decorative and fragrant shrubs bloom in the late spring and grow unusually well in dry soils.

Various species of *Philadelphus* have opposite entire or toothed leaves, a solid, white pith, and often a flaky bark. The flowers are showy and usually white-petaled, with clumps of bright yellow stamens. Some species are not more than 1.2 m (4 feet) high, while others may attain a height of 4.6 m (15 feet).

The very fragrant common mock orange, *P. coronarius,* is a shrub up to 3 m (10 feet) high with clusters of creamy-white flowers; certain varieties, however, may possess golden flowers. *P. microphyllus,* a smaller shrub, has solitary 2.5-centimetre- (1-inch-) wide flowers with a pineapple scent. *P. lemoinei,* a hybrid of *P. coronarius* and *P. microphyllus,* has given rise to a number of horticultural varieties with large and fragrant flowers.

Philae, Arabic JAZĪRAT FĪLAH, island in the Nile River just above the First Cataract and the old Aswān Dam and 7 miles (11 km) south-southwest of Aswān city, in Aswān *muḥāfaẓāh* (governorate), Egypt. Its ancient Egyptian name was P-aaleq; the Coptic-derived name Pilak ("End," or "Remote Place") probably refers to its marking the boundary with Nubia. The conventional name is Greek, but locally it is known as Qasr Anas al-Wujūd, after a hero of *The Thousand and One Nights.* Before its gradual submergence in the reservoir created by the old Aswān Dam in 1902 and 1907, the alluvium-covered granite rock of Philae, measuring 1,500 by 480 feet (460 by 150 m), had always been above the highest Nile floodings. Accordingly, it attracted a number of ancient temple and shrine builders, earning the still current name of Jazīrat al-Birba ("Temple Island").

From early Egyptian times the island was sacred to the goddess Isis; the earliest structures known are those of Taharqa (reigned 689–664 BC), the Cushite 25th-dynasty pharaoh. The Saites (664–525 BC) built the earliest-known temple, found dismantled and reused in the Ptolemaic structures. Nectanebo II (Nekhtharehbe [reigned 360–343 BC]), last pharaoh of the 30th dynasty and last independent native ruler of Egypt prior to 1952, added the present colonnade. The complex of structures of the Temple of Isis was completed by Ptolemy II Philadelphus (reigned 285–246 BC) and his successor, Ptolemy III Euergetes (fl. 246–221 BC). Its decorations, dating from the period of the later Ptolemies and the Roman emperors Augustus and Tiberius (27 BC to AD 37), were, however, never completed. The Roman emperor Hadrian (reigned AD 117–138) added a kiosk west of the complex and a gate to the east. Other small temples or shrines dedicated to Egyptian deities include a temple to Imhotep and one to Hathor and chapels to Osiris, Horus, and Nephthys.

The Temple of Isis continued to flourish during Roman times and was not closed until the reign of Justinian I (AD 527–565), even though since 378 there had been an edict of Theodosius I banning worship of Osiris and Isis. The priests of Isis had obtained great powers in Upper Egypt, probably because they held gold mines at Wadi Alaki and controlled the terminus of the caravan route at Kubban. Their influence in Nubia remained strong long after Egypt became Christian, since the Nobadae and Blemmye tribes continued to worship Isis. By lending the goddess's image for annual rites, the Roman and Byzantine rulers of Egypt maintained a measure of control over these tribes, which continually threatened and harassed Egypt proper. Late in Justinian's reign the Temple of Isis was converted into a church, and two other Coptic churches were built in the still-prosperous town.

All these structures were thoroughly explored and reinforced (1895–96) before being partially flooded behind the old Aswān Dam. In 1907 a careful inspection revealed that salts were damaging paints on the decorations. When the temples reemerged after 1970 with the completion of the High Dam upstream, it was found that considerable damage had been done to the shrines. A decision was therefore made to remove them to higher ground on the nearby island of Agilkia. The island was leveled to resemble the original Philae, and the temples were rebuilt in 1980, returning them to some measure of their original beauty.

Philagathus, Johannes: *see* John XVI (or XVII) *under* John (Papacy).

philanthropic foundation, a nongovernmental, nonprofit organization, with assets provided by donors and managed by its own officials, and with income expended for socially useful purposes. Foundation, endowment, and charitable trust are terms used interchangeably to designate these organizations, which can be traced far back in history. They existed in the ancient civilizations of the Middle East, Greece, and Rome. Plato's Academy (*c.* 387 BC), for example, was established with an endowment that helped to sustain its existence for some 900 years. The medieval Christian church set up and administered trusts for benevolent purposes. The Islāmic world, despite its differing religious, political, and social concepts, developed an equivalent to the foundation, entitled the waqf, as early as the 7th century AD. Merchants in 17th- and 18th-century western Europe founded similar organizations for worthy causes.

These early philanthropic forms were usually small and for local and palliative purposes. Although there are still many small foundations, the late 19th and the 20th centuries witnessed the creation of the distinctive large modern ones. Having broad purposes and great freedom of action, including the ability by many to conduct programs worldwide, such foundations are variously categorized as: community, which have support from many donors and are located in a specific community or region; corporation-sponsored, which have increased dramatically in number, size, scope, and importance since World War II; operating, which carry out projects with their own staff; and independent, which are established by individuals and families. Most of the larger and best-known foundations in the United States and other countries have been of the last type.

James Smithson and George Peabody provided funds for the establishment in the United States of the Smithsonian Institution (1846) and the Peabody Education Fund (1867), respectively. At the turn of the century, Andrew Carnegie and John D. Rockefeller inaugurated the first of their many philanthropies. Carnegie's giving exceeded $350,000,000, with much of it used for the establishment of such foundations as The Carnegie Foundation for the Advancement of Teaching (1905) and the Carnegie Corporation of New York (1911). Rockefeller established the General Education Board (1902) and The Rockefeller Foundation (1913), and four generations of Rockefellers have given well over $1,000,000,000 for these entities and other philanthropic purposes.

Other American foundations of considerable size and impact were the Russell Sage Foundation (1907), The Commonwealth Fund (1918), and the John Simon Guggenheim Memorial Foundation (1925). The Ford Foundation (1936), with multibillion-dollar assets, is the largest foundation in the world. Its annual grants of millions of dollars support activities in the United States, Asia, Latin America, and Africa. Other American foundations with assets in excess of $1,000,000,000 and supporting a broad range of activities include the W.K. Kellogg Foundation (1930), The Robert Wood Johnson Foundation (1936), The Pew Memorial Trust (1948), and the John D. and Catherine T. MacArthur Foundation (1970).

Outside the United States some of the wealthiest foundations include the Wellcome Trust, England (1936); Nuffield Foundation, England (1943); Juan March Foundation, Spain (1955); Calouste Gulbenkian Foundation, Portugal (1956); Alfried Krupp von Bohlen und Halbach Foundation, West Germany (1967); J.W. McConnell Family Foundation, Canada (1967); and the Toyota Foundation, Japan (1974).

The large modern foundations have expended most of their funds for activities in the fields of education, social welfare, science, health, religion, conservation, international relations, and public policy. Some foundations have been reluctant to publicize their activities. Others, especially the larger ones, provide reports on their operations and, in recent years, have been instrumental in establishing such informational and archival organizations as The Foundation Center, U.S. (1956), the Foundation Library Center of Japan (1985), and the European Foundation Centre, Belgium (1989). (J.C.Ki.)

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Philanthropinum, late 18th-century school founded in Dessau, Ger., by the educator Johann Bernhard Basedow. Aiming to foster in its students a humanitarian worldview and awareness of the community of interest among men, it taught rich and poor boys together regardless of religious or class distinctions. The school had many enthusiastic supporters, among them the philosophers Immanuel Kant, Gotthold Ephraim Lessing, and Moses Mendelssohn, and its influence spread to neighbouring countries, particularly Switzerland.

Basedow believed in state rather than religious control of education and in a pragmatic approach to teaching. He stressed modern rather than classical languages, teaching them through conversation and games. Scientific subjects such as natural history, anatomy, and physics and practical ones such as carpentry were emphasized. Physical education was an important part of the curriculum. Further, in an age when many schools were noted for their harsh discipline, Basedow held that school could be so pleasant and absorbing that punishment would be virtually unnecessary.

Philaret, also spelled FILARET, original name FYODOR NIKITICH ROMANOV (b. *c.* 1554/55—d. Oct. 22 [Oct. 12, Old Style], 1633, Moscow, Russia [now in Russian S.F.S.R.]), Russian Orthodox patriarch of Moscow and father of the first Romanov tsar.

During the reign (1584–98) of his cousin, Tsar Fyodor I, Philaret served in the military campaign against the Swedes in 1590 and later (1593–94) conducted diplomatic negotiations with them. After Fyodor's death, Philaret was banished to a monastery by Boris Godunov (reigned 1598–1605). On Godunov's sudden death in 1605 and the subsequent shift of power to the first False Dmitry, Philaret was released and made metropolitan, or archbishop, of Rostov. In 1610 he was imprisoned by the Poles while attempting to arrange the accession of Prince Władysław of Poland to the Russian throne, but he was freed in 1619 after the election of his son Michael as tsar. Philaret was made patriarch of Moscow in the same year.

Exercising both ecclesiastical and political rule in Russia, Philaret reformed the church administration, instituted a program of establishing a divinity college in each diocese, and established libraries to upgrade theological scholarship. In a Moscow synod he decreed that all Latin Christians coming into the Russian Orthodox church would require rebaptism. His ecclesiastical policy strove to minimize the influence of the Roman Catholic church among Russian and Polish bishops. In addition to further developing the Russian liturgical books, Philaret also sponsored social legislation to stabilize the peasant farmers, reformed the tax structure, and reorganized the military.

Philaret, also spelled FILARET, original name VASILY MIKHAYLOVICH DROZDOV (b. Jan. 6, 1783 [Dec. 26, 1782, Old Style], Kolomna, near Moscow, Russia [now in Russian S.F.S.R.]—d. Dec. 1 [Nov. 19], 1867, Moscow), Russian Orthodox biblical theologian and metropolitan, or archbishop, of Moscow whose scholarship, oratory, and administrative ability made him the leading Russian churchman of the 19th century.

Upon his graduation from the Trinity Monastery, near Moscow, in 1803, Philaret was appointed as a teacher there and, in 1806, as a monastery preacher. In 1808 he took monastic vows and also was named professor of philosophy and theology, and subsequently rector, at St. Petersburg's Theological Academy. Rising rapidly in his church career, he became a member of the Holy Synod in 1818 after serving with numerous ecclesiastical-reform commissions, was named archbishop of Tver (modern Kalinin) in 1819, and in 1821 was transferred to Moscow. An activist, Philaret quickly established himself as a power in church and state. Considered as charismatic by the Russian Orthodox, he served as the final authority in theological and legal questions, his decisions eventually being published in 1905 with the title "Views and Comments."

By 1858, having overcome extended opposition, Philaret successfully directed the translation of the Bible into modern Russian. His chief theological work was the "Christian Catechism of the Orthodox Catholic Eastern Greco-Russian Church," treating the 4th-century Nicene Creed, the theology of prayer, and the Mosaic Law. First published in 1823, Philaret's "Catechism" was subjected to several revisions to expunge its Lutheran influences, but after 1839 it exercised widespread influence on 19th-century Russian theology.

Philaretus (Dutch philosopher): *see* Geulincx, Arnold.

Philargos, Petros: *see* Alexander (V) *under* Alexander (Papacy).

Philastre, Paul-Louis-Félix (b. Feb. 7, 1837, Brussels, Belg.—d. Sept. 11, 1902, Buyat-Beayeau, Fr.), French administrator and diplomat who, in the formative years of colonialism in French Indochina, played a crucial role in mitigating relations between the European colonialists and the French administration, on the one hand, and the indigenous population and its royal court at Hue, in central Vietnam. He was considered generally sympathetic to the Vietnamese.

Philastre graduated from France's naval school in 1857 and signed onto the *Avalanche,* bound for China. He arrived in Cochinchina (now in southern Vietnam) in 1861 and was named inspector of indigenous affairs in January 1863 at My Tho, a Mekong River delta village. Two years after being made chief of native law (June 1868), he grew ill and returned to France. During the Franco-German War and the Paris Commune, Philastre commanded an artillery regiment in the defense of Paris. He returned to Saigon in 1873, working under Admiral Marie-Jules Dupré.

An avid imperialist, Dupré had been seeking official recognition from the Vietnamese emperor Tu Duc of French holdings in three western provinces formally ceded to France in an 1862 treaty that Tu Duc had reneged upon. Meanwhile, in the summer of 1873 the profiteering trader Jean Dupuis, eager to secure northern Vietnam for trade with China, attacked Hanoi. Dupré then sent an expedition north under Francis Garnier, ostensibly to suppress Dupuis's bold move. Garnier, however, with Dupré's approval, joined forces with the trader and laid claim to Hanoi. But Dupré had meanwhile received word from France officially condemning the whole affair, and he commissioned Philastre as ambassador to try to win concessions from Tu Duc.

Philastre was poorly received at Hue by Tu Duc, who asked him to go north to resolve matters with the French forces there. At Hanoi, feeling that the Vietnamese had been wronged, he acted against Dupré's implicit directives and, presenting himself as Dupré's representative, ordered a cease-fire. Arriving shortly after Garnier had been killed in battle, Philastre was able to assert his authority. He laid the foundations of the treaty of 1874, under which Tu Duc at last bowed to the French conquest of the south. So impressed were the Vietnamese by Philastre's honesty and sincerity that they agreed to terms in the treaty that exceeded what the French had asked. Thereafter he served as representative of the protectorate of Cambodia (1876) and as chargé d'affaires at Hue (1877–79). He returned to France in 1880 and taught mathematics at Cannes and Nice (1882–94).

Briefly discredited because of his countercoup in the Dupuis–Garnier affair, which delayed French expansion into the north of Indochina for a decade, Philastre won the acclaim of later French writers for his honesty and for the respect he showed for the people and traditions of Vietnam. His most important scholarly achievement was the translation into French of the Vietnamese legal code and its commentaries. The erudite work was published as *Le Code annamite* ("The Annamite Code") in two volumes in Paris in 1876.

philately, also called STAMP COLLECTING, the hobby of collecting and studying postage stamps. The term philately was coined in 1864 by a Frenchman, Georges Herpin, who invented it from the Greek *philos,* "love," *a,* "negative," *telein,* "to tax"; the postage stamp permitted the letter to come free of charge to the recipient, rendering it untaxed.

There have been several claimants to the invention of the adhesive postage stamp, but the first recorded sale of such stamps took place on May 1, 1840, in England, followed soon after by the earliest reference to stamp collecting, an advertisement in *The Times* of London in 1841 placed by "a young lady, being desirous of covering her dressing-room with cancelled postage stamps."

The first lists of stamps were issued in 1861 by Oscar Berger-Levrault in Strasbourg and Alfred Potiquet in Paris. In England, Frederick Booty, J.E. Gray, and Mount Brown all issued catalogs in 1862; Brown's third edition (1866) listed 2,400 varieties, inclusive of what is now termed postal stationery or envelopes, wrappers, and letter sheets, as well as many local issues. The standard modern catalogs (*e.g.,* Yvert and Tellier in France, Michel's in Germany, Gibbons' in Great Britain, and Scott or Minkus in the United States) exclude this latter material, and yet the total number of listings, including minor varieties, reaches more than 100,000.

Because of the sheer bulk, not to mention the prohibitive expense, of a general collection embracing the stamps of all nations and all periods, most collectors turn to limited fields. They may collect only the stamps of one country, for example, or of one continent or one period. Others specialize in collections of certain kinds of stamps; some collect only one issue and study it thoroughly, and others may collect only revenue stamps or postal stationery. Those interested purely in stamp designs may collect art or religion on stamps, or flowers, fish, bridges, etc.; this sort of collecting is called topical, or thematic.

The collection of postal markings, both on stamped and pre-stamp covers, is a form of specialization; collecting of precancelled stamps is another. Meters (machines that print a postal frank on the envelope) have given rise to yet another specialized form. Telegraph stamps or Christmas seals are also collected by some specialists.

Many famous collections of the past have been dispersed and absorbed by others; some have been sold at auction, bringing total prices of several million dollars. The unique one-cent British Guiana magenta of 1856 was sold by private negotiation for a price reputed to be more than $50,000. In 1970 it was sold again at auction for $280,000.

One of the outstanding collections in Europe—especially rich in British and colonial issues—was formed principally by King George V, a famed philatelist, and passed on to those who succeeded him as the British monarch. The Thomas K. Tapling collection, bequeathed to the British Museum, may well be the finest in public hands. The Smithsonian Institution collection at Washington, D.C., stresses U.S. stamps. The postal museums of many European capitals have outstanding collections, such as those at Berlin, at The Hague, and at Stockholm; the last received the Hans Lagerlof (New York) collection.

Clubs or societies of collectors are to be found in most cities of the world, with national and international societies to bind them together. Many of the prominent national societies, such as the Royal Philatelic Society of London and the American Philatelic Society, were formed in the 19th century. The International Philatelic Federation was formed in 1926. Many specialist societies have also sprung up, notably since 1945. One of the most important activities of stamp clubs is the holding of exhibitions, including sales, from time to time. International, national, and regional societies hold regular exhibitions, offering valuable awards to outstanding collections.

Philbrick, Herbert Arthur (b. May 11, 1915, Rye Beach, N.H., U.S.), U.S. counterintelligence agent for the Federal Bureau of Investigation (FBI) against the Communist Party of the United States during the 1940s.

Philbrick studied engineering at Lincoln Technical Institute of Northeastern University in Boston, and in 1938 he became an advertising salesman. Through a sales call, he became interested in the Massachusetts Youth Council and later helped to set up a subsidiary organization in Cambridge. Gradually he came to realize that the organization was controlled and used for propaganda by the Communist Party. He took his suspicions to the FBI and was asked by them to act as an undercover agent. He did so for nine years, reporting on activities that violated the Smith Act and other laws. On April 6, 1949, he broke cover to testify against 12 Communist leaders who had been indicted in part on evidence he had provided. All 12 were found guilty, and Philbrick became a public figure. In 1952 he published a record of his undercover work called *I Led Three Lives,* which became a best-seller and was the basis for a popular television series of the same name.

Philby, H(arry) Saint John (Bridger) (b. April 3, 1885, Saint Johns, Badula, Ceylon [now Sri Lanka]—d. Sept. 30, 1960, Beirut), British explorer and Arabist, the first European to cross the Rubʿ al-Khali, or Empty Quarter, of Arabia from east to west.

Philby was educated at Trinity College, Cambridge, and joined the Indian Civil Service in 1907. In 1917, as political officer of the Mesopotamian Expeditionary force, he was dispatched on a diplomatic mission to ʿAbd al-ʿAzīz ibn Saʿūd. After meeting with the future king of Saudi Arabia, he crossed the desert from al-ʿUqayr to Jidda—an exploit recorded in his book, *Heart of Arabia* (1922). Philby succeeded T.E. Lawrence as chief British representative in Transjordan (1921–24) but resigned to establish a business in Arabia. He was an unofficial adviser of Ibn Saʿūd and converted to Islām in 1930.

After an unsuccessful foray into politics in England in 1939 and a brief incarceration there in 1940 because of his antiwar views, Philby returned to Arabia in 1945. Ten years later he was expelled because of his public criticism of the inefficiency and extravagance of the oil-enriched Saʿūdi regime. Philby made important contributions based on his Arabian explorations to the fields of archaeology, cartography, and linguistics. His son, Kim Philby, became a Soviet agent within the British intelligence service.

Philby, Kim, byname of HAROLD ADRIAN RUSSELL PHILBY (b. Jan. 1, 1912, Ambāla, India—d. May 11, 1988, Moscow), British intelligence officer until 1951 and the most successful Soviet double agent of the Cold War period.

While a student at the University of Cambridge, Philby became a Communist and in 1933 a Soviet agent. He worked as a journalist until 1940, when Guy Burgess, a British secret agent who was himself a Soviet double agent, recruited Philby into the MI-6 section of the British intelligence service. By the end of World War II, Philby had become head of counterespionage operations for MI-6, in which post he was responsible for combating Soviet subversion in western Europe. In 1949 he was sent to Washington to serve as chief MI-6 officer there and as the top liaison officer between the British and U.S. intelligence services. While holding this highly sensitive post, he revealed to the U.S.S.R. an Allied plan to send armed anti-Communist bands into Albania in 1950, thereby assuring their defeat; warned two Soviet double agents in the British diplomatic service, Burgess and Donald MacLean, that they were under suspicion (the two men consequently escaped to the Soviet Union in 1951); and transmitted detailed information about MI-6 and the Central Intelligence Agency to the Soviets.

After Burgess' and MacLean's defection, suspicion fell on Philby, and he was relieved of his intelligence duties in 1951 and dismissed from MI-6 in 1955. Thereafter he worked as a journalist in Beirut until fleeing to the Soviet Union in 1963. There he settled in Moscow and eventually reached the rank of colonel in the KGB, the Soviet intelligence service. Philby published a book, *My Silent War* (1968), detailing his exploits.

Philby seems to have been a lifelong and committed Communist whose primary devotion lay toward the Soviet Union rather than his native country. He was apparently responsible for the deaths of many Western agents whose activities he betrayed to the Soviets during the 1940s and early '50s.

Philemon (b. *c.* 368 BC, Syracuse, Sicily [now in Italy]—d. *c.* 264 BC), poet of the Athenian New Comedy, elder contemporary and successful rival of Menander.

As a playwright Philemon was noted for his neatly contrived plots, vivid description, dramatic surprises, and platitudinous moralizing. By 328 he was producing plays in Athens, where he eventually became a citizen; he also worked in Alexandria for a time. Of 97 comedies by him, some 60 titles survive in Greek fragments and Latin adaptations.

Philemon, Letter of Paul to, brief New Testament letter written by Paul the Apostle to a wealthy Christian of Colossae, Asia Minor, on behalf of Onesimus, Philemon's former slave. Paul, writing from prison, expresses affection for the newly converted Onesimus and asks that he be received in the same spirit that would mark Paul's own arrival, even though Onesimus may be guilty of previous failings. While passing no judgment on slavery itself, Paul exhorts Philemon to manifest true Christian love that removes barriers between slaves and free men. The letter was probably composed in Rome about AD 61.

Philemon and Baucis, in Greek mythology, a pious Phrygian couple who hospitably received Zeus and Hermes when their richer neighbours turned away the two gods, who were disguised as wayfarers. As a reward, they were saved from a flood that drowned the rest of the country; their cottage was turned into a temple, and at their own request they became priest and priestess of it. Long after, they were granted their wish to die at the same moment, being turned into trees. Similar stories occur in the *Märchen* ("fairy tales") of the Grimm brothers.

Philepittidae, bird family, order Passeriformes, consisting of the asities and false sunbirds, four species of small birds confined to the forests of Madagascar.

Members range in size from 9 to 16.5 centimetres (3.5 to 6.5 inches) long. The two species of asities (*Philepitta*) are plump, stout-legged pitta-like birds that browse foliage for berries and other fruit. The false sunbirds (*Neodrepanis*) are smaller and have weak legs and longer down-curved bills with which they dip into flowers for nectar and small insects. They were formerly classified with the sunbirds (family Nectariniidae). All members have bare skin, or wattles, around the eyes.

The Philepittidae is currently placed in the suboscine suborder Tyranni, but certain anatomical features suggest that they are more closely allied to families in the suborder Eurylaimi.

Philetaerus (b. *c.* 343 BC, Tios, in Paphlagonia, a region of northern Anatolia—d. 263 BC), founder (reigned 282–263) of the Attalid dynasty, a line of rulers of a powerful kingdom of Pergamum, in northwest Asia Minor, in the 3rd and 2nd centuries BC.

Philetaerus initiated the policies that made Pergamum a leading centre of Greek civilization in the East. He served under Antigonus I Monophthalmus, successor to Alexander the Great in Phrygia, in northern Anatolia, until 302, when he deserted to Antigonus' rival, Lysimachus, ruler of Thrace. Lysimachus made him guardian of the fortress of Pergamum with its treasure of some 9,000 talents. In 282 Philetaerus transferred his allegiance to Seleucus I, the successor to Alexander the Great in Syria, who allowed him a far larger measure of independence than he had hitherto enjoyed.

The territory Philetaerus controlled was as yet quite small—no more than Pergamum and its environs—and it was largely of necessity that he curried favour with the first Seleucid kings. His gifts to the temples at Delphi, Greece, and on the island of Delos, in the Aegean Sea, secured for his family some prestige outside of Anatolia. When, after the death of Seleucus I in 280, the Seleucid grip on Asia Minor slackened, Philetaerus found a chance to increase the area under his control. Before his death in 263 he had abandoned the Seleucids in favour of a tie with Egypt.

Philetaerus was reportedly a eunuch; he adopted one of his nephews, Eumenes, as his heir and successor.

Philetas OF **Cos,** Philetas also spelled PHILITAS (b. *c.* 330 BC—d. *c.* 270 BC), Greek poet and grammarian from the Aegean island of Cos, regarded as the founder of the Hellenistic school of poetry, which flourished in Alexandria after *c.* 323 BC. He is reputed to have been the tutor of Ptolemy II and the poet Theocritus. The Roman poets Propertius and Ovid mention him as their model, but only fragments of his work have survived. His most important poem appears to have been the *Demeter,* an elegy narrating the wanderings of the goddess of the Earth, Demeter. He also compiled a dictionary of rare words from Homer, the Greek dialects, and other sources.

Philidor, André, original family name DANICAN, byname L'AÎNÉ (b. *c.* 1647—d. Aug. 11, 1730, Dreux, Fr.), musician and composer, an outstanding member of a large and important family of musicians long connected with the French court.

The first recorded representatives of the family were Michel Danican (died *c.* 1659), upon whom the nickname Philidor (the name of a famous Italian musician) was bestowed by Louis XIII as a complimentary reference to his skill, and André's father Jean (died 1679), who, like Michel, played various instruments in the Grande Écurie, the king's band. André and his brothers, Jacques, called "le Cadet" (died 1708), and Alexandre, whose birth and death dates are unknown, also played in the royal band. André distinguished himself as a performer in Louis XIV's chamber and chapel and composed several divertissements, or opéra ballets, for royal entertainment, as well as marches, fanfares, and similar music. Further, as keeper of the royal music library from 1684, he collected hundreds of volumes of dances, operas, sacred music, songs, marches, and other music from the time of Henry III onward; a large part of this invaluable collection survives.

André and Jacques each had children who carried on the family tradition, the most important being André's son François-André Philidor (*q.v.*), noted as a composer and Chess player. Another son of André, Michel, whose birth and death dates are unknown, a drummer in the Grande Écurie, is said to have worked with the instrument builder Jean Hotteterre (*q.v.*) in the invention of the oboe.

Philidor, François-André, original name FRANÇOIS-ANDRÉ DANICAN (b. Sept. 7, 1726, Dreux, Fr.—d. Aug. 24, 1795, London), French composer whose operas were successful and widely known in his day and who was a famous and remarkable Chess player. The last member of a large and prominent musical family, François-André was thoroughly trained in music, but at age 18 he turned entirely to Chess competition throughout Europe. He was particularly well received in England, where he published a book on Chess and eventually received a pension from the London Chess Club. In 1754 he returned to Paris and set about composing highly popular operas, such as *Sancho Pança dans son isle* (1762) and *Tom Jones* (1765), as well as other dramatic and sacred music. He continued playing Chess and composing for the remainder of his life, travelling regularly to London.

Philikí Etaireía (Greek: Friendly Brotherhood), Greek revolutionary secret society founded by merchants in Odessa in 1814 to overthrow Ottoman rule in southeastern Europe and to establish an independent Greek state. The society's claim of Russian support and the romance of its commitment (each member swore "irreconcilable hatred against the tyrants of my country") brought thousands into its ranks. Though some recruits believed that the society was secretly directed by the Russian emperor's foreign secretary—the Greek Ioánnis, Count Kapodístrias—it was Alexander Ypsilantis, an officer in the Russian Army, who accepted the leadership in 1820. Having planned uprisings in the Danubian principalities as well as in the Peloponnese and the Greek islands, Ypsilantis launched the revolt in the spring of 1821. The Romanian peasants did not join his forces, however; the Russian emperor Alexander I repudiated him, and the Turks quickly defeated him. The venture resulted primarily in bringing an end to the rule of the Greek Phanariotes in Moldavia and Walachia.

Philip, name of rulers grouped below by country or papacy and indicated by the symbol •.

Foreign-language equivalents:

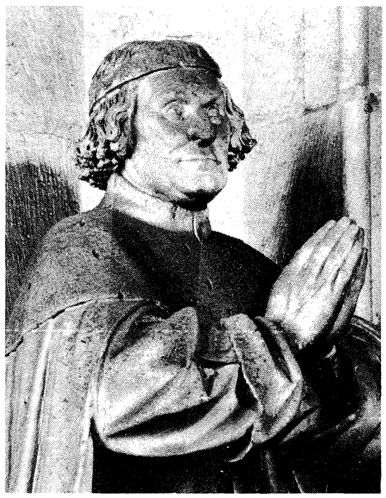
French	Philippe
German	Philipp
Greek	Philippos
Latin	Philippus
Portuguese	Filipe
Spanish	Felipe

BURGUNDY

• **Philip I,** also called PHILIP OF ROUVRES, French PHILIPPE DE ROUVRES (b. 1345, Rouvres, Burgundy—d. November 1361, Rouvres), last Capetian duke of Burgundy (1349–61) and count of Boulogne and Artois.

Son of Philip of Burgundy, he inherited the duchy upon the death of his grandfather, Eudes IV, and inherited the countships upon the death of his grandmother, Joan of France. His mother, Joan of Boulogne, who subsequently married the king of France, John II, ruled Philip's lands during his minority, but after her death in 1360 he was declared of age. Though he married at the age of 12, he died without heirs, and his domains were dismembered. King John granted the duchy of Burgundy to his own son, Philip II the Bold (1363).

• **Philip II,** byname PHILIP THE BOLD, French PHILIPPE LE HARDI (b. Jan. 17, 1342, Pontoise, Fr.—d. April 27, 1404, Halle, Brabant), duke of Burgundy (1363–1404) and the youngest son of the French king John II the Good.



Philip II, detail of a sculpture by Claus Sluter, 14th century; portal of the Chartreuse de Champmol, Dijon
Lauros—Giraudon from Art Resource/EB Inc.

One of the most powerful men of his day in France, he was for a time regent for his nephew Charles VI; and when Charles went insane, he became virtual ruler of France.

John II's grant of the duchy of Burgundy to Philip in September 1363 did not become effective until June 1364, when the new king, Philip's brother Charles V, confirmed it. Philip and Charles supported each other's policies. The duke's marriage (June 1369) to Margaret of Flanders was arranged by Charles to prevent her from marrying an English prince. In 1384, Philip and his wife inherited Flanders, Artois, Rethel, Nevers, Franche-Comté, and some lands in Champagne. By purchase and skillful alliance he also secured several holdings in the Netherlands. In 1386 his domains had become so extensive that he arranged separate administrations at Lille and Dijon for his northern and southern territories.

During the minority of their nephew Charles VI, Philip and his brothers shared the government of France and the spoils of power. Philip did not hesitate to involve the government in the furtherance of his own aims, which, because of the location of his domain, were shaped by the necessity of friendly relations with Germany and England. In November 1388, Charles rejected the tutelage of his uncles; but, when Charles became insane in 1392, Philip regained his preeminence and imposed his own policies on the French government: an alliance with England (1396) and (in relation to the papal Western Schism) the withdrawal (1398) of support for the Avignon pope Benedict XIII, since Philip's Flemish subjects adhered to the Roman pope Boniface IX. He furthermore diverted huge sums from the royal treasury, thus coming into conflict with his chief rival for power, Charles VI's brother Louis, duke d'Orléans.

Philip was a patron of the arts. He collected illuminated books and manuscripts, purchased jewelry and precious cloth, and encouraged painters. He fell heavily into debt, chiefly from financing his son John's crusade against the Ottoman Turks (1396).

• **Philip III,** byname PHILIP THE GOOD, French PHILIPPE LE BON (b. July 31, 1396, Dijon, Burgundy [now in France]—d. June 15, 1467, Bruges [now Brugge, Belg.]), the most important of the Valois dukes of Burgundy (reigned 1419–67) and the true founder of the Burgundian state that rivaled France in the 15th century.

Philip was the son of John the Fearless and Margaret of Bavaria. When he became duke of Burgundy at the age of 23, his first aim was

Philip III, detail of a portrait attributed to Rogier van der Weyden; in the Louvre, Paris
Cliche des Musees Nationaux, Paris

to extricate himself as expeditiously as possible from the French affairs in which his father, Duke John, had been embroiled and that had led to his assassination in 1419. Holding the dauphin Charles (later Charles VII of France) answerable for his father's murder, Philip signed the Treaty of Troyes with King Henry V of England in 1420, a treaty in which the queen of France, Isabella of Bavaria, conferred succession to the French crown on Henry and partitioned France among England, Burgundy, and her disinherited son, the dauphin Charles.

Philip paid little attention to potential conquests in France and preferred to remain uncommitted there. He maintained his alliance with England, apart from a break in 1435–39, when he tried but failed to conquer Calais, but seldom gave England serious help against France. On the other hand, especially after 1435, when he acknowledged Charles as king of France and accepted his disavowal of the murder of John the Fearless, he did his best to be on reasonably good terms with the king of France. His real interests lay not in France but in the development of his own territories.

Behind an impressive, if bizarre, facade of courtly splendour and chivalrous festivity, Duke Philip the Good was an aggressive opportunist who, especially in the first half of his ducal reign, concentrated on the task of attacking and swallowing up his smaller neighbours. Namur was purchased in 1421; Hainaut fell to Burgundian arms in 1427; the rich duchy of Brabant was taken over in 1430; and the combined counties of Holland and Zeeland were conquered in a long series of personally led and bitterly contested campaigns between 1424 and 1433. The crowning achievement of Philip's policy of territorial expansion was his conquest of the duchy of Luxembourg in 1443.

It was under Philip that the richness and extravagance of court life in the European Middle Ages reached its apogee. Philip, whose personal tastes in clothes were relatively simple, loved to surround himself with all the pomp and pageantry that the age could command. In 1430 he founded a new order of chivalry, a Burgundian version of the British Order of the Garter, called the Toison d'Or, or Golden Fleece, membership of which was limited to 24 noblemen of proven valour and wide renown. Court was held at Brussels or Bruges, in Brabant and Flanders, respectively; or at Hesdin or Lille, in northeastern France; or at some other centre.

The best artists of the day were employed by Philip to paint his banners and pennons, to decorate his palaces and carriages, and to illuminate what was probably the finest collection of picture books ever put together. The artist Jan van Eyck accompanied a ducal embassy to Portugal to paint the king's daughter Isabella, so that Philip could see her likeness before committing himself to marrying her. Sculptors worked on tombs at Philip's command, and exquisite tapestries were embroidered under his personal supervision. A host of musicians, jewelers, goldsmiths, and other craftsmen and artists were employed at his court. The bawdy stories exchanged by Philip and his courtiers after dinner were collected into *Les Cent Nouvelles Nouvelles,* or "The Hundred New Short Stories."

Some of the more elaborate banquets, notably the Feast of the Pheasant in 1454, at Lille, were open to the public, who could admire the endless array of model ships and towers, pies with people inside them, peacocks, swans, and eagles (mock or real), and other paraphernalia that accompanied the various dishes. Other entertainment was held from time to time in the form of tournaments or passages of arms, and Duke Philip's courtiers roamed about Europe issuing challenges and doing battle with their colleagues from other lands.

Duke Philip was tall, handsome, and bony in figure; his face was long and lean, with a high forehead, prominent nose, and bushy eyebrows. Excellent in health, he enjoyed hunting, tennis, archery, and jousting in his youth, but he turned in his later years to making clogs, repairing broken glasses, and soldering broken knives. His many bastard children caused the bishop of Tournai (himself a bastard) to criticize him for what the ecclesiastic called "the weakness of the flesh." Some were brought up at court; others went into the church. His mistresses were kept out of affairs of state, and it was mere geographic convenience and economy that caused him to maintain several at once in the different towns where he held court. Self-assured and flamboyant almost to the end, he died, possibly of pneumonia, at Bruges in 1467. (R.Va.)

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• **Philip IV:** *see* Philip I (Spain).

FRANCE

• **Philip I** (b. 1052—d. July 29/30, 1108, Melun, Fr.), king of France (1059/60–1108) who came to the throne at a time when the Capetian monarchy was extremely weak but who succeeded in enlarging the royal treasury by a policy of devious alliances, the sale of his neutrality in the quarrels of powerful vassals, and the practice of simony on a huge scale.

Philip was the elder son of Henry I of France by his second wife, Anne of Kiev. Crowned at Reims in May 1059, he became sole king on his father's death in 1060. Two years after he came of age in 1066, he obtained the county of Gâtinais as the price of his neutrality in a family struggle over Anjou and thereby linked the royal possessions in Sens with those around Paris, Melun, and Orléans. His major efforts, however, were directed toward Normandy, in which from 1076 he supported Robert II Curthose, its ineffectual duke, first against Robert's father, King William I of England, then against Robert's brother, William II. Philip's true goal was to prevent emergence of a rival power in Normandy, for he was willing to abandon Robert whenever it seemed possible he might become dangerous.

Because of his firm determination to retain control over all appointments to ecclesiastical posts, which he blatantly sold, Philip was eventually drawn into conflict with the papacy. This conflict was exacerbated by his matrimonial affairs; his scandalous "marriage" with Bertrada de Montfort, wife of a vassal, brought him repeated excommunication. By 1104, when the struggle with the papacy was finally ended, Louis VI, Philip's son by his legitimate wife, Bertha, had taken over the administration of the kingdom, Philip having been rendered inactive by his extreme obesity.

• **Philip II,** byname PHILIP AUGUSTUS, French PHILIPPE AUGUSTE (b. Aug. 21, 1165, Paris, Fr.—d. July 14, 1223, Mantes), the first of the great Capetian kings of medieval France (reigned 1179–1223), who gradually reconquered the French territories held by the kings

Philip II, seal of majesty, showing the king crowned and enthroned, from a document of 1180
Archives Photographiques, Paris

of England and also furthered the royal domains northward into Flanders and southward into Languedoc. He was a major figure in the Third Crusade to the Holy Land in 1191.

Early life and kingship. Philip was the son of Louis VII of France and Adela of Champagne. In order to be associated as king with his father, who had fallen mortally ill, he was crowned at Reims on Nov. 1, 1179. His uncles of the House of Champagne—Henry I, count of Champagne; Guillaume, archbishop of Reims; and Thibaut V, count of Blois and Chartres—hoped to use the youthful king to control France. To escape from their tutelage, Philip, on April 28, 1180, married Isabella, the daughter of Baldwin V of Hainaut and the niece (through her mother) of Philip of Alsace, the count of Flanders, who promised to give the King the territory of Artois as her dowry.

When Henry II of England arrived in Normandy, perhaps with the intention of responding to an appeal by the House of Champagne, Philip II entered into negotiations with him and, at Gisors on June 28, 1180, renewed an understanding that Louis VII had reached with him in 1177. As a result, the House of Champagne was politically isolated, and Philip II was making all decisions for himself and acting as he saw fit when his father died, on Sept. 18, 1180, leaving him sole king in name as well as in fact.

When the Count of Flanders allied himself with the Champagne faction, there followed a serious revolt against the King. In the Peace of Boves, in July 1185 (confirmed by the Treaty of Gisors in May 1186), the King and the Count of Flanders composed their differences (which had been chiefly over possession of Vermandois, in Picardy), so that the disputed territory was partitioned, Amiens and numerous other places passing to the King and the remainder, with the county of Vermandois proper, being left provisionally to Philip of Alsace. Thenceforward the King was free to run against Henry II of England.

Territorial expansion. Henry's French possessions—the so-called Angevin Empire, consisting of Normandy, Maine, Anjou, and Touraine, with Aquitaine in the hands of his son, the future Richard I the Lion-Heart of England, and Brittany ruled by another son, Geoffrey (died 1186)—all were a constant menace to the French royal domain. Furthermore, there were long-standing disputes over the Vexin (between Normandy and the Île-de-France), Berry, and Auvergne.

Philip II launched an attack on Berry in the summer of 1187 but then in June made a truce with Henry, which left Issoudun in his hands and also granted him Fréteval, in Vendômois. Though the truce was for two years, Philip found grounds for resuming hostilities in the summer of 1188. He skillfully exploited the estrangement between Henry and Richard, and Richard did homage to him voluntarily at Bonmoulins in November 1188. Finally, by the Treaty of Azay-le-Rideau, or of Colombières (July 4, 1189), Henry was forced to renew his own homage, to confirm the cession of Issoudun, with Graçay also, to Philip, and to renounce his claim to suzerainty over Auvergne. Henry died two days later.

Richard, who succeeded Henry as king of England, had already undertaken to go on crusade (the Third Crusade) against Saladin in the Holy Land, and Philip now did likewise. Before his departure, he made the so-called Testament of 1190 to provide for the government of his kingdom in his absence. On his way to Palestine, he met Richard in Sicily, where they promptly found themselves at variance, though they made a treaty at Messina in March 1191. Arriving in Palestine, they cooperated against the Muslims at Acre, until Philip fell ill and made his illness a pretext for returning to France, quite determined to settle the succession to Flanders (Philip of Alsace had just died on the crusade) while Richard was still absent. Thus, by the end of 1191, Philip II was back in France.

In spite of promises he had made in the Holy Land, Philip at once prepared to attack the Plantagenet possessions in France. Informed of this, Richard also left the crusade but was taken prisoner while on his way back by the duke of Austria, Leopold V of Babenberg. Philip did everything he could to prolong his rival's captivity, but Richard was at last set free (1194) and went to war against Philip. The French king suffered a number of defeats (from that at Fréteval in July 1194 to that at Courcelles in September 1198) in a series of campaigns that were occasionally punctuated by negotiations. It was fortuitous for Philip, however, when Richard was killed in April 1199.

Richard's brother John was by no means as formidable a fighter. Moreover, his right to Richard's succession could be contested by Arthur of Brittany, whose father had been senior to John. To secure the succession, therefore, John came to terms with Philip: by the Treaty of Le Goulet (May 22, 1200), in return for Philip's recognition of him as Richard's heir, he ceded Évreux and the Norman Vexin to Philip; agreed that Issoudun and Graçay should be the dowry of his niece Blanche of Castile, who was to marry the future Louis VIII (Philip's son by Isabella of Hainaut); and renounced any claim to suzerainty over Berry and Auvergne.

Shortly afterward, however, John entered into conflict with the Lusignan family of Poitou (in Aquitaine), who appealed to Philip as overlord. When he was summoned to appear before the royal court as a vassal of the French crown, John did not present himself, and Philip, in April 1202, pronounced John's French fiefs forfeit and undertook to carry out the sentence himself. He invaded Normandy, overran the northeast, and laid siege to Arques, while Arthur of Brittany, the son of Geoffrey, who died some years before, campaigned against John's supporters in Poitou; but John, marching south from Maine, captured Arthur at Mirebeau (August 1). In fury, Philip abandoned the siege of Arques and marched southwestward to Tours, ravaging John's territory on his way before returning to Paris. Guillaume des Roches, the powerful seneschal of Anjou, who had taken John's side, came to terms with Philip in March 1203.

Resuming operations against Normandy, Philip occupied the towns around the great fortress of Château-Gaillard, to which he laid siege in September 1203, having overruled Pope Innocent III's attempts to mediate. John, who is reported to have murdered Arthur of Brittany in April, retired to England in December, and Château-Gaillard fell to Philip in March 1204. Rouen, the Norman capital, surrendered in June, after 40 days' resistance.

After his conquest of Normandy, Philip subdued Maine, Touraine, Anjou, and most of Poitou with less difficulty (1204–05), though the castles of Loches and Chinon held out for a year. He sought to secure his conquests by lavishing privileges on the towns and on the religious houses but otherwise left the local barons in power. Unrest, however, was endemic in Poitou, and in June 1206 John landed at La Rochelle. After a campaign in the south, he turned north toward the Loire. At Thouars in October 1206, he and Philip made a two-year truce, leaving John in possession of the reconquered Poitevin lands. In the following year, however, Philip invaded Poitou again; and, after a further campaign in 1208, only the south and part of the west of Poitou remained loyal to John (with Saintonge, Guyenne, and Gascony).

Philip next hoped to exploit the dispute between John and Pope Innocent III. While Innocent was threatening to declare John unfit to reign (1212), plans were being made for a French landing in England and for the accession of Philip's son Louis to the English throne. The plans had to be dropped when John made his submission to the Pope (1213). Throwing himself into schemes for revenge, John formed a coalition against France: the Holy Roman emperor Otto IV, the Count of Flanders (Ferrand, or Ferdinand, of Portugal), and the Count of Boulogne (Raynald, or Renaud, of Dammartin) were to invade the Capetian territory from the northeast while John attacked from the west, with the help of his Poitevin barons.

John landed at La Rochelle in February 1214 and advanced into Anjou but was put to flight by Louis at La Roche-aux-Moines on July 2; his confederates were completely defeated by Philip in the decisive Battle of Bouvines on July 27. The Anglo-Angevin power in France and the coalition had both been broken in one month. Thus Philip, who, in 1213, had transferred Brittany to his cousin Peter of Dreux, was left without any significant opposition to his rule in France.

It was not only at the Plantagenets' expense that Philip enlarged the royal domain. His claim to Artois through his first marriage and his gains by the settlement of 1185–86 have been mentioned above, and he subsequently proceeded, step by step, to acquire the rest of Vermandois and Valois. His insistence on his suzerainty over vacant fiefs and on his tutelage over minors and heiresses was particularly effective with regard to Flanders, where two successive Flemish counts, Philip of Alsace (died 1191) and Baldwin IX (died *c.* 1205) had left no male issue.

Though he did not personally take part in the crusade proclaimed by Pope Innocent III against a Cathari religious sect in Languedoc, Philip allowed his vassals and knights to carry it out. Simon de Montfort's capture of Béziers and Carcassonne (1209) and his victory at Muret over Raymond VI of Toulouse and Peter II of Aragon (1213) prepared the way for the eventual annexation of eastern Languedoc to the royal domain six years after Philip's death and for the union of northern and southern France under Capetian rule.

Internal affairs. Several years before he tried to take advantage of the papacy's quarrel with John of England, Philip had himself been in dispute with Rome. After the death (1190) of Isabella of Hainaut, he had married Ingeborg, sister of the Danish king Canute IV, on Aug. 14, 1193, and on the next day, for a private reason, had resolved to separate from her. Having procured the annulment of his marriage by an assembly of bishops in November 1193, he took a Tirolese lady, Agnes, daughter of Bertold IV of Meran, as his wife in June 1196. Denmark, meanwhile, had complained to Rome about the repudiation of Ingeborg, and Pope Celestine III had countermanded it in 1195; but Celestine died (1198) before he could resort to coercion against Philip. The next pope, Innocent III, was sterner: in January 1200 he imposed an interdict on France. Philip, therefore, in September 1200, had to submit, pretending to be reconciled with Ingeborg. In fact, he refused to cohabit with her and kept her in semicaptivity until 1213, when he accepted her beside him—not as his wife but at least as his queen. Agnes had died in 1201, after bearing two children to Philip: Marie, countess of Namur (1211) and duchess of Brabant (1213), by successive marriages; and Philip, called Hurepel, count of Clermont.

Throughout his reign, Philip kept a close watch over the French nobility, which he brought effectively to heel. He maintained excellent relations with the French clergy, leaving the canons of the cathedral chapters free to elect their bishops and favouring the monastic orders. He knew, too, how to win the support of the towns, granting privileges and liberties to merchants and frequently aiding their struggles to free themselves from the seignorial authority of the nobles. In return, the communes helped financially and militarily. Most of all, Philip gave his attention to Paris, not only fortifying it with a great rampart but also having its streets and thoroughfares put in order. For the countryside, he multiplied the number of *villes neuves* ("new towns"), or enfranchised communities.

The Capetian monarchy's hold on the huge royal domain as well as on the kingdom as a whole was considerably strengthened by Philip's institution of a new class of administrative officers, the royal *baillis* and the seneschals for the provinces, who were appointed by the king to supervise the conduct of the local *prévôts* ("provosts"), to give justice in his name, to collect the revenues of the domain for him, and to call up the armed forces, in addition to other duties.

Conclusion. Philip II died on July 14, 1223. Knowing his own strength, he was the first of the Capetians not to have his eldest son crowned and associated with him during his lifetime; in fact, his conquests and strong government made him the richest and most powerful king in Europe and prepared the way for France's greatness in the 13th century.

(M.Pa.)

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• **Philip III,** byname PHILIP THE BOLD, French PHILIPPE LE HARDI (b. April 3, 1245, Poissy, Fr.—d. Oct. 5, 1285, Perpignan), king of France (1270–85), in whose reign the power of the monarchy was enlarged and the royal domain extended, though his foreign policy and military ventures were largely unsuccessful.

Philip, the second son of Louis IX of France (Saint Louis), became heir to the throne on the death of his elder brother Louis (1260). Accompanying his father's crusade against Tunis in 1270, he was in Africa when Louis IX died. He was anointed king at Reims in 1271.

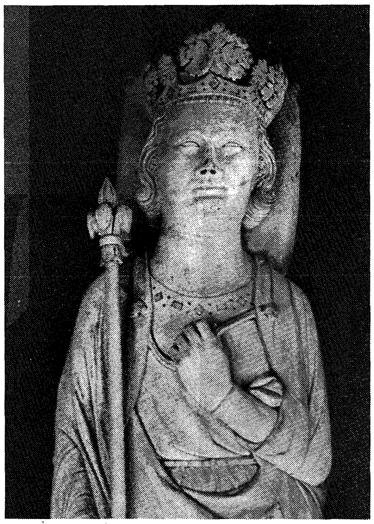
Philip continued his father's highly successful administration by keeping in office his able and experienced household clerks. Mathieu de Vendôme, abbot of Saint-Denis, whom Louis IX had left as regent in France, remained in control of the government. The death in 1271 of Alphonse of Poitiers and his wife, heiress of Toulouse, enabled Philip early in his reign to annex their vast holdings to the royal demesne. Nevertheless, in 1279 he was obliged to cede the county of Agenais to Edward I of England. The marriage in 1284 of Philip's son, the future Philip IV, to Joan, the heiress of the crown of Navarre and the countships of Champagne and Brie, brought these important areas also under Capetian control. In addition Philip over the years made numerous small territorial acquisitions.

Philip III being crowned, miniature in *Les Grandes Chroniques de France,* about 1400; in the Bibliothèque Nationale, Paris (MS. Fr. 2608)

By courtesy of the Bibliotheque Nationale, Paris

Philip was less successful militarily. In 1276 he declared war to support the claims of his nephews as heirs in Castile but soon abandoned the venture. In 1284, at the instigation of Pope Martin IV, Philip launched a campaign against Peter III of Aragon, as part of the War of the Sicilian Vespers, in which the Aragonese opposed the Angevin rulers of Sicily. Philip crossed the Pyrenees with his army in May 1285, but the atrocities perpetrated by his forces provoked a guerrilla uprising. After a meaningless victory at Gerona and the destruction of his fleet at Las Hormigas, Philip was forced to retreat. He died of fever on the way home.

• **Philip IV,** byname PHILIP THE FAIR, French PHILIPPE LE BEL (b. 1268, Fontainebleau, Fr.—d. Nov. 29, 1314, Fontainebleau), king of France from 1285 to 1314 (and of Navarre, as Philip I, from 1284 to 1305, ruling jointly with his wife, Joan I of Navarre). His long struggle with the Roman papacy ended with



Philip IV, detail of the statue from his tomb, 14th century; in the abbey church at Saint-Denis, Fr.

Archives Photographiques, Paris

the transfer of the Curia to Avignon, Fr. (beginning the so-called Babylonian Captivity, 1309–78). He also secured French royal power by wars on barons and neighbours and by restriction of feudal usages. His three sons were successively kings of France: Louis X, Philip V, and Charles IV.

Early years. Born at Fontainebleau while his grandfather was still ruling, Philip, the second son of Philip III the Bold and grandson of St. Louis (Louis IX), was not yet three when his mother, Isabella of Aragon, died on her return from the crusade on which Louis IX had perished. The motherless Philip and his three brothers saw little of their father, who, stricken by Isabella's death, threw himself into campaigning and administrative affairs. His troubled childhood and the series of blows he suffered explain in some measure the conflicting elements in his adult personality. In 1274 his father married Marie de Brabant, a beautiful and cultivated woman, and, with her arrival at court, intrigue began to flourish. In the same year, the two-year-old Joan, heiress of Champagne and Navarre, was welcomed as a refugee. Reared with the royal children, she would, when she was 12, become the bride of Philip the Fair.

In 1276 Philip's older brother, Louis, died, and the shock of this event, which suddenly made Philip heir of the kingdom, was compounded by persistent rumours of poisoning and suspicions that Philip's stepmother intended to see Isabella's remaining sons destroyed. Vague allegations were circulated that Louis's death was linked with certain unspecified "unnatural acts" of his father. These rumours, never satisfactorily put to rest, together with the unexpected change in Philip's fortunes, apparently served to arouse in him feelings of insecurity and mistrust.

Consequently, Philip turned elsewhere in search of a model for his own conduct. He found it in Louis IX, whose memory was increasingly venerated as the number of miracles attributed to him mounted. Reports of Louis's exacting standards of rulership and his saintly virtues were reinforced by the precepts of the religious advisers who surrounded the adolescent Philip. A more self-confident person might have been able to discriminate realistically among the sometimes artificially exaggerated stories and the utopian ideals. Philip, however, became convinced that it was his God-given duty to attain the lofty goals of his grandfather.

When Philip was 16, he was knighted and married to Joan of Navarre. In 1285 he accompanied his father to the south on a campaign to install Philip's brother Charles on the throne of Aragon. He had no sympathy with the enterprise, however, which was backed by his stepmother and aimed against the King of Aragon, his late mother's brother. When his father died in October 1285, Philip immediately abandoned the venture.

Wars with England and Flanders. In the first years of Philip's reign the Aragonese affair was settled, and Philip intensified his predecessors' efforts to reform and rationalize the administration of the realm. He dispatched investigators to inquire into the conduct of royal officials and into infringements upon royal prerogatives. Philip persisted in seeking such reforms, which strengthened the monarchy's position but angered the nobles, townsmen, and ecclesiastics who had profited from the laxer policies of earlier kings.

War with England began in 1294, initiating a 10-year period of conflict that severely strained Philip's resources. There had been some naval clashes, but full-scale war might well have been avoided had not Philip, perhaps in a fit of youthful bravado, decided to demonstrate his power over England's mighty Edward I, his vassal, for control of the duchy of Gascony. Philip's victories in 1297 may have satisfied his ambitions, but they brought no territorial gain, for the many lands that Philip had seized were returned. Nevertheless, the war was significant. First, the peace treaty of 1303 stipulated that Philip's daughter Isabella should marry the future Edward II of England—an alliance that resulted in years of peace between the two kingdoms. Second, during the war, Philip's vassal Guy of Dampierre, count of Flanders, had allied himself with Edward I, a move that Philip considered to be base treachery and that resulted in a breach between the two that persisted until long after Philip's death.

Before the peace, but after fighting with England had ceased, Philip made a move to crush the Flemings, only to see a host of his nobles fall at Courtrai in 1302. This stunning defeat was redeemed two years later at Mons-en-Pévèle, where Philip showed exceptional personal courage. Finally, in 1305, Philip forced Flanders to accept a harsh peace treaty that exacted heavy reparations and humiliating penalties.

In financing the prolonged effort against Flanders, Philip had held assemblies and had bartered privileges and promises of reform for support in the war. Most important, in abandoning the property taxes that earlier had been levied for defense, he enforced the principle that all must fight to defend France but might purchase exemption if they wished. This successful policy was later employed as a regular wartime expedient by the French monarchy.

Conflict with the papacy. Philip's rupture with Boniface VIII can be considered a third consequence of the English war. Because the hostilities interfered with papal plans for a crusade, Boniface intervened aggressively and sometimes tactlessly to promote peace. In February 1296 he issued the bull *Clericis Laicos*, prohibiting lay taxation of clergy without papal approval. Both Edward I and Philip, affronted by this threat to their authority and their treasuries, responded with retaliatory measures, forcing Boniface to retreat and, in July 1297, to proclaim the legitimacy of clerical taxation without the pope's permission when the ruler attested its necessity.

To mollify Philip, Boniface supported him against the Flemings and canonized Philip's grandfather Louis IX in 1297. The Pope's position in France was even weaker than he realized, for, at least as early as 1297, his enemies had spread charges against him, such as that he questioned the immortality of the soul or that he had plotted the death of his predecessor on the papal throne. Philip, for his part, had not rejected these stories out of hand.

New grounds for dispute developed in 1301, when Philip arrested Bernard Saisset, bishop of Pamiers, as a suspected traitor. Boniface, his confidence buoyed after the triumphant papal jubilee of 1300, determined not only to force Philip to send Saisset to Rome, but also to launch a frontal attack on the king's authority. In December 1301 Boniface suspended Philip's right to tax ecclesiastics and summoned the French clergy to Rome to discuss the King's governance and the state of the French Church. Saisset was permitted to go to Rome, but Boniface's other measures encountered immediate resistance. Philip had a papal bull burned and ceremoniously invoked curses on any of his sons who dared subordinate the kingdom to any power other than God's.

In April 1302 he rallied public support in a large assembly. Undaunted by his humiliating defeat by the Flemings at Courtrai and by Boniface's declaration of the universal supremacy of the Roman pontiff in the bull *Unam Sanctam*, Philip held additional assemblies in the spring of 1303. He issued his own grand ordinance of reform that included remedies for administrative weaknesses enumerated by the Pope. Then, in response to appeals by his ministers Guillaume de Nogaret and Guillaume de Plaisians, Philip pledged to see Boniface judged for the heretical words and criminal and immoral deeds with which he had been charged.

Boniface's plans to issue a personal sentence of excommunication against Philip were forestalled when Nogaret appeared in Anagni and seized Boniface on Sept. 7, 1303. Nogaret probably intended to press Boniface to submit to conciliar judgment, but his plans were frustrated when troops, rallied by Boniface's Italian enemies, turned to violence and pillage. Two days later townsmen of Anagni freed the Pope, whose death the following month saved him from having to appear before a council to answer Philip's charges. Accusations against Boniface's memory, however, proved a useful negotiating device in dealing with his successor, Benedict XI, and even more so with Clement V, the Gascon-born pope who pleased Philip by transferring the papal curia from Rome to Avignon, a city near Philip's realm. Charges against Boniface were pressed until 1311, when Clement declared Philip's zeal praiseworthy and nullified all the offensive bulls that Boniface had issued after November 1301.

The years of peace between 1304 and 1313 allowed Philip not only to pursue his posthumous vendetta against Boniface but also to formulate plans to establish himself as the undisputed champion of orthodoxy. Before 1304 Philip had given thought to the moral implications of his deeds, taking steps to indemnify those harmed by coinage changes and advancing approved justifications of other wartime measures. After 1304 his scrupulousness became more apparent. He secured bulls from Pope Clement that absolved him from future crusading vows, annulled any obligation to return sums wrongfully taken from ecclesiastics for his wars, and—after lengthy negotiation—declared the Flemings subject to ecclesiastical sanctions if they failed to observe the peace treaty of 1305. In 1306 reformation of the coinage, long advocated by the church, was begun, and in later years Philip sought his subjects' advice concerning monetary policy. Philip's intensified preoccupation with questions of conscience and morals may have been prompted by the death in April 1305 of Queen Joan, a determined woman of scholarly inclinations and a devotee of St. Louis. Philip never married again, and in the months after his wife's death he considered abdicating and assuming the kingship of the Holy Land as head of a consolidated crusading order.

Persecution of the Jews and Knights Templars. Philip soon found more practical ways of venting his grief and proving his dedication to God, while also advancing the material interests of a realm that was impoverished by long years of warfare. In 1306 he expelled all Jews from France, seizing their property and confiscating the monies owed to them. Philip's devotion to St. Louis was witnessed that same year by elaborate ceremonies in his honour, and Louis's anti-Semitic proclivities might have inspired Philip to act against the Jews, whose usefulness as a source of regular revenue had in any case been exhausted by his earlier repeated impositions.

Similarly mixed motivations influenced Philip to attack the Knights Templars, the wealthy, powerful, independent crusading order that had long acted as the French monarchy's financial agent. Philip's newfound interest in uniting the crusading orders made him mistrustful of the Templars' opposition to such plans. Thus, he was receptive to charges of heresy and sodomy presented against them in 1305. His tentative overtures to Clement V were fruitless, but, with the support of Nogaret and his own Dominican confessor—who was also the papal inquisitor in France—Philip decided in September 1307 to seize all Knights Templars in France and to exhort his fellow rulers to follow his lead.

At first dubious and reluctant, Clement V eventually supported Philip; he had been told of outraged anti-Templars appeals voiced in a large assembly of Philip's subjects, and he had heard damning confessions from the mouths of representatives of the order, many of whom had been tortured. Far-flung tribunals had gathered enough materials to cast doubts on the Templars' dedication, and, although not condemned as heretical, the order was quashed and its property assigned to the Knights Hospitallers. Whatever Philip's reasons for launching his attack against the order, his action brought him substantial financial gain despite Clement V's repeated attempts to protect the Templars' interests.

During the interwar years Philip asserted his independence of the Holy Roman Empire in diplomatic exchanges with imperial princes and the emperors themselves. He also fortified his eastern border by arranging marriages for his sons that extended French influence over the county of Burgundy and by exerting his authority over the city of Lyon. Less successful were his attempts to implement his dream of gaining control of the empire. He failed to have his brother Charles elected emperor in 1308, nor did he succeed on behalf of his second son Philip in 1313.

Last years. This disappointment presaged the troubles of Philip's last year as king. In June 1313 his fortunes had reached a high point. Having knighted his sons, taken the crusader's cross, and issued coinage-reform ordinances, he witnessed the triumphal departure of his sons against the Flemings, who had been excommunicated for their failure to observe the treaty of 1305. When the Flemings capitulated and accepted a truce, Philip magnanimously ordered the return of money collected for the army. After these successes and demonstrations of royal grace, 1314 brought only troubles. Philip's stubborn resolve to defend morality and the faith was shown when, with royal acquiescence, the grand master of the Templars, Jacques de Molay, was burned at the stake after retracting his earlier confession. Far graver were the public trial and execution of two young squires convicted of adultery with Philip's daughters-in-law.

The death of Clement V was another blow, but an even greater one was the Flemings' fresh uprising. With his subjects' agreement, Philip mounted another campaign, but the negotiation of a truce caused difficulties. There were rumours of treason involving one of Philip's ministers and insistent demands for the restitution of all money collected for the war. Philip, who needed the funds, delayed, and a coordinated movement of opposition developed. Nobles in northern and eastern France presented their grievances to the King, who by early November was lying ill at Poissy, St. Louis's birthplace, recovering from a minor stroke. Having regained strength, he travelled to his own birthplace, Fontainebleau, and there, a day before his death, he halted collection of his last tax and provided for a crusading expedition to be conducted in his name.

Assessment. Philip was aloof, sternly reserved, and physically striking—tall, fine-featured, and blond—hence his name, "the Fair." Frankly enjoying the trappings of monarchy, he built and maintained the palaces befitting his estate, but his chief concern was for the dignity of his office. He believed that he and his kingdom were guarded by God and chosen as special defenders of the Catholic faith. He valued the curative powers that he believed God's grace had given him. Proud of his orthodoxy and inspired by a priestly sense of mission, he was receptive to accusations of sin and heresy levelled against others, and he prosecuted ruthlessly those charged with such failings.

A visionary idealist, he also possessed a fundamental sense of the possible and the necessary, and those of his grandiose schemes that exceeded the bounds of practicality were abandoned. As authoritarian and determined as he sometimes appeared, he lacked the firmness and independence of judgment that a surer sense of confidence in himself might have afforded him. He often turned for guidance to the intelligent and able ministers whom he promoted and protected, and he solicited the support of his subjects, who were called together with unprecedented frequence to endorse and sometimes to help construct royal policy. Such consultation may have been politically expedient, but, like the expressions of reassurance obtained from spiritual authorities, it also served to convince Philip of the legitimacy of his actions.

Philip was, by all accounts, an impressive ruler. Some Italian writers detested him and his line, but most contemporaries acknowledged his piety and good intentions, although many of them disapproved of his wars, his taxes, and his influential advisers. In the later years of the 14th century, when memory of these sources of complaint had faded, his reign was considered a golden age of freedom from burdensome and unjust taxation. Historians of recent times have differed in their judgments, and nationalistic and ecclesiastical biases have affected many assessments. It now seems possible to conclude, however, that the most striking accomplishments of his reign bear the ultimate impress of the complex personality of a scrupulous, suspicious, rigorous, visionary, determined man who fervently believed himself called by God to act as judge of the morals and welfare of his subjects.

(E.A.R.B.)

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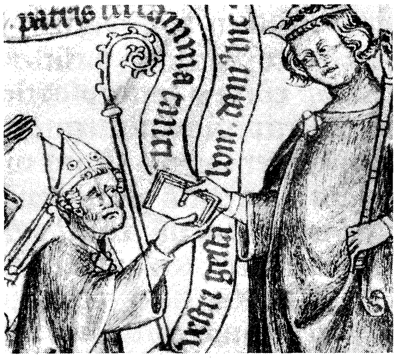
Where the same name may denote a person, place, or thing, the articles will be found in that order

Philip V, byname PHILIP THE TALL, French PHILIPPE LE LONG (b. *c.* 1293—d. Jan. 3, 1322), king of France (from 1316) and king of Navarre (as Philip II, from 1314), who largely succeeded in restoring the royal power to what it had been under his father, Philip IV.



Philip V, detail of a Latin manuscript, early 14th century; in the Bibliothèque Nationale, Paris (MS. Latin 5286)

By courtesy of the Bibliotheque Nationale, Paris

Philip was the second son of Philip IV, who made him count of Poitiers in 1311. When his elder brother, King Louis X, died in 1316, leaving an infant daughter Joan by his adulterous first wife, and a pregnant widow, Philip won recognition as regent for the unborn child and then, upon its death in November 1316, five days after birth, declared himself king. Anointed at Reims in January 1317, Philip quickly moved to consolidate his position, and on February 2 an assembly of barons, prelates, Parisian bourgeois, and doctors of the University of Paris recognized him as king, enunciating the principle that Joan, as a woman, could not succeed to the throne of France.

Anxious to ensure peace and order as a means to the prosperity of the kingdom, Philip established a system of local militias under officers responsible to the crown; he also increased the efficiency of government machinery at all levels and checked the abuses of local officials. He was succeeded by his brother, Charles IV.

Philip VI, byname PHILIP OF VALOIS, French PHILIPPE DE VALOIS (b. 1293—d. Aug. 22, 1350, near Paris), first French king of the Valois dynasty. Reigning at the outbreak of

Philip VI, detail from a French manuscript, 14th century; in the Bibliothèque Nationale, Paris (MS. Fr. 18437)

By courtesy of the Bibliotheque Nationale, Paris

the Hundred Years' War (1337–1453), he had no means of imposing on his country the measures necessary for the maintenance of his monarchical power, though he continued the efforts of the 13th-century Capetians toward the centralization of the administration in Paris. To raise taxes for war, he was obliged to make concessions to the nobility, the clergy, and the bourgeoisie; hence his reign witnessed the important development of the political power of the estates. The bourgeoisie, profiting from the king's power, proved grateful and loyal; among the clergy and nobility, however, a movement for reform of finances took root.

The elder son of Charles of Valois, Philip was first cousin to the brothers Louis X, Philip V, and Charles IV, the last Capetian kings of the direct line. On the death of Charles IV in 1328, Philip, in the face of opposition from the partisans of the claim of Edward III of England, assumed the regency until the end of the pregnancy of Charles IV's widow. When the widow produced a daughter, who therefore could not succeed to the throne, Philip became king and was crowned at Reims in May 1328.

After the outbreak of a revolt in Flanders in August of that year, the count of Flanders appealed to Philip, whose knights butchered thousands of rebellious Flemings at the Battle of Cassel. When shortly thereafter Robert of Artois, who had helped Philip to win the crown, claimed the countship of Artois against a member of the royal family, Philip was forced to institute judicial proceedings against Robert, who became his bitter enemy. In 1334 Robert went to England and began to foment trouble between Edward III and Philip, hastening the deterioration of Anglo-French relations, which in 1337 led to the outbreak of the Hundred Years' War. Military operations were at first restricted. In 1340, however, France suffered a grave defeat in the naval Battle of Sluys. Meanwhile, the internal situation had worsened, as a result of resentment over the preponderant influence of the nominees of the powerful Duke of Burgundy in the king's council. A serious crisis resulted in 1343 and forced Philip to summon to Paris the estates of the kingdom, which took some measures to appease public opinion and to relieve the burdens of administration. France's devastating defeat by the English at Crécy (1346) gave rise to another crisis. To conciliate opponents, the government was obliged to entrust finances to three abbots. A new meeting of the estates in November 1347 again forced the King to recast his council. The spread of the Black Death in 1348 and 1349, however, overshadowed all political questions. When Philip died, he left France divided by war and plague, although by purchase he had made some important additions to the territory of the kingdom.

GERMANY/HOLY ROMAN EMPIRE

• **Philip,** also called PHILIP OF SWABIA, German PHILIPP VON SCHWABEN (b. 1178—d. June 21, 1208, Bamberg, Ger.), German Hohenstaufen king whose rivalry for the crown involved him in a decade of warfare with the Welf Otto IV.

The youngest son of the Holy Roman emperor Frederick I Barbarossa, Philip was destined for the church. After being provost of the cathedral at Aachen, he was, in 1190 or 1191, elected bishop of Würzburg. Shortly after the death of his brother Frederick (1191), however, he abandoned his ecclesiastical career. Another brother, the Holy Roman emperor Henry VI, made him duke of Tuscany in 1195 and duke of Swabia in 1196. In May 1197 he married Irene, daughter of the Byzantine emperor Isaac II Angelus.

Philip, sculpture, *c.* 1207; in the St. Ulrich Museum, Regensburg, Ger.

By courtesy of the St. Ulrich Museum; photograph, Foto Marburg—Art Resource/EB Inc.

At Henry VI's death in September 1197, his son, the future emperor Frederick II, was less than three years old, and the German princes were unwilling to accept him as king. The princes favourable to the Hohenstaufens elected Philip German king in March 1198. The opposing party, led by Archbishop Adolf of Cologne, elected Otto, a son of Henry the Lion of Brunswick of the rival Welf dynasty, king in June of that year. Otto was crowned at Aachen, the proper place for the ceremony, by Archbishop Adolf. Philip's coronation, by another prelate, did not take place until September 1198 at Mainz.

In the ensuing civil war the Hohenstaufen cause prospered at first. In 1201, however, Pope Innocent III recognized Otto as king and excommunicated Philip. Philip's fortunes were only restored in 1204, by a series of defections from Otto's side, culminating in that of Adolf of Cologne himself. In June 1205, Adolf crowned Philip at Aachen.

The city of Cologne, which, notwithstanding its archbishop, had sided with Otto, was captured in January 1207, and Otto's cause seemed lost. Late in 1207, however, when Philip offered to give Otto one of his daughters in marriage and to enfeoff him with either the duchy of Swabia or the kingdom of Arles, Otto, buoyed by hopes of financial, if not military, support from the kings of England and Denmark, rejected the offer. Nevertheless, a truce was arranged that lasted until June of the following year.

In 1208 Pope Innocent III recognized Philip as king and promised to crown him emperor. Philip, who had mobilized his army at Bamberg in order to move against Otto, was waiting for the truce to expire when he was murdered by Otto of Wittelsbach, count Palatine of Bavaria, to whom he had refused to give one of his daughters in marriage. Eventually his daughters were married: Beatrix the Elder to his old rival Otto, Cunigunda to King Wenceslas of Bohemia, and Beatrix the Younger to Ferdinand III of Castile.

A brave man, Philip was praised by contemporaries for his mildness and generosity. The diversion of the Fourth Crusade to Constantinople is assumed by some authorities to have been prompted by him in the interests of his brother-in-law, the Byzantine emperor Alexius IV Angelus.

HESSE

• **Philip,** byname PHILIP THE MAGNANIMOUS, German PHILIPP DER GROSSMÜTIGE (b. Nov. 13, 1504, Marburg, Hesse [Germany]—d. March 31, 1567, Kassel), landgrave (*Landgraf*) of Hesse (1509–67), one of the great figures of German Protestantism, who championed the independence of German princes against the Holy Roman emperor Charles V.

Early years. Philip was the son of Landgrave William II, a cultivated, austere man and an experienced soldier. He died when Philip was barely five years old. Philip's mother, Duchess Anna of Mecklenburg, was a passionate, energetic, and ambitious woman; her relations with her son, however, were cool and were impaired by her second marriage in 1519 and by Philip's conversion to the doctrines of Martin Luther. As a victim of political forces he spent a gloomy youth, attaching himself increasingly to his older sister Elizabeth, later duchess of Saxony; throughout his life no one was closer to him than she.

In March 1518 the emperor Maximilian I declared Philip to be of age. While assuming the government in name, he retained his parents' capable counselors, mostly lawyers by training, who imbued the young man with his parents' single-minded devotion to the welfare of the state. Philip eventually developed into a self-reliant politician. From his youth, he characteristically thought in terms of the territorial state, an attitude that was to determine his future relations with the Habsburg emperors. He ruled his territory in the spirit of an early enlightened despotism.

Philip, detail of a portrait by Hans Krell, 1525; in the Wartburg Sammlungen, Eisenach, Ger.

By courtesy of the Wartburg Sammlungen, Eisenach; photograph, Deutsche Fotothek Dresden/Mobius

The landgraviate of Hesse had suffered greatly during his mother's regency, but Philip succeeded in bringing order to the confused administration of the state and, through skillful management of alliances, in freeing Hesse from its isolation in foreign affairs. In 1523 Philip, fighting alongside the powerful electors of the Palatinate and of Trier, defeated the rebellious imperial knight Franz von Sickingen. This victory also crushed the remaining opposition of the Hessian nobility and undoubtedly strengthened the young man's self-confidence.

Two years later, in fact, he scored his first personal triumph when he suppressed the peasant revolt in the neighbouring imperial abbeys of Fulda and Hersfeld. He then advanced into Thuringia and, allied with the elector of Saxony and the dukes of Brunswick-Wolfenbüttel and Saxony, defeated Thomas Müntzer, a popular preacher from Mühlhausen/Thüringen, at a battle near Frankenhausen in May 1525. By this victory Philip saved the central German principalities from destruction.

Conversion to Protestantism. During these years, while the first storm of the Reformation was sweeping through Germany, Luther's teachings gained a firm hold in many Hessian localities and at the landgrave's court. It was not until the summer of 1524, however, after making a detailed study of the Bible, the writings of the Church Fathers, and the history of the church, that Philip himself joined Luther. At the same time, orthodox Roman Catholic princes of southern Germany were uniting to make common cause against the ecclesiastical innovations. After the defeat of the peasants this alliance was aimed to bring down the middle and northern German princes as well, in order "to eradicate the damned Lutheran sect, the source of this revolt."

Philip was deeply convinced that the religious question was at the same time a political one, and he was the first to recognize that freedom for the new faith would be secured only if Protestant sovereigns and towns united for defense. In May 1526 he won over the elector John of Saxony for a defensive alliance, which other northern and eastern German princes then joined. Henceforward, he strove to unite the Protestant estates into a powerful alliance, which would render them unassailable and thus allow them to build their state churches.

Only when the decree of August 1526 of the imperial Diet of Speyer seemed to provide a legal basis for it and when a Hessian "synod" (part church council, part provincial diet) at Homberg had publicly discussed the religious question did Philip carry through the Reformation in his state. The Homberg deliberations led to the *Reformatio ecclesiarum Hassiae,* unique for its democratic-presbyterian church constitution and the ecclesiastical discipline of the congregations. On Luther's advice this reform, conceived by the former Franciscan Franz Lambert, was not carried out; instead Hesse became Protestant on the model provided by the electorate of Saxony.

Philip, however, continued to favour the teachings of the southern German and Swiss reformers and consequently resolved to mediate between the Lutherans and the Zwinglians, adherents of the Swiss reformer Huldrych Zwingli. Within one year, 1527, Philip secularized all the monasteries. The new state-church organization was now methodically built up. In order to ensure a new generation of clergy and officials, the landgrave took the educational system in hand and founded the first Protestant university in 1527 at Marburg. On former monastic and church estates, he set up four hospitals for the insane, the first "psychiatric" hospitals known to medical history. Church and school were subordinated to the "common good."

There arose the Protestant authoritarian state, which considered itself a taskmaster responsible for the religious and moral life of its subjects and dictated their beliefs. Like all his fellow princes, Philip was intolerant, but, in contrast to most, he respected the individual's freedom of conscience by permitting dissenters to emigrate. He soon showed this attitude in his dealings with the Anabaptists: his purpose was not to punish them as the imperial laws dictated but to convert them by clemency and instruction in doctrine; in this work Martin Bucer, the reformer from Strasbourg, was his helper. They introduced into Hesse in 1539 the rite of confirmation, which became a model for Protestant churches.

Leadership of the Protestant states. His agile and fertile mind, infectious energy, and fearlessness rapidly made Philip the leader of the Protestant estates. He continued to strive for a great Protestant alliance, for he clearly recognized that the situation of the Protestants would deteriorate if the Roman Catholic emperor Charles V were to triumph in the struggle for European predominance. The way to change and reform began in 1529, when the second imperial Diet of Speyer repealed the first imperial Diet's decree of 1526. A group of princes and towns led by Philip protested (hence Protestants) against the repeal on the epoch-making grounds that in questions of faith each imperial estate would have to justify itself before God alone.

Moreover, the landgrave saw with growing apprehension that doctrinal differences between Protestants endangered the development of an all-embracing Protestant defensive alliance. His attempt at the Colloquy of Marburg, in October 1529, to bring about a theological settlement in personal discussion with the reformers, headed by Luther and Zwingli, essentially failed over the question of the Eucharist. Thus, the ambitious plans he shared with Zwingli for a European alliance against the Roman Catholic house of Habsburg remained only a dream.

Despite everything, Philip managed in 1531 to unite 6 princes and 10 towns in the Schmalkaldic League, which was to serve as a defensive alliance. Although it had serious organizational shortcomings, the league gradually became the centre of Protestant politics. At the same time, it became a rallying point for the enemies of the house of Habsburg as well as for those Roman Catholic princes who were fearful for their independence. The league, of which the landgrave was the driving spirit, became, moreover, a factor in European politics. Philip reached the peak of his career in 1534, when he executed a campaign to restore Duke Ulrich of Württemberg, who had been driven from his state by the Habsburgs. As a result of his success, Württemberg was opened up to the Reformation, and Austria's power in southern Germany was broken.

Decline. It was Philip's tragedy that he destroyed his own leading position a few years later by his extremely provocative marital transactions. In addition to his marriage to the duchess Christina of Saxony in 1523, he contracted a second marriage with Margarete von der Saale, a maid of honour of his sister Elizabeth. As a bigamist he fell under the judgment of the Holy Roman emperor, with whom he now tried to come to terms, but, while Philip and the Schmalkaldic League remained inactive and the other Protestant princes indulged in petty disputes, the emperor Charles V prepared to settle the religious problem once and for all by force of arms. In the summer of 1546 he attacked. The league's unwieldy organization, long deplored by Philip, now took its toll. Mistakes of leadership, lack of finance, and ultimately the attack by the Protestant duke Maurice of Saxony on the territory of his cousin the elector John Frederick of Saxony hastened the collapse.

After the capture of the Elector, Philip submitted himself to the mercy of the Emperor in June 1547. Deceived by Charles, he, too, was led away a prisoner. His long imprisonment in the Netherlands deeply affected his mental powers of resistance. In order to gain his freedom, he accepted the so-called Augsburg Interim, by which the Emperor attempted to restore the unity of the Catholic faith without interference from the princes. Philip, however, failed in his attempt to gain his freedom, for the Hessian population resisted conversion to Catholicism. Only after his son-in-law, Maurice of Saxony, and Philip's eldest son, William, in alliance with other German princes and Henry II of France, unexpectedly rose against the Emperor in March 1552 were he and John Frederick released.

Aged and ailing, but also wiser, the Landgrave returned to his homeland. After the victory over the Emperor, the adherents of the Confession of Augsburg—the official Lutheran doctrine—succeeded in gaining a position of legal equality with the Catholics in the empire, in accordance with the Peace of Augsburg of 1555. In this respect Philip, who was far ahead of his time, expressed genuine tolerance for all Christian denominations. He continued to pursue his old plans for a Protestant union and strove on behalf of his embattled co-religionists in France and the Netherlands, but in his later years he cautiously remained in the background of the political stage. He devoted all his strength to the rebuilding of his state, which had been ravaged by war and by its occupation by foreign troops. By the time of his death in 1567, his contemporaries were already referring to the warm-hearted and generous sovereign as the Magnanimous.

(W.He.)

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JUDAEA

• **Philip** (b. 20 BC—d. AD 34), son of Herod I the Great; he ruled ably as tetrarch over the former northeastern quarter of his father's kingdom of Judaea.

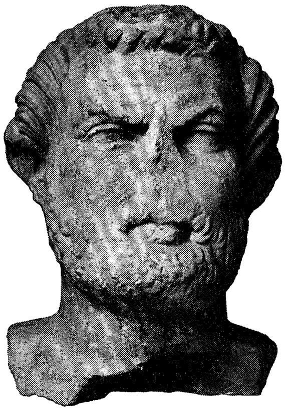
When the Roman emperor Augustus adjusted Herod's will, Philip was assigned to the region east of the Sea of Galilee, in modern northern Israel, Lebanon, and southern Syria. In AD 6, he may have joined in charging his half brother with misgoverning Judaea, but with little benefit to himself, for Judaea then became a Roman province.

Of his father's inheritance his was the poorest share, but he ruled it well. Because he had few Jewish subjects, he pursued a policy of Hellenization. His coins bore the Emperor's image, and he rebuilt a town, Beth-saida (on the northern shore of the Sea of Galilee), renaming it Julias in honour of the Emperor's daughter. Near the source of the Jordan he founded another town and allowed it a large degree of self-government, on the Greek pattern.

Philip was less extravagant a ruler than any of his brothers. He avoided prolonged trips to Rome, instead travelling extensively in his territory and devoting his time to his subjects. Late in his reign he married Salome, the daughter of Herodias, who was her mother's tool in securing from Herod Antipas the execution of John the Baptist.

MACEDONIA

• **Philip II,** byname PHILIP OF MACEDON (b. 382 BC—d. 336, Asia Minor), 18th king of Macedonia (359–336 BC), who restored internal peace to his country and then, by 339, had gained domination over all Greece by military and diplomatic means, thus laying the foundations for its expansion under his son Alexander III the Great.



Bust, tentatively identified as Philip II of Macedonia, middle of the 4th century BC; in the Ny Carlsberg Glyptotek, Copenhagen

By courtesy of the Ny Carlsberg Glyptotek, Copenhagen

Early life and accession. Philip was a son of Amyntas III. In his boyhood he saw the Macedonian kingdom disintegrating while his elder brothers Alexander II and Perdiccas III, who each reigned for a few years, strove unsuccessfully against insubordination of their regional vassal princes, intervention of the strong Greek city Thebes, and invasion by the Illyrians of the northwest frontier.

Philip himself spent some time as a hostage at Thebes, the leading city (with Athens) of this decade (370–360 BC), where the great Epaminondas, the most inventive tactician of all Greek generals until then, was in charge of the best army in Greece. These were probably the most formative years of Philip's education. When he returned to Macedonia his brother Perdiccas soon found him ready for a command.

Philip came to the throne suddenly and unexpectedly in 359, when Perdiccas was killed meeting an Illyrian invasion. The Illyrians prepared to close in; the Paeonians were raiding from the north, and two claimants to the throne were supported by foreign powers. In this crisis Philip showed a good sense of priorities by buying off his dangerous neighbours and, with a treaty, ceding Amphipolis to Athens. He used the time gained in military preparations. The army that later conquered Persia was developed all through his reign, but the decisive innovations in arms—the *sarissa,* a pike nearly half as long again as the spear of the Greeks—tactics, and training belong probably to this first year.

Macedonian expansion. In 358 he invaded Paeonia, and then he defeated the Illyrians decisively, in a battle that already suggests a master of war. The next year his marriage with Olympias, the Molossian princess of Epirus (the mother of Alexander the Great), helped to stabilize his western frontier. Now he ventured to antagonize Athens by recapturing Amphipolis, the strategic key securing the eastern frontier and giving access into Thrace; and in 356 he took the west Thracian Crenides (renamed by him Philippi), a place newly founded to exploit new finds of silver and gold in Mount Pangaeum. These successes frightened his neighbours into forming a coalition against him, which was joined by Athens; but it achieved nothing.

The 10-year "war for Amphipolis" with Athens showed that the Athenians, with all their naval power, were quite unable to damage the continental and military power of Macedonia or even to save their own allies from Philip's attacks. Meanwhile he twice penetrated deeply into Thrace. And in the south a Thessaly divided against itself gave him an entry into Greece. These same 10 years saw central Greece immersed in the Sacred War to liberate Delphi from its occupation by the Phocians, enabling Philip to intervene as the ally of Thebes and the Thessalian League of city states. His only great defeat in the field came in Thessaly in 353, owing (it seems) to overconfidence and failure of reconnaissance. The next year he retrieved it with a spectacular victory, which forced the Athenians to occupy Thermopylae and bar his path to the south.

Presidency of the Thessalian League. Characteristically, Philip declined the trial of strength, prepared to wait for six years until he could gain Thermopylae by negotiation and without striking a blow. Meanwhile his Thessalian victory earned him election as president (*archōn*) of the Thessalian League (probably 352), a position unique for a foreigner in a Greek confederation and one that was to bind Thessaly to the kings of Macedonia for 150 years and more.

Philip's capture of Olynthus and annexation of Chalcidice in 348, enslaving the Olynthians and other of the Chalcidians, was disquieting to many. The Greeks themselves occasionally were brutal to small cities, but Olynthus was a large city. Philip's enemies could affect a high moral tone and contempt for a barbarous Macedonian, but even his friends might have wondered whether he ought to be allowed into the heart of Greece with an army. Yet there were many ways in which he could serve them. Particularly, he could finish the Sacred War, which the Thessalians, Thebans, and others still could not finish for themselves. Athens could not prevent this now and had reason to fear that Philip's next campaign in Thrace (346) might challenge its own control of the sea route to southern Russia, its main source for imported corn. Significantly, however, it was Philip, and not Athens, who made the first overtures for peace, though all the military initiatives lay in his own hand. His plans for the future, in Greece and farther afield, included Athens as a willing ally, not as a defeated enemy.

Even before the peace with Athens was ratified (346), the Athenian publicist Isocrates was inviting Philip to reconcile the four leading cities of Greece and to lead a united Greek alliance in a war of expansion against Persia. A step in this direction was Philip's intervention now to end the Sacred War, in recognition of which he was admitted to membership of the Delphic Amphictyony—an association of neighbouring states. The votes of the Thessalians and their clients gave him a control of its council, which could be used on occasion for political and diplomatic ends.

He lost no opportunity in the next years (346–343) of penetrating Greece without war, by winning and buying friends among the politicians of the smaller cities and intervening occasionally with subsidies or a force of mercenaries in their local disturbances. This policy made him some enemies, too, and it played into the hands of the great orator Demosthenes and others at Athens. Demosthenes saw Philip now as a bar to Athenian greatness and a threat to its freedom and existence; he talked tirelessly to warn the Athenians of the danger and to convince the Greeks in general that it was their danger too. Philip in these years conciliated Athens in small ways even under provocation, but he came to see that Demosthenes and the anti-Macedonians were beyond conciliation (343–342). Meanwhile, he reasserted his suzerainty over the neighbouring Illyrians, tightened his grip on Thessaly, and in 342 began the series of campaigns in Thrace that enabled him in two years to annex great parts of it as a province, and finally to demonstrate his power against the Scythians settled on the southern banks of the Danube Delta. The events in Thrace caused two of his Greek allies, the cities of Perinthus (later called Heraclea, present-day Marmaraereğlisi) and Byzantium, to review their position, and his coercion of them led to the two great sieges that showed the development of his artillery and allied arms, of which his son Alexander was to make greater use in Asia.

The declaration of war by Athens in 340 enabled him to raise the two sieges without undue loss of face, though he had failed to establish a threat to the Athenian corn route to southern Russia. Athens was to be intimidated now by invasion of its territory through central Greece, where the key position was held by Thebes, his ally hitherto, but of late a dissatisfied and recalcitrant one. His services to it in the Sacred War had been more than offset by his new position as its successful rival for leadership in and through the Amphictyony, and his moves toward hegemony in Greece could be seen in Thebes as encroachments.

Victory of Chaeronea. When Philip swept south with his army in November 339, he hoped to rush the Thebans into honouring their alliance and letting him through into Attica. The Thebans listened instead to Demosthenes and to their own instinct of self-preservation. The Greek alliance became something formidable with the accession of Thebes, and Philip was forced, as a contemporary orator put it with only a mild exaggeration, "to stake his all on the issue of one short day." Chaeronea was a famous victory, gained by decisive blows of Philip's cavalry. His real skill as a general can be seen, though dimly, in a manoeuvre of controlled retreat aimed at dislocating the advancing Greeks and creating gaps for the cavalry to strike. By winning this battle he had won the war.

In the various peace treaties with the Greek states, Thebes had to admit a Macedonian garrison, and its democratic constitution was replaced by a pro-Macedonian government; but Athens suffered neither invasion of its territory nor interference with its democracy and was not disarmed by dismantling of the walls or surrender of the navy. For Philip, Athens was the one Greek state from which he needed not neutrality or unwilling alliance but active cooperation. All past experience had shown that wars against Persia succeeded only when the Persians were denied the use of the Aegean, and for this the great Athenian navy was the first need.

In Greece (outside Thessaly), Philip could have had no illusions about his own unpopularity, except among those of the well-to-do who were attracted by his court and his patronage; some cities also (especially the neighbours of Sparta) were glad to lean on Macedonia for support against an ancient enemy. Philip intended to involve all the Greeks with the Persian war. So Isocrates had advised him eight years before; but on the details of the ways and means he had no advice to offer. Philip himself organized the Greeks now to keep the peace with him and with each other and to support him in the Persian war overseas. In the constitutional details of his settlement of Greece he may well have had the help of Aristotle, free from his recent duties as tutor of the young Alexander.

The League of Corinth. Philip's so-called League of Corinth, established in 337, was an organization designed to preserve and perpetuate a general peace (*koinē eirēnē*), inaugurated when the delegates of all the states of Greece (except Sparta) and the islands swore to abide by it and to recognize Philip as president (*hēgemōn*) for this purpose. The general peace was a political innovation of the Greeks themselves, used several times in the past 50 years in attempts to stabilize affairs while promoting this or that hegemony. The peace had never lasted long because the leading Greek states had neither the power nor the mutual trust to create an effective organization for collective action against aggressors.

Philip designed a council of representatives from all the states (*synedrion*), which was empowered to deliberate and decide on action to be taken in the event of the peace being broken or threatened. After the decisions were made, their execution lay with Philip as *hēgemōn.* The states were under obligation to supply troops or ships to the *hēgemōn* on demand, by quotas corresponding to their voting power on the council. Though neither Philip nor Macedonia had representatives on the council, it was the knowledge that the *hēgemōn* had the power of Macedonia in his hand that made this organization effective. As it happened, Corinth, where the inaugural meeting was held, was one of only three Greek cities with a Macedonian garrison, a fact the significance of which can have been lost on nobody.

Last years. Philip was wise, no doubt, to build on the foundation of the earlier practice of the Greeks themselves and also to refrain from organizing them in any permanent alliance that would have recalled too much the unpalatable experiences of the past. He was not, however, a Greek politician or even a Greek, but king of the Macedonians; and he cannot possibly have seen the settlement of Greece—as most modern historians have seen it—as the culmination of his life's work. For him it culminated nothing and was not even an end in itself but only a means. Chaeronea had brought the Greeks to order, and his plans required that they should stay in order now. The *synedrion* at Corinth heard his program for a Persian war and duly acclaimed it early in 337. Early the next year an advance force of the Macedonian army crossed to Asia Minor. Philip would lead the grand army into Asia presently, and the Greeks would be with him.

This meteor fizzled out. The subtle, pliant, patient, calculating diplomatist, master of timing in politics and war, ended his life in a tale of irresponsible incompetence. The historian Theopompus, who saw Philip at close quarters, made much of his vices, his love of drink and debauchery, and his wild extravagance with money. Allowance made for this notably faultfinding and puritanical writer, Philip's character did contain some real ambiguities, extending into his domestic life. His "political marriages" were mostly opportune symbols of goodwill toward princes or groups worth conciliating, but his last marriage, in 338, to the Macedonian Cleopatra, led to a final break with Olympias, his queen, who left the country accompanied by the crown prince Alexander. Though Olympias was unpopular at court and though Cleopatra's connections were powerful and important, it was not "politic" to put the succession in jeopardy. Philip showed that he had never intended this result, by taking trouble to be reconciled with Alexander. The tradition that makes him infatuated with Cleopatra is probably right. If so, he misjudged fatally the amount of harm that could be done by marrying her.

With the preparations far advanced for the crossing into Asia, at the grand celebration of his daughter Cleopatra's marriage to Alexander of Epirus (brother of Olympias), Philip was assassinated by Pausanias, a young Macedonian noble with a bitter grievance against the young queen's uncle Attalus and against Philip for denying him justice. This was the official explanation, and Pausanias himself could add nothing to it; he was killed on the spot. Suspicion fell on Olympias and Alexander, those with most to gain from Philip's death, and many modern interpreters have followed it. Aristotle, however, clearly did not believe it. In his *Politics* a few years later he used this incident as an example of a monarch murdered for private and personal motives—which would have been a puerile indiscretion if either he or the world in general had ever taken the canard seriously.

Assessment. So ended, unworthily, the first of the great Macedonians. Everything known about him comes from Greek sources, which concentrate on his impact upon the Greeks and their history. Yet even more impressive, in view of Macedonia's troubled and undistinguished past, would be the full story of his unification and expansion of his own kingdom; his control of its regional princes, nobles, and gentry and their retainers, to form a great Macedonian people, symbolized by the finest army the world had seen; and his continuing attrition by warfare and diplomacy, which in some 20 years reduced much of the Balkan peninsula to subservience.

The apparently untidy record of his campaigns into Illyria or Thrace and of his interventions with diplomacy or arms (or both) in Thessaly, Euboea, and the Peloponnese, which might suggest that repetition is a sign of incompetence, seem better interpreted as the work of a strategist operating always on several fronts, often preferring diplomacy to war, limited objectives to the grandiose, the smaller risks to the greatest; especially never forgetting that there is always another day. His decisive day at Chaeronea came, in a sense, because his true policy in Greece had failed, thanks partly to Demosthenes. But probably to take control of Greece without a Chaeronea was a real impossibility at this date (or indeed later).

Though Philip certainly wanted to be acceptable in Greece and did attract many important Greeks to his court, his philhellenism has been overrated: Olynthus and other Greek cities knew better. Though he cultivated the Athenians for reasons of high policy, there is no evidence that he ever in his life set foot in Athens, a remarkable piece of insouciance at every level. Pella, his capital, had long been a resort or refuge of great men of letters, and under Philip the connection with Plato's Academy was preserved, Theopompus was entertained, and Isocrates was invited; the leading actors of the Athenian stage appeared in Macedonia, too. Aristotle, whose father had been physician to Amyntas, Philip's father, spent three or four important years as Alexander's tutor.

Philip presumably was at home with these people, but tradition says nothing of him as a man of letters himself or as an intellectual, though as an orator he could impress a party of Athenians that included Demosthenes and Aeschines and other professionals. His charm was great; he was by nature convivial, hospitable, and a bon viveur. Undoubtedly he drank too much and too often, with the saving grace that he was known to listen to home truths even when drunk. As a commander in the field he was unwearying, and in action he fought like a lion; in the end he was really disfigured with old wounds. He was a general perhaps not of genius but of a very high order, with the tactical skill to coordinate the cavalry and infantry arms which were largely of his own creating. Making and training over the years a great army, he was paradoxically sparing and even cautious in using it.

If he had survived to invade Asia, it would not have been to overthrow the Persian Empire. He might have established a Macedonian empire in Asia, perhaps, but it would have been a Mediterranean empire in character. The Greeks would have benefitted by colonization, but the problem of Greek freedom would have remained, with the political domination of the higher culture by the lower. Philip was aware of the problem, and the League of Corinth, with its facade of freedom, was his answer. It did not deceive the Greeks or satisfy them; but no later Macedonian king could improve on it. Philip had made Macedonia, and now Macedonia and its kings made world history. (G.T.G.)

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• **Philip V** (b. 238 BC—d. 179, Amphipolis, Macedonia), king of Macedonia from 221 to 179, whose attempt to extend Macedonian influence throughout Greece resulted in his defeat by Rome. His career is significant mainly as an episode in Rome's expansion. The son of Demetrius II and his wife Phthia (Chryseis), the young prince was adopted, after his father's death in 229, by his half-cousin Antigonus Doson, who took the throne. Philip succeeded upon Antigonus' death (summer 221) and soon won renown by supporting the Hellenic League in its war against Sparta, Aetolia, and Elis (220–217). In 215 Philip, allied with Hannibal, the Carthaginian general who was invading Italy (Second Punic War), attacked the Roman client states in Illyria and initiated 10 years of inconclusive warfare against Rome (First Macedonian War). The Romans countered his moves by an alliance with the Greek cities of the Aetolian League, but Philip effectively aided his allies. When the Romans withdrew in 207, he forced an independent settlement upon Aetolia (206) and concluded the war with Rome on favourable terms (Peace of Phoenice, 205).

Philip then turned to the east. He plotted against Rhodes and in 203–202 conspired with Antiochus III of Syria to plunder the possessions of the Egyptian king Ptolemy V. But the people of Rhodes and Pergamum defeated Philip at sea off Chios (201) and so exaggerated reports of his aggression that Rome decided to declare war (Second Macedonian War, 200–196). The Roman campaigns in Macedonia (199) and Thessaly (198) shook Philip's position in Greece, and in 197 the Romans decisively defeated him at Cynoscephalae in Thessaly.

The terms of the peace confined Philip to Macedonia; he had to surrender 1,000 talents indemnity and most of his fleet and deposit hostages, including his younger son, Demetrius, at Rome. Until 189 Philip aided Rome against her enemies on the Greek peninsula. As a reward his tribute was remitted and his son restored (190).

Philip devoted the last decade of his life to consolidating his kingdom. He reorganized finances, transplanted populations, reopened mines, and issued central and local currencies. Neighbouring states constantly and successfully accused him at Rome, however. Becoming convinced that Rome intended to destroy him, he extended his authority into the Balkans in three campaigns (184, 183, 181). In 179, while pursuing a scheme for directing the Bastarnae against the Dardanians, Philip died. He had been a fine soldier and a popular king whose plans for expansion lacked consistent aims and achieved only temporary success. F.W. Walbank's *Philip V of Macedonia* (1940) is the standard biography.

Navarre

• **Philip I–II:** *see* Philip IV–V (France).

Papacy

• **Philip** (fl. 8th century, Italy), antipope in July 768. Temporal rulers coveted the papal throne following the death (767) of Pope St. Paul I, and Toto, duke of Nepi, had his brother Constantine II, a layman, elected pope. The Lombard king Desiderius then sent troops to Rome, killing Toto and deposing Constantine. Backed by some Romans, the Lombards, in 768, secretly set Philip up as pope. Philip had been a monk in the monastery of St. Vito. He was ejected, however, and Stephen III (IV) was elected pope on Aug. 1, 768, at which time Philip retired to his monastery.

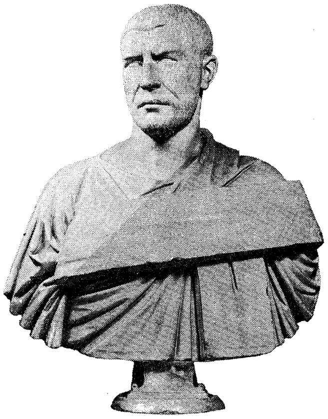
Portugal

• **Philip I–III:** *see* Philip II–IV (Spain).

Roman Empire

• **Philip,** byname PHILIP THE ARABIAN, Latin in full MARCUS JULIUS PHILIPPUS (d. 249), Roman emperor from 244 to 249.

A member of a distinguished equestrian family of Arab descent, he was praetorian prefect



Philip, marble bust in the Vatican Museum
The Mansell Collection

when the emperor Gordian III was killed in a mutiny (perhaps with Philip's connivance). Philip became emperor and quickly concluded a peace ending a war with Persia. After undertaking a series of campaigns against the Goths and other tribes on the Danube, he returned to Rome to celebrate in 248 the 1,000th anniversary of the founding of the city. Philip then faced a series of revolts by provincial army commanders, the last of whom, Decius, killed and succeeded him in the autumn of 249.

Christian writers of the 4th century and later regarded Philip as the first Christian emperor; whether he was or not is unclear, but it is certain he did not adopt Christianity openly.

Spain

• **Philip I,** byname PHILIP THE HANDSOME, Spanish FELIPE EL HERMOSO (b. July 22, 1478, Bruges—d. Sept. 25, 1506, Burgos, Spain), king of Castile for less than a month before his death and the founder of the Habsburg dynasty in Spain.

Philip was the son of the future Holy Roman emperor Maximilian I of Habsburg and Mary of Burgundy. At his mother's death (1482) he succeeded to her Netherlands dominions, with Maximilian acting as regent for him during his minority. When Philip became of age, his interest in the Netherlands was soon subordinated to his hopes for the Spanish succession. In 1496 Philip was married to Joan the Mad, daughter of Ferdinand II the Catholic of Aragon and Isabella I the Catholic of Castile; Joan later inherited the crown of Castile. From January 1502 to March 1503 Philip and Joan lived in Spain and received homage as prospective heirs to the kingdoms of Aragon and Castile. Isabella died in 1504, leaving the crown of Castile to Joan. Philip was recognized as king consort. Because Joan was in the Netherlands at the time, Ferdinand, in accordance with Isabella's will, acted as regent.

Philip soon began to oppose his father-in-law, who was unwilling to give up his control of Castile, and in early 1506 sailed to Spain to claim his wife's inheritance. On his voyage his ships had to take shelter in England, where King Henry VII forced him to agree to two treaties, the first of which secured English support for Philip's Castilian rights. The second (April 30, 1506), the *Intercursus Malus*, was a trade agreement disadvantageous to the Netherlands. In Castile, Philip, backed by the nobility, soon raised a strong army. He negotiated Ferdinand's withdrawal on June 27, 1506. By that time Joan's mental condition had deteriorated further, and Philip assumed sole control. He was in the process of organizing his administration when he was stricken with a fever and died. His son Charles I of Spain (the Holy Roman emperor Charles V) became king of Aragon and Castile on Ferdinand's death in 1516, thus firmly establishing the dynasty that was to govern Spain for nearly two centuries.

• **Philip II** (b. May 21, 1527, Valladolid, Spain—d. Sept. 13, 1598, El Escorial, Spain), king of Spain (1556–98) and king of Portugal (as Philip I, 1580–98), champion of the Roman Catholic Counter-Reformation. During his reign the Spanish Empire attained its greatest power, extent, and influence, though he failed to suppress the revolt of the Netherlands (beginning in 1566) and lost the "Invincible Armada" in the attempted invasion of England (1588).

Early life and marriages. Philip was the son of the Holy Roman emperor Charles V and Isabella of Portugal. From time to time, the Emperor wrote Philip secret memoranda, impressing on him the high duties to which God had called him and warning him against trusting any of his advisers too much. Philip, a very dutiful son, took this advice to heart. From 1543 Charles conferred on his son the regency of Spain whenever he himself was abroad. From 1548 until 1551, Philip travelled in Italy, Germany, and the Netherlands, but his great reserve and his inability to speak fluently any language except Castilian made him unpopular with the German and Flemish nobility.

Philip contracted four marriages. The first was with his cousin Maria of Portugal in 1543. She died in 1545, giving birth to the ill-fated Don Carlos. In 1554 Philip married Mary I of England and became joint sovereign of England until Mary's death, without issue, in 1558. Philip's third marriage, with Elizabeth of Valois, daughter of Henry II of France, in 1559, was the result of the Peace of Cateau-Cambrésis (1559), which, for a generation, ended the open wars between Spain and France. Elizabeth bore Philip two daughters, Isabella Clara Eugenia (1566–1633) and Catherine Micaela (1567–97). Elizabeth died in 1568, and in 1570 Philip married Anna of Austria, daughter of his first cousin the emperor Maximilian II. She died in 1580, her only surviving son being the later Philip III.

King of Spain. Philip had received the Duchy of Milan from Charles V in 1540 and the kingdoms of Naples and Sicily in 1554 on the occasion of his marriage to Mary of England. On Oct. 25, 1555, Charles resigned the Netherlands in Philip's favour and, on Jan. 16, 1556, the kingdoms of Spain and the Spanish overseas empire. Shortly afterward Philip also received the Franche-Comté. The Habsburg dominions in Germany and the imperial title went to his uncle Ferdinand I. At this time Philip was in the Netherlands. After the victory over the French at St. Quentin (1557), the sight of the battlefield gave him a permanent distaste for war, though he did not shrink from it when he judged it necessary.

Philip II, detail of an oil painting by Titian; in the Corsini Gallery, Rome
Alinari—Art Resource/EB Inc.

After his return to Spain from the Netherlands in 1559 Philip never again left the Iberian Peninsula. From Madrid he ruled his empire through his personal control of official appointments and all forms of patronage. Philip's subjects outside Castile, thus, never saw him, and they gradually turned not only against his ministers but also against him. This happened particularly in the Netherlands, in Granada, and in Aragon.

Method of government. By sheer hard work Philip tried to overcome the defects of this system. His methods have become famous. All work was done on paper, on the basis of *consultas* (that is, memoranda, reports, and advice presented him by his ministers). In Madrid, or in the gloomy magnificence of his monastic palace of El Escorial, which he built (1563–84) on the slopes of the Sierra de Guadarrama, the King worked alone in his small office, giving his decisions or, as often, deferring them. Nothing is known of his order of work, but all his contemporaries agreed that his methods dangerously, and sometimes fatally, slowed down a system of government already notorious for its dilatoriness. Painstaking and conscientious, Philip's craving for ever more information hid an inability to distinguish between the important and the trivial and a temperamental unwillingness to make decisions.

This was coupled with an almost pathological suspicion of even his most able and faithful servants. Margaret of Austria, duchess of Parma; the Duke of Alba; Don John of Austria; Antonio Pérez; and Alessandro Farnese—to name only the most distinguished—suffered disgrace. "His smile and his dagger were very close," wrote his official court historian, Cabrera de Córdoba. It was no exaggeration, for, in the case of Juan de Escobedo, the secretary of Don John of Austria, Philip even consented to murder. As a result, Philip's court became notorious for the bitterness of its faction fights. The atmosphere of the Spanish court did much to poison the whole Spanish system of government, and this played no small part in causing the rebellions of the Netherlanders (1568–1609), of the Moriscos of Granada (1568–70), and of the Aragonese (1591–92).

Yet the "black legend" that, in Protestant countries, represented Philip II as a monster of bigotry, ambition, lust, and cruelty is certainly false. Philip's spare and elegant appearance is known from the famous portraits by Titian and by Anthonis Mor (Sir Anthony More). He was a lover of books and pictures, and Spain's literary Golden Age began in his reign. An affectionate father to his daughters, he lived an austere and dedicated life. "You may assure His Holiness," Philip wrote to his ambassador in Rome, in 1566, "that rather than suffer the least damage to religion and the service of God, I would lose all my states and an hundred lives, if I had them; for I do not propose nor desire to be the ruler of heretics." This remark may be regarded as the motto of his reign. To accomplish the task set him by God of preserving his subjects in the true Catholic religion, Philip felt in duty bound to use his royal powers, if need be, to the point of the most ruthless political tyranny, as he did in the Netherlands. Even the popes found it sometimes difficult to distinguish between Philip's views as to what was the service of God and what the service of the Spanish monarchy.

Foreign policy. For the first 20 years of his reign, Philip sought to preserve peace with his neighbours in western Europe. He was fighting a major naval war with the Ottoman Empire in the Mediterranean and, from 1568, he was faced with rebellion and war in the Netherlands. From the late 1570s, his policy gradually changed. The death (August 1578) without heirs of his nephew, King Sebastian of Portugal, opened up the prospect of Philip's succession to Portugal. He had to conquer (1580) by force what he regarded as his just, hereditary rights, but the rest of Europe was alarmed at this growth in Spanish power.

Both England and France gave increasing support to the rebellious provinces of the Netherlands. Gradually, in the 1580s, Philip became convinced that the Catholic religion in western Europe, and his own authority in the Netherlands, could be saved only by open intervention against England and France. To this end he fitted out the Armada that, with the help of the Spanish Army in the Netherlands, was intended to conquer England (1588). He sent money and troops to support the League, the ultra-Catholic party in France, against Henry of Navarre and the Huguenots. He even claimed the throne of France for his daughter, Isabella Clara Eugenia, after the murder of Henry III in 1589. Again, even his Catholic allies found it difficult to distinguish between Philip's championship of the Catholic Church and the interests of Spain.

All these plans failed. Henry of Navarre became a Catholic (1593) and Philip had to accept (Peace of Vervins, 1598) his succession as Henry IV of France. England and the northern Netherlands remained Protestant and unconquered. Yet Philip's reign as a whole was not a failure. He had defeated the great Ottoman offensive in the Mediterranean at the Battle of Lepanto (1571). In the Iberian Peninsula he had completed the work of unification begun by the "Catholic Kings," Ferdinand and Isabella. Most important of all, in his own eyes, he had won great victories for the Catholic Church. If England, Scotland, and the northern Netherlands were lost, the southern Netherlands (modern Belgium) had been preserved. In Spain and Italy he had prevented the spread of heresy, and his intervention in France was one of the factors that forced Henry IV to become a Catholic.

When Philip II died of cancer at El Escorial in 1598, Spain was still at the height of its power; it took almost 50 years before it was clear that the Counter-Reformation would make no further major conquests.

(H.G.K.)

BIBLIOGRAPHY. The fullest account of Philip II's life was written in the early 17th century by his official court historian, L. Cabrera de Córdoba, *Felipe Segundo, rey de España,* 4 vol. (1876–77). Cabrera was very well informed, especially about life and personalities at Philip's court. His work has proved indispensable to all later biographers. The best full-scale modern political biography is R.B. Merriman, *The Rise of the Spanish Empire in the Old World and the New,* vol. 4 (1934). G. Mattingly, *The Defeat of the Spanish Armada* (1959), is distinguished both by its impeccable scholarship and by the brilliance of its writing. An attempt to assess Philip II's aims and methods in the light of modern research is an article by H.G. Koenigsberger, "The Statecraft of Philip II," in *European Studies Review,* 1:1–21 (1971).

•**Philip III** (b. April 14, 1578, Madrid—d. March 31, 1621, Madrid), king of Spain and of Portugal (as Philip II) whose reign (1598–1621) was characterized by a successful peaceful foreign policy in western Europe and internally by the expulsion of the Moriscos (Christians of Moorish ancestry) and government by the King's favourites.

Philip III, detail of a portrait by Diego Velázquez; in the Prado, Madrid
By courtesy of the Museo del Prado, Madrid

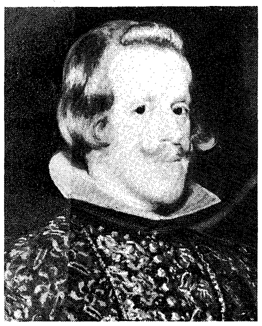
Philip was the son of Philip II of Spain by his fourth consort, his Habsburg cousin Anna of Austria. Though pious, benevolent, and highly virtuous in private conduct, Philip, after he became king (Sept. 13, 1598), showed himself to be indolent and indifferent to his responsibilities. His father revealed his disappointment when he remarked that his son was unfit to govern the kingdoms God had given him and would instead be governed by them. In April 1599 the new king married his Habsburg cousin the Austrian archduchess Margaret.

From the beginning, Philip placed affairs entirely in the hands of a favourite, Francisco Gómez de Sandoval y Rojas, marqués de Denia, later the duke of Lerma—the first in a line of royal favourites who governed 17th-century Spain. Philip's government continued a policy of hostility to the Turks, and in Italy it faced the rivalry of the Republic of Venice and the Duchy of Savoy. In the rest of western Europe, however, a Spanish policy of conciliation ruled. Peace in the West enabled the government to deal with the internal problem of the Moriscos; and on April 9, 1609, the decision was made for their expulsion, which caused serious economic and demographic difficulties in certain areas. The peace was brought to an end by the outbreak (1618) of the Thirty Years' War, in which Philip gave his unconditional support to the Holy Roman emperor Ferdinand II and the Catholic German princes.

Remote from his subjects, Philip spent huge sums on court entertainments and neglected Spain's growing economic problems, which were to reach crisis proportions in the following reign. Having resided in Valladolid in the first years of his reign, he eventually fixed his court in Madrid. After a visit to Portugal (1619), he suffered the first attack of an illness that two years later brought about his death.

• **Philip IV** (b. April 8, 1605, Valladolid, Spain—d. Sept. 17, 1665, Madrid), king of Spain (1621–65) and of Portugal (1621–40), during the decline of Spain as a great world power.

He succeeded his father, Philip III of Spain, in 1621, and, for the first 22 years of his



Philip IV, detail of a portrait by Diego Velázquez; in the National Gallery, London

By courtesy of the National Gallery, London

reign, Philip's *valido*, or chief minister, was the Conde-Duque de Olivares, who took the spread of the Thirty Years' War as an opportunity not only for resuming hostilities against the Dutch at the end of the Twelve Years' Truce of 1609 (1621) but also for an ambitious attempt to restore Spanish hegemony in Europe, in close alliance with the imperial branch of the Habsburg dynasty. The Spanish armies won some conspicuous victories—for instance, the capture of Breda from the Dutch (1626) and the defeat of the Swedes and Weimarians at Nördlingen (1634)—but France declared open war in 1635, and Spain's early successes were offset, from 1640, by the separatist rebellions of Catalonia and of Portugal (Portugal becoming independent in 1640 under John IV of the House of Bragança).

Philip dismissed Olivares in 1643 and replaced him with Don Luis Méndez de Haro, who remained in office until his death in 1661. Thereafter the King had no *valido*, but frequently relied on the advice of a nun and mystic, María de Ágreda, who corresponded with him on both spiritual matters and affairs of state. By the end of his reign Spain, weakened by military reverses and economic and social distress, had become a second-class power.

Philip's first wife was Elizabeth (Spanish, Isabel), daughter of Henry IV of France; after her death in 1644, he married Maria Anna (Mariana), daughter of the Holy Roman emperor Ferdinand III. A poet and patron of the arts, Philip was the friend and patron of the painter Velázquez, many of whose works portray Philip and members of his court.

• **Philip V**, also called (until 1700) PHILIPPE, DUC (duke) D'ANJOU (b. Dec. 19, 1683, Versailles, Fr.—d. July 9, 1746, Madrid), king of Spain from 1700 (except for a brief period from January to August 1724) and founder of the Bourbon dynasty in Spain. During his reign Spain regained much of its former influence in international affairs.

Philip was a son of the dauphin Louis (son of Louis XIV of France) and of Marie Anne, daughter of Ferdinand, elector of Bavaria. Philip's whole career was influenced by the fact that he was a grandson of Louis XIV of France and a great grandson of Philip IV, king of Spain. Philip held the title of duc d'Anjou until 1700, when he emerged as a person of political importance. In that year Charles II, the last Habsburg king of Spain, who died without issue, left Philip all his possessions (Spain, Spanish America, the Spanish Netherlands, and parts of Italy). The refusal of Louis XIV to exclude Philip from the line of succession to the French throne resulted in the War of the Spanish Succession. The Treaty of Utrecht, signed in 1713, deprived Philip of the Spanish Netherlands and of the Italian possessions of the Spanish Habsburgs, but left him the throne of Spain and Spanish America.

During the first 13 years of Philip's reign France had a dominant influence on the Spanish court, and the French ambassador had a place on the inmost council of state. After the death of his first wife (María Luisa of Savoy) in 1714, Philip came under the influence of his second wife, Princess Isabella Farnese, who was the niece and stepdaughter of the duke of Parma. Because of Isabella's desire to secure territories in Italy for her sons, Spain became embroiled in conflict with Austria, Great Britain, France, and the United Provinces but managed to secure the succession of Philip and Isabella's oldest son, Don Carlos (later Charles III of Spain), to the duchy of Parma. Philip abdicated from the Spanish throne in January 1724 in favour of his oldest son, Luis, but was persuaded to become king again after Luis died of smallpox in August 1724. Philip's reign is noted primarily for the governmental and economic reforms instituted by his French and Italian advisers.

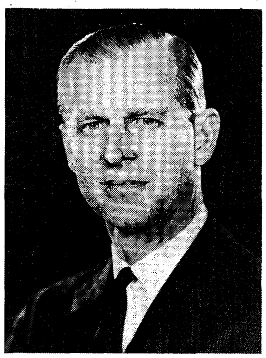
Philip V, detail of a portrait by Louis-Michel Van Loo; in the Prado, Madrid

By courtesy of the Museo del Prado, Madrid

Philip had few intimate friends; his chief interests were religion, hunting, and music. During the last years of his reign he often lapsed into periods of insanity, and his wife largely controlled public affairs.

Philip, DUKE OF EDINBURGH, in full PRINCE PHILIP, DUKE OF EDINBURGH, EARL OF MERIONETH AND BARON GREENWICH, also called PHILIP MOUNTBATTEN, original name PHILIP, PRINCE OF GREECE AND DENMARK (b. June 10, 1921, Corfu, Greece), husband of Queen Elizabeth II of the United Kingdom.

Philip's father was Prince Andrew of Greece and Denmark (1882–1944), a younger son of King George I of the Hellenes (originally Prince William of Denmark). His mother was Princess Alice (1885–1969), who was the eldest daughter of Louis Alexander Mountbatten, 1st marquess of Milford Haven, and Princess Victoria of Hesse and by Rhine, granddaughter of Queen Victoria. Reared chiefly in Great Britain, Philip was educated at Gordonstoun School, near Elgin, Moray, and at the Royal Naval College, Dartmouth.



Prince Philip, 1962

Camera Press

From January 1940 to the end of World War II, he served with the Royal Navy in combat in the Mediterranean and the Pacific.

On Feb. 28, 1947, Philip became a British subject, renouncing his right to the Greek and Danish thrones and taking his mother's surname, Mountbatten. (His father's family name had been Schleswig-Holstein-Sonderburg-Glücksburg.) His marriage to his distant cousin Princess Elizabeth took place in Westminster Abbey on Nov. 20, 1947. On the eve of his wedding he was designated a royal highness and was created a Knight of the Garter, Baron Greenwich, earl of Merioneth, and duke of Edinburgh. He continued on active service with the Royal Navy, commanding the frigate "Magpie," until Elizabeth's accession on Feb. 6, 1952, from which time he shared her official and public life.

In 1957 she conferred on him the dignity of prince of the United Kingdom, and in 1960 his surname was legally combined with the name of her family as Mountbatten-Windsor as a surname for lesser branches of the royal family.

Philip AUGUSTUS: *see* Philip II *under* Philip (France).

Philip NERI, SAINT: *see* Neri, Saint Philip.

Philip OF MACEDON: *see* Philip II *under* Philip (Macedonia).

Philip OF POKANOKET also called KING PHILIP (Wampanoag Indian chief): *see* Metacom.

Philip OF ROUVRES: *see* Philip I *under* Philip (Burgundy).

Philip OF SWABIA: *see* Philip *under* Philip (Germany/Holy Roman Empire).

Philip OF VALOIS: *see* Philip VI *under* Philip (France).

Philip THE APOSTLE, SAINT (b. Bethsaida of Galilee—d. traditionally Hierapolis; fl. 1st century; Western feast day May 1, Eastern feast day November 14), one of the Twelve Apostles. Mentioned only by name in the Apostle lists of the Synoptic Gospels, he is a frequent character in the Gospel According to John, according to which (1:43–51) he came from Bethsaida, answered Jesus' call ("Follow me"), and was instrumental in the call of St. Nathanael (probably St. Bartholomew the Apostle), whom he brought to Jesus.

At the time of his call, Philip seemingly belonged to a group influenced by St. John the Baptist. He participated in the miracle of the loaves and fishes (John 6:5–9), accounting for his symbol in medieval art of loaves. With St. Andrew the Apostle, he brought word to Jesus that certain Greeks had asked to see him (John 12:21–22). In John 14:8–9, Philip asked Jesus to reveal the Father, receiving the answer, "Have I been with you so long, and yet you do not know me, Philip? He who has seen me has seen the Father."

Nothing more is known about him from the New Testament. In later legends he was often confused with St. Philip the Evangelist (Philip the Deacon), one of the seven deacons of the early church (Acts 6:5). His apostolate was supposedly in the territory of Scythia, an ancient Eurasian area. He died of natural causes according to one tradition but, according to another, of crucifixion, accounting for his other medieval symbol of a tall cross. The *Acts of Philip* are apocryphal and probably date from the 3rd/4th century.

Philip THE ARABIAN: *see* Philip *under* Philip (Roman Empire).

Philip THE BOLD: *see* Philip II *under* Philip (Burgundy); Philip III *under* Philip (France).

Philip THE EVANGELIST, SAINT, also called PHILIP THE DEACON (b. Caesarea? Palestine [now in Israel]; fl. 1st century; feast day June 6), in the early Christian church, one of the seven deacons appointed to tend the Christians of Jerusalem, thereby enabling the Apostles to freely conduct their missions. His energetic preaching, however, earned him the title of Philip the Evangelist and led him to minister successfully in Samaria, in Palestine, where he converted, among others, the famous magician Simon Magus (Acts 8:9–13). Later, on the road from Jerusalem to Gaza, he instructed and baptized a court official from Ethiopia.

Philip's missionary journey ended at Caesarea (Acts 8), where he raised his four daughters, reputed to be prophets, and where, about AD 58, he entertained the Apostle St. Paul and his companions on their last journey to Jerusalem (Acts 21:8). According to Greek tradition, he became bishop of Tralles (modern Aydin, Tur.).

Philip THE FAIR: *see* Philip IV *under* Philip (France).

Philip THE GOOD: *see* Philip III *under* Philip (Burgundy).

Philip THE HANDSOME: *see* Philip I *under* Philip (Spain).

Philip THE MAGNANIMOUS: *see* Philip *under* Philip (Germany/Holy Roman Empire).

Philip THE TALL: *see* Philip V *under* Philip (France).

Philip, John (b. April 14, 1775, Kirkcaldy, Fife, Scot.—d. Aug. 27, 1851, Hankey, Cape Colony [now in South Africa]), controversial Scottish missionary in South Africa who championed the rights of the Africans against the European settlers.

In 1818, at the invitation of the London Missionary Society, Philip left his congregation in Aberdeen, where he had served since 1804, to investigate the conditions at mission stations in South Africa. His findings led to a condemnation of the colonists for their harsh treatment of the Hottentots. Subsequently appointed the first superintendent for the missions of the society, Philip devoted the rest of his life to promoting the cause of the Africans. He was unpopular among the settlers and ignored by local authorities, but he aroused philanthropic sentiment in Britain with his lecture tour in 1826 and his *Researches in South Africa* (1828). Supported by influential friends, Philip secured the enactment by the British government of an ordinance bestowing equal rights for all the native peoples in South Africa in 1828. Philip hoped to create a series of native states to the north and east of Cape Colony, but in the end colonial expansion prevailed.

To Philip's admirers, he was a high-minded, far-sighted humanitarian who did much to promote the welfare of the Africans. His many white detractors in South Africa saw him as an arbitrary mischief-maker who used false evidence and political intrigue to gain his ends.

Philip Morris Companies Inc., American holding company founded in 1985, the owner of several major American companies, notably Philip Morris Inc., the General Foods Corporation, and Kraft, Inc., with diversified interests in food products. Headquarters are in New York City.

The ancestor of the present company was incorporated in 1919 as Philip Morris & Company, Ltd. Inc., acquiring the assets of a New York corporation of the same name. Throughout the 1930s, '40s, and '50s it expanded its interests in tobacco processing and marketing and became a principal maker of cigarettes. Although Philip Morris' namesake cigarette brand has been eclipsed by later brands, the company continues to receive more than three-fifths of its revenues from the sale of tobacco products. Major cigarette brands sold in the United States and abroad include Marlboro, Benson and Hedges, Parliament, Virginia Slims, and Merit. Cigarettes are sold throughout the world through distributors, retailers, and vending-machine chains.

Philip Morris obtained controlling interest in the Miller Brewing Company in 1969. In 1978 Philip Morris acquired the international cigarette business of the Liggett Group Inc. (formerly Liggett & Myers) and the Seven-Up Company, a soft-drink maker; unable to expand its soft-drink market, it sold Seven-Up in 1986. In order to reduce its dependence on the faltering tobacco market, in 1985 the company bought the General Foods Corporation (*q.v.*), carrier of such well-known food products as Maxwell House coffee and Birds Eye frozen dinners. In 1988 Philip Morris acquired Kraft, Inc. (*q.v.*), a large maker of cheeses and grocery products. Philip Morris thus became one of the world's largest corporate producers of consumer goods. Other corporate properties include Philip Morris Industrial, which manufactures adhesives and other specialty chemical products.

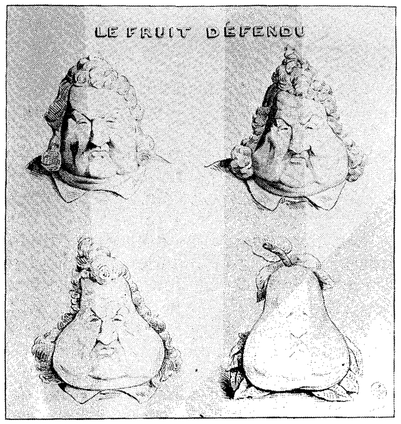
Philipe, Gérard (b. Dec. 4, 1922, Cannes, Fr.—d. Nov. 25, 1959, Paris), one of France's most popular and versatile actors, whose brilliant performances on both stage and screen established his international reputation.

Philipe attended Conservatory of Dramatic Art in Paris and made his debut in Nice at the age of 19. Consequently, he was invited to Paris, where he played Angel in *Sodome et Gomorrhe* (1943), a performance that made him an overnight star. His stage notoriety led to film offers, and within five years his screen appearances created an international furor. Two of his earliest film roles—as the obsessed prince in *L'Idiot* (1946; adapted from Fyodor Dostoyevsky's novel) and as the soulful 17-year-old tragically in love with an older woman in Claude Autant-Lara's *Le Diable au corps* (1946; *Devil in the Flesh*)—fixed the dual image that came to be associated with Philipe throughout his career. In the former role, his portrayal of the tormented hero revealed his intelligence and innovative talent; in the latter, his good looks and latent sensuality attracted a following that saw him as a "pin-up." Other films, which brought him into contact with such great directors of the period as René Claire, Max Ophüls, and Luis Buñuel, include *La Beauté du diable* (1949; *Beauty and the Devil*), *La Ronde* (1950), *Fanfan la tulipe* (1951), *Les Belles de nuit* (1952; *Night Beauties*), and *Grandes Manoeuvres* (1955; *Summer Manoeuvres*).

Film stardom did not diminish Philipe's enthusiasm for the stage. In 1951 he joined the Théâtre National Populaire to portray *Le Cid* and continued to work there until his death. He created particularly memorable roles in *Caligula* (1945; by Albert Camus), *Prinz Friedrich von Homburg* (1951), *Lorenzaccio* (1952; by Alfred de Musset), *Ruy Blas* (1954), and *Richard II* (1954). He also appeared in the first French production of Bertolt Brecht's *Mother Courage and Her Children* (1951). With the company of the Théâtre he toured onstage in the Soviet Union, the United States, and Canada. He was president of the French actors' union at the time of his death.

Philipon, Charles (b. April 19, 1806, Lyon, Fr.—d. Jan. 25, 1862, Paris), French caricaturist, lithographer, and liberal journalist who made caricatures a regular journalistic feature.

Philipon settled in Paris in 1823, took to lithography, and began to draw caricatures for a living. He was an excellent draftsman with a fertile and irrepressible sense of satire.



"La Poire," caricature of Louis-Philippe by Charles Philipon, about 1830–35; in the Musée Carnavalet, Paris

Giraudon—Art Resource/EB Inc.

Moreover, he had vigorous political opinions, an enterprising spirit, and boundless energy. In 1830 he published a journal of political satire, *La Caricature.* The career of the journal was brief and turbulent; after an avalanche of legal actions, it was suppressed in 1835. Meanwhile, in 1832, Philipon had produced a daily paper (with a new caricature every day) called *Le Charivari.* Ten years later *Le Charivari* was to become godfather to *Punch,* subtitled *The London Charivari.* In 1838 *La Caricature* made a cautious and short-lived reappearance under the title of *La Caricature Provisoire.* His next publication of importance, *Le Journal pour Rire* ("The Journal for Laughing"; later *Le Journal Amusant*), appeared in 1848 in the form of large newspaper sheets filled with woodcuts. Besides these journals, Philipon issued many occasional publications, such as *Le Musée Philipon, Les Robert Macaires, Les Physiologies,* and numerous political brochures.

As an artist, his best-known invention was a drawing that depicted the gradual transformation of Louis-Philippe into the shape of a pear. *La Poire* became the common symbol of the king, and all Philipon's artists used it in their caricatures. They were a notable group: he was able to attract and inspire the best talents in France. Honoré Daumier and Gustave Doré were the most famous, but there were also Paul Gavarni, Grandville (J.-I.-I. Gérard), Henri Monnier, and Auguste Raffet. His effect on caricature in France was considerable and decisive, as was his influence on the development of lithography as an artistic and commercial medium.

Philipp (German personal name): *see under* Philip.

Philipp, Isidor (b. Sept. 2, 1863, Budapest—d. Feb. 20, 1958, Paris), French pianist who had a long, highly successful tenure at the Paris Conservatoire.

He was brought to Paris as an infant. As a piano student of Georges Mathias at the Conservatoire, he won the first prize in 1883. After study with Saint-Saëns and Stephen Heller, he began a brief solo concert career, making his London debut in 1890. From 1893 to 1934 he was professor of piano at the Conservatoire, where he taught many notable students, including Albert Schweitzer. He lived in America from 1941 to 1955, teaching privately, mainly in New York. At the age of 91 he played the demanding piano part of the Franck violin sonata at his farewell concert. His influence was mainly as a teacher, and he published several books of technical exercises for the piano.

Philippa OF HAINAUT (b. *c.* 1314—d. Aug. 15, 1369, Windsor, Berkshire, Eng.), queen consort of King Edward III of England (ruled 1327–77); her popularity helped Edward maintain peace in England during his long reign.

Philippa's father was William the Good, count of Hainaut (in modern Belgium) and Holland, and her mother, Jeanne de Valois, was the granddaughter of King Philip III of France. She was married to Edward in October 1327, nine months after he ascended the throne. Accompanying him on his expeditions to Scotland (1333) and Flanders (1338–40), she won universal respect for her gentleness and compassion. In 1347 she interceded and saved the lives of six burghers of Calais, Fr., whom Edward had threatened to execute. Unlike earlier foreign queens of England, she did not alienate the English barons by bringing large numbers of her countrymen to the royal court.

She was patron to the Hainauter chronicler Jean Froissart, who served as her secretary from 1361 until her death. Queen's College, Oxford University, was founded by her chaplain and named after her. Philippa bore Edward five daughters and seven sons; five of their sons were prominent in 14th-century politics.

Philippe (French personal name): *see under* Philip, except as below.

Philippe ÉGALITÉ: *see* Orléans, Louis-Philippe-Joseph, duc d'.

Philippe, Charles-Louis (b. Aug. 4, 1874, Cérilly, Fr.—d. Dec. 21, 1909, Paris), writer of novels that describe from personal experience the sufferings of the poor.

Philippe was the son of a shoemaker; he was ambitious to become an army officer but was

Charles-Louis Philippe
Harlingue—H. Roger-Viollet

refused entry to the École Polytechnique in 1894 because of his slight physique. He finally found employment in the Paris municipal service as a shop inspector.

His novels either describe the Paris poor or are set in his native province of Bourbonnais. Of the first group, the most notable is *Bubu de Montparnasse* (1901; Eng. trans., 1952), which tells the story of a young prostitute's relationship with her procurer and with a young intellectual who tries to save her. The novels of rural poverty include *La Mère et l'enfant* (1900), in which the author tenderly recalls his own childhood; *Le Père perdrix* (1902; title page 1903), the story of an old blacksmith, reduced by illness to indigence, and of a young engineer who loses his job because of his independent outlook; and the unfinished *Charles Blanchard* (1913), an evocation of the unhappy childhood of the author's father. Philippe's novels are distinguished by pity for the social outcast and by his power to depict the misery of poverty.

Philippeville (Algeria): *see* Skikda.

Philippi, modern FÍLIPPOI, hill town in the department (*nomós*) of Kavála, Greece, overlooking the coastal plain and the bay at Neapolis (Kavála). Philip II of Macedon fortified this old Thasian settlement in 356 BC to control neighbouring gold mines.

In 42 BC Philippi was the site of the decisive Roman battle in which Mark Antony and Octavian (later the emperor Augustus) defeated Brutus and Cassius, the leading assassins of Julius Caesar. Brutus and Cassius, whose forces roughly equalled those of their opponents, lay astride the Via Egnatia to the west of Philippi, their position being partly protected by a marsh. Antony made a successful attack on the camp of Cassius, who, not knowing that Brutus' forces had successfully assailed Octavian's camp, committed suicide. About three weeks later, on October 23, Brutus, against his better judgment, fought a second action in which he was routed; despairing of restoring the republican cause, he too took his own life. After the battle a colony for Roman veterans was started at Philippi, and this was later reinforced by Augustus.

The Letter of Paul to the Philippians was addressed to Christian converts in Philippi whom he had visited in his second and third missionary journeys. Many ruins, especially of the imperial epoch, are spread over the site. Pop. (1981) 728.

Philippi, city, seat (1843) of Barbour County, northeastern West Virginia, U.S., on the Tygart Valley River, 13 mi (21 km) south of Grafton. Settled in 1780, it was early called Anglin's Ford and Booths Ferry until it was chartered in 1844 and named for Philip Pendleton Barbour, associate justice (1836–41) of the U.S. Supreme Court. It is known primarily as the site of an important early Civil War battle, fought June 3, 1861, and locally called the "Philippi Races" because of the speed of the retreat of the Confederate forces under Col. George A. Porterfield when routed by the Federal forces under Col. B.F. Kelley. A marker at the site on Broaddus Hill, now the campus of Alderson-Broaddus College (1871; Baptist), describes it as the "First Land Battle between North and South." A covered bridge, spanning the Tygart and used by both sides during the battle, was reinforced in 1937 and is believed to be the nation's only covered two-lane bridge in current use. Tygart Lake State Park is just to the north. Coal mines, gas and oil wells, timber, and mixed farming are the economic mainstays. Inc. city, 1905. Pop. (1980) 3,194.

Philippians, Letter of Paul to the, New Testament letter written by Paul the Apostle, while he was in prison (probably at Rome about AD 62), and addressed to the Christian congregation he had established in Macedonia. Apprehensive that his execution was close at hand, yet hoping somehow to visit the Philippians again, Paul explains that he was imprisoned for preaching the gospel of Christ. Though he welcomes death for Jesus' sake, he is equally concerned to continue his apostolate. Paul exhorts his readers to remain steadfast in their faith and to imitate the humility of Christ, who "emptied himself" and "became obedient unto death, even death on a cross" (2:7–8). Exegetes generally believe that this much-quoted passage was taken from an early Christian hymn. Paul further urges the Philippians to work out their "own salvation with fear and trembling" (2:12), words often cited by theologians in discussing the role of free will in gaining personal salvation.

Philippicus Bardanes, original name VARDAN (b. Armenia—d. after 713), Byzantine emperor whose brief reign (711–713) was marked by his quarrels with the papacy and his ineffectiveness in defending the empire from Bulgar and Arab invaders.

Philippicus was the son of the patrician Nicephorus of Pergamum (modern Bergama, western Turkey). His original name, Vardan, may have been derived from that of his mother. Emperor Tiberius III Apsimar (ruled 698–705) exiled Vardan to the Ionian island of Cephalonia for his pretensions to the throne, but in 711, Tiberius' rival, Justinian II, recalled him and sent him to Cherson (in the Crimea) to suppress a revolt. Instead, he made common cause with Cherson and was proclaimed emperor under the Greek name of Philippicus. He sailed to Constantinople, gained the throne, and had Justinian and his family killed.

Philippicus was an advocate of the Monothelite heresy, the belief in a single will of Christ. Even before entering Constantinople, he had ordered the picture of the Third Council of Constantinople (which had condemned Monothelitism in 680) to be removed from the palace and the names of those the council had condemned restored. Patriarch Cyrus refused to support the new policy and was deposed and replaced by the more compliant deacon John early in 712. Pope Constantine therefore refused to recognize the new emperor.

In foreign policy, Philippicus' reign was disastrous. The Bulgarians besieged Constantinople in 712, and in 712–713 the Arabs captured several cities. On June 3, 713, military conspirators overthrew and blinded Philippicus and installed his chief secretary, Artemius, as Anastasius II (mainly at the instigation of the Senate and people).

Philippine Autonomy Act of 1916: *see* Jones Act.

Philippine Commonwealth and Independence Act: *see* Tydings–McDuffie Act.

Philippine Deep (Pacific Ocean): *see* Philippine Trench.

Philippine Independent Church, Spanish IGLESIA FILIPINA INDEPENDIENTE, also called AGLIPAYAN CHURCH, independent church organized in 1902 after the Philippine revolution of 1896–98 as a protest against the Spanish clergy's control of the Roman Catholic Church. Co-founders of the church were Isabelo de los Reyes y Florentino, author, labour leader, and senator, who was imprisoned during the revolution for his criticism of Spanish clergy and government officials in the Philippines, and Gregorio Aglipay y Labayán, a Philippine Roman Catholic priest who was excommunicated in 1899 for his activities on behalf of the revolution. Aglipay accepted de los Reyes' request that he serve as supreme bishop of the new church in 1903, a position he held until his death in 1940.

The church continued to follow Roman Catholic forms of worship, but for many years doctrine was strongly influenced by Unitarianism. A schism developed in 1946, and a unitarian faction left the church. Under Isabelo de los Reyes, Jr., elected bishop in 1946, the church adopted in 1947 a new declaration of faith and articles of religion that were Trinitarian. The Protestant Episcopal Church in the United States consecrated three bishops of the Philippine Independent Church in 1948, and the two churches entered into a close association. In 1961 the church was accepted into full communion with the Church of England and the Old Catholic churches.

In 1970 membership was 1,437,000.

Philippine Insurrection, a war between the United States and Filipino revolutionaries from 1899 to 1902; the insurrection may be seen as a continuation of the Philippine Revolution against Spanish rule. The Treaty of Paris (1898) transferred Philippine sovereignty from Spain to the United States but was not recognized by Filipino leaders, whose troops were in actual control of the entire archipelago except the capital city of Manila. Although an end to the insurrection was declared in 1902, sporadic fighting continued for several years thereafter.

Commo. George Dewey defeated the Spanish fleet in Manila Bay on the morning of May 1, 1898, but could not occupy Manila until ground troops arrived three months later. On August 13 Manila fell after a bloodless "battle." Spanish Governor Fermín Jáudenes had secretly arranged a surrender after a mock show of resistance to salvage his honour. With American troops in possession of the city and Filipino insurgents controlling the rest of the country, conflict was inevitable.

The war began with shooting on the outskirts of Manila on the night of February 4, 1899. Throughout the spring of 1899, American troops pushed north into the central Luzon Plain, and by the end of that year the Filipino general Emilio Aguinaldo retreated into the inaccessible northern mountains. The period of conventional battles ended, but insurgent leaders in many provinces continued bitter guerrilla warfare.

Fighting flared with increased bitterness on the island of Samar in 1901. Gen. Jacob F. Smith, enraged by a guerrilla massacre of U.S. troops, launched a retaliatory campaign of such indiscriminate ferocity that he was court-martialled and forced to retire.

After 1902 the American civil government regarded the remaining guerrillas as mere bandits, though the fighting continued. About 1,000 guerrillas under Simeón Ola were not defeated until late 1903, and in Batangas province, south of Manila, troops commanded by Macario Sakay resisted capture until as late as 1906.

The last organized resistance to U.S. power took place on Samar from 1904 to 1906. There, the rebels' tactic of burning pacified villages contributed to their own defeat. The United States gained an undisputed control of the Philippines and retained possession of the islands until 1946.

Philippine languages, about 70 to 75 aboriginal languages of the Philippine Islands. They belong to the Indonesian branch of the Austronesian family and are subdivided into two main subgroups—the central (or Mesophilippine) division and the northern (or Cordilleran) division—with a number of other member languages forming smaller groups or remaining unclassified.

The most important languages in the central division are Tagalog (a standardized form of which, Pilipino, is the official national language) and Cebuano. The most important in the northern division is Ilocano.

Philippine Revolution (1896–98), Filipino independence struggle that, after more than 300 years of Spanish colonial rule, exposed the weakness of Spanish administration but failed to evict Spaniards from the islands. The Spanish–American War brought Spain's rule in the Philippines to a close in 1898 but precipitated the Philippine Insurrection, a bloody war between Filipino revolutionaries and the U.S. Army.

Numerous quasi-religious uprisings had punctuated the long era of Spanish sovereignty over the Philippines, but none possessed sufficient coordination to oust the Europeans. During the 19th century, however, an educated Filipino middle class emerged and with it a desire for Philippine independence. Opposition before 1872 was primarily confined to the Filipino clergy, who resented the Spanish monopoly of power within the Roman Catholic Church in the islands. In that year the abortive Cavite Mutiny, a brief uprising against the Spanish, served as an excuse for renewed Spanish repression. The martyrdom of three Filipino priests—José Burgos, Mariano Gómez, and Jacinto Zamora—for allegedly conspiring with the rebels at Cavite sparked a wave of anti-Spanish sentiment.

Reform-minded Filipinos took refuge in Europe, where they carried on a literary campaign known as the Propaganda Movement. Dr. José Rizal quickly emerged as the leading Propagandist. His novel *Noli me tângere* (1886; *The Social Cancer,* 1912) exposed the corruption of Manila Spanish society and stimulated the movement for independence.

By 1892 it became obvious that Spain was unwilling to reform its colonial government. Andres Bonifacio, a self-educated warehouse clerk, organized a secret revolutionary society, the Katipunan, in Manila. Membership grew to an estimated 100,000 by August 1896, when the Spaniards discovered its existence. Bonifacio immediately issued a call for armed rebellion. The Spanish then arrested Rizal, who had advocated reform but never condoned the revolution. Rizal's public execution, on Dec. 30, 1896, so enraged and united Filipinos as to make permanent retention of power by Spain clearly impossible.

In March 1897 leadership of the revolution passed to a young general, Emilio Aguinaldo, who had Bonifacio shot for alleged sedition. Aguinaldo proved incapable of militarily defeating the Spanish troops, who were augmented by Filipino mercenaries. In the later months of 1897, Aguinaldo's revolutionary army was pushed into the mountains southeast of Manila.

On Dec. 15, 1897, the pact of Biak-na-Bato was proclaimed. Though its precise terms have been a matter of impassioned debate ever since, the pact brought a temporary end to the Philippine Revolution. Aguinaldo and other revolutionary leaders accepted exile in Hong Kong and 400,000 pesos, plus Spanish promises of substantial governmental reforms, in return for laying down their arms. Neither side executed the terms of the pact in good faith. Aguinaldo used the money to purchase arms in Hong Kong, and the Spanish reneged on the promised reforms.

After the U.S. Navy commodore George Dewey annihilated the Spanish fleet in Manila Bay on May 1, 1898, Aguinaldo immediately returned to the Philippines. He began the revolution anew, this time against the United States, which had assumed title to the Philippines as a result of the Spanish defeat. Aguinaldo was captured in 1901 and subsequently appealed to Filipinos to cease fighting and accept U.S. sovereignty.

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

Philippine Sea, section of the western North Pacific, lying east and north of the Philippines. The floor of this portion of the ocean is formed into a structural basin by a series of geologic folds and faults that protrude above the surface in the form of bordering island arcs. The Philippine islands of Luzon, Samar, and Mindanao are on the southwest; Palau, Yap, and Ulithi (of the Carolines) on the southeast; the Marianas, including Guam, Saipan, and Tinian, on the east; the Bonin and Volcano islands (Iwo Jima) on the northeast; the Japanese islands of Honshu, Shikoku, and Kyushu on the north; the Ryukyu Islands (Okinawa) on the northwest; and Taiwan (Formosa) in the extreme west. They surround an area measuring 1,800 mi (2,900 km) north–south by 1,500 mi east–west and occupying a total surface area of 40,000 sq mi (1,000,000 sq km), about 3 percent of the entire Pacific region. The basin, with a general depth of 19,700 ft (6,000 m), plunges to its greatest depths in trenches to the east of the island arcs. The deepest is the 34,578-ft Philippine Trench. Numerous seamounts rise from the basin floor, some of which are volcanic; their peaks, often flat (called tablemounts, or guyots), are capped with coral. The warm Pacific North Equatorial Current flows westward across the southern part of the sea. On meeting the Philippines, the current divides; part swings north near Luzon to form the Kuroshio (*q.v.*), of which some will return to the sea as the Kuroshio Countercurrent, and part swings south as the Pacific Equatorial Countercurrent. These currents, together with areas near reefs, ridges, and seamounts, are the sites of fishing grounds. Hurricanes and typhoons, which become particularly strong in September, originate in the sea.

Philippine Sea, Battle of the (June 19–21, 1944), naval battle of World War II between the Japanese Combined Fleet and the U.S. 5th Fleet. It accompanied the U.S. landing on Saipan and was known as "the greatest carrier battle of the war," ending in a complete U.S. victory.

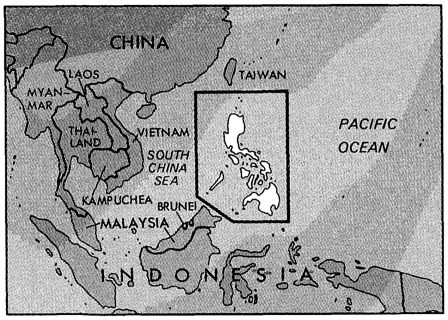
It began on the morning of June 19, when Adm. Ozawa Jisaburo, determined on a showdown with the U.S. invaders, sent 430 planes in four waves against ships under the command of Adm. Raymond Spruance. The result for the Japanese was a disaster: in the first day of the battle the Japanese lost more than 300 planes and two regular carriers; and, as their fleet retired northward toward safe harbour at Okinawa, it lost another carrier and nearly 100 more planes. During the two days of battle, U.S. losses totalled 130 aircraft and some damage to ships.

The poor showing by the Japanese has been attributed to many factors, but two may be singled out for special mention: men and matériel. Some Japanese pilots went into action with as little as three months of training, whereas many U.S. pilots had spent two full years in training. Japanese planes were highly manoeuvrable and had a longer range than U.S. planes, but they were inferior in several respects, particularly in their inadequate armour protection and lack of self-sealing fuel tanks. U.S. submarines also played an important but less publicized role in providing U.S. commanders with intelligence of enemy movements and in sinking Japanese ships.

Philippine Trade Act of 1946: *see* Bell Trade Act.

Philippine Trench, also called PHILIPPINE DEEP, MINDANAO TRENCH, or MINDANAO DEEP, submarine trench in the floor of the Philippine Sea of the western North Pacific Ocean bordering the east coast of the island of Mindanao. The abyss, which reaches the second greatest depth known in any ocean, was first plumbed in 1927 by the German ship "Emden." The reading obtained at that time was the first indication of the actual near-record depth. In 1945 the USS "Cape Johnson" recorded a sounding of 34,440 ft (10,497 m), slightly exceeded by the 34,578-ft sounding originally made by the Danish "Galathea" in 1951. Later soundings reported to exceed these have been found to be instrumentation errors.

Philippines, officially REPUBLIC OF THE PHILIPPINES, Pilipino REPUBLIKA NG PILIPINAS, archipelago of about 7,100 islands and islets lying about 500 miles (800 km) off the southeastern coast of Asia, covering a land area of about 115,800 square miles (300,000 square km). The capital is Manila. The country spans about 1,150 miles (1,850 km) from south to north at its longest extent and about 700 miles (1,125 km) from west to east at its widest extent; surrounded by the Pacific



Philippines

Ocean, it is bounded by the Philippine Sea to the east, the Celebes Sea to the south, the Sulu Sea to the southwest, and the South China Sea to the west. The two principal islands of the Philippines are Luzon in the north, occupying 40,420 square miles (104,688 square km), and Mindanao in the south, occupying 36,537 square miles (94,630 square km). The Visayan group of islands in the central Philippines include Panay, Negros, Cebu, Leyte, and Samar; Mindoro is situated directly south of Luzon, and Palawan is isolated in the west. The population in 1990 was estimated at 61,483,000.

A brief treatment of the Philippines follows. For full treatment, *see* MACROPAEDIA: Philippines.

For current history and for statistics on society and economy, *see* BRITANNICA WORLD DATA ANNUAL.

The land. The Philippine topography is varied, with inactive volcanoes and mountain ranges the conspicuous features of most of the larger islands. Many islands have narrow and often-interrupted coastal plains and river systems that generally trend northward. Large lakes on Luzon and Mindanao are of volcanic origin except Laguna de Bay, the country's largest lake (356 square miles [922 square km]), southeast of Manila; it was probably once an arm of Manila Bay. Northern Luzon has rugged north–south-trending mountain ranges (including the Sierra Madre in the east and the Cordillera Central in the west) separated by the fertile Cagayan River valley. A merger of these mountain systems in central Luzon separates the Cagayan valley from the 150-by-50-mile (240-by-80-kilometre) densely populated, agriculturally productive central plain of Luzon to the south. Manila is located at the southern end of this plain on the natural harbour provided by Manila Bay. The convoluted peninsular arm of southeastern Luzon is occupied by isolated volcanoes and irregular masses of mountains and hills. Irregularly shaped Mindanao has a complex topography including five major mountain systems and a number of sizable gulfs, bays, and peninsulas giving the island an extremely long coastline. Mount Apo, at 9,692 feet (2,954 m) the highest peak in the Philippines, overlooks Davao, Mindanao's largest city.

The Philippines have a maritime tropical climate with temperature variations being almost entirely a result of elevation. Manila has an average annual temperature of 81° F (27° C). The archipelago is well-watered, with the western Philippines having a distinct dry season. Typhoons frequently strike the more northerly eastern coast. More than one-third of the country is forested. There are many valuable hardwoods, such as lauan (Philippine mahogany), as well as many softwoods, including pine. Native plants and animals include some 800 species of orchid and at least 56 species of bat.

The Philippines is rich in mineral resources. Deposits of gold, silver, iron ore, copper, lead, chromite, nickel, manganese, and limestone occur in commercial quantities. Limited petroleum reserves are located off the island of Palawan.

The people. The people of the Philippines (who are called Filipinos) are predominantly of a Malay stock frequently admixed with Chinese and sometimes with American or Spanish ethnic groups. Pilipino, a language based on Tagalog (the language spoken around Manila by almost one-third of the country's total population), and English are both official languages. There are scores of other languages, the main groups of which are the Cebuano (spoken by approximately one-fourth of the total population), Ilocano, Hiligaynon, and Bicol.

More than four-fifths of the population is Roman Catholic, and a sizable minority is Muslim. Some of the population belongs to the Philippine Independent Church (Aglipayan) and others are mainline Protestant.

Population density in the Philippines is relatively high. Nearly two-fifths are younger than 15 years of age. Family-planning programs have been concentrated especially in rural areas. Overall life expectancy has increased to almost 64 years. Heavy migration from rural to urban areas has caused overcrowding, particularly in metropolitan Manila; about two-fifths of the country's population is urban. Emigration and immigration generally balance each other, although many of the emigrants include highly skilled workers.

The economy. The economy of the Philippines is largely based on agriculture, light industries, and services. A market economy predominates, though intervention by the government was increased in the late 20th century. Prices have tended to rise more rapidly than purchasing power, and wages are among the lowest in East Asia. The gross national product (GNP) per capita, which has a negative real growth rate, is similar to that of other developing countries.

Agriculture accounts for approximately one-fourth of the gross domestic product (GDP) and employs more than two-fifths of the work force, many of them tenant farmers. More than one-fourth of the land is arable; irrigation is insufficient, and the government and various international agencies have sponsored programs to expand the land under irrigation. However, the country has not attained agricultural self-sufficiency.

Rice is the leading staple, though corn (maize) predominates in some islands. Various hybrid strains of rice have been introduced and greater amounts of fertilizer are now used, but yields are far from optimum. The Philippines is a leading producer of coconuts, exported mainly as coconut oil as well as whole and as copra. Sugarcane, bananas, and pineapples are also widely grown and have supplanted traditional abaca (Manila hemp) and tobacco as sources of foreign exchange.

The Philippines' forests are being depleted by widespread illegal cutting and patterns of shifting cultivation that still persist. Large quantities of high-quality timber and veneers are exported to Japan, the United Kingdom, and the United States. Mining accounts for only a small percentage of the GDP, but copper, gold, and iron ore are sources of foreign exchange. Manufacturing accounts for approximately one-fourth of the GDP and employs about one-tenth of the work force. Major manufactures include processed foods, beverages, petroleum products, textiles, and footwear. The government has encouraged the development of labour-intensive industries, including the assembly of electrical and electronic equipment. Only one-seventh of the country's roads are paved. There are international airports at Manila and near Cebu on Mactan Island. The country's most important port is Manila. The transportation infrastructure, however, is poorly developed and has been a major obstacle to increasing agricultural output. Exports include electrical and electronic equipment and components, coconut products, clothing, fruits and vegetables, and sugar and sugar products. Mineral fuels, capital goods, cereals, and chemicals are imported. The balance of trade is frequently unfavourable. The United States and Japan are the Philippines' leading trading partners. Remittances from Filipinos working abroad are an important source of foreign exchange. The government's budgetary expenditures have traditionally exceeded revenues, and the external public debt has increased sharply since 1980.

Government and social conditions. The Philippine constitution of 1987 (which replaced the Constitution of 1973, as amended in 1981 and 1984) vests executive power in the president, the head of state, who is directly elected to a single six-year term. The president appoints the Cabinet, which is responsible for the day-to-day administration of the country. Legislative power is vested in the bicameral Congress of the Philippines, consisting of a 250-member House of Representatives and a 24-member Senate. House members are elected from districts, although a number of them are appointed, and senators are elected at large. The judicial system is headed by a politically independent Supreme Court. A martial-law ban on political parties was lifted in 1978, and since the mid-1980s partisan political activity has been vigorous. Outlawed political organizations operating in the country include a group seeking autonomy for Muslim Filipinos and a communist-led insurgency.

Health-care facilities and personnel are concentrated in Manila; the city has some 15 times as many physicians as the outlying rural areas. Malnutrition is widespread, and the demand for health care continues to outstrip available resources. A serious housing shortage exists, and some squatter communities (especially around Manila) lack elementary facilities for health and sanitation.

The literacy rate is high relative to Southeast Asian countries. Six years of elementary education is officially compulsory and free in public schools, and enrollment is almost universal. Many large universities, mostly established in the early 20th century, are concentrated in Manila. Freedom of the press is guaranteed by the constitution. Newspapers are published in Pilipino, English, and many of the country's vernacular dialects. There are numerous radio and television stations in operation in the Philippines.

Cultural life. The Philippines has been strongly influenced by centuries of rule by Spain and a half-century of rule by the United States, but strong Southeast Asian moorings have remained. Many Filipino songs and dances of the Spanish period have been preserved or reinterpreted. Ensembles such as Bayanihan have made these traditional performances known to a worldwide audience. A rich folkloric tradition preserves legends and myths of the origin of the world and tales associated with the Spanish conquest. Distinctive regional wood carvings attract nationwide attention.

History. Chinese traders are known to have visited and resided on the islands from about

AD 1000, but the influence of both China and India on the Philippines was of little importance. At the beginning of the 15th century Filipinos were primarily shifting cultivators, hunters, and fishermen having animistic beliefs. Islām was introduced later in the same century (particularly in the area of Mindanao) followed by Ferdinand Magellan's European discovery of the Philippines in 1521. The late 16th-century, militarily enforced Spanish colonization of much of the northern and central Philippines led to the nominal conversion of all the inhabitants to Roman Catholicism. The Moros, as the Spanish called the Muslims of Mindanao and the Sulu Archipelago farther southwest, were never completely subdued by the Spanish.

Central government in Manila retained a medieval, autocratic cast into the 19th century; the city also dominated the islands as an oppressive ecclesiastical centre and as a commercial centre serving as an entrepôt for Chinese silks and Mexican silver. By the 1830s Manila was open to foreign markets. The European demand for sugar and abaca led to intensive growth of commercial agriculture. In the late 19th-century, sons of wealthy landholders returned from European schools to the Philippines imbued with nationalistic ideals that led to an 1896 insurrection that was put down by Spanish troops.

The islands were ceded to the United States after the Spanish-American War of 1898, but an independence movement within the Philippines was not subdued until 1906. The juxtaposition of U.S. democracy and imperialistic rule over the Filipinos was sufficiently jarring to most Americans that, from the beginning, the training of Filipinos for self-government and ultimate independence was an essential rationalization for U.S. hegemony.

The Commonwealth of the Philippines was established in 1935 in an attempt to prepare the country for political and economic independence, but this effort was delayed by World War II and the subsequent Japanese invasion and occupation. The Republic of the Philippines was proclaimed on July 4, 1946, with a government patterned on that of the United States and with Manuel Roxas as the first president.

In 1965 Ferdinand E. Marcos was elected president, and in 1969 he became the first Philippine president to be reelected. In 1972 Marcos declared martial law, a state of affairs that was formally ended in 1981, although Marcos continued to rule by decree. The assassination of opposition leader Benigno S. Aquino, Jr., in 1983 became the focal point of mounting opposition to Marcos' rule. In a presidential election held in February 1986, Marcos was declared the official winner over opposition candidate Corazon Aquino, Benigno's widow, but the apparent fraudulence of Marcos' electoral victory precipitated a revolt that drove him from power. Aquino took over as president immediately after Marcos' departure.

Philippus (Latin personal name): *see under* Philip.

Philips, Ambrose (b. Oct. 9, 1674, Shrewsbury, Shropshire, Eng.—d. June 1/2, 1749, London), English poet and playwright.

Philips was educated at John's College, Cambridge. His first and best-known poems were collected in *Pastorals* and were probably written while he was a fellow at Cambridge, although they were not published until 1710. For *Pastorals,* Philips won immediate praise from leading men of letters, including Sir Richard Steele, Joseph Addison, and even Alexander Pope (who later attacked Philips in his satires). His adulatory verses ("Dimpley damsel, sweetly smiling") won Philips the nickname "Namby-Pamby." *The Distrest Mother* (1712), his adaptation of Jean Racine's *Andromaque,* was a success.

Philips, Peter (b. 1561—d. 1628, Brussels), English composer of madrigals, motets, and keyboard music of considerable reputation in his lifetime.

He was a Roman Catholic, and in 1582 he left England for Italy, where he became organist of the English College in Rome. In 1585 he entered the service of Lord Thomas Paget, with whom he traveled extensively. After Paget's death in 1590 Philips went to Antwerp. In 1597 he moved to Brussels, becoming organist of the royal chapel of the archduke Albert of Austria. In 1593 he was accused by the Dutch authorities of planning the murder of Queen Elizabeth I, but after imprisonment and trial he was released. He probably took holy orders, for in 1610 he was appointed to a canonry.

Philips published volumes of his own madrigals, to Italian texts, in 1596, 1598, and 1603. Eight volumes of his church music were published between 1612 and 1633. A posthumously published volume of masses is lost. Many of his compositions appeared in contemporary collections, including Thomas Morley's *First Book of Consort Lessons* (1599) and the *Fitzwilliam Virginal Book,* which contains 19 keyboard pieces by him. Philips' style reveals Italian and Dutch as well as English traits; J.P. Sweelinck was a powerful influence, and his firm polyphonic passages are at times reminiscent of William Byrd.

Philips' Gloeilampenfabrieken NV, English PHILIPS' INCANDESCENT LAMP WORKS, Dutch manufacturer specializing in the production of electrical and electronic equipment and household appliances. Headquarters are in Eindhoven, The Netherlands.

The company traces its origins to the formation of Philips and Company in 1891. It became a partnership in 1899 and was incorporated under its present name in 1912. In 1939 the company's noncontinental assets were transferred to two trusts: the British Trust in Great Britain and the American Trust in the United States. An affiliate of the American Trust is North American Philips Corporation, a major U.S. defense contractor.

The company manufactures electrical and electronic products and systems in several major product areas: lighting and batteries, with research emphasis on providing the same amount of light using less energy; home electronics—televisions, radios, and audio and video recorders; home appliances and personal care products; professional products, including telecommunications, computer systems, and office equipment; and industrial supplies. Other miscellaneous activities of the company include the manufacture of musical instruments, furniture, and sporting goods. The company also has affiliates engaged in musical recording and motion picture production in Europe and the United States. Philips has manufacturing and marketing subsidiaries throughout the world.

Philistine, one of a people of Aegean origin who settled on the southern coast of Palestine in the 12th century BC, about the time of the arrival of the Israelites. According to biblical tradition (Deuteronomy 2:23; Jeremiah 47:4), the Philistines came from Caphtor (possibly Crete). They are mentioned in Egyptian records as *prst,* one of the Sea Peoples that invaded Egypt in about 1190 BC after ravaging Anatolia, Cyprus, and Syria. Repulsed by the Egyptians, they occupied the coastal plain of Palestine from Joppa (modern Tel Aviv–Yafo) to the Gaza Strip. The area contained the five cities (the Pentapolis) of the Philistine confederacy (Gaza, Ashkelon [Ascalon], Ashdod, Gath, and Ekron) and was known as Philistia, or the Land of the Philistines. It was from this designation that the whole of the country was later called Palestine by the Greeks.

The Philistines expanded into neighbouring areas and soon came into conflict with the Israelites, a struggle represented by the Samson saga (Judges 14–16). With their superior arms and military organization the Philistines were able (*c.* 1050) to occupy part of the Judaean hill country. They were finally defeated by the Israelite king David (10th century), and thereafter their history was that of individual cities rather than of a people.

In the early part of the 7th century, Gaza, Ashkelon, Ekron, Ashdod, and probably Gath were vassals of the Assyrian rulers; but during the second half of that century the cities became Egyptian vassals. With the conquests of the Babylonian king Nebuchadrezzar II (605–562) in Syria and Palestine, the Philistine cities became part of the Neo-Babylonian Empire. In later times they came under the control of Persia, Greece, and Rome.

There are no documents in the Philistine language, which was probably replaced by Canaanite, Aramaic, and, later, Greek. Nor is much known of the Philistine religion, since all their gods mentioned in biblical and other sources have Semitic names and were probably borrowed from the conquered Canaanites. Until their defeat by David, the Philistine cities were ruled by *seranim,* "lords," who acted in council for the common good of the nation. After their defeat, the *seranim* were replaced by kings.

The Philistines long held a monopoly on smithing iron, a skill probably acquired in Anatolia. At sites occupied by the Philistines at an early period, a distinctive type of pottery, a variety of the 13th-century Mycenaean styles, has been found.

Philistus (b. *c.* 430 BC, Syracuse, Sicily [now in Italy]—d. 356), Greek historian of Sicily during the reigns of Dionysius I and II.

Philistus helped Dionysius I to seize power in 405 and then became his right-hand man and commander of the citadel. He was later exiled (386/385) for unknown reasons but was recalled after 20 years by Dionysius II at the time of Plato's first visit to his court. Philistus held high command first in the Adriatic and later at home in the civil war and died on active service.

During his exile, spent mostly in Epirus, he began his history, which ultimately totaled 13 books, seven on Sicilian affairs before 405, four on the reign of Dionysius I, and two on the early years of Dionysius II (367–363). It was continued by the Syracusan Athanas. His history clearly became a standard work, used by Ephorus in his Sicilian sections and also by Timaeus and Plutarch, writers who disliked his pro-monarchical viewpoint.

Philitas OF COS: *see* Philetas of Cos.

Phillip, Arthur (b. Oct. 11, 1738, London—d. Aug. 31, 1814, Bath, Somerset, Eng.), British admiral whose convict settlement established at Sydney in 1788 was the first permanent European colony on the Australian continent.

Arthur Phillip, detail from an oil painting by F. Wheatley, 1786; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

Phillip joined the British Navy in 1755, retired in 1763 to farm for 13 years in England, then served with the Portuguese Navy against Spain (1776) and with the British Navy against France (1778). In 1786 he was assigned the duty of founding a British convict settlement in New South Wales, and the following year he set sail with 11 ships.

As the first governor of New South Wales, Phillip struggled with rebellious convicts and troops and—until the middle of 1790—with the threat of famine; but he successfully created a permanent community. Despite his conciliatory policy toward the native Aborigines, he failed to establish peace between the settlers and the natives. He returned to England in 1792 because of poor health, but he saw further action at sea (1796–98) and was promoted to admiral in 1814.

Phillip Island, island astride the entrance to Western Port (bay) on the south coast of Victoria, Australia, southeast of Melbourne. About 14 mi (23 km) long and 6 mi at its widest, the island occupies 40 sq mi (100 sq km) and rises to 360 ft (110 m). Visited in 1798 by the English explorer George Bass, it was originally called Snapper Island and then Grant Island, after Lieut. James Grant, who landed there in 1801, and renamed in honour of Capt. Arthur Phillip, first governor of New South Wales. Sealers and whalers were in residence by 1802. It was proclaimed a shire in 1928. The island, the main town of which is Cowes, supports stock grazing and chicory cultivation and is a growing resort and retirement centre. It is the site of a koala bear sanctuary, seal, muttonbird, and fairy penguin rookeries, and a geological formation known as the Giant's Pipe Organ. The island is bridged to San Remo, on the east (mainland) shore of Western Port. Pop. (1981) 2,832.

Phillips, Stephen (b. July 28, 1864, Summertown, Oxfordshire, Eng.—d. Dec. 9, 1915, Deal, Kent), English actor and poet who was briefly successful as a playwright.

Phililips was educated at Trinity College

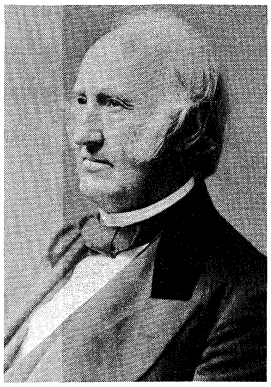
Stephen Phillips, watercolour by Percy Anderson, 1902; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

School, Stratford-upon-Avon, and at King's School, Peterborough. He joined F.R. Benson's company in 1885. His first collection of poetry, *Poems* (1897), was followed by several verse dramas, including *Herod* (1901), *Ulysses* (1902), and *Nero* (1906). Phillips was compared to Shakespeare for *Paolo and Francesca* (1900), but his reputation soon declined and he died in poverty.

Phillips, Wendell (b. Nov. 29, 1811, Boston—d. Feb. 2, 1884, Boston), Abolitionist crusader whose oratorical eloquence helped fire the antislavery cause during the period leading up to the U.S. Civil War.

After opening a law office in Boston, Phillips,



Wendell Phillips

By courtesy of the Library of Congress, Washington, D.C.

a wealthy Harvard Law School graduate, sacrificed social status and a prospective political career in order to join the antislavery movement. He became a close associate of the Abolitionist leader William Lloyd Garrison and began lecturing for antislavery societies, writing pamphlets and editorials for Garrison's *Liberator*, and contributing financially to the Abolition Movement.

His reputation as an orator was established at Faneuil Hall, Boston (Dec. 8, 1837), at a meeting called to protest the murder of Abolitionist Elijah Lovejoy at Alton, Ill., the previous month. When Phillips spontaneously delivered a stirring and passionate denunciation of the mob action against the martyred editor, he was recognized as one of the most brilliant orators of his day.

As a reform crusader, Phillips allied himself with Garrison in refusing to link Abolition with political action; together they condemned the federal Constitution for its compromises over slavery and advocated national disunion rather than continued association with the slave states. During the Civil War (1861–65) he assailed Pres. Abraham Lincoln's reluctance to uproot slavery at once, and after the Emancipation Proclamation (January 1863) he threw his support to full civil liberties for freedmen. In 1865 he became president of the American Anti-slavery Society after Garrison resigned.

After the Civil War, Phillips also devoted himself to temperance, women's rights, universal suffrage, and the Greenback Party (a minor political movement). He was an unsuccessful Massachusetts gubernatorial candidate of the Labor Reform and Prohibition parties in 1870. He continued to lecture on the lyceum circuits until the 1880s.

Phillips Academy, also called PHILLIPS ANDOVER ACADEMY, or ANDOVER, private, coeducational college-preparatory school (grades 9–12) in Andover, Mass., U.S.

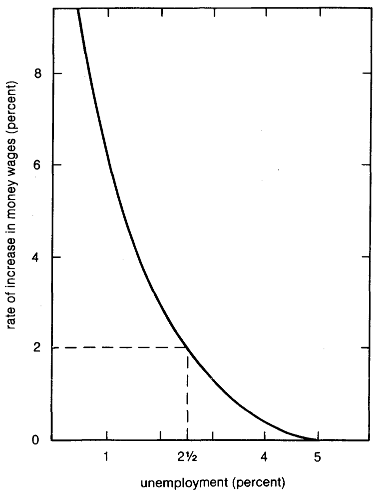
Founded as a boarding school for boys in 1778 by Samuel Phillips, then lieutenant governor of Massachusetts, it is the oldest incorporated academy in the United States. Sons of some of America's most influential families have enrolled at Andover, including Washingtons and Lees from Virginia, and Lowells from Massachusetts. In 1973 Andover merged with adjoining Abbott Academy for girls, established in 1829 as the first incorporated New England school for girls.

Phillips Collection, museum containing an outstanding small collection of late 19th- and 20th-century American and European painting and sculpture that was founded in 1918 by Duncan Phillips. It is housed in Phillips' residence (built 1897) in Washington, D.C.

The museum sponsors concerts, docent programs, gallery talks, guided tours, lectures, organized educational programs, radio programs, and temporary and permanent exhibits. It also publishes books and catalogs.

Phillips curve, graphic representation of the economic relationship between the rate of unemployment (or the rate of change of unemployment) and the rate of change of money wages. It indicates that wages tend to rise faster when unemployment is low. In his original article (1958), A.W. Phillips plotted the unemployment rates and the rates of change of money wages for the U.K. from 1861 to 1957. He found that, except for the years of unusually large and rapid increases in import prices, the rate of change in money wages could be explained by the level of unemployment. As traditional economic theory would predict, in times with low rates of unemployment employers are more likely to bid wages up in an effort to lure the higher quality employees away from their competitors. When unemployment rates are high, such bidding is unnecessary and the rate of change in money wages is lower.

The main implication of the Phillips curve is that, because a particular level of unemployment implies a particular rate of wage increase, the aims of low unemployment and



Phillips curve

From *Economica* (1958)

a low rate of inflation may be inconsistent. In recent years, however, the relation between unemployment and inflation has been too unstable, most observers would argue, to make much use of the Phillips curve concept. In particular, the situation in the early 1970s, with both relatively high unemployment and extremely high wage increases in most countries, represented a point well off the Phillips curve.

Phillips Exeter Academy, also called EXETER, private, coeducational college-preparatory school (grades 9–12) in Exeter, N.H., U.S. It was founded as a boys' school in 1781 by John Phillips, a local merchant and uncle of Samuel Phillips, the founder three years earlier of Phillips Academy in Andover, Mass.

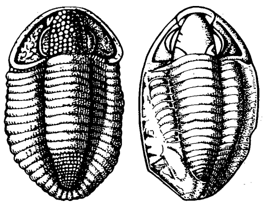
Exeter's curriculum emphasizes group discussion led by the instructor in a Socratic manner, an instructional method called the Harkness Plan after philanthropist Edward S. Harkness, who richly endowed the school in 1931. Exeter has gained a national reputation for faculty participation in decision making and freedom of speech, and in 1953 an Exeter Study Commission under the direction of William Saltonstall issued a report that led to a national reexamination of the role of secondary education. The school began admitting girls in 1970.

Phillips Petroleum Company, major U.S. petroleum company. Headquarters are in Bartlesville, Okla.

The company was incorporated in 1917 to acquire the Oklahoma and Kansas oil-producing properties of Frank and L.E. Phillips. The acquisition of a refinery in 1927 led to its development as an integrated oil company, so that it is now engaged in every phase of the petroleum industry, including exploration and development, transportation, refining and processing, and marketing and distribution. Phillips has important oil and gas holdings in the North Sea, Nigeria, and Indonesia, and owns its own refineries, pipelines, tankers, and tank cars.

The company markets its products primarily in the Midwest, under the trade name of Phillips 66, and abroad. It markets gasoline for automobiles and aviation, oils and greases, kerosene, and liquefied gas. It also produces petrochemicals, synthetic fibres, plastics, and agricultural chemicals. It has subsidiaries in North and South America, Europe, Africa, Australia, and the Far East.

Phillipsia, genus of trilobites (an extinct group of aquatic arthropods) uncommonly found as fossils in Carboniferous and Permian rocks (360,000,000 to 245,000,000 years old) in Europe, North America, and the Far



Phillipsia

Reprinted from H. Shimer and R. Shrock, *Index Fossils of North America,* by permission of the M.I.T. Press, Cambridge, Massachusetts, Copyright 1944 by the Massachusetts Institute of Technology, Copyright renewed 1972 by the Massachusetts Institute of Technology

East. One of the last known trilobite genera, *Phillipsia* is characterized by a relatively large head region and a large posterior region. Some forms are characterized by an unusual development of small surface nodes.

phillipsite, hydrated calcium, sodium, and potassium aluminosilicate mineral in the zeolite family $(Ca,Na_2,K_2)_3Al_6Si_{10}O_{32} \cdot 12H_2O$. It typically is found as brittle white crystals filling cavities and fissures in basalt and in phonolite lava, occurring near Rome; on Sicily; in Victoria, Australia; and in Germany. Phillipsite's molecular structure is a framework containing rings of four or eight linked silicate or aluminate tetrahedra (each consisting of four oxygen atoms arranged at the points of a triangular pyramid about a central silicon or aluminum atom); the openness of this structure and the presence of the aluminum atoms (each of which contributes a negatively charged site) give phillipsite cation-exchange properties (dissolved sodium, potassium, calcium, and magnesium readily replacing one another in the structure), making phillipsite useful in water softeners. For detailed physical properties, *see* zeolite (table). *Compare* harmotome.

Phillpotts, Eden (b. Nov. 4, 1862, Mount Abu, Rājasthān, India—d. Dec. 29, 1960, Broad Clyst, near Exeter, Devon, Eng.), British novelist, poet, and dramatist especially noted for novels evoking their Devon setting in a manner reminiscent of the style of Thomas Hardy.

Phillpotts was educated at Plymouth and for 10 years was a clerk in an insurance office. He then studied for the stage and later decided to become a writer. He produced more than 100 novels, many of them about rural Devon life. Among his more important works are the novels *Children of the Mist* (1898), *Sons of the Morning* (1900), and *Widecombe Fair* (1913); the autobiographical studies of boyhood and adolescence, *The Human Boy* (1899) and *The Waters of the Walla* (1950); the plays *The Farmer's Wife* (1917) and *Yellow Sands* (with his daughter Adelaide, 1926); and the poetry collections *The Iscariot* (1912), *Brother Beast* (1928), and *The Enchanted Wood* (1948). He also wrote *One Thing and Another* (1954), a collection of poems and essays.

Phillpotts, Henry (b. May 6, 1778, Bridgwater, Somersetshire, Eng.—d. Sept. 18, 1869, Torquay, Devonshire), Church of England bishop of Exeter (from 1830), who represented the conservative High Church wing of the Oxford Movement and emphasized litur-

Henry Phillpotts, engraving by D.J. Pound after a photograph

BCC Hulton Picture Library

gical forms of worship, episcopal government, monastic life, and early Christian doctrine as normative of orthodoxy. His unsuccessful attempt to block (1847–51) the pastoral appointment of George C. Gorham because of his Calvinistic view of Baptism gave rise to one of the most publicized ecclesiastical lawsuits in the 19th century and agitated High Church feeling against Parliament's intervention in religious questions. He actively supported Tory politics, opposing social reform and religious toleration.

Philo JUDAEUS, also called PHILO OF ALEXANDRIA (b. 15–10 BC, Alexandria—d. AD 45–50, Alexandria), Greek-speaking Jewish philosopher, the most important representative of Hellenistic Judaism. His writings provide the clearest view of this development of Judaism in the Diaspora. As the first to attempt to synthesize revealed faith and philosophic reason, he occupies a unique position in the history of philosophy. He is also regarded by Christians as a forerunner of Christian theology.

Life and background. Little is known of the life of Philo. Josephus, the historian of the Jews who also lived in the 1st century, says that Philo's family surpassed all others in the nobility of its lineage. His father had apparently played a prominent role in Palestine before moving to Alexandria. Philo's brother Alexander Lysimachus, who was a general tax administrator in charge of customs in Alexandria, was the richest man in the city and indeed must have been one of the richest men in the Hellenistic world, because Josephus says that he gave a huge loan to the wife of the Jewish king Agrippa I and that he contributed the gold and silver with which nine huge gates of the Temple in Jerusalem were overlaid. Alexander was also extremely influential in Roman imperial circles, being an old friend of the emperor Claudius and having acted as guardian for the Emperor's mother.

Philo was born between 15 and 10 BC. The community of Alexandria, to judge from the language of the Jewish papyri and inscriptions, had for nearly three centuries been almost exclusively Greek-speaking and indeed regarded the Septuagint (the 3rd-century-BC translation of the Hebrew Bible into Greek) as divinely inspired. During the century and a half before Philo's birth, Alexandria had been the home of a number of Jewish writers whose works exist now only in fragments. These men were often influenced by the Greek culture in which they lived and wrote apologies for Judaism.

The Alexandrian Jews were eager to enroll their children of secondary school age in Greek gymnasiums, institutions with religious associations dedicated to the liberal arts and athletics; in them, Jews were certainly called upon to make compromises with their traditions. It may be assumed that Philo was a product of such an education: he mentions a wide range of Greek writers, especially the epic and dramatic poets; he was intimately acquainted with the techniques of the Greek rhetorical schools; and he praises the gymnasium. Philo's education, like that which he ascribes to Moses, most probably consisted of arithmetic, geometry, astronomy, harmonics, philosophy, grammar, rhetoric, and logic.

Like the cultured Greeks of his day, Philo often attended the theatre, though it had distinctly religious connotations, and he noted the different effects of the same music on various members of the audience and the enthusiasm of the audience for a tragedy of Euripides. He was a keen observer of boxing contests and attended chariot races as well. He also mentions the frequency with which he attended costly suppers with their lavish entertainment.

Philo says nothing of his own Jewish education. The only mention of Jewish education in his work indicates how relatively weak it must have been, because he speaks only of Jewish schools that met on the Sabbath for lectures on ethics. That he was far from the Palestinian Hellenizers and that he regarded himself as an observant Jew is clear, however, from his statement that one should not omit the observance of any of the Jewish customs that have been divinely ordained. Philo is critical both of those who took the Bible too literally and thus encountered theological difficulties, particularly anthropomorphisms (*i.e.,* describing God in terms of human characteristics), and those who went to excesses in their allegorical interpretation of the laws, with the resulting conclusion, anticipating Paul's antinomianism, that because the ceremonial laws were only a parable, they need no longer be obeyed. Philo says nothing of his own religious practices, except that he made a festival pilgrimage to Jerusalem, though he nowhere indicates whether he made more than one such visit.

In the eyes of the Palestinian rabbis the Alexandrian Jews were particularly known for their cleverness in posing puzzles and for their sharp replies. As the largest repository of Jewish law apart from the Talmud before the Middle Ages, Philo's work is of special importance to those who wish to discern the relationship of Palestine and the Diaspora in the realm of law (*halakah*) and ritual observance. Philo's exposition of the law may represent either an academic discussion giving an ideal description of Jewish law or the actual practice in the Jewish courts in Egypt. On the whole, Philo is in accord with the prevailing Palestinian point of view; nonetheless he differs from it in numerous details and is often dependent upon Greek and Roman law.

That Philo experienced some sort of identity crisis is indicated by a passage in his *On the Special Laws.* In this work, he describes his longing to escape from worldly cares to the contemplative life, his joy at having succeeded in doing so (perhaps with the Egyptian Jewish ascetic sect of the Therapeutae described in his treatise *On the Contemplative Life*), and his renewed pain at being forced once again to participate in civic turmoil. Philo appears to have been dissatisfied with his life in the bustling metropolis of Alexandria: He praises the Essenes—a Jewish sect who lived in monastic communities in the Dead Sea area—for avoiding large cities because of the iniquities that had become inveterate among city dwellers, for living an agricultural life, and for disdaining wealth.

The one identifiable event in Philo's life occurred in the year 39 or 40, when, after a pogrom against the Jews in Alexandria, he headed an embassy to the emperor Caligula asking him to reassert Jewish rights granted by the Ptolemies (rulers of Egypt) and confirmed by the emperor Augustus. Philo was prepared to answer the charge of disloyalty levelled against the Jews by the notorious anti-Semite Apion, a Greek grammarian, when the Emperor cut him short. Thereupon Philo told his fellow delegates not to be discouraged because God would punish Caligula, who, shortly thereafter, was indeed assassinated.

Works. Philo's genuine works may be classified into three groups:

1. Scriptural essays and homilies based on specific verses or topics of the Pentateuch (the first five books of the Bible), especially Genesis. The most important of the 25 extant treatises in this group are *Allegories of the Laws,* a commentary on Genesis, and *On the Special Laws,* an exposition of the laws in the Pentateuch.

2. General philosophical and religious essays. These include *That Every Good Man Is Free,* proving the Stoic paradox that only the wise man is free; *On the Eternity of the World,* perhaps not genuine, proving, particularly in opposition to the Stoics, that the world is uncreated and indestructible; *On Providence,* extant in Armenian, a dialogue between Philo, who argues that God is providential in his concern for the world, and Alexander, presumably Philo's nephew Tiberius Julius Alexander, who raises doubts; and *On Alexander,* extant in Armenian, concerning the irrational souls of animals.

3. Essays on contemporary subjects. These include *On the Contemplative Life,* a eulogy of the Therapeutae sect; the fragmentary *Hypothetica* ("Suppositions"), actually a defense of the Jews against anti-Semitic charges to which Josephus' treatise *Against Apion* bears many similarities; *Against Flaccus,* on the crimes of Aulus Avillius Flaccus, the Roman governor of Egypt, against the Alexandrian Jews and on his punishment; and *On the Embassy to Gaius,* an attack on the Emperor Caligula (*i.e.,* Gaius) for his hostility toward the Alexandrian Jews and an account of the unsuccessful embassy to the Emperor headed by Philo.

A number of works ascribed to Philo are almost certainly spurious. Most important of these is *Biblical Antiquities,* an imaginative reconstruction of Jewish history from Adam to the death of Saul, the first king of Israel.

Philo's works are rambling, having little sense of form; repetitious; artificially rhetorical; and almost devoid of a sense of humour. His style is generally involved, allusive, strongly tinged with mysticism, and often obscure; this may be a result of a deliberate attempt on his part to discourage all but the initiated few.

Originality of his thought. The key influences on Philo's philosophy were Plato, Aristotle, the Neo-Pythagoreans, the Cynics, and the Stoics. Philo's basic philosophic outlook is Platonic, so much so that Jerome and other Church Fathers quote the apparently widespread saying: "Either Plato philonizes or Philo platonizes." Philo's reverence for Plato, particularly for the *Symposium* and the *Timaeus,* is such that he never took open issue with him, as he did with the Stoics and other philosophers. But Philo is hardly a plagiarist; he made modifications in Plato's theories. To Aristotle he was indebted primarily in matters of cosmology and ethics. To the Neo-Pythagoreans, who had grown in importance during the century before Philo, he was particularly indebted for his views on the mystic significance of numbers, especially the number seven, and the scheme of a peculiar, self-disciplined way of life as a preparation for immortality. The Cynics, with their diatribes, influenced him in the form of his sermons. Though Philo more often employed the terminology of the Stoics than that of any other school, he was critical of their thoughts.

In the past, scholars attempted to diminish Philo's importance as a theological thinker and to present him merely as a preacher, but in the mid-20th century H.A. Wolfson, an American scholar, demonstrated Philo's originality as a thinker. In particular, Philo was the first to show the difference between the knowability of God's existence and the unknowability of his essence. Again, in his view of God, Philo was original in insisting on an individual Providence able to suspend the laws of nature in contrast to the prevailing Greek philosophical view of a universal Providence who is himself subject to the unchanging laws of nature. As a Creator, God made use of assistants: hence the plural "Let us make man" in Genesis, chapter 1. Philo did not reject the Platonic view of a preexistent matter but insisted that this matter too was created. Similarly, Philo reconciled his Jewish theology with Plato's theory of Ideas in an original way: he posited the Ideas as God's eternal thoughts, which God then created as real beings before he created the world.

Philo saw the cosmos as a great chain of being presided over by the Logos, a term going back to pre-Socratic philosophy, which is the mediator between God and the world, though at one point he identifies the Logos as a second God. Philo departed from Plato principally in using the term Logos for the Idea of Ideas and for the Ideas as a whole and in his statement that the Logos is the place of the intelligible world. In anticipation of Christian doctrine he called the Logos the first-begotten Son of God, the man of God, the image of God, and second to God.

Philo was also novel in his exposition of the mystic love of God that God has implanted in man and through which man becomes Godlike. According to some scholars, Philo used the terminology of the pagan religions and mystery cults, including the term *enthousiasmos* ("having God within one"), merely because it was part of the common speech of the day; but there is nothing inherently contradictory in Judaism in the combination of mysticism and legalism in the same thinker. The influence of the mystic notions of Platonism, especially of the *Symposium,* and of the popular mystery cults on Philo's attempt to present Judaism as the one true mystery is hardly superficial; indeed, Philo is a major source of knowledge of the doctrines of these mystery cults, notably that of rebirth. Perhaps, through his mystic presentation of Judaism, Philo hoped to enable Judaism in the Diaspora to compete with the mystery religions in its proselyting efforts, as well as in its attempts to hold on to its adherents. That he was essentially in the mainstream of Judaism, however, is indicated by his respect for the literal interpretation of the Bible, his denunciation of the extreme allegorists, and his failure to mention any specific rites of initiation for proselytes, as well as the lack of evidence that he was himself a devotee of a particular mystery cult.

The purpose of what Philo called mystic "sober intoxication" was to lead one out of the material into the eternal world. Like Plato, Philo regarded the body as the prison house of the soul, and in his dualism of body and soul, as in his description of the flight from the self, the contrast between God and the world, and the yearning for a direct experience of God, he anticipated much of Gnosticism, a dualistic religion that became important in the 2nd century BC. But unlike all the Greek philosophers, with the exception of the Epicureans, who believed in limited freedom of will, Philo held that man is completely free to act against all the laws of his own nature.

In his ethical theory Philo described two virtues, under the heading of justice, that are otherwise unknown in Greek philosophic literature—religious faith and humanity. Again, for him repentance was a virtue, whereas for other Greek philosophers it was a weakness. Perfect happiness comes, however, not through men's own efforts to achieve virtue but only through the grace of God.

In his political theory Philo often said that the best form of government is democracy; but for him democracy was far from mob rule, which he denounced as the worst of polities, perhaps because he saw the Alexandrian mob in action. For Philo democracy meant not a particular form of government but due order under any form of government in which all men are equal before the law. From this point of view, the Mosaic constitution, which embodies the best elements of all forms of government, is the ideal. Indeed, the ultimate goal of history is that the whole world be a single state under a democratic constitution.

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Introductory works and surveys. E.R. Goodenough, *An Introduction to Philo Judaeus,* 2nd ed. rev. (1963); H. Chadwick, "Philo," in A.H. Armstrong (ed.), *The Cambridge History of Later Greek and Early Medieval Philosophy,* pp. 137–157 (1967), the best balanced, brief, comprehensive survey of Philo's thought.

Major works on Philo. E.R. Goodenough, *By Light, Light: The Mystic Gospel of Hellenistic Judaism* (1935, reissued 1969), a challenging, if one-sided, presentation of Philo as a mystic; Samuel Belkin, *Philo and the Oral Law* (1940, reprinted 1968), presentation of Philo as thoroughly acquainted with Palestinian Halakha; H.A. Wolfson, *Philo,* 2 vol. (1947), stresses Philo's relationship to Palestinian Pharisaic Judaism and his importance for the history of philosophy; Samuel Sandmel, *Philo's Place in Judaism* (1956), a case study of the account of Abraham in Philo as compared with rabbinic and other contemporary literature.

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Philoctetes, Greek legendary hero who played a decisive part in the final stages of the Trojan War.

He (or his father, Poeas) had been bequeathed the bow and arrows of the Greek hero Heracles in return for lighting his funeral pyre; Philoctetes thus became a notable archer. En route to Troy he was incapacitated by a snakebite and was left behind. After a seer revealed that Troy could be taken only with the aid of Heracles' bow and arrows, the Greek warriors Odysseus and Diomedes went to Philoctetes and persuaded him to accompany them to Troy. There he was healed of his wound and killed Paris (son of Priam, king of Troy), by which action he paved the way for the city's fall. He subsequently returned home but later wandered as a colonist to southern Italy, where he ultimately died in battle.

The theme of this story was used by the ancient Greek writer Sophocles in his *Philoctetes.*

Philodemus (b. *c.* 110 BC, Gadara, Syria—d. *c.* 35 BC, Herculaneum, Campania), Greek poet and Epicurean philosopher who did much to spread Epicureanism to Rome.

After studying under the Epicurean Zeno of Sidon at Athens, he moved to Rome *c.* 75 BC and became the mentor of the Roman aristocrat Lucius Calpurnius Piso, who invited Philodemus to live in his villa at Herculaneum, near Naples. In the ruins of that villa were found fragments of Philodemus' writings. He was known for his theory of art, which contradicted classical doctrines of aesthetics. His fame rests largely, however, on his love epigrams in the Palatine Anthology, allusions to which are found in works by the later Roman poets Virgil, Ovid, and Horace.

Philodendron, genus of mostly climbing herbs, commonly called philodendron, comprising about 200 species in the arum family (Araceae), native to tropical America, some of which are popular indoor foliage plants in colder areas and landscape plants in warmer climates.

The leaves are often large and smooth-margined to variously lobed and cut. The inflorescence, uncommonly produced in cultivation indoors, is a leaflike cone or spathe, green to white or reddish, which surrounds a central stout spadix bearing inconspicuous flowers. Identification is complicated by differences in leaf size and shape between the young and mature plants and by the large number of cultivated varieties that exist. The mature phase occurs only under ideal conditions and in some cases only when vertical support is provided.

Many forms of philodendron are available in cultivation, foremost among them being the common heart-leaf philodendron (*Philodendron scandens oxycardium*); the velvet-leaf philodendron (*P. scandens micans*) has small bronzy-green velvety leaves with reddish undersides. Of moderate size is the fiddle-leaf, or horsehead, philodendron (*P. bipenniflorium*), with fiddle-shaped, large, glossy green leaves up to 15–25 centimetres (6–10 inches) wide and 45 cm long. Larger types include the spade-leaf philodendron (*P. domesticum* or *P. hastatum*), with triangular leaves up to 60 cm long, and the selloum philodendron (*P. selloum*), with deeply cut leaves up to one metre (three feet) long, both of which are striking plants that require considerable indoor space.

Philokalia (Greek: "Love of the Good, the Beautiful"), prose anthology of Greek Christian monastic texts that was part of a movement for spiritual renewal in Eastern monasticism and Orthodox devotional life in general. Compiled by the Greek monk Nikodimos and by Makarios, the bishop of Corinth, the *Philokalia* was first published in Venice in 1782 and gathered the unpublished writings of all major Hesychasts (hermits) of the Christian East, from Evagrius Ponticus to Gregory Palamas.

The *Philokalia* is concerned with "inner asceticism," not merely outward obedience to one's superior or the practice of physical austerities. Inner asceticism means, above all, daily recollection of death and judgment, together with perpetual remembrance of God as omnipresent and omnipotent, and ceaseless prayer. It is through this compilation that the tradition of the "prayer of the mind," or Jesus prayer, uttered in a particular bodily position with a special way of breathing, became better known and gained new followers among Orthodox as well as Western Christians.

The *Philokalia* had great success in the Slavic countries, especially Russia, and a Church Slavonic version appeared in 1793 in St. Petersburg under the title of *Dobrotoliubie.* It was translated by the starets (spiritual leader) Paissy Velitchkovsky, who introduced a neo-Hesychast spiritual renewal into Russian and Moldavian monasticism. Whereas in Greece the *Philokalia* apparently had little influence outside certain schools of monasticism (although attempts were made to reach a wider public with new editions in 1867 and 1957), the Church Slavonic version became, through the influence of the startsy, one of the favourite spiritual books of all classes of Russian laity during the 19th century. In 1877 Theophan Zatvornik (Theophane the Recluse), the former bishop of Tambov, compiled a Russian version in five volumes.

Philolaus (fl. *c.* 475 BC), philosopher of the Pythagorean school, named after the Greek thinker Pythagoras (fl. *c.* 530 BC).

Philolaus was born either at Tarentum or, according to the 3rd-century-AD Greek historian Diogenes Laërtius, at Croton, in southern Italy. When, after the death of Pythagoras, dissension was prevalent in Italian cities, Philolaus, according to some accounts, fled first to Lucania and then to Thebes, in Greece. He later returned to Italy, where he may have been a teacher of the Greek thinker Archytas.

Philolaus was a student of the celebrated number theory of Pythagoras, who stressed the importance of numerical groupings. He was particularly interested in the properties inherent in the decad, the sum of the first four numbers. Speusippus, the successor of Plato as head of the Greek Academy, is reported to have reproduced the doctrine of the first four numbers from a book by Philolaus. Only fragments of his works survive, however, and the belief that Philolaus was the first systematizer of Pythagoreanism is widely disputed.

philology, a term now rarely used but once applied to the study of language and literature. Nowadays a distinction is usually made between literary and linguistic scholarship, and the term philology, where used, means the study of language—*i.e.,* linguistics (*q.v.*). It survives in the titles of a few learned journals that date to the 19th century. Comparative philology was a former name for what is now called comparative linguistics (*q.v.*).

Philombe, René, pseudonym of PHILIPPE-LOUIS OMBEDE (b. 1930, Ngaoundéré, Cameroon), African novelist, poet, playwright, essayist, and journalist. The *Cameroon Tribune* called him "one of the most influential personalities in the new wave of creative writing in Cameroon."

Philombe, a cultural and political activist from his teens, became a policeman in 1949. He unionized the police and became their union secretary in Douala. In the mid-1950s, after he was permanently crippled by spinal disease, he began writing seriously. His *Lettres de ma cambuse* (1964; *Tales from my Hut,* 1977), which he had written in 1957, won the Prix Mottard of the Académie Française. His other published works include *Sola, ma chérie* (1966; "Sola, My Darling"), a novel about seemingly unjust marriage customs; *Un Sorcier blanc à Zangali* (1970; "A White Sorcerer in Zangali"), a novel about the effect of a missionary's clash with the colonial administration in a small village; *Choc anti-choc* (1978), "a novel made of poems"; and *Africapolis* (1978), a tragedy. The latter two are both thinly veiled allegories of life under a malevolent dictatorship.

In 1960 Philombe was a co-founder of the National Association of Cameroonian Poets and Writers, and he remained its permanent general secretary. Many of his patriotic literary activities earned him long periods in prison, in spite of his infirmities. In 1981 he was once again released under house arrest, but all of his manuscripts were retained.

Philopoemen (b. *c.* 252 BC, Megalopolis, Arcadia—d. 182, Messene, Messenia), general of the Achaean League notable for his restoration of Achaean military efficiency.

He was trained to a career of arms by the Academic philosophers Ecdelus and Demophanes. After spending some 10 years as a mercenary leader in Crete, he returned to Achaea and was elected federal cavalry commander for 210/209, when his reorganized cavalry defeated the Aetolians on the Elean frontier. As general of the confederation for 208/207 he introduced heavier Macedonian armour and phalanx tactics and crushed the Spartans under Machanidas at Mantineia (207). General again in 206/205 and 201/200, he expelled Nabis of Sparta from Messene and routed him at Tegea. In a fourth generalship (193/192) he failed against Nabis by sea but almost annihilated his army near Gythium. The Roman general Flamininus prevented his taking Sparta, but on Nabis' assassination (192) Philopoemen incorporated it in the confederation. Henceforth he dominated Achaean policy, but, when Messene rebelled, he was taken in a skirmish and given poison (182). Plutarch relates his life.

Philoponus, John, also called JOHN THE GRAMMARIAN, Greek JOANNES PHILOPONUS, or JOANNES GRAMMATICUS (fl. 6th century), Greek Christian philosopher, theologian, and literary scholar whose writings expressed an independent Christian synthesis of classical Hellenistic thought, which in translation contributed to Syriac and Arabic cultures and to medieval Western thought. As a theologian, he proposed certain esoteric views on the Christian doctrine of the Trinity and the nature of Christ.

A native of Alexandria, Egypt, and a student there of the celebrated Aristotelian commentator Ammonius Hermiae, Philoponus interpreted Aristotle critically in the light of Neoplatonic Idealism and Christian theology; thus, he identified Aristotle's concept of the first cause with the Christian notion of a personal God. Arguing for the Christian doctrine of creation, he composed a treatise, now lost, "On the Eternity of the World," contradicting the 5th-century Neoplatonist Proclus.

Possibly Philoponus' Christianization of Aristotelian doctrine allowed the Alexandrian academy to continue despite criticism from the church. Among his notable commentaries are those on Aristotle's *Metaphysics,* the logical treatises of the *Organon,* the tract on *Physics,* the three books of *De anima* ("On the Soul"), and *De generatione animalium* ("On the Generation of Animals"). In philosophical theology Philoponus produced his major work, *Diaitētēs ē peri henōseōs* ("Mediator, or Concerning Union"), in which he discusses the Trinity and Christology. Because he held that every nature necessarily is individualized, he concluded that in Christ only one nature was possible, the divine. Although such a theological position appeared to be heretical Monophysitism, Philoponus approximated the orthodox teaching by explaining that though Christ's humanity was devoid of personhood, it was not dissolved by its fundamental union with the divinity. Claiming that his Christology was traditional, he criticized the doctrinal statements of Pope Leo I (440–461) and the Council of Chalcedon (451), and in 681 he was censured by the third Council of Constantinople for his alleged Monophysitism.

In order to defend the Christian dogma of personal immortality, Philoponus broke with the common Aristotelian and Stoic interpretation of a single universal mind operative in all men and taught that each person possesses an individual intellect. Among his other original contributions to Western thought was his development of Aristotle's kinetic theory of motion (the principle that nothing moves unless it is moved by an external force), by affirming that velocity is directly proportional to the excess of force to resistance. Philoponus' two treatises on grammar were later revised in lexicon form and received wide recognition during the Middle Ages.

Philosophe, any of the literary men, scientists, and thinkers of 18th-century France who were united, in spite of divergent personal views, in their conviction of the supremacy and efficacy of human reason. Inspired by the philosophic thought of René Descartes, the Skepticism of the Libertins, or freethinkers, and the popularization of science by Bernard de Fontenelle, they expressed support for social, economic, and political reforms, occasioned by sectarian dissensions within the church, the weakening of the absolute monarchy, and the ruinous wars that had occurred toward the end of Louis XIV's reign. In the early part of the 18th century, the movement was dominated by Voltaire and Montesquieu, but that restrained phase became more volatile in the second half of the century. Diderot, Rousseau, Georges-Louis Leclerc de Buffon, Étienne Bonnot de Condillac, Anne-Robert-Jacques Turgot, and the Marquis de Condorcet were among the Philosophes who devoted their energies to compiling the *Encyclopédie,* one of the great intellectual achievements of the century.

philosophical anthropology, discipline that seeks to unify the several empirical investigations of human nature in an effort to understand individuals as both creatures of their environment and creators of their own values.

A brief treatment of philosophical anthropology follows. For a full treatment, *see* MACROPAEDIA: Philosophical Anthropology.

Philosophical anthropology emerged as an academic discipline in Germany in the 1920s, after a time of increasing specialization in the human sciences. Scholars such as Helmuth Plessner, Max Scheler, and, earlier, Wilhelm Dilthey were concerned that the analysis of human nature through one narrow discipline (*e.g.,* psychoanalysis, physical anthropology) would result in as many limited and deterministic views of humanity as there were empirical disciplines. Marxists, for example, saw economic forces as the only determinant of the human condition, while Freudians identified subconscious forces in that role. Philosophical anthropologists argued that human nature is complex and dynamic and is able constantly to rediscover and re-create itself within the confines of its biology and culture.

Although established in reaction to scientific specialization, philosophical anthropology had its intellectual roots in the British Empirical philosophers—especially Francis Bacon, John Locke, and David Hume—and the great naturalists Carolus Linnaeus, the Comte de Buffon, and Charles Darwin. In their studies of human nature, these men assumed no causal connections or final design in the phenomena they observed and admitted only those facts that could be proved by experience. Plessner and Scheler built on the Phenomenology of Edmund Husserl in an effort to begin scientific inquiry into human nature with the intuitive, personal consciousness of experience. Other philosophical anthropologists have borrowed from Existentialism.

Philosophical Radical, adherent of the Utilitarian political philosophy that stemmed from the 18th- and 19th-century English jurist Jeremy Bentham and culminated in the doctrine of the 19th-century English philosopher John Stuart Mill. Bentham believed that "Nature has placed mankind under the governance of two masters, pain and pleasure" and that actions should be judged morally right or wrong according to whether or not they tend to maximize pleasure and minimize pain among those affected by them. He explored the implications of this principle for legal and other social institutions. Bentham's theory was developed and refined by Mill, who held that actions are right in proportion as they tend to promote the greatest happiness of the greatest number. Other Philosophical Radicals included the economists James Mill and David Ricardo, the jurist John Austin, and the historian George Grote. They favoured economic and political liberalism and, although primarily theorists, they aimed at and achieved considerable practical influence.

philosophy (from Greek, by way of Latin, *philosophia,* "love of wisdom"), the critical examination of the grounds for fundamental beliefs and an analysis of the basic concepts employed in the expression of such beliefs. Philosophical inquiry is a central element in the intellectual history of civilization.

The subject of philosophy is treated in a number of articles in the MACROPAEDIA. For treatments of the major systems of Chinese philosophy, *see* Buddhism, The Buddha and; Confucius and Confucianism; Taoism. *See also* the biography of Chu Hsi. For treatment of Japanese philosophical systems, *see* Buddhism, The Buddha and; Shintō. The philosophical traditions of the Indian subcontinent are treated historically in the article Indian Philosophy. For further treatment of particular Indian systems, *see* Buddhism, The Buddha and; Hinduism; Jainism; Sikhism. For historical treatment of Western philosophy, *see* Philosophy, The History of Western. Major systems are treated individually under the title Philosophical Schools and Doctrines, Western. *See also* Aristotelianism, Aristotle and; Augustine; Christianity: *Christian Thought and Doctrine;* Cartesianism, Descartes and; Hegelianism, Hegel and; Hume; Islām: *Islāmic Philosophy;* Judaism: *Jewish Philosophy;* Kantianism, Kant and; Locke; Marxism, Marx and; Mill, J.S.; Nietzsche; Platonism, Plato and; Socrates. For treatment of particular branches of philosophical inquiry, *see* Aesthetics; Epistemology; Ethics; Ideology; Logic, The History and Kinds of; Metaphysics; Mind, Philosophy of; Philosophical Anthropology; Philosophies of the Branches of Knowledge.

For a description of the place of philosophy in the circle of learning and for a list of both MACROPAEDIA and MICROPAEDIA articles on the subject, *see* PROPAEDIA: Part Ten, Division V.

Philostorgius (b. *c.* AD 368, Borissus, Cappadocia—d. *c.* 433, probably Constantinople), Byzantine historian, partisan of Arianism, a Christian heresy asserting the inferiority of Christ to God the Father. His church history, preserved in part, was the most extensive collection of Arian source texts assembled in a single work and furnished valuable data on the history, personalities, and intellectual milieu of theological controversy in the early church.

Philostorgius was the son of a staunch Arian and from the age of 20 studied in Constantinople and became a follower of Eunomius of Cyzicus, a leading exponent of extreme Arianism. This branch of the heresy stressed an absolute monotheism: only the Father is perfect God; the Son, Christ, is created.

Between 425 and 433 (during the reign of Emperor Theodosius II), Philostorgius wrote his church history in 12 books, after visiting Arian communities throughout the Eastern empire. The work, covering the period 300 to 425, was intended to continue the monumental *Ecclesiastical History* by the 4th-century chronicler Eusebius of Caesarea. In reality it constituted an apology for the radical Arian school. Beyond fragmentary references by Byzantine historians from the 9th to the 13th century, it has survived only in a summary and commentary in the *Bibliotheca* ("The Library," or annotated bibliography) of Photius, the 9th-century scholarly patriarch of Constantinople. Although he acclaimed Philostorgius' style and diction, Photius charged him with obscurity and bias, particularly in his laudatory treatment of Eunomius and other Arian spokesmen and in his condemnation of orthodox theologians and emperors. Philostorgius refrained from attacking directly the celebrated orthodox leaders Gregory Nazianzene and Basil of Caesarea; he admitted the cogency of some of their refutations of heterodox Trinitarian theology but chided them for their criticism of his mentor, Eunomius. The *History* appealed to the cultured Greek because of its Arian emphasis on the rational intelligibility of Christian revelation. It also depicts the Arian response to the pagan accusation that Christianity influenced the political misfortunes of the Greco-Roman empire and civilization. Philostorgius countered that the lamentable collapse of classical culture into barbarism verified Christian apocalyptic teaching, or the predictions and signs portending the end of the world and the Second Coming of Christ.

Byzantine chronicles mention an apology for Christianity, written against the 3rd-century Neoplatonist Porphyry, but this tract has been lost. An English translation of *The Ecclesiastical History of Philostorgius as Epitomized by Photius* was done by E. Walford (1851). A critical edition of the Greek text was compiled by Joseph Bidez in the series *Die Griechischen christlichen Schriftsteller der ersten drei Jahrhunderte,* vol. 21 (1913; "The Greek Christian Writers").

Philostratus, any of at least three members of a family of ancient Greek writers. They are often confused with one another, and the attribution of certain works among them is controversial.

Flavius Philostratus (b. *c.* AD 170—d. *c.* 245), called "the Athenian," studied at Athens and some time after 202 entered the circle of the philosophical Syrian empress of Rome, Julia Domna. On her death he settled in Tyre. He wrote the *Gymnasticus* (a treatise dealing with athletic contests); a life of the Pythagorean philosopher Apollonius of Tyana; *Bioi sophiston* (*Lives of the Sophists*), treating both the Classical Sophists of the 5th century BC and later philosophers and rhetoricians; a discourse on nature and law; and the epistles ("Love Letters"), of which one forms the basis of Ben Jonson's "Drink to Me Only with Thine Eyes."

Philostratus (b. *c.* AD 190), called "the Lemnian," son-in-law of Flavius Philostratus, was the author of a letter to Aspasius of Ravenna and of the first series of the *Imagines* in two books, discussing 65 real or imaginary paintings on mythological themes in a portico at Naples. They are an important source for the knowledge of Hellenistic art and roused the enthusiasm of Goethe.

Philostratus, called "the Younger," grandson of Philostratus the Lemnian, wrote a second series of *Imagines* in the 3rd century AD.

Philotheus Kokkinos (b. *c.* 1300, Salonika, Greece—d. 1379, Constantinople), theologian, monk, and patriarch of Constantinople, a leader of the Byzantine monastic and religious revival in the 14th century. His numerous theological, liturgical, and canonical works received wide circulation not only in Byzantium but throughout the Slavic Orthodox world.

Born of a Jewish mother, Philotheus became a monk and then abbot of the Great Laura on Mt. Athos, Greece, where he became a leading advocate of Hesychasm (a form of contemplative prayer) and a close friend of the theologian Gregory Palamas. In 1347 Philotheus was named bishop of Heraclea, near Constantinople, but spent most of his time at the imperial capital.

A protégé of the emperor John VI Cantacuzenus, Philotheus was appointed patriarch of Constantinople in November 1353. He was deposed by John V Palaeologus in 1354 and then restored by Callistus I. After he was reappointed patriarch in 1364, Philotheus opposed the efforts of John V to negotiate with the popes Urban V and Gregory XI. Asserting his patriarchal authority, he fostered the Hesychast cause by canonizing Gregory Palamas and acclaiming him a doctor of the Greek Orthodox Church at the synod of 1368.

Through an independent ecclesiastical policy, moreover, Philotheus consolidated the Orthodox Serbs, Bulgarians, and Russians with the Greek patriarchate. Concomitantly, he implemented his theory of Constantinople's patriarchal supremacy over the entire Eastern church. In 1367 he agreed to hold a Union Council with the Western church, but the idea was rejected by Pope Urban VI. Philotheus actively intervened in the political and ecclesiastical affairs of Russia, consolidating administrative functions under a single metropolitan of Kiev and all Russia (who actually resided in Moscow).

Philoxenus OF MABBUG, Syriac AKHSĒNĀYĀ (b. *c.* 440, Tahal, Beth-Garmaï [near modern Kirkūk, Iraq]—d. *c.* 523, Gangra, Paphlagonia [near modern Samsun, Turkey]), Syrian bishop, theologian, and classical author. He was a leader of the Jacobite Monophysite church, a heterodox group teaching a single, divine nature in Christ, subsuming his humanity. He also contributed significantly to the Syriac literary heritage, particularly with the Philoxenian New Testament based on the original Greek text.

A student at the school of Edessa, now Urfa, Tur., Philoxenus rejected the Nestorian doctrine of Christ that posited in him an autonomous human nature conjoined to the divinity simply by a moral bond. Instead, Philoxenus emphasized the dynamic hegemony of Christ's divinity over his humanity. Because of his zeal in expounding the Monophysite cause, he was expelled from Edessa by the Orthodox patriarch of Antioch. But with the support of Peter the Fuller, Monophysite patriarch of Antioch, Philoxenus was named bishop of Hierapolis (Mabbug), near modern Aleppo, Syria, in 485.

Investigated by Flavian II, orthodox successor to Peter the Fuller, Philoxenus was condemned as a heretic by Macedonius, patriarch of Constantinople. Supported, however, by the new emperor, Anastasius I, Philoxenus undertook a campaign to replace Orthodox bishops with Monophysite churchmen. At the accession of the Orthodox emperor Justin I in 518, Philoxenus was exiled to Philippopolis, now Plovdiv, Bulg., where he continued his polemical and ascetical writings during the rigours of captivity. It is possible he died violently.

Philoxenus collaborated in a Syriac version of the New Testament in about 508 with Polycarp of Hierapolis, his chorepiscopus ("auxiliary bishop"). Together with the celebrated Peshitta, an early Syriac Bible text, the Philoxenian New Testament, as it is called, served as the principal scriptural source for Syriac Christianity for two centuries. *The Discourses of Philoxenus,* 2 vol. (1894), a collection of 13 of Philoxenus' addresses on the Christian life, were edited and translated by Sir Ernest Alfred Thompson Wallis Budge.

Phios, also spelled PHIOPS (Egyptian kings): *see* Pepi.

Phitsanulok, town, north-central Thailand. Phitsanulok lies along the Nan River and the Bangkok–Chiengmai railroad. It is also served by an airport and by a major highway to Sukhothai (west) and Khon Kaen (east). The commercial centre in the southern part of town deals in rice, cotton, and tobacco. The old walled city dates to the 13th century, and from 1350 to 1767 it was second in size and importance to the national capital of Phra Nakhon Si Ayutthaya. The temple complex Wat Phra Si Rattana Mahathat houses the Phra Buddha Jinaraj, an early bronze figure famed for its beauty. Modern buildings in Phitsanulok include a 15-story hotel. Rice is the main crop grown in the surrounding agricultural area. Pop. (1985 est.) town, 76,008.

Phiz: *see* Browne, Hablot Knight.

phlebitis, inflammation of the wall of a vein. Phlebitis may result from the infection of tissues adjacent to the vein, or it may result from trauma or from a surgical operation or childbirth. A long period of bed rest and an attendant lack of blood circulation may also cause phlebitis. Varicose veins, obesity, and atherosclerosis are other predisposing factors. In many cases the cause of phlebitis is not known.

Phlebitis can last for years, and if it continues for a long time, the inner lining of the inflamed vein becomes irritated to the point that various elements in the blood are deposited there, forming a blood clot. This condition is known as thrombophlebitis (*q.v.*).

Phlebitis usually occurs in one of the superficial veins of the lower leg. The condition is more serious when it occurs in a more deeply situated blood vessel, since if a blood clot develops there and then breaks away and begins to circulate in the bloodstream, it can cause a serious circulatory obstruction. The indications of phlebitis include localized pain, swelling, redness, and heat over the inflamed vein. Examination may reveal a tender, cordlike mass under the skin at the site. If phlebitis affects a superficial vein, the condition is relatively innocuous and can be treated by analgesics and bed rest until the inflammation disappears, at which time mild exercise should be taken. In severe or serious cases of phlebitis, anticoagulants are administered to prevent the formation of blood clots.

phlebothrombosis, formation of a blood clot in a vein that is not inflamed. Inactivity, such as bed rest during convalescence, can lead to the condition, which frequently progresses to thrombophlebitis (*q.v.*), in which the clot adherent to the wall of the vein is accompanied by inflammation of the vessel.

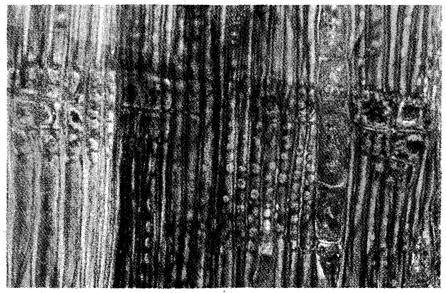
phlebotomus fever: *see* pappataci fever.

phlegmasia alba dolens (medicine): *see* milk leg.

Phlipon, Jeanne-Marie: *see* Roland (de La Platière), Jeanne-Marie.

phloem, also called BAST, tissues in plants that conduct foods made in the leaves to all other parts of the plant. Phloem is composed of various specialized cells called sieve tubes, companion cells, phloem fibres, and phloem parenchyma cells. Primary phloem is formed by the apical meristems (zones of new cell production) of root and shoot tips; it may be either protophloem, the cells of which are matured before elongation (during growth) of the area in which it lies, or metaphloem, the cells of which mature after elongation. Sieve tubes of protophloem are unable to stretch with the elongating tissues and are torn and destroyed as the plant ages. The other cell types in the phloem may be converted to fibres. The later maturing metaphloem is not destroyed and may function during the rest of the plant's life in plants such as palms but is replaced by secondary phloem in plants that have a cambium.

Sieve tubes, which are columns of sievetube cells having perforated, sievelike areas in their lateral or end walls, provide the channels in which food substances travel. Phloem parenchyma cells, called transfer cells and border parenchyma cells, are located near the finest branches and terminations of sieve tubes



Longitudinal section through xylem (pink) and phloem (blue green); small circles within the phloem are the sieve areas of the sieve cells, and the dark red areas in the phloem are phloem parenchyma cells

J.M. Langham

in leaf veinlets, where they also function in the transport of foods. Phloem fibres are flexible long cells that make up the soft fibres (*e.g.,* flax and hemp) of commerce.

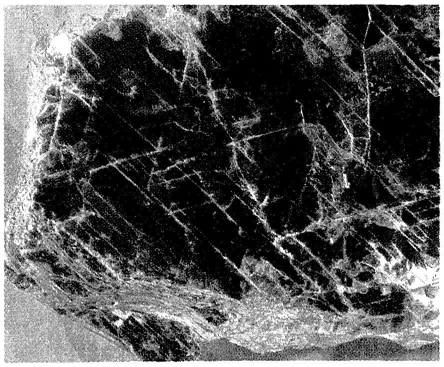
phlogiston, in early chemical theory, hypothetical principle of fire, of which every combustible substance was in part composed. In this view, the phenomena of burning, now called oxidation, was caused by the liberation of phlogiston, with the dephlogisticated substance left as an ash or residue.

Johann Joachim Becher in 1669 set forth his view that substances contained three kinds of earth, which he called the vitrifiable, the mercurial, and the combustible. He supposed that, when a substance burned, combustible earth (Latin *terra pinguis,* meaning "fat earth") was liberated. Thus, wood was a combination of phlogiston and wood ashes. To this hypothetical substance Georg Ernst Stahl, at about the beginning of the 18th century, applied the name phlogiston (from Greek, meaning "burned"). Stahl believed that the corrosion of metals in air (*e.g.,* the rusting of iron) was also a form of combustion, so that when a metal was converted to its calx, or metallic ash (its oxide, in modern terms), phlogiston was lost. Therefore, metals were composed of calx and phlogiston. The function of air was merely to carry away the liberated phlogiston.

The major objection to the theory, that the ash of organic substances weighed less than the original while the calx was heavier than the metal, was of little significance to Stahl, who thought of phlogiston as an immaterial "principle" rather than as an actual substance. As chemistry advanced, phlogiston was considered a true substance, and much effort was expended in accounting for the weight changes observed. When hydrogen, very light in weight and extremely flammable, was discovered, some thought it was pure phlogiston.

The phlogiston theory was discredited by Antoine Lavoisier between 1770 and 1790. He studied the gain or loss of weight when tin, lead, phosphorus, and sulfur underwent reactions of oxidation or reduction (deoxidation); and he showed that the newly discovered element oxygen was always involved. Although a number of chemists—notably Joseph Priestley, one of the discoverers of oxygen—tried to retain some form of the phlogiston theory, by 1800 practically every chemist recognized the correctness of Lavoisier's oxygen theory.

phlogopite, also called BROWN MICA, basic aluminosilicate of potassium, magnesium, and iron that is a member of the common mica group. Varieties that contain only small amounts of iron are economically important as electrical insulators. Phlogopite occurs typically as a metamorphic product (*e.g.*, in crystalline metamorphosed limestones), and it also



Phlogopite mica from Warwick, N.Y.
By courtesy of the Field Museum of Natural History, Chicago; photograph, John H. Gerard—EB Inc.

occurs in ultrabasic igneous rocks. Phlogopite forms a chemical substitution series with biotite, from which it is arbitrarily distinguished by a magnesium-to-iron ratio greater than 2:1. For detailed physical properties, *see* mica (table).

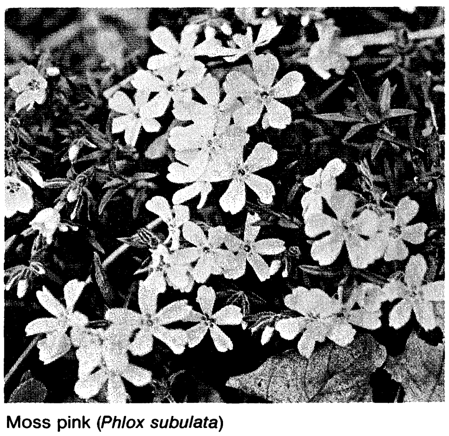
The name phlogopite also denotes an iron-free compound regarded as making up a large part of the mineral. Its chemical composition is $K_2Mg_6(Si_6Al_2O_{20})(OH)_4$.

Phlórina (Greece): *see* Flórina.

Phlox, genus of about 65 species of plants belonging to the family Polemoniaceae, admired both in gardens and in the wilds for their clustered heads of flowers. All species but one from northeastern Asia are native to North America. Phlox is herbaceous, usually with oval or linear leaves; it has heads of massed tubular flowers with five flaring lobes.

Summer phlox (*P. paniculata*) sometimes reaches more than 1½ m (5 feet) high, on straight, stiff stems topped by reddish purple to white, fragrant, large, flat flower heads. It grows in rich, moist soils. Annual phlox (*P. drummondii*) is a 45-centimetre (1½-foot), branching plant with usually reddish purple blooms. It has given rise to many cultivated forms with petals of two colours and starlike shape. Blue phlox (*P. divaricata*) is a spring-flowering woodland perennial growing to 45 cm, with blue to white flower clusters. Perennial phlox (*P. pilosa*), about the same height, bears red-purple flowers on hairy plants in summer in upland woods and prairies of central North America.

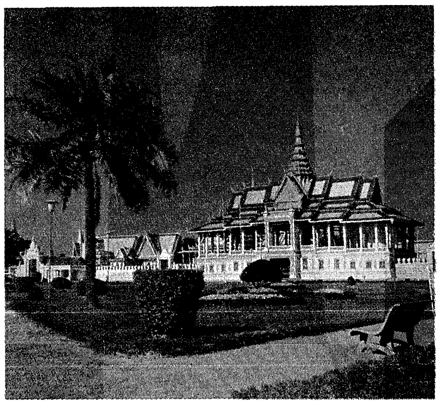
Moss pink, or creeping phlox (*P. subulata*), a low, evergreen mat covered in early spring with blue, purple, pink, or white massed blooms, is native to sandy soil and rocky ledges in eastern North America. Moss pinks, often grown as garden perennials, creep along the soil, branching freely.



Moss pink (*Phlox subulata*)
Russ Kinne—Photo Researchers/EB Inc.

Phnom Penh, Khmer PHNUM PÉNH, also spelled PNOM PENH, or PHOM PENH, capital and chief city of Kampuchea (Cambodia). It lies at the confluence of the Basăk (Bassac), Sab, and Mekong river systems, in the south-central part of the country.

Phnom Penh was founded in 1434 to succeed Angkor Thom as the capital of the Khmer nation but was abandoned several times before being reestablished in 1865 by King Norodom. The city formerly functioned as a processing centre, with textiles, pharmaceuticals, machine manufacturing, and rice milling. Its chief assets, however, were cultural. Institutions of higher learning included the National University of Phnom Penh (founded in 1956 as the Royal Khmer University), with schools of engineering, fine arts, technology, and agricultural sciences, the latter at Chamcar Daung, a suburb. Also located at Phnom Penh were the Royal University of Agronomic Sciences and the Agricultural School of Prek Leap.



The Royal Palace at Phnom Penh, Kampuchea
M. Mattson—Shostal/EB Inc.

The picturesque city of Phnom Penh was built around the royal palace and Preah Morokot Pagoda, the latter known for its floor of silver tiles. The royal palace compound included the royal palace (1919), the Royal Palace Museum, and the Veal Mien (Royal Plain), on which the national congress met twice a year. The Jayavarman VII Art Museum had a display of Khmer jewels, and the National Museum displayed Khmer art and historical documents. The European quarter, in the northern sector of the city, stood at the foot of the high Phnom Penh (Penh Hill), atop which was a pagoda housing the ashes of the legendary Lady Penh, whose discovery of a bronze Buddha there inspired the settlement bearing her name. Phnom Penh's other educational institutions included the independent Buddhist University and institutes for Buddhist and Pāli studies. A world-renowned attraction was the Royal Ballet, until modern times restricted to performances before Cambodian royalty. Its authentically bejeweled dancing girls gave mimed versions of ancient Buddhist and Hindu legends. There was also a national theatre.

When the Khmer Rouge came to power in Cambodia in 1975, they forcibly evacuated the entire population of Phnom Penh and drove its residents into the countryside. The city remained virtually deserted until Vietnamese forces invaded Kampuchea and overthrew the Khmer Rouge in 1979. Phnom Penh was gradually repopulated in the following years. Because of the virtual extermination of Kampuchea's educated class by the Khmer Rouge, the city's educational institutions face a long and difficult period of recovery.

Although situated 180 miles (290 km) from the sea, Phnom Penh is a major port of the Mekong River valley, since it is linked to the South China Sea via Vietnam by the Hau Giang channel of the Mekong Delta. The city trades in dried fish, corn (maize), cotton, and pepper. Four national highway routes and three rail lines converge on the city, linking it with other parts of Kampuchea, with the seaport at Kâmpóng Saôm (formerly Sihanoukville), and with neighbouring Thailand, Vietnam, and Laos. The international airport in nearby Pochentong has flights to Bangkok, Ho Chi Minh City (formerly Saigon), and Hong Kong and to Siĕmréab (Siem Reap), location of ancient Khmer ruins. Pop. (1988 est.) 750,000.

phobia, an extreme, irrational fear of a specific object or situation. A phobia is classified as a type of anxiety disorder, since anxiety is the chief symptom experienced by the sufferer. Phobias are thought to be learned emotional responses. It is generally held that phobias occur when fear produced by an original threatening situation is transferred to other similar situations, with the original fear often repressed or forgotten. An excessive, unreasoning fear of water, for example, may be based on a forgotten childhood experience of almost drowning. The person accordingly tries to avoid that situation in the future, a response that, while reducing anxiety in the short term, reinforces the person's association of the situation with the onset of anxiety.

Behaviour therapy is often successful in overcoming phobias. In such therapy, the phobic person is gradually exposed to the anxiety-provoking object or situation in a controlled manner until he eventually ceases to feel anxiety, having realized that his fearful expectations of the situation remain unfulfilled. In this way, the strong associative links between the feared situation, the person's experience of anxiety, and his subsequent avoidance of that situation are broken and are replaced by a less maladaptive set of responses. Psychotherapy may also be useful in the treatment of phobias.

Although psychiatrists classify phobias as a single type of anxiety disorder, hundreds of words have been coined to specify the nature of the fear by prefixing "phobia" with the Greek word for the object feared. Among the more common examples are acrophobia, fear of high places; claustrophobia, fear of closed places; nyctophobia, fear of the dark; ochlophobia, fear of crowds; xenophobia, fear of strangers; and zoophobia, fear of animals. Agoraphobia, the fear of being in open or public places, is a particularly crippling illness which may prevent its victims from even leaving home. School phobia may afflict schoolchildren who are overly attached to a parent. *See also* anxiety.

Phobos, the inner of the two satellites of Mars. It was discovered by the American astronomer Asaph Hall in 1877. A small, irregular, heavily cratered body about 27 × 22 × 19 km (17 × 14 × 12 miles) across, Phobos circles Mars every 7.65 hours at a distance of 9,378 km (5,814 miles) in a nearly circular orbit that lies only 1° from Mars's equatorial plane. Since the satellite's orbital period is less than the spin period of Mars (24 hours 37 minutes), Phobos moves from west to east in the Martian sky. The surface is covered with a gray, very dark regolith whose reflectance is only about 6 percent, or about one-half that of the lunar surface. These facts and the satellite's low mean density (two grams per cubic centimetre) are consistent with a carbonaceous composition, suggesting that Phobos may be a captured asteroid-like object. Remarkable linear grooves, typically 100 m (328 feet) wide and 20 m (66 feet) deep, cover much of the surface. There is strong evidence that they are associated with the formation of the largest crater on Phobos; this structure, known as Stickney, measures about 10 km (6 mi) across. Precise observations of Phobos' position over the past century suggest that Mars's tides are slowly pulling the satellite toward the planet. If such is the case, Mars will have only one satellite—Deimos—in perhaps 1,000,000,000 years.

An internationally built Mars probe sponsored by the Soviet Union was scheduled to pass within 50 m (164 ft) of Phobos in 1988, using laser and charged-particle beams to analyze surface material.

Phocaea, modern FOÇA, ancient Ionian city on the northern promontory of the Gulf of Smyrna, Anatolia (now the İzmir Körfezi, Turkey); it was the mother city of several Greek colonies. The Phocaeans arrived in Anatolia perhaps as late as the 10th century BC and, lacking arable land, established colonies in the Dardanelles at Lampsacus, on the Black Sea at Amisus (Samsun), and in the Crimea. In the Mediterranean they colonized as far west as Massilia (Marseille) and Emporion (Ampurias in northeastern Spain). When Phocaea was besieged by the Persians about 545 BC, most of the citizens chose emigration rather than submission. In 190 BC, allied with the Seleucids against Rome and Pergamum, the Phocaeans so savagely repelled the Roman forces that the praetor Lucius Aemilius Regillus was obliged to withdraw his men and entreat the citizens not to take the war so seriously; his infuriated troops took advantage of the truce to sack the city. After participating in an uprising against Roman rule in 132 BC, Phocaea was sentenced to destruction but was reprieved through the intercession of its colony Massilia.

Modern Foça is located in an olive- and tobacco-growing region of İzmir *il* (province); it is 70 km (45 mi) from the industrial metropolis of İzmir. Tourists are attracted to ruins of the ancient city and to a commercial resort village. Pop. (1981 prelim.) 6,150.

Phocas (d. 610), Thracian centurion who was Byzantine emperor from 602 to 610.

Following an army rebellion against the emperor Maurice in 602, Phocas was sent to Constantinople as spokesman. There he took advantage of revolts in the capital to get himself chosen emperor in place of Maurice, who, together with his son, was executed. Phocas enjoyed good relations with Rome, his recognition of the primacy of the pope in matters of religion winning him praise from Pope Gregory I. Having made peace with the Avars (604) by agreeing to pay them an increased annual tribute, he had to face the avenging forces of Maurice's ally, Khosrow II, under whom the Persians moved into Asia Minor, reaching the Bosporus by 608. Phocas' persecution of a Christian sect, the Monophysites, and of the Jews brought him the hatred of the Eastern provinces, and in the capital he grew increasingly tyrannical. Fear of the Persians, together with general discontent, led to an appeal to the exarch of Carthage, who in 610 sent an expedition under his son Heraclius; the latter had Phocas executed and was himself proclaimed emperor on Oct. 5, 610. A column honouring Phocas still stands in the Roman Forum.

Phocion (b. *c.* 402 BC—d. 318), Athenian statesman and general, virtual ruler of Athens between 322 and 318. Formidable in the defense of his city, he nevertheless urged Athens to accommodate itself to the Macedonian Empire.

Phocion was a pupil of Plato and in later life a close friend of the Platonic philosopher Xenocrates. After serving Persia as a mercenary, he was drawn into Athens' efforts to remain independent of Macedonia. In 348 his tactical skills saved an Athenian force sent to crush allies of Philip II in Euboea. He helped

"Phocion," marble statue in the Vatican Museum, Rome
Anderson—Art Resource/EB Inc.

Megara (343) and Byzantium (340) defend themselves against Philip, but from about this time he regarded the Macedonians as unstoppable and cultivated diplomatic relations with them in order to avoid outright conquest. Following the death of Alexander the Great in 323, he advised against the Lamian War, though he led the defense against a Macedonian raid into Athenian territory. Sent to sue for peace the next year, he managed to reduce his city's indemnities but was forced to accept the occupation of Athens' port, Piraeus.

Phocion ruled Athens as Macedonia's agent with great moderation and personal honesty. In the power struggle after the death of the regent in 319, however, he was deposed, convicted of treason, and executed by Athenians hoping to restore democracy. Shortly afterward the Athenians decreed a public burial and a statue in his honour.

Articles are alphabetized word by word, not letter by letter

Phocis, Modern Greek FOKÍS, district of ancient central Greece, extending northward from the Gulf of Corinth over the range of Mt. Parnassus to the Locrian Mountains, which formed the northern frontier. In the fertile Cephissus River valley, between the two mountain ranges, lay most of the Phocian settlements: Amphicleia (or Amphicaea), Tithorea, Elatea, Hyampolis, Abae, and Daulis. A mountain spur running south from Mt. Parnassus to the Gulf separated the city of Crisa and its port, Cyrrha, on the Crisaean plain from the port city of Anticyra.

Its early history is obscure; Phocis was mainly pastoral, and the population was thought to be of the Aeolians, one of the earliest Greek-speaking peoples in the peninsula. Before the 6th century BC, however, Boeotians from the east and Thessalians from the north encroached on their territory. Traditionally, the Phocians controlled the sanctuary of Delphi; pilgrims landing at Cyrrha on their way to the sacred oracle were tolled heavily on the road through Crisa. Galled by this impiety, a coalition of Greek states in about 590 BC proclaimed a sacred war, destroyed Crisa, and put the sanctuary under the control of a council administered jointly by neighbouring communities. The irresolute conduct of the Phocians contributed to the Greek defeat by Persia at Thermopylae (480); at Plataea they were on the Persian side. In 449 or 448 the Spartans expelled the Phocians from Delphi but with the help of their new ally, Athens, they soon recaptured it. When Athenian land power declined, Phocis wavered again and became an ally of Sparta in the Peloponnesian War (431–404 BC).

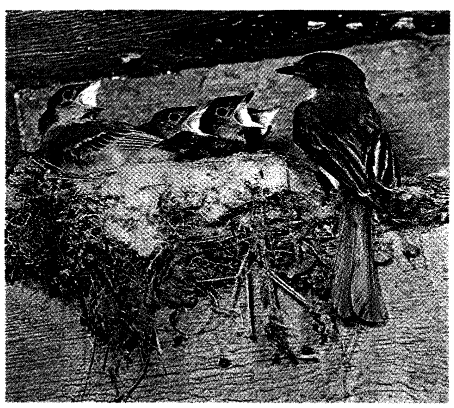
In the 4th century Phocis was constantly endangered by Boeotian aggression. During the Corinthian War (395–387) Phocis helped Sparta to invade Boeotia, but afterward it submitted to the growing power of Boeotia's principal city, Thebes. Phocians took part in the Theban Epaminondas' campaigns in the Peloponnese (370–366) but not in the successful campaign of Mantineia (362). In return for this negligence the Thebans secured a penal decree against them (for religious offenses). The Phocians retaliated by seizing Delphi, which they looted to finance mercenaries for an invasion of Boeotia and Thessaly; they were driven out of Delphi by Philip II of Macedon, who split their towns into villages and exacted an indemnity (346). During the 3rd century Phocis passed under the control of Macedonia; it was annexed to the Aetolian League in 196.

Ancient Phocis corresponds to the southeastern portions of present Fthiótis and Fokís *nomoi* (departments), whose capitals are Lamía and Amphissa (*qq.v.*), respectively. The agriculture of the area includes wheat, olives, and grapes; livestock are also important. Bauxite is mined in the Parnassian range, and there is an aluminum-reducing plant at Aspra Spítia, near ancient Anticyra. The small port of Itéa, near the site of Cyrrha, serves tourists on their way to Delphi.

Phocus, in Greek mythology, the son of Aeacus, king of Aegina, and the Nereid Psamathe, who had assumed the likeness of a seal (Greek *phoce*) in trying to escape Aeacus' embraces. Peleus and Telamon, Aeacus' legitimate sons, resented Phocus' superior athletic prowess. At the instigation of their mother, Endeis, they plotted his death, drawing lots to decide which should destroy him. The lot fell on Telamon, who murdered Phocus, feigning an accident. Aeacus, however, discovered the truth and banished both his sons.

Phoebe, in Greek mythology, a Titan, daughter of Uranus and Gaea. By Coeus she was the mother of Leto and grandmother of Apollo and Artemis. She was also the mother of Asteria and Hecate. Her epithet was Gold-Crowned, but her name, like Apollo's forename Phoebus, signified brightness. In later mythology she was identified with the moon as were Artemis and her Roman counterpart Diana. *See also* Selene.

phoebe, any of three species of New World birds of the family Tyrannidae (order Passer-



Eastern phoebe (*Sayornis phoebe*)
John Hennessy—The National Audubon Society Collection/Photo Researchers

iformes). In North America the best known species is the eastern phoebe (*Sayornis phoebe*), 18 centimetres (7 1/2 inches) long, plain brownish gray above and paler below. Its call is a brisk "fee-bee" uttered over and over. It makes a mossy nest, strengthened with mud, on a ledge, often under a bridge. In the open country of western North America is Say's phoebe (*S. saya*), a slightly larger bird with buff-hued underparts. The most widely distributed is the black phoebe (*S. nigricans*), occurring from the southwestern United States to Argentina; it is dark above, with a contrasting white belly. All phoebes have the habit of twitching their tails when perching.

Phoebe, outermost known satellite of Saturn. About 220 kilometres (136 miles) in diameter, the satellite has a mean distance from Saturn of about 12,952,000 km (8,030,240 mi). The orbit is significantly eccentric, retrograde, and steeply inclined to the plane of Saturn's rings and regular satellites. Thus it seems possible that Phoebe may be a captured object similar to an asteroid, rather than a primordial satellite of Saturn.

Phoebe Island (Pacific Ocean): *see* Baker Island.

Phoebus (Greek god): *see* Apollo.

Phoenicia, ancient region corresponding to modern Lebanon with adjoining parts of modern Syria and Israel. The chief cities (excluding colonies) were Gebal (Greek: Byblos, modern Jubayl); Sidon (modern Ṣaydā); Tsor (Greek: Tyros, modern Tyre, Arabic: Ṣūr); and Berot (Greek: Berytos, modern Beirut).

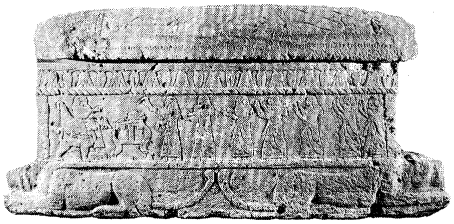
It is not certain what the Phoenicians called themselves in their own language; it appears to have been Kena'ani (Akkadian: Kinahna), "Canaanites." In Hebrew the word *kena'ani* has the secondary meaning of "merchant," a term that well characterizes the Phoenicians. The Phoenicians probably arrived in the area about 3000 BC. Nothing is known of their original homeland, though some traditions place it in the region of the Persian Gulf.

At Byblos, commercial and religious connections with Egypt are attested from the Egyptian 4th dynasty (*c.* 2613–*c.* 2494); extensive trade was certainly carried on by the 16th century, and the Egyptians soon established suzerainty over much of Phoenicia. The 14th century, however, was one of much political unrest, and Egypt eventually lost its hold over the area. Beginning in the 9th century, the independence of Phoenicia was increasingly threatened by the advance of Assyria, the kings of which several times exacted tribute and took control of parts or all of Phoenicia. In 538 Phoenicia passed under the rule of the Persians. The country was later taken by Alexander the Great and in 64 BC was incorporated into the Roman province of Syria; Aradus, Sidon, and Tyre, however, retained self-government. The oldest form of Phoenician government seems to have been kingship—limited by the power of the wealthy merchant families. Federation of the cities on a large scale never seems to have occurred.

The Phoenicians were well known to their contemporaries as sea-traders and colonizers, and by the 2nd millennium they had already extended their influence along the coast of the Levant by a series of settlements, including Joppa (Jaffa, modern Yafo), Dor, Acre, and Ugarit. Colonization of areas in North Africa (*e.g.,* Carthage), Anatolia, and Cyprus also occurred at an early date. Several smaller Phoenician settlements were planted as stepping stones along the route to Spain and its mineral wealth. Phoenician exports included cedar and pine wood, fine linen from Tyre, Byblos, and Berytos, cloths dyed with the famous Tyrian purple (made from the snail *Murex*), embroideries from Sidon, wine, metalwork and glass, glazed faience, salt, and dried fish. In addition, the Phoenicians conducted an important transit trade.

Phoenician glass vessels from Camirus (left) and from Tharros (right) inlaid with threads of different colours; in the British Museum
By courtesy of the trustees of the British Museum

In the artistic products of Phoenicia, Egyptian motifs and ideas were mingled with those of Mesopotamia, the Aegean, and Syria. Though little survives of Phoenician sculpture in the round, relief sculpture is much more abundant. The earliest major work of Phoenician sculpture to survive was found at Byblos; it was the limestone sarcophagus of Ahiram, king of Byblos at the end of the 11th century.



Carved limestone sarcophagus of Ahiram bearing a Phoenician inscription, 11th century BC; in the Musée National, Beirut
By courtesy of the National Museum of Lebanon, Beirut

Ivory and wood carving became Phoenician specialties, and Phoenician goldsmiths' and metalsmiths' work was also well known. Glassblowing was probably invented in the coastal area of Phoenicia in the 1st century or earlier.

Although the Phoenicians used cuneiform (Mesopotamian writing), they also produced a script of their own. The Phoenician alphabetic script of 22 letters was used at Byblos as early as the 15th century. This method of writing, later adopted by the Greeks, is the ancestor of the modern Western alphabet. It was the Phoenicians' most remarkable and distinctive contribution to arts and civilization.

The religion of the Phoenicians was inspired by the powers and processes of nature. Many of the gods they worshipped, however, were localized and are now known only under their local names. A pantheon was presided over by the father of the gods, El; Asherah of the Sea was his wife and their mother. Of his family, the goddess Astarte (Ashtart) was the principal figure.

Phoenician alphabet, writing system that developed out of the North Semitic alphabet and was spread over the Mediterranean area by Phoenician traders. It is the probable ancestor of the Greek alphabet and, hence, of all Western alphabets. The earliest Phoenician inscription that has survived is the Ahiram epitaph at Byblos in Phoenicia, dating from the 11th century BC and written in the North Semitic alphabet. The Phoenician alphabet gradually developed from this North Semitic prototype and was in use until about the 1st century BC in Phoenicia proper. Phoenician colonial scripts, variants of the mainland Phoenician alphabet, are classified as Cypro-Phoenician (10th–2nd centuries BC) and Sardinian (*c.* 9th century BC) varieties. A third variety of the colonial Phoenician script evolved into the Punic and neo-Punic alphabets of Carthage, which continued to be written until about the 3rd century AD. Punic was a monumental script and neo-Punic a cursive form.

The Phoenician alphabet in all its variants changed from its North Semitic ancestor only in external form—the shapes of the letters varied a little in mainland Phoenician and a good deal in Punic and neo-Punic. The alphabet remained, however, essentially a Semitic alphabet of 22 letters, written from right to left, with only consonants represented and phonetic values unchanged from the North Semitic script. *See also* Semitic alphabet, North.

Phoenician language, Semitic language of the Northern Central (often called Northwestern) group, spoken in ancient times on the coast of Syria and Palestine in Tyre, Sidon, Byblos, and neighbouring towns, and in other areas of the Mediterranean colonized by Phoenicians. Phoenician is very close to Hebrew and Moabite, with which it forms a Canaanite subgroup of the Northern Central Semitic languages. The earliest Phoenician inscription deciphered dates probably from the 11th century BC; the latest inscription from Phoenicia proper is from the 1st century BC, when the language was already being superseded by Aramaic.

In addition to being used in Phoenicia, the language spread to many of its colonies. In one, the North African city of Carthage, a later stage of the language, known as Punic, became the language of the Carthaginian Empire. Punic was influenced throughout its history by the language of the Berbers and continued to be used by North African peasants until the 6th century AD.

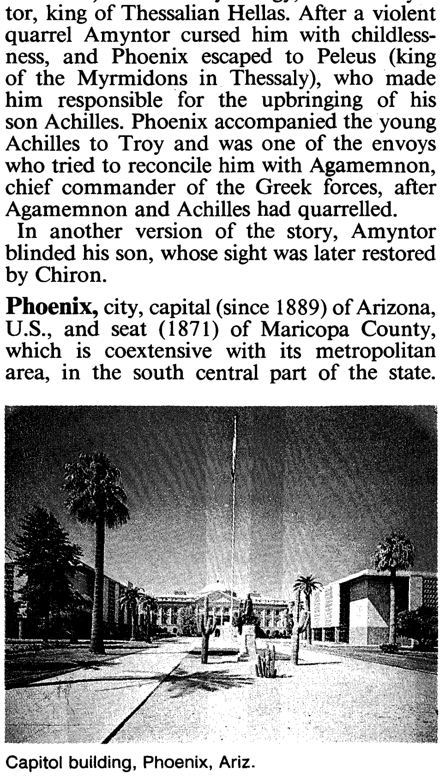
Phoenician words are found in Greek and Latin classical literature as well as in Egyptian, Akkadian, and Hebrew writings. The language is written with a 22-character alphabet that does not indicate vowels.

Phoeniculidae (bird family): *see* wood hoopoe.

Phoenix, in Greek mythology, son of Amyntor, king of Thessalian Hellas. After a violent quarrel Amyntor cursed him with childlessness, and Phoenix escaped to Peleus (king of the Myrmidons in Thessaly), who made him responsible for the upbringing of his son Achilles. Phoenix accompanied the young Achilles to Troy and was one of the envoys who tried to reconcile him with Agamemnon, chief commander of the Greek forces, after Agamemnon and Achilles had quarrelled.

In another version of the story, Amyntor blinded his son, whose sight was later restored by Chiron.

Phoenix, city, capital (since 1889) of Arizona, U.S., and seat (1871) of Maricopa County, which is coextensive with its metropolitan area, in the south central part of the state.



Capitol building, Phoenix, Ariz.
Markow Photography

On the Salt River, it occupies a semiarid, saucer-shaped valley, surrounded by mountains and green irrigated fields, west and south of the Tonto National Forest. In 1867 Jack Swilling visited the area and organized an irrigation company; canals and harvests followed, and a village was founded. An associate of Swilling, Darrel Duppa, was impressed by evidences of a prehistoric culture, the Hohokam. Like the legendary phoenix that, consumed by fire, arose from its own ashes, so, Duppa predicted, would the Salt River city be born from the ancient Indian ruins.

Phoenix developed as the commercial focus of the extensive Salt River irrigation projects, fed from the Roosevelt and other dams. Diversified manufacturing (almost nonexistent before 1940) has become the chief source of income, augmented by agriculture, mining, timbering, tourism, and military airfields and test stations. The city experienced rapid growth after World War II and expanded widely in area (248 sq mi [643 sq km]); it embraces the Desert Botanical Gardens and Papago Park. The original State Capitol building is constructed of native tufa in neoclassic style. Phoenix Civic Plaza is a six-square-block convention centre. Educational institutions include Phoenix College (1920), Grand Canyon College (1949), American Graduate School of International Management, Thunderbird Campus (1946), Southwestern College (1960), DeVry Institute of Technology (1967), and Maricopa Technical Community College (1968). Arizona State University is at nearby Tempe. Annual events are the Copper Bowl parade and football game, the World's Championship Rodeo, and the Arizona State Fair. The city is the home of many professional sports teams. Inc. 1881. Pop. (1970) city, 581,562; metropolitan area (SMSA), 967,-522; (1980) city, 789,704; metropolitan area (SMSA), 1,508,030.

phoenix, in ancient Egypt and in classical antiquity, a fabulous bird associated with the worship of the sun. The Egyptian phoenix was said to be as large as an eagle, with brilliant scarlet and gold plumage and a melodious cry. Only one phoenix existed at any time, and it was very long-lived—no ancient authority gave it a life span of less than 500 years. As its end approached, the phoenix fashioned a nest of aromatic boughs and spices, set it on fire, and was consumed in the flames. From the pyre miraculously sprang a new phoenix, which, after embalming its father's ashes in an egg of myrrh, flew with the ashes to Heliopolis ("City of the Sun") in Egypt, where it deposited them on the altar in the temple of the Egyptian god of the sun, Re. A variant of the story made the dying phoenix fly to Heliopolis and immolate itself in the altar fire, from which the young phoenix then rose.

The *bennu,* a heron, was traditionally associated with sun worship in Egypt, appearing on monuments as a symbol of the rising sun and of the life after death. But despite the common religious associations, the phoenix as described in literature did not at all resemble a heron in appearance, and its home was not in Egypt but nearer the rising sun (normally in Arabia or India, where spices for the nest and egg were plentiful). Probably the phoenix story originated in the Orient and was assimilated to Egyptian sun worship by the priests of Heliopolis. The adaptation of the myth to an Egyptian environment helped to bring about the connection between the phoenix and the palm tree (also called *phoinix* in Greek), which was long associated with sun worship in Egypt.

The Egyptians associated the phoenix with immortality, and that symbolism had a widespread appeal in late antiquity. The phoenix was compared to undying Rome, and it appears on the coinage of the late Roman Empire as a symbol of the Eternal City. It was also widely interpreted as an allegory of resurrection and life after death—ideas which also appealed to emergent Christianity.

In Islamic mythology the phoenix was identified with the *'anqā'* (Persian *sīmorgh*), a huge, mysterious bird (probably a heron) that was originally created by God with all perfections but had thereafter become a plague and was killed.

Phoenix Islands, group of uninhabited coral atolls, part of Kiribati, in the west central Pacific Ocean, 1,650 mi (2,650 km) southwest of Hawaii. The group comprises Phoenix (Rawaki), Sydney (Manra), McKean, Gardner (Nikumaroro), Birnie, Hull (Orona), Kanton (Canton), and Enderbury atolls. They have a total land area of about 11 sq mi (28 sq km). All are low, sandy atolls that were discovered in the 19th century by U.S. whaling ships. Several also were worked for their limited supplies of guano. The islands, annexed by Britain in 1889, were joined to the Gilbert and Ellice Islands Colony in 1937. Settlement of Sydney, Gardner, and Hull islands by Gilbertese colonists in 1938 proved infeasible over time because of inconsistent rainfall. The entire populaiton was moved to the Solomon Islands in 1958 and 1963. After 1939 Kanton and Enderbury were under joint U.S.–British administration for use as stops on transpacific airline flights. Starting in 1970, the United States used Kanton Atoll for missile tracking. All of the Phoenix Islands became part of independent Kiribati in 1979.

Phoenix Park murders (May 6, 1882), assassination by stabbing, in Dublin, of the chief secretary of Ireland, Lord Frederick Cavendish, and his under secretary, T.H. Burke. The Chief Secretary had arrived in Dublin only that day and was walking in the city's Phoenix Park in the evening when set upon by members of a nationalist secret society, the Invincibles.

The event occurred just after Charles Stewart Parnell, leader of the Irish Home Rule party in the British House of Commons, was released from Kilmainham jail, Dublin, where he had been confined for his violent speeches against the Land Act (1881), which he considered insufficient land-reform legislation. The result of the assassinations was a revulsion against terrorism. Parnell, who had just compromised with the British government over the land question, was consequently able to subordinate the Irish National League, a nationalist organization, to the more moderate Home Rule Party in Parliament.

Phoenixville, borough, Chester County, southeastern Pennsylvania, U.S., on the Schuylkill River between French and Pickering creeks, 28 mi (45 km) west of Philadelphia. The site was originally settled in 1720 by the Rev. Francis Buckwalter, a German refugee, and the town was founded (1731) by his followers. It marked the most westerly point reached by the British in Pennsylvania during the U.S. War of Independence. The steel industry dates from around 1785 beginning with Benjamin Longstreth's unsuccessful iron forge. Other forges, including Lewis Wernwag's Phoenix Iron Works (1813), which gave the borough its name, were established. In 1856 John Griffen, superintendent of the Phoenix Iron Works, turned out the first Griffen gun (a light cannon), later used by the Federal Army during the Civil War. Steel remains economically important. Light manufactures include textiles, paper and rubber products, abrasives, and chemicals. Phoenixville is the seat of Valley Forge Christian College. Inc. 1849. Pop. (1980) 14,165.

Phom Penh (Kampuchea): *see* Phnom Penh.

phon, unit of loudness level. The loudness level of a sound is a subjective, rather than an objective, measure. To measure loudness, the volume of a 1,000-hertz reference tone is adjusted until it is perceived by listeners to be equally as loud as the sound being measured. The loudness level, in phons, of the measured sound is then equal to the sound-pressure level, in decibels, of the adjusted reference sound above the standard reference level, which is the minimum audible threshold. A variation of one phon in the loudness level of a sound is approximately the smallest change in sound-pressure level detectable by the human ear under normal listening conditions.

phoneme, in linguistics, smallest unit of speech distinguishing one word (or word element) from another, as the sound *p* in "tap," which separates that word from "tab," "tag," and "tan." A phoneme may have more than one variant, called allophones (*q.v.*), which function as a single sound; for example, the *p* of "pat," "spat," and "tap" differ slightly phonetically, but that difference, determined by context, has no significance in English. In some languages, where the variant sounds of *p* can change meaning, they are classified as separate phonemes—*e.g.,* in Thai the aspirated *p* (pronounced with an accompanying puff of air) and unaspirated *p* are distinguished. Phonemes are based on spoken language and may be recorded with special symbols, like those of the International Phonetic Alphabet (*q.v.*). In transcription, linguists conventionally place symbols for phonemes between slash marks: /p/. The term phoneme is usually restricted to vowels and consonants, but some linguists extend its application to cover phonologically relevant differences of pitch, stress, and rhythm. Nowadays the phoneme has a less central place in phonological theory than it used to have, especially in American linguistics. Many linguists regard the phoneme as a set of simultaneous distinctive features, rather than as an unanalyzable unit.

phonemics, in linguistics, the study of the phonemes and phonemic system of a language. For linguists who analyze phonological systems wholly in terms of the phoneme, phonemics is coextensive with phonology (*q.v.*).

phonetics, the study of how speech sounds are made (articulatory phonetics), the acoustic properties of speech sounds (acoustic phonetics), and how speech sounds are organized in language (linguistic phonetics).

The first phoneticians were Indian scholars who, 2,300 years ago, tried to preserve the correct pronunciation of their Sanskrit holy texts so that the sacred sounds were not modified in transmission. The classical Greeks are credited with being the first to develop a writing system based on a phonetic alphabet. Some works of articulatory phonetics were produced in the 17th century. Modern phonetics began with the publication in 1867 of *Visible Speech* by Alexander Melville Bell; this book introduced a notation for writing down speech sounds with sufficient precision to permit thorough investigation of human phonological activity.

The modern emphasis in phonetics is toward developing a system of classification that can permit all human speech sounds to be compared. Linguists Noam Chomsky and Morris Halle have put forward a checklist of 30 properties that they maintain can be used to specify every different significant speech sound. Another concern of phonetics is the investigation of the mental processes by which speech is perceived. Some experiments have suggested that people understand speech elements less by identifying their acoustic properties than by identifying the motor activity used in making the utterances; this theory is supported by the observation that people have difficulty hearing the differences between sounds that they themselves are unable to produce in pronunciation.

Phôngsali, formerly PHONG SALY, town, extreme northern Laos. It lies in the northern tip of Laos, between Yunnan province, China, and northern Vietnam. The mountainous surrounding area was a trouble spot for the colonial French, who fought Chinese bandits there during World War I. The area in 1962 became a refuge for Pathet Lao insurgents, who used the Ou River valley to launch attacks on the former royal capital, Luang Prabang (now Louangphrabang), 125 miles (200 km) south of Phôngsali. The river valleys of the area are occupied by valley Lao, who raise rice and corn (maize). Phôngsali town is a small market centre that is served by the port of Hat Sa on the Ou River and is linked by road to Chiang-ch'eng, China. Pop. (latest est.) town, 3,000.

phonocardiography, diagnostic technique that creates a graphic record, or phonocardiogram, of the sounds and murmurs produced by the heart and associated great vessels. The phonocardiogram is obtained either by acoustic pickup with a chest microphone or with a miniature sensor in the tip of a small tubular instrument that is introduced into one of the heart chambers. The phonocardiogram usually supplements the information obtained by listening to body sounds with a stethoscope (auscultation) and is of special diagnostic value when performed simultaneously with measurement of the electrical properties of the heart (electrocardiography) and pulse rate.

Phonofilm, system used in the 1920s to provide sound synchronized with motion pictures. A sound track was photographically recorded on the film by a beam of light modulated by the sound waves. The sound was reproduced during projection by directing a beam of light through the sound track onto a photocell, the response of which was electronically amplified.

phonograph, also called RECORD PLAYER, instrument for reproducing sounds by means of the vibration of a stylus, or needle, following a groove on a rotating disc or cylinder. Though experimental mechanisms of this type appeared as early as 1857, the invention of the phonograph is generally credited to the United States inventor Thomas Edison (1877).

All modern phonographs have certain components in common: a turntable that spins the record; a stylus that tracks a groove in the record; a pickup that converts the mechanical movements of the stylus into electrical impulses; an amplifier that intensifies these electrical impulses; and a loudspeaker that converts the amplified signals back into sound. Some phonographs are also equipped with a record changer. A phonograph capable of undistorted reproduction of sound is one component of what is known as a high-fidelity sound system (*q.v.*). *See also* sound recording.

phonolite, any member of a group of extrusive igneous rocks (lavas) that are rich in nepheline and potash feldspar. The typical phonolite is a fine-grained, compact igneous rock that splits into thin, tough plates which make a ringing sound when struck by a hammer, hence the rock's name.

The most important constituent of phonolite is alkali feldspar, either sanidine or anorthoclase, which forms not only the bulk of the groundmass (matrix) but most of the large crystals (phenocrysts) in porphyritic varieties. Nepheline rarely appears in large crystals but may occur either interstitially or in well-formed microphenocrysts. The principal dark-coloured mineral is pyroxene: aegirine or titaniferous augite. Pyroxene phenocrysts occur as well-formed crystals; in the groundmass, pyroxene occurs characteristically as slender needles, often abundant enough to colour the rock green. An alkaline amphibole nearly always occurs as phenocrysts; barkevikite, riebeckite, or arfvedsonite are typical. Feldspathoids other than nepheline may be present as accessory minerals; the most common are noselites, sodalite, and leucite. Glass has been reported occasionally, but only in small amounts.

Most phonolites are of Tertiary or Recent age and therefore formed within about the last 66 million years; but excellent examples occur at several localities in the Carboniferous strata of Scotland and Brazil, which means that they are at least 286 million years old. Tertiary or Recent phonolites are common in Europe, as in Auvergne, France; the Eifel plateau and the Laacher See, Germany; Czechoslovakia; and the Mediterranean area (chiefly in Italy). They also occur at Cripple Creek, Colorado, and the Black Hills, South Dakota; Devil's Tower, Wyoming, is variously described as tinguaite or phonolite, depending on whether it is considered a volcanic plug or a flow.

Leucite phonolites are perhaps best known from the vicinity of Naples. Apachite, from the Apache Mountains, Texas, is an amphibole phonolite. Kenyite, from Mount Kenya, in east Africa, is rich in olivine. The phonolite of Olbrück, Ger., a rather popular local building stone, is said to contain about 15 percent noselite and 8 percent leucite. Phonolite trachytes occur on St. Helena and a number of other volcanic islands.

phonology, study of the sound patterns that occur within languages. Some linguists include phonetics, the study of the production and description of speech sounds, within the study of phonology. Diachronic (historical) phonology examines and constructs theories about the changes and modifications in speech sounds and sound systems over a period of time. For example, it is concerned with the process by which the English words "sea" and "see," once pronounced with different vowel sounds (as indicated by the spelling), have come to be pronounced alike today. Synchronic (descriptive) phonology investigates sounds at a single stage in the development of a language, to discover the sound patterns that can occur. For example, in English, *nt* and *dm* can appear within or at the end of words ("rent," "admit") but not at the beginning.

phonon, in solid-state physics, quantum of lattice vibrational energy. In analogy to a photon (a quantum of light), the phonon can be viewed as a wave packet with particle-like properties. Its behaviour characteristics determine or affect various properties of solids. The concept of the phonon is, for example, particularly useful in the theory of the thermal conductivity of insulators. It has been found that ionic crystals are better thermal insulators than metals. In such a crystal, so-called anharmonic forces exist that cause different phonons to interact with one another. This interaction in turn enables the phonons to transmit heat energy to the crystal as a whole, resulting in the establishment of a smooth temperature variation throughout the solid.

Phonons also provide a basis for understanding the property of superconductivity in certain metals. In most metallic solids phonons, along with impurities, scatter individual electrons. Under certain conditions, however, the interaction between phonons and electrons has quite a different effect and leads to an interaction between the electrons themselves. This action couples together electrons with energies near the Fermi level. At temperatures near absolute zero (−273.15° C), its effects are sufficient to cause these electrons to move as a coherent group through the medium. Thus, after an electric current has been set up, phonons must produce a change in the motion of the entire group of coupled electrons rather than simply scatter individual electrons. Because the relatively weak, thermally excited phonons are not able to do so, they move through the lattice without scattering. As a consequence, a current set up in the material persists indefinitely, and the metal becomes a superconductor of zero resistance.

phorate, generically, a powerful pesticide effective against insects, mites, and nematodes. It is a systemic insecticide that acts by inhibiting cholinesterases, enzymes involved in transmitting nerve impulses. Chemically, it is an organophosphate, *O,O*-diethyl *S*-(ethylthio)methyl phosphorodithioate. Like all organophosphates, it is related to the nerve gases and is among the most toxic of all pesticides to vertebrates, including humans.

As a systemic, phorate is taken up by the roots of plants and translocated to the parts above ground, where it is concentrated in new leaves and fruits and kills sucking pests that consume sufficient plant sap containing the chemical.

Because of its persistence in soil it is most useful in controlling soil-dwelling nematodes (microscopic roundworms that suck plant roots and transmit disease thereby). It is not recommended for use by the homeowner because it is extremely toxic and persistent.

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

phoresy, transportation of a minute parasite, such as a mite or a feather louse (Mallophaga), by a larger, more mobile parasite (*e.g.,* a hippoboscid fly) of the same host, enabling the smaller parasite to colonize new host individuals. Feather lice accomplish phoresy by clinging to the body hairs of blood-sucking flies.

Phormion (d. *c.* 428 BC), brilliant Athenian admiral who won several engagements before and during the Peloponnesian War.

Phormion was one of the generals leading reinforcements to the Athenian siege of Samos in 440. He assisted the Acarnanians and Amphilochians against Ambracia, which resulted in an alliance with Acarnania that was useful to Athens. In 432–431 he headed the siege of Potidaea and was sent with 20 ships to block the entrance to the Gulf of Corinth. There in the summer of 429 he won two brilliant victories. In the first, he defeated 47 Peloponnesian ships that were advancing to reinforce the Spartan Cnemus' campaign in Acarnania; in the second battle, he routed Cnemus' 77-vessel fleet.

phormium (*Phormium tenax*), Portuguese FORMIO, a plant of the family agave (Agavaceae), and its fibre, belonging to the leaf fibre (*q.v.*) group. The plant is native to New Zealand, where the fibre, sometimes called New Zealand "hemp," or "flax," has been used since ancient times for cordage, fabrics, and baskets. It has been grown in southern Ireland, mainly as an ornamental plant, since 1798 and was later introduced to parts of Europe; commercial plantings were started in St. Helena, the Azores, Australia, southern Africa, and Japan. In the 1930s cultivation was established in the South American countries of Brazil, Chile, and Argentina.

The plant is composed of about 8 to 12 shoots growing from a central rootstock. Each shoot bears at least five dark green, lance-shaped leaves arranged in fanlike form. The leaves, tapering to a point from a base about 2 inches (5 cm) wide, are about 3 to 14 feet (0.9 to 4.2 m) long, with smooth, hard outer surfaces and undersides marked with a middle rib. The flower stalk grows from the plant centre to a height of 12 to 15 feet (3.6 to 4.5 m) and bears bunches of yellow flowers, each about 1.5 inches (3.8 cm) long. The numerous black seeds are flat and shiny.

Crops are adaptable to various soils but grow best in well-drained, loose, moderately rich soil and in temperate climates with moderate rainfall. Plants are propagated from shoots of mature roots (rhizomes) or sometimes from seed and are spaced 4 to 6 feet (1.2 to 1.8 metres) apart. The first leaves are ready for harvesting four to six years after planting, and additional leaves can be taken at intervals of one to four years thereafter. At each harvest three to four outer leaves are taken from each shoot. They are cut off by hand, 6 to 8 inches (15 to 20 centimetres) above the point at which they grow from the stalk, since lower cutting would free the red-coloured plant juice, staining the fibre.

In commercial processing the leaves, sorted according to quality and length, are subjected to machine decortication, a crushing and scraping process that frees the fibre. The fibre strands are then washed and sun-dried to promote bleaching and bring out lustre. Phormium, creamy white when carefully processed, is flexible, with fair strength and good lustre, and is resistant to damage in saltwater. It is used in twines and ropes and also made into bagging fabrics and such items as mats and shoe soles.

phoronid (marine invertebrate): *see* horseshoe worm.

phosgene, also called CARBONYL CHLORIDE, a colourless, chemically reactive, highly toxic gas having an odour like that of musty hay, used in making organic chemicals, dyestuffs, polycarbonate resins, and isocyanates for making polyurethane resins. It first came into prominence during World War I, when it was used, either alone or mixed with chlorine, against troops. Inhalation causes severe lung injury, the full effects appearing several hours after exposure.

First prepared in 1811, phosgene is manufactured by the reaction of carbon monoxide and chlorine in the presence of a catalyst. It can be formed by the thermal decomposition of chlorinated hydrocarbons; *e.g.,* when carbon tetrachloride (*q.v.*) is used as a fire extinguisher. Gaseous phosgene, which has a density about three and one-half times that of air, liquefies at a temperature of 8.2° C (46.8° F); it is usually stored and transported as the liquid under pressure in steel cylinders or as a solution in toluene. With water, phosgene reacts to form carbon dioxide and hydrochloric acid.

phosphate, any of numerous chemical compounds related to phosphoric acid (H_3PO_4). One group of these derivatives is composed of salts containing the phosphate ion (PO_4^{3-}), the hydrogen phosphate ion (HPO_4^{2-}), or the dihydrogen phosphate ion ($H_2PO_4^-$), and positively charged ions such as those of sodium or calcium; a second group is composed of esters, in which the hydrogen atoms of phosphoric acid have been replaced by organic combining groups such as ethyl (C_2H_5) or phenyl (C_6H_5).

phosphate mineral, any of a group of naturally occurring inorganic salts of phosphoric acid, $H_3(PO_4)$. More than 200 species of phosphate minerals are recognized, and structurally they all have isolated (PO_4) tetrahedral units. Phosphates can be grouped as: (1) primary phosphates that have crystallized from a liquid; (2) secondary phosphates formed by the alteration of primary phosphates; and (3) rock phosphates formed at low temperatures from phosphorus-bearing organic material.

Primary phosphates usually crystallize from aqueous fluids derived from the late stages of crystallization. Particularly common in granitic pegmatites are the primary phosphates apatite [$Ca_5(F,Cl,OH)(PO_4)_3$], triphylite [$LiFePO_4$], lithiophilite [$LiMnPO_4$], and the rare-earth phosphates monazite [$(LaCe)(PO_4)$] and xenotime [$Y(PO_4)$]. Primary phosphates commonly occur in ultrabasic rocks (*i.e.,* those very low in silica), including carbonatites and nepheline syenites. Metamorphic apatite occurs in calc-silicate rocks and impure limestones.

Secondary phosphates are extremely varied, forming at low temperatures, in the presence of water, and under variable oxidation states. Both di- and tri-valent oxidation states of iron and manganese are usually present, producing brilliant colours. Two common species are strengite [$Fe(PO_4)(H_2O)_2$] and vivianite [$Fe_3(PO_4)(H_2O)_8$].

Rock phosphates develop from bones, shells, and diatoms, but are poorly characterized because of their fine grain-size. Deposits of such phosphates do, however, occur on a wide-scale basis.

For individual phosphate minerals and their properties, *see* Table, pages 396–397. For additional information, *see also* the separate entry for each of the varieties listed therein.

phosphate rock: *see* phosphorite.

phosphine (PH_3), also called HYDROGEN PHOSPHIDE, a colourless, flammable, extremely toxic gas, with a disagreeable, garlic-like odour. Phosphine is formed by the action of a strong base or hot water on white phosphorus or by the reaction of water with calcium phosphide (Ca_3P_2). Phosphine is structurally similar to ammonia (NH_3), but phosphine is a much poorer solvent than ammonia and is much less soluble in water.

Organic compounds with bonds between phosphorus and carbon or hydrogen are named as derivatives of phosphine; in primary, secondary, and tertiary phosphines, one, two, and three hydrogen atoms have been replaced by organic combining groups. Thus methylphosphine (CH_3PH_2) is a primary phosphine, in which the methyl group (CH_3) takes the place of one of the hydrogen atoms of phosphine itself. The metal salts are called phosphides, and the protonated forms (compounds to which a hydrogen ion has been added) are called phosphonium compounds. The organic derivatives of phosphine are usually made by substitution reactions using the readily available phosphorus trichloride (PCl_3).

phosphofructokinase, enzyme that is important in regulating the process of fermentation, by which one molecule of the simple sugar glucose is broken down to two molecules of pyruvic acid. The enzyme, one of a class called transferases, catalyzes one of several specific reactions involved in this breakdown—the formation of fructose-1,6-diphosphate and adenosine diphosphate (ADP) from fructose-6-phosphate and adenosine triphosphate (ATP); its activity is sensitive to the ATP/ADP ratio in the cell.

phospholipid, also called PHOSPHATIDE, any member of a large class of fatlike, phosphorus-containing substances that play important structural and metabolic roles in living cells. The phospholipids, with the sphingolipids, the glycolipids, and the lipoproteins, are called compound lipids, as distinguished from the simple lipids (fats and waxes) and from other fat-soluble cell components, mostly isoprenoids and steroids. The term phosphoglyceride is used by some as a synonym for phospholipid and by others to denote a subgroup of phospholipids.

In general, phospholipids are composed of a phosphate group, two alcohols, and one or two fatty acids. On one end of the molecule are the phosphate group and one alcohol; this end is polar, *i.e.,* has an electric charge, and is attracted to water (hydrophilic). The other end, which consists of the fatty acids, is neutral; it is hydrophobic and water-insoluble but is fat-soluble. This amphipathic nature (containing both hydrophobic and hydrophilic groups) makes phospholipids important in membranes; they form a two-layer structure with the polar head facing out on each surface to interact with water, and with the neutral "tails" driven inward and pointing toward one another. This structural arrangement of membranes is nearly impermeable to ions and most polar molecules. Proteins embedded in the phospholipid matrix transport many substances across the membrane.

Lecithin (*q.v.;* phosphatidyl choline) and the cephalins (phosphatidyl ethanolamine and phosphatidyl serine) are groups of phospholipids of widespread occurrence in plants and animals; lecithin is the most abundant, but is rare in microorganisms.

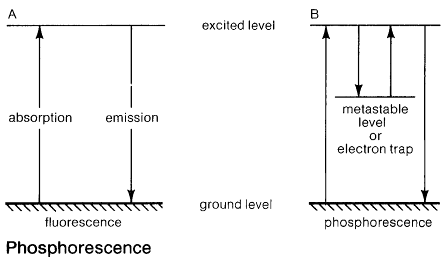
Other phospholipids include plasmalogens, present in brain and heart and apparently of limited occurrence in nonanimal tissues; phosphoinositides, present in brain; and cardiolipin, initially isolated from heart.

phosphor, solid material that emits light, or luminesces, when exposed to radiation such as ultraviolet light or an electron beam. Hundreds of thousands of phosphors have been synthesized, each one having its own characteristic colour of emission and period of time during which light is emitted after excitation ceases. When certain phosphors luminesce from electron excitation, the process is called electroluminescence (*q.v.*), and these phosphors are used in the production of radar and television screens. Phosphors excited by ultraviolet, visible, and infrared radiation are used principally in the so-called fluorescent lamps commonly employed for general illumination.

phosphor bronze, alloy of copper and tin that contains a trace of phosphorus. *See* bronze.

phosphorescence, emission of light from a substance exposed to radiation and persisting as an afterglow after the exciting radiation has been removed. Unlike fluorescence, in which the absorbed light is spontaneously emitted about 10^{-8} second after excitation, phosphorescence requires additional excitation to produce radiation and may last from about 10^{-3} second to days or years, depending on the circumstances.

To understand the difference between phosphorescence and fluorescence it is helpful to refer to the energy level diagrams in the Figure, in which the relative distance of a line, or level, above a base line (the ground level) denotes the energy of an electron occupying that level. In A, representing fluorescence, an electron is raised from the ground level to an excited level by a light photon or other radiation. Transition of the electron back to the ground level can occur spontaneously with radiation of the same energy as that which was absorbed. According to electromagnetic theory, the return is almost coincident, occurring within 10^{-8} second or so. The case for phosphorescence is illustrated in the Figure by B. There, interposed between the ground level and the excited level, is a level of intermediate energy, called a metastable level, or electron trap, because a transition between the metastable level and other levels is forbidden (highly improbable). Once an electron has fallen from the excited level to the metastable level (by radiation or by energy transfer to the system), it remains there until it makes a forbidden transition or until it is further excited



Phosphorescence

back to the transition level. This excitation may come about through thermal agitation of the neighbouring atoms or molecules (called thermoluminescence) or through optical (*e.g.*, infrared) stimulation. The time spent in the metastable level, or electron trap, determines the length of time that phosphorescence persists.

phosphorescence, marine: *see* marine phosphorescence.

phosphoric acid (H_3PO_4), also called ORTHOPHOSPHORIC ACID, the most important oxygen acid of phosphorus, used to make phosphate salts for fertilizers. It is also used in dental cements, in the preparation of albumin derivatives, and in the sugar and textile industries. It serves as an acidic, fruitlike flavouring in food products.

Pure phosphoric acid is a crystalline solid (melting point 42.35° C, or 108.2° F); in less concentrated form it is a colourless syrupy liquid. The crude acid is prepared from phosphate rock, while acid of higher purity is made from white phosphorus.

Phosphoric acid forms three classes of salts corresponding to replacement of one, two, or three hydrogen atoms. Among the important phosphate salts are: sodium dihydrogen phosphate (NaH_2PO_4), used for control of hydrogen ion concentration (acidity) of solutions; disodium hydrogen phosphate (Na_2HPO_4), used in water treatment as a precipitant for polyvalent metals; trisodium phosphate (Na_3PO_4), used in soaps and detergents; calcium dihydrogen phosphate or calcium superphosphate ($Ca[H_2PO_4]_2$), a major fertilizer ingredient; calcium monohydrogen phosphate ($CaHPO_4$), used as a conditioning agent for salts and sugars.

Phosphoric acid molecules interact under suitable conditions, often at high temperatures, to form larger molecules (usually with loss of water). Thus, diphosphoric, or pyrophosphoric, acid ($H_4P_2O_7$) is formed from two molecules of phosphoric acid, less one molecule of water. It is the simplest of a homologous series of long chain molecules called polyphosphoric acids, with the general formula $H(HPO_3)_nOH$, in which $n = 2, 3, 4, \ldots$. Metaphosphoric acids, $(HPO_3)_n$, in which $n = 3, 4, 5, \ldots$, are another class of polymeric phosphoric acids. The known metaphosphoric acids are characterized by cyclic molecular structures. The term metaphosphoric acid is used also to refer to a viscous, sticky substance that is a mixture of both long chain and ring forms of $(HPO_3)_n$. The various polymeric forms of phosphoric acid are also prepared by hydration of phosphorus oxides.

phosphorite, also called PHOSPHATE ROCK, rock with a high concentration of phosphates in nodular or compact masses. The phosphates may be derived from a variety of sources, including marine invertebrates that secrete shells of calcium phosphate, and the bones and excrement of vertebrates.

A brief treatment of phosphorite follows. For full treatment, *see* MACROPAEDIA: Minerals and Rocks.

For statistical data on mine production of ore, refining of metal, reserves (or production capacity), and trade worldwide and for major national industries, *see* mining (table).

The thickest deposits of phosphorite form in areas of geosynclinal subsidence, where phosphorite is associated with carbonaceous shale and chert. The phosphorite is usually carbonaceous and pelletal, and it is mixed with skeletal matter and phosphatic shells. Deposits may be up to one metre (about 3 feet) thick. Phosphorites also form on stable areas associated with sandstone or shale. These deposits are not carbonaceous but do contain nodules and phosphatized shells. Typical phosphorite beds contain about 30 percent phosphorous pentoxide (P_2O_5) and constitute the primary source of raw materials for most of world's production of phosphate fertilizers. Significant deposits of phosphorites in the United States include the Phosphoria Formation in Idaho and the Monterey Formation in California. Major deposits also occur in the Sechura Desert in Peru. Alteration of phosphorites tends to leach carbonates and sulfides and increase the percentage of phosphorus pentoxide. The Phosphoria Formation, for example, contains about 34 percent phosphorus pentox-

Phosphate minerals

name formula	colour	lustre	Mohs hardness	specific gravity	habit or form	fracture or cleavage	refractive indices	crystal system space group	remarks
amblygonite (Li, Na)$AlPO_4$(F, OH)	white to creamy white; slightly tinted	vitreous to greasy	5½–6	3.0–3.1	large, translucent, cleavable masses; small transparent crystals	one perfect and one good cleavage	ambl mont α = 1.578–1.611 β = 1.595–1.619 γ = 1.598–1.633	triclinic $P\bar{1}$	forms solid solution series with montebrasite which has a greater percentage of OH than F
apatite carbonate-apatite $Ca_{10}(PO_4)_6CO_3 \cdot H_2O$ chlorapatite $Ca_5(PO_4)_3Cl$ fluorapatite $Ca_5(PO_4)_3F$ hydroxylapatite $Ca_5(PO_4)_3OH$	variable, greens predominating	vitreous	5	2.9–3.2	prismatic or thick tabular crystals; coarse granular to compact massive; nodular concretions	conchoidal to uneven fracture	n = 1.63–1.67	hexagonal $C\frac{6_3}{m}$	often fluorescent in ultraviolet light, cathode rays, or X-rays; phosphorescent; sometimes strongly thermoluminescent
autunite $Ca(UO_2)_2(PO_4)_2 \cdot$ 10–12H_2O	lemon yellow to sulfur yellow; greenish yellow to pale green	vitreous to pearly	2–2½	3.1–3.2	thin tabular crystals; flaky aggregates; crusts	one perfect, micalike cleavage	α = 1.553 β = 1.575 γ = 1.577	tetragonal $I\frac{4}{m}mm$	fluoresces yellowish green under ultraviolet light
brushite $CaHPO_4 \cdot 2H_2O$	colourless to pale yellow	vitreous or pearly	2½	2.3	transparent to translucent efflorescences or minute crystals	two perfect cleavages	α = 1.539 β = 1.546 γ = 1.551	monoclinic A2	piezoelectric
collophane (massive apatite)	grayish white; yellowish; brown	weakly vitreous to dull	3–4	2.5–2.9	cryptocrystalline massive; hornlike concretions and nodules		n = 1.59–1.61		
lazulite $MgAl_2(PO_4)_2(OH)_2$	azure blue or sky blue; bluish white, bluish green; deep blue	vitreous	5½–6	3.1–3.4	crystals; compact masses; grains	two cleavages; uneven to splintery fracture	lazul scorz α = 1.604–1.639 β = 1.626–1.670 γ = 1.637–1.680	monoclinic $P\frac{2_1}{n}$	forms solid solution series with scorzalite in which Fe replaces Mg in the crystal structure
monazite (Ce, La)PO_4	yellowish brown or reddish brown to brown	usually resinous or waxy; sometimes vitreous or adamantine	5–5½	4.6–5.4; usually 5.0–5.2	translucent, small, flattened crystals	one distinct cleavage	α = 1.79–1.80 β = 1.79–1.80 γ = 1.84–1.85	monoclinic $P\frac{2_1}{n}$	moderately paramagnetic
pyromorphite $Pb_5(PO_4)_3Cl$	olive green; yellow; gray; brown to orange	resinous to subadamantine	3½–4	7.0	barrel-shaped prisms; globular, kidney-shaped, or grape-like masses	uneven to subconchoidal fracture	ϵ = 2.030–2.031 ω = 2.041–2.144	hexagonal $C\frac{6_3}{m}$	forms solid solution series with mimetite in which As replaces P in the crystal structure
torbernite $Cu(UO_2)_2(PO_4)_2 \cdot$ 8–12H_2O	various shades of green	vitreous to subadamantine	2–2½	3.2	tabular crystals; micalike masses	one perfect, platy cleavage	ϵ = 1.582 ω = 1.592	tetragonal $I\frac{4}{m}mm$	water content depends on temperature and humidity

ide near the surface compared to only about 28 percent at depth.

Phosphoros (mythology): *see* Lucifer.

phosphorous acid (H_3PO_3), also called ORTHOPHOSPHOROUS ACID, one of several oxygen acids of phosphorus, used as reducing agent in chemical analysis. It is a white or yellowish crystalline substance (melting point about 73° C, or 163° F) with a garlic-like taste. An unstable compound that readily absorbs moisture, it is converted to phosphoric acid (H_3PO_4) in the presence of oxygen or when heated above 180° C (360° F). Phosphorous acid (H_3PO_3) forms salts called phosphites, also used as reducing agents. Phosphorous acid is prepared by dissolving tetraphosphorus hexoxide (P_4O_6) or phosphorus trichloride (PCl_3) in water.

phosphorus (P), nonmetallic chemical element of the nitrogen family (Group Va of the periodic table).

Properties, occurrence, and uses. Ordinarily a colourless, semitransparent, soft, waxy solid that glows in the dark, it takes fire spontaneously upon exposure to air and forms dense white fumes of the oxide. Phosphorus was first prepared in elemental form in 1669 by a German alchemist, Hennig Brand, from a residue of evaporated urine.

Phosphorus is present in the fluids within cells of living tissues as the phosphate ion, PO_4^{3-}, one of the most important mineral constituents for cellular activity. The genes, which direct heredity and other cellular functions and are found in the nucleus of each cell, are molecules of DNA (deoxyribonucleic acid), which all contain phosphorus. Cells store the energy obtained from nutrients in molecules of adenosine triphosphate (ATP). Calcium phosphate is the principal inorganic constituent of teeth and bones.

Not found free in nature except in a few meteorites, phosphorus occurs in compounds that are widely distributed in many rocks, minerals, plants, and animals. Ranking 12th in abundance among the elements in the Earth's crust, phosphorus composes approximately 0.12 percent of the crust in the form of minerals such as apatite, wavellite, and vivianite; it always occurs as the phosphate ion. The chief commercial source is phosphorite, or phosphate rock, an impure massive form of carbonate-bearing apatite.

Elemental phosphorus is prepared industrially in electric furnaces in which phosphate rock, coke, and silica pebble are continuously charged and heated until they are chemically converted into phosphorus vapour, carbon monoxide gas, and a calcium silicate slag. The stream of gas is cooled to condense the phosphorus to the liquid and eventually to the solid form, which is stored under water to prevent spontaneous ignition.

The element has about 10 forms (allotropes) that occur within three major categories: white, red, and black. White phosphorus has two allotropes: the alpha form, which is stable at ordinary temperatures, has a cubic crystal structure; the beta form, which is stable below −78° C (−108° F), has a hexagonal crystal structure. White phosphorus is poisonous. Exposure to sunlight or to heat converts white phosphorus to red, which neither phosphoresces nor spontaneously burns in air. Black phosphorus, which is flaky like graphite, is made by subjecting white phosphorus to high pressures, it is chemically the least reactive form, and white is by far the most reactive. White phosphorus has been used for military purposes as a source of smoke and to fill incendiary shells and grenades. Red phosphorus is used in preparing the striking surface for safety matches.

All naturally occurring phosphorus is the stable isotope, phosphorus-31. Radioactive phosphorus-32 has a half-life of 14.3 days; it is a useful tracer in studies of the life cycles of plants and animals.

Principal compounds. Phosphorus is used almost entirely in the form of compounds, usually in the oxidation states of +3, +5, and −3. Unlike nitrogen and various other members of the family, phosphorus tends to exhibit a preference for the +5 state, however.

Of considerable economic significance is phosphine, or hydrogen phosphide, PH_3. This gaseous compound is produced either by the action of a strong base (or hot water) on white

Phosphate minerals (continued)

name formula	colour	lustre	Mohs hardness	specific gravity	habit or form	fracture or cleavage	refractive indices	crystal system space group	remarks
triphylite $LiFePO_4$	bluish or greenish gray (triphylite); clove brown, honey yellow, or salmon (lithiophilite)	vitreous to subresinous	4–5	3.3–3.6 not varying linearly with composition	transparent to translucent cleavable or compact massive	one perfect cleavage	triph lith $\alpha = 1.694–1.669$ $\beta = 1.695–1.673$ $\gamma = 1.700–1.682$	orthorhombic Pmnb	forms solid solution series with lithiophilite in which Mn replaces Fe in the molecular structure; structure similar to olivine
triplite $(Mn, Fe, Mg, Ca)_2PO_4(F, OH)$	dark brown; flesh red; salmon pink	vitreous to resinous	5–5½	3.5–3.9	massive	one good cleavage	$\alpha = 1.643–1.696$ $\beta = 1.647–1.704$ $\gamma = 1.668–1.713$	monoclinic $I\frac{2}{m}$	
turquoise $CuAl_6(PO_4)_4(OH)_8 \cdot 4H_2O$	blue to various shades of green; greenish to yellowish gray	waxy	5–6	2.6–2.8	opaque, dense, cryptocrystalline to fine granular massive	one perfect and one good cleavage	$\alpha = 1.61$ $\beta = 1.62$ $\gamma = 1.65$	triclinic $P\bar{1}$	forms solid solution series with chalcosiderite in which Fe replaces Al in the molecular structure
variscite $AlPO_4 \cdot 2H_2O$	yellowish green, pale to emerald green, bluish green or colourless (variscite); peach-blossom red, carmine, violet (strengite)	vitreous to faintly waxy	3½–4½	2.2–2.5	fine-grained, round or grape-like aggregates, nodules, veins, or crusts	one good cleavage	varis stren $\alpha = 1.563–1.707$ $\beta = 1.588–1.719$ $\gamma = 1.594–1.741$	orthorhombic Pcab	forms solid solution series with strengite in which Fe replaces Al in the molecular structure; both variscite and strengite have monoclinic forms
vivianite $Fe_3(PO_4)_2 \cdot 8H_2O$	colourless when fresh, darkening to deep blue or bluish black	vitreous	1½–2	2.7	rounded prismatic crystals; kidney-shaped, tubelike, or globular masses; concretions	one perfect cleavage	$\alpha = 1.579–1.616$ $\beta = 1.602–1.656$ $\gamma = 1.629–1.675$	monoclinic $C\frac{2}{m}$	
wavellite $Al_3(PO_4)_2(OH)_3 \cdot 5H_2O$	greenish white; green to yellow	vitreous	3½–4	2.4	translucent, hemispherical, or globular aggregates	one perfect and one good cleavage	$\alpha = 1.520–1.535$ $\beta = 1.526–1.543$ $\gamma = 1.545–1.561$	orthorhombic Pcmm	
xenotime YPO_4	yellowish brown to reddish brown; flesh red, grayish white, pale yellow, or greenish	vitreous	4–5	4.4–5.1	small prismatic crystals; coarse radial aggregates; rosettes	uneven to splintery fracture	$\epsilon = 1.816–1.827$ $\omega = 1.721–1.720$	tetragonal $I\frac{4}{a}md$	moderately paramagnetic; similar in appearance and identical in form and structure to zircon, but softer

phosphorus or by the hydrolysis of a metal phosphide. Phosphine is primarily employed as a starting material in the synthesis of various organic phosphorus compounds and as a doping agent for solid-state electronics components.

Among the most commercially important phosphorus compounds are the oxides and acids. Much of the industrially produced white phosphorus is burned to form phosphorus pentoxide, or phosphorus(V) oxide, P_4O_{10}. Sometimes called phosphoric anhydride, or diphosphorus pentoxide, this compound can be obtained in the from of a soft white powder or colourless crystalline solid. It is widely used in chemical analysis as a dehydrating agent and in organic synthesis as a condensing agent. Large quantities are treated with water to make orthophosphoric acid (H_3PO_4), commonly called phosphoric acid (*q.v.*), which has diverse industrial applications, including the production of phosphates, salts that contain the phosphate ion (PO_4^{3-}), the hydrogen phosphate ion (HPO_4^{2-}), or the dihydrogen phosphate ion ($H_2PO_4^-$). Such salts are used as leavening agents in baking, as abrasives in toothpaste, and sometimes as additives to detergents. Another salt, prepared by the action of phosphoric acid on phosphate rock, is calcium dihydrogen phosphate, or superphosphate, $Ca(H_2PO_4)_2$, the most widely used phosphate fertilizer.

With the halogen elements phosphorus forms varous halides, which are used to synthesize organic phosphorus chemicals. Phosphorus reacts with sulfur to form several sulfides that are utilized in the manufacture of organic chemicals and matches. It reacts with many metals and metalloids to form phosphides.

Phosphorus atoms can bond directly with carbon atoms, yielding a large number of organic phosphorus compounds. These are found in many important biological processes. The phosphoglycerides, for example, are required for fermentation. The adenosine phosphates are essential in photosynthesis and for muscle action. Industrially important organic phosphorus compounds include plasticizers and gasoline additives. Certain highly toxic forms are employed in insecticides of the parathion type. Poisonous organic derivatives of phosphorus have been used as nerve gas, a key weapon of chemical warfare.

atomic number	15
atomic weight	30.9738
melting point (white)	44.1° C (111.4° F)
boiling point (white)	280° C (536° F)
density (white)	1.82 g/cc at 20° C (68° F)
oxidation states	−3, +3, +5
electron configuration	2-8-5 or $1s^2 2s^2 2p^6 3s^2 3p^3$

phosphorus cycle, circulation of phosphorus in various forms through nature. Of all the elements recycled in the biosphere, phosphorus is the scarcest and therefore the one most limiting in any given ecological system. It is indispensable to life, being intimately involved in energy transfer and in the passage of genetic information in the deoxyribonucleic acid (DNA) of all cells.

Much of the phosphorus on Earth is tied up in rock and sedimentary deposits, from which it is released by weathering, leaching, and mining. Some of it passes through freshwater and terrestrial ecosystems via plants, grazers, predators, and parasites, to be returned to those ecosystems by death and decay. Much of it, however, is deposited in the sea, in shallow sediments, where it circulates readily, or in ocean deeps, whence it wells up only occasionally. Phosphorus is brought back to the land through fish harvests and through collection of guano deposited by seabirds. Although there are seasonal pulses of availability, there appears to be a steady loss of phosphorus to the ocean deeps.

Because of its high reactivity, phosphorus exists in combined form with other elements. Microorganisms produce acids that form soluble phosphate from insoluble phosphorus compounds. The phosphates are utilized by algae and terrestrial green plants, which in turn pass into the bodies of animal consumers. Upon death and decay of organisms, phosphates are released for recycling.

Because of the steady diversion of phosphorus into the oceans, the element must be added (in fertilizers) to soils to maintain fertility and agricultural productivity.

phosphorus deficiency, condition in which an organism does not receive an adequate supply of phosphorus, a mineral vitally important to the normal metabolism of numerous compounds and (in solution) an acid that, with sulfur, must be neutralized by the base-forming ions of sodium, potassium, calcium, and magnesium. About 70 percent of retained phosphorus combines with calcium in bone and tooth structure, while nitrogen combines with most of the remaining 30 percent to metabolize fats and carbohydrates. Phosphorus is the principal element in the structure of the nucleus and cytoplasm of all tissue cells. In addition, this mineral probably has the power to regulate hydrogen ion concentration and vitamin absorption in living tissues. It is also a universally distributed component of skeletal, nerve, and muscle tissues. A reduced concentration of phosphate in the blood serum is a disorder known as hypophosphatemia (*q.v.*).

Deficiencies relating to the ratio of phosphorus to calcium may cause bone diseases such as rickets in children and osteoporosis or osteomalacia in adults. Sometimes an improper ratio causes bone fragility and tetany (severe muscle spasms in fingers and toes).

Dietary sources of phosphorus include milk products, egg yolk, fresh foods, legumes, nuts, and whole grains.

phosphorylation, in chemistry, the addition of a phosphoryl group (PO_3^{2-}) to an organic compound. The process by which much of the energy in foods is conserved and made available to the cell is called oxidative phosphorylation (*see* cellular respiration). The process by which green plants convert light energy to chemical energy is called photophosphorylation (*see* photosynthesis).

Phothisan, also spelled PHOTISARATH, or PHOTHISARA (b. 1501—d. 1547), ruler (1520–47) of the Lao kingdom of Lan Xang whose territorial expansion embroiled Laos in the warfare that swept mainland Southeast Asia in the latter half of the 16th century.

Phothisan was a pious Buddhist who worked to undermine animism and Brahmanic religious practices and promote Buddhism. He resided much of the time not in the capital at Luang Prabang but in Vientiane, which was located farther south and maintained better communications with the major states of the region. Phothisan married a princess from Chiang Mai (now in northern Thailand), and when his father-in-law, the ruler of Chiang Mai, died in 1546 without male issue, Phothisan had his own son Setthathirat I placed on the Chiang Mai throne. When Phothisan died in the following year, after a fatal accident while hunting wild elephants, Setthathirat succeeded him and joined together the two kingdoms—which were soon embroiled in Siamese-Burmese wars that devastated much of the region over the next half-century.

Photian Schism, a 9th-century-AD controversy between Eastern and Western Christianity that was precipitated by the opposition of the Roman pope to the appointment by the Byzantine emperor Michael III of the lay scholar Photius to the patriarchate of Constantinople. The controversy also involved Eastern and Western ecclesiastical jurisdictional rights in the Bulgarian church, as well as a doctrinal dispute over the *Filioque* ("and from the Son") clause that had been added to the Nicene Creed by the Latin church.

photic zone, surface layer of the ocean that receives sunlight. The uppermost 80 m (260 feet) or more of the ocean, which is sufficiently illuminated to permit photosynthesis by phytoplankton and plants, is called the euphotic zone. Sunlight insufficient for photosynthesis illuminates the disphotic zone, which extends from the base of the euphotic zone to depths of about 200 m (650 feet). The thicknesses of the photic and euphotic zones vary with the intensity of sunlight as a function of season and latitude and with the degree of water turbidity. The bottommost, or aphotic, zone is the region of perpetual darkness that lies beneath the photic zone and includes most of the ocean waters.

Photius, SAINT (b. *c.* 820, Constantinople [now Istanbul]—d. Feb. 6, 891?, Bordi, Armenia; canonized 10th century?; feast day February 6), patriarch of Constantinople (858–867 and 877–886), defender of the autonomous traditions of his church against Rome and leading figure of the 9th-century Byzantine renascence.

Photius, lead seal; in the Dumbarton Oaks Research Library and Collection, Washington, D.C.

By courtesy of the Dumbarton Oaks Research Library and Collection, Washington, D.C.

Background and early career. Photius was related through his father to Tarasius, a civil servant who was patriarch from 784 to 806, and through his mother to the empress Theodora and her brother Bardas, who was a power behind the throne from 842 to 866. The circle to which both families belonged had strained relations with some army officers, who wished to reduce the expense of government by an educated civil service, and with monks who distrusted the worldly wisdom of bureaucrats. In controversies that had arisen over the place of pictures (icons) in Christian worship, the learned civil servants resisted the iconoclasts (the destroyers of sacred images), who had support in the army. When the icons were restored in 787, however, and again after renewed controversy in 843, the civil servants were lenient with the former iconoclasts, whereas the monks, especially the Studites of the monastery of St. John of the Stoudion, would have purged them, as dangerous heretics, from all important positions.

The parents of Photius were condemned to exile by an iconoclast council early in his childhood and took him with them. In the first years of the regency of Theodora (842–856), after his parents had died, Photius became a distinguished teacher. A circle gathered around him for regular readings in classical and Christian prose literature, including medical and scientific works. On the basis of notes taken at these readings, which continued after he left the schools for the civil service, he composed his *Myriobiblon* or *Bibliotheca* (*Bibliothēkē*), a digest of Greek prose literature, with more than 270 articles. This work was begun on a diplomatic mission in the Muslim world and most probably completed during his temporary retirement from public life after 867.

Patriarch of Constantinople. He became first secretary of state, probably before 855, and in 858 he was promoted through all the ecclesiastical orders to be made patriarch of Constantinople on Christmas Day, replacing the austere Ignatius, who had fallen out with Bardas. The deposition of Ignatius offended not only the Studites and other monks, who objected to the promotion of a civil servant, but also Pope Nicholas I, who did not understand the role of laymen educated in theology and in Byzantine civilization. Photius offended him further by refusing to restore dioceses transferred from the Roman to the Byzantine patriarchate during the iconoclastic controversy. The importance of these dioceses had been increased by the conversion to Christianity of leading chiefs among the Slavonic nations (the Moravians, Croats, and Bulgarians); jurisdictionally they might belong to either the Roman or the Byzantine patriarchate.

As conflicts developed among Roman, German, and Byzantine missions, Photius wrote a circular letter to the other Eastern patriarchs complaining of theological, liturgical, and other innovations by Latin missionaries in Bulgaria. At a council in Constantinople in 867, he condemned and excommunicated Nicholas I, who had refused to recognize him as the lawful patriarch—thus bringing about the Photian Schism—and in letters to other bishops had represented him as a persistent adversary of the West.

By this time, however, the fall of Bardas had weakened the position of Photius. When he protested against the murder of the emperor Michael III by Basil the Macedonian, he was deposed, in the autumn of 867, and Ignatius was restored. Pope Adrian II, who had just succeeded Nicholas I at Rome, now envisioned a settlement of the differences between Rome and Constantinople. The terms proposed by his legates to a council in Constantinople in 869–870, however, were unacceptable to many Byzantine ecclesiastics. Ignatius himself in 870 consecrated bishops for Bulgaria. Without help from the friends of Photius, however, he could neither reach a satisfactory settlement of tensions between East and West nor solve the internal problems of the Byzantine Orthodox Church.

Photius returned to the court before 876 as tutor to the princes of the imperial family, and at the death of Ignatius in 877 or 878 he also returned to the patriarchate. Though some of the monks resented his return, as they had objected to his first promotion, he now won support from Rome, since Pope John VIII was in need of Byzantine naval assistance against the Moors, who were harrying the Italian coastline. The Pope sent legates to a new council at the church of Hagia Sophia in Constantinople in 879–880. In the resulting settlement, Bulgaria was assigned to the Roman patriarchate, but the continued presence of Greek bishops secured its cultural links with the East. Bulgaria soon became a centre from which the Byzantine liturgy in the language of the Macedonian Slavs spread to other Slavonic-speaking lands.

The filioque controversy. Rome did not press its claims to Greek dioceses in Italy and Greece under the jurisdiction of Constantinople, and the Roman legates consented to the Byzantine demand to condemn Western additions to the Nicene Creed, without explicit mention of the contentious use of the word *filioque* (Latin: "and the Son"), whereby the Holy Spirit was said by some to proceed from the Father "and the Son." This interpolation had been introduced into the Nicene Creed in Spain and had spread among the Franks, but it was not yet in use in Rome. Photius' Latin was limited, and on the *filioque* controversy his information was inadequate, though he showed more understanding of the question in his later work on *The Mystagogia of the Holy Spirit,* completed in or after his second patriarchate.

The settlement between Rome and Constantinople was once thought to have been obtained by fraud and repudiated by Pope John VIII, but most likely it was accepted by the Pope. John VIII was murdered in 882, and his successor, whose position was irregular, was probably not recognized at Constantinople. Photius was in communion not only with John but also with Adrian III (884–885) and with Stephen V in 886. In that year he resigned the patriarchate on the accession to the throne of his pupil the emperor Leo VI. The Pope suspected that the resignation of Photius had been forced upon him to make way for another pupil, Prince Stephen, but if he was more than 80 years old it may well have been voluntary. He died on February 6, perhaps 891, but the year is not certain. (Ge.E.)

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photo-ionization, the interaction of electromagnetic radiation with matter resulting in the dissociation of that matter into electrically charged particles. The simplest example, the photoelectric effect (*q.v.*), occurs when light shines on a piece of metal, causing the ejection of electrons. Another category of photo-ionization involves the disruption of covalent chemical bonds, producing positively and negatively charged fragments; such a reaction is often called the primary process of a photochemical reaction (*q.v.*).

Photo-Secession Group, the first important group of U.S. photographers that worked to get photography accepted as an art form. Led by Alfred Stieglitz (1864–1946), the group also included Edward Steichen (1879–1973), Clarence H. White (1871–1925), Gertrude Käsebier (1852–1934), and Alvin Langdon Coburn (1882–1966). These photographers broke away from the Camera Club of New York in 1902 and pursued techniques of manipulating negatives and printing paper to approximate the effects of drawings, etchings, and oil paintings.

The Photo-Secession Group actively promoted its ideas. Stieglitz edited and published the important quarterly *Camera Work* and opened the Little Gallery (also known as the Photo-Secession Gallery and "291" from its address on Fifth Avenue), providing the group with a place to exhibit their work. In 1910 the Photo-Secession sponsored an international show of more than 500 photographs by its members or photographers whose aims were similar to its own. The show, occupying more than half of the exhibition space at the Albright-Knox Art Gallery in Buffalo, was a sensation and significantly advanced the acceptance of photography as an art form.

By 1910, however, the members of the Photo-Secession had become divided. Some continued to manipulate their negatives and prints to achieve nonphotographic effects, while others came to feel that such manipulation destroyed tone and texture and was inappropriate to photography. Torn by this division, the group soon dissolved.

photocathode, an element of a photoelectric cell (*q.v.*) that emits electrons when struck by light, making possible the flow of electric current through the device. A substance often used for photocathodes is a partially oxidized silver–cesium alloy.

photocell: *see* photoelectric cell.

photochemical equivalence law, fundamental principle relating to chemical reactions induced by light, which states that for every quantum of radiation that is absorbed, one molecule of the substance reacts. A quantum is a unit of electromagnetic radiation with energy equal to the product of a constant (Planck's constant, h) and the frequency of the radiation, symbolized by the Greek letter nu (ν). In chemistry, the quantitative measure of substances is expressed in terms of gram moles, one gram mole comprising 6.0225×10^{23} (Avogadro's number) molecules. Thus, the photochemical equivalence law is restated as: for every mole of a substance that reacts 6.0225×10^{23} quanta of light are absorbed.

The photochemical equivalence law applies to the part of a light-induced reaction that is referred to as the primary process; that is, the initial chemical change that results directly from the absorption of light. In most photochemical reactions the primary process is usually followed by so-called secondary processes that are normal interactions between reactants not requiring absorption of light. As a result such reactions do not appear to obey the one quantum–one molecule reactant relationship. The law is further restricted to conventional photochemical processes using light sources with moderate intensities; high-intensity light sources such as those used in flash photolysis and in laser experiments are known to cause so-called biphotonic processes; *i.e.,* the absorption by a molecule of a substance of two photons of light.

The photochemical equivalence law is also sometimes called the Stark–Einstein law after the German-born physicists Johannes Stark and Albert Einstein, who independently formulated the law between 1908 and 1913.

photochemical reaction, any type of chemical process initiated by the absorption of visible, ultraviolet, or infrared radiation. The most important photochemical process for living systems is photosynthesis, the production by green plants of carbohydrates from carbon dioxide and water. Vision in animals depends on photochemical reactions that occur in the eye, and reactions of this kind are involved in photography, bleaching of laundry and tanning of the skin by sunlight, and in numerous processes used in the chemical industry.

A brief treatment of photochemical reactions follows. For full treatment, *see* MACROPAEDIA: Chemical Reactions.

For a photochemical process to occur, energy in the form of visible, infrared, or ultraviolet radiation must be absorbed by a substance.

Primary photochemical processes are those that occur as an immediate consequence of this absorption. Secondary processes are those subsequent changes that follow the primary processes. The core of photochemical theory is derived mainly from the principles of quantum mechanics and of atomic and molecular physics.

Photochemical reactions often convert light energy into chemical energy very efficiently. This is a consequence of the fact that when an atom or molecule absorbs light energy it gains much more energy than it ever could by other methods such as heating. An example of this type of photochemical process is photosynthesis. Another important photochemically based natural phenomenon is the production of ozone in the upper atmosphere. Ozone, which filters out most of the harmful ultraviolet radiation from the Sun, is produced when sunlight breaks the bonds of some oxygen molecules, allowing atomic oxygen to combine with oxygen molecules to yield ozone.

Photography employs another type of photochemical process. Grains of silver chloride or silver bromide in photographic film absorb minute amounts of light when the camera shutter opens, thereby converting bound silver to metallic silver. Conventional chemical action (development of the film) then amplifies the photochemical action of light alone.

Types of photochemical effects. Light energy may trigger a reaction that, once started, can proceed spontaneously. A mixture of hydrogen and chlorine gases, for example, will not react if kept in darkness, but they will react explosively if violet or ultraviolet light reaches the mixture.

Light may boost a reaction that might otherwise proceed at an imperceptibly slow rate. Certain types of molecular rearrangements that alter molecular geometry result from this kind of photochemical process.

Absorbed light may convert reacting molecules to an energy state higher than their initial state. The absorbed energy is converted into potential energy and is stored. Most photochemical processes occurring in biological systems are of this type.

Light energy may be stored as chemical energy and later released as electrical energy. This principle is utilized in solar batteries.

Energy considerations. Fundamental to all quantitative interpretations of photochemical processes is the quantum-mechanical principle that energy exists in discrete packets, or quanta. Furthermore, the energy of each quantum of electromagnetic radiation, known as a photon is related to the frequency with which its waves propagate. This relationship is expressed by the equation $E = h\nu$, where E is the energy (in ergs) of the photon, ν is the frequency of the radiation (in cycles per second), and h is Planck's constant, which has the value 6.625×10^{-27} erg-sec.

A photochemical process begins when an atom or molecule absorbs a photon. The absorber, initially in a relatively low energy state, achieves an excited state, usually because one electron from a state of low energy has been boosted to a state of higher energy. An electron, however, can absorb only a photon whose energy corresponds to the allowed quantum jump for that particular electron. The energy of the photon also corresponds to a characteristic absorption line or band of the absorbing species.

The absorber, excited by a photon, may then undergo any of several different primary photochemical steps. The absorber may emit a photon as the excited electron settles back into a lower energy state. This phenomenon is called luminescence. In some instances the absorber may return to its lower energy state if it collides with a second substance that carries off the excitation energy. This is called nonradiative decay. The absorber, however, may react in several other ways. It may undergo photoionization or photodissociation. In the former case, the excited electron is, in a sense, promoted out of the atom or molecule, leaving behind a charged particle, or ion. In the latter case, the excited electron ceases to participate in a chemical bond (though it remains associated with one atom or group of atoms), thereby enabling the molecule to split, or dissociate. Or an absorber may undergo an internal rearrangement of its atoms to form a stereoisomer, for example.

photocollography (printing): *see* collotype.

photocomposition, also called PHOTOTYPESETTING, or FILMSETTING, method of assembling or setting type by photographing characters on film from which printing plates are made. The characters are developed as photographic positives on film or light-sensitive paper from a negative master containing all the characters; the film, carrying the completed text, is then used for making a plate for letterpress, gravure, or lithographic printing by a photomechanical process.

Some photocomposing machines automatically select and position the negative of the desired characters in rapid succession so that their images are projected on a roll of film, which is exposed at high speed. Varying the projection scale produces different type sizes. In other machines the characters are generated by computer and electronically created on the film. A typewriter-like keyboard controls the operation in either case.

Typesetting by photography was proposed as early as 1866. The Hungarian engineer Eugene Porzolt designed the first photocomposing machine in 1894, but machines such as the Fotosetter did not become available commercially until the 1950s. By the 1960s, such machines were being combined with digital computers, which prepared tapes and controlled machines in high-speed operations. Present-day photocomposition machines use computers to make end-of-line (hyphenation and justification) and page design decisions automatically, thereby producing copy faster and cheaper than units that require operators to make end-of-line decisions. *See also* computerized typesetting.

photoconductivity, that portion of the ability of a material to allow an electric current to flow in it that is affected by exposure to light, frequently used to detect and measure the amount of light.

Many crystals, including those made from the chemical elements silicon and germanium, are poor current conductors because their electrons are unable to move freely within the material when an electrical voltage is applied. Light directed on such materials is absorbed by some electrons, however, freeing them to pass more easily from one atom to the next when a voltage is applied. In contrast, good conductors such as metals have an abundance of free, current-carrying electrons.

When photoconductive materials are removed from the light, the freed electrons return to their more tightly bound state. The time required for the return to normal conductivity varies widely from one type of crystal to another. *See* photoelectric effect.

photocopying machine, also called PHOTOCOPIER, any device for producing copies of text or graphic material by the use of light, heat, chemicals, or electrostatic charges. The need for a process other than wet photographic reproduction for copying documents stimulated the invention of various techniques, notably the diffusion-transfer and dye-line processes, during the early 1950s. In the diffusion-transfer process a master copy is made on a translucent sheet, which is placed on light-sensitized negative paper and exposed to light. The negative is then placed in contact with a sheet of positive transfer paper and fed into a developer. When the two sheets are peeled apart, the image is transferred to the positive paper. The dye-line process also requires a translucent original but only one sheet of sensitized paper. This process uses ammonia fumes rather than liquid to develop the image, obviating problems of paper shrinkage.

Another photocopying method that became available in the early 1950s uses the heat of infrared light. In this process, sometimes called thermography, sensitized copy paper is placed in contact with the original and both are exposed to infrared rays. The original absorbs the rays in areas darkened by print or by the lines and shades of an illustration, and thereby transfers the impressions to the surface of the copy paper.

The method most widely used by modern office photocopiers is called xerography (from the Greek words meaning "dry writing"). Although developed by the U.S. physicist Chester F. Carlson in 1937, the process did not become available for commercial use until 1950. Xerography, which involves the application of electrostatic charges and heat, is extremely versatile and can be employed to produce copies of all kinds of written, printed, and graphic matter. The basis of the process is photoconductivity, an increase in the ability of certain substances to allow an electric current to flow through them when struck by light. The chemical element selenium, for example, is a poor electrical conductor, but when light is absorbed by some of its electrons and a voltage is applied, these electrons are able to pass more freely from one atom to another. When the light is removed, their mobility falls. Xerography typically uses an aluminum drum coated with a layer of selenium. Light passed through the document to be copied, or reflected from its surface, reaches the selenium surface, onto which negatively charged particles of ink (*i.e.*, the toner) are sprayed, forming an image of the document on the drum. A sheet of copy paper is passed close to the drum, and a positive electric charge under the sheet attracts the negatively charged ink particles, resulting in the transfer of the image to the copy paper. Heat is then momentarily applied to fuse the ink particles to the paper. The copy paper itself originally provided the treated surface, but the substitution of the selenium-coated drum permitted the use of ordinary paper. Other improvements were introduced, making it possible to print on both sides of the paper, sort and collate, automatically produce a predetermined number of copies, and enlarge or reduce the image reproduced from the original. Xerographic machines capable of duplicating coloured materials became available in the 1970s.

The development of fast and efficient photocopying machines has benefitted business and government tremendously. It has, however, created copyright problems and stimulated changes in existing copyright laws and regulations in the United States and elsewhere.

Where the same name may denote a person, place, or thing, the articles will be found in that order

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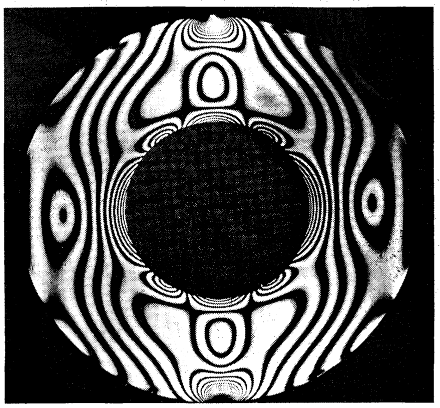
photodisintegration, also called PHOTOTRANSMUTATION, in physics, nuclear reaction in which the absorption of high-energy electromagnetic radiation (a gamma-ray photon) causes the absorbing nucleus to change to another species by ejecting a subatomic particle, such as a proton, neutron, or alpha particle. For example, magnesium-25, upon absorbing a photon of sufficient energy, emits a proton and becomes sodium-24. Photodisintegration differs from the nuclear reaction photofission, in which a nucleus, upon absorbing a photon, splits into two fragments of nearly equal mass.

photodynamism, conversion of certain substances in the skin of animals into other substances by the action of light. The resultant compounds may be beneficial (*e.g.,* vitamin D), but in some cases they produce disorders of the skin. The original compound may be present in normal skin; it may be derived from certain foods; it may result from an inherited biochemical defect; or it may be a combination of the preceding.

photoelasticity, the property of some transparent materials, such as glass or plastic, while under stress, to become doubly refracting (*i.e.,* a ray of light will split into two rays at entry). When photoelastic materials are subjected to pressure, internal strains develop that can be



Photoelastic stress pattern of a ring in diametral compression

By courtesy of Dr. W.M. Murray, Massachusetts Institute of Technology, Cambridge

observed in polarized light; *i.e.,* light vibrating normally in two planes, which has had one plane of vibration removed by passing through a substance called a polarizer. Two polarizers that are crossed ordinarily do not transmit light, but if a stressed material is placed between them and if the principal axis of the stress is not parallel to this plane of polarization, some light will be transmitted in the form of coloured fringes. Stresses in opaque mechanical structures can be analyzed by making models in plastic and studying the fringe pattern under polarized light, which may be either white (a mixture of all wavelengths) or a single wavelength. A photoelastic model under stress is shown in the photograph. *See* double refraction.

photoelectric cell, also called ELECTRIC EYE, PHOTOCELL, or PHOTOTUBE, an electron tube with a photosensitive cathode that emits electrons when illuminated and an anode for collecting the emitted electrons. Various cathode materials are sensitive to specific spectral regions, such as ultraviolet, infrared, or visible light. The voltage between the anode and cathode causes no current in darkness because no electrons are emitted, but illumination excites electrons that are attracted to the anode, producing current proportional to the intensity of the illumination. These tubes are used in control systems, where interrupting a beam of light opens a circuit, actuating a relay that, in turn, supplies power to a mechanism that brings about the desired operation, such as the opening of a door. The tubes are also used in photometry and in spectroscopy.

photoelectric effect, phenomenon in which charge particles are released from a material when it absorbs radiant energy. The photoelectric effect commonly is thought of as the ejection of electrons from the surface of a metal plate when light falls on it. In the broad sense, however, the phenomenon can take place when the radiant energy is in the region of visible or ultraviolet light, X-rays, or gamma rays; when the material is a solid, liquid, or gas; and when the particles released are electrons or ions (charged atoms or molecules).

Discovery and early work. The photoelectric effect was discovered in 1887 by a German physicist, Heinrich Rudolf Hertz, who observed that ultraviolet light changes the lowest voltage at which sparking takes place between given metallic electrodes. At the close of the 19th century, it was established that a cathode ray (produced by an electric discharge in a rarefied-gas atmosphere) consists of discrete particles, called electrons, each bearing an elementary negative charge. In 1900 Philipp Edward Anton Lenard, a German physicist, studying the electrical charges liberated from a metal surface when it was illuminated, concluded that these charges were identical to the electrons observed in cathode rays. It was further discovered that the current (given the name photoelectric because it was caused by light rays), made up of electrons released from the metal, is proportional to the intensity of the light causing it for any fixed wavelength of light that is used. In 1902 it was proved that the maximum kinetic energy of an electron in the photoelectric effect is independent of the intensity of the light ray and depends on its frequency.

The observations that (1) the number of electrons released in the photoelectric effect is proportional to the intensity of the light and that (2) the frequency, or wavelength, of light determines the maximum kinetic energy of the electrons indicated a kind of interaction between light and matter that could not be explained in terms of classical physics. The search for an explanation led in 1905 to Albert Einstein's fundamental theory that light, long thought to be wavelike, can be regarded alternatively as composed of discrete particles (now called photons), equivalent to energy quanta.

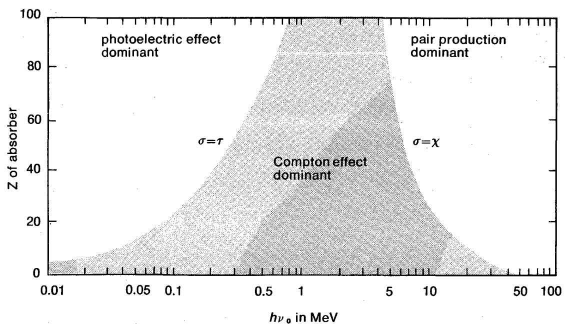
In explaining the photoelectric effect, Einstein assumed that a photon could penetrate matter, where it would collide with an atom. Since all atoms have electrons, an electron would be ejected from the atom by the energy of the photon, with great velocity. The kinetic energy of the electron, as it moved through the atoms of the matter, would be diminished at each encounter. Should it reach the surface of the material, the kinetic energy of the electron would be further reduced as the electron overcame and escaped the attraction of the surface atoms. This loss in kinetic energy is called the work function, symbolized by omega (ω). According to Einstein, each light quantum consists of an amount of energy equal to the product of Planck's universal constant (h) and the frequency of the light (indicated by the Greek nu, ν). Einstein's theory of the photoelectric effect postulates that the maximum kinetic energy of the electrons ejected from a material is equal to the frequency of the incident light times Planck's constant, less the work function. The resulting photoelectric equation of Einstein can be expressed by $E_k = h\nu - \omega$, in which E_k is the maximum kinetic energy of the ejected electron, h is a constant, later shown to be numerically the same as Planck's constant, ν is the frequency of the incident light, and ω is the work function.

The kinetic energy of an emitted electron can be measured by placing it in an electric field and measuring the potential or voltage difference (indicated as V) required to reduce its velocity to zero. This energy is equal to the product of the potential difference and an electron's charge, which is always a constant and is indicated by e; thus, $E_k = eV$.

The validity of the Einstein relationship was examined by many investigators and found to be correct but not complete. In particular, it failed to account for the fact that the emitted electron's energy is influenced by the temperature of the solid. The remedy to this defect was first formulated in 1931 by a British mathematician, Ralph Howard Fowler, who, on the assumption that all electrons with energies greater than the work function would escape, established a relationship between the photoelectric current and the temperature: the current is proportional to the product of the square of the temperature and a function of the incident photon's energy. The equation is $I = \alpha AT^2\varphi(x)$, in which I is the photoelectric current, α and A are constants, and $\varphi(x)$ is an exponential series, whose numerical values have been tabulated; the dimensionless value x equals the kinetic energy of the emitted electrons divided by the product of the temperature and the Boltzmann constant of the kinetic theory: $x = (h\nu - \omega)/kT$; in which x is the argument of the exponential series, h is Planck's constant, ν is the frequency of the incident radiation, ω is the work function of the material, k is Boltzmann's constant, and T is temperature.

Originally, most investigations of photoemission centred on the emissive properties of solid metals that are good conductors of electricity. Gradually, with the recognition of the effects of volume and surface impurities, there evolved an interest in the photoelectric emission from insulators, which are nonconductors, and from semiconductors, which conduct electricity only under certain circumstances. The energy distribution of electrons in insulators and semiconductors is different from that of metals. As a consequence, the photoelectric yield (number of electrons emitted for each incident quantum of radiation) versus energy of the incident photon can be different for materials having the same work function.

The photoelectric effect in semiconductors can be understood only in terms of quantum mechanics. It is possible to think of solids as



Locus of equal atomic cross sections for Compton and photoelectric interactions ($\sigma = \tau$) and for Compton and pair-production interactions ($\sigma = \chi$); the incident photon energy is $h\nu_0$, and Z is the atomic number of the atoms in the absorber

From S. Flugge (ed.), *Encyclopedia of Physics,* vol. 34, Berlin-Göttingen-Heidelberg: Springer 1958, in L. Marton, *Methods of Experimental Physics;* Academic Press Inc.

being composed of tiny crystals, each of which has an orderly array of atoms in three dimensions called a lattice structure. Every electron in the lattice, whether bound to an atom or unbound, has a definite energy, called its energy state. Energy states are influenced by the lattice structure of the crystal. Electrons can change to a higher energy state by absorbing heat or electromagnetic energy. According to the laws of quantum mechanics, only specific discrete energy states may exist, and these are grouped together in energy bands, with the regions between them called forbidden bands. The band of highest energy that is occupied when the crystal is at absolute zero temperature is the valence band. If this band contains states that are unoccupied, it is called a conduction band and the crystal is a metal. If all the states are occupied, the crystal is either an insulator or a semiconductor, depending on whether or not electrons from the valence band can be transferred to the next unoccupied band, which then becomes a conduction band. In a semiconductor the input of energy, in the form of light, can raise a valence electron into the conduction band. Electrons can also be supplied to a semiconductor by atoms having energy levels in the forbidden gap, called impurity atoms. In an insulator the forbidden gap is too large to be bridged easily.

Photoconductivity. Many materials exhibit a marked change in electrical conductivity when irradiated. Usually the conductivity increases, although a few instances of the opposite reaction are known. In highly conductive substances, such as metals, the change in conductivity is insignificant. It is most important in semiconductors.

In a semiconductor there are a certain number of "free" electrons occupying energy levels in the conduction band and a certain number of positively charged "holes" left in the valence band by the free electrons that entered the conduction band because of the natural vibrations of atoms. During irradiation of the substance, the generation of free charge carriers (electrons and holes) increases, producing an increased conductivity, continuing until the carriers generated by the photon absorption can no longer move through the material. The electronic processes can be manifold, depending upon the band structure of the material, the imperfections in the material, and other factors. One of the most important factors in determining photosensitivity (*i.e.,* the change in conductivity per photon absorbed) is the free-carrier lifetime, which must be finite because recombination or neutralization takes place between negatively charged electrons and positively charged holes, and there are thus fewer electrons available for the conduction process. This lifetime can vary from 10^{-2} second to 10^{-12} second, not only from substance to substance but also in a single substance having varying degrees of imperfections or impurities.

Another important factor determining photosensitivity is the light absorption characteristic of the photoconductors. When the photon energy is greater than the forbidden energy gap of the solid, each photon creates a free pair—a free electron and a free hole. If the photon energy is much larger than the band gap (as, for instance, the photon energy of X-rays), the absorption of a single photon can give rise to many free pairs.

Photovoltaic effect. The photovoltaic effect consists in the generation of an electromotive force as a consequence of the absorption of radiation; that is to say, a current will flow across the junction of two dissimilar materials when light falls upon it. The primary effect is photo-ionization; *i.e.,* the production of equal numbers of positive and negative charges. One or both charges can then migrate to a region in which charge separation can occur. This charge separation happens normally at a potential barrier between two layers of the solid material.

For a large photovoltaic effect, the change of potential at the barrier should be large and the distance over which the carrier has to move should be small. This effect implies an abrupt change in some property of the material, including an abrupt change of the conductivity. The response time of the photovoltaic effect is relatively short, although not so instantaneous as photoemission. An important characteristic of the photovoltaic effect is its relatively high efficiency as a device to convert the energy of radiation to electrical current.

Other photoelectric effects. Photoemissive phenomena are well known for the higher energy ranges in the X-ray and gamma regions because such penetrating radiation can release photoelectrons from inner atomic shells. If a vacancy is produced in an inner shell because of the removal of an electron through the photoelectric process, the vacancy will be filled by an electron from a less tightly bound state; the resulting excess energy may cause the simultaneous emission from the atom of a second electron, called an Auger electron, from another less tightly bound state. This is the Auger effect, which is generally, but not exclusively, observed at higher energies. A given inner vacancy can be followed by a great number of different Auger transitions. This fact, coupled with the development of high-resolution spectroscopy and improved methods for the study of low-energy electrons, makes the Auger effect an important tool in the exploration of many nuclear processes such as capture and internal conversion. Also, the knowledge of the energies and intensities of Auger electrons gives information about transition probabilities, both in atoms and in molecules. Conversely, Auger spectroscopic lines with precisely known energies can be used for the energy calibration of conversion electrons—electrons that are ejected from their shells when a nucleus loses its excitation energy.

One other significant photoemissive process is the Compton effect, which relates the directions taken by a photon and an electron after they collide. In the collision between a higher energy photon and an electron initially at rest, the photon will share some of its energy and momentum with the electron, and the photon and electron will take off in divergent paths. The laws for the conservation of energy and momentum show that kinetic energy of the electron is strongly dependent on the energy of the photon, whereas the Compton shift in wavelength of the photon is independent of the energy. The Compton shift of wavelength between the incident and scattered photon, which represents an increase in wavelength before and after collision, is equal to the product of two terms: the first term is the ratio Planck's constant to the rest mass of an electron (according to relativity, a body has the least mass when at rest relative to the observer) times the velocity of light; the second term is the difference between 1 and the cosine of the angle that the scattered photon makes with the path of the incident photon. In equation form, $\Delta\lambda = (h/m_0c)(1 - \cos\theta)$, in which $\Delta\lambda$ represents the shift in wavelength, h is Planck's constant, m_0 is the rest mass of the electron, c is the velocity of light, and θ is the scattering angle of the photon. The term h/m_0c that corresponds to a 90° scattering angle of the photon is called the Compton wavelength for all electrons. It is a fundamental atomic unit of length having a numerical value of 2.4262×10^{-10} centimetre.

Atoms, electrons, and nuclei can interact with electromagnetic radiation in many possible ways. Whereas at low energies the photoelectric effect dominates, and at very high energies pair production (the conversion of a photon into an electron and a positron) is prevalent, there exists a broad range of energies in which the attenuation of radiation depends almost exclusively on Compton scattering (see figure).

Applications. The many technological variants of photoemissive devices take advantage of a response that is linear with light intensity, coupled with an extremely short response time. A photoemissive device (photodiode) can be coupled with a suitable amplifying system, its sensitivity thus extended to the detection of single photons. The best known amplifying system, the photomultiplier, consists of a suitable set of secondary emitters built into the same container. Photodiodes and photomultipliers are being applied in a growing number of fields such as the control of industrial products and of manufacturing processes, the measurement of light intensities, scintillation counters, facsimile transmission, spectral analysis, and many others.

Photodiodes and photomultipliers integrate the light falling over the surface of the photoemitter to give the total amount received. Image converters, image intensifiers, television camera tubes, and image storage tubes take advantage of the point-by-point emission of the photocathode. In the first two examples, an optical image incident on a semitransparent photocathode is used to transform the light image into an "electron image." The electrons released by each element of the photoemitter are focussed by an electron-optical device onto a fluorescent screen, reconverting it in the process again into an optical image. This process can be carried out in a single step or in several steps, amplifying the image at each step. In the most common type of television camera tubes, the first step, as with the image converter, is to transfer an electron image from the photocathode onto a thin insulating target, where, through emission of secondary electrons, a pattern of positive charges results. An independent electron beam scans the target, is influenced by the charges residing on its surface, and conveys the information to a secondary electron multiplier. The amplified signal goes to the external circuit.

Photoconductors, too, have been widely used, mostly in the form of thin film devices, for storage tubes, television pickup tubes, display devices, radiation-controlled variable resistances, electronic switches, image amplifiers, X-ray intensifiers, and, for electrophotography. As radiation detectors, photoconductors offer an extension of the spectral range to lower incident photon energies than obtainable with photoemitters. Infrared detectors have been described, such as indium-antimony detectors, that have a lower energy limit of 0.15 electron volt. Special detectors for the infrared are commercially available with a low energy limit corresponding to 0.030–0.040 electron volt. Silicon detectors are widely used for X-ray and gamma-ray detection and spectral analysis.

Photovoltaic devices have been used extensively as photographic light meters and similar devices and have gained prominence as energy conversion devices, mainly because of their high efficiency in the visible region of the spectrum. Solar-cell arrays have been developed that can provide the necessary power for the operation of many electrical devices.

photoengraving, any of several processes for producing printing plates by photographic means. In general, a plate coated with a photosensitive substance is exposed to an image, usually on film; the plate is then treated in various ways, depending upon whether it is to be used in a relief (letterpress) or an intaglio (gravure) printing process.

A brief treatment of photoengraving follows. For full treatment, *see* MACROPAEDIA: Printing, Typography, and Photoengraving.

In relief printing the printing areas of the plate are defined by cutting away the nonprinting areas to a lower depth; ink is uniformly distributed (usually by a roller) on the raised surface only and is then transferred to paper. With intaglio plates, on the contrary, it is the nonprinting areas that are raised; the printing areas are cut or etched away with acid. The whole plate is washed with ink, which is then wiped off the top surface, leaving the incised areas filled with ink to be transferred, under pressure, to paper.

Although early 19th-century experiments with photographically prepared printing plates and chemically etched letterpress printing surfaces were contemporary with the first developments in photography, the commercial development of photoengraving did not start until the 1850s, after the introduction of the wet-collodion process. This process, still widespread until the 1930s, uses a plate coated with a light-sensitive solution of collodion to capture a negative image for transfer to the printing plate.

A major difficulty was that of producing tones intermediate between black and white by letterpress printing. In the second half of the 19th century various kinds of halftone screens were invented that solved the problem and ensured the rapid growth of photoengraving. Light falling on a surface coated with a photosensitive substance was made to pass first through a patterned screen (usually glass ruled with a uniform grid of lines, either the lines themselves or the squares between them being opaque), as well as through a transparent film carrying the image (*e.g.*, a photographic transparency). The screen broke the image into a pattern of dots of various sizes, the size of any given dot being dependent on the amount of light transmitted by the image at that point. Thus, when the plate was developed—usually by washing away the unexposed coating—the surface was left covered with dots of varying size corresponding to the varying tones of the image. The exposed, hardened coating acted as a resist during the subsequent etching of the plate by acid. This process can be applied whether a plate is being prepared for relief or intaglio printing. For relief printing, a halftone screen with opaque lines and a negative transparency are used. The areas of large dots (which take more ink than small ones) will print as the dark areas of the image. Intaglio printing using this process, known as photogravure, was invented in 1878. A transparent positive is used with a screen of opaque squares, producing a plate of tiny cells etched to varying depths, the deepest (which hold the most ink) representing the dark areas on the image. Because the cell pattern breaks up fine lines, photogravure is not ideal for printing type, but it is very useful for continuous tone copy like photographs and drawings and is used in printing periodicals and other commercial work needing very long press runs. It is generally done by rotary printing (known therefore as rotogravure) from copper cylinders, which are often plated with chromium to make it longer wearing.

A related process, line intaglio, or copperplate gravure, in which the images are composed exclusively of lines of varying width and depth, is used extensively in the printing of bank notes, stamps, securities, and the like. The characteristic sharpness and variety of the lines make it hard to reproduce them by any photographic or other means.

An important technical difficulty in photoengraving can occur at the etching stage, from the tendency of acid to act equally in all directions and not merely downward, thus broadening lines and undercutting and weakening halftone dots. This was overcome initially by coating the sidewalls of the etched areas with an acid-resist, sometimes repeatedly, but later by the discovery of various compounds that control the lateral action of the chemicals used to etch magnesium, copper, and zinc.

photofission, in physics, splitting of an atomic nucleus into two fragments of nearly equal mass upon absorption of electromagnetic radiation. It most commonly occurs in heavy nuclei, as in those of uranium or thorium, upon their bombardment by high-energy gamma rays. *Compare* photodisintegration.

photogram, shadowlike photographic image made by placing opaque, translucent, or transparent objects between light-sensitive paper or film and a light source; exposing the assemblage to light; and developing the latent image on the paper. The artistic potential of the photogram was extensively exploited during the 1920s.

The Swiss photographer Christian Schad, Hungarian-born painter-photographer László Moholy-Nagy, and U.S. expatriate Surrealist Man Ray were the medium's chief proponents. Ray, whose photograms are known as rayographs, applied the contact-exposure technique to motion-picture making as well.

photogrammetry, technique that uses photographs for mapmaking and surveying. As early as 1851 the French inventor Aimé Laussedat perceived the possibilities of the application of the newly invented camera to mapping, but it was not until 50 years later that the technique was successfully employed. In the decade before World War I terrestrial photogrammetry, as it came to be known later, was widely used; during the war the much more effective technique of aerial photogrammetry was introduced. Although aerial photogrammetry was used primarily for military purposes until the end of World War II, thereafter, peacetime uses expanded enormously. Photography is today the principal method of making maps, especially of inaccessible areas, and is also heavily used in ecological studies and in forestry, among other uses.

From the air, large areas can be photographed quickly using special cameras, and blind areas, hidden from terrestrial cameras, are minimized. Each photograph is scaled, using marked and known ground reference points; thus, a mosaic can be constructed that may include thousands of photographs. Plotting machines and computers are used to overcome complications.

Instruments used in photogrammetry have become very sophisticated. Developments in the second half of the 20th century include satellite photography, very large scale photographs, automatic visual scanning, high-quality colour photographs, use of films sensitive to radiations beyond the visible spectrum, and numerical photogrammetry.

photographic emulsion, nuclear: *see* nuclear photographic emulsion.

photography, method of recording the permanent image of an object by the action of light, or related radiation, on a sensitive material. The word, derived from the Greek *photos* ("light") and *graphien* ("to draw"), was first used by Sir John F.W. Herschel in 1839.

A brief account of photography follows. For full treatment, *see* MACROPAEDIA: Photography.

Louis-Jacques-Mandé Daguerre announced the first commercially successful photographic process, the daguerreotype, in 1839. A year later William Henry Fox Talbot described his negative–positive calotype process, which became the forerunner of modern photographic processes. This was followed by the wet collodion process in 1851 and by dry plates in 1871. Flexible films were introduced in 1889 by George Eastman. Since then, the light sensitivity (speed) of films has been greatly improved, and the quality of film emulsions has become so fine that prints many times larger than the size of the film can be made. Colour photography, expensive and complicated in the 19th century, has been so refined that it is nearly as easy as black-and-white photography. Technical improvements in the camera have transformed it from a bulky, cumbersome apparatus to a compact, sophisticated device that is often small enough to fit in a pocket.

The development of photography has had a profound effect on society. At first its main use was in portraiture and in showing people the sights of the world. In the 1850s and 1860s, Roger Fenton and Mathew B. Brady pioneered war photography and founded photo-journalism, which has become pervasive in modern mass media. Professional photography now covers an enormous range of activities. Portraiture consists mainly of photography and pictures of the newsworthy. Social photography records people at parties, weddings, and other celebrations. Publicity, fashion, and advertising photography has become highly sophisticated, as has industrial and architectural photography. Pictures taken for their own sake, rather than to display a particular subject, are used in magazines, books and calendars and increasingly as decorative art. The use of posters and prints for wall decoration has increased, as has the interest in "fine prints" especially monochrome ones. Photography is also used for scientific and technical research. It has made a direct contribution to work in virtually every discipline, and its ability to record invisible radiation and photographs in uninhabitable situations has provided pictures of many phenomena that would otherwise have gone unseen.

To make a photograph it is first necessary to form an image on a light-sensitive plate or film in a camera by means of a system of lenses in the camera. The plate or film may be of cellulose acetate, glass, or other transparent material coated with an emulsion of a halide (or salt) of silver, such as silver bromide or silver chloride. After exposure to light for a certain time period, the film is removed from the camera and placed in a chemical developer solution that yields, fine, black silver particles. The particles cluster where light was strongest on the film, producing a reverse, or negative, image of the light and shadow of the object photographed. The particles are chemically fixed on the negative by washing in a fixer, which is frequently a solution of sodium thiosulfate called hypo. Other chemicals dissolve the unexposed silver salts, which are then washed out with water.

An accurate positive image, or photograph, is made on special sensitized paper by placing the finished negative over the paper and exposing it to light. The lightest portions of the negative transmit the most light, and darker portions screen out more light, so that the negative image is reversed on the print. This positive image is fixed and washed in a process similar to the one used to produce the negative. In instant-print photography the processing chemicals are included in the film or camera, and the pictures are processed immediately upon their removal from the camera. Film intended to produce slides can be processed to bypass the negative stage. Such "reversal" films are commonly used to produce colour transparencies and, rarely, black-and-white ones.

Colour photography is accomplished by two basic methods. In the additive processes, now seldom used, the subject is photographically separated into its blue, green, and red components (three-colour process), and negative images are used to combine blue, green, and red light to reproduce the subject with the same proportions of colours as in the original. In subtractive processes, positives are made in colours complementary (yellow, magenta, and cyan) to negative images photographed by blue, green, and red light; the three positive layers superimposed on each other reproduce the colours present in the original subject.

Infrared photography is used to record the image of an object by using film sensitive to invisible infrared radiation instead of to ordinary light. Hot objects emit infrared rays and may be photographed in the dark, showing details of temperature distribution over the survace. Distant objects may be photographed with improved clarity because infrared light is not scattered as much by atmospheric haze as is ordinary light. The technique is widely used in astronomy; nebulae and stars that are invisible because of haze may be photographed by infrared photography. It has been applied to detect irregularities in treated and dyed textiles; to decipher old or altered documents; in aerial photography to observe pollution in streams and lakes and to detect diseased trees in forests; and by the military to distinguish painted camouflage from foliage, chlorophyll being transparent to infrared radiation.

Ultraviolet photography is a method of making a photograph of an object illuminated with ultraviolet rather than ordinary visible light. In the direct method, a plate or film sensitive to ultraviolet light is exposed to the ultraviolet rays reflected off the object. In the fluorescence method, and ultraviolet light induces fluorescence, or the production of visible light, in the object, and this fluorescent light provides the illumination for the photograph.

Ultraviolet photography, with its capability of detecting characteristic fluorescences, serves as a tool for identifying paintings, ceramics, grades of paper, and erasures in documents. Because of the excessive scattering of the short wavelengths of ultraviolet by the atmosphere, ultraviolet photography is not adapted to landscape photography; such photos appear blurred and show no shadows.

photoluminescence, emission of light from a substance as a result of absorption of electromagnetic radiation; such a substance is called a phosphor (*q.v.*), and the emitted light usually has a longer wavelength than the incident radiation.

photolysis, chemical process by which molecules are broken down into smaller units through the absorption of light.

The best known example of a photolytic process is the experimental technique known as flash photolysis, employed in the study of short-lived chemical intermediates formed in many photochemical reactions. The technique, developed by the English chemists R.G.W. Norrish and George Porter in 1949, consists of subjecting a gas or liquid to an intense burst of light lasting a few microseconds or milliseconds, followed by a second, ordinarily less intense flash. The first flash dissociates the absorbing compound into short-lived molecular fragments and the second flash provides a means for their identification by spectrophotometry (*q.v.*). The method is a valuable tool for the identification of transient chemical intermediates and hence for the study of mechanisms of fast chemical reactions.

photometer, device that measures the strength of electromagnetic radiation in the range from ultraviolet to infrared and including the visible spectrum. Such devices are generally transducers that convert an electric current into a mechanical indication, *e.g.*, a pointer moving across a dial. The source of the current may be a selenium cell, which generates a current when light falls on it, or it may be a permanent source, such as a battery, in which case the current passes through a cadmium sulfide cell whose resistance varies with the amount of light falling on it.

Photometers are made in many forms for various applications. They may be used directly, as in photography or in measuring glare, colour variation, reflectance, or other qualities, or they may be incorporated into such devices as densitometers, spectrographs, and telescopes.

photometry, in astronomy, the measurement of the brightness of stars and other celestial objects (nebulae, galaxies, planets, etc.). Such measurements can yield large amounts of information on structure, temperature, distance, age, etc.

A brief treatment of astronomical photometry follows. For full treatment, *see* MACROPAEDIA: Analysis and Measurement, Physical and Chemical.

The earliest observations of the apparent brightness of the stars were made by Greek astronomers. The system used by Hipparchus about 130 BC divided the stars into classes called magnitudes; the brightest were described as being of first magnitude, the next class were second magnitude, and so on in equal steps down to the faintest stars visible to the unaided eye, which were said to be of sixth magnitude. The application of the telescope to astronomy in the 17th century led to the discovery of many fainter stars, and the scale was extended downward to seventh, eighth, etc., magnitudes.

In the early 19th century it was established by experimenters that the apparently equal steps in brightness were in fact steps of constant ratio in the light energy received and that a difference in brightness of five magnitudes was roughly equivalent to a ratio of 100. In 1856 N. Pogson suggested that this ratio should be used to define the scale of magnitude, so that a brightness difference of one magnitude was a ratio of 2.5188 in intensity and a five-magnitude difference was a ratio of $(2.5188)^5$, or precisely 100. Steps in brightness of less than a magnitude were denoted by using decimal fractions. The zero point on the scale was chosen to cause the minimum change for the large number of stars traditionally established as of sixth magnitude, with the result that several of the brightest stars proved to have magnitudes less than 0 (*i.e.*, negative values).

The introduction of photography provided the first nonsubjective means of measuring the brightness of stars. The fact that photographic plates are sensitive to violet and ultraviolet radiation, rather than to the green and yellow wavelengths to which the eye is most sensitive, led to the establishment of two separate magnitude scales, the visual and the photographic. The difference between the magnitudes given by the two scales for a given star was later termed the colour index and was recognized to be a measure of the temperature of the star's surface.

Observations in the 19th century, especially by E. Pickering at Harvard, revealed that while the majority of stars are of unchanging brightness, five classes of variable stars could be identified. The most spectacular of these are the novae, stars that suddenly brighten by 10 or more magnitudes before fading slowly back into obscurity. Three types of stars show regular changes in brightness; The simplest are the eclipsing binaries, pairs of stars rotating about one another that are seen from Earth regularly to occult one another. Second are the long-period variables, the best known being Mira Ceti, which fluctuates between second and ninth magnitude in a cycle of 332 days. The third group, called the Cepheid variables after delta Cephei, the best known example, fluctuate faster but over a narrower range. The fifth class of unsteady stars, the irregular variables, show small changes in brightness, with no discernible pattern; Betelgeuse is a first-magnitude example. The Cepheid variables are the most important of these five groups because their periods of variation are related to their absolute brightness; they can thus be used to measure distances to clusters or galaxies in which they are observed.

Since the 1940s astronomical photometry has been vastly extended in sensitivity and wavelength range, especially by the use of photoelectric rather than photographic detectors. The faintest stars now observed have magnitudes around 24. Magnitudes are now measured not only in the visible but also in the ultraviolet and infrared.

The dominant photometric classification system, the UBV system introduced in the early 1950s by H.L. Johnson and W.W. Morgan, uses three wave bands, one in the ultraviolet, one in the blue, and the other in the dominant visual range. More elaborate systems can use many more measurements, usually by dividing the visible and ultraviolet regions into narrower slices or by extension of the range into the infrared. Routine accuracy of measurement is now of the order of 0.01 magnitude, and the principal experimental difficulty in much modern work is that the sky itself is luminous, due principally to photochemical reactions in the upper atmosphere. The limit of observations is now about 1/1,000 of the sky brightness in visible light and approaches 1/1,000,000 of the sky brightness in the infrared.

Photometric work is always a compromise between the time taken for an observation and its complexity. A small number of broad-band measurements can be done quickly, but as more colours are used for a set of magnitude determinations for a star, more can be deduced about the nature of that star. The simplest measurement is that of effective temperature, while data over a wider range allow the observer to separate giant from dwarf stars, to assess whether a star is metal-rich or deficient, to determine the surface gravity, and to estimate the effect of interstellar dust on a star's radiation.

photomicrography, photography of objects under a microscope. Such opaque objects as metal and stone may be ground smooth, etched chemically to show their structure, and photographed by reflected light with a metallurgical microscope.

Biological materials may be killed, dyed so that their structure can be seen, and mounted on glass slides for photographing by transmitted light using ordinary light microscopes; or, by using ultraviolet, infrared, electron, or X-ray microscopes, sharp photographs can be made of living, unstained specimens. Cinephotomicrography, taking motion pictures of magnified objects, is useful in studying organism growth, colloidal movement, and chemical reactions.

photomontage, composite photographic image made either by pasting together individual prints or parts of prints, by successively exposing individual images onto a single paper, or by exposing the component images simultaneously through superimposed negatives. In the 1880s the juxtaposition of separate images

Study for a composition picture by Henry Peach Robinson, *c.* 1860

Gernsheim Collection, Humanities Research Center, The University of Texas at Austin through successive exposures became fashionable in the "combination print," especially in the form of the contrived group portrait. The subjective, fragmented, potentially absurd qualities of this juxtaposition were exploited by Dadaist and Futurist artists of the early 20th century.

The photomontages of George Grosz and John Heartfield from this period are among the major examples of the form. Photomontage was also used extensively in the Pop art movement of the 1960s and 1970s. A technically sophisticated form of photomontage was developed by the U.S. photographer Jerry Uelsmann.

photomultiplier tube, electron multiplier tube that utilizes the multiplication of electrons by secondary emission to measure low light intensities. It is useful in television camera tubes, in astronomy to measure intensity of faint stars, and in nuclear studies to detect and measure minute flashes of light. The tube utilizes a photosensitive cathode, that is, a cathode that emits electrons when light strikes it, followed by a series of additional electrodes, or dynodes, each at a successively higher positive potential so that it will attract electrons given off by the previous dynode.

The first dynode is made to emit several electrons by each electron striking it; similarly, each electron from the first dynode causes the second dynode to emit several electrons, leading to an increase, or multiplication, of electrons at each dynode until the final dynode is reached. Total amplification may reach 1,000,000, with nine dynodes customarily employed.

photon, also called LIGHT QUANTUM, minute energy packet of electromagnetic radiation. The concept originated (1905) in Einstein's explanation of the photoelectric effect, in which he proposed the existence of discrete energy packets during the transmission of light. Earlier (1900), the German physicist Max Planck had prepared the way for the concept by explaining that heat radiation is emitted and absorbed in distinct units, or quanta. The concept came into general use after the U.S. physicist Arthur H. Compton demonstrated (1923) the corpuscular nature of X-rays. The term photon (from Greek *phōs, phōtos,* "light"), however, was not used until 1926. The energy of a photon depends on radiation frequency; there are photons of all energies from high-energy gamma- and X-rays, through visible light, to low-energy infrared and radio waves. All photons travel at the speed of light. Considered among the subatomic particles, photons are bosons, having no electric charge or rest mass and one unit of spin; they are field particles that are thought to be the carriers of the electromagnetic field.

photoperiodism, the functional or behavioral response of an organism to changes of duration in daily, seasonal, or yearly cycles of light and darkness. Photoperiodic reactions can be reasonably predicted, but temperature, nutrition, and other environmental factors also modify an organism's response.

A brief treatment of photoperiodism follows. For full treatment, *see* MACROPAEDIA: Behaviour, Animal.

In animals, the regular activities of migration, reproduction, and the changing of coats or plumage can be induced out of season by artificially altering daylight. Birds, for example, have migrated north in the winter after having been exposed to reversed seasonal lighting in laboratories. The manipulation of a specific stimulating period of darkness, which is required by each species for every phase of the migratory process, is an important factor in photoperiodism.

When stimulated by light, an animal's pituitary gland will release hormones that affect reproduction. Thus, the mating season of a species can be made to occur at an unusual time by manipulating daylight. Long periods of light followed by short periods will induce mating behaviour in species that normally breed in autumn (*e.g.,* goats and sheep), while spring breeders (*e.g.,* mink) will start the reproductive process when daylight is increased. Application of photoperiodism is common in the poultry industry, as daylight affects egg-laying, mating, and body weight of the fowl.

photophore, light-emitting organ present in fireflies and certain other bioluminescent animals. Photophores are glandular in origin and produce light by a chemical reaction. Photophores vary in size and form but often contain such structures as lenses, reflecting layers, and filters in addition to the light-producing material. *See also* bioluminescence.

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photoprotein, in biochemistry, any of several proteins that give off light upon combination with oxygen, hydrogen peroxide, or other oxidizing agents. Unlike the oxidation of luciferin, the production of light by a photoprotein requires no catalyst. Such a system occurs in *Aequorea*, a luminescent jellyfish, in which the single organic chemical aequorin requires calcium or strontium ions for luminescence to occur. *See also* bioluminescence.

photoreception, any of the biological responses of organisms to stimulation by light.

A brief treatment of photoreception follows. For full treatment, *see* MACROPAEDIA: Sensory Reception.

In plants the primary photoreceptive response is photosynthesis, the conversion of carbon dioxide and water to the essential nutritive elements of all life, using the energy of the Sun. A secondary consequence of photoreception in plants and in many animals is the indirect determination of growth and reproductive patterns by annual cyclic fluctuations in the availability of sunlight. Most frequently, however, the term photoreception is used in reference to the mechanism by which animals receive sensory data transmitted by light of different qualities and wavelengths, only some of which are perceptible by humans.

The apparatus for the reception of light may involve an entire organism, as in many single-celled animals, or may range in specialization and complexity from the simple eyespots, or light-receptors, distributed over the surface of some animals, to the intricate structure of the mammalian eye. The operation of most eyes relies on the chemical response of a light-sensitive pigment that begins a chain of nerve responses. The camera-like apparatus of vertebrate eyes uses a lens and an external layer of transparent membrane, the cornea, to focus and project an inverted image onto the retina, a lining within the eye structure. The size of the lens and its distance from the photosensitive retina are fixed in a ratio that provides the optimal balance between light-gathering and image-focussing capacities for each organism, according to its habits and its environment. In nocturnal animals such as the opossum, for instance, a wide lens relatively near the retina allows for a high light-gathering ability, but results in poor resolution. The amount of light entering the eye is also determined by the diameter of the pupil, the central channel through which light enters, which is controlled by the musculature of the surrounding iris, the coloured portion of the eye. In humans, because the pupil retains its circular shape, its range of expansion and contraction is limited, while in some nocturnal species such as cats the pupil contracts into a slit that can block nearly all light.

Image reception in the vertebrate retina is controlled by two types of photoreceptor cells: the longer rod cells are responsive to light under relatively dark conditions (scotopic reception), and cone cells are responsible for colour perception and for vision under brighter conditions (phototopic reception). The two types are found together on the retinas of animals that are active both day and night. Animals that function nocturnally have retinas composed mostly of rods. Diurnal vertebrates focus light on the fovea, a retinal depression containing only cones. The photoreception of both rods and cones is controlled by an outer sheath of disks known as lamellae. The optic structure of cephalopods, such as the octopus, is essentially the same as in vertebrates, though the retina is differently organized.

The most rudimentary optical apparatus is the eyespot, found in many unicellular animals and some primitive worms. Its basic structure in multicellular animals consists of an internal pocket coated with photosensitive pigment, known as a rhabdomere. A more sophisticated form of eye is the ocellus, found in mollusks and arthropods, which, like the eye of the vertebrates, inverts the image it focusses on a photosensitive membrane.

Certain worms and arthropods make use of compound eyes, which consist of a number of visual structures known as ommatidia that are densely set together. These take a rectangular or octagonal shape, and contain components analogous to those of the more complex, camera-like vertebrate eye. Each one is capable of receiving light independently, and they are sometimes separated by a thin film of pigment, as in the appositional eye of the honeybee, or by cilia that divide the rhabdomeres of different cells.

Photoreceptor cells absorb light through a layer of pigment and convert it into a stimulus directed toward the nervous system. In many photoreceptors small, hairlike projections, cilia, help in the internal and intercellular transport of essential substances. This is the case with mitochondria, minute structures that produce the adenosine triphosphate needed for photoreception. The function of the cilia is performed in vertebrate rod and cone cells by the surrounding lamellae. In rod cells old lamellae are replaced by new ones throughout the life of the cell, while in cone cells disks are renewed through the replacement of exhausted tissue materials. Photoreceptor cells in vertebrates are connected by means of a neural projection known as a foot piece, to the retina, which is itself an extension of the brain. The photoreceptors of invertebrates are linked to nerves or nerve ganglia within the eye through thin fibres called axons.

The pigment responsible for nerve excitation in both vertebrates and invertebrates consists of the chemical compound chromophore, which absorbs light, and a protein complex known as opsin. Though the chromophore contained in all visual pigments is virtually identical, variations in the range of wavelength reception by different pigments are the result of differences in the structures of animal proteins. In the conversion of light reception to nervous responses by photoreceptor cells, stimulation by light results in changes in the electrochemical equilibrium of cell membranes, which in turn produce nervous stimuli.

photorecovery, restoration to the normal state, by the action of visible light, of the deoxyribonucleic acid composing the hereditary material in animal skin cells and plant epidermal cells damaged by exposure to ultraviolet light. The phenomenon is also called photoreactivation, especially in microorganisms. The failure of cells to repair such damage, in individuals with certain biochemical disorders, leads to serious skin problems.

photosensitization, the process of initiating a reaction through the use of a substance capable of absorbing light and transferring the energy to the desired reactants. The technique is commonly employed in photochemical work, particularly for reactions requiring light sources of certain wavelengths that are not readily available. A commonly used sensitizer is mercury, which absorbs radiation at 1849 and 2537 angstroms; these are the wavelengths of light produced in high-intensity mercury lamps. Also used as sensitizers are cadmium; some of the noble gases, particularly xenon; zinc; benzophenone; and a large number of organic dyes.

In a typical photosensitized reaction, as in the photodecomposition of ethylene to acetylene and hydrogen, a mixture of mercury vapour and ethylene is irradiated with a mercury lamp. The mercury atoms absorb the light energy, there being a suitable electronic transition in the atom that corresponds to the energy of the incident light. In colliding with ethylene molecules, the mercury atoms transfer the energy and are in turn deactivated to their initial energy state. The excited ethylene molecules subsequently undergo decomposition. Another mode of photosensitization observed in many reactions involves direct participation of the sensitizer in the reaction itself.

photosphere, visible surface of the Sun, about 400 kilometres (250 miles) thick, from which is emitted most of the Sun's light that reaches the Earth directly. Light generated deeper in the Sun cannot get out without absorption and re-emission. Temperatures in the Sun's photosphere range from about 10,000 K (18,000° F) at the bottom to 4,400 K (8,000° F) at the top; density is about 1/1,000 that of air at the surface of the Earth. Sunspots are photospheric phenomena.

Large-scale photographic images of the photosphere show it to have a granular structure. Each grain or cell is a mass of hot gas several hundred kilometres in diameter; each rises from inside the Sun, radiates energy, and sinks back within a few minutes to be replaced by others in a constantly changing pattern, shown particularly well in time-lapse motion pictures of the Sun.

photosynthesis, the process by which green plants and certain other organisms transform light energy into chemical energy. Photosynthesis in green plants harnesses the energy of sunlight to convert carbon dioxide, water, and minerals into organic compounds and gaseous oxygen.

A brief treatment of photosynthesis follows. For full treatment, *see* MACROPAEDIA: Photosynthesis.

In addition to the green plants, photosynthetic organisms include certain protists (such as euglenoids and diatoms), cyanophytes (blue-green algae), and various bacteria. The process in photosynthetic protists and cyanophytes resembles that in green plants; it differs in the photosynthetic bacteria in that compounds other than water serve as a reactant and oxygen is not produced. All photosynthetic organisms—with the exception of a minor group of bacteria, the halobacteria—contain the light-absorbing pigment chlorophyll, which plays a key role in the transfer of energy from light to chemical compounds.

Photosynthesis is the fundamental process that maintains life on Earth. Living cells convert food into energy and structural components. Almost all organisms derive this food, directly or indirectly, from the organic compounds formed within plants during photosynthesis. The stored energy in these compounds is essential for growth, repair, reproduction, movement, and other vital functions. Without photosynthesis, not only would replenishment of the fundamental food supply halt but the Earth would eventually become devoid of oxygen.

Just as the organic molecules in the bodies of living organisms contain energy converted by photosynthesis from the energy of the Sun, so do the molecules of fossil fuels. The energy provided by coal, oil, and gas comes from photosynthesis carried on by plants of earlier times and preserved down through the ages, to be released by combustion in modern industrial processes. Most of the energy released both by the burning of fossil fuels and by the metabolism of living cells is given off as heat and must be replaced by the continued input of radiant energy from the Sun.

The principal organic products of plant photosynthesis are carbohydrates. Formation of the simple carbohydrate glucose is shown by the equation

$$\underset{\text{carbon dioxide}}{6CO_2} + \underset{\text{water}}{12H_2O} \xrightarrow[\text{green plants}]{\text{light}} \underset{\text{glucose}}{C_6H_{12}O_6} + \underset{\text{oxygen}}{6O_2} + \underset{\text{water}}{6H_2O}$$

The molecules of glucose produced are usually linked with other molecules to form more complex carbohydrates. Other products of photosynthesis are formed by incorporating mineral elements into the process. The energy required to break the chemical bonds in the reactants and to create new bonds in the products is provided by light. The excess energy not used up in the chemical reactions is stored as chemical energy in the organic products formed.

The rate of photosynthesis is dependent on the following environmental factors: light intensity, temperature, and the availability of carbon dioxide, water, and certain minerals. A shortage of any one of these factors can limit the rate of photosynthesis, and an increase in the particular rate-limiting factor will, up to a point, speed up the process. The rate also varies with the plant species and its physiological state.

Photosynthesis is not a single process but consists of a number of photochemical and enzymatic reactions. In green plants, the intricate apparatus required for such complex processes is located in the chloroplasts, the cell organelles that contain the chlorophyll. The chloroplasts are crowded with multiple layers of membranes, the lamellae, composed of proteins and lipids. The protein matter includes some of the enzymes and coenzymes used in the photosynthetic process; the lipid portion contains two types of chlorophyll, along with other pigments that assist in absorbing light energy.

The unique feature of photosynthesis consists in the coupling of enzymatic reactions to photochemical systems that can trap electrons set free by the impact of light. In essence, photosynthesis is an oxidation–reduction reaction between carbon dioxide and water, in which carbon dioxide is reduced and water oxidized when hydrogen atoms are transferred from the water to the carbon dioxide; light is the energy source that impels the reaction. Subreactions that form part of this complex process include photolysis (splitting by light) of water, photophosphorylation, and carbon dioxide fixation.

The reactions of photosynthesis include a photochemical, or light-dependent, stage and an enzymatic, or dark, stage that involves enzymatic reactions. During the light stage the chlorophyll absorbs light energy, which excites some electrons in the pigment molecules to higher energy levels. These high-energy electrons leave the chlorophyll and are transferred along through a series of molecules, called electron carriers, that can gain electrons (reduction) or lose them (oxidation). During the tandem operation of two different systems of light reactions, electrons are split off from water by photolysis, thus oxidizing it; oxygen gas is released; energy is stored in the compound ATP (adenosine triphosphate) by photophosphorylation and the coenzyme $NADP^+$ (nicotine adenine dinucleotide phosphate) is reduced to NADPH.

During the carbon-reduction cycle, occurring in the dark stage of photosynthesis, carbon dioxide is fixed, reduced, and used to synthesize carbohydrates and other organic compounds. The cycle involves formation of intermediate compounds called sugar phosphates. The compound RuBP (ribulose-l,5-bisphosphate) combines with the carbon dioxide to form PGA (phosphoglycerate). The carbon is then reduced by further enzymatic reactions involving the energy contained in the ATP and NADPH that were formed during the light reactions. The sugars produced by these reactions are used to synthesize higher carbohydrates, proteins, and fats—the plant foodstuffs that are the end products of photosynthesis. Regulatory enzymes control the rate at which the various steps in the photosynthetic process take place.

The manner in which plants convert light energy into chemical energy began to be understood somewhat in the 19th century. Investigation of the mechanism of photosynthesis is still going on, aided by the use of radioactive isotopes and fluorescence techniques and by the study of photosynthetic bacteria and algae.

phototransmutation: *see* photodisintegration.

phototube: *see* photoelectric cell.

phototypesetting: *see* photocomposition.

photovoltaic effect, process in which two dissimilar materials in close contact act as an electric cell when struck by light or other radiant energy.

Light striking such crystals as silicon or germanium, in which electrons are usually not free to move from atom to atom within the crystal, provides the energy needed to free some electrons from their bound condition. Free electrons cross the junction between two dissimilar crystals more easily in one direction than in the other, giving one side of the junction a negative charge and, therefore, a negative voltage with respect to the other side, just as one electrode of a battery has a negative voltage with respect to the other. The photovoltaic battery can continue to provide voltage and current as long as light continues to fall on the two materials. This current can be used to measure the brightness of the incident light or as a source of power in an electrical circuit, as in the modern solar battery.

A solar battery is a combination of many individual photovoltaic cells. One composed of two different types of silicon crystals, when exposed to sunlight outside the Earth's atmosphere, can capture 14 percent of the incident energy and supply 170 watts per square metre (16 watts per square foot) of the contact area between the two materials. *See also* photoelectric effect.

Phra (Egyptian god): *see* Re.

Phra Nakhon, also spelled PHRA NAKHORN or PHRA NAKORN, section of Bangkok Metropolis, Thailand's capital and largest city, on the east bank of the Mae Nam (river) Chao Phraya. It was a *changwat* (province) until 1972, when it was merged with Thon Buri, west of the river, to form the enlarged province of Krung Thep Mahanakhon (*q.v.;* Bangkok Metropolis).

Phra Naret (Siamese king): *see* Naresuan.

Phraates, Persian FARHĀD, name of Parthian kings, grouped below chronologically and indicated by the symbol •.

• **Phraates II** (d. 128 BC), king of Parthia (reigned *c.* 138–128 BC), the son and successor of Mithradates I.

Phraates was attacked in 130 by the Seleucid Antiochus VII Sidetes, who after initial successes was defeated and killed during 129 in Media. With his defeat, Seleucid dominion over the countries east of the Euphrates River was finally ended. During these wars two powerful nomadic tribes, the Śakas and the Tochari, had forced their way into eastern Persia. Phraates advanced against them, pressing into service Greek prisoners from the army of Antiochus; but when the Greeks deserted him in battle, Phraates was defeated and slain. He was succeeded by his uncle Artabanus II.

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• **Phraates III** (d. *c.* 57 BC), king of Parthia (reigned 70–58/57 BC), the son and successor of Sanatruces (Sinatruces).

On Phraates' accession, the Roman general Lucullus was preparing to attack King Tigranes I of Armenia, who had wrested several vassal states from the Parthian kingdom. Phraates refused to help Tigranes fight the Romans; instead he made an alliance with the Roman general Pompey and invaded Armenia (66 BC). Pompey at first abandoned Mesopotamia to Phraates but later reversed his stand and occupied the Parthian vassal states of Gordyene and Osroëne. Before Phraates could take any action, he was murdered by his two sons, Orodes II and Mithradates III.

• **Phraates IV** (d. 2 BC), king of Parthia (reigned *c.* 37–2 BC) who murdered his father, Orodes II, and his brothers to secure the throne.

In 36 the Romans under Mark Antony attacked Parthia, penetrating through Armenia into Media Atropatene. Phraates, however,

Phraates IV, coin, 1st century

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

defeated Antony, who retreated with heavy losses. In 34 Phraates' vassal king in Media made an alliance with Antony; but when Antony later withdrew, the Parthians reoccupied Media. A revolt soon broke out in Parthia, and Tiridates II of Armenia drove Phraates from the throne, forcing him to take refuge with the Śaka nomads. In 30, however, Phraates was able to regain power, and Tiridates fled to the Romans with the son of Phraates as a hostage.

The emperor Augustus made peace with Phraates and returned his son. Armenia and Osroëne were recognized as Roman dependencies. Augustus also sent Phraates an Italian concubine named Musa. On her advice, Phraates sent four of his sons to Rome, where they remained as hostages of Augustus. Phraates was later poisoned by Musa, who then ruled jointly with her son Phraates V.

• **Phraates V** (d. *c.* AD 4), king of Parthia (reigned *c.* 2 BC–*c.* AD 4), the son and successor of Phraates IV.

Phraates' mother, Musa, secured the throne for him by murdering his father. The two were later married (AD 2) and ruled jointly. Under Phraates, war with Rome threatened to break out over the control of Armenia. When the Roman emperor Augustus sent his adopted son Gaius Caesar to invade Parthia, the Parthians preferred to conclude a treaty (AD 1), by which Armenia was recognized as being in the Roman sphere. Together with his mother, Phraates was later slain or driven into Syria.

Phrachomklao (Siamese king): *see* Mongkut.

Phrachunlachomklao (Siamese king): *see* Chulalongkorn.

Phrae, town in the mountainous northern region of Thailand. It is located on the Yom River and the Sukhothai-Nan road in a historic region with many temples and ruins. Teak lumbering is a major activity, and tobacco and rice are grown extensively around the town. Phrae has an airport with scheduled flights. Pop. (1986 est.) town, 20,180.

Phramongkutklao (Siamese king): *see* Vajiravudh.

Phranangklao (Siamese king): *see* Rama III.

Phraortes, Iranian FRAVARTISH, also called KHSHATHRITA, Assyrian KASHTARITI (d. 653 BC), king of Media from 675 to 653 BC. Phraortes, who was known by that name as a result of the writings of the 5th-century-BC Greek historian Herodotus, was originally a village chief of Kar Kashi, but he later subjugated the Persians and a number of other Asian peoples, eventually forming an anti-Assyrian coalition of Medes and Cimmerians. In his attack on Assyria, however, he was defeated and killed in battle.

Another Phraortes was a usurper who reigned for a short time in Media during a rebellion against the Achaemenian king Darius I in 522 BC. Darius' rock inscription at Bīsitūn relates that "a man of the name of Fravartish [*i.e.,* Phraortes], a Mede, rebelled in Media and spoke to the people thus 'I am Khshathrita, of the family of Uvakhshtra [Cyaxares].' " After a short reign this king was defeated and executed at Ecbatana, the Median capital. The deception of the usurper Phraortes may have led to Herodotus' mistake about the name of the earlier king.

Phraphutthaloetla Naphalai (Siamese king): *see* Rama II.

Phraphutthayotfa Chulalok (Siamese king): *see* Rama I.

Phrapokklao (Siamese king): *see* Prajadhipok.

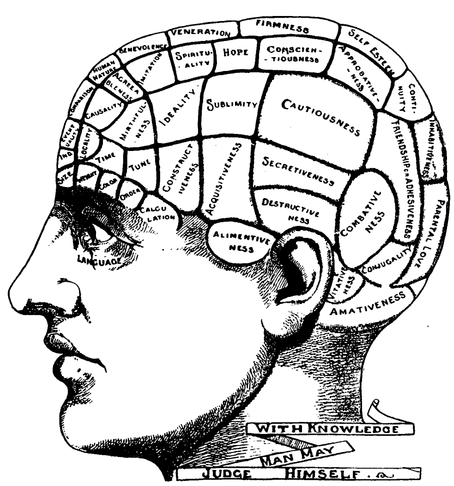
phratry, in anthropology, cluster of sibs, clans, or kinship groups that have grouped together, either because they share a belief in a common ancestor or because, even though the sibs or clans are not actually related by blood, they have adopted common ceremonial and kinship practices. The term phratry also must refer to three or more groups constituting a tribal society. (With only two such groupings, the society takes on features of dual organization, and the groups are termed moieties.)

A description of the phratry in relation to sib and moiety is useful. A sib is a group of unilineal descent groups, either matrilineal or patrilineal, whose members claim a common ancestor. (Some anthropologists, particularly in Europe, use the word clan instead of sib.) The next order of magnitude in social groupings above the lineage and the sib is the phratry, a group of sibs banded together for common practical or ceremonial purpose or because of kinship claims. Finally comes the moiety, one of two exhaustive divisions of a society, each moiety containing a number of sibs and possibly of phratries. If three or more phratries are not further distributed into moieties, however, relationships between members of different phratries will not take on the characteristics of dual organization, which appear only when a society is divided into two moieties. *See also* dual organization; clan.

Phraya Taksin (Siamese king): *see* Taksin.

phrenology, the study of the conformation of the skull as indicative of mental faculties and traits of character, especially according to the hypotheses of Franz-Joseph Gall (1758–1828), a Viennese doctor, and such 19th-century adherents as Johann Kaspar Spurzheim (1776–1832) and George Combe (1788–1858). Phrenology enjoyed great popular appeal well into the 20th century but was wholly discredited by scientific research.

The principles upon which phrenology was based were five: (1) the brain is the organ of the mind; (2) human mental powers can be



Phrenological diagram, 1893

BBC Hulton Picture Library

analyzed into a definite number of independent faculties; (3) these faculties are innate, and each has its seat in a definite region of the surface of the brain; (4) the size of each such region is the measure of the degree to which the faculty seated in it forms a constituent element in the character of the individual; (5) the correspondence between the outer surface of the skull and the contour of the brain-surface beneath is sufficiently close to enable the observer to recognize the relative sizes of these several organs by the examination of the outer surface of the head.

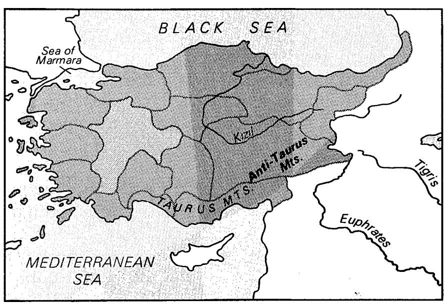
The system of Gall was constructed by a method of pure empiricism, and his so-called organs were identified on quite specious grounds. Having arbitrarily selected the place of a faculty, he examined the heads of his friends and casts of persons with that peculiarity in common, and in them he sought for the distinctive feature of their characteristic trait. Some of his earlier studies were made among inmates of jails and lunatic asylums, and some of the traits that he presumed to detect were "criminal." These he named after their excessive manifestations, mapping out organs of murder, theft, etc. However, the names were changed by Spurzheim to align with more moral and religious considerations. Gall marked out on his model of the head the places of 26 organs as round enclosures with vacant interspaces. Spurzheim and Combe divided the whole scalp into oblong and conterminous patches identified by such designations as amativeness, philoprogenitiveness, concentrativeness, adhesiveness, combativeness, destructiveness, secretiveness, acquisitiveness, constructiveness, self-esteem, love of approbation, cautiousness, benevolence, veneration, conscientiousness, firmness, hope, wonder, ideality, wit, imitativeness, individuality, form perception, size perception, weight perception, colour perception, locality perception, number perception, order perception, memory of things, time perception, tune perception, linguistic perception, comparative understanding, and metaphysical spirit.

Phrygia, ancient district in west-central Anatolia, named after a people the Greeks called Phryges, who dominated Asia Minor between the Hittite collapse (12th century BC) and the Lydian ascendancy (7th century BC). The Phrygians, perhaps of Thracian origin, settled in northwestern Anatolia late in the 2nd millennium. Upon the disintegration of the Hittite kingdom they moved into the central highlands, founding their capital at Gordium and an important religious centre at "Midas City" (modern Yazılıkaya).

Between the 12th and 9th century Phrygia formed the western part of a loose confederation of peoples (identified as "Mushki" in Assyrian records) that dominated the entire Anatolian peninsula. This early civilization borrowed heavily from the Hittites, whom they had replaced, and established a system of roads later utilized by the Persians. About 730 the Assyrians detached the eastern part of the confederation, and the locus of power shifted to Phrygia proper under the rule of the legendary king Midas.

Midas' kingdom came to an abrupt end (*c.* 700) with the invasions of the Cimmerians, a Transcaucasian people who burned Gordium and transferred the hegemony of western Anatolia to the Lydians. After the Cimmerian invasion Phrygia lingered as a geographical expression under the successive rulers of Anatolia; its people were valued as slaves by the Greeks. The Phrygians excelled in metalwork and wood carving and are said to have originated the art of embroidery. Phrygian carpets were famous. Some magnificently carved stone tombs and shrines were uncovered after World War II by American archaeologists. Among the various Phrygian religious practices, the cult of the Great Mother (Cybele) predominated and was passed on to the Greeks.

Little else is known of Phrygian society. Vast lands were owned by the great shrines such as Pessinus, as was the Oriental custom, the high priests being virtually autonomous rulers. Society was probably feudal. An intelligent and



The district of Phrygia under the Roman Empire

From W. Shepherd, *Historical Atlas*, Harper & Row, Publishers (Barnes & Noble Books), New York; revision copyright © 1964 by Barnes & Noble, Inc.

evidently cultivated elite (they were able to read and write) existed at Gordium and Midas City, together with an important nucleus of craftsmen and merchants, some doubtless being foreigners—Greeks, Phoenicians, Syrians, and Urartaeans.

A staple industry was sheep rearing, which provided a fine wool much in demand in Miletus, Pergamum, and other Greek centres of industry. The neighbourhood of Midas City harboured considerable forestland, and timber was clearly an important economic factor. Another specialty was horse rearing, the Phrygians probably being, like many of the Indo-Europeans, an equestrian aristocracy ruling over other native peoples.

Phrygian cap, soft felt or wool conical headdress fitting closely around the head and characterized by a pointed crown that curls forward. It originated in the ancient country

Youth wearing a Phrygian cap, marble, Roman copy of a Greek original, 4th century BC; in the Fitzwilliam Museum, Cambridge, Eng.

By permission of the Syndics of the Fitzwilliam Museum, Cambridge, Eng.

of Phrygia in Asia Minor and is represented in ancient Greek art as the type of headdress worn by Orientals. In Rome the Phrygian cap was worn by emancipated slaves as a symbol of their freedom. During the 11th and 12th centuries, it was again extensively used.

The Phrygian cap once more became the emblem of liberty in the 18th century during the French Revolution, when it was adopted by the Revolutionaries as "the red cap of liberty." It continues to be associated with the national allegorical figure of Liberté.

Phrygian language, ancient language spoken in north-central Asia Minor north and east of Lydia. Texts occur in two alphabets corresponding to two separate time periods: Old Phrygian texts in an early Greek alphabet, dating from about 730–450 BC, and New Phrygian texts (most of them sepulchral inscriptions) in the Greek alphabet from the 1st and 2nd centuries AD. Phrygian is believed by most scholars to be an Indo-European language somehow connected to Greek or Armenian. Some scholars believe it to be related to the Thracian language.

Phrygian mode, in music, third of the eight medieval church modes. *See* church mode.

Phryne (Greek: "Toad"), byname of MNESARETE (b. Thespiae, Boeotia; fl. 4th century BC), famous Greek courtesan; because of her sallow complexion she was called by the Greek name for "toad."

She was born in Boeotia but lived at Athens, where she earned so much by her beauty and wit that she offered to rebuild the walls of Thebes, on condition that the words "destroyed by Alexander, restored by Phryne the courtesan" were inscribed upon them. At a festival of Poseidon and also at the festival at Eleusis she walked into the sea naked with her hair loose, suggesting to the painter Apelles his great picture of "Aphrodite Anadyomene" ("Aphrodite Rising From the Sea"), for which Phryne sat as model. She was also (according to Athenaeus) the model for the statue of the Cnidian Aphrodite by Praxiteles, whose mistress she was; copies of the statue survive in the Vatican and elsewhere. When accused of blasphemy (a capital charge), she was defended by the orator Hyperides. When it seemed as if the verdict would be unfavourable, he tore her dress and displayed her bosom, which so moved the jury that they acquitted her; another version has Phryne tear her own dress and plead with each individual juror.

Phrynichus (fl. *c.* 500 BC, Athens), Athenian tragic poet, an older contemporary of Aeschylus; he was the earliest tragedian of whose work some conception can be formed.

Phrynichus' first victory probably occurred in about 510, and he was probably the first to introduce the female mask, *i.e.,* women characters, into his plays. After the fall of Miletus in 494 he produced the *Capture of Miletus,* which so harrowed Athenian feelings that he was fined; in 476 his *Phoenissae,* in which news of the battle of Salamis comes to the Persian court, proved a more acceptable subject and won the first prize.

Phrynichus (fl. *c.* 420 BC), Athenian poet of the Old Comedy.

A contemporary of Aristophanes, Phrynichus began producing in 430 and won two victories in the Great Dionysia. His most clearly recognizable subjects show an odd parallelism with Aristophanes: his *Monotropos* ("The Solitary"), which rejected contemporary civilization, was placed third when Aristophanes' *Birds* was second in 414, and Phrynichus' *Muses* second to Aristophanes' *Frogs* in 405.

Phrynichus ARABIUS (fl. 2nd century AD, Bithynia), grammarian and rhetorician who produced *Sophistike Paraskeue* ("A Grounding in Sophistic"), of which a few fragments and a summary by Photius survive, and an *Attikistes,* extant in an abridged form, called the *Ekloge* ("Selected Atticisms"). He is critical not only of contemporary deviations from the best Old Attic usage but also of what he considers the lapses of his Attic models themselves. In spite of some mistaken pedantry his judgments are often acute and learned and provide a useful commentary on the language of his own day.

Phthah (Egyptian religion): *see* Ptah.

phthalic acid, also called 1,2-BENZENEDICARBOXYLIC ACID, colourless, crystalline organic compound ordinarily produced and sold in the form of its anhydride. The annual production of phthalic anhydride exceeded 1,000,000 metric tons in the late 20th century; most of it was used as an ingredient of polyesters, including alkyd resins (vehicles for paints and enamels), and simple esters used as plasticizers for polyvinyl chloride and other polymers. Smaller quantities were consumed in the manufacture of anthraquinone (a dye intermediate), phenolphthalein (a laxative and acid-base indicator), and phthalocyanine pigments.

Phu Cuong (Vietnam): *see* Thu Dau Mot.

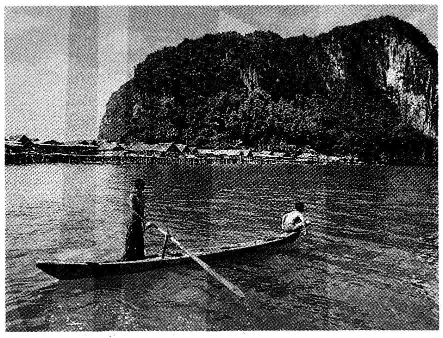
Phu Quoc Island, Vietnamese DAO PHU QUOC, island in the Gulf of Thailand, belonging to Vietnam. Lying 7 miles (11 km) off the Kampuchean (Cambodian) coast south of Bok Koŭ (formerly Bokor) and 43 miles (69 km) west of the west coast of southern Vietnam, the partially forested island is almost 30 miles (48 km) long from north to south and has a maximum width of 17 miles (27 km). It has an area of 230 square miles (596 square km). The climate is tropical monsoonal year-round with a short two- to three-month drier winter season. The eastern half has elevations ranging from about 2,000 feet (600 m) in the north to about 1,200 feet in the south. The western half and the southern tip are considerably lower.

The island's economic activities include the mining of jet (a dense, black mineral, a variety of coal) and anthracite, lumbering, and the production of pepper, cocoa, coffee, betel, and coconuts. Following World War I the

French imported 3,000 colonists from Tonkin (northern Vietnam) in an unsuccessful scheme to establish plantations. Fishing is important, and *nuoc mam* (a fish-sauce condiment), copra, and tortoise shells are exported. A garrison and a harbour have been built on the island. Duong Dong, in the west, is the chief town, and at An Thoi, on the southern tip, there is an airport. South of the island lie the associated Anthoi Islands, which have iron-ore deposits.

Phuket, city and island, southern Thailand. The island is located in the Andaman Sea, off the west coast of peninsular Thailand. Phuket city, located in the southeastern portion of the island, is a major port and commercial centre on the Andaman Sea. Its harbour exports tin, rubber, charcoal, lumber, and fish products south to Malaysia and Singapore and north to Myanmar (Burma). Rice and manufactures are imported. The city airport has regular flights to Bangkok, towns of southern Thailand, and Penang, Malaysia.

The island's area of 210 square miles (543 square km) is mostly level land but is dotted with isolated hills that reach a height of 1,700 feet (520 m). It was settled as early as the 1st century BC. The island was part of various Thai states from an early time and was incorporated into the Ayutthaya kingdom about the 16th century. After the 18th century, large



Children boating off the island of Phuket, Thailand
Jack Fields—Photo Researchers

numbers of Chinese arrived; and more than half the population is now Chinese. Called Ujong Salang ("Cape Salang") by Malays, the island has also been known as Tongka, Junk Ceylon, and Jonsalam.

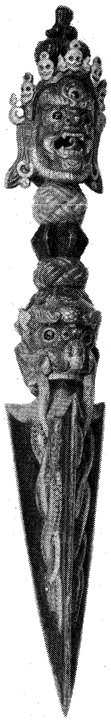
Phuket is noted for its rich tin mines, which account for approximately one-third of Thailand's production. The ore, found in lowland gravels and on the shallow sea floor, is mined by river and ocean boat dredges and pumps.

The island has also become a major seaside resort. It is reached by ferry from the mainland to the north across a narrow strait. A road links the major settlements of Thalang, Phuket, and Ban Rawai. Pop. (1986 est.) city, 47,430; island, 150,295.

Phūlbani, town, central Orissa state, eastern India. The city, located about 22 miles (35 km) southwest of the Mahānadi River, is relatively modern, although small in size. Its industries produce milled rice, glassware, and woven cloth. Phūlbani is the site of a government science college affiliated with Berhampur University. Roads connect the city with Berhampur and Bolāngir towns. Pop. (1981) city, 18,326.

Phumiphon Adunlayadet (Thai king): *see* Bhumibol Adulyadej.

phur-bu (Tibetan: "peg," or "nail"), a ritual dagger used in the Tantric (esoteric) rites of Tibetan Buddhism to exorcise evil. The dagger has a three-sided blade and a hilt that terminates in the head of Hayagrīva (Tibetan: Rta-mgrin), the fierce protective deity identified by a horse's head in the headdress. Other symbols characteristically used to ornament



Phur-bu, painted wood, *c.* 1800; in the Newark (New Jersey) Museum
By courtesy of the Newark Museum, New Jersey

the *phur-bu* are the knots of immortality, head of a *makara* (crocodile-like creature), and entwined serpents.

Phuthaditjhaba, formerly WITSIESHOEK, town, capital of the territory designated by South Africa as the nonindependent black state of Qwaqwa, northeastern Orange Free State, South Africa, near the merger point of the Orange Free State-Lesotho borders. The inhabitants of the town are mostly southern Sotho resettled from other areas of South Africa in the 1970s and early 1980s. The few industrial establishments in the town include a furniture factory, a bakery, and plants producing clothing and knitted articles. The inhabitants mostly commute to towns outside the state such as Marrismith and Bethlehem for employment. Pop. (latest est.) 7,043.

Phya Tak (Siamese king): *see* Taksin.

phycology: *see* algology.

Phycomycetes, in general, any of the six classes of lower fungi, or algal fungi: Chytridiomycetes, Hyphochytridiomycetes, Plasmodiophoromycetes, Oomycetes, Zygomycetes, and Trichomycetes (*qq.v.*). The term had class rank in earlier classification systems.

Phyfe, Duncan, original name DUNCAN FIFE (b. 1768, near Loch Fannich, Ross and Cromarty, Scot.—d. Aug. 16, 1854, New York, N.Y., U.S.), Scottish-born American furniture designer, a leading exponent of the Neoclassical style, sometimes considered the greatest of all American cabinetmakers.

The Fife family went to the United States in 1784, settling in Albany, N.Y., where Duncan worked as an apprentice cabinetmaker and eventually opened his own shop. In 1792 he moved to New York City (changing the spelling of his name to Phyfe about 1793). Two years later he was listed as a cabinetmaker in the *New York Directory and Register*. From his first shop on Broad Street, he later moved to Fulton Street. In later years he employed more than 100 carvers and cabinetmakers. One of the first U.S. cabinetmakers to successfully use the factory method of manufacturing furniture, in 1837 he took two of his sons, Michael and James, into partnership as Duncan Phyfe and Sons. After the death of Michael (1840), the firm name was changed to Duncan Phyfe and Son. In 1847 the business was sold and Duncan retired.

Although Phyfe did not originate a new furniture style, he interpreted fashionable European styles in a manner so distinguished by grace and excellent proportions that he became a major spokesman for Neoclassicism in the United States. He produced America's most highly individual Neoclassical furniture, using a unique combination of motifs. About 1800 his workshop was executing delicate furniture in the Sheraton, Regency, and French Directoire styles; by 1825, as taste changed, his pieces transpired into the Empire style. His Sheraton chairs, tables, and sofas often had delicate, reeded legs; and his Empire pieces, massive claw feet. His furniture, with its low relief carvings in the manner of the great English Neoclassicist Robert Adam, was decorated with typical period ornaments—harps, lyres, acanthus leaves, bow knots, and lion masks—and generally was made of high-quality mahogany; often he executed suites for fashionable New Yorkers.

The patronage of John Jacob Astor, Anglo-American tycoon and philanthropist, helped make Phyfe's furniture popular. Phyfe was particularly popular in the South. At his death

Mahogany side chair designed by Phyfe, 1807; in The Henry Francis du Pont Winterthur Museum, Delaware
By courtesy of The Henry Francis du Pont Winterthur Museum, Delaware

his fortune was estimated to have been almost $500,000. Interest in Phyfe's furniture was revived in 1922 when the Metropolitan Museum of Art, New York City, organized a comprehensive exhibition of his work.

phyi-mchod, in Tibetan Buddhist ceremonies, the eight offerings of external worship, presented before the tranquil deities. They are basically the eight ways of honouring a distinguished guest—by offering water for drinking, water for washing, flowers, incense, lamps, perfume, food (the sacrificial cake *gtor-ma*), and the music of cymbals. In the regular, daily attendance on the deities, the offerings are often represented by small bowls filled with water, though special ceremonies and festivals require the full offerings.

The *phyi-mchod* are distinguished from the *nang-mchod* (*q.v.*), or offerings of internal worship, also called offerings of the five senses.

For honouring the wrathful Tantric deities, the presentations are six in number—a cemetery flower, incense of singed flesh, lamp burning human fat (or a substitute), scent of bile, blood (usually symbolized by red water), and human flesh (symbolically made from parched barley flour and butter realistically coloured and modeled).

phylactery, Hebrew TEFILLIN, also spelled TEPHILLIN, or TFILLIN, in Jewish religious practice, one of two small, black leather, cube-shaped cases containing Torah texts written on parchment, which, in accordance with Deuteronomy 6:8 (and similar statements in Deut. 11:18 and Exodus 13:9, 16), are to be

Worshipper putting on phylacteries
Irving Herzberg, Brooklyn, N.Y.

worn by male Jews of 13 years and older as reminders of God and the obligation to keep the Law during daily life. The name phylactery is derived from the Greek *phylaktērion*, meaning amulet. Such outward signs are common to many religions, and the ancient Hebrews are known to have worn amulets and signs. Phylacteries, however, have a purely religious significance.

According to rabbinic regulations, one of the phylacteries is worn on the left arm facing the heart and the other on the forehead at the morning service (except on the Sabbath and festivals) and at the afternoon service on the Ninth of Av.

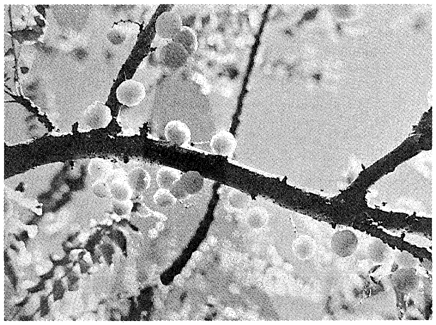
The *tefillin* are worn in a prescribed manner so as to represent the letters *shin*, *daleth*, and *yod*, which taken together form the divine name Shaddai. The hand phylactery (*tefillin shel yad*) has one compartment with the texts written on a single parchment; the head phylactery (*tefillin shel rosh*) has four compartments, each with one text. The extracts are Ex. 13:1–10, 11–16; Deut. 6:4–9, 11:13–21. Reform Jews interpret the biblical commandment in a figurative sense and, hence, do not wear phylacteries. Because of rabbinic indecision about the exact sequence of the four scriptural passages, very pious Jews may have two pairs of phylacteries.

phyle, plural PHYLAE, largest political subgroup of all Dorian and most Ionian Greek city-states in antiquity. Phylae were kinship groups embracing all citizens, corporations with their own officials and priests, and local units for administrative and military purposes. Sometimes the phylae of a state would be altered after a change in the form of government or makeup of the body of citizens. The original phylae of Athens were the Geleontes, Hopletes, Argadeis, and Aegicoreis (found sometimes in other Ionian states also).

At Athens the old phylae, which were dominated by the nobles and excluded a large number of new citizens, were supplanted by 10 new phylae in Cleisthenes' political reorganization (508/507 BC). They were, in their official order, Erechtheis, Aegeis, Pandionis, Leontis, Acamantis, Oeneis, Cecropis, Hippothontis, Aeantis, and Antiochis. Enrollment depended upon residence when the reform was instituted; thereafter membership was transmitted by descent. The governmental organs and personnel of the Athenian democracy were based on the phylae: the nine archons (magistrates) plus their secretary, the 10 *stratēgoi* ("generals"), and others were each chosen from a specific phyle; each of the 10 *prytaneis* (executive committees) of the Boule (council) of 500 represented a phyle; the 10 regiments of hoplites and 10 cavalry detachments were each drawn from a particular phyle. In dramatic competitions at festivals each phyle was represented by a *choros* and a *chorēgos* ("producer"). In the Hellenistic and Roman periods some new phylae were added to honour certain rulers; altogether their number usually did not exceed 12.

The original three Doric phylae at Sparta were supplanted by five local phylae (*c.* 8th century BC) from which the five ephors (magistrates) and the five *lochoi* (regiments) of the Spartan army were recruited.

Phyllanthus, genus of flowering plants, of the spurge family (Euphorbiaceae), that contains among its 650 species some of ornamental value and others with interesting botanical adaptations. Some have flattened, green stems, called phyllodes, that function as leaves. Whitish flowers cluster along the flattened stems of the West Indian seaside



Otaheite gooseberry (*Phyllanthus acidus*, or *Cicca disticha*)
W.H. Hodge

laurel (*P. arbuscula*). There are similar reddish blooms on *P. angustifolius*. Other species have deciduous twigs along which small leaves resembling leaflets alternate; the leaflets are shed along with the twig.

Species best showing this shedding adaptation are sometimes referred to two other genera, *Cicca* and *Emblica*, though many less known *Phyllanthus* species have the same adaptation. Otaheite gooseberry (*P. acidus, Cicca disticha*) is a small Indian tree bearing dangling clusters of light-yellow or green, vertically ribbed, acid-sour fruits, nearly 2 centimetres (0.8 inch) in diameter; the fruit is used for making preserves. The long, deciduous twigs are lined with rows of sharp-pointed, alternating leaves. Because of its even more feathery leaf-bearing twigs, each with about 100 tiny alternating leaves, the emblic, or myrobalan (*P. emblica*), gives the impression of a hemlock. Its acid-tasting yellow or reddish fruits are prescribed in traditional Indian medicine as a tonic. The leaves and bark contain tannin, utilized for tanning and as a colour concentrator in dyeing. The dried fruit has been used as ink, hair dye, and detergent. The delicately branched Polynesian shrub, snowbush (*Breynia nivosa*, formerly *P. nivosus*), is widely grown in the tropical gardens and as a greenhouse plant in the north for its gracefully slender branches and delicate green and white leaves (pink and red in *B. nivosa* variety *roseopicta*).

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

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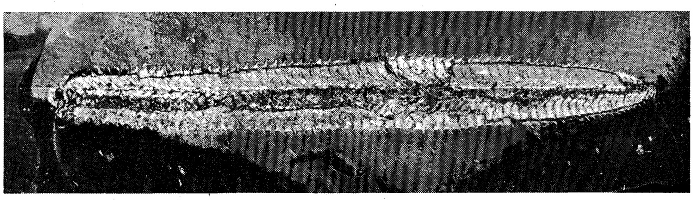
phyllite, fine-grained metamorphic rock formed by the reconstitution of fine-grained, parent sedimentary rocks, such as mudstones or shales. Phyllite has a marked fissility (a tendency to split into sheets or slabs) due to the parallel alignment of platy minerals; it may have a sheen on its surfaces due to tiny plates of micas. Its grain size is larger than that of slate but smaller than that of schist.

Phyllite is formed by relatively low-grade metamorphic conditions in the lower part of the greenschist facies. Parent rocks may be only partially reconstituted so that the original mineralogy and sedimentary bedding are partially preserved. Depending upon the direction of the stresses applied during metamorphism, phyllite sheets may parallel or crosscut the original bedding; in some rocks, two stages of deformation, called pre-crystalline and post-crystalline deformations, can be distinguished on the basis of two orientations of definable surfaces in the rock. Pre-crystalline surfaces have slaty cleavage, or flow cleavage, whereas post-crystalline surfaces have false, fracture, or strain-slip cleavage. Such terms can be used only when the type of deformation and its relation to time can be determined.

Phylloglossum, a plant genus of the order Lycopodiales (class Lycopsida), containing one species, *P. drummondii,* native to Australia and New Zealand. It is believed to be very old because of its high number of chromosomes. *Phylloglossum* has a bulblike underground base, a few spike-shaped, succulent leaves, and one stalk bearing a cluster of scale-like leaves bearing capsules. The plant is three to five centimetres (one to two inches) tall. It dies to the ground during the dry season and reappears with the return of the rains.

Phyllograptus, genus of graptolites, an extinct group of small colonial marine animals related to the primitive chordates, readily distinguished by its characteristic leaflike form and structure. Various species of *Phyllograptus* are excellent guide, or index, fossils for Ordovician rocks and time (the Ordovician Period began 500,000,000 years ago and lasted 70,000,000 years) and allow the correlation of sometimes widely separated rock units.



Phyllograptus
By courtesy of the trustees of the British Museum (Natural History); photograph, Imitor

phyllosilicate, formerly called DISILICATE, compound with a structure in which silicate tetrahedrons (a central silicon atom surrounded by four oxygen atoms at the corners of a tetrahedron) are arranged in sheets. Examples are talc and mica. Three of the oxygen atoms of each tetrahedron are shared with other tetrahedrons, but no two tetrahedrons have more than one oxygen atom in common; each tetrahedron, therefore, is linked to three others. The silicon atoms are arranged at the corners of hexagons, and the unshared oxygen atoms are commonly oriented on the same side of the sheet. Because these are capable of forming chemical bonds with other metal atoms, the silicate sheets are interleaved with layers of other elements. The various layers are stacked to form a grouping with the unshared oxygen atoms toward the centre, and these groups are weakly held together; this gives the phyllosilicates their distinct cleavage parallel to the layers. Phyllosilicates have chemical formulas that contain silicon (Si) and oxygen (O) in some multiple of Si_2O_5.

Phyllostomatidae, family of about 130 species of tropical and subtropical bats known collectively as American leaf-nosed, or spear-nosed, bats. Phyllostomatid bats are native to the New World from the United States to Argentina and are found in habitats ranging from forests to deserts. Their features vary, but most species are broad-winged and have a simple, spear-shaped structure, the nose leaf, on the muzzle. Coloration of the fur ranges within and among the species from gray, pale brown, and dark brown to orange, red, yellow, or whitish; some forms, such as the tent-building, or yellow-eared, bat (*Uroderma bilobatum*), have striped faces. Phyllostomatid bats are 4.0–13.5 cm ($1\frac{1}{2}$–$5\frac{1}{3}$ inches) without the tail, which may be absent or to 5.5 cm ($2\frac{1}{6}$ inches) long. The largest member of the family is the tropical American false vampire bat (*Vampyrum spectrum*); it is 12.5–13.5 cm (5–$5\frac{1}{3}$ inches) long with a wingspan of 90 cm (35 inches) or more.

The diet of phyllostomatid bats varies. Many, such as the naked-backed bats (*Pteronotus*), are insect eaters; some larger forms are carnivorous. Many other species feed on fruit, nectar, or pollen; among these are the long-tongued and brown-flower bats, with specialized long snouts and tongues for feeding.

Phyllostomatid bats usually live in groups; some, such as the mustache bats (*Chilonycteris*), form colonies of tens of thousands. Roosting sites include caves, tree hollows, buildings, and the undersides of bridges. The tent-building bat and the small fruit-eating *Artibeus cinereus watsoni* are the only bats that create shelters; they roost on the undersides of palm leaves after biting across the leaves to make the ends hang downward.

phylogenetic tree, also called DENDROGRAM, a diagram showing the evolutionary interrelations of a group of organisms derived from a common ancestral form. The ancestor is in the tree "trunk"; organisms that have arisen from it are placed at the ends of tree "branches." The distance of one group from the other groups indicates the degree of relationship; *i.e.,* closely related groups are located on branches close to one another. Phylogenetic trees, although speculative, provide a convenient method for studying phylogenetic relationships.

phylogeny, the history of the evolution of a species or group, especially in reference to lines of descent and relationships among broad groups of organisms.

Fundamental to phylogeny is the proposition universally accepted in the scientific community that plants or animals of different species descended from common ancestors. The evidence for such relationships, however, is nearly always incomplete, for the diversification of life has been in progress for more than 3,000,000,000 years; and the vast majority of species that have ever lived have become extinct. Relatively few of their remains have been preserved. Most judgments of phylogenicity, then, are based on indirect evidence and cautious speculation. Even when biologists use the same evidence, they often hypothesize different phylogenies, though they do agree that life is the result of organic descent from earlier ancestors and that true phylogenies are discoverable, at least in principle.

Taxonomy, the science of classifying organisms, is based on phylogeny. Early taxonomic systems had no theoretical basis; organisms were grouped according to apparent similarity. Since the publication of Charles Darwin's *Origin of Species* in 1859, however, taxonomy has been based on the accepted propositions of evolutionary descent and relationship.

Biologists who postulate a phylogeny derive their most useful evidence from the fields of paleontology, comparative anatomy, comparative embryology, and biochemistry. Studies of the fine structure of cells and geographical distribution of flora and fauna are also useful. The fossil record is often used to determine the phylogeny of groups containing hard body parts; soft parts are generally not preserved.

Most of the data used in making phylogenetic judgments have come from comparative anatomy and from embryology. In comparing features common to different species, anatomists try to distinguish between homologies, or similarities inherited from a common ancestor, and analogies, or similarities that arise in response to similar habits and living conditions. Embryologists measure the affinity between species by tracing the similar development of their embryos.

Biochemical investigations carried out in the latter half of the 20th century have contributed valuable data to phylogenetic studies. By counting differences in the sequence of units that make up protein and deoxyribonucleic acid (DNA) molecules, researchers have devised a tool for measuring the degree to which different species have diverged since evolving from a common ancestor.

The earliest organisms were probably the result of a long chemical evolution, in which random reactions in the primeval seas and atmosphere produced amino acids and then proteins. It is supposed that droplets containing proteins then formed membranes by binding molecules to their surface, and these membrane-bound proteins are said to have become organisms when they developed the capacity to reproduce. It is not certain whether these earliest self-reproducing organisms were proteins, nucleic acid–protein associations, or free-living viruses. There is general agreement that they were heterotrophic organisms—*i.e.,* ones that absorbed nourishment in the form of organic matter from early seas. Later, autotrophic forms appeared, having the ability to make their own food from inorganic matter. These organisms were the earliest bacteria; they could store energy as food and release energy as needed through respiration.

Blue-green algae, or cyanophytes, are thought to have been the next evolutionary step, as shown in Figure 1. They had larger bodies of cytoplasm than did bacteria and formed large colonies. Using photosynthesis, these single-celled organisms were pigmented with chlorophyll.

After the blue-green algae there appeared an extensive array of algae, molds, protozoans, and higher plants and animals. Three groups of algae can be dismissed with passing mention, as they arose from uncertain ancestors and have given rise to no further groups. These groups are the chrysophytes (yellow-green and golden-brown algae, chiefly diatoms); the pyrrophytes (cryptomonads and dinoflagellates); and the rhodophytes, or red algae. Three more groups have greater phylogenetic importance: the chlorophytes (green algae), which almost certainly gave rise to the land plants, *i.e.,* the bryophytes (mosses and liverworts) and the tracheophytes, or vascular plants (including all of the higher plants); the euglenoids (unicellular, flagellate organisms), which suggest a broad connection between plants and animals at this primitive level; and the phaeophytes (brown algae), which some biologists have considered to be a probable source of the animal kingdom. Finally, the protozoans (unicellular or acellular animals) were derived from unknown, more primitive ancestors, and one or more groups of protozoans have given rise to metazoans—*i.e.,* the multicellular, higher animals.

Land plants contain two major groups, bryophytes and tracheophytes, which differ in many ways but which share distinctive characteristics for adaptation to dry land. These include the housing of the plant embryo in maternal tissue.

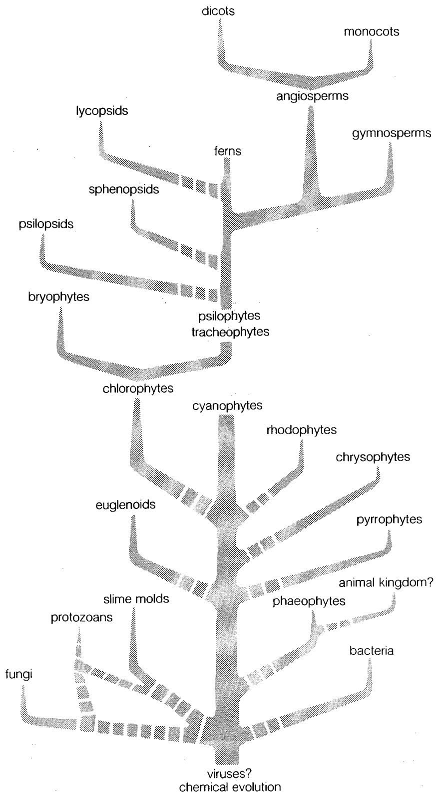


Figure 1: A summary of probable lines of plant evolution

Bryophytes are descended from green algae and include mosses, liverworts, and hornworts. Only small quantities of water are needed for their reproduction, so that the sperm may travel to the eggs. The fertilized egg matures within the maternal tissue. The plant is protected from dessication by a waxy cuticle. Bryophytes have apparently not advanced far beyond their algal predecessors and do not seem to be the evolutionary source of other groups.

All the dominant plants on Earth are included in the tracheophytes. The tracheophytes' development of large plant bodies has been made possible by having vascular parts that carry water and food inside these plants, and by a dominant sporophyte stage with a microscopic-sized gametophyte. Tracheophytes' tissues have differentiated into leaves, stems, and roots, and in the highest plants seeds and flowers are featured.

In explaining the evolution of tracheophytes from green algae, it has been suggested that a mutant form of green algae developed a primitive rootlike function with which to supply itself with water and minerals. The progeny of this organism eventually developed bundles of vascular tissues, a stem and leaves, and a cuticle for protection. The early vascular plants are called psilophytes. The development of seeds arose from the retention of the embryo inside maternal tissue. Early seed ferns gave rise to the gymnosperm group, including pines, spruces, and firs. Flowering plants, the angiosperms, probably came from the gymnosperm phase and have two subgroups: the dicotyledons, including most flowering plants; and the monocotyledons—grasses, palms, lilies, orchids, and related groups.

The problem of the origin of multicellular animals (metazoans) was long-dominated by the German embryologist Ernst Haeckel's theory that the original metazoan ancestor was a

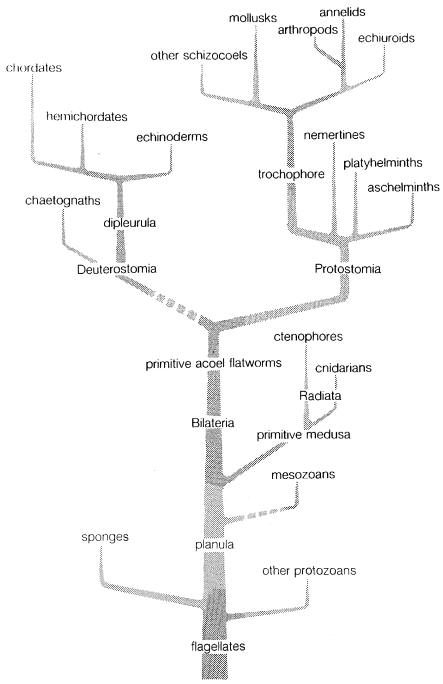


Figure 2: Hypothetical relationships in the animal kingdom

spherical protozoan that was structurally similar to the coelenterates (*e.g.,* jellyfishes, corals). Today there are two alternative explanations. The first traces metazoans back to flagellates, the presumed ancestors of flattened, ciliated animals (planulas) that eventually led to coelenterates and flatworms. Another theory hypothesizes that multinucleated protozoans, dividing into subcells, were the original metazoans, which developed into simple flatworms. No decisive information, however, yet exists to sustain either contention.

Lower metazoan forms developed the first symmetrical arrangement of body parts about a main axis, thus establishing the bilateral symmetry that characterizes most animals; major exceptions are the echinoderms (*e.g.,* starfishes, sea cucumbers). The development of tissues into an outer ectoderm, which provides protection and carries sense apparatus, and an inner endoderm, serving digestion and reproduction needs, was an important phase. Another important trend was cephalization (head formation). The anterior end of the body generally holds the central nervous system, sense organs, and mouth.

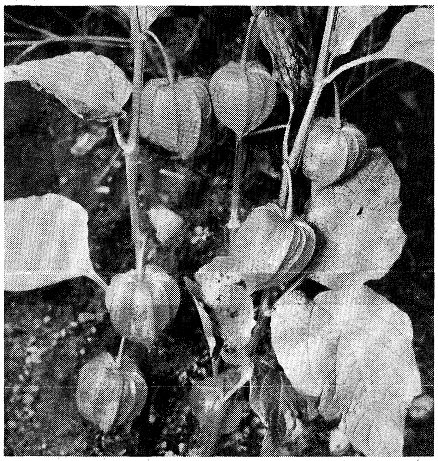
Two current theories postulate the lineage of the higher metazoans. The monophyletic sequence suggests that four groups evolved from lower forms to higher: Ameria (unsegmented animals), which includes flatworms, coelenterates, and mollusks; Polymeria (segmented animals), which includes annelids and arthropods; Oligomeria (reduced segmentation), which includes insects and echinoderms; and Chordonia (chordates). The (alternative) diphyletic theory has been proposed by many zoologists. It contends that the higher metazoans had two lines of descent, one of which led to annelids, arthropods, and mollusks and the other of which led to echinoderms and chordates, as in Figure 2. Both groups emanated from an ancient flatworm.

Humans are included in the chordates. Three basic structures are shared by all chordates: a dorsal nerve tube (brain and spinal cord in vertebrates); a notochord (supporting rod under the nerve tube); and a pharynx perforated by gill slits, at least during the embryonic stage.

The history of evolution is full of examples of primitive groups giving rise to more advanced groups, but it should be noted that it is the more primitive and less specialized members of a group—not the advanced members—that produce new groups. For example, birds and mammals arose not from advanced reptiles, but from primitive, unspecialized reptiles.

The data and conclusions of phylogeny show clearly that the world of life is the product of a historical process of evolution and that degrees of resemblance within and between groups correspond to degrees of relationship by descent from common ancestors. A fully developed phylogeny is essential for the devising of a taxonomy that reflects the natural relationships within the world of living things.

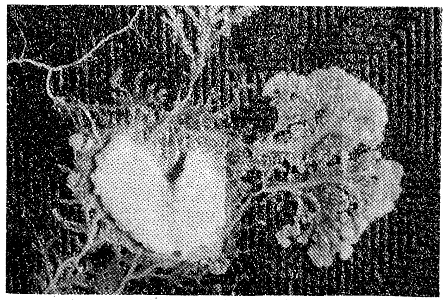
Physalis, genus of about 100 species (family Solanaceae) of small herbs noted for their inflated, baglike calyx (fused sepals), which encloses a fleshy berry and which occasionally becomes bright orange-red at maturity. The berries of some species of *Physalis* are edible, and the plants accordingly go by names such as Chinese lantern, or ground-cherry; winter



Chinese lantern (*Physalis alkekengi*)
G.E. Hyde from the Natural History Photographic Agency—EB Inc.

cherry; strawberry, or gooseberry, tomato; and husk tomato. Chinese lantern is a name alluding to the showy bladderlike calyx of the mature fruit of *P. alkekengi,* which has also been known as Japanese lantern. Tomatillos (*P. ixocarpa*) are raised commercially as vegetables in Mexico.

Physarum, large genus of true slime molds, accounting for about 20 percent of the species of the class Myxomycetes (*q.v.*). *Physarum polycephalum,* a fast-growing species, is the most notable; it has been used widely in physiological experiments in protoplasmic streaming and nuclear behaviour. *Physarum cinereum,* which forms an ashy-gray coating on lawn grasses under special conditions of



Streaming plasmodium (vegetative phase) of *Physarum*
Audrey Tomera

moisture and humidity, is unsightly but harmless and soon disappears.

Physcon (king of Egypt): *see* Ptolemy VIII Euergetes II.

physical anthropology, that branch of anthropology which is concerned with the comparative study of human evolution, classification, and physical variation, and which primarily uses techniques involving measurement and observation. *See* anthropology.

physical conditioning, the enhancement of physical fitness through the proper employment of exercise (*q.v.*).

physical constant, any of a set of fundamental, invariant quantities observed in nature and appearing in the basic theoretical equations of physics, mostly relating to the fundamental particles of which all matter is constituted. Accurate evaluation of these constants is essential in order to check the correctness of the theories and to allow useful predictions to be made on the basis of those theories.

The speed of light in a vacuum, c, appears in electromagnetic theory and in relativity theory; in the latter it relates energy to mass through the equation $E = mc^2$. Its value does not depend on any particular experimental conditions such as would be required for the determination of the speed of a sound wave in air (for which air temperature, density, and chemical composition would also have to be specified) but depends solely on an intrinsic property of the photon.

The charge on the electron, ε, is a fundamental property of a physical particle; it is the smallest unit of electric charge. Knowledge of its numerical value is required in many areas of physics and chemistry—*e.g.,* in calculating the mass of an element liberated by passage of current through an electrochemical cell.

Planck's constant, h, is not itself a property of a fundamental particle but is a constant appearing in the equations of quantum theory. It relates the energy of a photon (a quantum of electromagnetic radiation) to its frequency through the equation $E = h\nu$.

The universal gravitational constant, G, relates the magnitude of the gravitational attractive force between two bodies to their masses and the distance between them. Its value is extremely difficult to measure experimentally. It

Values of some selected fundamental constants

quantity	symbol	value
constant of gravitation	G	6.67259×10^{-11} cubic metre per second squared per kilogram
speed of light (in a vacuum)	c	$2.99792458 \times 10^{10}$ centimetres per second
Planck's constant	h	$6.6260755 \times 10^{-34}$ joule per second
Boltzmann constant	k	1.380662×10^{-23} joule per kelvin
Faraday constant	N_Ae	9.648456×10^{4} coulombs per mole
electron rest mass	m_e	9.109389×10^{-31} kilogram
proton rest mass	m_p	$1.6726231 \times 10^{-27}$ kilogram
neutron rest mass	m_n	$1.6749543 \times 10^{-27}$ kilogram
charge on electron	ε	4.803×10^{-10} electrostatic unit
Rydberg constant	R	1.09737×10^{5} per centimetre
Stefan–Boltzmann constant	σ	5.67032×10^{-8} watt per square metre kelvin
fine-structure constant	α	$7.29735308 \times 10^{-3}$

has been suggested that G has varied with time throughout the history of the universe and that it is scale-dependent. If such is the case, values determined in the laboratory would not be appropriate for terrestrial or astronomical problems.

Some physical constants can be expressed in terms of other constants; *e.g.*, the fine-structure constant (α)—which appears in the quantum-mechanical explanation of why certain atoms emit radiation of several closely spaced wavelengths rather than a single wavelength—can be expressed in terms of the permeability of free space (μ_0), the speed of light, the charge on the electron, and Planck's constant.

Numerical values of physical constants are determined at various laboratories throughout the world, such as the U.S. National Bureau of Standards, and are refined as experimental methods and techniques are improved. Definitive values are arrived at by international agreement.

physical education, training in physical fitness and in skills requiring or promoting such fitness. Many traditional societies included training in hunting, ritual dance, and military skills, while others—especially those emphasizing literacy—often excluded physical skills.

The spread of literacy in the West between 1500 and 1800 coincided with a new awareness that fitness helps the mind. Gymnasiums opened across Europe, the first in Copenhagen in 1799. The German *Turnverein* movement grew, expanding to the United States with immigration. Per Ling developed a teaching system for physical education in Stockholm in 1814, and Otto Spiess (1810–1858) popularized another system in Germany. As public schools in Germany, Denmark, and the United States tried these systems, physical education joined baccalaureate curricula, becoming a major at Columbia University in 1901 and elsewhere later.

Japan's schools have linked physical and mental training since the 17th century. Public schools with compulsory physical education were founded in 1872; the trend since 1945 has been toward individual physical and mental development. The Soviet Union, after 1917, placed great emphasis on physical education, both in schools and in special physical education institutes.

Today, physical education is a required course in most primary and secondary schools in countries with compulsory education. Most teaching takes place inside gymnasiums or other facilities built specifically for physical education activities, although outdoor sports are also emphasized.

physical medicine and rehabilitation, also called PHYSIATRY, PHYSICAL THERAPY, or REHABILITATION MEDICINE, medical specialty concerned with the treatment of chronic disabilities and with the restoration of normal functioning to the disabled through physical modes of treatment, such as exercise. This specialized medical service is generally aimed at rehabilitating persons disabled by pain or ailments affecting the motor functions of the body. Physical medicine is one means employed to assist these patients to return to a comfortable and productive life, often despite the persistence of a medical problem.

For centuries man used such natural physical agents as hot springs and sunlight to treat his ailments, but the development of physical medicine as a specialized medical service took place largely after World War I. Two factors influenced its growth in the 20th century—epidemic poliomyelitis and the two world wars—both of which created large numbers of young, seriously handicapped persons. Physical medicine was definitively established through the American physician Howard A. Rusk's efforts to rehabilitate wounded soldiers during and after World War II. Physical medicine then became available for the treatment of patients with such diverse problems as fractures, burns, tuberculosis, painful backs, strokes, nerve and spinal cord injuries, diabetes, birth defects, arthritis, and vision and speech impairments. Physical medicine is closely associated with orthopedic surgery, but it is also prescribed by physicians and surgeons in all branches of medicine. Physicians who specialize in physical medicine are called physiatrists.

The objectives of physical medicine are relief of pain, improvement or maintenance of functions such as strength and mobility, training in the most effective method of performing essential activities, and testing of function in various areas. Tests cover such fields as muscle strength, degree of joint mobility, breathing capacity, and muscular coordination.

The therapeutic means most commonly employed include heat, massage, exercise, electrical currents, and functional training. Since the 1970s these basic means have been supplemented and enhanced by psychological counseling, occupational therapy, and a variety of other treatments which may be used in concert to help the disabled person achieve the fullest possible life despite the persistence of his medical problem.

Heat is used generally to stimulate circulation and to relieve pain in the area treated. It may be applied by infrared lamps, shortwave radiation, or high-frequency electrical currents (diathermy); by hot, moist compresses or immersion in hot water (hydrotherapy); or by ultrasound. Massage primarily aids circulation and relieves local pain or muscle spasm.

Exercise, the most varied and widely used of all physical treatments, is usually designed to do one or more of three things: increase the amount of motion in a joint, increase the strength in a muscle, or train a muscle to contract and relax in useful coordination with other muscles. In addition to its obvious use following stiffness or paralysis, exercise may be used to improve the breathing of patients with lung disorders, assist circulation, relax tense muscles, and correct faulty posture.

In the late 20th century high technology was increasingly harnessed in efforts to rehabilitate paraplegics, quadriplegics, and others with severely impaired motor functions. Microcomputers were developed that could send precisely coordinated jolts of electricity directly into the muscles of such patients, mimicking the cerebral impulses that could no longer reach their muscle destinations because of a severed spinal cord. The microcomputers' sophisticated programs enable them to contract a patient's muscles in unison so that he can actually stand and sit, walk, and even use his hands to perform relatively fine movements. Such devices were still in the experimental stage and were costly to make and use, but they seemed to be the most promising development yet in efforts to restore the power of movement to nerve injury victims.

Other, less ambitious devices to help paralyzed patients include wheelchairs with specially equipped control systems that can be operated by the mouth and teeth movements of a quadriplegic. Mobile robotic arms have been developed that are equipped with a video camera so that they can move safely and intelligently about a patient's house. These personal robots can receive and execute oral commands from the patient to perform such simple household tasks as filling a glass with water or taking a book off a shelf.

Functional training teaches the impaired individual how to carry out most safely and effectively the activities of daily life. This training may mean learning to use crutches, a brace, or an artificial arm; or it may involve working out and practicing the movements required to do housework with the use of only one hand or the way to board public transportation with a stiff leg. Such training often requires long hours of practice; it may be facilitated by use of devices that make it easier to fasten buttons, hold a fork, or dial a telephone.

Physical medicine and rehabilitation underwent a rapid expansion during the late 20th century, largely because of the development of antibiotics and other fundamental advances in modern medicine, which not only save the lives of many who would not have survived illness or injury in earlier decades but also prolong life in general.

Physical medicine and rehabilitation are carried out by a "rehabilitation team," headed by a physiatrist who coordinates the team's efforts and assesses the areas of functioning in which the patient can improve. The physical therapist uses exercise to improve the patient's muscle strength and functioning, and a rehabilitation engineer may provide a special mechanical aid or device to assist that functioning. Meanwhile a rehabilitation nurse keeps track of the patient's physical condition and provides him with basic medical care, while a psychological counselor helps the patient cope with the discouragement or depression produced by the condition of physical disability. Respiratory or speech therapists may also be brought in to assist the patient with breathing or speaking difficulties. Eventually an occupational therapist and a social worker will help the patient adjust to life outside of the rehabilitation institute. *See also* occupational therapy.

physical science, the systematic study of the inorganic world, as distinct from the study of the organic world, which is the province of biological science. Physical science is ordinarily thought of as consisting of four broad areas: astronomy, physics, chemistry, and the Earth sciences. Each of these is in turn divided into fields and subfields.

A brief treatment of physical science follows. For full treatment, *see* MACROPAEDIA: Physical Sciences; Earth Sciences. For treatment of the scientific approach and methodology of the physical sciences, *see* MACROPAEDIA: Physical Science, Principles of.

Physics is the basic physical science. It deals with the structure and behaviour of individual atoms and their components, as well as with the different forces of nature and their relationships. It also is concerned with the physical properties of matter and with such phenomena as electricity and magnetism. Its goal is the formulation of comprehensive principles that summarize disparate phenomena in the most general way possible and that are expressed with economy and precision in the language of mathematics. The principal subject areas of physics are mechanics, gravitation, thermodynamics and heat, electricity and magnetism, optics, atomic and chemical physics, condensed-matter physics, nuclear physics, particle physics, quantum mechanics, relativistic mechanics, conservation laws and symmetry, and fundamental fields and forces.

Chemistry focuses on the properties and reactions of molecules. Broadly speaking, it tends to concentrate on the specific properties of different elements and compounds, as opposed to physics which is chiefly concerned with the general properties of matter as a whole. The principal divisions of chemistry are analytical chemistry, inorganic chemistry, organic chemistry, biochemistry, polymer chemistry, physical chemistry, and industrial chemistry.

Astronomy entails the study of the entire universe beyond the Earth. It includes investigations of the gross physical properties of the Earth (*e.g.*, mass and rotation period) primarily as they relate to interactions with other components of the solar system. Most other aspects are dealt with by the Earth sciences (*q.v.*). Modern astronomy includes astrophysics, the application of physical and chemical knowledge to the study of cosmic objects and the physical processes that control their formation, evolution, and emission of radiant energy. It also encompasses cosmology, the study of the structure and evolution of the universe.

physics, the science that deals with the structure of matter and the interactions between the fundamental constituents of the observable universe. In the broadest sense physics, which was long called natural philosophy (from the Greek *physikos*), is concerned with all aspects of nature on both the macroscopic and submicroscopic levels. Its scope of study encompasses not only the behaviour of objects under the action of given forces but also the nature and origin of gravitational, electromagnetic, and nuclear force fields. Its ultimate objective is the formulation of a few comprehensive principles that bring together and explain all such disparate phenomena.

Physics is treated in a number of articles in the MACROPAEDIA. For the history and principal treatment of the discipline, *see* Physical Sciences. For primary areas of study and divisions, *see* Subatomic Particles; Atoms; Matter; Electricity and Magnetism; Electromagnetic Radiation; Light; Radiation; Gravitation; Sound; Mechanics. For fundamental principles and theories, *see* Relativity; Thermodynamics, Principles of; Optics, Principles of. For methodology and instrumentation, *see* Analysis and Measurement; Particle Accelerators; Measurement and Observation. For general approach, *see* Physical Science, Principles of.

For a description of the place of physics in the circle of learning and for a list of both MACROPAEDIA and MICROPAEDIA articles on the subject, *see* PROPAEDIA: Part Ten, Division III.

physiocrat, any of a group of 18th-century writers and thinkers generally regarded as constituting the first scientific school of economics. The physiocrats are best understood as theorists reacting against the policies of the mercantilists, who had believed that national strength and security depended more on manufacturing and trade than on the products of the soil. The physiocrats instead regarded land, or agriculture, as the source of all wealth because they believed that only agriculture produced a clear surplus over the costs of production. Other forms of production merely changed the products of agriculture into consumable form; workers engaged in nonagricultural trades added only the value of their labour to the product and were regarded by the physiocrats as the sterile class. Agricultural products ought to be sold at high prices and manufactured products at low prices because a rise in agricultural income would mean a rise in net product (an increase in national prosperity). In addition to the productive (farming) and sterile (nonfarming and nonmining) classes, the physiocrats recognized the landowners as a legitimate class entitled to rent on their lands, because they or their ancestors were the first ones to clear it and prepare it for farming. In this sense, the physiocratic school accepted the prerevolutionary structure of society.

The founder of the physiocratic school was François Quesnay, court physician to Louis XV. His crowning work was the *Tableau économique* (1758), the first schematic portrayal of an entire economy. The term physiocracy denotes the rule of nature; their famous phrase *laissez faire, laissez passer* ("let it be, let it go") reflected their belief that natural economic laws should prevail. The physiocrats attacked mercantilism because of its mass of economic regulations.

Because they believed that only agriculture yielded a net surplus, the physiocrats favoured the imposition of an *impôt unique,* or single tax, directly on the net product that accrued to the landowners and the elimination of all the other taxes that had become so burdensome to the entire French economy.

Anne-Robert-Jacques Turgot became minister of finance in 1774 and began to effect some of the reforms suggested by physiocratic thought. As a result of some of these he was removed by the king in 1776 when the landed class strongly objected to his policies. With this, the influence of the physiocrats ended.

physiognomy, the study of the systematic correspondence of psychological characteristics to facial features or body structure. Because most efforts to specify such relationships have been discredited, physiognomy sometimes connotes pseudoscience or charlatanry on the level of fortune-telling or palmistry.

Physiognomy was regarded by those who cultivated it both as a mode of discriminating character by the outward appearance and as a method of divination from form and feature.

Physiognomy is of great antiquity, and in ancient and medieval times it had an extensive literature. Inasmuch as genetic flaws are sometimes revealed by physical characteristics (*e.g.,* the characteristic appearance of Down's syndrome—up-slanted eyes; broad, flat face), physiognomy has become a branch of physiology and biochemistry.

In its second aspect—*i.e.,* divination from form and feature—it was related to astrology and other forms of divination, and this aspect of the subject bulked large in the fanciful literature of the Middle Ages. There is evidence in the earliest classical literature, including Homer and Hippocrates, that physiognomy formed part of the most ancient practical philosophy.

The earliest-known systematic treatise on physiognomy is attributed to Aristotle. In it he devoted six chapters to the consideration of the method of study, the general signs of character, the particular appearances characteristic of the dispositions, of strength and weakness, of genius and stupidity, and so on. Then he examined the characters derived from the different features, and from colour, hair, body, limbs, gait, and voice. While discussing noses, for example, he says that those with thick, bulbous ends belong to persons who are insensitive, swinish; sharp-tipped belong to the irascible, those easily provoked, like dogs; rounded, large, obtuse noses to the magnanimous, the lionlike; slender, hooked noses to the eaglelike; and so on.

Among the Latin classical authors Juvenal, Suetonius, and Pliny refer to the practice of physiognomy, and numerous allusions occur in the works of the Christian scholars, especially Clement of Alexandria and Origen. While the earlier classical physiognomy was chiefly descriptive, the later medieval studies particularly developed the predictive and astrological side, their treatises often digressing into prophetic folklore and magic.

Along with the medical science of the period, Arabian writers such as the alchemist ar-Rāzī and Averroës also contributed to the literature of physiognomy. The medicine of systematic correspondence that evolved in China after the period of the Warring States is still associated with traditional Chinese science and has some bearing on the doctrine of yin–yang.

Physiognomy also is treated (in some cases extensively) by such scholars as Avicenna, Albertus Magnus, John Duns Scotus, and Thomas Aquinas. The development of a more accurate anatomy in the 17th century seems to have dampened the scientific interest in physiognomy. In the 18th and 19th centuries physiognomy was proposed as a means of detecting criminal tendencies, but each system was examined and discarded as fallacious, and by the 20th century physiognomy—as it was known in earlier times—was largely regarded as a historical subject.

physiological psychology, the study of the physiological basis of behaviour. Physiological psychology is primarily concerned with the relationship between psychological processes and the underlying physiological events, or, in other words, the mind-body phenomenon. Its focus is the function of the brain and the rest of the nervous system in activities (*e.g.,* thinking, learning, feeling, sensing, and perceiving) recognized as characteristic of human and other vertebrate animals. Physiological psychology has continually been involved in studying the physical basis for the reception of internal and external stimuli by the nervous system, particularly the visual and auditory systems. Other areas of study have included the physiological bases for motivated behaviour, emotion, learning, memory, cognition, and mental disorders. Also considered are other physical factors that directly affect the nervous system, including heredity, metabolism, hormones, disease, drug-ingestion, and diet.

Theories of the relationship between body and mind date back at least to Aristotle, who conjectured that the two exist as aspects of the same entity, the mind being merely one of the body's functions. In the dualism of French philosopher René Descartes, both the mind and the soul are spiritual entities existing separately from the mechanical operations of the human body. Related to this is the psychological parallelism theory of German philosopher Gottfried Wilhelm Leibniz. Leibniz believed that mind and body are separate but that their activities directly parallel each other. In recent times such behaviourists as American psychologist John B. Watson moved away from consideration of the spiritual or mental and focused on observable human and animal behaviour and its relationship to the nervous system.

physiology, study of the functioning of living organisms, animal or plant, or of the functioning of their constituent tissues or cells.

A brief treatment of physiology follows. For full treatment, *see* MACROPAEDIA: Biological Sciences.

Although historically physiology was usually considered separately from anatomy, with the development of high-powered microscopes, and in particular the electron microscope, structure and function at the cellular and even the molecular level came to be understood as inseparable. By the same token, while biochemistry is now a separate science, an understanding of biochemistry is fundamental to physiology.

A major feature of physiology is its dynamic state. Cells change their function in response to changes in the composition of their local environment, while the organism responds to alterations in both the internal and the external environment. Thus, many physiological reactions are aimed at preserving a constant physical and chemical internal environment, which Claude Bernard defined as the *milieu intérieur.* This property, known as homeostasis, a term introduced by American physiologist Walter Bradford Cannon, operates in animals through a range of sensory receptors for the detection of change in either the internal or external environment of the organism. These receptors initiate specific and appropriate responses from effector organs, such as the muscles, kidneys, liver, and endocrine glands.

Much of the current understanding of physiology has resulted from studying the responses of cells and tissues to imposed modifications in their environment. This has been done both in the living animal or plant (called *in vivo* studies) and in cells and tissues removed from the animal or plant and maintained alive in culture (called *in vitro* studies). For example, a lack of oxygen in arterial blood is sensed by receptors in small structures associated with the carotid arteries and the aorta called carotid and aortic bodies. By a variety of experimental procedures, both *in vivo* and *in vitro*, it has been shown that these receptors respond to reductions in the oxygen tension of blood perfusing through these structures and that they generate nerve impulses in afferent nerves that drive a reflex increase in the frequency and depth of breathing. This response tends to correct the reduction in oxygen tension. There are many similar examples of homeostasis—*e.g.*, the control of bodily metabolism by hormones. The release of insulin from the endocrine tissue of the pancreas is stimulated by glucose, among other factors, and this hormone then acts on muscle and fat cells to facilitate the transport of glucose and other substances into these cells. Thus, the level of glucose circulating in blood is continuously sensed and is also constantly being adjusted through the release of insulin and in other ways. There are physiological controls of almost all tissues and organs in the body. They form the basis for the understanding of clinical diseases and disorders in both human and veterinary medicine.

The advent of new techniques has significantly extended the boundaries of physiology; *e.g.*, radioactive isotopes have enabled the measurement of amounts and fluxes of substances present at low concentrations inside cells and in extracellular fluids. Also, by the application of techniques based on immunology, it has been possible to identify and trace the functions of minute quantities of hormones and other chemical agents that are important to understanding the responses of tissues to environmental stimuli. Parallel advances in the application of the physical and chemical sciences to physiology have promoted new understanding; such techniques as X-ray crystallography, nuclear magnetic resonance, and advanced forms of chromatography have enabled the molecular limits of cell physiology to be probed. Organic chemistry has assisted in the creation of new molecules similar in structure to natural molecules (called analogues), which have considerably advanced the understanding of tissue reactions to hormones and other substances and which form the basis of modern pharmacology.

Efforts are now being made to integrate all the information obtained from single cells, tissues, and organ systems into an understanding of the way in which the whole organism responds to its environment. Thus, the wide span of knowledge from subcellular molecular biology, including the biochemical basis of gene expression, to the behaviour of the whole animal is now appropriately encompassed by the term physiology.

phytoflagellate (class Phytomastigophorea in many traditional classifications), any of several flagellate protozoans that have many characteristics in common with typical algae, especially the pigment chlorophyll and various accessory pigments, which means that many phytoflagellates have a photosynthetic type of nutrition, although many organisms included in this group exhibit heterotrophy or myotrophy. Species without chlorophyll are similar in form to related chlorophyll-bearing species. Phytoflagellates may obtain nutrients by photosynthesis, by absorption through the body surface, or by ingestion of food particles. For some of the more important members of this group, *see* Euglena; Chlamydomonas; chloromonad; dinoflagellate; cryptomonad; and chrysomonad.

phytol, an organic compound used in the manufacture of synthetic vitamins E and K_1. Phytol was first obtained by hydrolysis (decomposition by water) of chlorophyll in 1909 by the German chemist Richard Wilstätter. Its structure was determined in 1928 by the German chemist F.G. Fischer. Phytol may be obtained in the process of separating chlorophyll from alfalfa.

Conversion of phytol to α-tocopherol, the most potent of the E vitamins essential for reproduction in rats, was reported from three laboratories in 1938 and has been applied in commercial manufacture. A synthesis of vitamin K_1 from phytol was developed in 1939.

phytoplankton, a flora of freely floating, often minute organisms that drift with water currents. Like land vegetation, phytoplankton uses carbon dioxide, releases oxygen, and converts minerals to a form animals can use. In fresh water, large numbers of green algae often colour lakes and ponds, and cyanobacteria may affect the taste of drinking water.

Oceanic phytoplankton is the primary food source, directly or indirectly, of all sea organisms. Composed of groups with siliceous skeletons, such as diatoms, dinoflagellates, and coccolithophores, phytoplankton varies seasonally in amount, increasing in spring and fall with favourable light, temperature, and minerals.

phytosaur, extinct, heavily armoured, semiaquatic reptile restricted to the Late Triassic (230 to 208 million years ago). Although they were not ancestral to the crocodiles, in many ways the phytosaurs resembled the modern crocodiles and probably had similar habits. The long and pointed jaws were armed with numerous sharp teeth; it is probable that the phytosaurs preyed largely upon fish. The nostrils in the phytosaurs were set in a mound high on the skull near the eyes, an adaptive feature related to an aquatic existence that allowed the animal to open its mouth underwater without drowning. The greater development of the hind limbs than of the forelimbs indicated that the phytosaurs descended from bipedal reptilian ancestors and reverted to a quadrupedal pose. Phytosaurs were well able to move about on land. Phytosaurian fossils occur in North America, Europe, and India, but their remains have not been found in the southern continents.

Familiar genera of phytosaurs include *Rutiodon* and *Phytosaurus*, the genus that gives its name to the group as a whole. *Rutiodon* was more than 3 m (10 feet) long; its skull alone was about 1 m (3.5 feet) long.

pi, Pinyin BI, in art, Chinese jade carved in the form of a flat disk with a hole in the centre. The earliest examples, which are unornamented, date from the Neolithic period (*c.* 3000–1500 BC).

Later examples, from the Shang dynasty (18th–12th century BC) and the Chou dynasty (1111–255 BC), have increasingly elaborate surface embellishment, especially in the late Chou (*c.* 600–255 BC), when the *pi* appears in combination with other forms. The *pi* may have been a symbol of heaven or of the Sun (in that it resembles the ancient graph for "sun."

pi, in mathematics, the symbol π denoting the ratio of the circumference of a circle to its diameter. The ratio is approximately 3.14159265, pi being an irrational number (one that cannot be expressed as a simple fraction or as a decimal with a finite number of decimal places) and a transcendental number (one without continuously recurrent digits). Electronic computers in the late 20th century have carried pi to more than 100,000,000 decimal places.

Pi occurs in various mathematical calculations. The circumference (c) of a circle can be determined by multiplying the diameter (d) by π: $c = \pi d$. The area (A) of a circle is determined by the square of the radius (r): $A = \pi r^2$. Pi is applied to mathematical problems involving the lengths of arcs or other curves, the areas of elipses, sectors, and other curved surfaces, and the volumes of solids. It is also used in various formulas of physics and engineering to describe such periodic phenomena as the motion of pendulums, the vibration of strings, and alternating electric currents.

In very ancient times, 3 was used as the approximate value of pi, and not until Archimedes (3rd century BC) does there seem to have been a scientific effort to compute it; he reached a figure equivalent to about 3.14. A figure equivalent to 3.1416 dates from before AD 200. By the early 6th century Chinese and Indian mathematicians had independently confirmed or improved the number of decimal places. By the end of the 17th century in Europe, new methods of mathematical analysis provided various ways of calculating pi. Early in the 20th century the Indian mathematical genius Srinivasa Ramanujan developed ways of calculating pi that were so efficient that they have been incorporated into computer algorithms, permitting expressions of pi in millions of digits.

pi bond, in chemistry, a cohesive interaction between two atoms and a pair of electrons that occupy an orbital located in two regions roughly parallel to the line determined by the two atoms. A pair of atoms may be connected by one or by two pi bonds only if a sigma bond also exists between them; in the molecule of nitrogen (N_2), for example, the triple bond between the two nitrogen atoms comprises a sigma bond and two pi bonds.

P'i-chia (Mongol khan): *see* Bilge.

pi meson, lightest member of the meson family of subatomic particles (*see* meson).

P'i-nan (Taiwan): *see* T'ai-tung.

p'i-p'a, Pinyin PIPA, short-necked Chinese lute prominent in Chinese opera orchestras and as a solo instrument. Ultimately of West Asian origin, it was known in China by the 2nd century AD. It has a shallow, pear-shaped body with a wooden belly and, sometimes, two crescent-shaped sound holes. There are 4 convex frets on the neck and 6 to 13 frets on the belly. The four silk strings run from a fastener on the belly to conical tuning pegs in the sides of the bent-back pegbox. Although formerly a plectrum was used, the strings are now plucked with bare fingers while the instrument is held vertically on the player's thigh. A common tuning (relative pitch) is c–f–g–c′ (top note around middle C).

There are several varieties of *p'i-p'a* in China, and closely related instruments are also found

Woman playing a *p'i-p'a*, detail from 18th-century silk painting; in the Náprstkovo Muzeum Asijských, Prague

By courtesy of the Naprstkovo Muzeum Asijskych, Prague in Vietnam and Korea. The *p'i-p'a* reached Japan by the 8th century AD. The Japanese form of the instrument, the *biwa,* exists in several varieties. The *biwa,* which has only four frets, is important in narrative and court music.

Pi Ramesse (ancient Egyptian city): *see* Per Ramessu.

Piacenza, Latin PLACENTIA, city, capital of Piacenza *provincia,* in the Emilia-Romagna *regione* of northern Italy, on the south bank of the Po River just below the mouth of the Trebbia, southeast of Milan. It was founded

Marconi Square, Piacenza, Italy
Photo Research International

as the Roman colony of Placentia in 218 BC. After being besieged unsuccessfully by the Carthaginian general Hasdrubal in 207 BC and sacked by the Gauls in 200, it was restored and reinforced. In 187 BC it became the terminus of the Via Aemilia, the great arterial road to Ariminum (Rimini), and was later the focus of other major Roman roads. After the barbarian invasions, Piacenza was governed by its bishops from 997 to 1035. It became a free commune in the 12th century and a leading member of the Lombard League of towns in opposition to the emperor Frederick I Barbarossa. Despite political vicissitudes, it prospered from its control of river and road traffic. A long period of struggle between the Visconti and Sforza families, alternating with papal and French rule, was ended in 1545 by the creation by Pope Paul III of the hereditary duchy of Parma and Piacenza for his son Pier Luigi Farnese. For the subsequent history of Piacenza, *see* Parma and Piacenza, duchy of.

No Roman monuments survive, but the rectangular street plan in the centre of the city is Roman. The brick cathedral (1122–1253) is a fine example of Lombard Romanesque style. Other noteworthy medieval churches are the former Cathedral of San Antonino, incorporating an 11th-century facade and elements of the 13th- and 14th-century construction; the restored San Savino (consecrated 1107), with unusual 12th-century floor mosaics; San Francesco (begun 1278); San Sisto (1499–1511), the original home of Raphael's painting "Sistine Madonna"; and Santa Maria di Campagna (1522–28), with frescoes by Pordenone. Notable palaces include the Palazzo Comunale (begun 1281) and the grandiose Palazzo Farnese, begun in 1558 for Margaret of Austria and never completed.

Piacenza is a rail and road centre on the main routes from Milan to Bologna. It is a long-established centre for cereal growing and viticulture and has a number of rapidly developing light industries, including the manufacture of chemicals, office furniture, and buttons. Pop. (1988 est.) mun., 104,976.

Piacenza, duchy of: *see* Parma and Piacenza, duchy of.

Piaf, Edith, byname of EDITH GIOVANNA GASSION (b. Dec. 19, 1915, Paris, Fr.—d. Oct. 11, 1963, Paris), French singer and actress whose interpretation of the *chanson,* or French ballad, made her internationally famous. Among her most famous songs was "Non, je ne regrette rien" ("No, I don't regret anything").

Piaf's singing reflected the tragedies of her own life. Her mother, a café singer, abandoned her at birth, and she was reared by her grandmother. She became blind at the age of three as a complication of meningitis but recovered her sight four years later. Her father, a circus acrobat, took her along on tours and first encouraged her to sing. She sang in the streets of Paris until discovered by a cabaret owner who gave her her first nightclub job and suggested that she change her name to *Piaf,* Parisian slang for "sparrow," in apparent reference to her diminutive size (under five feet tall and about 90 pounds in weight). Her debut was acclaimed by Maurice Chevalier, who happened to be in the audience.

In 1935 Piaf made her theatrical debut, and within a few years she was singing in the large music halls of Paris. During World War II

Edith Piaf, 1948
UPI/Bettmann Newsphotos

she would only entertain French prisoners of war and aided several in their escapes. The subsequent years were spent in tours of Europe, South America, and the United States. Her simple yet dramatic style and throaty, tender voice with its tragic overtones brought her wide acclaim and never ceased to move her audiences. Despite her success, however, her life continued to be marred by illness, accidents, and personal unhappiness.

Piaget, Jean (b. Aug. 9, 1896, Neuchâtel, Switz.—d. Sept. 17, 1980, Geneva), Swiss psychologist who was the first to make a systematic study of the acquisition of understanding in children. He is thought by many to have been the major figure in 20th-century developmental psychology.

Piaget's early interests were in zoology; at the age of 10 he published an article on his observations of an albino sparrow, and by 15 his several publications on mollusks had gained him a reputation among European zoologists. At the University of Neuchâtel, he studied zoology and philosophy, receiving his doctorate in the former in 1918. Soon afterward, however, he became interested in psychology, combining his biological training with his interest in epistemology. He first went to Zürich, where he studied under Carl Gustav Jung and Eugen Bleuler, and then began two years of study at the Sorbonne in Paris in 1919.

In Paris Piaget devised and administered reading tests to schoolchildren and became interested in the types of errors they made, leading him to explore the reasoning process in these young children. By 1921 he had begun to publish his findings; the same year brought him back to Switzerland, where he was appointed director of the Institut J.J. Rousseau in Geneva. In 1926–29 he was professor of philosophy at the University of Neuchâtel, and in 1929 he joined the faculty of the University of Geneva as professor of child psychology, remaining there until his death. In 1955 he established the International Centre of Genetic Epistemology at Geneva and became its director. In more than 50 books and monographs over his long career, Piaget continued to develop the theme he first discovered in Paris, that the mind of the child evolves through a series of set stages to adulthood.

Piaget saw the child as constantly creating and recreating his own model of reality, achieving mental growth by integrating simpler concepts into higher level concepts at each stage. He argued for a "genetic epistemology," a timetable established by nature for the development of the child's ability to think, and he traced four stages in that development. He described the child during the first two years of life as being in a sensorimotor stage, chiefly concerned with mastering his own innate physical reflexes and extending them into pleasurable or interesting actions. During the same period, the child first becomes aware of himself as a separate physical entity and then realizes that the objects around him also have a separate and permanent existence. In the second, or preoperational, stage, roughly from age two to age six or seven, the child learns to manipulate his environment symbolically through inner representations, or thoughts, about the external world. During this stage, he learns to represent objects by words and to manipulate the words mentally, just as he earlier manipulated the physical objects themselves. In the third, or concrete operational, stage, from age 7 to age 11 or 12, occurs the beginning of logic in the child's thought processes and the beginning of the classification of objects by their similarities and differences. During this period, the child also begins to grasp concepts of time and number. The fourth stage, the period of formal operations, begins at age 12 and extends into adulthood. It is characterized by an orderliness of thinking and a mastery of logical thought, allowing a more flexible kind of mental experimentation. The child learns in this final stage to manipulate abstract ideas, make hypotheses, and see the implications of his own thinking and that of others.

Piaget's concept of these developmental stages caused a reevaluation of older ideas of the child, of learning, and of education. If the development of certain thought processes was on a genetically determined timetable, simple reinforcement was not sufficient to teach concepts; the child's mental development would have to be at the proper stage to assimilate those concepts. Thus, the teacher became not a transmitter of knowledge but a guide to the child's own discovery of the world.

Piaget reached his conclusions about child development through his observations of and conversations with his own children, as well as others. He asked them ingenious and revealing questions about simple problems he had devised, and then he formed a picture of their way of viewing the world by analyzing their mistaken responses.

Among Piaget's major works available in English are *Le langage et la pensée chez l'enfant* (1923; *The Language and Thought of the Child*), *Le Jugement et la raisonnement chez l'enfant* (1924; *Judgement and Reasoning in the Child*), and *La Naissance de l'intelligence chez l'enfant* (1948; *The Origins of Intelligence in Children*). He also wrote a series of books dealing separately with children's conceptions of time, space, physical causality, movement and speed, and of the world in general.

Pian del Carpini, Giovanni da (Franciscan author): *see* Giovanni da Pian del Carpini.

piano, also called PIANOFORTE, French PIANO, or PIANOFORTE, German KLAVIER, a musical instrument having wire strings that sound when struck by felt-covered hammers operated from a keyboard. The modern standard piano contains 88 black and white keys.

A brief treatment of pianos follows. For full treatment, *see* MACROPAEDIA: Musical Instruments.

The piano is a keyboard musical instrument in which tone is produced by the striking of strings. The vibration of the strings is transmitted to a soundboard by means of a bridge over which the strings are stretched; the soundboard amplifies the sound and affects its tone quality. The hammers that strike the strings are affixed to a mechanism resting on the far ends of the keys; hammer and mechanism compose the "action." The function of the mechanism is to accelerate the motion of the hammer, catch it as it rebounds from the strings, and hold it in position for the next attack. Modern hammers are covered with felt; earlier, leather was used. The modern piano has a cast-iron frame capable of withstanding the tremendous tension of the strings; early pianos had wood frames and thus could only be lightly strung. Modern pianos are therefore much louder than were those of the 18th century, an increase in loudness necessitated in part by the size of 19th-century concert halls. Of the three pedals found on most pianos, the damper pedal on the right lifts all the felt dampers above the strings, allowing them all to vibrate freely; the left pedal shifts the keyboard and action sideways to enable the hammer to strike only one of the two or three unison strings of each tenor and treble key (the bass notes are only single-strung); and the middle pedal usually holds up the dampers only of those keys depressed when the pedal is depressed.

Credit for priority of invention has been much disputed, but there is little doubt that it belongs to Bartolomeo Cristofori, who devised his *gravecembalo col piano e forte* ("harpsichord with soft and loud") in Florence in about 1709. This was not the first instrument using keyboard striking action; examples of the piano principle existed as early as about 1440. Cristofori had arrived at all the essentials of the modern piano action by 1726, and it is from Cristofori's piano that the modern piano stems.

The piano, made in a variety of forms, was widely popular in the mid-18th century. Preferring a lighter, less-expensive instrument with a softer touch, German piano makers perfected the square piano. When Wolfgang Amadeus Mozart and Muzio Clementi began to write for the piano, a distinctively pianistic style of playing and composing developed. From that point on, it became the preferred medium for salon music, chamber music, concerti, and song accompaniments.

By about 1860 the upright piano had virtually replaced the square piano for home use. Early upright pianos were made according to the design of upright harpsichords with the strings rising from keyboard level. They were consequently very tall, and many were made in elegant shapes. But by taking the strings down to floor level, John Isaac Hawkins made the upright shorter and more suitable for small rooms.

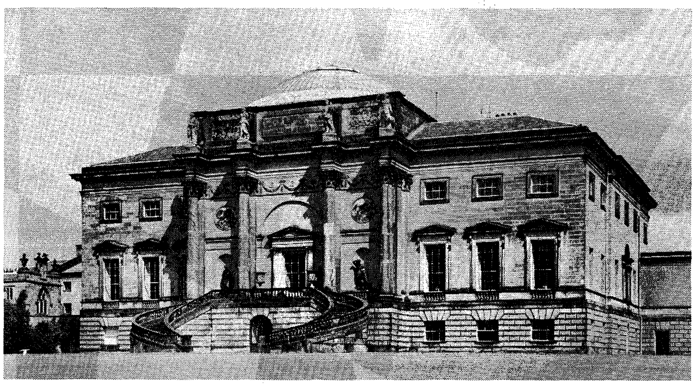
A number of developments followed in the 19th and 20th centuries. String tension, determined at 16 tons in 1862, increased to as much as 30 tons in modern instruments. The result is a dynamic range, sostenuto (ability to sustain a tone), and tonal spectrum unknown to Frédéric Chopin, Ludwig van Beethoven, and even Franz Liszt. A significant development in the 20th century (beginning in the 1930s) was the appearance of the electronic, or electric, piano, which relied on electroacoustic or digital methods of tone production and was heard through an amplifier and loudspeaker.

Double-action pianoforte built by Bartolomeo Cristofori in 1720; in the Metropolitan Museum of Art, New York City

By courtesy of the Metropolitan Museum of Art, New York City, the Crosby Brown Collection of Musical Instruments, 1889

See also barrel piano; player piano; square piano; upright piano.

piano nobile (Italian: "noble floor"), in architecture, main floor of a Renaissance building. In the typical palazzo, or palace, erected by an Italian prince of the Renaissance, the main reception rooms were in an upper story, usually the story immediately above the basement or ground floor. These rooms had higher ceilings than the rooms on the other floors of the palace and were more elegantly decorated. Often a grand exterior staircase or pair of staircases led from ground level up to the piano nobile. The term is also used in reference to the main floors of similarly constructed buildings of the English Palladian style of the 18th century and of those built in Great Britain and the United States during the Renaissance revival of the mid- and late 19th century.



Piano nobile of Kedleston Hall near Derby, Eng., designed by Robert Adam in the 1760s

A.F. Kersting

Pianosa Island, Italian ISOLA PIANOSA, ancient (Latin) PLANASIA, island of the Toscano Archipelago, in the Tyrrhenian Sea, part of Livorno (Leghorn) *provincia,* Italy, 8 miles (13 km) southwest of the island of Elba. It has an area of 4 square miles (10 square km) and is, as its name (Italian *piano,* "flat") indicates, flat, with its highest point only about 90 feet (27 m) above sea level. In Roman history it figures as the place of banishment of Agrippa Postumus, grandson of the emperor Augustus. It suffered from the depredations of the Turks in the 16th century. In 1856 an agricultural penal colony was established there. Pop. (1971) 784.

Piast DYNASTY, first ruling family of Poland. According to a 12th-century legend, when Prince Popiel of Gnesen (now Gniezno) died, in the second half of the 9th century, he was succeeded by Siemowit, the son of the prince's plowman, Piast, thus founding a dynasty that ruled the Polish lands until 1370. (The name Piast was not applied to the dynasty until the 17th century.) By 963 Mieszko I (reigned *c.* 963–992), probably the fourth prince of the Piast line, was ruling a highly developed, if somewhat isolated, political community in the territories later known as Great Poland and possibly also in Mazovia. Mieszko brought his state into closer association with western Europe, converted it to Christianity (966), and expanded it to include Pomerania (Polish Pomorze) on the Baltic Sea (967–990) as well as Silesia and Little Poland (989–992). His son Bolesław I the Brave (reigned 992–1025) continued the country's expansion, strengthened its internal administration and church organization, and was crowned its king shortly before his death.

A period of decline then set in during the reigns of Bolesław's successors—Mieszko II Lambert (1025–34), Bezprym (1031–32), Casimir I the Restorer (1034–37, 1038/39–58), Bolesław II the Bold (1058–79), and Władysław I Herman (1079–1102). The Piast princes lost their title of king (although Bolesław II held it briefly, from 1076 to 1079); they allowed the authority of the central government to diminish in favour of the power of the regional nobility, and they engaged the state in numerous struggles that resulted in a territorial loss. Only after Bolesław III the Wry-Mouthed (reigned 1102–38) succeeded to the throne and exiled his brother and coruler Zbigniew (1107) did Poland's boundaries reach those of Mieszko I's domain (by 1125). But Bolesław failed to regain the title of king as well as to reverse the decentralizing tendencies that were undermining the unity of his state. Therefore, in order to avoid future internal conflict based on regional rivalry and to retain unity among the Piast lands, Bolesław divided Poland among his sons. Each of the territorial subdivisions—defined by 1166 as Silesia, Great Poland, Mazovia, and Sandomir—was to be held as the hereditary domain of one of Bolesław's sons. The senior member of the entire dynasty was also to acquire temporary possession of Kraków and Pomerania and rule as grand prince over the entire loosely federated state of Poland.

The new arrangement, however, stimulated more divisiveness; the power of the grand prince of Kraków declined after the reign of Casimir II the Just (1177–94). For the next 150 years Poland suffered from increasing disunity and disintegration, aggravated by dynastic struggles and civil wars, foreign intervention and invasion, and the secession and conquest of its border regions.

Nevertheless, throughout this period of political division, the Piast lands retained their common church structure, language, and economy, all of which provided a basis for various

The Piast dynasty

MIESZKO I
(descendant of legendary Piast)
prince of Poland
c. 963–992

BOLESŁAW I the Brave
prince of Poland
992–1025
king of Poland
1025

MIESZKO II Lambert
king of Poland
1025–31
prince of Poland
1032–34

BEZPRYM
prince of Poland
1031–32

CASIMIR I the Restorer
prince of Poland
1034–37, 1038/39–1058

BOLESŁAW II the Bold
prince of Poland
1058–76
king of Poland
1076–79

WŁADYSŁAW I Herman
prince of Poland
1079–1102

ZBIGNIEW
prince of Great Poland
and Mazovia
1102–07

BOLESŁAW III the Wry-mouthed
prince of Little Poland and Silesia
1102–07
prince of Poland
1107–38

WŁADYSŁAW II the Exile
prince of Silesia and Kraków
grand prince of Poland
1138–46

BOLESŁAW IV the Curly
prince of Mazovia and Cujavia
1138–73
prince of Silesia and Kraków
grand prince of Poland
1146–73
prince of Sandomir
1166–73

MIESZKO III the Old
prince of Great Poland
1138–77
prince of Kraków
1173–77
grand prince of Poland
1173–77, 1190–91, 1198/99–1202

HENRY
prince of Sandomir
1146–66

CASIMIR II the Just
prince of Sandomir
1173–94
prince of Kraków
1177–97
prince of Cujavia and Mazovia
1186–94
grand prince of Poland
1177–1190/91, 1190/91–1194

LOWER SILESIAN LINE

BOLESŁAW I the Tall
grand prince of Poland
1146–63
prince of Lower Silesia
1163–1201

HENRY I the Bearded
prince of Lower Silesia
1201–38
prince of Kraków
1229–38
prince of Great Poland
1234–38

HENRY II the Pious
prince of Lower Silesia,
Kraków, and
Great Poland
1238–41

BOLESŁAW II the Bold
prince of Lower Silesia
1242–49

HENRY III the White
prince of Lower Silesia
1247/48–1266

CONRAD I
prince of Głogów
1249–50

Principality divided into
six branches, the last
of which died out in 1675

UPPER SILESIAN LINE

MIESZKO I the Crosslegged
prince of Upper Silesia
1163–1211

CASIMIR I
prince of Upper Silesia
1211–29

MIESZKO II the Fat
prince of Upper
Silesia
1229–46

WŁADYSŁAW
prince of Upper
Silesia
1246–81

Principality divided into
four branches, the last
of which died out in 1625

GREAT POLAND LINE

WŁADYSŁAW III Spindleshanks
prince of Great Poland
1202–24
prince of Kraków
1202, 1228

Odon

WŁADYSŁAW Odonic
prince of Great Poland
1229–39

PRZEMYSŁ I
coprince of Great Poland
1239–47
prince of Poznan, etc.
1247–57

PRZEMYSŁ II
prince of Great Poland
1279–95
king of Poland
1295–96

BOLESŁAW the Pious
coprince of Great Poland
1239–47
prince of Kalisz, etc.
1247–49, 1253–57
prince of Great Poland
1257–79

LITTLE POLAND LINE

LESZEK I the White
prince of Kraków
1194–1198/99, 1201, 1202–27
prince of Sandomir
1194–1227

BOLESŁAW V the Chaste
prince of Kraków and Sandomir
1243–79

CONRAD I
prince of Cujavia
and Mazovia
1202–47

MAZOVIAN LINE

SIEMOWIT I
prince of Mazovia
1248–62

CONRAD II
prince of Czersz
1262–94

BOLESŁAW II
prince of Mazovia
1294–1313

Principality divided into
three branches, the last
of which died out in 1526

KUJAWY LINE

CASIMIR I
prince of Cujavia
1233–67
prince of Łeczycz
and Sieradz
1247–60

SIEMOMYSŁ
prince of Cujavia
1267–68, 1271–87

LESZEK the Black
prince of Łeczycz
and Sieradz
1260–88
prince of Kraków
and Sandomir
1279–88

WŁADYSŁAW I the Short
prince of Cujavia and Łeczycz
1267–96
prince of Great Poland
1296–1300, 1314
king of Poland
1320–33

CASIMIR III the Great
king of Poland
1333–70

CASIMIR II
prince of Cujavia
1267–94
prince of Łeczycz
1288–94

princes to try to reunify the Polish kingdom. The first attempts failed; they were made by the Silesian princes Henry I and Henry II in the 1230s and by the prince of Great Poland Przemysł II (reigned at Kraków 1279–95 and as king of Poland 1295–96). But after Wenceslas II (Polish Wacław) of Bohemia gained control of two-thirds of the Polish lands and became king of Poland (1300–05), Władysław I the Short (Łokietek), a grandson of Conrad I of Mazovia, gained support from the gentry, the leading clergy, and some members of the upper nobility and won control of Sandomir and Kraków (by 1306); with the aid of Hungary and the pope, he became the ruler of Great Poland and also king of Poland (1320). Władysław I strengthened Poland substantially by forming close alliances, through the marriages of his children, with both Hungary and Lithuania.

His son Casimir III the Great assumed the throne of the restored Polish kingdom (1333) and further improved its position by coming to terms with his two major enemies, Bohemia and the Teutonic Knights. He accepted Poland's loss of Silesia and Pomerania, annexed Galicia, and regained Mazovia (1349). Casimir also consolidated his rule over the state by improving its economy and military and civil administrations, codifying the laws of Great and Little Poland, and founding a university at Kraków (1364).

Casimir's death, however, brought an end to his line of the Piast dynasty. Having developed the newly reunified Piast lands into a stable, prosperous, and powerful nation, he left his kingdom to his sister's son, Louis I of Hungary. After ruling from 1370 to 1382, Louis was succeeded by his daughter Jadwiga and her husband Jogaila (Władysław II Jagiełło), the grand duke of Lithuania. This succession marked the founding of the Jagiellon dynasty in Poland.

Piatigorsk (Russian S.F.S.R.): *see* Pyatigorsk.

Piatra-Neamţ, city, capital of Neamţ *judeţ* (county), northeastern Romania. It lies in the valley of the Bistriţa River and is surrounded by mountains. It is first documented in the 15th century as Piatra lui Crăciun, or Camena, a market town where fairs were held. Stephen the Great of Moldavia built the Church of St. John there in 1497–98, a classic example of ornate Moldavian architecture. The Bistriţa Monastery, founded at the beginning of the 15th century by Prince Alexander the Good and rebuilt in 1554 by Prince Alexander Lăpuşneanu, is 5 miles (8 km) west of Piatra-Neamţ. The city has a state theatre, a regional natural-science museum, and an archaeological museum of Neolithic pottery. The city's industries include a fertilizer plant, a pulp and paper mill, and several food-processing plants. Southeast of the city, in the Bistriţa River valley, are large factories producing synthetic fibre and nitrogenous fertilizer. Pop. (1986 est.) 109,393.

Piauí, *estado* ("state") of northeastern Brazil, bordered by the states of Ceará, Pernambuco, and Bahia, by a very small part of Tocantins on the east and south, and by Maranhão on the west and north. Covering less than 3 percent of Brazil's total area, it has an area of 96,886 square miles (250,934 square km). The state capital is Teresina, located at the confluence of the Parnaíba and Poti rivers. The state has a small Atlantic coastline of about 40 miles (64 km).

The settlement of Piauí in the 17th century came with the expansion of cattle ranching in the backlands of the interior, setting that area apart from the sugarcane agriculture of the coastal lowlands. The settlers arrived from the east, moving up the valley of the São Francisco River in Pernambuco and onward in a westward direction into Piauí. One of their leaders was Francisco Dias d'Avilla, who fought bloody battles with the Indians. Piauí was a part of the captaincy of Maranhão from 1718 until 1811, at which time Piauí became a separate administrative unit.

The Parnaíba River runs along the western boundary of the state, linking the Atlantic port of Parnaíba with the inland cities of Teresina and Floriano. As one moves away from the river and the coastal area toward the south and east, the land rises gradually in a series of plateaus edged by cliffs. On the border of the state of Ceará, the plateau is broken by a gap through which the Poti River runs.

Temperatures show little variation, averaging about 79° F (26° C) in the northern part of the state and a few degrees less in some of the higher elevations in the south. Annual rainfall is about 59 inches (1,500 mm) in the north, but, in the drier east and southeast, it averages about 20 inches (500 mm) a year. The dry months are in winter and spring.

The vegetation of the south and east is that of Brazil's semiarid northeastern backlands: a thorny, deciduous scrub woodland known as caatinga. This gives way in the north to deciduous forests interspersed with areas of palms and cocoa trees.

Piauí is sparsely populated. Most of its inhabitants are of mixed Indian and European ancestry, although blacks are found in the northeastern coastal zones, where the colonial sugar plantations once employed many African slaves. The largest city is Teresina, the capital. Other towns include Parnaíba, Floriano, Campo Maior, Picos, and Oeiras. The principal economic activities are the raising of livestock and the production of palm seeds, palm oil, and palm wax from the carnauba and babassu palm trees.

Standards of living in Piauí are among the lowest in Brazil. Infant mortality rates are very high, largely because of infectious and parasitic diseases. Hospital clinics reach about one-quarter of the population. The national government, however, is engaged in programs to control malaria and other endemic diseases.

Piauí had a few thousand primary schools in the late 20th century with a few hundred thousand students. In the lower-level secondary schools there were several thousand students. The state also had newspapers, radio stations, one theatre, and numerous cinemas.

Piauí is a somewhat isolated state, lacking good communications even with neighbouring states of the northeast. Teresina has rail connections across the state of Maranhão on the west to the port of São Luis; another railroad runs from Teresina northward through Campo Maior to the state's port of Luís Correia. One good all-weather federal highway runs from Teresina northeastward to Sobral in the state of Ceará. Several important new highways were under construction in the late 20th century by the federal government, including one from Teresina to Picos, another from Fortaleza in Ceará to Picos and southward toward Brasília, and an east-west trans-Amazonian road that will pass through Picos. Pop. (1989 est.) 2,616,900.

Piave River, Italian FIUME PIAVE, river in northeastern Italy. It rises on the slopes of Mount Peralba in the Carnic Alps near the Austrian frontier and flows southward to the Belluno basin and its gorge at Feltre, where it turns southeast to meander across the Venetian plain, reaching the Adriatic Sea at Cortellazzo, northeast of Venice. The river is 137 miles (220 km) long and has a drainage basin of 1,580 square miles (4,092 square km). The variations in its flow are extreme; during late summer most of the Piave's lower course is a bed of dry gravel. Until about 1500 the mouth of the Piave was farther south, near Treporti on the lagoon of Venice. After several changes, the river mouth settled near Caorle until a disastrous flood in 1683, when it shifted to its present outlet. In 1966, swollen by rains, the river burst its dikes in a major flood. The Piave's upper valley has major hydroelectric stations at Pieve di Cadore and Fadalto, while downstream its waters are used extensively for irrigation. In World War I the Piave River became the main line of Italian defense after the Austrian breakthrough at Caporetto in 1917. Despite concerted Austrian attacks in 1918, the line held, and the Austrians were decisively defeated at the Battle of Vittorio Veneto at the end of October 1918.

Piazza Armerina, town and episcopal see, Enna *provincia,* central Sicily, Italy, west-southwest of Catania. Among the many historic monuments in the town are the 17th-century cathedral, with a 14th-century campanile, the Baroque palace of Trigona della Floresta, the Church of San Rocco (1613), the Civic Museum, the 14th-century four-sided castle, and the well-preserved remains of the Roman villa of Casale. The Norman count Roger, associated with the foundation of the town in the 11th century, is said to have received from Pope Nicholas II the Byzantine statue "Madonna delle Vittorie" ("Our Lady of Victories") that is in the cathedral and that is borne through the streets on the Feast of the Assumption. There are sulfur mines in the neighbourhood, and nougat is produced in the town. Pop. (1988 est.) mun., 22,288.

Piazzetta, Giovanni Battista, also called GIAMBATTISTA PIAZETTA (b. Feb. 13, 1682, Venice [Italy]—d. April 28, 1754, Venice), painter, illustrator, and designer who was one of the outstanding Venetian artists of the 18th century. His art evolved from Italian Baroque traditions of the 17th century to a Rococo manner in his mature style.

Piazzetta began his career in the studio of his father, Giacomo, a woodcarver. Soon after assisting the latter to carve the still-surviving bookcases of the library of the Church of Santi Giovanni e Paolo at Venice, he abandoned the family profession and began to study painting under Antonio Molinari. In about 1703 he went to Bologna, where he worked in the studio of Giuseppi Maria Crespi. He was back in Venice by 1711 and continued to work there until his death.

Little is known of the dating of Piazzetta's paintings, especially those of his youth. His "St. James Led to Martyrdom" (Venice) dates to 1717; at this period he was a power-

"Fortune Teller," oil painting by Piazzetta, 1740; in the Accademia, Venice

Giraudon—Art Resource, New York City

ful influence on the young Giovanni Battista Tiepolo, who was to become the most famous Venetian painter of the 18th century. In about 1725–27 he undertook his only ceiling painting, the "Glorification of St. Dominic," for the Chapel of the Sacrament in Santi Giovanni e Paolo. The "Ecstasy of St. Francis," perhaps his finest religious work, dates from about 1732, and some three years later he was commissioned to execute an "Assumption" for the elector of Cologne. The celebrated "Fortune Teller" is dated 1740. "The Pastoral" and the "Idyll by the Seashore," both in the same Rococo-pastoral vein, must have been painted about the same time or a little before. In his last years he carried out a number of large-scale decorations with subjects taken from classical history.

In 1727 Piazzetta was elected a member of the Bolognese Clementina Academy, and, on the foundation of the Venetian Academy in 1750, he was made its first director and teacher of drawing from the nude. He was a very slow worker and in spite of his popularity was compelled to produce innumerable drawings for sale to support his large family.

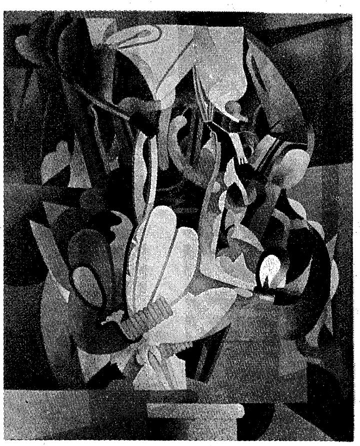
Piazzi, Giuseppe (b. July 16, 1746, Ponte di Valtellina, Lombardy, Habsburg crown land [Italy]—d. July 22, 1826, Naples), Italian astronomer who discovered (Jan. 1, 1801) and named the first asteroid, or "minor planet," Ceres.

Piazzi became a Theatine monk in about 1764 and a professor of theology in Rome in 1779, and in 1780 he was appointed professor of higher mathematics at the Academy of Palermo. Later, with the aid of the Viceroy of Sicily, he founded the Observatory of Palermo. There he produced his great catalog of the positions of 7,646 stars and demonstrated that most stars are in motion relative to the Sun. There also he discovered Ceres and the high proper motion of the important double star 61 Cygni.

Pibul Songgram (Thai premier): *see* Phibunsongkhram, Luang.

Picabia, Francis (b. Jan. 22, 1879, Paris, Fr.—d. Nov. 30, 1953, Paris), French painter, illustrator, designer, writer, and editor who was successively involved with the Cubist, Dadaist, and Surrealist movements.

After studying at the École des Beaux-Arts and the École des Arts Décoratifs, Picabia worked for nearly six years in an Impressionist mode akin to that of Alfred Sisley. In 1911 he became a member of the Section d'Or ("Golden Section"), a Cubist group. Also in 1911 he met the artist Marcel Duchamp, and Picabia's rejection of the unemotional themes of Cubism for intricate still lifes and symbolic figures is thought to have resulted from this association.



"I See Again in Memory My Dear Udnie," oil on canvas by Francis Picabia, 1914, perhaps begun 1913, 8 ft 2½ in. × 6 ft 6¼ in. (2.5 × 2m); in the Museum of Modern Art, New York City

By courtesy of the Museum of Modern Art, New York City, Hillman Periodicals Fund; © S.P.A.D.E.M., Paris, 1981

In 1913 he was in New York City, where he exhibited at the Armory Show and at Alfred Stieglitz' Photo-Secession Gallery. He contributed to the proto-Dadaist review *291* and also to Stieglitz' magazine *Camera Work*, where he promulgated Amorphism, a satire on current art trends. In 1917 Picabia and the wealthy poet-scholar-collector Walter Arensberg launched the periodical *391*, a continuation of *291*. With Marcel Duchamp, Marius de Zayas, and Man Ray, he was part of a Dada-like group of European artists living in New York City.

In 1917 Picabia returned to Europe and was active in Barcelona, Paris, and Zürich, where he collaborated in 1918 with Tristan Tzara on the fourth and fifth issues of the magazine *Dada*. In Paris in 1920 he started a review called *Cannibale*. After Dadaism broke up about 1921, he followed the poet André Breton into the Surrealist movement. Among his many literary works, *Poèmes et dessins de la fille née sans mère* (1918; "Poems and Drawings of a Daughter Born Without a Mother") is generally considered the most important.

Picard, (Charles-)Émile (b. July 24, 1856, Paris, Fr.—d. Dec. 11, 1941, Paris), French mathematician whose theories did much to advance research into analysis, algebraic geometry, and mechanics.

Émile Picard

H. Roger-Viollet

Picard became a lecturer at the University of Paris in 1878 and a professor at the University of Toulouse the following year. From 1881 to 1898 he held various posts with the University of Toulouse and the École Normale Supérieure, Paris, and in 1898 he was appointed professor at the University of Paris. In 1917 he was elected permanent secretary for the mathematical sciences in the Academy of Sciences, Paris.

Picard worked on quadratic forms, on Fuchsian and Abelian functions, and on the allied theories of discontinuous and continuous groups of transformation; he also discovered hyperfuchsian and hyperabelian functions. His work led to a study of the algebraic manifold now known as the Picard variety, which plays a fundamental role in algebraic geometry. In 1879 he proved the theorem known by his name, that an integral function of the complex variable takes every finite value, with one possible exception. His theorem became the starting point for many important studies in the theory of complex functions.

Picard introduced a new means of proving the existence of solutions to differential equations: the method of successive approximations. His method proved so useful that for ordinary differential equations it replaced the Cauchy–Lipschitz method. He also created a theory of linear differential equations, later extended by his pupil Ernest Vessiot, analogous to the Galois theory of algebraic equations.

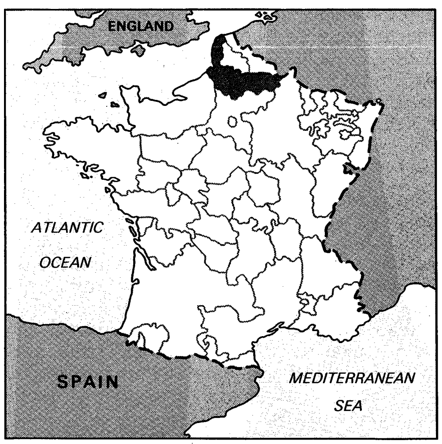
Inspired by Niels H. Abel of Norway and Bernhard Riemann of Germany, Picard's study of the integrals attached to algebraic surfaces and the related topological questions developed into an important part of algebraic geometry, with varied applications to topology and function theory. His research was expounded in the treatise that he published with Georges Simart, *Théorie des fonctions algébriques de deux variables indépendantes*, 2 vol. (1897, 1906; "Theory of Algebraic Functions of Two Independent Variables"). His studies of harmonic vibrations, coupled with the contributions of Hermann Schwarz of Germany and Henri Poincaré of France, marked the beginning of the theory of integral equations.

Picard, Jean (b. July 21, 1620, La Flèche, Fr.—d. July 12, 1682, Paris), French astronomer who first accurately measured the length of a degree of a meridian (longitude line) and from that computed the size of the Earth.

Picard became professor of astronomy at the Collège de France, Paris, in 1655. His measurement of the Earth was used by Sir Isaac Newton to verify his theory of gravitation. In 1671 Picard went to the observatory of the noted 16th-century Danish astronomer Tycho Brahe at Hven Island, Sweden, to determine its exact location so that Brahe's observations could be more precisely compared with those made elsewhere. He brought back copies of the originals of Brahe's principal work.

Picard is also given credit for the introduction of telescopic sights and the use of pendulum clocks as contributions to greater precision in astronomical observations. In 1675 he made the first recorded observation of barometric light, the light that appears in the vacuum above the mercury in a barometer when the barometer is moved about. In 1679 Picard founded and became editor of *La Connaissance des temps ou des mouvements célestes* ("Knowledge of Time or the Celestial Motions"), the first national astronomical ephemeris, or collection of tables giving the positions of celestial bodies at regular intervals.

Picardy, French PICARDIE, *région de programme* ("planning region") encompassing the northern French *départements* of Oise, Somme, and Aisne and roughly coextensive with the historical region of Picardy. The capital is Amiens. Picardy has an area of 7,490 square miles (19,399 square km) and is bounded by the *départements* of Pas-de-



The *gouvernement* of Picardy in 1789

Calais and Nord to the north, Ardennes and Marne to the east, Seine-et-Marne and Seine-Saint-Denis to the south, and Eure and Seine-Maritime to the west. Somme borders the English Channel to the west.

Since Picardy was never unified in the feudal period, its boundaries are disputable. Linguistically, Picardy extended beyond its geographic boundaries to Artois, Cambrésis, Tournésis, and parts of Flanders and Hainaut; ecclesiastically it embraced not only the medieval dioceses of Amiens, Noyon, and Laon but also the northern parts of those of Beauvais and of Soissons. The province of Picardy from the 16th century to the end of the ancien régime in 1789 comprised the Somme River basin from Saint-Quentin to the Channel, the basins of the Serre and of the upper Oise, and Montreuil on the Canche beyond the Authie.

Occupied by the Salian Franks in the 5th century, Picardy was divided in the feudal period and encompassed six countships: Boulogne, Montreuil, Ponthieu, Amiénois, Vermandois, and Laonnois. King Philip II Augustus gradually united Amiénois and Vermandois to his domain (from 1185), but Ponthieu was held by the English as a fief almost continuously from 1279 to 1360 and then as an outright possession until 1369. The dukes of Burgundy acquired Ponthieu, the Somme towns, and Montdidier under the Treaty of Arras in 1435. Reconquered for France by Louis XI in 1477, Picardy was thereafter a frontier area invaded frequently from the Habsburg Netherlands until the French acquisition of Artois and southern Hainaut in 1659. Some of the bloodiest fighting in World War I occurred in Picardy (reflected in the melancholy English popular song "Roses of Picardy" [1916]). It was also the scene of bitter fighting in World War II—in May 1940 and August–September 1944.

Picardy belongs to the Paris Basin and is essentially flat; elevations lie below 1,000 feet (300 m). The calcareous plateaus of Laon, Soissons, and Valois rise to the east. An oceanic climate prevails.

The population declined by 19 percent between 1861 and 1946, as did that of most of rural France during this period. It has subsequently grown at a rate above the national average. Demographic recovery has favoured Oise over Aisne and Somme. Oise has benefited from its proximity to Paris and has a large population of migrants. Much of the population lives in towns with fewer than 15,000 inhabitants. The countryside is densely populated.

Agriculture is highly mechanized. The average farm is large for France, exceeding 100 acres (40 hectares); crops include sugar beets, wheat, barley, and potatoes. Animal husbandry, which has been adversely affected by the policies of the European Economic Community, is of declining importance. Metalworking is the leading industry. Automotive parts are manufactured in Montataire, Beauvais, and Amiens. Bicycles, airplanes, agricultural machinery, and textiles are also produced. Picardy imports coal from the *département* of Nord and has benefited from the decentralization of Parisian industries since 1950. Pop. (1988 est.) 1,783,400.

Consult the INDEX *first*

picaresque novel, early form of novel, usually a first-person narrative, relating the adventures of a rogue or low-born adventurer (Spanish *pícaro*) as he drifts from place to place and from one social milieu to another in his effort to survive. In its episodic structure the picaresque novel resembles the long, rambling romances of medieval chivalry, to which it provided the first realistic counterpart. Unlike the idealistic knight-errant hero, however, the picaro is a cynical and amoral rascal who, if given half a chance, would rather live by his wits than by honourable work. The picaro wanders about and has adventures among people from all social classes and professions, often just barely escaping punishment for his own lying, cheating, and stealing. He is a casteless outsider who feels inwardly unrestrained by prevailing social codes and mores, and he conforms outwardly to them only when it serves his own ends. The picaro's narrative becomes in effect an ironic or satirical survey of the hypocrisies and corruptions of society, while also offering the reader a rich mine of observations concerning people in low or humble walks of life.

The picaresque novel originated in Spain with *Lazarillo de Tormes* (1554; doubtfully attributed to Diego Hurtado de Mendoza), in which the poor boy Lazaro describes his services under seven successive lay and clerical masters, each of whose dubious character is hidden under a mask of hypocrisy. The irreverent wit of *Lazarillo* helped make it one of the most widely read books of its time. The next picaresque novel to be published, Mateo Alemán's *Guzmán de Alfarache* (1599), became the true prototype of the genre and helped establish realism as the dominant trend in the Spanish novel. The supposed autobiography of the son of a ruined Genoese moneylender, this work is richer in invention, variety of episode, and presentation of character than *Lazarillo,* and it too enjoyed extraordinary popularity.

Among *Guzmán's* numerous successors were several short novels by Miguel de Cervantes in the picaresque manner, notably *Rinconete y Cortadillo* (1613) and *El Coloquio de los perros* (1613; "Colloquy of the Dogs"). Francisco López de Úbeda's *La picara Justina* (1605; "Naughty Justina") tells the story of a woman picaro who deceives her lovers just as the picaro does his masters. Francisco Gómez de Quevedo's *Vida del Buscón* (1626; "The Life of a Scoundrel") is a masterpiece of the genre, in which the profound psychological depiction of a petty thief and swindler is underlain by a deep concern for moral values. After *Buscón* the picaresque novel in Spain declined gradually into the novel of adventure.

In the meantime, however, the picaro had made his way into other European literatures after *Lazarillo de Tormes* was translated into French, Dutch, and English in the later 16th century. The first picaresque novel in England was Thomas Nashe's *Unfortunate Traveller, or, the Life of Jacke Wilton* (1594). In Germany the type was represented by H.J. von Grimmelshausen's *Simplicissimus* (1669). In England the female picaro was revived in Daniel Defoe's *Moll Flanders* (1722), and many picaresque elements can be found in Henry Fielding's *Jonathan Wild* (1725), *Joseph Andrews* (1742), and *Tom Jones* (1749), and Tobias Smollett's *Roderick Random* (1748), *Peregrine Pickle* (1751), and *Ferdinand, Count Fathom* (1753). The outstanding French example is Alain René Lesage's *Gil Blas* (1715–35), which preserves a Spanish setting and borrows incidents from forgotten Spanish novels but portrays a gentler, more humanized picaro.

In the mid-18th century the growth of the realistic novel with its tighter, more elaborated plot and its greater development of character led to the final decline of the picaresque novel, which came to be considered somewhat inferior in artistry. But the opportunities for satire provided by the picaresque novel's mingling of characters from all walks of life, its vivid descriptions of industries and professions, its realistic language and detail, and above all its ironic and detached survey of manners and morals helped to enrich the realistic novel and contributed to that form's development in the 18th and 19th centuries. Elements of the picaresque novel proper reappeared in such mature realistic novels as Nikolay Gogol's *Dead Souls* (1842–52), Mark Twain's *Huckleberry Finn* (1884), and Thomas Mann's *Confessions of Felix Krull* (1954).

Picasso, Pablo (Ruiz y) (b. Oct. 25, 1881, Málaga, Spain—d. April 8, 1973, Mougins, Fr.), Spanish expatriate painter, sculptor, printmaker, ceramicist, and stage designer, one of the greatest and most influential artists of the 20th century and the creator (with Georges Braque) of Cubism.

A brief treatment of Pablo Picasso follows. For full treatment, *see* MACROPAEDIA: Picasso.

Even Picasso's earliest drawings (*c.* 1890), executed when he was about 10 years old, showed an exceptional technical facility. When the family moved to Barcelona in October 1895, Picasso attended La Lonja, the school of fine arts there (1896), and the Royal Academy of Fine Arts of San Fernando in Madrid (1897). In October 1900 he made the first of three visits to Paris, where he established himself finally in April 1904. During the intensely creative years 1899–1905, Picasso's style varied considerably. At the start, he used strong colours in a Postimpressionist manner (1900–01). Then he painted predominantly in blue (the so-called Blue Period; late 1901–spring 1904). Until mid-1901 his principal subjects were lively scenes of popular and bourgeois life (cabarets, racecourses, dance halls, etc.); toward the end of 1901, however, Picasso's world became that of the suffering victims of society: prostitutes, beggars, drunkards, etc. In 1904 his gloom lifted, and he looked freshly at humanity with tenderness and admiration and adopted warmer colours and a more harmonious, classical style of draftsmanship; during this Rose Period, his favourite subjects were dancers and acrobats, particularly the Harlequin figure of the commedia dell'arte.

Between the end of 1906 and the spring of 1907, while influenced by the painting of Paul Cézanne, by Greco-Iberian art, and by African sculpture, Picasso produced a painting later called "Les Demoiselles d'Avignon" that constitutes a violent break with tradition. This painting pointed the way toward Cubism, a new pictorial style that Picasso and his friend Braque began to develop side by side and in close friendship. They disregarded the conventional means used for creating an illusion of reality, such as one-point perspective, chiaroscuro, and the definition of form and colour by light, aiming instead to represent objects more conceptually by breaking them into geometrical units, or small cubes, and by depicting a single object on the same canvas from a multiplicity of angles. Picasso was to continue elaborating and perfecting this style until about 1925. Simultaneously, from about 1915 onward, he began to work in the opposite direction, depicting figures of a subtly detached classicism—linear, sculptural, and monumental.

After 1925 Picasso began to depict emotionally charged bodies and heads whose dislocations give rise to double images and pictorial metaphors. A private Surrealist vocabulary of powerful symbols (*e.g.,* the Minotaur) emerged in the 1930s to express his personal dilemmas and distress. Picasso's interest in sculpture, dormant since 1905, revived at this time. The outbreak of the Spanish Civil War in 1936 inspired the great and harrowing mural painting "Guernica" (1937), the first reference in his work to political events. In 1944 Picasso joined the Communist Party, and in 1949 his "Dove" lithograph was adopted as the symbol of the World Peace Congress. In the postwar years much of Picasso's work centred on the themes of war and peace and man's right to leisure and peaceful relaxation. After 1955 the theme of the artist and his magic powers assumed great importance in his work.

Picasso's powerful inventive gifts led him to work in many fields. He produced (1917–24) some famous decors for Sergey Diaghilev's Russian ballet company (*e.g., Parade, Le Tricorne, Pulcinella*). He also made significant technical innovations in lithography and linocutting and produced a great quantity of painted pottery.

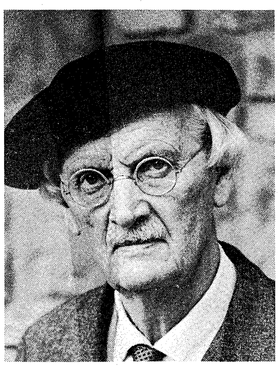
Piccard, Auguste (b. Jan. 28, 1884, Basel, Switz.—d. March 24, 1962, Lausanne), Swiss-born Belgian physicist notable for his exploration of both the upper stratosphere and the depths of the sea in ships of his own design. In 1930 he built a balloon to study cosmic rays. In 1932 he developed a new cabin design for balloons and in the same year ascended to 16,916 m (55,000 feet). He completed a bathyscaphe in 1948 and later made several dives with his son Jacques.

Piccard was born into a family of Swiss scholars. His father, Jules Piccard, was a professor of chemistry at the University of Basel. Auguste and his twin brother, Jean, enrolled together at the Swiss Federal Institute of Technology, in Zürich, where they studied physics and chemistry, respectively. When they became doctors of science, both decided to teach in universities; Jean, the chemist, went first to Munich, then to Lausanne, then to the United States; and Auguste, the physicist, stayed on at the Institute. In 1919 Auguste married the daughter of a French historian at the Sorbonne.

Piccard became interested in balloon ascents as a means of making experiments. He participated in many important research studies, and when the University of Brussels in 1922 created a chair for applied physics, Piccard, who was also a mechanic and an engineer, readily accepted the post. Having studied cosmic rays, he conceived of an experiment for observing them at 16,000 or more metres in the upper atmosphere. Previous ascents had shown that the stratosphere could be fatal and that to penetrate the isothermal layer, with its low pressure, a revolutionary balloon would be necessary. He built such a balloon in 1930, with Belgian financing. Its main innovative feature was an airtight cabin, equipped with pressurized air; today this technique has become commonplace on airplanes. Another innovation was the design of a very large balloon having sufficient ascent strength so that, on departure, it need not be completely filled. On May 27, 1931, Piccard and Paul Kipfer reached an altitude of 15,781 m (51,762 feet), where the atmospheric pressure is about $^1/_{10}$ that at sea level. Upon returning to the surface, the scientist-adventurers were received triumphantly in Zürich and then Brussels.

In 1932, in a new cabin, this time equipped with a radio, Piccard was able to reach an altitude of 16,940 m (55,563 feet). In 1933, using the same technique but with bigger balloons, other balloonists rose to 18,500 m (60,700 feet) in the Soviet Union and 18,665 m (61,221 feet) in the United States.

As a child, Piccard had been fascinated by accounts of marine fish and thought that man should also descend into the depths. Now, after his aeronautical successes, he wanted to build a device capable of resisting the pressures of the ocean depths, the bathyscaphe.



Auguste Piccard, 1961
Horst Tappe—EB Inc.

Depth-resistant cabins are, of necessity, heavier than water. Up to that time, around 1948, they had been suspended from a cable, but at great depths this procedure was not dependable. Piccard revolutionized the dive by the principle of the balloon. Just as a lighter-than-air balloon carried the nacelle, or balloon gondola, a lighter-than-water float would support the cabin. Just as the balloon required a release of ballast to rise, the bathyscaphe would release weight in order to ascend after having completed its dive. Air, because it is too easily compressed, was not used in the floats; Piccard chose gasoline.

World War II interrupted the construction of the bathyscaphe, which was not completed until 1948. In October 1948 an unpiloted trial dive with the bathyscaphe F.N.R.S. 2 was conducted successfully. The cabin withstood the 1,400-metre (4,600-foot) pressure perfectly, but the float was severely damaged by a heavy swell of water that it encountered after the dive. The bathyscaphe project was subsequently troubled by various difficulties until Jacques Piccard, Auguste's son, intervened.

Jacques, an assistant in economics at the University of Geneva, had already conducted the negotiations with the French government. Then, while in Trieste for the purpose of preparing a study of that port, he received an unexpected offer from that city's local industry to build a new bathyscaphe. Thus, in August 1953, two bathyscaphes competed in the Mediterranean, at Toulon, Fr., and at Naples: the French craft F.N.R.S. 3 descended to 2,100 m (6,900 feet), and the Piccards' *Trieste* went down to 3,150 m (10,330 feet). At the age of 69, Auguste Piccard had realized his dream. His son, abandoning economics, followed in his father's footsteps and collaborated in future work with bathyscaphes. In 1954 Piccard retired from teaching and left Brussels for Switzerland. (P.de L./Ed.)

BIBLIOGRAPHY. In French, see Pierre de Latil and Jean Rivoire, *Le Professeur Auguste Piccard* (1962). The same authors' *A la recherche du monde marin* (1954; *Man and the Underwater World,* 1956), deals with the explorations undertaken by Auguste and Jacques. English translations of Auguste Piccard's writings are: *Earth, Sky and Sea* and *In Balloon and Bathyscaph* (both 1956).

Piccard, Jacques (-Ernest-Jean) (b. July 28, 1922, Brussels), Swiss oceanic engineer, economist, and physicist, who helped his father, Auguste Piccard, build the bathyscaphe for deep-sea exploration and who also invented the mesoscaphe, an undersea vessel for exploring middle depths.

He was born in Brussels while his Swiss-born father was professor at the University of Brussels. After graduating from the École Nouvelle de Suisse Romande in Lausanne, Switz., in 1943, he studied at the University of Geneva, taking a year off in 1944–45 in order to serve with the French First Army. Upon receiving his licentiate in 1946, he taught at the university for two years before entering private teaching.

Meanwhile, he was helping his father to design bathyscaphes and in 1953 accompanied him in the *Trieste* on a dive of 10,168 feet (3,099 m) off the island of Ponza, Italy. In 1956 Jacques Piccard went to the United States seeking funding; two years later the U.S. Navy bought the *Trieste* and retained him as a consultant. On Jan. 23, 1960, he and Lieutenant Don Walsh of the U.S. Navy set a new submarine depth record by descending 35,800 feet (10,912 m) into the Mariana Trench in the Pacific Ocean using the *Trieste.* In the early 1960s, working with his father, he designed and built the mesoscaphe (capable of carrying 40 tourists) for underwater observation through portholes. In 1966 in the bathyscaphe he conducted research in the Gulf Stream for the U.S. Navy. In his later career he was consultant scientist for several private American organizations for deep-sea research, including the Grumman Aircraft Engineering Corporation, New York (1966–71).

Piccard, Jean-Felix (b. Jan. 28, 1884, Basel—d. Jan. 28, 1963, Minneapolis, Minn., U.S.), Swiss-born American chemical engineer and balloonist who conducted stratospheric flights for the purpose of cosmic-ray research.

The twin brother of Auguste Piccard, he graduated (1907) from the Swiss Federal Institute of Technology with a degree in chemical engineering and then earned a doctorate in natural science (1909). He taught at the universities of Munich (1914), Lausanne (1914–16, 1919–25), and Chicago (1916–18). He became a U.S. citizen (1931) and lectured in aeronautical engineering at the University of Minnesota (1936–52) until his retirement.

He made his first balloon ascent in 1913 with his twin brother. On Oct. 23, 1934, with his wife, he made the first successful stratosphere flight through clouds, ascending to a height of 11 miles (18 km). In 1937 he made an ascent of 11,000 feet (3,350 m) to test a metal gondola attached to a cluster of 98 balloons. Later he developed a frost-resistant window for balloon gondolas and an electronic system for emptying ballast bags.

Where the same name may denote a person, place, or thing, the articles will be found in that order

Piccinino, Niccolò (b. 1386, Perugia, Papal States—d. 1444, Milan), Italian soldier of fortune who played an important role in the 15th-century wars of the Visconti of Milan against Venice, Florence, and the pope.

A butcher's son, Piccinino became a soldier and eventually joined the forces of the condottiere Braccio da Montone, whose daughter he married. When Braccio was killed in battle (1424), Piccinino took over command of his company, and the following year, with the young soldier of fortune Francesco Sforza, he entered the employ of Duke Filippo Maria Visconti of Milan. After brief service against Venice and Florence, he was dispatched to fight Pope Eugene IV (1434) and helped to drive the latter out of Rome. In 1438 Piccinino, battling the Venetians at Lake Garda, faced Sforza, now the Venetian captain general. After destroying a Venetian fleet on the lake, Piccinino was surrounded by the enemy and barely escaped—according to one story, concealed in a sack.

Invading Tuscany in 1440, Piccinino suffered a crushing defeat by the Florentines at Anghiari near Florence, leading his Visconti employer to sue for peace. The following year Piccinino, so ill that he could hardly ride a horse, had a last confrontation with Sforza, who was now fighting for the pope and King Alfonso of Naples, in the Marches in east-central Italy. After a preliminary setback, Piccinino was summoned to Milan; as soon as he left, Sforza attacked, capturing Piccinino's son Francesco and inflicting a decisive defeat. Piccinino died a few days after receiving the news, a frustrated man.

Piccinni, Niccolò (b. Jan. 16, 1728, Bari, Kingdom of Naples—d. May 7, 1800, Passy, Fr.), one of the outstanding opera composers of the Neapolitan school, who wrote in both the comic and the serious styles but who, in the century following his death, was chiefly remembered as the rival of Gluck. He studied in Naples, where he produced several operas. The masterpiece of his early years was the opera buffa *La buona figliuola,* or *La cecchina* (1760), on a libretto by Goldoni based on Richardson's novel *Pamela.* It was written in the new style, later epitomized in the operas of Mozart, that incorporated serious or sentimental subject matter into the flexible musical style of the older, farcical, opera buffa.

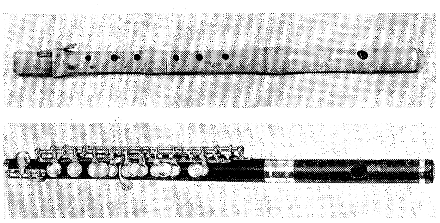
In 1776 he was invited to Paris by supporters of the Italian operatic style, who opposed the opera reforms of Gluck. Piccinni was

Piccinni, engraving by J.F. Schröter
By courtesy of the Royal College of Music, London

thus drawn into a continuation of the earlier controversy between supporters of Italian opera and supporters of French opera, the "Guerre des Buffons." Although Piccinni admired Gluck's operas and steadfastly refused to encourage his own partisans, the warring factions nevertheless created a rivalry. Each composer's work was compared unfavourably with that of the other, although their aims were quite dissimilar: Piccinni maintained the traditional sequence of arias and recitatives, whereas Gluck was laying the foundations of an operatic reform. At the height of the controversy, both composers were commissioned to write operas on the subject *Iphigénie en Tauride*. Gluck's famous opera was given in 1779, Piccinni's in 1781. After Gluck's departure from Paris in 1779, Piccinni continued to produce operas but was deprived of his post at the École Royale de Musique in 1789, during the Revolution. He then returned to Naples but went to Paris again in 1798 before retiring to Passy.

piccolo, in full FLAUTO PICCOLO (Italian: "small flute"), highest pitched woodwind instrument of orchestras and military bands. It is a small transverse (horizontally played) flute of conical or cylindrical bore, fitted with Böhm-system keywork and pitched an octave higher than the ordinary concert flute.

The piccolo's compass extends three octaves upward from the second D above middle C. Its orchestral use dates from the late 18th century, when it replaced the flageolet (also called flauto piccolo). A six-keyed piccolo in D♭ was



(Top) One-keyed English piccolo, in the Pitt-Rivers Museum, Oxford; (bottom) contemporary wood piccolo
By courtesy of (top) the Pitt-Rivers Museum, Oxford, (bottom) Conn Corporation, Oak Brook, Ill.

formerly used in military bands to facilitate playing in flat keys.

Piccolo San Bernardino, Colle del (France–Italy): *see* Little Saint Bernard Pass.

Piccolomini FAMILY, noble family prominent in Sienese politics from the 12th century as leaders of the Guelf (papal) party and as operators of a banking firm with branches in France and England as well as in Italy.

Tracing their origins, according to family legend, to Lars Porsena, king of Clusium, the Piccolomini by the 12th century played an important role in the aristocratic consular commune of Siena. In the 13th century the family reached its commercial apogee, despite being twice banished from their native city, a Ghibelline (imperial) party stronghold. They managed to escape the economic crisis of the 14th century, thanks to large investments in land, and in 1458 were named counts palatine by the Holy Roman emperor Frederick III. The family included soldiers, prelates, literary men, and two popes—Enea Silvio, who became Pius II (1458–64), and his nephew Francesco, who was Pius III (1503).

Piccolomini, Enea Silvio (pope): *see* Pius II.

Piccolomini, Francesco Todeschini (pope): *see* Pius III.

Piccolomini-Pieri, Ottavio, DUCA (duke) D'AMALFI, REICHSFÜRST (imperial prince) (b. Nov. 11, 1599, Florence—d. Aug. 11, 1656, Vienna), general and diplomat in the service of the House of Habsburg during the Thirty Years' War (1618–48) and one of the

Ottavio Piccolomini, an anonymous engraving, *c.* 1640
Archiv fur Kunst und Geschichte, West Berlin

imperial generalissimo Albrecht von Wallenstein's most trusted lieutenants. His skills both on the battlefield (Thionville, 1639) and at the conference table (Congress of Nürnberg, 1649) made him an invaluable servant of the Austrian and Spanish crowns.

Born into a noble Tuscan family, Piccolomini entered the Habsburg service in 1616. After campaigning in Bohemia and Hungary (from 1618), he returned to Italy in 1623 as a volunteer in Spanish pay. In 1627, Piccolomini began his association with Wallenstein, whose bodyguard he soon commanded. From 1627 to 1629, he was used on a number of the generalissimo's diplomatic missions and, after the outbreak of the War of the Mantuan Succession, in which Austria opposed France, he went to Italy with both military and diplomatic powers (1629). Two years later, however, he was forced to sign an unfavourable peace in order to give Austria a free hand against the Swedes in the north.

After his return to Germany, Piccolomini, who was instrumental in Wallenstein's reinstatement as generalissimo and almost turned the Battle of Lützen (November 1632) into an imperial victory, became increasingly disillusioned when his superior bequeathed favours and promotions on other men. He played a leading role with the Austrian general Matthias von Gallas in the generals' conspiracy that toppled and assassinated Wallenstein on Feb. 25, 1634. Although Emperor Ferdinand II rewarded Piccolomini richly, he gave the supreme command to Gallas. After the victory at Nördlingen (Sept. 6, 1634), which freed Bavaria, Piccolomini returned to the Spanish service and campaigned against the French in the Netherlands (1635–39), winning the spectacular victory of Thionville (June 1639), for which he was created duke of Amalfi. He then reentered the Austrian Army, but, after his defeat at the second Battle of Breitenfeld (November 1642), he again returned to the Spanish service in the Netherlands. Finally, in May 1648, the emperor Ferdinand III named him commander in chief, and Piccolomini thus conducted the last campaign of the Thirty Years' War. The next year he served as head of the imperial delegation to the Congress of Nürnberg, which negotiated issues left unsettled by the Peace of Westphalia (1648). Named imperial prince (*Reichsfürst*) in 1650, he died in the Austrian capital six years later.

Piceni, English PICENES, Early Iron Age inhabitants of the Adriatic coast of Italy from Rimini to the Sangro River. Men and women dressed in wool; men wore armour, weapons, and ornaments of bronze or iron; women had numerous fibulae, torques, bracelets, girdles, and ornamental pendants. They had two main centres, one at Novilara in the north, and another around Belmonte and Fermo farther south. The Piceni traded with the Greeks as early as the 7th century BC, but there is little evidence of trade with Etruria, except at the inland site of Fabriano. The evidence suggests that Piceni were warlike, with little artistic ability of their own, but wealthy enough to sustain a flourishing trade. In 268 BC their territory was annexed by Rome.

Pichegru, (Jean-)Charles (b. Feb. 16, 1761, near Arbois, Fr.—d. April 5, 1804, Paris), general of the French Revolutionary Wars who played a leading role in the conquest of the Austrian Netherlands and Holland (1794–95); he subsequently ruined his reputation by conspiring with counterrevolutionaries (1795) and against Napoleon Bonaparte (1804).

Born into a peasant family, Pichegru taught mathematics at the military academy at Brienne before he joined an artillery regiment in 1780. He was sergeant major at the outbreak of the Revolution in 1789 and in 1792 became lieutenant colonel. Appointed commander of the Army of the Rhine in October 1793, he helped Gen. Lazare Hoche drive the Austro-Prussian armies from Alsace in December. Nevertheless, Pichegru was jealous of Hoche. By convincing the government that Hoche was a traitor, he managed to have his rival imprisoned (March 1794). Pichegru was given command of the 150,000-man Army of the North.

In April 1794, Pichegru and Gen. Jean-Baptiste Jourdan, commander of the Army of the Moselle, launched an invasion of the Austrian Netherlands, capturing Amsterdam by January 1795. Returning to Paris, he was hailed as a saviour of his country. Although he was appointed commander of the armies of the Rhine and Moselle in mid-1795, he had already begun to turn against France's republican regime. He initiated secret contacts with agents of French émigrés in August.

Pichegru, portrait by C.H. Hodges
H. Roger-Viollet

In March 1796, Pichegru resigned his commission. Elected president of the Council of Five Hundred (the lower chamber of the legislature) in May 1797, he sided with the royalist deputies. Nevertheless, word of his previous treasonable contacts reached Paris, and when the royalists were expelled from the government in the coup d'etat of 18 Fructidor (Sept. 4, 1797), Pichegru was arrested and deported to the Guianas. Escaping from the islands, he made his way to Germany, then to England. In January 1804, he secretly entered France and began plotting to overthrow Bonaparte's military regime. Arrested in Paris on February 28, he was found strangled with his cravat in Temple prison on April 5; it is not known whether he was murdered or committed suicide.

pichhwāi, cloth hanging used as a backdrop for images worshipped in temples of the Hindu Vallabhācārya sect, who are ardent devotees of the god Krishna. *Pichhwāi*s, which form a part of the temple decor, are frequently changed according to the day, the season, and the occasion. Some are fairly large and are made from such costly fabrics as velvet and brocade, while others are smaller and are made of cotton cloth decorated with embroidery or

Detail of a *pichhwāi* showing landscape and female figures, from Andhra Pradesh, 18th century; in the Prince of Wales Museum of Western India, Bombay
P. Chandra

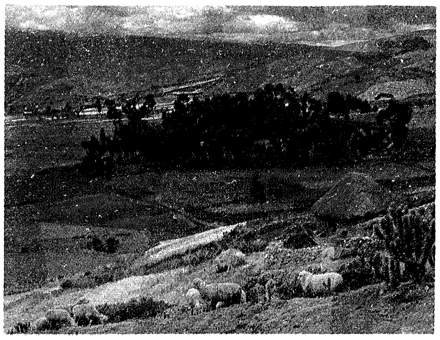
painting. In the 18th century the decoration consisted mainly of landscapes with small animal and human figures; later, large human figures began to predominate.

Among the main themes are episodes from the life of Krishna, such as the lifting of Mt. Govardhana, the stealing of the clothes of the bathing milkmaids, and the divine dance. Representations of rituals and festivals are also found. Although *pichhwāi*s were painted at several centres in Rājasthān, Gujarāt, and the Deccan, the main centre of manufacture has been Nathdwāra, near Udaipur in Rājasthān.

pichi, South American species of armadillo (*q.v.*).

pichiciago, species of armadillo (*q.v.*).

Pichincha, province of north central highland Ecuador, with a small lowland fringe to the west, covering a total area of 5,243 sq mi (13,579 sq km). The provincial capital, Quito



Sheep grazing in a valley of the Andean plateau, Pichincha province, Ecuador
Bjorn Bolstad—Photo Researchers

(*q.v.*), also the national capital, has made it a focal point of Ecuadorian history and politics.

In the early 15th century the Quitu Indians, original inhabitants of the area, were conquered by the Cara Indians. These last were soon supplanted by the Incas, who, from their Peruvian centre, swept through central Ecuador at about the same time as the landfall of Columbus. The Inca emperor Huayna Capac (died *c.* 1525) established Quito as an important governmental and military outpost, and his followers settled the territory now composing Pichincha province. Later, the province was the site of a decisive battle in the Latin-American wars of independence. *See* Pichincha, Battle of.

Most of the population is concentrated in the more temperate valleys of the high Andean plateau. Although agriculture and cattle raising are the main occupations, thriving industries (concentrated mainly in Quito), including textile mills and food-processing plants, contribute to the economy. The province produces cereals, potatoes, sugarcane, cacao, coffee, and rice. Its forests are sources of fine woods and there are copper deposits. Tourism is a growing economic factor. The Pan-American Highway and the Guayaquil–Quito railway run through the province from north to south. Pop. (1982 prelim.) 1,369,059.

Pichincha, Battle of (May 24, 1822), in the Latin-American wars of independence, a victory by South American rebels, commanded by Antonio José de Sucre, over the Spanish royalists on the lower slopes of Cerro Pichincha, an Andean volcano. It enabled the rebels to occupy nearby Quito, Ecuador, the following day. Simón Bolívar, leader of the revolutionary forces in northern South America, was acclaimed liberator, and Ecuador was joined to the newly formed but transitory Republic of Gran Colombia.

Picidae, bird family of the order Piciformes that includes woodpeckers, piculets, and wry-

Eurasian wryneck (*Jynx torquilla*)
Eric Hosking—The National Audubon Society Collection/EB Inc.

necks. The 210 species occur worldwide except in Madagascar and east of Borneo and Bali (*i.e.,* they do not cross Wallace's Line). Most are specialized for gleaning insects from tree bark, usually by boring with their bills; some also eat nuts, fruits, and sap; and a few gather ants and grubs from the ground.

piciform, order of birds (Piciformes) consisting of six families of arboreal birds: the familiar woodpeckers, their relatives the piculets and wrynecks (collectively, the family Picidae), and the exotic tropical jacamars (Galbulidae), puffbirds (Bucconidae), barbets (Capitonidae), honey guides (Indicatoridae), and toucans (Ramphastidae).

A brief treatment of piciforms follows. For full treatment, *see* MACROPAEDIA: Birds.

Piciforms vary in size from 3.5 inches (9 centimetres) to 24 inches. Characteristic of this order is the zygodactyl foot, where two toes point forward and two backward. The structure of the bill varies greatly throughout the Piciformes. That of some species of woodpeckers is chisel-like and broadly based, with slitlike nostrils to keep wood chips out. The huge, serrated bill of the toucans is supported by a crisscrossing of many bony fibres; it is strong but surprisingly lightweight for its size.

The medium-sized jacamars have long, slender bills and resemble hummingbirds in their body shape and their bright, iridescent plumage. The puffbirds are similar to the jacamars, although with shorter tails and bills. Their plumage is relatively subdued, usually brown, tan, or mottled. Large heads and stout bills on thick bodies typify the barbets, in addition to bristles at the base of the beak. The barbets include some of the most beautifully coloured of birds; many of these are bright green with red, orange, and yellow highlights. Honey guides have thick skins which protect them against bee stings. These birds are small and the plumage is generally drab. Coloration of the toucan is quite vivid—toucans are black or green with various patterns of bright hues on the underparts and the laterally flattened bill. The woodpeckers are well adapted to their life-style. Strong leg muscles and toes enable them to cling to vertical surfaces, and the central tail feathers are stiffened and help to support the birds while they are foraging on tree trunks. The woodpecker's tongue has tiny barbs and can be extruded at high speeds to take insects found in holes in the bark.

There is a great diversity of habits within the piciforms. Jacamars and puffbirds are the flycatchers of the order; both tend to go after their prey from a perch. Jacamars are more forest-oriented while puffbirds inhabit more open areas. When jacamars capture large insects, they take them back to the perch and beat them against it before eating them, pulling the wings off the prey if it is to be given to nestlings. Barbets are usually inhabitants of savannas and woodlands. They feed upon insects, fruits, berries, and buds.

The honey guides also dwell in forests or savannas, where they subsist mainly on insects, beeswax, and fruit. This wax-eating habit is unique among birds; honey guides have special intestinal bacteria which help break down this substance. A few species in the genus *Indicator* actually lead man or other mammals to bees' nests. The greater, or black-throated, honey guide (*I. indicator*) raises and spreads its tail and weaves about in flight. When this attracts attention, it flies to a perch and calls again; then it repeats the display, slowly moving toward the bees' nest where it feasts on wax and exposed larvae after the "guided" mammal has torn open the nest and taken the honey.

The toucans are well known as fruit eaters; they pick up small pieces of fruit in the bill and then throw them back into the mouth. Their diet, however, also includes insects, eggs, and even baby birds. Toucans usually reside in the forest but they may forage in clearings or around farms.

Among the woodpeckers, the soft-tailed wrynecks (*Jynx*) forage for ants in both terrestrial and arboreal situations, and the piculets tap and probe for insects in a woodpecker-like manner as they travel along vines and small branches. Most woodpeckers (Picinae) take insects from the surface of the tree or crevices within the bark. Only a few of the heaviest billed birds, such as the nearly extinct ivory-bills (genus *Campephilus*) and a few other species actually drill into the tree while foraging.

All the piciforms are hole nesters. Woodpeckers drill nesting cavities into living or dead trees. Their two to nine white eggs require an incubation period of 11 to 20 days. The adults share in the incubation of the eggs and in feeding the nestlings. Both jacamars and puffbirds usually nest at the end of tunnels dug into the ground, although some puffbirds nest in trees. Again, both male and female are involved in parenting. Barbets excavate their nests in dead trees with well-rotted heartwood. Two to five eggs are incubated from 13 to 15 days. The toucans usually take over an old woodpecker hole, which they may enlarge slightly. The parents take turns incubating the one to four eggs for about 16 days. The young of the larger toucan species may remain in the nest for seven weeks or longer and then may remain with the parents for an extended period.

Reproduction in the honey guides is unlike that of the other piciforms; they are brood parasites. The female honey guide lays one white egg within the nest of a hole-nesting host species; she breaks any other eggs in the nest at that time. When the young honey guide hatches it has a sharply hooked tip on its beak with which it kills off any other nestlings which have hatched. Black-throated honey guides frequently parasitize the red-throated bee-eater (*Merops bulocki*); the food call of the young honey guide sounds like the calls of two hatchling bee-eaters—this keeps the foster parents highly stimulated to provide food for their parasite.

pickaback plant, also called PIGGYBACK PLANT (*Tolmiea menziesii*), hairy-leaved herbaceous plant, in the family Saxifragaceae, native to western North America. The pickaback is a popular houseplant, particularly notable for its curious reproductive abilities: the leaves of the parent plant arise from an underground stem and, when mature, they produce new plantlets from buds at the base of their leaf blades.

Pickaback plant can be grown in shaded rock gardens in mild climates, as along the Pacific coastal United States but is primarily an indoor plant elsewhere.

Pickard, Greenleaf Whittier (b. Feb. 14, 1877, Portland, Maine, U.S.—d. Jan. 8, 1956, Newton, Mass.), U.S. electrical engineer who invented the crystal detector (one of the first devices widely used for receiving radio broadcasts) and who was also one of the first scientists to demonstrate the wireless electromagnetic transmission of speech.

Pickard, who was a grandnephew of the poet John Greenleaf Whittier, was educated at Harvard University and the Massachusetts Institute of Technology, Cambridge. In 1899, at the Blue Hills Observatory in Milton, Mass., he transmitted spoken messages by radio over a distance of 10 miles, using a carbon-steel detector to recover the audible signal that had been impressed on the radio-frequency carrier waves. As an engineer at the American Telephone and Telegraph Company (1902–06), he contributed to the development of the radiophone; from 1906 until 1931 he worked with the Wireless Specialty Apparatus Co., and after 1945 he headed the electronics engineering firm of Pickard and Burns.

Pickard is best known for discovering that the contact between a fine metallic wire ("cat's whisker") and the surface of certain crystalline materials (notably silicon) rectifies and demodulates high-frequency alternating currents, such as those produced in a receiving antenna by radio waves. This device, called a crystal detector and patented by Pickard in 1906, was an essential component of the crystal set, a form of radio receiver that was popular until the crystal detector was superseded by the triode vacuum tube. (The point-contact rectifier was the forerunner of the transistor, invented in 1948.)

pickerel, any of several North American pikes, family Esocidae, distinguished from the related muskellunge and northern pike by its smaller size, completely scaled cheeks and gill covers, and banded or chainlike markings. The chain pickerel (*Esox niger*) grows to about 0.6 metres (2 feet) and a weight of about 1.4 kilograms (3 pounds). The barred pickerel (*E. americanus*) and the grass pickerel (*E. vermiculatus*) are smaller species reaching a maximum weight of about 0.5 kilograms. *See also* pike.

pickerel frog (*Rana palustris*), dark-spotted frog (family Ranidae), found in eastern North America, usually in such areas as meadows, cool streams, and sphagnum bogs. The pickerel frog is about 5 to 7.5 centimetres (2 to 3 inches) long and has lengthwise rows of squarish spots on its golden or brownish skin.

When the pickerel frog leaps it reveals the orange or yellow on the inner surfaces of its hind legs. The skin secretions, which protect this frog from snakes, are reported also to be toxic to other frogs.

Pickerel frog (*Rana palustris*)
Leonard Lee Rue III

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pickerelweed, any of several genera of aquatic plants comprising the family Pontederiaceae, especially those of the genus *Pontederia*. Most species are perennials, native primarily to tropical America. They have creeping rootstocks, fibrous roots, and leaves in clusters at the base of the plant or borne on branched stems. The fruit is a capsule containing many seeds, or a one-seeded winged structure. Plants of the genus *Pontederia*, about five species of perennials, have spikes of bluish-purple flowers at the top of a one-leaved stem, clusters of lance- or heart-shaped leaves at the base, and thick rootstocks.

Pickerelweed (*P. cordata*) is common in shallow lakes and muddy shores in eastern North America. It is sometimes cultivated as an ornamental garden pool or aquarium plant. Water hyacinth (*Eichhornia*) and mud plantain (*Heteranthera*) are other widely distributed genera of the family.

Pickering, Edward Charles (b. July 19, 1846, Boston—d. Feb. 3, 1919, Cambridge, Mass., U.S.), U.S. physicist and astronomer who introduced the use of the meridian photometer to measure the magnitude of stars and established the *Harvard Photometry* (1884), the first great photometric catalog.

In 1867 Pickering became professor of physics at the Massachusetts Institute of Technology, Cambridge, where he established the first U.S. laboratory in which students were required to use laboratory instruments to make measurements. In 1876 he was appointed professor of astronomy and director of the Harvard College Observatory.

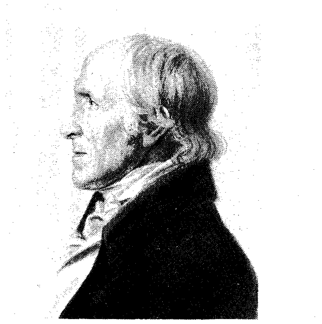
Edward Charles Pickering
By courtesy of Harvard College Observatory and the Niels Bohr Library, American Institute of Physics, New York

He invented the meridian photometer, which utilized a calcite prism to juxtapose the image of a star with one of a designated group of north polar stars to compare their brightnesses, and used it to compile his catalog. After the Arequipa Observatory was established in Peru in 1891, it became possible to include measurements of the southern stars within the scope of the work of the Harvard College Observatory. Under Pickering this work included photometry, a scale of photographic magnitudes, a system of classification of variable stars, and a system of stellar spectroscopy that was for many years universally adopted.

Pickering, Timothy (b. July 17, 1745, Salem, Mass.—d. Jan. 29, 1829, Salem, Mass., U.S.), American Revolutionary officer and Federalist politician who served (1795–1800) with distinction in the first two U.S. Cabinets.

During the Revolutionary War, Pickering served in several capacities under Gen. George Washington, among them quartermaster general (1780–85). In 1786, after taking up residence in Philadelphia, he helped resolve the dispute with Connecticut settlers over claims to Pennsylvania's Wyoming Valley and helped develop the town of Wilkes-Barre.

Pickering served as Indian commissioner (1790–95), postmaster general (1791–95), secretary of war (1795), and secretary of state (1795–1800). He was dismissed from office by Pres. John Adams after a policy dispute.



Timothy Pickering, pastel drawing by C.-B.-J. Fevret de Saint-Mesmin; in the Museum of Fine Arts, Boston
By courtesy of the Museum of Fine Arts, Boston, Frederick Brown Fund

During the administrations of Jefferson and Madison, Pickering led the Federalist opposition in Congress, serving as senator from Massachusetts (1803–11) and as a member of the House of Representatives (1813–17). Remaining friendly to England and fearing the power of Napoleon, he bitterly opposed the War of 1812. After his retirement from Congress, he devoted himself to agricultural experimentation and education.

Pickering, William Hayward (b. Dec. 24, 1910, Wellington, N.Z.), U.S. engineer, physicist, and head of the team that developed Explorer 1, the first U.S. satellite.

He studied at the California Institute of Technology, Pasadena (B.S. 1932, M.S. 1933, Ph.D. 1936), and joined the staff of the Institute in 1936. Working under the U.S. physicist Robert A. Millikan, Pickering developed cosmic-radiation-detection gear for high-altitude balloon flights. In 1944 he became a section chief of the Jet Propulsion Laboratory, where he developed the first telemetry system used in U.S. rockets. He was manager of the Corporal rocket project, which brought about important early advances in guidance and communication techniques.

In 1951 Pickering became chief of the division of guided-missile electronics and three years later was appointed director of the Jet Propulsion Laboratory. He was in charge of the development of the Explorer 1 satellite and the modification of the Jupiter C launch vehicle. Among other important projects of the laboratory were the Ranger and Surveyor spacecraft for unmanned flights to the Moon, the Mariner spacecraft for survey flights to Venus and Mars, and numerous other unmanned probes into the solar system.

Pickering retired from the Jet Propulsion Laboratory in 1976 and served for two years as director of the research institute of the University of Petroleum and Minerals in Saudi Arabia. He then returned to Pasadena to establish a private consulting practice.

Pickering, William Henry (b. Feb. 15, 1858, Boston—d. Jan. 17, 1938, Mandeville, Jam.), U.S. astronomer who discovered Phoebe, the ninth satellite of Saturn.

In 1891 Pickering joined his brother Edward in establishing the Boyden station of the Harvard Observatory at Arequipa, Peru. He returned to the United States in 1893 and the next year erected the observatory and telescope at Flagstaff, Ariz., for the noted U.S. astronomer Percival Lowell. In 1900 he established a station for the Harvard Observatory at Mandeville.

He discovered Phoebe in 1899 and noted that it revolves around Saturn in the opposite direction (retrograde) from that of Saturn's other satellites. His announcement in 1905 of a 10th satellite, which he named Themis, is generally discounted, for it was never observed again. The 10th satellite (Janus) that was discovered in 1967 is probably not the same one, for its orbit is the innermost of all Saturn's moons, whereas Pickering's Themis was supposed to lie between Titan and Hyperion. In 1919 Pickering also predicted the existence of, and gave a position for, the planet Pluto.

William Henry Pickering

By courtesy of the Lick Observatory Archives, Santa Cruz, Calif.

pickeringite, magnesium-rich variety of the mineral halotrichite (*q.v.*).

Pickett, Bill (b. Dec. 5, 1870?, Williamson County, Texas, U.S.—d. April 21, 1932, Tulsa, Okla.,), American rodeo cowboy who introduced bulldogging, a modern rodeo event that involves wrestling a running steer to the ground.

Pickett was descended from American Indian and black slave stock in the Southwest. He grew up in West Texas, learning to ride and rope as a boy, and became a ranch hand; he performed simple trick rides in town on weekends. In 1900 he became a showman, sponsored by Lee Moore, a Texas rodeo entrepreneur. In 1907 Pickett signed with the 101 Ranch Wild West Show, becoming one of its star performers and assuming the status of a legendary figure for his masterful handling of both wild and domestic animals. For bulldogging, or steer wrestling, he perfected a technique of jumping from his horse, grabbing the steer around the neck or horns, sinking his teeth into the animal's lip, and pulling it to the ground. Pickett's most gruelling performance came in 1908 in a bullring in Mexico City. He there wrestled and rode a Mexican fighting bull for seven minutes before a riotous audience enraged at this original interpretation of the Mexican national pastime of bullfighting.

Pickett performed until about 1916, working as a cowhand and rancher thereafter. He died after being kicked by a horse in April 1932.

Pickett, George Edward (b. Jan. 25, 1825, Richmond, Va., U.S.—d. July 30, 1875, Norfolk, Va.), Confederate Army officer during the American Civil War, known for Pickett's Charge at the Battle of Gettysburg.

After graduating last in his class from the U.S. Military Academy at West Point, N.Y.,

George Edward Pickett

By courtesy of the Library of Congress, Washington, D.C.

(1846), Pickett served with distinction in the Mexican War (1846–47). He resigned his commission in June 1861 and entered the Confederate Army, in which he was made brigadier general in February 1862. Pickett rose to major general in October and was given command of a Virginia division. At the Battle of Fredericksburg he commanded the centre of Gen. Robert E. Lee's line but saw little action.

At Gettysburg (July 3, 1863) three brigades of Pickett's division (4,300 men) constituted somewhat less than half the force in the climactic attack known as Pickett's Charge. The attack was actually under the command of Gen. James Longstreet. Its bloodily disastrous repulse is often considered the turning point of the war. Although Pickett was much criticized and charged by some with cowardice, Lee retained him in divisional command throughout the Virginia Campaign of 1864. Eight days before the surrender at Appomattox (April 9, 1865), Pickett's division was almost destroyed at Five Forks while he was attending a shad bake. After the war he worked in an insurance business in Norfolk, Va.

Pickett, Joseph (b. 1848, New Hope, Pa., U.S.—d. 1918, New Hope), U.S. primitivist or folk painter known for his naive depictions of town and landscape around his native New Hope, Pa.

After a life spent as a carpenter, shipbuilder, carny, and storekeeper, Joseph Pickett began painting when he was about 65. His works exemplify an untrained artist's detailed interest in local landscape and history, portrayed with straightforward disregard of perspective but with full sense of colour and flat pattern design; *e.g.*, "Manchester Valley" (*c.* 1914–18; Museum of Modern Art, New York City). Pickett's works were not discovered by the art critics and public until the 1930s.

Pickford, Mary, original name GLADYS MARY SMITH (b. April 9, 1893, Toronto—d. May 28, 1979, Santa Monica, Calif., U.S.), Canadian-born U.S. motion-picture actress,

Mary Pickford

By courtesy of United Artists Corp. and the Museum of Modern Art, Film Stills Archive, New York City

"America's sweetheart" of the silent screen, and one of the first film stars. At the height of her career, she was one of the richest and most famous women in the United States.

She made her first stage appearance in a Toronto stock company at the age of five. At eight she went on tour and within 10 years was playing on Broadway under her original name. Mary Pickford began working as a motion-picture extra at D.W. Griffith's Biograph Studio, starring in his 1909 film *The Lonely Villa.* By 1913 she had turned permanently to the screen, rising to first rank with Adolph Zukor's Famous Players Company. She is famous for such films as *Tess of the Storm Country* (1914), *Pollyanna* (1920), *Rebecca of Sunnybrook Farm* (1917), and *Poor Little Rich Girl* (1917).

Pickford was not only America's symbol of sweetness and innocence but also a shrewd businesswoman. In 1919 she was primarily instrumental in forming the United Artists Corporation with two actors, Charlie Chaplin and Douglas Fairbanks, and the director D.W. Griffith. She married Owen Moore, a fellow actor at Griffith's Biograph Studio, in 1911 (divorced, 1919); Douglas Fairbanks in 1920 (divorced, 1935); and actor Charles (Buddy) Rogers in 1937. Pickford retired from motion pictures in the early 1930s.

Pick's disease, form of premature senility caused by atrophy of the frontal and temporal lobes of the brain. It resembles Alzheimer's disease (pre-senile dementia) but is much less common. There is a progressive deterioration of intellect, judgment, and memory, resulting in increased irritability, inappropriate behaviour, depression, and paranoia. Some cerebral nerve cells are swollen and contain abnormal inclusions called Pick bodies. The cause of cerebral atrophy is not known but in some cases the disease appears to be inherited as an autosomal (*i.e.,* carried on other than a sex chromosome) dominant trait. Average survival from onset to death is about 10 years; there is no specific treatment.

pickwickian syndrome, a complex of respiratory and circulatory symptoms associated with some cases of extreme obesity. The name of this disease originates from the red-faced, fat man depicted in Charles Dickens' *Pickwick Papers,* who showed some of the same traits. (Extreme obesity is medically classified as body weight of 325 pounds [147 kilograms] or more.) The main symptoms are breathlessness on exertion and drowsiness. There may also be a bluish tint to the skin, increased heartbeats, high blood pressure with dilation of the vessels, enlargement of the liver, and an abnormally high number of red blood cells. The increased abdominal fat causes elevation of the diaphragm, diminished total lung volume, and more airway resistance during breathing. The oxygen saturation level of the blood may be much reduced, particularly during sleep, and there is retention of carbon dioxide in the bloodstream.

The factors causing this syndrome are not clear, but obesity seems to be a predominant factor. Obesity causes an increased work load, which always places stress on the heart. With a low oxygen level and high blood pressure in the pulmonary circulation, heart and lung failure eventually ensue. The abundance of fat in the chest muscles and diaphragm has been blamed for the reduced ability to expand and contract the lungs; some authorities think that merely the added body weight on the chest restricts the respiratory movements. The treatment is directed toward loss of weight.

Pico della Mirandola, Giovanni, CONTE (count) DI CONCORDIA (b. Feb. 24, 1463, Mirandola, Duchy of Ferrara—d. Nov. 17, 1494, Florence), Italian scholar and Platonist philosopher whose *De hominis dignitate oratio* ("Oration on the Dignity of Man"), a characteristic Renaissance work composed in 1486, reflected his syncretistic method of taking the best elements from other philosophies and combining them in his own work.

His father, Giovanni Francesco Pico, prince of the small territory of Mirandola, provided for his precocious child's thorough Humanistic education at home. Pico then studied canon law at Bologna and Aristotelian philosophy at Padua, and visited Paris and Florence, where he learned Hebrew, Aramaic, and Arabic. At Florence he met Marsilio Ficino, a leading Renaissance Platonist philosopher.

Introduced to the Hebrew Kabbala, Pico became the first Christian scholar to use Kabbalistic doctrine in support of Christian theology. In 1486, planning to defend 900 theses he had drawn from diverse Greek, Hebrew, Arabic,

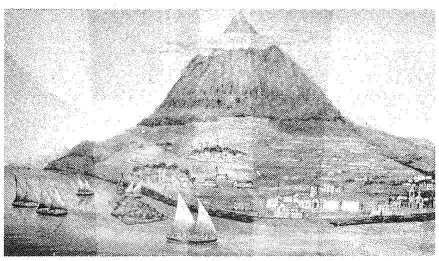
Pico della Mirandola, detail of a portrait by an unknown artist, late 15th century; in the Uffizi, Florence
Alinari—Art Resource/EB Inc.

and Latin writers, he invited scholars from all of Europe to Rome for a public disputation. For the occasion he composed his celebrated *Oratio.* A papal commission, however, denounced 13 of the theses as heretical, and the assembly was forbidden by Pope Innocent VIII.

Despite his ensuing *Apologia* for the theses, Pico found it prudent to flee to France, where he was arrested. After a brief imprisonment he settled in Florence, where he became associated with the Platonic Academy, under the protection of the Florentine prince Lorenzo de' Medici. Except for short trips to Ferrara, Pico spent the rest of his life there. He was absolved from the charge of heresy by Pope Alexander VI in 1492. Toward the end of his life he came under the influence of the strictly orthodox Girolamo Savonarola, martyr and enemy of Lorenzo.

Pico's unfinished treatise against enemies of the church includes a discussion of the deficiencies of astrology. Though this critique was religious rather than scientific in its foundation, it influenced the 17th-century scientist Johannes Kepler, whose studies of planetary movements underlie modern astronomy. Pico's other works include an exposition of Genesis under the title *Heptaplus* (Greek *hepta,* "seven"), indicating his seven points of argument, and a synoptic treatment of Plato and Aristotle, of which the completed work *De ente et uno* is a portion. Pico's works were first collected in *Commentationes Joannis Pici Mirandulae* (1495–96); E. Garin began a modern edition in 1942.

Pico Island, Portuguese ILHA DO PICO, island, part of the Portuguese Azores archipelago in the North Atlantic Ocean and administratively within Horta district. Separated from the Ilha do Faial by the Canal (channel) do Faial, it has an area of 163 sq mi (433 sq km) and



Ships off the coast of Pico Island, detail of "A Whaling Voyage Round the World," tempera panorama by Russell-Purrington, 1846; in the Whaling Museum, New Bedford, Mass.
By courtesy of the Whaling Museum, New Bedford, Mass.

is dominated by the Ponta do Pico volcano, highest in the Azores (7,713 ft [2,351 m]). Its economy is basically agricultural, dairying being the most important activity, followed by cattle raising and vine cultivation. Whaling is still practiced in small boats without mechanical aids. Lajes and São Roque do Pico are the island's two urban centres. Pop. (1981) 15,224.

Piconnerie, Thomas-Robert Bugeaud, marquis de la: *see* Bugeaud, Thomas-Robert.

picornavirus, any of a group of viruses constituting the family Picornaviridae, a large group of the smallest known animal viruses, "pico" referring to small size and "rna" referring to its core of ribonucleic acid (RNA). This group includes enteroviruses, which attack the vertebrate intestinal tract and often invade the central nervous system as well; rhinoviruses, which infect the tissues in the vertebrate nose; and the virus agent of foot-and-mouth disease. Among the enteroviruses are polioviruses, echoviruses (*e*nteric, *c*ytopathogenic, *h*uman, *o*rphan), and Coxsackie viruses. Echoviruses cause fever with rash and meningitis. Coxsackie viruses cause sore throat or fever with chest or abdominal pains. The virus particle lacks an envelope, is spheroidal, measures from 20 to 30 nanometres (nm; 1 nm=10^{-9} metre) across, and is covered with subunits called capsomeres.

picric acid, also called 2,4,6-TRINITROPHENOL, pale yellow, odourless crystalline solid that has been used as a military explosive, as a yellow dye, and as an antiseptic. Picric acid (Greek *pikros,* "bitter") was so named by J.-B.-A. Dumas, a 19th-century French chemist, because of the extremely bitter taste of its yellow aqueous solution. Percussion or rapid heating can cause it (or its salts with heavy metals, such as copper, silver, or lead) to explode.

Picric acid was first obtained in 1771 by Peter Woulfe, a British chemist, by treating indigo with nitric acid. It was used as a yellow dye, initially for silk, beginning in 1849.

As an explosive, picric acid was formerly of great importance. The French began using it from 1886 as a bursting charge for shells under the name of melinite. By the time of the Russo-Japanese War, picric acid was the most widely used military explosive. Its highly corrosive action on the metal surfaces of shells was a disadvantage, however, and after World War I its use declined.

Ammonium picrate, one of the salts of picric acid, is used in modern armour-piercing shells because it is insensitive enough to withstand the severe shock of penetration before detonating.

Picric acid has antiseptic and astringent properties and is used medically incorporated in a surface anesthetic ointment or solution, and in burn ointments.

Picric acid is a much stronger acid than phenol; it decomposes carbonates and may be titrated with bases. In a basic medium, lead acetate produces a bright yellow precipitate, lead picrate.

picrite, intrusive igneous rock of ultrabasic (very silica-poor) composition that is composed largely of olivine and augite and is somewhat similar to peridotite. Picrites are dark, heavy rocks and contain a small but variable amount of plagioclase feldspar; hornblende and biotite may also be present. Picrites usually occur in sills (tabular bodies inserted while molten between other rocks), but, unlike peridotites, seldom in large plutonic masses. Varieties include augite-, enstatite-, and hornblende-picrite. The term picrite-basalt is reserved for feldspar-poor basalts rich in olivine.

The minerals in picrite are, in many cases, decomposed. Serpentine partially or wholly replaces olivine, and hornblende, talc, and chlorite appear as secondary products after the mineral. Augite passes into hornblende or chlorite, and the essential feldspar is often represented by epidote, prehnite, and white mica. In some picrites, as in the peridotites, a lustre mottling is produced by the inclusion of unoriented grains of olivine within large crystals of augite or hornblende.

The augite picrites of Scotland and central Czechoslovakia contain interstitial analcime and are closely related to the teschenites with which they are associated. Other picrites are more clearly calc-alkaline and are associated with diorites or diabases; the hornblende picrites of Gwynedd and Anglesey, Wales, are of this type. Picrites accompany diabases in the Devonian rocks of the Fichtelgebirge (in Germany) and Nassau, as well as Cornwall and Devon.

Pict (from Latin Picti, "painted"), one of an ancient non-Celtic people who inhabited an area in what is now eastern and northeastern Scotland, from Caithness to Fife. Their name may refer to their custom of body painting or possibly tattooing.

Probably descendants of pre-Celtic aborigines, the Picts were first noticed in AD 297, when a Roman writer spoke of the "Picts and Irish [Scots] attacking" Hadrian's Wall; warfare with the Romans during the occupation was almost continual. Then or soon after, they seem to have developed two kingdoms north of the Forth, a southern and a northern; but, by the 7th century, there was a united "Pictland," which already had been penetrated by Christianity. In 843, Kenneth I MacAlpin, king of the Scots (centred in Argyll and Bute), became also king of the Picts, uniting their two lands in a new kingdom of Alba, which evolved into Scotland.

The Pictish kingdom is notable for the stylized but vigorous beauty of its carved memorial stones and crosses. The round stone towers known as brochs, or "Pictish towers," and the underground stone houses called weems, or "Picts' houses," however, both predate this kingdom.

Pictet de Rochemont, Charles (b. Sept. 21, 1755, Geneva—d. Dec. 28, 1824, Lancy, Switz.), statesman, writer, and diplomat who prepared the declaration of Switzerland's permanent neutrality ratified by the great powers in 1815.

After serving in the French Army, Pictet settled in Geneva in 1789 and reorganized the militia. He was arrested during the Reign of Terror (1794) in Geneva following the French Revolution and subsequently was imprisoned. With the reestablishment of the Republic of Geneva after the retreat of Napoleon's armies (1813), he resumed political activity, taking part in the provisional government created in December 1813.

In January 1814 Pictet argued on behalf of Geneva's independence and union with the Swiss Confederation before the allied sovereigns at Basel and later obtained recognition of his canton's independence in the Treaty of Paris (May 1814). In October 1814 he was delegated to the Congress of Vienna, where he helped secure Geneva's attachment to the reconstructed Swiss Confederation; and at the Paris peace conference (August–November 1815) that followed Napoleon's defeat at Waterloo, he served as representative of the whole confederation. He personally redrafted the act that was accepted as the basis of permanent Swiss neutrality by the powers on March 20, 1815. His last diplomatic mission—to Turin (January–March 1816)—secured a rectification of the Swiss–Sardinian frontier (Treaty of Turin, March 1816). A man of letters, he helped edit the *Bibliothèque britannique* (the *Bibliothèque universelle* after 1815) and wrote works on politics and agriculture.

Pictish language, language spoken by the Picts in northern Scotland and replaced by Gaelic after the union in the 9th century of the Pictish kingdom with the rest of Scotland. Knowledge concerning the Pictish language is derived from place-names, the names in medieval works such as the *Pictish Chronicle* and the writings of Bede, inscriptions from the Pictish areas of Britain, statements about the language by medieval writers who wrote while the language was still in use, and names from northern Scotland found in classical works.

Pictish was apparently a Celtic language (more closely related to Gaulish and Brythonic than to Goidelic), but some scholars think that it was not Celtic, nor even Indo-European.

pictography, expression and communication by means of pictures and drawings having a communicative aim. These pictures and drawings (called pictographs) are usually considered to be a forerunner of true writing and are characterized by stereotyped execution and by omission of all details not necessary for the expression of the communication. (Pictographs that are drawn or painted on rocks are known as petrograms; those that are incised or carved on rocks are called petroglyphs.) A pictograph that stands for an individual idea or meaning may be called an ideogram; if a pictograph stands for an individual word, it is called a logogram (*q.v.*). Pictographs are also used as memory aids. Various North American Indian tribes used pictographs both as ideograms and as memory aids.

Picton, town, seat of Prince Edward County, southeastern Ontario, Canada, on Lake Ontario's Bay of Quinte, 15 mi (25 km) southeast of Belleville. Founded in 1786 by United Empire Loyalists led by Andrew and Henry Johnson, the town was known as Hallowell before being renamed in honour of Sir Thomas Picton, a British major general in the Napoleonic Wars. Picton is the commercial centre of the county; its deepwater port on Picton Bay, an arm of the Bay of Quinte, handles iron-ore shipments from mines near Marmora, 40 mi northwest. Industries include fruit and vegetable canning, textile and lumber milling, and dairying. A large army base and several provincial parks are nearby. Inc. 1837. Pop. (1981 prelim.) 4,361.

Picton, borough and port, northeastern South Island, New Zealand, on Waitohi Bay (Picton Harbour), a southwest extension of Queen Charlotte Sound off Davis Strait. In 1848 a Maori *pa* (fortified settlement) on this site was occupied by Gov. Sir George Grey (1845–53) and Francis Dillon Bell, of the New Zealand Company. They proceeded to lay out the village of Newton, renamed in 1859 to honour Sir Thomas Picton, a commander under the Duke of Wellington in the Peninsular War. In 1864 its population increased for a time as the result of a gold strike to the west on the Wakamarina River. Sir Edward Stafford, prime minister of New Zealand, was then waging an unsuccessful campaign to have the town designated as the national capital. It was made a borough in 1876. Picton is the northern terminus of the South Island Main Trunk Railway from Christchurch (218 mi [351 km] southwest) and has regular ferry service (for cargo and vehicles) to Wellington, 40 mi west across Cook Strait. Its deepwater port exports wool, grain, and fruit. Other industries are meat freezing, fish packing and curing, general engineering, and small boatbuilding. Picton serves as the centre of a holiday resort area based on the many inlets along the coast. Pop. (1983 est.) 3,190.

Pictor, Quintus Fabius: *see* Fabius Pictor, Quintus.

Pictou, town, seat of Pictou county, northern Nova Scotia, Canada, just northwest of New Glasgow, on Pictou Harbour, facing Northumberland Strait. The site, a former Micmac Indian village, was settled in 1767 by a group of families from Maryland and Pennsylvania. They were joined in 1773 by Highlanders from Scotland. The community probably derived its name from an Indian word *piktook* ("bubbling water" or "explosion"). It has developed one of Canada's largest lobster fisheries and holds a lobster carnival each July. Lumbering and coal mining are also well established; other industries include foundries, canneries, tire factories, and the production of biscuits. During World War II, steel merchant ships were built in the shipyard. Pictou Academy was founded in 1816. There are ferry services from nearby Caribou to Pictou Island (5 mi [8 km] long by 2 mi wide) offshore, and to Wood Islands, P.E.I., 14 mi across the strait. Inc. 1874. Pop. (1981) 4,628.

picture frame, mounting assemblage designed to protect, display, and often enhance a painting, drawing, photograph, or other visual representation. *See* frame design.

picture-winged fly: *see* otitid fly.

Pictured Rocks, cliff formations of red Cambrian sandstone, extending east of Munising for about 15 mi (24 km) along the southern shore of Lake Superior in Alger County, in the Upper Peninsula of Michigan, U.S. Rising to 200 ft (60 m) above the shoreline, the cliffs are multicoloured and form intricate designs, caves, and columns carved by wind and wave action. Named as the dwelling place of the gods of thunder and lightning in Longfellow's poem *The Song of Hiawatha*, the area was created a national lakeshore by the U.S. Congress in 1966 and includes Grand Sable Dunes and Banks (west of Grand Marais) and surrounding forest.

Picturesque style, English-based architectural mode of the late 18th and early 19th centuries that was a precursor of the Gothic Revival. Picturesque evolved through a reaction against early 18th-century trends toward the formality of scientific and mathematical exactitude. The fundamental tenets of proportion and order in architecture were overthrown, emphasizing natural sensibilities and variety and irregularity.

Thomas Whately's *Observations on Modern Gardening* (1770) was the pioneering study espousing the Picturesque theory. It was through English gardens that the Picturesque style evolved. Gardens, or more generally the environment, were essential to the Picturesque style. One of the most striking effects of this era was that of architecture as part of an environment.

The prominent English architect and town planner John Nash (1752–1835) produced the first "garden city" and some of the most exemplary establishments during the ensuing era. The Picturesque love of irregularity was noteworthy in the asymmetrical silhouettes of his Cronkhill (1802) at Atcham in Salop. Nash's Blaise Hamlet (1811) is a model village of neo-thatched "Rustic Cottages," arranged in irregular clusters. James Renwick's Smithsonian Institute in Washington, D.C., surrounded by a charming parklike landscape, is another example of Picturesque style. *See also* folly.

piculet, any of about 29 species of small, stub-tailed birds related to the woodpeckers and constituting the subfamily Picumniae, family Picidae (*q.v.*). Nearly all are restricted to Central and South America; there are three species in eastern Asia and one in western Africa. Piculets, 9–14 centimetres (3½–5½ inches) long, are mottled gray-green to brown above, often with salt-and-pepper head, and are white below, with spots or bars. They climb like nuthatches, looking for insects,

White-scaled piculet (*Picumnus albosquamatus*)
Painting by Murrell Butler

and are able to perch crosswise on branches. Though small-billed, piculets dig nest holes in soft wood. The most widely distributed New World species is the white-barred piculet (*Picumnus cirratus*), found from the Guiana Highlands to Argentina. The speckled piculet (*P. innominatus*) of southeast Asia drums on dry bamboo.

Picus, in Roman mythology, ancient Roman woodpecker sacred to the god Mars. It was widely worshipped in ancient Italy and developed into a minor god. Picus was an agricultural deity associated particularly with the fertilization of the soil with manure. The woodpecker was also an important bird in augury.

Later rationalizations made Picus an early king of Italy. The Roman poet Virgil, for instance, made him son of Saturn, father of Faunus, and grandfather of Latinus. His bride, Circe, for reasons of unrequited love, changed him into a woodpecker. As son of Saturn he later came to be identified with Zeus. His earliest representations were as a wooden pillar mounted with the image of a woodpecker. In more sophisticated form, Picus is a youth carved of marble with a woodpecker on his head. In zoology, *Picus* is a genus of woodpecker (*q.v.*).

Pidal, Ramón Menéndez: *see* Menéndez Pidal, Ramón.

piddock, any of the marine bivalve mollusks of the family Pholadidae (Adesmoidea). Worldwide in distribution, they are especially adapted for boring into rock, shells, peat, hard clay, or mud. Most species occur in the intertidal zone, a few in deeper water.

One end of each of the two valves is armed with rows of serrated cutting edges for boring. Some species drill to a depth only slightly more than the length of the shell. Others, with extensible siphons, may bore to depths several times the length of the shell. The siphons of many deep borers are protected by tough plates. Like most bivalves, piddocks feed on minute organisms in the water.

The great piddock (*Zirfaea crispata*), which attains lengths of up to eight centimetres (about three inches) and has an oblong shell that is grayish white or rusty in colour, occurs on both sides of the Atlantic Ocean. Found from the intertidal zone to depths of 75 metres (250 feet), *Z. crispata* bores into limestone and wood.

The wood piddock (*Martesia striata*), up to 2.5 centimetres long and grayish white in colour, commonly occurs in waterlogged timbers cast up on the beach and ranges from North Carolina to Brazil. *M. pusilla* and *M. cuneiformis* have similar habits and distribution. Smith's martesia (*M. smithi*), which resembles a fat, gray pea, bores into rocks and mollusk shells in the Atlantic from New York to the Gulf of Mexico.

The flat-topped piddock (*Penitella penita*), from the Arctic Ocean to Lower California, bores into hard clay, sandstone, and cement, sometimes damaging man-made structures. Some *Penitella* and *Diplothyra* species bore into the shells of other mollusks, particularly oysters and abalone.

Pholas dactylus, which bores into gneiss—a very hard rock—is luminescent. At one time it was highly esteemed in Europe as food. *Pholas chiloensis,* found on the Pacific coast of South America, is eaten locally.

pidgin, a language with a greatly reduced vocabulary and a simplified grammar, often based on a western European language. Pidgins usually arise as methods of communication between groups that have no language in common; the pidgins in some instances later become established first or second languages of one of the groups involved. Some examples of pidgin are Chinese Pidgin English, Haitian French Creole, and Melanesian Pidgin English.

A brief treatment of pidgin follows. For full treatment, *see* MACROPAEDIA: Languages of the World.

A pidgin is a linguistic adaptation to nonintimate contact and remains in existence as long as it is required for communication. If closer relations develop between the groups, one of them may learn the language of the other fully, and the pidgin will no longer be needed. When a pidgin persists, however, relations between the two groups have often become socially institutionalized. They may be master and servant, as was the case in New Guinea and the South Seas, or they may be owner and slave, as in Africa and on early American plantations. Or they may be pairs of diplomats desiring to maintain a comfortable distance in their relations, with neither really wanting to learn the other's language. This was the case for certain speakers of Chinese Pidgin English, which survived for some 300 years. Pidgins may also be very useful for communication in multilingual societies, of which modern New Guinea is a good example. No one speaks a pidgin as his native language. If a pidgin does become established as the native language of a people, it is then known as a "creole."

The first recorded pidgin was the simplified Italian used by European crusaders and merchants who visited eastern Mediterranean ports in the Middle Ages. Because there were many French among these travellers, this pidgin was known as Lingua Franca. The expression lingua franca that is used today means something rather different: it refers to any language used for communication in multilingual settings, as, for example, English might be used in an international assembly. A pidgin is therefore a reduced lingua franca.

A Chinese Pidgin English arose as the English increased their commercial activity in the Far East. Other pidgins appeared with the slave trade in Africa and with the importation of West African slaves to the Caribbean plantations. A number of these New World pidgins of English, French, Spanish, and Portuguese have survived as creoles. English creoles are still spoken in the islands off the South Carolina coast, in the Antilles, and in Suriname. French creoles remain in Louisiana, Haiti, and the Lesser Antilles; the creole of Curaçao is based on Spanish and Portuguese.

The appearance and attestation of pidgin languages since the 17th century followed the increase in European commercial trading and colonization. The establishment of these languages reflected the ethnocentric European view of the indigenous peoples as intellectually and culturally inferior. In his first encounter with the newly arrived European, the native may have attempted a few words in the European's language. The European, believing the other to be incapable of further learning, would respond in a similarly incomplete fashion. The native would assume that this simplified speech was the proper form of the language and so would continue to use the forms that he had heard, naturally adding some vocabulary and a few grammatical elements from his own language. This is not to suggest that pidgins have no grammar or that they are merely a variety of the indigenous language with borrowed European words inserted. In fact, pidgins are considered languages; although their structures are simpler than those of the languages from which they derive, they are complete. English pidgins spoken in different areas have been found to share the same underlying structure, that of English, although they may differ with regard to inflectional suffixes and other details.

A very small vocabulary is another characteristic of pidgins and creoles, although the size of the lexicon may vary: Melanesian Pidgin has 2,000 words, while Chinese Pidgin English has only 700. Most of this vocabulary is from English. Melanesian Pidgin, with its great lexicon, for example, has an English word stock of more than 90 percent (greater than the percentage of Anglo-Saxon words in English). This figure is even higher for Chinese Pidgin English. Pidgins are therefore not mixed languages, as is often supposed. Within this small lexicon, each word can have a wide variety of meanings, with a range far greater than its European counterpart. Words are frequently combined in compounds and phrases for further flexibility.

Pidgins originally are spoken languages only. In some cases, often when pidgins have become creoles, the need has arisen for an orthography to record them, especially in connection with missionary and other educational programs. Attempts to impose European spelling conventions have been misguided; the most successful, efficient orthographies have been phonemic, with consistent spelling patterns reflecting the sound and structure of the creole without reference to the language from which it was derived.

pidyon ha-ben (Hebrew: "redemption of the son"), plural PIDYON HA-BONIN, or PIDYON HA-BENS, Jewish ceremony in which the father redeems his wife's firstborn son by offering to a cohen (a male Jew descended from the first priest, Aaron) the equivalent of five silver shekels (ancient coins). The ceremony, which normally takes place 30 days after the child's birth, dates from Old Testament times, when the firstborn sons of the Israelites were spared from death on the first Passover (Exodus 12). These children subsequently belonged to God in a special way and would have constituted the Jewish priesthood had not the Levites been substituted in their place. *Pidyon ha-ben* thus commemorates a historical event, for the father ritually gives money to a cohen in order to keep his son. If the father is a cohen or if either parent is related to the tribe of Levi, such children already belong to God by reason of heredity, and no redemption is required.

In rabbinic law, the firstborn son may not actually have been the first, since the law does not apply to stillbirths, cesarean deliveries, and malformed offspring. *Pidyon ha-ben* also acknowledges the general law that, in the broadest sense, all "first fruits" (including grain, animals, and fruit) rightfully belong to God.

pie, dish made by lining a shallow container with pastry (*q.v.*) and filling the container with a sweet or savoury mixture. A top crust may be added; the pie is baked until the crust is crisp and the filling is cooked through. Pies have been popular in the United States since colonial times, so much so that apple pie has become symbolic of traditional U.S. home cooking. The typical U.S. pie is round, 8–10 inches (20–25 centimetres) in diameter, 2–3 in. thick, and usually contains a sweet filling of fruit, custard, or a pastry cream. Some U.S. specialties are pecan pie, pumpkin custard pie (traditionally served on Thanksgiving Day), lemon cream pie with a soft meringue topping, and shoo-fly pie, a Pennsylvania Dutch pie with a rich filling containing molasses.

In the United Kingdom, meat, game, and fish pies have been staple dishes since the Middle Ages. Steak and kidney, pork, game, veal and ham, and poultry are all popular. Tourtière, a pork pie, is one of Canada's national dishes.

Tarts are similar to pies and the names are often used interchangeably. Tarts are made with short rather than flaky pastry and are frequently baked "blind," or empty, and filled after baking. A flan is a tart made in an open-bottom pan that is placed on a baking sheet. Tarts and flans, which are usually straight-sided, are often removed from their pans before serving. Because pies are baked in pie pans with flaring sides, they are usually served from the pans.

pièce bien faite (theatre): *see* well-made play.

pied goose: *see* magpie goose.

Piedmont, Italian PIEMONTE, region, northwestern Italy, comprising the provinces of Alessandria, Asti, Cuneo, Novara, Torino, and Vercelli, with an area of 9,807 square miles (25,399 square km).

A brief treatment of Piedmont follows. For full treatment, *see* MACROPAEDIA: Italy.

Surrounded to the south, west, and north by the vast arc of the Ligurian Apennines and the Maritime, Cottian, Graian, and Pennine Alps, the core of Piedmont is the Po River Valley, which lies open to the east and consists of some of the best farmlands in Italy. The name piedmont ("at the foot of a mountain") has become a term generally applied to such a region. South of the Po River are the low and intensively cultivated hills of Monferrato and of Langhe. In the foothills of the Alps are Lakes Maggiore and Orta. The Po and its tributaries, the Dora Baltea, Dora Riparia, Sesia, Tanaro, and Scrivia, provide the area with ample water for agriculture.

In Roman times Piedmont was important because its passes connected Italy with the transalpine provinces of the empire. After periods of Lombard and Frankish rule, the House of Savoy emerged as the most important feudatory of northwestern Italy. This dynasty first became powerful as successor to the marquesses of Ivrea and of Turin, but after 1400 Savoy's control of both slopes of the Alps, ruling over what is now French Savoie and over Piedmont, gave it undisputed sovereignty over much of the region. After 1700 practically all of Piedmont passed under Savoyard domination, and the addition of Sardinia and its territories provided still wider interests. During the Risorgimento (movement for Italian independence), Piedmont led the attempts of 1848, 1859, and 1866 to unite all Italy; and Victor Emmanuel II, originally king of Piedmont and Sardinia, became modern Italy's first king in 1861.

The Alpine arc of Piedmont plays a vital part in the power production of the region and of northern Italy as a whole; the region's hydroelectric plants supply energy for industry, transportation, and domestic use. The forests provide lumber, and the Alpine and sub-Alpine meadows afford excellent pasture for cattle as the base of a prosperous dairy industry. The lowlands produce wheat and rice, vegetables and fruit, and milk and cheese; the hills south of the Po are noted for the production of some of Italy's highest-quality wines, both of the sparkling (Asti) and still (Barbera) varieties. Piedmont forms part of the great industrial triangle of northern Italy (Turin–Genoa–Milan), and its manufactures are widely diversified. Turin (*q.v.*), the capital, largest city, and leading industrial centre, is the site of one of the largest automobile plants in Europe, as well as of printing, textile, and machine industries. Ivrea (*q.v.*), northeast of Turin, is the headquarters of one of Europe's leading makers of office machinery. Textiles, chemicals, and glass are among the other important Piedmontese industries. The principal rail connection between France and Italy, the Turin–Col du Mont Cenis (Mount Cenis Tunnel)–Paris line, passes through Piedmont, while to the north the Simplon Tunnel leads to Switzerland. An excellent network of roads and expressways ties all parts of the region closely together; Genoa, easily reached from Piedmont, is its port. Developments in the 1970s included an all-weather road between France and Italy, passing through a 7-mile (11-kilometre) tunnel under Mont Blanc and thence through the Valle d'Aosta to Turin and Milan. Pop. (1985 est.) 4,411,921.

Piedmont, geographical region in the eastern United States, running some 600 miles (950 km) between New Jersey (north) and Alabama (south) and lying between the Appalachian Mountains (west) and the Atlantic Coastal Plain (east). It comprises a relatively low rolling plateau (from 300 to 1,800 feet [90 to 550 m]) cut by many rivers and is a fertile agricultural region. Cotton is the most important crop in the southern areas, while tobacco and fruit predominate in the north.

piedmont, in geology, landform created at the foot of a mountain (Italian *pie monte*) or mountains by debris deposited by shifting streams. Such an alluvial region in a humid climate is known as a piedmont for the Piedmont district of Italy; in arid climates such a feature is called a bajada (*q.v.*).

Piedmont-Sardinia, Kingdom of: *see* Sardinia, Kingdom of.

piedmontite, a silicate mineral that belongs to the epidote (*q.v.*) series.

Piedras Negras, city, northeastern Coahuila state, northeastern Mexico. It lies at 722 feet (220 m) above sea level on the Rio Grande (Bravo del Norte River), just across from Eagle Pass, Texas, U.S., with which it is connected by two bridges. Founded in 1849, it was renamed Ciudad Porfirio Díaz in 1888; after that dictator's downfall, the original name was restored. Much of the city's prosperity is due to its function as a customs station and an international highway, railroad, and airline hub 840 miles (1,350 km) north by west of Mexico City. Piedras Negras is also the commercial and manufacturing centre for the agricultural hinterland, in which cotton and corn (maize) are cultivated and cattle are raised. Coal, silver, gold, and zinc are mined nearby. Industries in the city include zinc smelters, a cement plant, flour and textile mills, a lard factory, and sawmills. Its principal exports are cattle, sheep, hides, wheat, and bran. A superhighway to Mexico City was opened in 1958. Pop. (1980) 67,455.

Where the same name may denote a person, place, or thing, the articles will be found in that order

Pielinen, Lake, Finnish PIELISJÄRVI, lake located in Pohjois-Karjalan *lääni* (Pohjois-Karjala province), eastern Finland, near the U.S.S.R. border. The lake is approximately 60 miles (100 km) long between the town of Nurmes and the village of Uimaharju and ranges from 1 to 25 miles (1.5 to 40 km) in width. Its area is about 328 square miles (850 square km). Lake Pielinen has many islands and is drained southward into the large Saimaa lake system by the Pielis River. It is surrounded by dense forests, particularly on its scenic and rugged western shore, capped by Koli hill, which rises to a height of 1,141 feet (348 m); the hill is the centre of an important winter-sports area. There is no passenger ship service on the lake. Apart from Nurmes, the town of Lieksa on the eastern shore and the village of Juuka on the western shore are the only major settlements on the lake.

Pieman River, river, northwestern Tasmania, Australia, formed near Tullah by the confluence of the Rivers Macintosh and Murchison. The 61-mile- (98-kilometre-) long main stream is fed by the Huskisson and Stanley rivers and then flows generally west to its estuary, which also receives the Donaldson, Whyte, and Savage rivers at Belton Bay on the Indian Ocean. The river was named for an infamous convict, Alexander Pierce (Jimmy the Pieman), who was recaptured at its mouth after escaping from the Macquarie Harbour penal colony. It was the scene of some gold and tin mining during the 1870s and 1890s. After 1965 the development of iron-ore mining on the Savage and increased copper-mining activity at nearby Mount Lyell provided the impetus for the harnessing of the Pieman's hydropower potential. There is a small timber industry based at the port of Corinna on the estuary.

Pien Canal, Wade-Giles romanization PIEN HO, Pinyin BIAN HE, canal running through Honan, Anhwei, and Kiangsu provinces of China. In medieval times the name was given to several different canals that connected the Huang Ho (Yellow River), north of Cheng-chou in Honan, with the Huai River, and thus via the old-established Shan-yang Canal to the Yangtze River at Yang-chou, in Kiangsu. The terrain in the region is so flat and the drainage system so impermanent that no major engineering works were involved, apart from the manpower needed to excavate new channels. The canals made considerable use of existing waterways, which were widened, linked, and canalized.

The eastern section of the canal, from the Huang Ho to the region of modern K'ai-feng (Honan), was constructed as early as Han times (206 BC–AD 220), possibly before, and was known as the Lang-tang Canal. The Han Canal, known in later times as the Old Pien Canal, ran southeast from K'ai-feng as far as modern Shang-ch'iu (Honan) and then ran eastward to pass through the gap in the southward spur of the Shantung Hills at modern Suchow in Kiangsu Province. There it joined the Ssu River, which flows into the Huai above Ch'ing-chiang (Kiangsu).

The New Pien Canal was built in 605 by the emperor Sui Yang Ti of the Sui dynasty (581–618). It followed the old canal as far as Shang-ch'iu (Honan) but then flowed southeastward through Yung-ch'eng (Honan) and Su-hsien (Anhwei) to Ssu-hung (Kiangsu), where it joined the Huai above the Hung-tse Lake in Kiangsu, which was very much smaller in the 7th century. The New Pien Canal was constructed on a much larger scale than its predecessors. The whole length of the canal was followed by a post road and lined with willow trees; the canal itself had regular anchorages and guard stations. A million corvée labourers were mustered for its construction and worked under terrible conditions, leaving a legacy of disaffection with the Sui government. In 610, with the construction of the Yung-chi Canal, joining the Huang Ho to the region of modern Peking, there was a direct transport link from the Yangtze Basin to the north of the North China Plain.

Increasingly dependent upon revenue and grain supplies from the Huai and Yangtze region, the T'ang dynasty (618–907) developed this canal system still further during the 8th century. Under the Pei (Northern) Sung (960–1127), when the capital was moved to K'ai-feng, the canal became even more important, and by the 11th century the volume of traffic on it was probably about three times that in T'ang times.

In the early 12th century, however, with the division of China between the Juchen (Chin; 1115–1234) in the north and the Southern Sung (1127–1279) in the south, the canal was abandoned. When, under the Mongols (1206–1368) and the Ming dynasty (1368–1644), the unity of the empire was restored, the political centre was transferred to Peking (known to the Mongols as Ta-tu) and a totally new north–south canal—the Grand Canal—was built. The old east–west link between the Huang Ho and the Huai River lost its importance.

In the late 1960s, however, a New Pien Canal was constructed, as a part of the water-conservancy project for the Huai River Basin. The New Pien Canal scheme was initiated in 1966 and completed in 1970, with 450,000 labourers working on it for four successive years. Altogether some 155 mi (250 km) long, it takes the canalized upper waters of the Tuo and Kuo rivers, via the canalized course of the Sui-dynasty New Pien Canal, through a new channel 85 mi long, roughly following the course of the T'ang-period Pien Canal, through Ling-pi (Anhwei), Ssu-hsien, and Ssu-hung, and thus into the Hung-tse Hu. Although designed as a flood-control project, the canal also provides transport facilities for the area on the borders of Honan, Anhwei, and Kiangsu and is used for irrigation in several counties.

piepoudre court, piepoudre also spelled PIEPOWDER, lowest and most expeditious of the courts of justice known to the ancient common law of England. It was generally constituted by merchants and dealt with fair trading. The name is derived from the dusty feet of the participants (from French *pied poudré*, "dusty foot"), for the courts were often held outdoors.

The court decided summarily and on the spot disputes arising in fairs and markets. Its civil jurisdiction extended to all matters of contract arising within the district of the fair or market. These cases were mostly trade disputes; hence, the decisions were based upon the law as it was interpreted by the local merchants (*see* law merchant). Its criminal jurisdiction extended to all offenses committed at the particular fair where the court was held.

pier (marine architecture): *see* dock.

pier, in building construction, vertical load-bearing member such as an intermediate support for adjacent ends of two bridge spans. In foundations for large buildings, piers are usually cylindrical concrete shafts, cast in prepared holes, while in bridges they take the form of caissons, which are sunk into position. Piers serve the same purpose as piles but are not installed by hammers and, if based on a stable substrate, will support a greater load than a pile.

Especially adapted to large construction jobs, pier shafts having widths of more than 6 feet (1.8 metres) have been excavated to depths greater than 100 feet (30 metres). The lower portion of a pier may be widened to better distribute the downward pressure of a massive overlying structure. Formerly hand-dug shafts were widely used for piers where ground water presented no serious problem, but hand excavation has been largely superseded by the use of rotary or percussion drilling. The massive augers used to drill shafts for the piers of modern skyscrapers are mounted vertically on derricks, and the piers themselves are sufficiently long and wide to support the tremendous weight of even the tallest building. Piers for bridges are often installed by the caisson method. The caisson is a hollow boxlike structure that is sunk down through the water, and then through the ground to the bearing stratum by excavating from its interior, and it ultimately becomes a permanent part of the completed pier.

Pierce, Franklin (b. Nov. 23, 1804, Hillsboro, N.H., U.S.—d. Oct. 8, 1869, Concord, N.H.), 14th president of the United States (1853–57). He failed to deal effectively with the corroding sectional controversy over slavery in the decade preceding the American Civil War (1861–65).

An attorney and the son of a governor of New Hampshire, Pierce entered political life there as a Democrat, serving in the state legislature (1829–33), the U.S. House of Representatives (1833–37), and the Senate (1837–42). He became a devoted supporter of Pres. Andrew Jackson but was continually overshadowed by older and more prominent men on the national scene. Resigning from the Senate for personal reasons, he returned to Concord, where he resumed his law practice and also served as federal district attorney.

Except for a brief stint as an officer in the Mexican War (1846–48), Pierce remained out of the public eye until the Democratic nominating convention of 1852, at which a deadlock developed among the leading presidential contenders. Pierce's name was entered as a compromise candidate after the leading candidates, Lewis Cass, Stephen A. Douglas, and James Buchanan, failed in their bids for the nomination due to factional rivalries. The ensuing presidential campaign was dominated by controversy over the slavery issue. Both the Democrats and the Whigs were too badly split internally to stake out strong stands on the issue; the chief question in the public mind was the finality of the Compromise of 1850, and while both parties declared themselves in favour of it, the Democrats were more thoroughly united in its support. As a result, Pierce, who was almost unknown nationally, unexpectedly swept the country in the November election. Pierce then tried to promote sectional unity in the selection of his Cabinet, to which he named a coalition of Southern planters and Northern businessmen.

Franklin Pierce
By courtesy of the Library of Congress, Washington, D.C.

The youngest man to have been elected to the presidency as of that date, Pierce was handsome, genial, and possessed of a certain superficial brilliance. He represented the Eastern element of the Democratic Party, which was inclined for the sake of harmony and business prosperity to oppose antislavery agitation and generally to placate Southern opinion. Pierce accordingly sidestepped the fierce sectional antagonisms of the domestic scene by ambitiously and aggressively promoting the extension of U.S. territorial and commercial interests abroad. In an effort to buy Cuba, he ordered the U.S. minister to Spain, Pierre Soulé, to try to secure the influence of European financiers upon the Spanish government. The resulting diplomatic statement, the Ostend Manifesto (October 1854), was interpreted by the public as a call to wrest Cuba from Spain by force if necessary. The ensuing controversy forced the administration to disclaim responsibility for the document and to recall Soulé. The following year a U.S. adventurer, William Walker, conducted a notorious filibustering expedition into Central America with the hope of establishing a proslavery government that would be under the control of the United States. He established himself as military dictator, and then as president, of Nicaragua, and his dubious regime was recognized by the Pierce administration. A more lasting diplomatic achievement came from the expedition that had been sent out by Pres. Millard Fillmore in 1853 under Commo. Matthew C. Perry to Japan. In 1854 Pierce received Perry's report that his expedition had been successful and that U.S. ships would have limited access to Japanese ports. The Pierce administration also effected a reorganization of the diplomatic and consular service and the creation of the U.S. Court of Claims.

Among Pierce's domestic policies were preparations for a transcontinental railroad and the opening up of the Northwest for settlement. In order to open the way for a southerly route to California, almost 30,000 square miles (78,000 square kilometres) of territory were acquired from Mexico (1853; the Gadsden Purchase) for $10,000,000. Mainly to stimulate migration to the Northwest and to facilitate the construction of a central route to the Pacific, the Kansas–Nebraska Act was enacted in 1854 and received the President's sanction. This measure opened two new territories for settlement and provided resolution of the slavery question by popular sovereignty (local option). The indignation aroused by the act, which included repeal of the Missouri Compromise of 1820 (prohibiting slavery in the territories north of latitude 36° 30′), and the resultant violent conflict over slavery in the territories were the main causes of the rise of the Republican Party in the mid-1850s. Pierce's ineptness in handling the Kansas struggle made him unacceptable as a candidate for a second term, and he retired from public life in 1857.

Pierce, George Washington (b. Jan. 11, 1872, Webberville, Texas, U.S.—d. Aug. 25, 1956, Franklin, N.H.), U.S. inventor who was a pioneer in radiotelephony and a noted teacher of communication engineering.

The second of three sons of a farm family, Pierce grew up on a cattle ranch and fared well enough in the modest rural schools of central Texas to graduate (1893) after three years at the University of Texas, Austin. He taught in rural secondary schools in his native central Texas until 1898, when he won a fellowship to Harvard University. There he turned to physics, and after receiving his Ph.D. in 1900 he had an opportunity to study for a time in the laboratory of Ludwig Boltzmann in Leipzig.

Pierce returned to the United States and took up teaching at Harvard, where he served from 1903 to 1940. Upon the establishment of Harvard's Cruft High Tension Electrical Laboratory in 1914, Pierce became its director. There he did work that led to the practical application of a variety of experimental discoveries in piezoelectricity and magnetostriction. He developed the Pierce oscillator, which utilizes quartz crystal to keep radio transmissions precisely on the assigned frequency and to provide similar accuracy for frequency meters.

Pierce was an exceptional teacher, and he offered a number of the earliest courses in radio communications. This pioneering teaching, together with his numerous influential publications on radiotelegraphy and electroacoustics, led to his being credited with building the scientific foundations of electrical communication. His other accomplishments include the mathematical calculation of the radiation properties of radio antennas; invention of the mercury-vapour discharge tube, which was the forerunner of the thyratron; invention of a method of recording sound on film; and work on the magnetostriction of nickel and nichrome, which has important applications for underwater signalling and submarine detection. His later work concerned sound generation by bats and insects, a field in which he was still active and publishing in 1948.

Pierce wrote two classic textbooks, *Principles of Wireless Telegraphy* (1910) and *Electric Oscillations and Electric Waves* (1919).

Pierce, John Davis (b. Feb. 18, 1797, Chesterfield, N.H., U.S.—d. April 5, 1882, Medford, Mass.), Michigan's first superintendent of public instruction and leader in the establishment of the University of Michigan.

Though denied an extensive education as a youth because of his father's early death and consequent family financial limitations, Pierce decided at age 20 to educate himself. He succeeded so well that he was accepted at Brown

University, Providence, R.I., from which he was graduated in 1822. After a brief stint of teaching, he enrolled in the Princeton Theological Seminary and was ordained a minister of the Congregational Church by 1825.

He held pastorates in Sangerfield, N.Y., and Goshen, Conn., but Pierce was a Freemason, and when the Anti-Masonic Movement caught fire in America in the late 1820s, he lost his pulpits. He then moved to Michigan as a missionary and settled in 1831 in the pioneer town of Marshall.

After playing a prominent role in formulating the articles on education in Michigan's first constitution (1837), Pierce was appointed the state's first superintendent of public instruction. In that post he organized the primary schools; arranged for the sale of public lands to support public education; established qualifications for teachers; divided the state into school districts, providing for a library in each; and laid the groundwork for the creation of the University of Michigan.

He resumed his role of town preacher in Marshall in 1841 but in 1847 was elected to the state legislature. There he supported legislation establishing Michigan's first normal school. He left state government after serving as a member of Michigan's constitutional convention in 1850, and his only other participation in public life occurred in 1867–68, when he served as county superintendent of schools for Washtenaw County. He lived nearly all of the final three decades of his life in retirement at his farm near Ypsilanti.

Pierce was the founder and, from 1838 to 1840, the editor of *The Journal of Education,* the first professional education journal in the Great Lakes region.

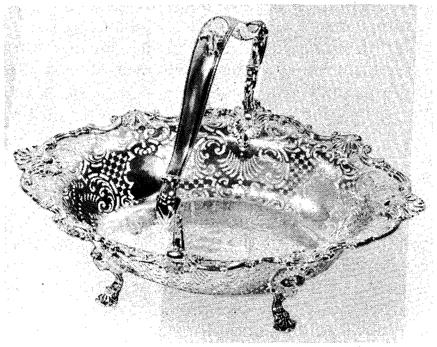
Pierce, John Robinson (b. March 27, 1910, Des Moines, Iowa, U.S.), U.S. communications engineer, scientist, and father of the communications satellite.

Pierce began working for Bell Telephone Laboratories, Inc., New York City, in 1936. He improved the travelling-wave tube, which is used as a broad-band amplifier of microwaves, and designed a new electrostatically focussed electron-multiplier tube, used as a sensitive radiation detector. His Pierce electron gun produces high-density electron beams. During World War II, in collaboration with J.O. McNally and W.G. Shepherd, Pierce developed the low-voltage reflex klystron oscillator that was almost universally used in U.S. radar receivers.

In 1952 Pierce became director of electronics research at the New Jersey division of Bell Laboratories at Murray Hill. Two years later he began work on the theory of communications satellites. Although he wrote numerous papers detailing the advantages of using satellites to relay radio communications to all parts of the Earth, his ideas were largely ignored. Seeing the opportunity offered by the Echo balloon satellite for studying space phenomena, he persuaded the National Aeronautics and Space Administration (NASA) to convert the 100-foot (30-metre) aluminized sphere into a radio-wave reflector. Echo I was launched on Aug. 12, 1960. The success of the communications experiments carried out with Echo I provided the impetus to develop Telstar, a satellite designed to amplify signals from one Earth station and relay the signals back to another Earth station. These early satellites marked the beginning of efficient worldwide radio and television communication.

Pierce retired from Bell Laboratories in 1971 and became professor of engineering at California Institute of Technology, Pasadena; in 1979 he was named chief technologist at the Jet Propulsion Laboratory in Pasadena. He had begun writing science fiction in high school and later published stories under the pseudonym J.J. Coupling; in one of his stories he forecast the advent of communications satellites. His nonfiction works include *Traveling-wave Tubes* (1950) and *Symbols, Signals and Noise* (1961).

pierced work, in metalwork, perforations created for decorative or functional effect or both; the French term for such work is ajouré. Both hand-operated and mechanical tools such as saws, drills, chisels, and punches are used. The principal present-day exponents of this ancient technique are perhaps Asiatic Indian craftsmen. In European metalwork—apart from its functional and decorative use on handles, lids, covers, finials, and the like—pierced work is most often associated with such articles as locks and keys, iron and steel caskets, and guns, as well as with jewelry and other small objects. In the 18th century, however, it enjoyed a period of great popularity, when certain pieces of domestic silver—for example, cake baskets, sugar basins, and coasters—consisted almost entirely of intricate pierced-work patterns. A new tool was developed in order to pierce Sheffield plate in this manner. *See also* opus interassile.



Pierced-work silver cake basket, by Samuel Courtauld, London, 1751; in the Folger's Coffee Collection of Antique English Silver

By courtesy of the Procter and Gamble Company

Pieris, genus of about eight species of evergreen, white-flowered shrubs and small trees, of the heath family (Ericaceae), native to eastern Asia and eastern North America.

The leaves are usually alternate, broad, leathery, lance-shaped, and toothed. The flowers, which are cylindrical or urn-shaped, have a five-lobed calyx (the sepals, collectively) and grow in a terminal or axillary (*i.e.,* from the leaf axil) cluster.

Pieris (*Pieris*)

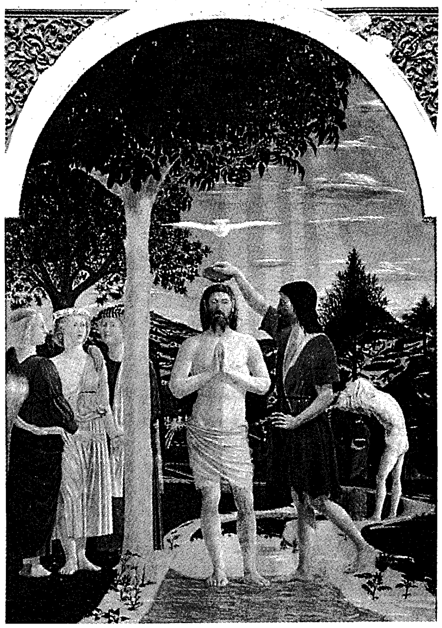
Valerie Finnis

Several species of *Pieris,* including *P. floribunda, P. japonica,* and *P. taiwanensis,* are cultivated as ornamentals. *P. japonica,* the lily-of-the-valley bush or Japanese andromeda, is very popular and is found in several varieties.

Pierleoni, Pietro (pope): *see* Anacletus (II).

Piero (Italian personal name): *see under* Peter, except as below.

Piero DELLA FRANCESCA (b. *c.* 1420, Sansepolcro?, Republic of Florence—d. Oct. 12, 1492, Sansepolcro), painter whose serene, disciplined exploration of perspective had little influence on his contemporaries but came to be recognized in the 20th century as a major contribution to the Italian Renaissance. The fresco cycle "The Legend of the True Cross" (1452–66) and the diptych portrait of Federico da Montefeltro, duke of Urbino, and his consort (1465) are among his best known works.



"The Baptism of Christ," panel painting by Piero della Francesca, *c.* 1440–45; in the National Gallery, London

By courtesy of the trustees of the National Gallery, London; photograph, A.C. Cooper Ltd.

Formative period. The documented facts of Piero della Francesca's life, which are few, permit a reasonably accurate reconstruction of his career and interests but not an exact chronology of his surviving paintings. His father, Benedetto de' Franceschi, was evidently a tanner and shoemaker, prosperous enough for his son to become well educated and literate in Latin. Nothing is known about Piero's early training as a painter, though it is assumed that he was instructed by local masters who had been influenced by Sienese art.

In 1439 Piero worked as an associate of Domenico Veneziano, who was then painting frescoes for the hospital of Sta. Maria Nuova in Florence, where the early Renaissance style was beginning to flourish. There he probably studied the statuary of Donatello and Luca Della Robbia, the buildings of Filippo Brunelleschi, and the paintings of Masaccio and Fra Angelico, and he might have read a theoretical treatise on painting by the Humanist and architect Leon Battista Alberti. Undoubtedly, he would have been directed to these luminaries by Domenico Veneziano, whose own works demonstrate a Renaissance emphasis on colour and light as elements of pictorial construction. It was Piero's contact with the early Renaissance art of Florence that provided the foundation of his own style.

Back in Sansepolcro by 1442, Piero was elected to the town council. Three years later the Confraternità della Misericordia commissioned an altarpiece from him. This polyptych shows Piero's indebtedness to the Florentines Donatello and Masaccio, his fondness for geometric form, and the slowness and deliberation with which he habitually worked—for the Misericordia altarpiece was not completed until 1462.

Periodic retreat to the provincial isolation of Sansepolcro seems to have been necessary for Piero's work. For the rest of his life he alternated between the calm of Sansepolcro and contact with the Humanistic life of the Renaissance in artistic and intellectual centres such as Ferrara and Rimini.

Around 1448 Piero probably worked in the service of Marchese Leonello d'Este in Ferrara, where he may have been influenced by northern Italian art. In 1451, at another northern Italian city, Rimini, he executed a splendidly heraldic fresco (*i.e.,* resembling a heraldic emblem in design) of "Sigismondo Malatesta Before St. Sigismund" in the Tempio Malatestiano, a memorial church built according to the architectural designs of Alberti. Also to this early formative period before 1451 belongs "The Baptism of Christ."

Mature period. Piero della Francesca's mature style is revealed in frescoes painted in the choir of the church of S. Francesco at Arezzo. The decorations had been begun in 1447 by the elderly Bicci di Lorenzo, who died in 1452; Piero presumably was retained to complete the work shortly thereafter. The narrative cycle, depicting "The Legend of the True Cross," was completed by 1466. Its simplicity and clarity of structure, controlled use of perspective, and aura of serenity are all typical of Piero's art at its best. Contemporary with the Arezzo cycle are a fresco of the "Magdalen" in Arezzo cathedral, the "Resurrection" in the Palazzo Comunale at Sansepolcro, and a "Madonna del Parto" in the chapel of the cemetery at Monterchi. In 1454 a burgher of Sansepolcro, Agnolo di Giovanni di Simone d'Angelo, commissioned an altarpiece for S. Agostino that Piero, characteristically, did not complete until 1469. The surviving panels of the altarpiece reveal Piero's interest in the creation of monumental human figures through the sculptural use of line and light.

In 1459 Piero was in Rome to paint frescoes (now destroyed) for Pope Pius II in the Vatican. "St. Luke" (Sta. Maria Maggiore), executed at the same time, was probably done by assistants in the studio he had established in Rome. More fruitful was Piero's long association with Count (later Duke) Federico da Montefeltro, whose highly cultured court was considered "the light of Italy." In the late 1450s Piero painted the "Flagellation of Christ," originally in the sacristy of the cathedral of Urbino; its lucid perspectival construction contrasts with treatment of the subject wherein Christ is relegated to the background while three unidentified figures dominate the foreground. The content of the picture has become the focus of modern academic controversy. A famous diptych portrait of Count Federico and his consort, Battista Sforza (Uffizi, Florence), probably commemorates their marriage in 1465. The paintings show Piero's respect for visual fact in the unidealized features of the Count and in the enchanting landscape backgrounds, which also indicate that he had discovered Netherlandish painting. The reverse depicts the couple in a triumphal procession accompanied by the Virtues. The Count reappears as a kneeling donor in an altarpiece from S. Bernardino, Urbino (now in the Brera, Milan). He, the Madonna and her child, and accompanying saints are placed before the apse (semicircular choir) of a magnificent Albertian church. The painting may have been a memorial to Countess Battista, who died in childbirth, and it has been dated between 1472 and 1474. The altarpiece is one of the most accomplished Renaissance presentations of forms in space and exerted a decided influence on the development of monumental devotional paintings in northern Italian and Venetian art.

Last years. The last two decades of Piero's life were spent in Sansepolcro, where paintings, now lost, were commissioned by local churches in 1474 and 1478. In 1480 Piero became prior of the Confraternità di San Bartolomeo. Among the few extant paintings from this period are the harmonious "Nativity," in London, the "Madonna" from the church at Sta. Maria delle Grazie near Senigallia, now in Urbino, and an awkwardly constructed altarpiece in Perugia, "Madonna with Child and Saints." The "Annunciation" from that altarpiece, however, indicates that Piero's interest in perspectival problems remained keen.

In his old age Piero seems to have abandoned painting in favour of more abstruse pursuits. Between 1474 and 1482 he wrote a treatise on painting, *De prospectiva pingendi* ("On Perspective in Painting"), dedicated to his patron, the Duke of Urbino. In its range of topics and method of organization, the book follows Alberti and the ancient Greek geometer Euclid. The principal manuscript, in Parma (Biblioteca Palatina), was handwritten by the artist himself and illuminated by him with diagrams on geometric, proportional, and perspectival problems. A second treatise, the *De quinque corporibus regularibus* ("On the Five Regular Bodies"), written some time after 1482, follows Plato and Pythagoras in dealing with the notion of perfect proportions. The manuscript, again illustrated by Piero, is in the Vatican Library. *Del abaco* ("On the Abacus," Laurentian Library, Florence) is a pamphlet on applied mathematics.

Piero's fascination with geometry and mathematics is a corollary of his own art; his manner of theoretical expression owes much to his mentor Alberti and is analogous to that of his younger contemporary Leonardo da Vinci; the rigour and logic of the arguments, however, are unique to Piero.

A reliable 16th-century tradition claimed that Piero was blind in his last years. If true, this must have occurred after 1490 because several autographs from that year survive. Moreover, his will of 1486 refers to the painter as aged but sound of mind and body.

Piero did not establish a lasting tradition in central Italy. Luca Signorelli and Perugino, who are presumed to be his most important pupils, followed the examples of other masters. Although Piero's reticent art had little influence on the experiments of his great Florentine contemporaries, he enjoyed great fame for his scientific contributions. In 1497 he was described as "the monarch of our times of painting and architecture," and the biographer Giorgio Vasari gave him high praise two generations later. In the 20th century, Piero's career has been reconstructed and his position reevaluated, giving proper credit to both the science and the poetry of his art. (P.F.W.)

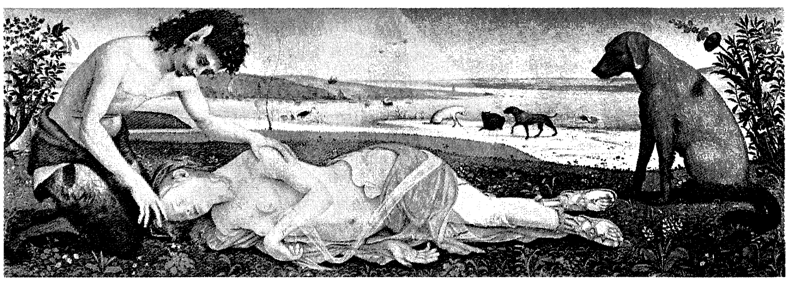
MAJOR WORKS. The following list includes nearly all of Piero's surviving works—panel paintings except where stated otherwise. "The Baptism of Christ" (*c.* 1440–45; National Gallery, London); "Polyptych of the Misericordia" ("Madonna della Misericordia"; 1445–62; Palazzo Comunale, Sansepolcro, Italy); "St. Jerome Penitent" (1450; Staatliche Museen Preussischer Kulturbesitz, Berlin); "Sigismondo Malatesta Before St. Sigismund" (fresco, 1451; Tempio Malatestiano, Rimini, Italy); "The Legend of the True Cross" (fresco cycle, 1452–66; S. Francesco, Arezzo, Italy); panels from the altarpiece of S. Agostino in Sansepolcro (commissioned 1454, finished 1469): "St. Augustine" (Museu Nacional de Arte Antiga, Lisbon); "St. Michael" (National Gallery, London); "St. Simon the Apostle(?)" (Frick Collection, New York City); "St. Nicholas of Tolentino" (Museo Poldi Pezzoli, Milan); and "Flagellation of Christ" (late 1450s; Galleria Nazionale delle Marche, Urbino, Italy); "Hercules" (*c.* 1460–66; Isabella Stewart Gardner Museum, Boston); "Resurrection" (fresco, *c.* 1463; Palazzo Comunale, Sansepolcro); "Portraits of Federico da Montefeltro, Duke of Urbino and of His Wife, Battista Sforza" (1465; Uffizi, Florence); "The Madonna with Child, Angels, Saints and Federico da Montefeltro, Duke of Urbino" (1470s; Brera, Milan); "Senigallia Madonna" (1470s; Galleria Nazionale delle Marche); "Madonna with Child and Saints" (*c.* 1472–74; Galleria Nazionale dell'Umbria, Perugia, Italy); "The Nativity" (*c.* 1480; National Gallery, London).

BIBLIOGRAPHY. The earliest biography of the artist is Vasari's "Life of Piero" (1550 and 1568), included in his *Lives of the Painters, Sculptors, and Architects,* trans. by A.B. Hind, vol. 2 (1963). Roberto Longhi, *Piero della Francesca* (1927; 2nd ed., 1946; Eng. trans. 1930), is the definitive critical and scholarly monograph. A useful catalog of paintings is Piero Bianconi, *Tutta la pittura di Piero della Francesca,* 2nd ed. (1959; *All the Paintings of Piero della Francesca,* 1962). Kenneth Clark, *Piero della Francesca,* 2nd ed. rev. (1969), remains the standard account of the artist in English. It is a rare union of eloquence and scholarship.

Piero DI COSIMO, original name PIERO DI LORENZO (b. 1462, Florence—d. 1521, Florence), Italian Renaissance painter noted for his eccentric character and his fanciful mythological paintings.

His name derives from that of his master, Cosimo Rosselli, whom he assisted (1481) in the frescoes "Crossing of the Red Sea" and "Sermon on the Mount" in the Sistine Chapel in the Vatican. There he saw the frescoes of Sandro Botticelli and Domenico Ghirlandajo, whose styles dominate his early "Story of Jason" (1486; National Gallery of South Africa, Cape Town). In "The Visitation with Two Saints" (*c.* 1487; National Gallery of Art, Washington, D.C.), the permanent influence of the enamel-like colours of Hugo van der Goes' "Portinari Altarpiece" is first visible.

Piero's mature style is exemplified by his mythological paintings, which exhibit a bizarre, romantic fantasy. Many are based on Vitruvius' account of the evolution of man. They are filled with fantastic hybrid forms of men and animals engaged in revels ("The Discovery of Wine," *c.* 1500; Fogg Art Museum, Cambridge, Mass.) or in fighting ("Battle of the Centaurs and the Lapiths," 1486; National Gallery, London). Others show early man learning to use fire ("A Forest Fire," *c.* 1487; Ashmolean Museum, Oxford) and tools ("Vulcan and Aeolus," *c.* 1486; National Gallery of Canada, Ottawa). The multitude of firm, glossy-skinned nudes in these paint-



"The Death of Procris," panel painting by Piero di Cosimo, *c.* 1500; in the National Gallery, London

By courtesy of the trustees of the National Gallery, London; photograph, J.R. Freeman & Co. Ltd.

ings show Piero's interest in Luca Signorelli's work. But, while "The Discovery of Honey" (*c.* 1500; Worcester Art Museum, Worcester, Mass.) retains Signorelli's figure types, its forms are more softly modelled, and its light is warmer, showing Piero's mastery of the new technique of oil painting. In the "Rescue of Andromeda" (*c.* 1515; Uffizi, Florence), Piero adopts Leonardo da Vinci's *sfumato* (smoky light and shade) to achieve a new lush, atmospheric effect.

Piero painted several portraits, of which the best known is the memorial bust of Simonetta Vespucci (*c.* 1498; Musée Condé, Chantilly), mistress of Giuliano de' Medici. Simonetta is partly nude, and her rhythmic profile is accentuated by the black cloud placed behind it. She wears a gold necklace, around which two snakes coil, possibly an allusion to her death from consumption. The transience of youth and beauty is the theme of the famous "Death of Procris" (*c.* 1490–1500; National Gallery, London). The softly undulating form of the accidentally slain Procris lies in a meadow bathed in a golden light while a curious satyr kneels beside her and her faithful dog—considered the first humanized dog in art—mourns at her feet.

Piero's art reflects his bizarre, misanthropic personality. He belonged to no school of painting. Instead, he borrowed from many artists, incorporating elements of their style into his own idiosyncratic manner. He painted many works to please only himself (an unusual practice for the time) and declared that he often found inspiration for his paintings in the stains on walls.

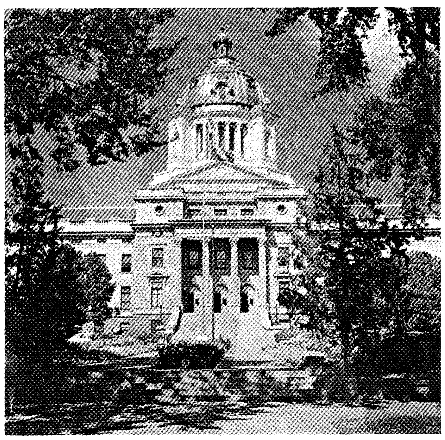
Piero DI GIOVANNI: *see* Lorenzo Monaco.

Piero THE GOUTY (Florentine ruler): *see* Medici, Piero di Cosimo de'.

Piero THE UNFORTUNATE, also called PIERO THE FATUOUS (Florentine ruler): *see* Medici, Piero di Lorenzo de'.

Pierozzi, Antonio: *see* Antoninus, Saint.

Pierre, capital of South Dakota, U.S., seat (1880) of Hughes County, on the Missouri River, in the geographical centre of the state. Before 1800 the capital of the Arikara Indian nation was located on its site. Founded in June 1880 as the western terminus of the Chicago and North Western Railway, it was first known as Mahto (Sioux: "bear"), but was renamed in December 1880 for Pierre Chouteau, French



State Capitol, Pierre, S.D.
Art Resource—EB Inc.

fur trader. Growth was spurred by its position as a railhead for the mining industry and as a trade centre for a large area, including three Indian reservations and prosperous farming and cattle country. In 1889, when South Dakota became a state, Pierre was named the temporary capital; in elections in 1890 and 1904 it was chosen the permanent capital. The capitol building (1905–10) is on a 30-ac (12-ha) tract overlooking the Missouri River, which includes a war memorial building housing the State Historical Society and Museum (1930), the governor's mansion (1936), state office building (1951), state highway building (1955), and a 7-ac artesian-fed lake. The Oahe Dam (1948–62), a power, irrigation, and flood-control project 5 mi (8 km) north of Pierre, has impounded a 200-mi lake along the Missouri River.

Fort Pierre, across the river, was the fur-trade capital of the Northwest from 1817 to *c.* 1867. A monument there marks the place where Louis and François Vérendrye buried a lead plate in 1743 (found in 1913) claiming the region for France. Pierre is the hub of a large diversified agricultural area. Lakes created by the Missouri Basin Development Plan form the basis of a large tourist industry. The Farm Island State Recreation Area is 4 mi east. Inc. city, 1883. Pop. (1980) 11,973.

Pierre (French personal name): *see under* Peter, except as below.

Pierre DE TARENTAISE (pope): *see* Innocent V, Blessed.

Pierre Shale, division of Upper Cretaceous rocks in the United States (the Cretaceous Period began about 136,000,000 years ago and lasted about 71,000,000 years). Named for exposures studied near old Ft. Pierre, S.D., the Pierre Shale occurs in South Dakota, Colorado, Minnesota, New Mexico, Wyoming, and Nebraska. The Pierre consists of about 600 metres (2,000 feet) of dark-gray shale, some sandstone, and many layers of bentonite (altered volcanic-ash falls that look and feel much like soapy clays). In some regions the Pierre Shale may be as little as 200 metres (650 feet) thick. The fossil Cretaceous sea turtle *Archelon,* the largest known turtle species that ever lived, has been found in South Dakota.

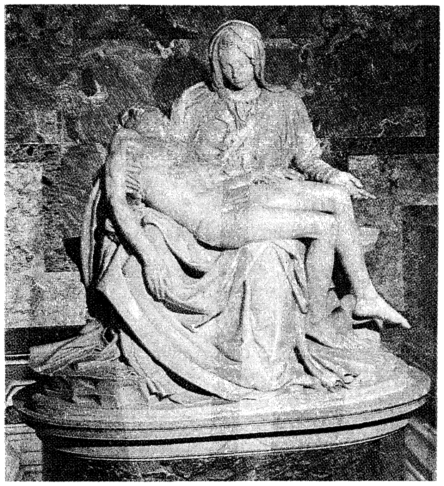
Pierrot (theatrical character): *see* Pedrolino.

Piešt'any, Hungarian PÖSTYÉN, town, Západoslovensky *kraj* (Western Slovakia region), Czechoslovakia, on the Váh River, about 48 mi (77 km) northeast of Bratislava. It is a Carpathian health resort, known since the Middle Ages for its warm sulfur springs and mud baths. It has specialized since the 16th century in treating rheumatic and arthritic diseases. The State Research Institute for Rheumatic Diseases is located there. Pop. (1983 est.) 31,257.

Pietà, as a theme in Christian art, depiction of the Virgin Mary supporting the body of the dead Christ. Some representations of the Pietà include John the Apostle, Mary Magdalene, and sometimes other figures on either side of the Virgin; but the great majority show only the two figures of Mary and her Son. The theme, which has no literary source but grew out of the theme of the lamentation over Christ's body, first appeared in the early 14th century in Germany. It soon spread to France and enjoyed great popularity in northern Europe in the 14th and 15th centuries. Although the Pietà remained primarily a Franco-German theme, its supreme representation is that completed by Michelangelo in 1499 and housed in St. Peter's Basilica. Influenced by the northern style, Michelangelo draped the figure of Christ across Mary's lap. Through this pyramidal design and the details of his figures, Michelangelo created a scene which displayed at once agony, solemnity, and heroic resignation.

The Pietà was widely represented in both painting and sculpture, being one of the most poignant visual expressions of current popular concern with the emotional aspects of the lives of Christ and the Virgin.

The format of the Virgin bearing the body



"Pietà," marble sculpture by Michelangelo, 1499; in St. Peter's, Rome (photo taken before the sculpture was damaged in 1972)
SCALA—Art Resource/EB Inc.

of Christ on her knees was standard until the 16th century, when, influenced by the Renaissance concern with logic and proportions, artists usually depicted Christ lying at the Virgin's feet, with only his head propped against her knees. This form was adopted by Italian Baroque art and was passed on to Spain, Flanders, and Holland. The theme of the Pietà found its most delicate and psychologically penetrating expression in France; in Spain it was treated with the greatest depth of emotion.

Most religious art suffered a decline after the 17th century, but, because of its special emotional appeal, the Pietà continued to be a vital theme through the 19th century.

Pietarsaari, Swedish JAKOBSTAD, city, Vaasan *lääni* (Vaasa province), western Finland, northeast of the city of Vaasa. Pietarsaari, which was formerly mainly Swedish speaking, was founded in 1652; it became an important commercial centre because of its location on the Gulf of Bothnia. The poet Johan Ludvig Runeberg (who wrote in Swedish but is Finland's national poet) was born there in 1804. Notable buildings include a 13th-century church, Malm House, which contains the municipal library and historical museum, and a wooden church built in 1731. Pietarsaari is a seaport and timber-export centre. Its industries include lumber and cellulose milling and the manufacture of lace, chicory, and machinery. Finland's oldest tobacco factory was founded there in 1762, and the city still maintains tobacco-processing facilities. Pietarsaari's outport, Leppäluoto (Swedish Alholm), is $2\frac{1}{2}$ mi (4 km) to the north. Pop. (1983 est.) mun., 20,658.

Pietas, in Roman religion, personification of a respectful and faithful attachment to gods, country, and relatives, especially parents. Pietas had a temple at Rome, dedicated in 181 BC, and was often represented on coins as a female figure carrying a palm branch and a sceptre or as a matron casting incense upon an altar, sometimes accompanied by a stork, the symbol of filial piety.

Pietermaritzburg, city, capital of Natal, South Africa, in the Umsindusi River Valley, at the base of a tree-covered escarpment, inland from Durban. Boers from the Cape Colony, who founded it in 1839 after a victory over the Zulus at Blood River, named it to honour their dead leaders Piet Retief and Gerrit Maritz. The British took control in 1843 and built Ft. Napier (now a historical monument). Pietermaritzburg was incorporated in 1854 and achieved capital status in 1856. Known as the "City of Flowers" for its azaleas, roses, and Botanical Gardens, the city shares with Durban the University of Natal (1909) and has many well-preserved late 19th-century government buildings, the Natal Museum, the Voortrekker Museum, and many recreational facilities. It has excellent highway and rail connections to Durban. Pietermaritzburg is the heart of an industrial complex; its industries include the manufacture of furniture and aluminum ware and the processing of wattle extract. At an elevation of 2,218 ft (676 m), the city is a gateway to Natal's game reserves and mountain resorts. Pop. (1983 est.) mun., 159,500.

Pietersburg, town, north central Transvaal, South Africa, located about midway between Pretoria and the Zimbabwe border, at an elevation of 4,199 ft (1,280 m). The town was founded by Voortrekkers (Afrikaans: "Pioneers") in 1886 on land purchased in 1884 from a local farmer and was named after Petrus (Piet) Joubert, a Boer general. It was the temporary capital in 1900 of both the Transvaal and the Orange Free State during the South African War. The British occupied the town in 1901.

Pietersburg is now a centre of trade for the surrounding agricultural area producing potatoes, alfalfa (lucerne), garlic, corn (maize), sorghum, peanuts (groundnuts), and fruits and is also a centre for some of the finest cattle ranches in South Africa. It is the largest urban area in the northern Transvaal and is an educational centre. The University of the North (founded 1959) serves the Tsonga, Sotho, Venda, and Tswana peoples and is located at Turfloop 14 mi (22.5 km) east of Pietersburg in the black homeland of Lebowa.

Industries in the town produce processed meat, asbestos and corundum products, dairy products, fruit juice, mineral waters, and candy. To the south of the town there is a nature reserve and recreation park. There is also a large military air installation (opened 1964). Pietersburg has major road and railway connections with the South Africa–Zimbabwe border (north) and with Johannesburg. Pop. (1983 est.) mun., 28,261.

Pieterszoon, Pieter: *see* Heyn, Piet.

Pietism, German PIETISMUS, an influential religious reform movement that began in German Lutheranism in the 17th century. Emphasizing personal faith in protest against secularization in the church, Pietism soon spread to other countries and during its history expanded its emphases to include social and educational concerns.

A brief treatment of Pietism follows. For full treatment, *see* MACROPAEDIA: Protestantism.

Throughout Christian history, pietistic movements have arisen in revolt whenever religion has become divorced from experience. By the beginning of the 17th century, Lutheranism had hardened into a scholastic system useful for contending with Roman Catholic and Reformed opponents but not for spiritual nourishment. Out of the devastation wrought upon Germany by the Thirty Years' War there appeared some notable signs of renewal. Interest was awakened in devotional literature and the pious mystical tradition. Influences of English Puritanism reached the Continent through the translation of works by Richard Baxter, John Bunyan, and others. Religious exiles in the Netherlands, among them William Ames, generated a distinctive brand of Dutch Pietism that soon spread into Germany as part of the reform movement that had already begun to take shape in German Lutheran circles as "Reform Orthodoxy." The "pectoral heart theology" of these orthodox Lutherans found its highest expression and widest audience in the writings of Johann Arndt (1555–1621). Lutheran hymnody of the period also contributed significantly to the atmosphere of spiritual renewal.

The various streams of the renewal movement converged in the life and work of Philipp Jakob Spener (1635–1705). Upon assuming an administrative pastorate in Frankfurt am Main, Spener became distressed by the degenerate life of the city and organized the first *collegia pietatis* ("assembly of piety"), in which lay Christians met regularly for devotional reading and spiritual exchange. The practice quickly became characteristic of the movement, and those who attended the conventicles acquired the name Pietists.

In his most famous work, *Pia Desideria* (1675; *Pious Desires*), Spener assessed contemporary orthodoxy's weaknesses and advanced proposals for reform. His proposals were: (1) greater private and public use of the scriptures; (2) greater assumption by the laity of their priestly responsibilities as believers; (3) the importance of bearing the practical fruits of a living faith; (4) ministerial training that emphasized piety and learning rather than disputation; and (5) preaching with the aim of edification. The *collegia pietatis* was the ideal instrument for such reforms.

From Spener, the leadership of German Pietism eventually passed to August Hermann Francke (1663–1727) of the University of Halle. Francke's capable leadership made Halle a thriving institutional centre of Pietism. A plethora of charitable institutions sprang up in association with the university. Among the illustrious figures sent out from Halle was Henry Melchior Mühlenberg (*see* Mühlenberg family), the organizer of colonial American Lutheranism.

Another Halle alumnus, Nikolaus Ludwig Count von Zinzendorf (1700–1760), founded the Moravian Church (*q.v.*) among Pietist-influenced Moravian refugees on his estate in Saxony. In contrast to the Halle Pietists' demand for penitential remorse, Zinzendorf's followers preached belief in Christ's atonement as the only requisite for salvation. It is perhaps through the efforts of Zinzendorf that Pietism exerted its greatest direct influence outside Germany.

John Wesley, the founder of Methodism, received his salutary inspiration among the Moravians and incorporated important pietistic elements, such as the emphasis on saving grace, into his fledgling evangelical movement. Other denominations felt the influence of Pietism on pastoral theology, mission activity, and modes of worship. The zenith of Pietism had been reached by the middle of the 18th century, but the movement continued to exist and still survives, both explicitly in parts of Germany and in the Moravian Church elsewhere and implicitly in evangelical Protestantism at large. The religious revival movements of the 19th and 20th centuries were connected directly or indirectly with Pietism, which in its turn received stimulation from them.

Consult the INDEX *first*

pietra dura (Italian: "hard stone"), in mosaic, any of several kinds of hard stone used in *commesso* mosaic work, an art that flourished in Florence particularly in the late 16th and 17th centuries and involved the fashioning of highly illusionistic pictures out of cut-to-shape pieces of coloured stone. The resulting decorative mosaics were used primarily for tabletops and small wall panels.

The term *pietra dura* signifies the requisite hardness and durability of the materials used in this work, officially describing those stones that fall between the 6th and 10th degrees of the Mohs scale of hardness—that is, between feldspar and diamond. The most commonly used of these hard stones were quartzes, chalcedonies, agates, jaspers, granites, porphyries, and petrified woods, all of which are variable in hue and together provide an almost limitless range of colour. Lapis lazuli, a semihard stone of brilliant blue, was the only stone regularly used in *commesso* work that does not fall into the *pietra dura* classification.

Pietrasanta, town, centre of a district known as Versilia, Lucca province, Toscana (Tuscany) region, central Italy, at the foot of the Alpi Apuane (mountains) just southeast of Carrara. Its piazza is surrounded by fine buildings including the cathedral of S. Martino and the church of S. Agostino (a baptistery with a medieval font), both dating from the 14th century, and the remains of the Rocca, a 12th-century citadel. Pietrasanta was strategically situated on the German Gothic Line in World War II and saw heavy fighting. Agricultural activities, tourism, and the quarrying and processing of marble are the principal industries of the town. Pop. (1981) mun., 25,384.

Pietro (Italian personal name): *see under* Peter, except as below.

Pietro DA CORTONA, French PIERRE DE CORTONE, original name PIETRO BERRETTINI (b. Nov. 1, 1596, Cortona, Tuscany—d. May

Church of Sta. Maria della Pace, Rome, by Pietro da Cortona

Anderson—Alinari from Art Resource/EB Inc.

16, 1669, Rome), Italian architect, painter, and decorator, an outstanding exponent of Baroque style.

Pietro studied in Rome from *c.* 1612 under the minor Florentine painters Andrea Commodi and Baccio Ciarpi and was influenced by antique sculpture and the work of Raphael. The most important of his earliest paintings were three frescoes (1624–26) in Sta. Bibiana, Rome. In the 1620s he designed the Villa del Pigneto near Rome and possibly another villa at Castel Fusano, both for his patrons, the Sacchetti family.

His fame reached its climax in the 1630s with the design of the church of SS. Luca e Martina, Rome (1635–50), and the ceiling fresco "Allegory of Divine Providence" (1633–39) in the Barberini Palace there. The design of SS. Luca e Martina derives more from Florentine than Roman sources, resulting in a different type of Baroque architecture from that of either Bernini or Borromini. The ceiling of the Gran Salone in the Barberini Palace, now the Galleria Nazionale, was conceived as a painted glorification of the Barberini pope, Urban VIII, and is treated illusionistically. Its strong colour and steep perspective recall Veronese, whose work Cortona may have seen in Venice in 1637.

Also in 1637 Pietro visited Florence, where he began painting the frescoes representing the "Four Ages of Man" for Grand Duke Ferdinand II of Tuscany in the Pitti Palace. In 1640 he returned to finish these and paint the ceilings of a suite of apartments in the palace named after the planets. He treated the entire surface as a single spatial unit, adding a wealth of real stucco decoration, partly gilt, in the carvings. He returned to Rome in 1647, where he painted the vault frescoes of Sta. Maria in Vallicella and the ceiling of the long gallery of the Pamphili Palace in Piazza Navona (1651–54) for Pope Innocent X. His chief architectural works of this period were the facades of Sta. Maria della Pace (1656–57)—perhaps his most ingenious conception—and Sta. Maria in Via Lata in Rome (1658–62). He also produced designs for the modernization of the Pitti Palace and the east front of the Louvre in Paris (1664). He painted religious and mythological easel pictures throughout his life. From 1634 to 1638 he was head of the Academy of St. Luke in Rome. Despite a correspondence in feeling between his architecture and his painting, there is little physical connection between them, and he never decorated one of his own churches.

Pietro DELLA VIGNA, also called PETRUS DE VINEA (b. *c.* 1190, Capua, Campania, Kingdom of Sicily—d. 1249, Pisa?), chief minister of the Holy Roman emperor Frederick II, distinguished as jurist, poet, and man of letters whose sudden fall from power and tragic death captured the imagination of poets and chroniclers, including Dante.

Born in the mainland part of the Kingdom of Sicily to a poor family (his parents were said to have been beggars), he studied law at Bologna, apparently at the expense of that city. In 1221 the Archbishop of Palermo presented him to Frederick, who made him a court notary. From 1225 to 1234, he served as a judge in the Magna Curia (high court) of Sicily, in which role he became the principal author of the constitution of Melfi (1231), a legal code that systematized Norman law, superimposing the new Hohenstaufen absolutism. The code was written in the elegant Latin style for which Pietro became famous. An exponent of the rhetorical *ars dictaminis* ("craft of composition"), Pietro influenced the literary form of Frederick's letters and public documents and, through them, the rhetoric of European courts. As a poet, writing in both Latin and Italian, he played a part in the development of the *dolce stil nuovo* ("sweet new style").

From 1230 on, Pietro was Frederick's closest adviser and most trusted ambassador. He undertook repeated missions to popes Gregory IX and Innocent IV and in 1234 travelled to England to arrange a marriage between Frederick and Isabella, sister of Henry III. The Emperor's collaborator and instrument in every important act of his reign, Pietro reached the apogee of his power in 1246, when he was appointed prothonotary (chief court official) and logothete (chancellor) of the Kingdom of Sicily.

In 1249, however, Pietro was accused of plotting to poison the Emperor. Arrested at Cremona, he was carried in chains from city to city until, finally, he was blinded at San Miniato, near Florence. It is not certain whether he died there from the injury or near Pisa by suicide. The question of the guilt of the man who, according to Dante, "held both keys of Frederick's heart" preoccupied contemporary writers, most of whom absolved him.

Pietro della Gondola, Andrea di (architect): *see* Palladio, Andrea.

Pietrobuono, Gasparino di (14th–15th-century educator): *see* Barzizza, Gasparino da.

piezoelectricity, appearance of positive electric charge on one side of certain nonconducting crystals and negative charge on the opposite side when the crystals are subjected to mechanical pressure. This effect is exploited in a variety of practical devices such as microphones, phonograph pickups, and wave filters in telephone-communications systems.

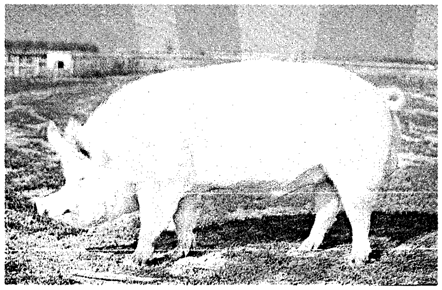
A brief treatment of piezoelectricity and piezoelectric devices follows. For a full treatment, *see* MACROPAEDIA: Electronics.

Pressure on certain electrically neutral crystals—those not having a centre of structural symmetry—polarizes them by slightly separating the centre of positive charge from that of the negative charge; equal and unlike charges on opposite faces of the crystal result. This charge separation may be described as a resultant electric field and may be detected by an appropriate voltmeter as a potential difference, or voltage, between the opposite crystal faces. This phenomenon, also called the piezoelectric effect, has a converse: the production of a mechanical deformation in a crystal across which an electric field or a potential difference is applied. A reversal of the field reverses the direction of the mechanical deformation. Alternating electric fields produce alternating mechanical vibrations of the same frequency. A piezoelectric material, such as a thin slab of quartz, can convert a high-frequency alternating electric signal to an ultrasonic wave of the same frequency. Or by the direct piezoelectric effect, such a crystal can convert a mechanical vibration, such as sound, into a corresponding electrical signal (alternating voltage). The converse piezoelectric effect is somewhat similar to electrostriction (*q.v.*).

Piezoelectricity was discovered in 1880 by Pierre and Paul-Jacques Curie, who found that when they compressed certain types of crystals including quartz, tourmaline, and Rochelle salt, along certain axes, a voltage was produced on the surface of the crystal. The next year, they observed the converse effect, the elongation of such crystals upon the application of an electric current.

For several decades piezoelectricity remained a laboratory curiosity. During World War I the converse piezoelectric effect was used to produce underwater acoustic waves in an early form of submarine-detecting sonar. Piezoelectric crystals later found wide use as frequency-control devices in radio communications. In World War II piezoelectric crystals were used in the detonators of air-dropped bombs; when the nose struck ground, the crystal sent a jolt of electricity to detonate the charge. The piezoelectric effect has subsequently been used in much electronic equipment, in clocks and watches, cigarette lighters, and many other items. Rochelle salt crystals exhibit strong piezoelectric effects, and they are used primarily in phonograph pickups. The mechanical vibration of the needle in the groove is converted by the crystal into a constantly varying electrical impulse. A problem with Rochelle salt crystals, however, is that the strength of their piezoelectric effect can change substantially with temperature, making them unsuitable for many applications, such as radio communications devices. For these, quartz crystals are used. While quartz crystals have a much weaker piezoelectric effect, they can be cut in ways to make them resist the effects of temperature change. About 1940 the ceramic material barium titanate was discovered to exhibit strong piezoelectric properties after being subjected to high temperature in a strong electric field. Similar ceramic materials are now widely used in high-power piezoelectric devices.

pig, wild or domestic swine, a mammal of the Suidae family. In Britain, the term pig refers to all domestic swine; in the United States, to younger swine not yet ready for market and weighing usually less than 180 pounds (82 kilograms), others being called hogs. Pigs are stout-bodied, short-legged, omnivorous mammals, with thick skins usually sparsely coated with short bristles. Their hooves have two functional and two nonfunctional digits. Domestic North American pigs originated from



Yorkshire Large White boar

J.C. Allen and Son

Breeds of domesticated pig

name and type	distribution	appearance	characteristics
Beltsville No. 1 and No. 2 (meat)	both developed in U.S.	No. 1 is black; No. 2 is red	both raised for meat
Berkshire (meat)	U.K., Japan, Australia, N.Z., South America	medium sized, colour mostly black	raised for pork and bacon in different areas
Chester White (lard)	developed Chester County, Pa.	large and white with pinkish skin	quiet disposition; sows prolific
Duroc, or Duroc-Jersey (lard)	North and South America	medium length body; drooping ears	½ Jersey Red, ½ Duroc
Hampshire (meat)	U.S. breed	medium weight, long body, black colour	active, alert, a good grazer
Hereford (lard)	developed U.S., about 1900	medium size; light to dark red colour	raised for lard
Landrace (meat)	north and central Europe and U.S.	medium size; white in colour	several breeds; raised for bacon
Maryland No. 1 (meat)	developed U.S., 1941	medium size; black and white spotted	about 60% Landrace, 40% Berkshire
Minnesota No. 1, No. 2, and No. 3	developed U.S.	various colours	all meat breeds
Montana No. 1 (meat)	developed U.S., 1930s	slightly curved back, trim jowls	combination of Landrace and Hampshire
Palouse (meat)	developed U.S., 1945	white, medium sized	⅔ Landrace, ⅓ Chester White
Poland China (meat)	developed U.S.	mostly black; white legs, nose, tail	developed from Russian, Byfield, Big China hogs
Spotted Poland China (meat)	developed U.S.	mostly white except for black legs	sometimes called Spots
Tamworth (meat)	U.S., U.K., N.Z., Australia, Canada	large, various colours	used for crossbreeding; raised for bacon
Yorkshire Large White (meat)	worldwide distribution	white colour	a bacon breed; sows are prolific

wild stocks still found in European, Asian and North African forests. Wild pigs are not truly native to North America but are believed to have been introduced on Columbus' second voyage in 1493 and brought to the mainland in the early 1500s. There is little difference between wild pigs, or boars, and domestic swine, though the tusklike teeth of domestic pigs are not as developed as the tusks of their wild kin, who use the sharp ends to forage for roots and as a defensive weapon. Wild pigs may live up to 25 years or more.

Domestic pigs are categorized according to three basic types: large-framed lard types with a comparatively thick layer of fat and carcasses usually weighing at least 220 pounds (100 kg); smaller bacon types, with carcasses of about 150 pounds (68 kg); and pork types with carcasses averaging around 100 pounds (45 kg). The U.S. Department of Agriculture's Regional Swine Breeding Laboratories oversee crossbreeding of domestic pigs, a process which has developed numerous breeds and strains.

In the late 20th century, China had the largest hog population of any country in the world, but scientific breeding was concentrated in Europe and the United States. Denmark produced the Landrace breed, raised for its excellent bacon. The Yorkshire Large White, the world's most popular breed, originated in Britain in the 18th century. Both Japan and the Soviet Union were endeavouring in the late 20th century to breed leaner hogs, partly with the help of imported breeds. *See also* livestock.

pig iron, crude iron obtained directly from the blast furnace and cast in molds. *See* cast iron.

Pigalle, Jean-Baptiste (b. Jan. 26, 1714, Paris—d. Aug. 21, 1785, Paris), French sculptor noted for his stylistically varied and original works.

Born into a family of master carpenters, Pigalle began training as a sculptor at age 18 with Robert Le Lorrain and then studied with Jean-Baptiste Lemoyne. After failing to win the Prix de Rome in 1735, he studied independently in Rome at his own expense from 1736 to 1739. While there Pigalle modeled the first version of his famous statue "Mercury Fastening his Sandals," a classicizing work conveying qualities of both graceful ease and youthful vitality. After returning to Paris he worked for local churches.

Pigalle was made a member of the Académie Royale in 1744, his reception piece being a marble version of the "Mercury." The statue became so popular that Louis XV commissioned a life-size marble version of it to present to Frederick II of Prussia in 1749. Pigalle was appointed a professor at the Académie Royale in 1752.

Pigalle enjoyed the patronage of Madame de Pompadour from 1750 to 1758. He created several allegorical figure groups for her, such as "Love and Friendship" (1758; Louvre), with some statues bearing her features in stylized form. He achieved considerable popularity with several smaller decorative, sentimental studies of children done in a Rococo style, such as the "Child With a Bird Cage" (1750; Louvre). He was also an original and intelligent portrait sculptor, as is evident in his forcefully observed bust of "Diderot" (1777; Louvre) and in the "Nude Voltaire" (1776; Louvre), an anatomically realistic rendering of the aged philosopher that caused a furor when first shown. Pigalle's two most important late commissions were the tomb of the Duc d'Harcourt (1769–76; Paris, Notre-Dame) and the grandiose and theatrically effective tomb of the Maréchal de Saxe in Strasbourg (1753–76). Stylistically, Pigalle was unable to harmoniously combine his naturalistic tendencies with the conventional classicizing formulas of the time, but his sculptures almost always show qualities of daring, inventiveness, and charm.

pigeon, any of several hundred species of birds constituting the family Columbidae (order Columbiformes). Smaller forms are usually called doves, larger forms pigeons. An exception is the white domestic pigeon, the symbol known as the "dove of peace" (*see* domestic pigeon).

Pigeons occur worldwide except in the coldest regions and the most remote islands. About 250 species are known; two-thirds of them occur in tropical Southeast Asia, Australia, and the islands of the western Pacific, but the family also has many members in Africa and South America and a few in temperate Eurasia and North America. All members of the family suck liquids, rather than sip and swallow as do other birds, and all pigeon parents feed their young "pigeon's milk," the sloughed-off lining of the crop, the production of which is stimulated by the hormone prolactin. The nestling obtains this "milk" by poking its bill down the parent's throat.

Pigeons are gentle, plump, small-billed birds with a skin saddle (cere) between the bill and forehead. All pigeons strut about with a characteristic bobbing of the head. Because of their long wings and powerful flight muscles, they are strong, swift fliers. Pigeons are monogamous; *i.e.,* they mate for life and the survivor accepts a new mate only slowly. The female lays two glossy white eggs in a flimsy nest that barely holds them. The female generally incubates the eggs by night, the male by day. The incubation period is 14 to 19 days, but the young are cared for in the nest for another 12 to 18 days.

The numerous genera of pigeons may be classified into subfamilies as follows:

The Columbinae, the typical, or true, pigeons, consists of about 175 species in about 30 genera. These often gregarious seed and fruit eaters are found worldwide in temperate and tropical regions. Some are ground feeders, others feed partly or wholly in trees. They are generally coloured soft gray and brown to black, sometimes with iridescent patches on the plumage. The cosmopolitan genus *Columba*—including the Old World wood pigeons and the New World band-tailed pigeons—is classified in this group, along with the *Streptopelia* species, the Old World turtledoves and ringdoves. To this genus also belong the street pigeons so common in urban areas. These are composed of a bewildering array of crossbreeds of domesticated strains, all of them ultimately traceable to the Old World rock dove (*Columba livia*). The rock dove is typically dull in colour—gray and white rump and two large black wing bars; this Eurasian species nests above 5,000 feet (1,525 m) in Asia. It has been domesticated and selectively bred since 3000 BC with the production of numerous colour variants and about 200 named strains—show pigeons, racing pigeons, and large edible types. Among such strains, pouter pigeons have a large, inflatable gullet; carrier pigeons have a long bill; runts, a massive bill and body; barbs, a short bill. Fantails may have 42 tail feathers; owl pigeons have diverging throat feathers; frillbacks, the feathers reversed; jacobins, hoodlike neck feathers. Tumblers tumble backward in flight.

The many other Old World genera in the subfamily Columbinae include the chicken-sized pheasant pigeon (*Otidiphaps nobilis*) of New Guinea. In the New World the white-winged doves and the mourning dove (*q.v.; Zenaida*) are popular game birds; Central and South America support the terrestrial ground doves (*Metriopelia*) and quail doves (*Geotrygon*). The New World passenger pigeon (*q.v.*) is extinct.

The Treroninae, or the fruit pigeons, consists of about 115 species in about 10 genera, found primarily in Africa, southern Asia, Australia, and the Pacific islands. These fruit-eating birds are soft-billed, short-legged, and arboreal in habit. Their plumage is usually greenish, often with yellow, red, or other brightly coloured markings. The group includes the heavyset imperial pigeons (*Ducula*); the small and extremely colourful fruit doves (*Ptilinopus*); the blue pigeons (*Alectroenas*), dark blue in colour with red wattles; and the usually crimson-legged green pigeons (*Treron*).

The Gourinae, or crowned pigeons, consists solely of three species (genus *Goura*), found in New Guinea. Blue-gray birds with fanlike head crests, they are the largest of all pigeons—nearly the size of a turkey.

The Didunculinae consists of a single species, the tooth-billed pigeon (*Didunculus strigirostris*), which is native to Samoa. This fruit-eating, terrestrial pigeon has adopted arboreal ways in response to near extermination by introduced predators. Unlike most pigeons, it uses its feet to hold down its food while pecking off pieces.

pigeon hawk: *see* merlin.

pigeon racing, also called PIGEON FLYING, racing for sport the homing pigeon, a specialized variety developed through selective crossbreeding and training for maximum distance and speed in directed flight.

The earliest record of the domestication of pigeons is from the fifth Egyptian dynasty (about 3000 BC). The sultan of Baghdad established a pigeon post system in AD 1150, and Genghis Khan used such a system as his conquests spread. Pigeons were widely used for messenger service in Europe during the Revolution of 1848, and in 1849 pigeons were used to carry messages during interruptions in telegraphic service between Berlin and Brussels. Pigeons were used as emergency message carriers in war well into the 20th century. The record flight for a U.S. Army Signal Corps pigeon was a flight of 2,300 miles (3,700 km). Flights of 1,000 miles (1,600 km) were routine.

Pigeon racing as a sport began in Belgium, where in 1818 the first long-distance race of more than 100 miles (160 km) was held. In 1820 a race took place between Paris and Liège and, in 1823, from London to Belgium. The sport gained prominence in the late 1800s in Great Britain, the United States, and France. Nowhere, however, did it match the popularity enjoyed in Belgium, where nearly every village had a Société Colombophile (Pigeon-fanciers Club). The annual Belgian Concours National, a race of about 470 miles (750 km) from Toulouse to Brussels, was inaugurated in 1881; during the same year, the first regular races in Great Britain—from Exeter, Plymouth, and Penzance to London—took place. The world governing body is the Fédération Colombophile Internationale, with headquarters in Brussels.

Racing pigeons are trained, by repeated practice, to return to their home loft when released at various distances and to enter the loft through the trapdoors. At the start of a race, competing birds are banded; they are then liberated together by a starter who records the time of release. The birds ascend rapidly, become oriented, and head directly toward their lofts. As the birds enter their home lofts, the band is removed from the leg and placed in a timing device that indicates the time of arrival. The distance of the pigeon's flight is divided by the time consumed to determine which pigeon has made the fastest speed. A bird is not considered to have arrived home until actually through the trap of its loft. Pigeons have been known to fly several thousand miles in returning home, and some have attained average speeds of more than 90 miles per hour (145 kilometres per hour) in races.

pigeon wheat: *see* hair-cap moss.

Piggott, Lester (Keith) (b. Nov. 5, 1935, Wantage, Berkshire, Eng.), one of the world's leading jockeys in Thoroughbred flat racing, British riding champion 11 times (1960, 1964–71, and 1981–82).

Born to parents whose families had long been associated with the turf, Piggott rode in his first race at the age of 12. He won the Derby nine times (1954, 1957, 1960, 1968, 1970, 1972, 1976, 1977, and 1983), the St. Leger eight times, the 2,000 Guineas four times, and the Oaks six times, along with other major British races. In 1974 he rode his 3,000th winner, in 1982 his 4,000th, and by the time he retired in 1985–86 to become a trainer he had won about 4,350 races in all. By 1985 he had won 29 victories in English classic races, more than any other rider. In 1970 he rode Nijinsky to victory as the winner of the English Triple Crown. He won numerous classic races in France and Ireland as well. He was created an officer in the Order of the British Empire in 1975. A biography by James Lawton was published in 1980.

piggyback plant: *see* pickaback plant.

pigment, any of a group of compounds that are intensely coloured and are used to colour other materials. Pigments are insoluble.

A brief treatment of pigments follows. For full treatment, *see* MACROPAEDIA: Chemical Compounds.

Pigments are applied not as solutions, but as finely ground solid particles. They are used in paints, printing inks, and plastics. Pigments may be organic (*i.e.,* contain carbon) or inorganic, but the organic pigments are generally brighter and last longer than the inorganic pigments. Pigments derived from natural sources have been used for centuries, but most pigments used today are synthetic. Organic synthetic pigments are derived from coal tars and other petrochemicals. Inorganic pigments are made by relatively simple chemical reactions—notably oxidation—or are found naturally as earths.

Inorganic pigments include white opaque pigments used to provide opacity and to lighten other colours. The most important member of the class is titanium dioxide. White extender pigments are added to paints to lower their cost or improve their properties. This class includes calcium carbonate, calcium sulfate, diatomaceous silica (the remains of marine organisms), and china clays. Black pigments are primarily created from particles of carbon. Iron oxide is used to give black colour to printing inks. Compounds of iron and oxygen are generally used to provide browns, maroons, reds, yellows, and oranges. The synthetic versions provide brighter, stronger colours. Certain compounds of chromium are used to provide yellows, oranges, reds, and greens. Various compounds of cadmium tend to be orange, red, yellow, or maroon. Iron blue, or Prussian blue, is the major inorganic blue pigment and is made of iron in combination with carbon, nitrogen, and hydrogen.

Organic pigments are primarily synthesized from aromatic hydrocarbons. These are compounds containing structures of carbon atoms with hydrogen atoms attached that are formed in closed rings. Organic pigments include azo pigments, which contain a nitrogen group. They account for most of the organic red, orange, and yellow pigments. Copper phthalocyanines are very important pigments because they provide brilliant, strong colours that are unusually colourfast for organic colours. Some pigments, such as fluorescent ones, are classified as precipitated dyestuff pigments. They are simply dyes that have been rendered insoluble by chemical reaction.

Pigneau de Béhaine, Pierre-Joseph-Georges (b. Nov. 2, 1741, Origny-Sainte-Benoîte, Fr.—d. Oct. 9, 1799, Qui Nhon, central Vietnam), Roman Catholic missionary whose efforts to advance French interests in Vietnam were regarded as important by later French colonizers.

Pigneau de Béhaine left France in 1765 and went to establish a seminary in southern Vietnam, then known as Cochinchina. He arrived at Ha Tien, near the Cambodian frontier, in 1767, and he remained there for two years, preparing Vietnamese pupils for the priesthood, until the seminary was destroyed in a Siamese invasion. He then escaped to Malacca with several of his students and reestablished the school in Pondicherry, India. He was made titular bishop of Adran in 1770, and about that time he left India and returned to Macau, where he compiled a dictionary and wrote a catechism in Vietnamese.

In 1774–75 Pigneau de Béhaine made his way back to Cochinchina via Cambodia. He remained at Ha Tien until 1777, when the rebel Tay Son brothers overthrew the seigneurial Nguyen family and orphaned the young heir, Nguyen Phuc Anh. In 1782, after Nguyen Anh's first attempt to regain control of the south had ended in disaster, the bishop met and befriended Nguyen Anh on the French-held island of Kah Kut, near Phu Quoc, for which he won the future king's enduring gratitude. The bishop returned to France in 1787 and persuaded King Louis XVI to sign a treaty with the Vietnamese prince, but he was unsuccessful in his attempts to obtain armaments and troops to reinstate his protégé. Undaunted, he returned to India, where he won support from French merchants for Nguyen Anh's cause. Unofficial French assistance played a significant, but not predominant, part in Nguyen Anh's successful battle to overcome the rebels. He became the emperor Gia Long over a united country in 1802.

Pigneau de Béhaine assisted Nguyen Anh in both foreign and domestic matters while the future emperor fought to extend his power over the whole country. The bishop was never able to convince Gia Long to do more than grudgingly tolerate Christian missionary work in Vietnam during his lifetime. After a long illness, Pigneau de Béhaine died on a journey to Nha Trang and was buried with military honours in Saigon.

pignut: *see* earthnut.

Pigot (of Patshul), George Pigot, Baron, 1ST BARONET (b. May 4, 1719, London—d. May 11, 1777, Madras), British East India merchant and governor of Madras who was arrested and deposed by his council in 1776.

At 17 Pigot entered the East India Company service, becoming governor and commander in chief of Madras in 1755. He stoutly defended Madras against the French in 1758–59, and after the capture of Pondicherry (a former French enclave on the southeast coast) by Lieutenant Colonel (afterward Sir) Eyre Coote in 1761, Pigot occupied the town on behalf of the Company. He returned to England in 1763 with a fortune of £400,000 and was given a baronetcy the following year. Member of Parliament for Wallingford (1765–68) and Bridgnorth (1768–77), he was created an Irish peer as Baron Pigot in 1766.

Pigot, oil painting by George Willison, 1777; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

Returning to Madras in 1775 as governor, Pigot tried to suppress widespread corruption in the public service but in so doing created enemies. A majority of his council, backed by the East India trader Paul Benfield, opposed Pigot because of his proposed restoration of the raja (ruler) of Tanjore (Thanjāvūr). Pigot suspended two members of the council and ordered the arrest of the commandant, Sir Robert Fletcher. The government was then taken over by the majority of the council, and Pigot was imprisoned. From London, the court of directors ordered the restoration of Pigot to his post followed by his resignation; but he died before the order arrived. Parliament discussed the case in 1779, and four of those responsible for his arrest were tried and fined £1,000 each.

In the absence of male issue, the barony became extinct upon Pigot's death, but the baronetcy went to his brother Robert.

Pigou, Arthur Cecil (b. Nov. 18, 1877, Ryde, Isle of Wight—d. March 7, 1959, Cambridge, Cambridgeshire, Eng.), one of the most eminent British economists of the 20th century, noted for his studies in welfare economics.

Educated at King's College, Cambridge, Pigou succeeded Alfred Marshall in the Cambridge chair of political economy in 1908. It was primarily through his efforts that Marshall's ideas were disseminated and provided the leading theoretical basis for what subsequently became known as the Cambridge school of economics.

Pigou's most significant and influential work was *The Economics of Welfare* (1920), in which he sought to explore the effects of economic activity upon the total welfare of society and its various groups and classes. Pigou applied his powers of economic analysis to a number of other problems, including tariff policy, unemployment, and public finance. He also served on the Royal Commission on Income Tax (1919–20) and on two committees on the currency (1918–19; 1924–25).

pigpen: *see* hog house.

pigweed, any of several coarse annual plants of cosmopolitan distribution that are often troublesome weeds. Several of them belong to the genus *Amaranthus,* of the family Amaranthaceae. Prostrate pigweed, or mat amaranth (*A. graecizans*), grows along the ground surface with stems rising at the tips; spiny pigweed, or spiny amaranth (*A. spinosus*), has spines at the base of the leafstalks; and rough pigweed, or redroot (*A. retroflexus*), is a stout plant up to 3 m (about 10 feet) tall.

Other pigweeds are from the goosefoot family (Chenopodiaceae), such as the edible *Chenopodium album,* also called lamb's quarters (*q.v.*). Winged pigweed (*Cycloloma atriplicifolium*) is a much-branched upright plant with scalloped leaves; it grows to 60 cm (about 2 feet) tall and is often seen on sandy soils.

Pijao, extinct Indian people of the southern highlands of Colombia. The Pijao spoke a language of the Chibchan family, related to that of the Páez, their neighbours to the south. They were agriculturists, raising corn (maize), sweet manioc (yuca), beans, potatoes, and many fruits; they also hunted and fished. They lived in settlements of several families in houses built of wood and plastered with mud and clay. They made pottery, wove cotton, worked stone, and smelted and worked gold and copper. They generally wore no clothing except palm-leaf hats, though they painted the body and adorned it with feathers and sometimes gold ornaments. They deformed the skulls of their infants by tying boards against them. They were also cannibals who devoured their slain enemies. The Pijao worshipped idols and believed that the dead were reincarnated as animals. They refused to make peace with the Spaniards and were completely annihilated by the mid-17th century.

Pijia (Mongol khan): *see* Bilge.

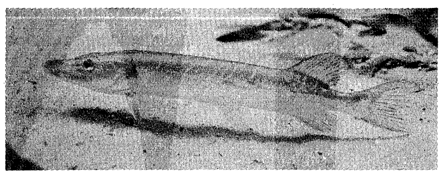
pika, also called LITTLE CHIEF HARE, MOUSE-HARE, WHISTLING HARE, or PIPING HARE, any of numerous small, essentially tailless, rabbitlike mammals found in parts of western North America as well as in Asia and eastern Eu-

Pika (*Ochotona princeps*)
Kenneth W. Fink—Root Resources

rope. Pikas belong to the genus *Ochotona,* the family Ochotonidae, and the order Lagomorpha. The names rock rabbit and cony (coney) are sometimes ambiguously applied to these animals as well as to the unrelated hyrax (*q.v.*).

Pikas have rounded ears; their brownish or reddish fur is soft, long, and thick. They are about 15 to 30 centimetres (6 to 12 inches) long and weigh about 125 to 440 grams (4 to 14 ounces). Most pikas live in rocky, mountainous areas, but, in Asia, some species inhabit burrows in forests and even in desert areas. Pikas do not seem to hibernate. During the summer and autumn months, pikas "harvest" vegetation, which they dry in the sun. This hay, stored under rocks or in other protected places, provides a source of food during the winter. Pikas bear several litters of two to six naked young in the spring and summer months. The gestation period is about one month.

pike, any of several voracious freshwater fishes, family Esocidae, caught both commercially and for sport. They are recognized by the elongate body, small scales, long head, shovellike snout, and large mouth armed with



Northern pike (*Esox lucius*)
Russ Kinne—Photo Researchers

strong teeth. The dorsal and anal fins are far back on the tail.

The northern pike (*Esox lucius*) of North America, Europe, and northern Asia has pale, bean-shaped spots on the body and lacks scales on the lower parts of the gill covers. It is a fairly common and prized game fish with a maximum size and weight of about 1.4 metres (4.5 feet) and 21 kilograms (46 pounds). The muskellunge and pickerel (*qq.v.*) are North American pikes similar in habit to the northern pike.

Solitary hunters, pikes, pickerel, and muskellunge lie motionless in the water or lurk in a clump of weeds. As the prey comes within reach, they make a sudden rapid lunge and seize it. They usually eat small fishes, insects, and aquatic invertebrates, but larger forms also take waterfowl and small mammals. They spawn in weedy shallows from late winter through spring.

Pikes are of the order Salmoniformes. Wall-eyed pikes are not true pikes; they are members of the perch order (Perciformes).

pike, ancient and medieval infantry weapon consisting of a long, metal-pointed spear with a heavy wooden shaft 10 to 20 feet (3 to 6 metres) long. Its use among the Swiss foot soldiers in the 14th century contributed to the decline of the feudal knights. The pike disappeared from land warfare with the introduction of the bayonet, though it was retained as a naval boarding weapon through the 19th century. A variety of pike is used by the picador in bullfighting.

Pike, Kenneth L(ee) (b. June 9, 1912, Woodstock, Conn., U.S.), U.S. linguist and anthropologist known for his studies of the aboriginal languages of Mexico, Peru, Ecuador, Bolivia, New Guinea, Java, Ghana, Nigeria, Australia, Nepal, and the Philippines. He was also the originator of tagmemics.

Tagmemics is an outgrowth of Bloomfieldian immediate constituent analysis and of Pike's own general theory of human behaviour, described in his *Language in Relation to a Unified Theory of the Structure of Human Behavior,* 3 vol. (1954–60; 2nd ed. 1967). The tagmeme is a unit comprising a function (for example, a subject) and a class of items fulfilling that function (*e.g.,* nouns). It is most suitable in describing languages (such as the Central and South American languages to which it has mostly been applied) in which a number of different classes can fulfill the same function or in which the same class can fulfill many functions. Tagmemics is also known as string constituent analysis and differs, in part, from Bloomfieldian linguistics in that semantic as well as syntactic function is used in identifying tagmemes. Pike later applied tagmemics to matrix of field theory and English rhetoric.

From 1955 to 1977 Pike held the post of professor of linguistics at the University of Michigan at Ann Arbor, where he received his Ph.D. in 1942. In addition to his work in tagmemics, Pike has done research in phonology and is the author of *Intonation of American English* (1945); co-editor of *Tone Systems of Tibeto-Burman Languages of Nepal, Parts I–IV* (1970); and co-author of *Grammatical Analysis* (1977) and *Songs of Fun and Faith* (1977). Selections from his work were published in *Selected Writings* in 1972.

Pike, Zebulon Montgomery (b. Jan. 5, 1779, Lamberton, N.J., U.S.—d. April 27, 1813, York, Ont.), U.S. army officer and explorer for whom Pikes Peak in Colorado was named.

In 1805 Pike, then an army lieutenant, led a 20-man exploring party to the headwaters of the Mississippi River with instructions to discover the river's source, negotiate peace treaties with Indian tribes, and assert the legal claim of the United States to the area. Pike travelled 2,000 miles (3,200 kilometres) by boat and on foot from St. Louis, Mo., to Leech and Sandy lakes, in northern Minnesota. He erroneously identified Leech Lake as the river's source.

In July 1806 Pike was dispatched to the Southwest to explore the Arkansas and Red rivers and to obtain information about the adjacent Spanish territory. Pike established an outpost near the site of present-day Pueblo, Colo., and then led his party northwest, where they encountered the Front Range of the Rocky Mountains. After trying unsuccessfully to scale the mountain peak later named for Pike, the party proceeded southward to northern New Mexico, where they were apprehended by Spanish officials on the charge of illegal entry into New Mexico. They were escorted across Texas to the Spanish–American border at Natchitoches, La., where on July 1, 1807, they were released.

Zebulon Pike, portrait by Charles Willson Peale, 1808; in Independence National Historical Park, Philadelphia
By courtesy of the Independence National Historical Park Collection, Philadelphia

Pike's report on Santa Fe, with information noting particularly the military weakness of the capital and the lucrativeness of the overland trade with Mexico, stimulated the expansionist movement into Texas. Pike served in the War of 1812, attaining the rank of brigadier general. He was killed in action during the attack on York.

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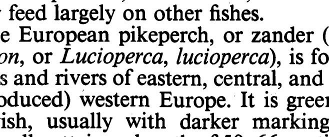
pikeperch, any of several freshwater food and game fishes of the family Percidae (order Perciformes), found in Europe and North



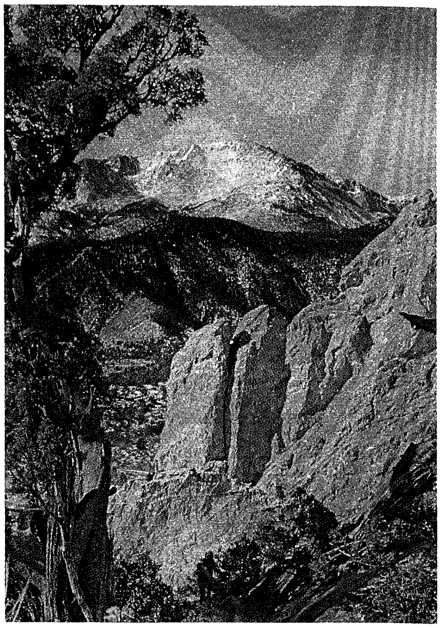
Pikeperch (*Stizostedion lucioperca*)
Painted especially for *Encyclopaedia Britannica* by Tom Dolan, under the supervision of Loren P. Woods, Chicago Natural History Museum

America. Although more elongated and slender than perches, pikeperches have the two dorsal fins characteristic of the family. They are, like perches, carnivorous, and as adults they feed largely on other fishes.

The European pikeperch, or zander (*Stizostedion,* or *Lucioperca, lucioperca*), is found in lakes and rivers of eastern, central, and (where introduced) western Europe. It is greenish or grayish, usually with darker markings, and generally attains a length of 50–66 centimetres (20–26 inches) and a weight of 3 kilograms (6.6 pounds).

The North American pikeperches include the walleye (*S. vitreum*), found in clear, cool lakes and rivers, and the sauger (*S. canadense*), found in lakes and rather silty rivers. Both are darkly mottled fishes native to eastern North America. The sauger, the smaller of the two, does not usually exceed a length and weight of about 30 cm and 1 kg. The walleye rarely weighs more than 4.5 kg and has a maximum length and weight of about 90 cm and 11 kg.

Pikes Peak, peak in the Front Range of the Rocky Mountains in El Paso County, Colorado, U.S., 10 mi (16 km) west of Colorado Springs. It ranks 32nd in altitude (14,110 ft [4,301 m]) among Colorado peaks and is widely known because of its commanding location and easy accessibility. Located on the edge of the Great Plains, it is in the southeastern corner of Pike National Forest; to the southwest is the famous Cripple Creek gold district. Ascent to the summit (a fairly level area of about 60 ac [24 ha]) may be easily accomplished by trail, cog railway (8.75 mi), or automobile toll road (18 mi). An average snowfall of about 9½ ft on the northern



Pikes Peak above Gateway Rocks, Colorado
David Muench—EB Inc.

slope and 14 ft on the southern assures skiing conditions. Colorado Springs draws its main water supply from Pikes Peak Watershed. The timberline is between 11,400 and 12,000 ft; above it rise nearly 2,500 ft of bare granite. The view from the summit is said to have inspired Katharine Lee Bates to write "America the Beautiful" in 1893.

The peak was discovered in November 1806 by Lieut. Zebulon Pike, who abandoned his attempt to climb it because of snow and a lack of warm clothing. It was climbed by Edwin James, J. Verplank, and Z. Wilson of Maj. Stephen Harriman Long's expedition on July 14–15, 1820; this was the first recorded ascent of a 14,000-ft peak in any area of what became the United States. Long named the mountain for James, but common usage had bestowed Pike's name upon it by 1859, when it became the focal point of a gold rush with the slogan "Pikes Peak or bust."

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

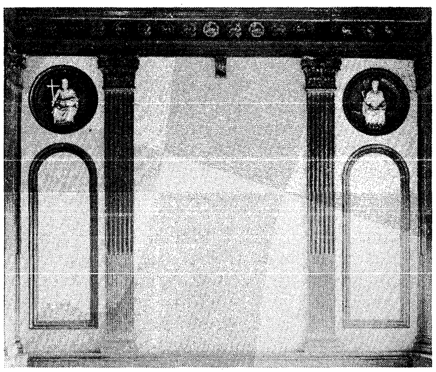
Piła, *województwo* (province), west central Poland, established 1975, comprising an area of 3,168 sq mi (8,205 sq km). It is bordered by the provinces of Koszalin and Słupsk on the north, Bydgoszcz on the east, Poznań on the south, and Gorzów Wielkopolski on the west. The Noteć River crosses the province from northeast to southwest on its way to the Oder, and the Gwda River flows from north to south to join the Noteć. Industries include lumber mills, railroad workshops, potato-processing facilities, and building-materials plants. Three inland ports are located on the Noteć River at Wieleń, Czarnków, and Ujście. Health spas and resorts are situated throughout the province's wooded areas. Piła city is the provincial capital. It suffered much damage in World War II and is largely rebuilt. Other major cities in the province are Wałcz, Wągrowiec, and Chodzież. The province's industry, almost completely destroyed in World War II, has been restored and expanded. Pop. (1984 est.) 455,000.

Piła, German SCHNEIDEMÜHL, city, capital of Piła *województwo* (province), west central Poland, on the Gwda River. Its economic growth has been steady since World War II. Industries include lumber mills, railroad workshops, and potato-processing facilities. The city lies on the Berlin–Gdańsk (Danzig) rail line.

First chronicled in the 15th century, Piła received town rights in 1512. It passed to Prussia in 1772 and was returned to Poland in 1945. About 80 percent of Piła was destroyed during World War II. Pop. (1984 est.) 64,600.

Pilar, capital, Ñeembucú department, southwestern Paraguay. It lies on the eastern bank of the Paraguay River across from the mouth of the Arrogo Bermejo (Bermejo Stream). Founded in 1779, the settlement was originally known as Ñeembucú. The city is now an important river port handling the agricultural products of the fertile area between the Paraguay and Paraná rivers; it is also a manufacturing centre, with textile mills, sawmills, and distilleries. The city has a teachers college, church, hospital, and a branch of the Bank of Paraguay. A road leads eastward from Pilar to the Asunción-Encarnación highway, and there is a small airport. Pop. (1982 prelim.) 13,135.

pilaster, in Greco-Roman Classical architecture, shallow rectangular column that projects slightly beyond the wall into which it is built and conforms precisely to the order or style of the adjacent columns. The anta of ancient



Renaissance pilasters in the Pazzi Chapel, Sta. Croce, Florence, designed by Filippo Brunelleschi
Foto Marburg—Art Resource/EB Inc.

Greece was the direct ancestor of the Roman pilaster. The anta, however, which served a structural purpose as the terminus of the side-wall of a temple, was not required to conform in style to the temple columns.

In ancient Roman architecture the pilaster gradually became more and more decorative rather than structural, as it served to break up an otherwise empty expanse of wall. The fourth-story wall of the Colosseum, the great amphitheatre built in Rome during the 1st century AD, contains examples of the Roman use of pilasters. In Renaissance architecture, beginning in Italy and spreading to France and England, pilasters were extremely popular on both interior and exterior walls. The decorative pilaster was also common in the designs of the later European Neoclassical periods.

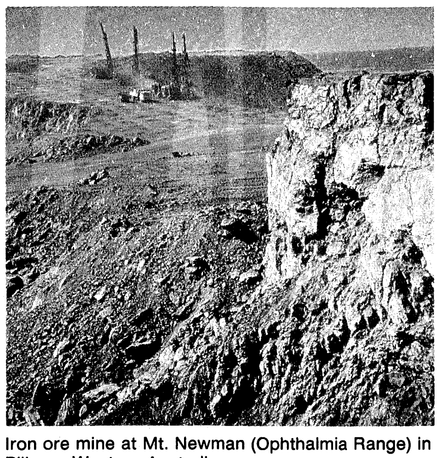
Pilate, Pontius (d. after AD 36), Roman prefect (governor or procurator) of Judaea (AD 26–36) under the emperor Tiberius; he presided at the trial of Jesus and gave the order for his crucifixion.

According to the traditional account of his life, Pilate was a Roman equestrian (knight) of the Samnite clan of the Pontii (hence his name Pontius). He was appointed prefect of Judaea through the intervention of Sejanus, a favourite of the Roman emperor Tiberius. Protected by Sejanus, he incurred the enmity of the Jews by insulting their religious sensibilities, as when he hung worship images of the Emperor throughout Jerusalem and had coins bearing pagan religious symbols minted. After Sejanus' fall (AD 31), Pilate was exposed to sharper criticism from the Jews, who may have capitalized on his vulnerability by obtaining a legal death sentence on Jesus (John 19:12). The Samaritans reported him to Vitellius, legate of Syria, after he had attacked them on Mt. Gerizim (AD 36). He was then ordered back to Rome to stand trial for cruelty and oppression, particularly on the charge that he executed men without proper trial. According to an uncertain 4th-century tradition, Pilate killed himself on orders from Emperor Caligula in AD 39.

Judgments of the man himself must be made inferentially, almost entirely on the basis of later Jewish and Christian writings, chiefly Josephus and the New Testament. Josephus' references appear to be consistent. They seem to picture a strong-willed, strict, authoritarian Roman leader who was, nevertheless, both rational and practical and who knew how far he should go in a given case. For example, Josephus tells us that "in order to abolish Jewish laws," and with the intent of diminishing privileges Jews had hitherto enjoyed, Pilate ordered his troops to encamp in Jerusalem and sent them into the city with images of the emperor attached to their ensigns. When the Jews demonstrated in Caesarea, Pilate's city of residence, he threatened them with death unless they desisted; but when the Jews showed their readiness to die, he ordered the images removed. Josephus states his inferential judgment that Pilate "was deeply affected with their firm resolution," suggesting his own strength of character.

The New Testament, however, suggests a weak, vacillating personality. Would the mob be just as happy if he released Jesus instead of Barabbas on the feast day (Mark 15:6 ff.)? Pilate weakly capitulates. His wife sends him word of her dream (Matt. 27:19), and Pilate abdicates his responsibility to the emperor. In the Fourth Gospel, Pilate is depicted as having accepted the Christian interpretation of the meaning of Jesus (John 19:7–11), and he rejects the Jews' reminder that Jesus has merely said that he is "the king of the Jews" (19:21). Clearly, as an index to the character and personality of Pilate, the New Testament is devastating. But it is preoccupied with concerns of the nascent Christian communities, increasingly making their way among the Gentiles and anxious to avoid giving offense to Roman authorities. Eventually, in Christian tradition, Pilate and his wife became converts, and the latter is a saint in the Eastern Church.

Pilbara, also spelled PILBARRA, region of northwestern Western Australia, extending south from the De Grey River to the Ashburton River and as far as 450 mi (720 km)



Iron ore mine at Mt. Newman (Ophthalmia Range) in Pilbara, Western Australia
By courtesy of the Australian Information Service

inland. It occupies an area of about 197,000 sq mi (510,000 sq km) and averages 1,000 ft (300 m) in elevation. It includes one of Australia's hottest spots at Marble Bar, where daytime temperatures from October to May often exceed 120° F (49° C); in a record heat wave in 1923–24, temperatures reached 100° F or more on 170 consecutive days.

Gold, discovered in the region in 1883, led to the declaration of the Pilbara (1888) and West Pilbara (1895) goldfields. Tin was found in 1899, and deposits of copper, talc, manganese, magnesium, silver, beryllium, and columbite have also been worked. There still remain valuable deposits of asbestos at Wittenoom Gorge in the Hamersley Range and tantalite at Wodgina.

Massive development of the iron industry, based on ore mined in the Hamersley Range (*q.v.*), brought an influx of population to the area in the 1970s. One of the principal mines is Mt. Newman, from which ore is shipped by rail northward to Port Hedland. Another railroad carries ore from Paraburdoo and Mt. Tom Pierce to Dampier, a newly built ore port west of old Roebourne. Salt is produced at Dampier and Port Hedland.

The Pilbara forms a statistical division comprising four shires: East and West Pilbara, Roebourne, and Port Hedland. Pop. (1981) 47,284.

pilchard, a species of sardine (*q.v.*) found in Europe. It is the local name in Great Britain and elsewhere.

Pilcher, Percy Sinclair (b. January 1866—d. Oct. 2, 1899, Leicestershire, England), British engineer, aviation pioneer, and glider experimenter. He began the study of heavier-than-air flight in 1895 under the influence of Otto Lilienthal, whom he twice visited in Germany.

In 1895 Pilcher built his first glider, the *Bat,* which he modified after Lilienthal's ideas and used in many successful glides. His second machine, the *Beetle,* was also built in 1895, and his third, the *Gull,* in 1896. With his fourth glider, the *Hawk* (1896), Pilcher achieved his most productive flying. It was a monoplane, with rear fin and tail plane and a wheeled undercarriage, controlled in the Lilienthal manner of swinging the torso and legs from a hanging position between the wings.

He then turned his attention to the problem of powered flying. He had almost completed his first powered machine—for which he had also built the engine—when on Sept. 30, 1899, the *Hawk* broke up in the air when Pilcher was gliding in it at Stanford Park, near Market Harborough. Two days later he died from his injuries.

Pilcomayo River, Spanish RÍO PILCOMAYO, chief western tributary of the Paraguay River, south central South America. It rises in the eastern Andes Mountains, in Bolivia, and flows in a southeasterly direction through the Gran Chaco plains of Paraguay to join the Paraguay River opposite Asunción, after a course of 1,550 mi (2,500 km). Its lower course (about 410 mi), used for navigation by small craft, flows through a number of small channels separated by bars and shifts direction with each flood season. The Pilcomayo (Guaraní: "River of the Birds") forms part of the international border (delimited in 1945) between Formosa Province (Argentina) and Paraguay.

pile, in textiles, the surface of a cloth composed of an infinite number of loops of warp threads, or else of an infinite number of free ends of either warp or of weft, or filling, threads that stand erect from the foundation or ground structure of the cloth. In looped pile the loops are uncut; in cut pile the same or similar loops are cut, either in the loom during weaving or by a special machine after the cloth leaves the loom.

Velvet is a short-pile fabric and plush a long-pile fabric, both of which have pile formed by warp threads. Velveteen is fabric with pile formed of filling threads that have been cut.

Among the loop-pile fabrics are Brussels tapestry, imitation Brussels carpeting, and Moquettes. In some cases the surfaces of carpets, such as Wilton and Axminster, are formed of cut pile; in others, both looped and cut pile appear on the surface of the same fabric. Imitation seal and other furs are pile fabrics. The surfaces of pile fabrics may have decorative designs appearing in both kinds of pile and in several colours.

pile, in building construction, a postlike foundation member used from prehistoric times. In modern civil engineering, piles of timber, steel, or concrete are driven into the ground to support a structure; bridge piers may be supported on groups of large-diameter piles. On unstable soils, piles are indispensable building supports and may also be used on stable ground when exceptionally large structural loads are involved. Piles are driven into the ground by pile drivers, machines consisting usually of a high frame with appliances for raising and dropping a pile hammer or for supporting and guiding a stream or air hammer.

pile (disease): *see* hemorrhoid.

Pilea, genus of herbaceous creeping plants in the nettle family (Urticaceae) but lacking the stinging hairs typical of that family. Of the more than 200 species widespread in temperate and tropical regions, a few are useful as border-edging plants in warm areas and many varieties are available as indoor pot plants and for hanging baskets.

Especially popular are the artillery plant (*P. microphylla*), with fine fernlike foliage and anthers that forcefully expel their pollen when mature; aluminum plant, or watermelon pilea (*P. cadierei*), with silvery markings on glossy dark green leaves; and friendship plant, or panamiga (*P. involucrata*), with quilted bronzy leaves.

One of several basket plants called Creeping Charlie, or Swedish Ivy, is *P. nummulariifolia,* with small, round, quilted leaves and a vigorous trailing habit. Giant baby tears (*P. depressa*), of similar habit, has small, smooth green leaves.

pileus, close-fitting, brimless hat worn by the ancient Romans and copied from the Greek sailor's hat called the *pilos.* In Roman times the head was generally left uncovered, but

Man wearing a pileus, detail of a Greco-Roman statue

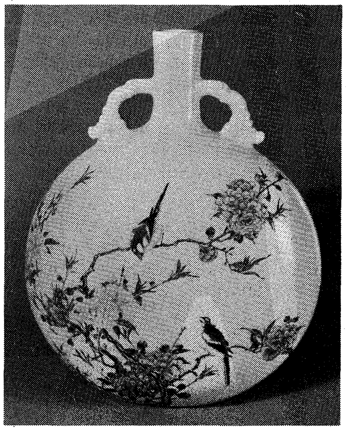
The Mansell Collection

commoners and freed slaves sometimes wore the felt pileus.

The hat was again popular during the Renaissance, especially in Italy, when it was square or rounded and made of black or red velvet or felt. The zucchetto and the biretta, worn by some orders of clergy, developed from the pileus.

pileworm (mollusk): *see* shipworm.

pilgrim bottle, vessel with a body varying from an almost full circle, flattened, to a pear shape, with a shortish neck, spreading foot and, generally, two loops on the shoulders.



Porcelain pilgrim bottle, Ch'ing dynasty, Yung-cheng period (1723–35); Percival David Collection

By courtesy of the Percival David Foundation of Chinese Art

Through the loops either a chain or cord was passed for carrying the bottle or for maintaining the stopper in place.

Pilgrim bottles date to ancient Roman times in the West and to 7th-century China in the East. They were made in a wide range of materials, including earthenware, porcelain, silver, and glass, and also in more perishable materials such as leather. Originally, these vessels may have been carried by travelers on their journeys; but the ones that have survived are so sumptuous that their function was probably purely ornamental, or, if they were used, it must have been—as in the case of some of the traveling tea or coffee sets in Meissen—exclusively by the very wealthy. Pottery pilgrim bottles are found in China from the T'ang dynasty (618–907), possibly imitations of even earlier metal prototypes dating as far back as the Chou dynasty (1111–255 BC). In 16th-century Europe, metal pilgrim bottles—generally of silver or silver gilt and probably of Chinese inspiration—were made mainly in Augsburg, Ger.; they were also made in coloured glass (generally green) with ormolu, or gilded brass, mounts. Along with the Chinese blue-and-white Ming (1368–1644) pilgrim bottles, the most famous are the pear-shaped stoneware bottles made at Meissen by Johann Friedrich Böttger.

Pilgrim Fathers, in American colonial history, settlers of Plymouth (*q.v.*), Mass., the first permanent colony in New England (1620). Of the 102 colonists, 35 were members of the English Separatist Church (radical faction of Puritanism) who had earlier fled to Leyden, the Netherlands, to escape persecution at home. Seeking a more abundant life along with religious freedom, the Separatists negotiated with a London stock company to finance a pilgrimage to America. Approximately two-thirds of those making the trip aboard the *Mayflower* (*q.v.*) were non-Separatists, hired to protect the company's interests; these included John Alden and Myles Standish.

These first settlers, initially referred to as the Old Comers and later as the Forefathers, did not become known as the Pilgrim Fathers until two centuries after their arrival. A responsive chord was struck with the discovery of a manuscript of Gov. William Bradford referring to the "saints" who had left Holland as "pilgrimes." At a commemorative bicentennial celebration in 1820, orator Daniel Webster used the phrase Pilgrim Fathers, and the term became common usage thereafter.

Pilgrim Festivals, Hebrew SHALOSH REGELIM, in Judaism, the three occasions on which male Israelites were required to go to Jerusalem to offer sacrifice at the Temple and bring offerings of their produce from the fields. In the synagogue liturgy, special Psalms (called collectively Hallel) are read and prayers are recited that vary with the nature of the festival. Thus, the Song of Solomon is read on Passover (*q.v.*), the Book of Ruth on Shavuot (*q.v.*), and Ecclesiastes on Sukkot (*q.v.*).

pilgrimage, in Christianity, journey to a saint's shrine or other sacred place, undertaken for a variety of motives: to gain supernatural help; as an act of thanksgiving or penance; for the sake of devotion. Records indicate that pilgrimages were made to Jerusalem as early as the 2nd century; and excavations in the 1940s at St. Peter's Basilica in Rome unearthed a 2nd-century memorial to the Apostle with numerous scratched inscriptions of the 2nd and 3rd centuries, evidencing acts of piety. The Roman liturgical calendar of the year AD 354 lists 29 local sanctuaries of the saints at which the faithful gathered annually. The travel memoir of Etheria (*c.* AD 400), a Spanish nun, testified to a system of guides and lodgings for those visiting the Palestinian holy sites. In Britain, Bede, the Venerable (died 735), a church historian, catalogued visits to graves of several saints from the 5th to the 8th century.

The medieval pilgrim began his journey with a blessing by a priest. His garb was recognizable, and on his return trip he would wear on his hat the badge of the shrine visited. Along the way he would find hospices set up specifically for pilgrims. The chief attractions for pilgrims in medieval times were the Holy Land, Santiago de Compostela in Spain, and Rome; but there were hundreds of pilgrim resorts of more local reputation, including the tombs of St. Francis (died 1226) in Assisi, Italy; of St. Martin (died 397) in Tours, Fr.; of St. Boniface (died 754) in Fulda, Ger.; of Thomas Becket (died 1170) at Canterbury, Eng.; and of St. Patrick at Downpatrick, Ire.

Not all churchmen approved entirely of pilgrimages. Some warned against excesses and questioned the value of the practice, while others questioned the authenticity of some of the relics.

Though many medieval centres still attract Roman Catholic pilgrims, the more recent shrines of St. Francis Xavier (died 1552) in Goa, India; of the Shroud of Turin (1578) at Turin, Italy; of St. Anne de Beaupré (1658) in Canada; of St. Jean-Baptiste-Marie Vianney (died 1859) at Ars and of St. Thérèse de Lisieux (died 1897) at Lisieux, both in France; and the Marian centres of Our Lady of Guadalupe (1531) in Mexico, of La Salette (1846) and Lourdes (1858) in France, and of Fâtima (1917) in Portugal have grown steadily in importance.

Members of the Eastern Orthodox faith commonly make pilgrimages to celebrated monasteries to ask for spiritual and practical help from the holy men (*startsy*).

The attitude of the 16th-century Protestant Reformers found expression in 1530 in the Augsburg Confession, which portrayed pilgrimages as "childish and useless works." Although modern Protestants may visit such places as Martin Luther's grave at Wittenberg or the Wesleyan Memorial at Epworth, Lincolnshire, such visits are regarded neither as a Christian duty nor as devotional acts to which spiritual benefits are attached; nor are the places viewed as shrines where miracles may occur.

Pilgrimage of Grace (1536), a rising in the northern counties of England, the only overt immediate discontent shown against the Reformation legislation of King Henry VIII. Part of the resentment was caused by attempts, especially under Henry's minister Thomas Cromwell, to increase government control in the north; there was an element of agrarian opposition to enclosures for pasture; and there was a religious element, aroused especially by the dissolution of the monasteries, then in progress. The arrival of commissioners sent by Cromwell to collect a financial subsidy and to dissolve the smaller monasteries triggered the rising. In Louth in Lincolnshire there were riots on October 1, and commissioners were attacked. The rebels occupied Lincoln, demanding an end to the dissolution, revenge on Cromwell, and the dismissal of heretical bishops. But Henry refused to treat with men in arms against him (although professing their loyalty), and the Lincolnshire movement collapsed on October 19. Meanwhile, a more serious rising had begun in Yorkshire, led by Robert Aske, a country gentleman and lawyer. Aske took York and by October 24 was supported by about 30,000 armed men and by magnates such as Edward Lee, archbishop of York, and Thomas Darcy, Baron Darcy of Templehurst. The government had insufficient troops in the area, but on October 27, at Doncaster Bridge, Thomas Howard, the 3rd duke of Norfolk, temporized with Aske, playing for time until adequate forces could be assembled. At a council at Pontefract on December 2, the rebels drew up their demands, similar to those of the Lincolnshire men but including a return of England to papal obedience and the summoning of a Parliament free from royal influence. To these Norfolk, on December 6, made vague promises and offered a full pardon, whereupon Aske naively assumed he had gained his objectives and persuaded his followers to disperse. Sporadic riots in January and February 1537 enabled the government to deal with the troubles piecemeal; about 220–250 men were executed, including Darcy and Aske. The pilgrimage achieved nothing and received no support from other parts of the country.

Pilgrim's Progress, religious allegory by the English writer John Bunyan, a symbolic vision of the good man's pilgrimage through life, at one time second only to the Bible in popularity. Part I (1678), in which Christian travels from the City of Destruction to the Celestial City, is presented as a dream. His anguished struggle toward salvation, though it dominates Part I, does not totally eclipse other, contrasting, qualities. Written in homely, yet dignified biblical prose, the work has some of the qualities of a folktale; and in its humour and realistic portrayals of Mr. Worldly Wiseman, Faithful, Hopeful, Pliant, and Obstinate, it anticipates the 18th-century novel. In Part II (1684), which deals with the effort of Christian's wife and sons to join him, the psychological intensity is relaxed and the capacity for humour and realistic observation becomes more evident. Christian's family has a somewhat easier time because Christian has smoothed the way, and even such companions as Mrs. Much-afraid and Mr. Ready-to-halt manage to complete the journey.

Pilgrims' Way, the North Downs trackway in southern England. It is a famous prehistoric route between the English Channel and the chalk heartland of Britain in Wessex and survives as minor roads or as bridle paths in many areas. Both a ridgeway and a lower terrace way beneath the chalk escarpment can be traced. Such tracks shifted seasonally with changing ground conditions. The name, not attested before the 18th century, was given further currency by the poet Hilaire Belloc. In *The Old Road* (1904), he posited a continuous prehistoric track between Winchester and Canterbury revived by pilgrims journeying to St. Thomas Becket's shrine. Pilgrims possibly did use it, although the London–Canterbury road celebrated earlier by Chaucer was the frequented route. Belloc's "Pilgrims' Way," however, does not coincide with the prehistoric trackway west of the Hog's Back in Surrey.

pili nut, the nut of any tree of the genus *Canarium* (family Burseraceae), particularly the edible nut of the Philippine tree *Canarium ovatum*. In the South Pacific the pili nut is a major source of fat and protein in the diet. The densely foliated tropical tree grows to 20 metres (65 feet) in height and produces up to 32 kilograms (70 pounds) of nuts annually. The fruit is 6–7 centimetres (2¼–3 inches) long, with a hard, thick-shelled, triangular nut surrounded by a small amount of pulp. The pulp is edible when cooked, but the main food source is the roasted nut, similar in shape and taste to the almond. The uncooked nuts are used as a laxative. The shell is removed by dipping the nut in hot water. Pili nuts are high in fat content and easily digestible. The sweet oil is used in confectionary. Roasted and powdered pili nuts are sometimes used to extend chocolate.

Pīlībhīt, town, administrative headquarters of Pīlībhīt district, Uttar Pradesh state, northern India, northeast of Bareilly, on a tributary of the Rāmganga River. It is a rail junction and is linked with Bareilly by road. Sugar processing is the largest industry, and there is an active trade in agricultural products, both locally and with Nepal. On the town's western outskirts is a large 18th-century mosque built by Ḥāfiz Raḥmāt Khān, the town's founder.

Pīlībhīt district, 1,352 sq mi (3,504 sq km) in area, lies on the Ganges Plain near the Himalayan foothills and adjoins Nepal on the northeast. It is watered by the Sārda Canal and by tributaries of the Ganges River. There are forests in the east. The most productive land and the greatest population density are in the district's extreme south. Crops include rice, wheat, gram, barley, and sugarcane. Pop. (1981) town, 88,548; district, 1,008,312.

Pílion, Óros (Greece): *see* Pelion, Mount.

Pilipinas: *see* Philippines.

Pilipino language, standardized form of Tagalog, and one of the two official languages of the Philippines (the other being English). It is a member of the Austronesian language phylum.

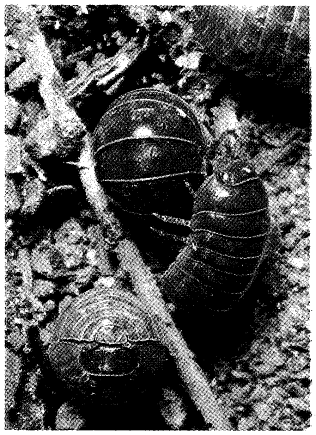
Tagalog is the mother tongue for nearly 25 percent of the population and is spoken as a first or second language by more than half of all Filipinos. The mandatory teaching of Pilipino in public schools since 1973 and the extensive literature in Tagalog has contributed to its increased use in the popular media.

Pilkington, Francis (d. 1638, Chester, Cheshire, Eng.), English composer of lute songs and madrigals.

Pilkington took a bachelor of music degree from Oxford in 1595, became a cantor at Chester cathedral in 1602, and a minor canon in 1612. His *First Book of Ayres* (1605) contains 21 songs for four voices or for solo voice and lute and a *Pavin for Lute and Bass Viol*. He published sets of madrigals in 1613 and 1624. Though not of the first rank, they are pleasing and well constructed. Particularly known is the madrigal "O softly singing lute," for six voices. He also composed a number of attractive lute solos.

pill bug, any of the terrestrial crustaceans of the families Armadillididae and Armadillidae (order Isopoda). When disturbed, the pill bug rolls itself up into a tiny ball. Like the related sow bug (*q.v.*), it is sometimes called the wood louse. For mollusks also known as pill bugs, *see* chiton.

The common pill bug *Armadillidium vulgare*

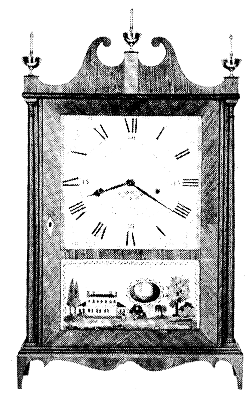


Pill bugs (*Armadillidium vulgare*)
E.S. Ross

(family Armadillididae) is about 17 millimetres (0.7 inch) long. The gray body, with its plate-like segments, somewhat resembles a miniature armadillo, an armoured mammal that also curls into a ball when disturbed. *A. vulgare* occurs in dry, sunny places, in leaf litter, and on the edges of wooded areas. Originally found in Europe, it now occurs worldwide. *A. nasatum,* native to northern Europe, has been introduced into North America. *Armadillo officinalis* (family Armadillidae), which attains lengths of 19 millimetres (0.75 inch), is native to southern Europe.

pillar, in architecture and building construction, any isolated, vertical structural member such as a pier, column, or post. It may be constructed of a single piece of stone or wood or built up of units, such as bricks. It may be any shape in cross section. A pillar commonly has a load-bearing or stabilizing function, but it may also stand alone, as do commemorative pillars. *See also* column.

pillar and scroll shelf clock, wooden shelf clock mass-produced in the United States



Pillar and scroll shelf clock by Eli Terry, 1816; in the Shelburne Museum, Vermont
By courtesy of the Shelburne Museum, Vermont

from the second decade of the 19th century onward. The rectangular case is topped by a scroll broken in the centre by an ornament such as an urn; on either side of the case is a vertical pillar topped by the same kind of ornament that breaks the scroll.

These clocks usually had a 30-hour wooden movement, using oak plates, laurelwood pillars, and black cherry wood gears, though these were later supplanted by brass around 1840, when that metal became cheaper. The clocks are usually associated with the name of Eli Terry (1772–1852), who gave them their definitive form.

Pillar of Fire, a white Holiness church of Methodist antecedence that was organized (1901) in Denver, Colo., U.S., as the Pentecostal Union by Alma Bridwell White, who married a Methodist minister. Her evangelistic fervour brought opposition from Methodist officials, which led to her withdrawal from the Methodist Church in 1917. At that time the church was renamed Pillar of Fire, and she was ordained bishop.

The church stresses holiness and sanctification by prayer and generally follows Methodist teachings. Women can occupy any ministerial office. The Pillar of Fire maintains several schools and conducts missions in Liberia. Headquarters, teacher-training facilities, and a publishing house are located in Zarephath, N.J., U.S.

Pillau (Russian S.F.S.R.): *see* Baltiysk.

Pillow Book, Japanese MAKURA NO SŌSHI (*c.* 1000), title of a book of reminiscences and impressions by the 11th-century Japanese court lady Sei Shōnagon (*q.v.*). Whether the title was generic and whether Sei Shōnagon herself used it is not known, but other diaries of the Heian period (794–1185) indicate that such journals may have been kept by both men and women in their sleeping quarters, hence the name. The entries in *Makura no sōshi,* although some are dated, are not in chronological order but rather are divided under such headings as "Amusing Things" and "Vexatious Things." A complete English translation of *Makura no sōshi* by Ivan Morris appeared in 1967 (*The Pillow Book of Sei Shōnagon*). The *Pillow Book* belongs to the genre of *zuihitsu* ("random jottings"). *Tsurezuregusa,* by Yoshida Kenkō (*q.v.*), is an outstanding 14th-century example of this genre.

pillow lace: *see* bobbin lace.

Pillsbury, Charles Alfred (b. Dec. 3, 1842, Warner, N.H., U.S.—d. Sept. 17, 1899, Minneapolis, Minn.), U.S. flour miller who built his company into one of the world's largest milling concerns in the 1880s.

After selling his share in a Montreal dry-goods business, Pillsbury went to Minneapolis in 1869 to join his uncle, John S. Pillsbury, who would later become the state's governor.

Staked by his uncle and his father, Pillsbury paid $10,000 for a one-third share of a small flour mill. A floundering enterprise, the mill used water power from the Falls of St. Anthony to produce 200 barrels of flour a day. Pillsbury installed purifiers, machines recently invented by Edmund La Croix, that could produce fine white flour from the district's hard spring wheat. The mill showed a $6,000 profit a year later. His was also the first American mill to use steam rollers instead of burr stones to crush the wheat.

In 1872, he founded C.A. Pillsbury & Co. and began purchasing and building more mills. By 1889, the Pillsbury mills produced 10,000 barrels a day.

Pillsbury had a share in getting low freight rates for Minneapolis, as well as in building up the railroad system that helped make Minneapolis the centre of the grain trade. To protect his supplies, he founded a grain elevator company that owned storage elevators throughout the Northwest.

In 1889, he sold his company to an English syndicate. He remained managing director of the combined Pillsbury-Washburn Flour Mills until his death.

Pillsbury was elected to the Minnesota state senate for five terms.

Pilnyak, Boris, pseudonym of BORIS ANDREYEVICH VOGAU, Pilnyak also spelled PILNIAK (b. 1894, Mozhaisk, Russia—d. 1937), Soviet writer of Symbolist novels and stories, prominent in the 1920s.

Pilnyak spent his childhood in provincial towns near Moscow, in Saratov, and in a village on the Volga river. He attended high school in Nizhny Novgorod and a commercial institute in Moscow. In his autobiography he stated that he began writing at the age of nine, but it was the publication of his novel *Goly god* (1922; *The Naked Year,* 1928) that brought him popularity. This book was a panorama of the Revolution and Civil War, seen through a series of flashbacks and close-ups encompassing all levels of society. Its fragmentary, chaotic style matched the character of the times he portrayed.

In 1926 he caused a scandal with his *Povest nepogashennoy luny* (*The Tale of the Unextinguished Moon*), a scarcely-veiled account of the death of Frunze, the famous military commander, during an operation. The issue of the magazine in which the tale was published was withdrawn immediately, and a new issue omitting it was put out. Pilnyak was compelled to recant, and the editorial board of the magazine admitted that it had committed a "gross error." Pilnyak was again in trouble in 1929, when he permitted an émigré publishing house in Berlin to publish his novel, *Krasnoye derevo* ("Mahogany"). The book, which included an idealized portrait of a Trotskyite Communist, was immediately banned in the Soviet Union.

Pilnyak's doubts and distaste with respect to Communist goals and methods were increasingly visible in his novels and stories. By the late 1920s he was the object of harsh official censure. In an attempt to redeem himself he wrote *Volga vpadayet v Kaspiyskoye more* (1930; *The Volga Falls to the Caspian Sea,* 1931), a novel glorifying the five-year plan on the theme of the construction of a Soviet dam. Pilnyak's ambivalence did not escape the authorities, and he fell into deeper disfavour. During 1937—at the height of the Stalin terror—his name and his works completely disappeared from Soviet literature. Nothing definite was learned concerning his fate until after Stalin's death, when official Soviet sources acknowledged that he had been arrested in 1937, placing the date of his death in the same year. Although Pilnyak was "posthumously rehabilitated," only in 1976 did a volume offering a very limited selection of his works appear.

Pilon, Germain (b. 1535, Paris—d. Feb. 3, 1590, Paris), French sculptor whose work, principally monumental tombs, is a transi-

Gisants of Catherine de Médicis and Henry II by Pilon, 1563–70; in the church of Saint-Denis, Paris
J.E. Bulloz

tional link between the Gothic tradition and the sculpture of the Baroque period.

A sculptor's son, Pilon was employed at the age of 20 on the decoration of the tomb of King Francis I at Saint-Denis. His earlier work clearly shows an Italian influence, but eventually he developed a more distinctively French expression by fusing elements from classical art, Gothic sculpture, and Michelangelo with the Fontainebleau adaptation of Mannerism, a style characterized by subjective conceptions, studied elegance, and virtuoso artifice.

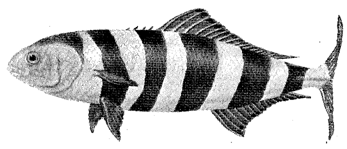
Pilon's best known works are funerary sculptures for Henry II. It was a custom of the period for men of high estate to assign their remains to more than one burial site—often one for the body, one for the heart, and one for the entrails. Pilon's monument for the heart of Henry II (*c.* 1561; Louvre) consists of three marble Graces of great elegance supporting an urn. It was perhaps based on a design by Primaticcio. For the principal tomb of Henry II and Catherine de Médicis at Saint-Denis (1563–70), also designed by Primaticcio, Pilon created four bronze corner figures and, above, the kneeling figures of the King and Queen in bronze. Most important, however, are the seminude, marble gisants, or figures of the royal pair recumbent in death. Considered by some to be his most sublime achievement, the gisants are a Renaissance idealization of a Gothic convention and possess a depth of emotion that Pilon perhaps never again attained.

Sculptor royal from 1568, Pilon enjoyed a successful career as a portraitist, his most celebrated work in the genre being the kneeling figure of René de Birague (1583–85; Louvre). Appointed controller of the mint in 1572, in 1575 he brought eminence to French medal casting with a distinguished series of bronze medallions.

Pílos (Greece): *see* Pylos.

pilot fish (*Naucrates ductor*), widely distributed marine fish of the family Carangidae (order Perciformes). Members of the species are found in the open sea throughout warm and tropical waters.

The pilot fish is elongated and has a forked tail, a lengthwise keel on each side of the tail base, and a few small spines in front of the dorsal and anal fins. It grows to a length of about 60 centimetres (2 feet) and is distinctively marked with 5 to 7 vertical, dark bands



Pilot fish (*Naucrates ductor*)
Painting by Gilbert Emerson

on a bluish body. It is carnivorous and follows sharks and ships apparently to feed on parasites and leftover scraps of food.

pilot whale, also called BLACKFISH, or CAA'ING WHALE (*Globicephala*), any of a genus of slender whales belonging to the family Delphinidae, found in all oceans of the world except the Arctic and Antarctic. One to three species, all more or less similar, are recognized, depending on the authority. They are *G. melaena, G. macrorhyncha,* and *G. scammoni.* The pilot whale is also known as caa'ing whale because of a roaring sound it makes when stranded. It is black, usually with a lighter splash on the throat and chest, and has a round, bulging forehead; a short, beaklike snout; and slender, pointed flippers. Its length is usually about 4 to 6 metres (13 to 20 feet); males are larger than females.

The pilot whale is highly gregarious and lives in schools, sometimes of hundreds or

Pilot whale (*Globicephala melaena*) performing at Marineland of Florida
Appel Color Photography with Marineland of Florida

thousands of individuals. It feeds mainly on squid. In some areas it is hunted for meat and oil and in the Faeroe Islands is captured in schools, the hunters frightening and driving them ashore. Pilot whales have been kept in oceanariums and have been trained to perform.

Piloty, Karl (Theodor) von (b. Oct. 1, 1826, Munich—d. July 21, 1886, Ambach, Ger.), the foremost representative of the realistic school of painting in Germany.

Piloty was the younger brother of Ferdinand Piloty, a noted lithographer. His picture of "Seni at the Dead Body of Wallenstein" (1855) gained for the young painter the membership of the Munich Academy, where he became a professor. He executed a number of mural paintings for the royal palace in Munich, and for Baron von Schach he painted the celebrated "Discovery of America." In 1874 he was appointed keeper of the Munich Academy and was later ennobled by the King of Bavaria. Many of Piloty's pupils became distinguished painters.

Pilsen (Czechoslovakia): *see* Plzeň.

Piłsudski, Józef (Klemens) (b. Dec. 5, 1867, Żułów, Pol., Russian Empire—d. May 12, 1935, Warsaw), Polish revolutionary and statesman, the first president (1918–22) of the newly independent Poland established in November 1918.

Early life and political activities. Piłsudski was the second son of an impoverished Polish nobleman. His mother, *née* Maria Billewicz, inspired him with hatred for the Russian imperial regime, which was treating the Poles with great harshness after their insurrection of 1863. On leaving the secondary school in Wilno (modern Vilnius), Piłsudski studied medicine at Kharkov in 1885 but was suspended as politically suspect in 1886. Returning to Wilno, he consorted with young Socialists and tried to read Karl Marx's *Kapital,* but its abstract argument proved uncongenial. Arrested in March 1887 on a false charge of plotting the assassination of the tsar Alexander III, he was banished to eastern Siberia for five years.

Piłsudski returned in 1892, determined to organize an insurrection and to work for the reestablishment of Poland's independence. He joined the newly founded Polish Socialist Party (PPS), of which he soon became a leader. He started a clandestine newspaper, *Robotnik* ("The Worker"), in Wilno. In July 1899 he married, in a Protestant church, the beautiful Maria Juszkiewicz, the divorced wife of a Polish civil engineer, and moved to Łódź, where he continued to edit and print his paper.

In February 1900 he was incarcerated by the Russians in the Warsaw citadel. He feigned insanity so successfully that he was transferred to a military hospital in St. Petersburg, from which he escaped in May 1901. He took refuge in Cracow in Austrian Poland, but in April 1902 he was back in Russian Poland looking after the party organization.

When the Russo-Japanese War broke out in February 1904, Piłsudski went to Tokyo to solicit Japanese assistance for an insurrection in Poland. He had been preceded by Roman Dmowski, his rival in the patriotic movement, who had told the Japanese that Piłsudski's plan was impracticable. The two Polish leaders agreed to disagree. Piłsudski returned clandestinely to Russian Poland to help direct the revolutionary movement that was spreading throughout the empire. After the Russian revolution was put down late in 1905, a split occurred within the PPS: the left wing, which proposed to delete from the party's program the stipulation that its main aim was an independent Poland, broke with Piłsudski's group, which insisted on that stipulation.

Attempts to organize a Polish army. Aware of the Russian Empire's structural weakness and foreseeing a European war, Piłsudski concluded that it was imperative to organize the nucleus of a future Polish army. In 1908 he formed a secret Union of Military Action—financed with a sum of money stolen from a Russian mail train by an armed band led by Piłsudski himself. In 1910, with the help of the Austrian military authorities, he was able to convert his secret union into a legal Union of Riflemen, actually a school for Polish officers. At a meeting of Polish sympathizers in Paris in 1914, he declared that war was imminent and that

> . . . the problem of the independence of Poland will be definitely solved only if Russia is beaten by Austria-Hungary and Germany, and Germany vanquished by France, Great Britain and the United States; it is our duty to bring that about.

World War I justified Piłsudski's prediction. Until 1916 the three brigades of the Polish Legion, technically under Austro-Hungarian command, distinguished themselves against the Russians. On Nov. 5, 1916, Germany and Austria-Hungary, short of manpower, proclaimed the independence of Poland, hoping that Polish divisions could be deployed on the Eastern Front so that German divisions could be moved to the west. Piłsudski, appointed head of the military department of the newly created Polish council of state, accepted the idea of a Polish army on condition that it be part of a sovereign Polish state. His position was unexpectedly reinforced by the Russian Revolution of March 1917. The German government, however, refused to bind itself as to Poland's future, demanding instead that the existing Polish units should swear "fidelity in arms with the German and Austrian forces." Piłsudski, refusing to comply, was arrested in July 1917 and imprisoned in Magdeburg.

An independent Poland. Released after the German collapse in the west, Piłsudski arrived in Warsaw on Nov. 10, 1918, as a national hero. Four days later he was unanimously accepted as head of state and commander in

Piłsudski
Culver Pictures

chief of the Polish Army. From that moment he ceased to be the man of a party, though his main support came from the left and from the centre; the right saw its leader in Dmowski, who had been heading the Polish National Committee in Paris and was now appointed by Piłsudski to be Poland's first delegate at the peace conference.

Piłsudski devoted himself to protecting Poland against the Russian Red Army, which was trying to fight its way into Germany in order to consolidate the revolution there. He led the Polish forces far to the east, occupying large areas that had belonged to Poland before the 18th-century partitions. He envisioned a federal state comprising Poles, Lithuanians, and Ukrainians, whereas Dmowski argued that these areas should simply be incorporated within a unitary Poland. In 1920 a counteroffensive by the Red Army forced the Poles to retreat westward almost to the suburbs of Warsaw, but Piłsudski, made marshal of Poland on March 19, conceived and directed a manoeuvre that in August brought victory to Poland.

After the adoption of a democratic constitution and a new general election, Piłsudski transmitted his powers on Dec. 14, 1922, to his friend Gabriel Narutowicz, the newly elected president of the republic, who two days later was assassinated. Stanisław Wojciechowski, another of Piłsudski's old colleagues, was next elected president, the marshal agreeing to serve as chief of the general staff. When a right-wing government assumed power, Piłsudski resigned his post on May 29, 1923, and went into retirement at Sulejówek, near Warsaw, with his second wife, *née* Aleksandra Szczerbińska, and his two daughters.

Piłsudski became disillusioned with the working of the parliamentary system, and on May 12, 1926, during a time of economic depression, he marched on Warsaw at the head of a few regiments. Wojciechowski and his government resigned two days later. The parliament elected Piłsudski president of the republic on May 31, but he refused the honour, and another of his old friends, Ignacy Mościcki, was elected instead. In the new government Piłsudski assumed the Ministry of Defense, which he held until his death. During the ensuing years he was the major influence behind the scenes, especially in the field of foreign policy.

Later years. With few exceptions, Piłsudski's former Socialist friends abandoned him and joined a centre-left coalition, which in the summer of 1930 started a mass campaign to overthrow his "dictatorship." Piłsudski's reaction was ruthless; to "cleanse" political life, he had 18 party leaders arrested and imprisoned in the fortress of Brześć. Though all of them were subsequently released, and their political parties were not dissolved, the country was ruled by Piłsudski's men. The most prominent among them was Col. Józef Beck, Piłsudski's former *chef de cabinet,* who became deputy foreign minister in December 1930 and foreign minister in November 1932.

When Hitler came to power in Germany on Jan. 30, 1933, Piłsudski sent to Paris a secret emissary, Count Jerzy Potocki, his former aide-de-camp, to find out whether France, Poland's ally from 1921, would operate in joint military action against Germany. The latter had been openly rearming in flagrant violation of the Treaty of Versailles. The French leadership answered in the negative, and consequently Piłsudski accepted Hitler's suggestion of a 10-year German-Polish nonaggression agreement (Jan. 24, 1934).

To show that Poland's intentions were above suspicion, Beck was sent to Moscow in February, and the existing Soviet-Polish nonaggression treaty was prolonged to Dec. 31, 1945. Later, Hitler repeatedly suggested a German-Polish alliance against the U.S.S.R., but Piłsudski took no notice of the proposal; he also declined to meet with Hitler. Piłsudski sought to gain time, believing that Poland should be ready to fight when the necessity arose. Such were the last instructions he gave to Beck. Shortly afterward, he died in Warsaw of cancer of the liver. He was buried in a crypt of the Wawel Cathedral in Kraków, among Polish kings.

A romantic revolutionary, a great soldier without formal military training, a man of rare audacity and willpower, as well as of great insight into European politics, Piłsudski was nevertheless poorly equipped to rule a modern state. He left Poland undeveloped economically and with an army that was ready to fight heroically but was doomed because of its composition and inadequate armament.

(K.M.S.)

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Piltdown man (*Eoanthropus dawsoni*), proposed species of prehistoric man whose fossil remains, later proved fraudulent, were discovered in England in 1912. The forgery was sufficiently convincing to generate scholarly controversy that lasted about 40 years. Apparently fossilized fragments of cranium and jawbone were found by Charles Dawson in a gravel formation at Barkham Manor, on Piltdown Common near Lewes, Eng. Together with these were fossil remains of extinct animals, which suggested an early Pleistocene age for the site, and worked implements of bone and flint, the latter attributable to a very early human culture (pre-Abbevillian). In 1926 the gravels were found to be much less ancient than supposed, and in 1953 and 1954, as an outcome of later discoveries of fossil man and intensive re-examination, the remains were shown to be skillfully disguised fragments of a quite modern human cranium and an ape (orangutan) jaw fraudulently introduced into the shallow gravels, as were the implements. The animal bones were found to be genuine remains of extinct species, but they were not of British provenance.

As long as the remains were accorded a high antiquity, Piltdown man seemed a feasible alternative to *Homo erectus* (then known from scanty remains as *Pithecanthropus*) as an ancestor for modern man. From 1930, more finds of *Pithecanthropus*, the discoveries of the more primitive *Australopithecus*, and further examples of Neanderthal man left Piltdown man completely isolated in the evolutionary sequence. The eventual exposure of the fraud clarified the sequence of human evolution by removing the greatest anomaly in the fossil record. At the same time, a series of valuable new tests were developed for paleontological study. Evidence sufficient to name those responsible for the fraud has not been found, however, and the issue remains unsolved.

For scientific papers dealing with all aspects of the exposure, see *Bulletin of the British Museum* (*Natural History*), vol. 2, no. 3 and 6. For accounts of the finds at Piltdown and for discussions of the authorship of the deception and the tests carried out, see J.S. Weiner, *The Piltdown Forgery* (1955), and Ronald Millar, *The Piltdown Men* (1972).

To make the best use of the Britannica, consult the INDEX *first*

Pima, North American Indians who traditionally lived along the Gila and Salt rivers in Arizona in what was the core area of the prehistoric Hohokam culture (*q.v.*). The Pima, who speak a Uto-Aztecan language and call themselves the "River People," are usually considered to be the descendants of the Hohokam, although this has not been proved. Like their presumed ancestors, the Pima originally were sedentary farmers who lived in one-room houses and utilized the rivers for irrigation. Some hunting and gathering were done to supplement the diet; but in drought years, which occurred on the average of one year in five, the crops of corn (maize) and other vegetables would fail, and hunting and gathering became the sole mode of subsistence. During these dry years jackrabbits and mesquite beans were the dietary staples.

"Pima *Ki,*" photograph by Edward S. Curtis, 1907; from *The North American Indian*
Courtesy of the Edward E. Ayer Collection, The Newberry Library, Chicago

The intensive farming of the Pima made possible larger villages than were feasible for their neighbours and relatives, the Papago. With larger communities came a stronger and more complex political organization. In early Spanish times the Pima possessed a strong tribal organization, with a tribal chief elected by the chiefs of the various villages. The tribal chief attained his status through his personal qualities rather than through birth, and this was true of local chiefs also. The village chief, aided by a council of all adult males, had the responsibilities of directing the communal irrigation projects and of protecting the village against alien tribes, notably the Apache. Planting and harvesting of crops were handled as a cooperative venture.

From the time of their earliest recorded contacts with whites, the Pima have been regarded as a friendly people. At the time of the California Gold Rush (1849–50), the Pima often gave or sold food to white emigrants and gold seekers and provided them with an escort through Apache territory. During the Apache wars (1861–86), Pima served as scouts for the U.S. Army. Such close contacts with white culture contributed to disintegration of aboriginal Pima culture.

In the late 20th century the Pima numbered about 10,000. With their traditional neighbours, the Maricopa, a group of Yuman Indians, the Pima live chiefly on the Gila River and Salt River reservations in Arizona.

pimiento, any of various mild peppers of the genus *Capsicum. See* pepper.

Pimiko, also spelled PIMIKU: *see* Himiko.

pimpernel (genus *Anagallis*), any of several plants of the primrose family (Primulaceae), consisting of about 30 species of low herbs mostly native to western Europe.

Most species are prostrate in habit. The plant has leaves that are opposite or in whorls and small, solitary flowers that are short-stalked and bell-shaped. The five-lobed corolla (the structure formed by the petals) is red, pink, or blue.

The scarlet pimpernel (*A. arvensis*), also called poor-man's weatherglass, is an annual native to Europe, Asia, and North America. It grows 6 to 30 cm (2.4 to 12 inches) tall and has red, pink, or blue flowers.

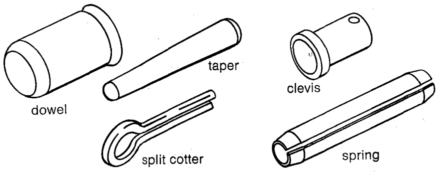
pin, the small, pointed and headed piece of stiff wire used to secure clothing or papers. In mechanical and civil engineering the term pin, or more properly pin fastener, designates a peg- or boltlike device designed to fasten machine and structural components together or to keep them properly aligned.

Bronze pins 2 to 8 inches (5 to 20 cm) long with gold heads or decorative gold bands have been found in ancient Egyptian tombs. The Greeks and Romans used pins or brooches similar to the safety pin for fastening their clothing. In medieval Europe, skewers of wood, bone, ivory, silver, gold, or brass were used, elaborately fashioned for persons of wealth and simply made of wood for common people. By the end of the 15th century the manufacture of pins from drawn iron wire was well established, particularly in France.

Pinmaking machines were introduced early in the 19th century. In New York John Ireland Howe founded a successful factory with his improved machines, while in Birmingham, Eng., Daniel Foote-Taylen profitably applied the pinmaking patents of Lemuel W. Wright. Subsequently many pinmaking machines were developed, including devices for thrusting finished pins through crimped papers. Modern machines are completely automatic.

pin fastener, a steel pin, usually cylindrical, that can keep machine parts in proper alignment or fasten them together. The illustration shows several types of pin fasteners in common use.

Hardened and precisely shaped dowel pins are used to keep machine components in accurate alignment; they are also used as location guides for adjacent machine parts and to



Several types of pin fasteners

keep the two sections of a punch and die in alignment.

The taper pin provides a cheap, convenient method of fixing the hub of a gear or a pulley to a shaft. The pin is driven into a tapered hole that extends radially through the hub and shaft.

The split cotter pin is used to prevent nuts from turning on bolts and to keep loosely fitting pins in place. The head of the nut has radial slots aligned with one of the radial holes in the bolt. The pin is a loose fit in the hole and is kept in place by spreading the ends. The clevis pin is a fastening device with a flange at one end and is kept in place by a cotter pin inserted through a hole in the other end.

The spring pin is a split tube with a slightly larger diameter than the hole into which it is placed. The pin is compressed when driven into the hole and exerts a spring pressure against the wall of the hole to create a frictional locking grip. These pins can be removed and reused without appreciable loss of effectiveness; they are widely used for attaching lightly loaded pulleys and gears to shafts.

Groove pins are solid pins with longitudinal grooves produced by upsetting the metal so that it interferes with the walls of the hole when the pin is driven in.

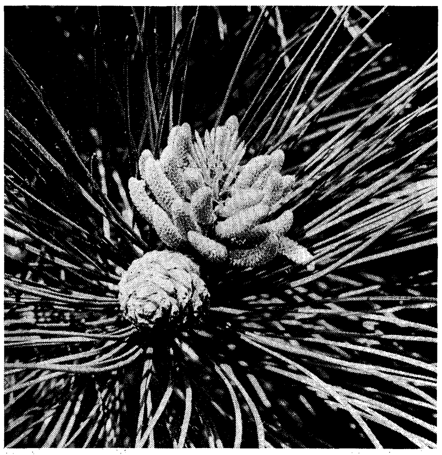
Pin-hsien, Pinyin BINXIAN, city in Heilungkiang *sheng* (province), China, situated on the eastern outskirts of Harbin (Ha-erh-pin). It is the communications centre of a prosperous and productive agricultural district that supplies a large part of the foodstuffs, particularly grain and vegetables, for Harbin. In addition to its importance as a collecting and commercial centre, Pin-hsien has also developed a number of light industries, consisting principally of food processing, light engineering, the production of bricks and tiles, and woodworking. Pop. (1984 est.) 40,499.

pin oak, either of two species of North American ornamental and timber trees belonging to the red oak group of the genus *Quercus* in the beech family (Fagaceae). The term is especially given to *Quercus palustris,* found on bottomlands and moist upland soils in the eastern and central United States. Usually about 25 m (80 feet) tall but occasionally reaching 35 m (115 feet), the tree has a broad, pyramidal crown and drooping lower branches. Spurlike, slender branchlets stand out like pins on the trunk and larger limbs. The elliptical, glossy green leaves, measuring about 13 cm (5 inches) long, have five to seven deeply cut lobes and turn scarlet in autumn. The dark brown acorns are enclosed at the base in a thin, shallow cup.

The northern pin oak, or jack oak (*Q. ellipsoidalis*), also has pinlike branchlets but usually occurs on upland sites that are dry. Its ellipse-shaped acorns are nearly half enclosed in a scaly cup. The leaves become yellow or pale brown in autumn, often with purple blotches.

Pin-yin romanization: *see* Pinyin romanization.

Pinaceae, the pine family of conifers, 10 genera of trees (rarely shrubs) native to north temperate regions. Fir (*Abies*), *Keteleeria, Cathaya,* Douglas fir (*Pseudotsuga*), hemlock (*Tsuga*), spruce (*Picea*), golden larch (*Pseudolarix*), larch, or tamarack (*Larix*), cedar (*Cedrus*), and pine (*Pinus*) contain many species that are sources of timber, paper pulp, oils, and resins. Some are cultivated as ornamentals. Both male and female reproductive structures are borne on the same plant. The needlelike leaves are solitary, in bundles, or on specialized short branches. The pollen-bearing male cones are solitary or clustered and have many spirally arranged scales, each bearing two pollen sacs. The compound, seed-bearing


(Centre) Pollen-bearing male cones and (left) immature seed-bearing female cone of red pine (*Pinus resinosa*)

Alvin E. Staffan from The National Audubon Society Collection/Photo Researchers—EB Inc.

female cones also have many spirally arranged scales. Each scale is free from the bract below it and bears two inverted ovules on its upper side. In members of the genus *Pinus,* the bract disappears as the cones mature.

pinacotheca, Greek PINAKOTHEKE, Latin PINACOTHECA, a picture gallery in either ancient Greece or ancient Rome. The original pinacotheca, which housed the tablets or pictures honouring the gods, formed the left wing of the Propylaea of the Acropolis in Athens. Evidence from ancient manuscripts indicates that the pictures were separate easel works rather than frescoes. Other Greek pinacothecas were at Ephesus and Samos.

In ancient Rome a pinacotheca was the gallery in a private home or villa in which were kept art objects, tablets, and statues. The Roman pinacotheca adjoined the atrium. In modern times the word may refer to an art gallery. The public galleries at Bologna and Siena, in Italy, are examples. In Munich, two famous galleries are called the Alte Pinakothek and the Neue Pinakothek, *i.e.,* the old and new pinacothecas.

Pinang (Malaysian island); *see* Penang.

pinang (nut): *see* betel.

Pinar del Río, *provincia,* western Cuba, bounded on the north by the Gulf of Mexico, on the west by the Yucatán Channel, on the south by the Caribbean Sea, on the southeast by the Gulf of Batabanó, and on the east by La Habana province. Low mountain ranges, including the Sierra de los Órganos and the Sierra del Rosario, form the backbone of the territory, which has an area of 4,218 square miles (10,925 square km). The sandy soils of the southern plain produce some of the world's best tobacco, in the Vuelta Abajo region, and the pine forests have been exploited heavily. Copper has been mined at Matahambre since 1913. The province also produces sugarcane, rice, pineapples, coffee, and live-

The Viñales Valley in Pinar del Río province, Cuba
Atlas Photo

stock. Railroads and highways traverse much of the province, passing through the capital city, Pinar del Río (*q.v.*). Pop. (1988 est.) 678,-197.

Pinar del Río, city, capital of Pinar del Río *provincia,* western Cuba. Founded in 1775, the city is situated in hilly pinelands at an elevation of about 200 feet (60 m) above sea level, near the base of the Sierra de los Órganos. In 1800 it was officially named Nueva Filipina and was made capital of the western jurisdiction of Cuba. Its economic importance dates from about 1830, when the tobacco industry of the Vuelta Abajo region was developed. With the completion of the railroad from Havana came the development of Pinar del Río as a commercial centre for the hinterland, which yields tobacco, sugarcane, rice, pineapples, coffee, and livestock. Industrial activity centres on the manufacture of cigars, cigarettes, and furniture. It has a small thermal-power plant. Pinar del Río is also the western terminus of the central highway. Pop. (1988 est.) 112,280.

Pinay, Antoine (b. Dec. 30, 1891, Saint-Symphorien-sur-Coise, Fr.), leader of the Republican Independents in France and premier in 1952. He later became his country's first ombudsman (1973–74).

Pinay got his start in politics with election in 1929 as mayor of Saint-Chamond, a position he held until he retired in 1977. He was a politically moderate deputy from 1936 to 1938 and a senator from 1938 to 1940. He supported Pétain and was a member of his government. After the war, he was again elected to the National Assembly, where he served as president of the Independents from 1956 to 1958. During those years he also held posts in several cabinets—secretary of state (1949), minister of public works (1950–52), and minister of foreign affairs (1955–56)—and for a brief period (March–December 1952) served as premier. Pinay helped bring Charles de Gaulle back to power in 1958. In the new government, Pinay served as minister of finance (1958–59, 1960) with a policy of limiting inflation even if it meant curtailing industrial expansion. He was president of regional economic development for Rhône-Alpes from 1964 to 1973 and was then appointed first ombudsman of France.

pinball machine, also called PINBALL GAME, earliest of the coin-activated popular electromechanical games, usually found in candy stores, pool halls, drinking establishments, and amusement arcades, some of which, at the height of the game's popularity, were exclusively devoted to pinball. Pinball originated in its modern form in about 1930. Earlier machines had been purely mechanical. The earliest machines with coin slots used marbles and cost a penny to play. Steel balls replaced the marbles, and the single-coin price to play rose with inflation.

The pinball player inserts a coin, which unlocks a spring plunger with which the player may propel a ball up an alley on the side of the glass-topped, inclined playing area. From the top, the ball descends through gates, between posts, and off bumpers, whose electrical contact points produce a cumulative score recorded on a lighted panel at the top of the machine. The scoring is accompanied by the ringing of bells and the flashing of lights. Finally, the ball drops into one of several holes, scoring variously. As the game grew in popularity, added features allowed the player control of choices by use of levers or buttons. A rollover slot acted to multiply scores, so that they rose from tens of thousands to hundreds of thousands and finally to millions. More than one ball could be put in play. The player could apply physical torque or impetus to the machine (called "body English"), the amount of such force allowable being controlled by cut-off switches, which could be set so that an excess of force would flash on a "Tilt" sign, ending the game automatically.

Games similar to pinball date back to ancient Greece, where an outdoor game using round stones and holes dug in a hillside was played. There were mechanical games in France in the 18th century and in the United States in the 19th century. The most obvious ancestor of the modern pinball-machine games, however, is the game of bagatelle.

Almost all pinball machines were manufactured in the United States, but the game came to be played worldwide. After World War II, the Japanese developed a similar vertical machine, onomatopoeically named pachinko, that hung on the wall and had an automatic payoff receptacle like that of a slot machine.

In the late 20th century, electronic games simulating sport contests, followed by video games that added the dimension of military and intergalactic struggles, displaced pinball games in popularity (*see* electronic game).

pinch effect, self-constriction of a cylinder of current-carrying plasma. When an electric current is passed through a gaseous plasma, a magnetic field is set up that tends to force the current-carrying particles together. This force can compress the plasma so that it is heated as well as confined, but such a self-pinched plasma cylinder is unstable and will quickly develop kinks or break up into a series of lumps resembling a string of sausages. The pinch effect, therefore, must be augmented with other magnetic-field configurations to produce a stable magnetic bottle.

Pinchback, Pinckney Benton Stewart (b. May 10, 1837, Macon, Ga., U.S.—d. Dec. 21, 1921, Washington, D.C.), black freedman who served as a Union officer in the American Civil War and played a leading role in Louisiana politics during Reconstruction (1865–77).

Pinchback was one of 10 children born to a white Mississippi planter and a slave mother—whom the father subsequently freed and who became his wife in everything but name (interracial marriages were prohibited by state law). When the father died in 1848, the family fled to Ohio, fearing that white relatives might attempt to disinherit and re-enslave them.

Destitute at 12 years of age, Pinchback found work as a cabin boy on a canal boat running out of Cincinnati and worked his way up to steward on the steamboats plying the Mississippi, Missouri, and Red rivers. When war broke out between the states, he ran the Confederate blockade on the Mississippi to reach Federal-held New Orleans; there he raised a company of black volunteers for the North, called the Corps d'Afrique. When he encountered racial discrimination in the service, however, he resigned his captain's commission.

Returning to the South after the war, Pinchback organized the Fourth Ward Republican Club in New Orleans and served as a delegate to the convention that established a new constitution for Louisiana. He was elected to the state senate in 1868 and then was named its president pro tempore; as such he became lieutenant governor upon the death of the incumbent in 1871. For 36 days he served as acting governor while impeachment proceedings were in progress against the holder of that office. In the meantime he went into business and acquired control of a Republican paper, the New Orleans *Louisianian.*

In 1872 Pinchback was elected to Congress, but his Democratic opponent contested the election and won the seat. A year later he was elected to the U.S. Senate, but he was again refused the seat amid charges and countercharges of fraud and election irregularities—although some observers said it was the colour

Pinchback
By courtesy of the Library of Congress, Washington, D.C.

of his skin that counted against him. He was appointed to his last office in 1882 as surveyor of customs in New Orleans.

At the age of 50 he decided to take up a new profession and entered Straight College, New Orleans, to study law; he was subsequently admitted to the bar. Disillusioned with the outcome of Reconstruction and the return to power of the traditional white hierarchy, he moved to Washington, D.C., where he practiced law until his death.

Pincherle, Alberto: *see* Moravia, Alberto.

pinching bug: *see* stag beetle.

Pinchot, Gifford (b. Aug. 11, 1865, Simsbury, Conn., U.S.—d. Oct. 4, 1946, New York, N.Y.), pioneer of U.S. forestry and conservation and public official.

Pinchot was graduated from Yale in 1889 and studied at the National Forestry School in Nancy, Fr., and in Switzerland, Germany, and Austria. Upon his return home in 1892, he began the first systematic forestry work in the United States at Biltmore, the estate of George W. Vanderbilt, in North Carolina. In

Pinchot
By courtesy of Yale University Archives, Yale University Library

1896 he was made a member of the National Forest Commission of the National Academy of Sciences, which worked out the plan of U.S. forest reserves, and in 1897 he became confidential forest agent to the Secretary of the Interior. In 1898 he was appointed chief of the Division, later Bureau, of Forestry and then the Forest Service (created 1905) in the Department of Agriculture, which office he held under Presidents William McKinley, Theodore Roosevelt, and William Howard Taft, until 1910. During his administration the entire forest-service system and administrative machinery were built up, and Pinchot's enthusiasm and promotional work did much for the conservation movement in general. He also served as a member of the Public Lands Commission, which he initiated in 1903, and the Inland Waterways Commission (1908). In 1908 he became chairman of the National Conservation Commission. He founded the Yale School of Forestry at New Haven, Conn., as well as the Yale Summer School of Forestry at Milford, Pa., and in 1903 became professor of forestry at Yale. In 1920 he was appointed state forester of Pennsylvania and began a systematic administration of the forest areas of that state.

With Theodore Roosevelt, Pinchot helped to found the Bull Moose Party in 1912. From 1923 to 1927 and from 1931 to 1935 he was governor of Pennsylvania. In his first term he forced a reorganization of the state government and the establishment of a budget system. He settled a coal strike by arbitration in 1923.

Pinchot's autobiography, *Breaking New Ground,* was published posthumously in 1947.

Pinckney, Charles (b. Oct. 26, 1757, Charleston, S.C. [U.S.]—d. Oct. 29, 1824, Charleston), American Founding Father, political leader, and diplomat whose proposals for a new government—called the Pinckney plan—were largely incorporated into the Federal Constitution drawn up in 1787.

During the American Revolution, Pinckney was captured and held prisoner by the British. Serving in the Continental Congress for three years (1784–87), he played a leading role in calling a national convention to revise and strengthen the Articles of Confederation.

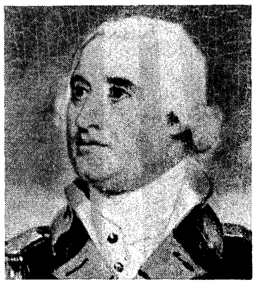
As a South Carolina delegate to the Constitutional Convention at Philadelphia, he submitted a detailed plan of government, which, although the original draft was not preserved, is known to have contained a number of provisions that were incorporated into the new Constitution. Pinckney possibly had as large a share in determining the style, form, and content of the document as any other individual. At home he supported ratification, presided over the convention that remodeled the South Carolina Constitution in 1790, and as governor (1789–92) guided the adjustment between the state and federal governments.

Pinckney began his political career as a Federalist but in 1791 transferred his allegiance to the Jeffersonian Republican Party. He served in the state legislature (1792–96, 1810–14) and as governor (1796–98, 1806–08), U.S. senator (1798–1801), and representative (1819–21). He supported amendments to the state constitution that gave greater representation to the back country and extended suffrage to all white men. By opposing Federalist policies, especially in 1798, he estranged his two politically active cousins, Charles Cotesworth Pinckney and Thomas Pinckney. Reflecting his Southern background, he bitterly assailed the proposed restrictions on slavery contained in the Missouri Compromise of 1820.

His fidelity to his party was rewarded by appointment as U.S. minister to Spain (1801–05), where he negotiated an agreement providing for a joint tribunal to settle spoliation claims (arising from the seizure of a ship's papers when confiscated for suspected smuggling, carrying contraband of war, or being an enemy ship) and the restoration to U.S. shippers of the right of deposit (temporary storage of goods) at the port of New Orleans. He also won Spain's reluctant consent to Napoleon's sale of Louisiana to the United States, but failed to achieve the U.S. acquisition of Florida.

Pinckney, Charles Cotesworth (b. Feb. 25, 1746, Charleston, S.C. [U.S.]—d. Aug. 16, 1825, Charleston), American soldier, statesman, and diplomat who participated in the XYZ Affair, an unsavory diplomatic incident with France in 1798.

Pinckney entered public service in 1769 as a member of the South Carolina Assembly. He served in the first South Carolina Provincial Congress (1775) and later in both houses of the South Carolina legislature. During the American Revolution he was an aide to General George Washington at Brandywine and Germantown, Pa. (both 1777), and later commanded a regiment at Savannah, Ga.; he was promoted to brigadier general in 1783. He took part in the Constitutional Convention of 1787, along with his cousin Charles Pinckney.



Charles Cotesworth Pinckney, detail of an oil painting on wood by John Trumbull, 1791; in the Yale University Art Gallery
By courtesy of the Yale University Art Gallery

Pinckney was appointed minister to France (1796) but was refused recognition by the French Directory and left Paris for Amsterdam. He returned to Paris the following year as a member of a commission that included John Marshall and Elbridge Gerry. When one of the group of French negotiators (later referred to in the correspondence as "X,Y, and Z") suggested that the U.S. representatives offer a gift, Pinckney is said to have replied, "No! No! Not a sixpence!" No treaty was negotiated, and an undeclared war with France ensued. Upon his return home Pinckney was made a major general. An unsuccessful Federalist candidate for vice president in 1800 and for president in 1804 and 1808, Pinckney spent his later years in law practice.

Pinckney, Elizabeth, *née* LUCAS, byname ELIZA PINCKNEY (b. *c.* Dec. 28, 1722, Antigua—d. May 26, 1793, Philadelphia, Pa., U.S.), British-American plantation manager known for the first successful cultivation of indigo in the United States, an accomplishment that subsequently helped to sustain the Carolina economy for 30 years.

When her father, George Lucas, was called to military duty in Antigua in the West Indies in 1739, Eliza Lucas remained to manage his three plantations in South Carolina. After three years of experimentation with ginger, cotton, indigo, and alfalfa, she succeeded in marketing the first crop of indigo. Parliament then subsidized the plant, and by 1754 South Carolina was exporting more than 1,000,000 pounds (454,000 kg) of the crop annually.

In 1744 she married Charles Pinckney, Carolina's first native lawyer, and on his Charleston plantation she revived the cultivation of silkworms and manufacture of silk. When her husband died in 1758, Eliza again became a plantation manager, guiding her family's extensive landholdings. Her sons Charles Cotesworth and Thomas became diplomats.

Pinckney, Thomas (b. Oct. 23, 1750, Charleston, S.C. [U.S.]—d. Nov. 2, 1828, Charleston), American soldier, politician, and diplomat who negotiated Pinckney's Treaty (Oct. 27, 1795) with Spain.

After military service in the American Revolutionary War, Pinckney, a younger brother of the diplomat Charles Cotesworth Pinckney, turned to law and politics. He served as governor of South Carolina (1787–89) and as president of the state convention that ratified the U.S. Constitution. As U.S. minister to Great Britain (1792–96) and envoy extraordinary to Spain in 1795, he negotiated the Treaty of San Lorenzo, or Pinckney's Treaty.

Pinckney was the unsuccessful Federalist candidate for vice president in 1796. He was a member of the U.S. House of Representatives (1797–1801) and a major general in the War of 1812. Upon retiring from public life, he practiced law and was a frequent contributor to the *Southern Agriculturist.*

Pinckney's Treaty, also called TREATY OF SAN LORENZO (Oct. 27, 1795), agreement between Spain and the United States, fixing the southern boundary of the United States at 31° N latitude and establishing commercial arrangements favourable to the United States. U.S. citizens were accorded free navigation of the Mississippi River through Spanish territory. The treaty granted Americans the privilege of tax-free deposit (temporary storage of goods) at New Orleans. Each side agreed to restrain Indians within its borders from attacks on the other, and there were provisions respecting freedom of the seas. The treaty was negotiated by Thomas Pinckney for the United States and Manuel de Godoy for Spain.

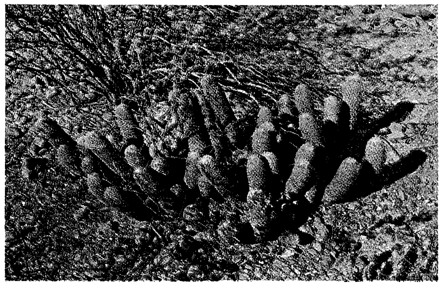
Pincus, Gregory (Goodwin) (b. April 9, 1903, Woodbine, N.J., U.S.—d. Aug. 22, 1967, Boston, Mass.), American endocrinologist whose work on the antifertility properties of steroids led to the development of the first effective birth-control pill.

Pincus was educated at Cornell University and Harvard University (M.S., Sc.D., 1927) and also studied in England and Germany. He was a faculty member at Harvard (1931–38), Clark University in Worcester, Mass. (1938–45), Tufts Medical School in Medford, Mass. (1946–50), and Boston University (1950–67).

In 1944 Pincus and Hudson Hoagland founded the Worcester Foundation for Experimental Biology, which became an important centre for the study of steroid hormones and mammalian reproduction. Margaret Sanger encouraged his work, and in 1951 Pincus and his collaborators began to work with synthesized hormones and the prevention of pregnancy. They found that inhibition of ovulation was an effective means of preventing pregnancy in laboratory animals and moved to perfect an oral contraceptive for women.

Pincus' publications include *The Eggs of Mammals* (1936) and *The Control of Fertility* (1965). He also edited a number of monographs on aspects of hormones.

pincushion cactus, any of about 60 species of the genus *Coryphantha,* family Cactaceae.



Pincushion cactus (*Coryphantha erecta*)
Edward F. Anderson

Pincushion also refers to the straight-spined species of the genus *Mammillaria.*

Coryphantha species are native to western North America and central Mexico, with one species in Cuba. Globose to cylindroid, with protuberances not connected into ribs, they range in size from *C. minima* of Texas, about 5 cm (2 inches) in height, to large Mexican species such as *C. calipensis,* which reach about 60 cm (24 inches) in length and 8 cm (3 inches) in diameter. A groove on the top of the tubercle, connecting the spine and flower-bearing parts, is characteristic of the genus and distinguishes it from *Mammillaria.*

C. vivipara (including its varieties) is almost as cold-resistant as the hardy prickly pears. It ranges from Alberta and Manitoba, in Canada, to Oklahoma and California, in the United States. *C. missouriensis* is also cold-resistant.

Coryphantha species have large flowers for the size of the plant. They are in shades of lavender, rose purple, pink, orange, yellow, and white. Fruits of the genus are green, red, or yellowish edible berries.

Neobesseya and *Escobaria* are usually considered subgenera of *Coryphantha.*

Pindar, Greek PINDAROS, Latin PINDARUS (b. 518/522 BC, Cynoscephalae, Boeotia, Greece—d. after 446, probably *c.* 438, Argos), the greatest lyric poet of ancient Greece, the master of epinicia, choral odes celebrating victories achieved in the Pythian, Olympic, Isthmian, and Nemean games.

Early training. Pindar was of noble birth, possibly belonging to a Spartan family, the Aegeids, though the evidence for this is inconclusive. His parents, Daiphantus and Cleodice, survive only as names; his uncle Scopelinus, a skilled flute player, doubtless helped with Pindar's early musical training. The family possessed a townhouse in Thebes (to be spared by express command of Alexander the Great in the general destruction of that city by the Macedonians in 335 BC). Such a background would give Pindar a ready entrée into aristocratic circles in other Greek cities, where his manifest gifts as a poet might be valued more highly than in his native Boeotia, which had little enough to offer in the way of precept and encouragement. (Two contemporary Boeotian female poets, Myrtis and Corinna, were of a very different tradition, more primitive and essentially feminine, though Corinna is reported to have criticized the lushness of Pindar's early style, advising him to "sow with the hand, not with the full sack.") It was natural, then, that Pindar should be sent to neighbouring Athens to complete his training and education. Athens and Thebes were seldom on neighbourly terms, but relationships between noble families transcended such difficulties. Pindar's horizons would have widened in the exciting atmosphere of a city beginning to realize its destiny, poised as it was on the verge of political and cultural greatness. He must have studied the choral lyric poets of the past, Alcman and Stesichorus in particular, and the work of his elder contemporaries, Simonides of Ceos and Lasus of Hermione. He would have steeped himself in the poetry of Homer and Hesiod, and he must have received detailed and systematic training in the techniques of choral composition in the city where dithyramb (a choral lyric) was cultivated and where tragedy was beginning to evolve from the dramatic ritual dance performed at religious festivals associated with the god Dionysus.

Professional career. Seventeen volumes of Pindar's poetry, comprising almost every genre of choral lyric, were known in antiquity. Only four books of epinicia have survived complete, doubtless because they were chosen by a teacher as a schoolbook in the 2nd century AD. They are supplemented by numerous fragments, and in recent years finds of papyri have helped toward a deeper understanding of Pindar's achievement, especially in paeans and dithyrambs. All the evidence, however, suggests that the epinicia were Pindar's masterpieces. These are divided as Olympian, Pythian, Isthmian, or Nemean—the games in which the victories he celebrated were held; the epinicia number 44 odes in all. The earliest surviving epinicion (Pythian ode 10) dates from 498, and Pindar already had an assured mastery of his medium when he wrote it. It would have been quite possible for him to evolve into a cosmopolitan artist like Simonides, welcome all over the Greek world and moving easily from city to city. No doubt Pindar visited the Panhellenic festivals, at Delphi (where the Pythian games were held) and Olympia in particular, to absorb the atmosphere of the games and the victories he celebrated. He would also have seen in person the homes of the aristocrats and the courts of the tyrants whose triumphs he sang. But in general he preferred to remain loyal to his native land and to reside in Thebes: it is Pindar's characteristic that his standards and values, like his poetry, changed little if at all over the years. Such patriotism meant sacrifices. Thebes, like Delphi, collaborated with the enemy in the Persian War—though admittedly Thebes had little alternative. But whereas Delphi's prestige was quickly restored after the retreat of the Persians, Thebes's defection was not lightly forgiven or forgotten. Athens was to dominate the history of the 5th century, and for the first two-thirds of it Athens had very much the better of its long, drawn-out quarrel with Thebes: from 457 to 447 BC Boeotia was virtually an Athenian dependency. And almost everywhere, the aristocratic way of life, integral alike to Pindar's personality and to his art, was threatened. Politically and economically the monopolies of power by the noble families were broken. The aristocratic code, with its ultimately selfish individualism (summed up in a famous line of Homer, "ever to excel and to surpass other men") was undermined by the radical rationalism of a new age. Choral lyric itself had little future as a separate art form: tragedy absorbed into itself what was most vital in the tradition, and Pindar had no worthy successors. It is a tribute to the quality of Pindar's poetry that although he must have regarded these contemporary cultural and political developments with disdain, or at best with indifference (apart perhaps from his reinterpretation of some of the traditional stories concerning the gods), he was universally respected and accepted as a major creative artist.

Pindar's early poems have almost all been lost; it is probable, however, that what gave him a growing reputation beyond the borders of Boeotia were hymns in honour of the gods. Pindar was born at the time of the Pythian festival, and from his youth he had a close connection with the Pythian priesthood, which served the oracular shrine of Apollo at Delphi. Pindar and his descendants, indeed, enjoyed special privileges at Delphi, where his memory was cherished in later times and where an iron chair, in which it was said he had sat to sing, was exhibited. The first commissions for epinicia came mostly from aristocratic connections: the Aleuads in Thessaly (Pythian ode 10; 498 BC); the Alcmaeonids in Athens (Pythian ode 7; 486 BC); Agesidamus of Epizephyrian Locri (Olympian ode 11; 484 BC); and above all the Aeacids of the island of Aegina (the series begins with paean 6, dating from 490 BC, and continues with Nemean ode 7). Progress in winning recognition seems to have been steady, if slow. A significant breakthrough came when Pindar established a link with the court of Theron of Acragas through the tyrant's brother Xenocrates, whose chariot won the Pythian contest (Pythian odes 6 and 12; both 490 BC). But the Persian invasion of Greece came before the promise of this new connection could be fulfilled. Pindar faced a crisis of divided loyalties, torn between a sense of solidarity with the aristocracy of Boeotia, who followed a pro-Persian policy, and a growing appreciation of Spartan and Athenian heroic resistance. Pindar was first and foremost a Theban and stood by his friends, many of whom paid for their policy with their lives. But it was Simonides, not Pindar, who wrote the poems of rejoicing at Greece's victories and of mourning for its glorious dead.

It took Pindar some years to reestablish himself: fortunately, his friends in Aegina were staunch (Isthmian ode 8; 478 BC). It is virtually certain that he visited Sicily in 476–474 BC and was made welcome at the courts of Theron of Acragas and Hieron I of Syracuse. They were to elicit much of his greatest poetry, and it was through these connections that Pindar's reputation spread all over the Greek world so that commissions flowed in from the mainland, the islands, and also from the remoter outposts of Hellenism. Promising new contacts were made with the royal houses of Macedon and Cyrene (Alexander of Macedon, Fragment 120; Arcesilas of Cyrene, Pythian odes 4 and 5; 462/461 BC). Theron and Hieron respected and admired Pindar, but his aristocratic temper made him dangerously outspoken. Diplomatic tact and finesse were not among his qualities, and his adroit rivals, Simonides and Bacchylides, were more pliant and adaptable (Bacchylides, not Pindar, celebrated Hieron's Olympic victory in the chariot race in 468 BC). Echoes of Pindar's bitter resentment sound in his poetry. So, too, Pindar's intervention on behalf of Damophilus, a noble exile from Cyrene (Pythian ode 4, 279 ff.), seems to have been taken amiss, and he was not invited to commemorate Arcesilas' triumph at Olympia in 460 BC. Nevertheless, these were the years of supreme achievement, and Pindar found a growing demand for his poetry and a growing appreciation of his skill. His debt to Athens was amply paid in a famous tribute (Fragment 76) that the Athenians never tired of citing, one that earned the poet special honours in that city (and, according to ancient tradition, a fine at Thebes). It was probably in this period that Pindar married.

The subsequent decade of Athenian domination in central Greece coincided with a period when Delphi was controlled by Phocis in northern Greece. These were dark years for Pindar, and his poetic output dwindled. But he continued to celebrate Theban victories (Isthmian odes 1 and 7); and he found inspiration in the achievements of his Aeacid friends of Aegina, though their days of nominal independence were clearly numbered (Isthmian odes 5, 6; Nemean odes 3–8; all celebrate Aeginetan successes). Pindar's last extant poem (Pythian ode 8) appropriately commemorates an Aeacid victory.

The tradition that Pindar lived to the age of 80 may be true, but there is no surviving poem from later than 446 BC.

Poetry. The epinicion form, which in Simonides' hands seems to have evolved into a relatively simple poem of rejoicing enhanced by touches of realism and humour, is assimilated by Pindar to the religious hymn. The praise and worship of the god whose festival is being celebrated set the tone, and thanksgiving is an integral part of the structure. A second constituent element is the myth, impressionistically treated in a series of short, sharply visualized scenes and meant to link the glorious present to the yet more glorious past, to give a new dimension to the transient moment of victory. A third ingredient is the aphoristic moralizing, often in Pindar of extreme beauty, even sublimity, in which the dangers of excessive pride in achievement are repeatedly stressed. The emotional impulse throughout stems from the aristocratic ideal of self-assertion, competition, and leadership—an ideal expressing itself most finely in battle but also finding fulfillment in athletic contests, in which the palm goes to superior physique and morale deriving from superior birth. His metrical range is exceptionally wide, with no two poems being identical in metre, and he controls difficult and involuted techniques with consummate professional mastery. His dialect is literary and eclectic, with few Boeotian elements; the vocabulary is enriched, poetic, and highly personal. Each poem is fused into a unity by the fire of Pindar's poetic inspiration, by a sweep and soar of imagination that give his poetry power and magnificence, by the shaping and controlling discipline of a fastidious art expressed in an intensely personal style. Delphic religious teaching found in Pindar a ready pupil, and he constantly spiritualized his material, turning away from the cruder traditional stories of the gods, avoiding the mundane details of the contest, striving to catch the fleeting radiance that plays about the moment of supreme endeavour when a man transcends his own limitations of physique and character and so proves worthy of his birth and ancestry. Delphi also profoundly influenced his style, which is frequently cryptic and oracular. He regarded himself as the Muse's prophet: she is the pythoness and he is the priest who puts her inspired message into intelligible shape.

The only other major poet produced by Boeotia was Hesiod, who had flourished in the 8th century BC. The two are poles apart in background and temperament, but they share a deep religiosity, a groping toward something more profound and satisfying than contemporary cults could offer, a fondness for abrupt and violent transitions in thought and mood, and a forthright pungency of speech. A somewhat muted epitaph preserved in the *Greek Anthology* (7, 35) describes Pindar as the servant of the Muses, welcomed by strangers, beloved by his fellow citizens. Perhaps the poet would have regarded it as adequate.

Pindar's odes make great demands on the modern reader, and it is only in recent times that his art has begun to be appreciated for what it is. (The so-called Pindaric ode has had a long and distinguished history in English literature, but it derives from an almost total misunderstanding and misapprehension of Pindar's own style and technique.) Even so, much essential evidence is missing. The musical settings that he composed to accompany his words are lost forever, though in view of the quality of the poetry it is probable that the words dominated the setting (as must have been the case in most Greek lyric). It is therefore impossible to re-create even in imagination the approximate sound of a Pindaric ode, or indeed to reconstruct visually the appearance and constitution of the choir: how many participated; what range of voices was employed; whether the singers were static, moved in procession, or danced—these are questions that cannot now be answered. Nor is it possible to picture at all clearly the festive occasion that was the background for the poetry. Yet efforts to understand the odes are rewarded by at least a glimpse of the poet behind them. The aristocratic society and standards, which meant everything to Pindar, were dead or dying. But in his art he re-created them, giving them new and permanent existence and value.

The tradition of Greek choral lyric culminated with the odes of Pindar. These are not easy to evaluate and appreciate, but it is still more difficult to comprehend and assess the poet who composed them. Even to his contemporaries, Pindar must have seemed an aloof and somewhat enigmatic figure. As an aristocrat he would more naturally have been a patron of poetry than himself a poet; he came from a part of central Greece that had made a relatively small contribution to literature and the arts. Because ancient biographies, dating from the 4th and 3rd centuries BC, are highly unreliable and of little help, any approach to the poet must be made through his poetry, and this involves a consideration of the historical setting, the religious usages, and the literary conventions that helped to shape his art. A modern reader needs a sympathetic insight into the nature and traditions of Greek aristocratic society before he can begin to understand how Pindar's subject matter—victory in an athletic contest or in a chariot race—could inspire poetry characterized by high seriousness and deep feeling. Pindar cannot, indeed, speak across the centuries with the directness of Homeric epic poetry or Sophoclean tragedy, but he does create, with disciplined mastery of a sophisticated and complex art form, a choral lyric of unsurpassed splendour and sustained nobility.

The best verse translations in English are by R.A. Lattimore, *The Odes of Pindar* (1947); and by C.M. Bowra, *The Odes of Pindar* (1969). (D.E.W.W.)

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Pindar, Peter, pseudonym of JOHN WOLCOT (baptized May 9, 1738, Dodbrooke, Devonshire, Eng.—d. Jan. 14, 1819, London), English writer of a running commentary in satirical verse on society, politics, and personalities, 1778–1817.

After studying medicine at Aberdeen, Scot., Wolcot went to Jamaica as physician to the governor in 1767. He was ordained in 1769 but then forsook the church. He returned to England in 1772 and practiced medicine in Cornwall until he settled in London in 1781. Despite blindness, he continued to write to the end of his life, producing more than 70 satirical works and some other poems. He was buried, at his own request, "close to the author of *Hudibras*," the 17th-century satirist Samuel Butler, in St. Paul's Covent Garden, London.

Although Pindar lacked the depth of the great satirists, he was a master of verse caricature, as shown especially in his scurrilous lampoons of George III in *The Lousiad, an Heroi-Comic Poem,* 1785–95; *Ode Upon Ode or a Peep at St. James's or New Year's Day,* 1787; and *The Royal Visit to Exeter,* 1795 (a tour de force of Devon dialect humour) and in the virtuosity of his doggerel rhymes. His other targets included James Boswell, author of *The Life of Samuel Johnson LL.D.,* and the painter Benjamin West. With some knowledge of art, he was at his best in attacks on painters; he became famous with his *Lyric Odes to the Royal Academicians* (1782–85).

Pindari, historically, an irregular horseman, plunderer, or forager attached to a Muslim army in India who was allowed to plunder in lieu of pay. The name is Marāṭhi and probably derives from two words, meaning "bundle of grass" and "who takes."

The Pindaris followed the Marāṭhā bands who raided Mughal territory from the late 17th century. With the collapse of the Mughal empire in the 18th century, these camp followers organized themselves into groups, each usually attached to one of the leading Marāṭhā chiefs. But as those chiefs themselves grew weak at the end of the century, the Pindaris became largely a law unto themselves and conducted raids from hideouts in central India. The majority of their leaders were Muslims, but they recruited from all classes.

After the regular forces of the Marāṭhās had been broken up by the British in the campaigns of 1803–04, the Pindaris made their headquarters in Mālwa, under the tacit protection of the rulers of Gwalior and Indore. They usually assembled in November to set forth over British-held territory in search of plunder. In one such raid on the Masulipatam coast, they plundered 339 villages, killing and wounding 682 persons, torturing 3,600 others, and carrying off much valuable property. In 1808–09 they plundered Gujarāt, and in 1812, Mirzāpur. In 1814 they numbered between 25,000 and 30,000 horsemen, half of them well armed.

At last their practices became intolerable, and in 1816 the British organized the campaign known as the Pindari War (1817–18). The Pindaris were surrounded by an army of about 120,000 men, which converged upon them from Bengal, the Deccan, and Gujarāt under the supreme command of the governor-general Warren Hastings. The Pindaris' protectors in Gwalior were overawed and signed a treaty (1817) against the Pindaris. Their other allies against the British took up arms but were separately defeated. The Pindaris themselves offered little resistance; most of the leaders surrendered, and their followers dispersed.

Pindaric ode, ceremonious poem by or in the manner of Pindar, a Greek professional lyrist of the 5th century BC. Pindar employed the triadic structure of Stesichorus (7th and 6th centuries BC), consisting of a strophe (two or more lines repeated as a unit) followed by a metrically harmonious antistrophe, concluding with a summary line (called an epode) in a different metre. These three parts corresponded to the movement of the chorus to one side of the stage, then to the other, and their pause midstage to deliver the epode.

Although fragments of Pindar's poems in all of the classical choral forms are extant, it is the collection of four books of epinicion odes that has influenced poets of the Western world since their publication by Aldus Manutius in 1513. Each of the books is devoted to one of the great series of Greek classical games: the Olympian, Pythian, Isthmian, and Nemean. Celebrating the victory of a winner with a performance of choral chant and dance, these epinicion odes are elaborately complex, rich in metaphor and intensely emotive language. They reveal Pindar's sense of vocation as a poet dedicated to preserving and interpreting great deeds and their divine values. The metaphors, myths, and gnomic sayings that ornament the odes are often difficult to grasp because of the rapid shifts of thought and the sacrifice of syntax to achieving uniform poetic colour.

With the publication of Pierre de Ronsard's four books of French *Odes* (1550), the Pindaric ode was adapted to the vernacular languages. Imitation Pindaric odes were written in England by Thomas Gray in 1757, "The Progress of Poesy" and "The Bard." Abraham Cowley's *Pindarique Odes* (1656) introduced a looser version known as Pindarics. These are irregular rhymed odes in which the length of line and stanza is capriciously varied to suggest, but not reproduce, the style and manner of Pindar. These spurious Pindarics are some of the greatest odes in the English language, including John Dryden's "Alexander's Feast" (1697), William Wordsworth's "Ode: Intimations of Immortality from Recollections of Early Childhood," Percy Bysshe Shelley's "Ode to the West Wind," Alfred Lord Tennyson's "Ode on the Death of the Duke of Wellington," and John Keats's "Ode on a Grecian Urn." *See also* ode.

Pindemonte, Ippolito (b. Nov. 13, 1753, Verona, Republic of Venice [Italy]—d. Nov. 18, 1828, Verona), Italian prose writer, translator, and poet, remembered for his pre-Romantic lyrics and particularly for his highly prized translation of the *Odyssey.*

Born into a noble and cultivated family, Ippolito Pindemonte was educated at a college in Modena and then traveled in Europe. He published a volume of Arcadian verse, *Le stanze* (1779), and one of lyrics, *Poesie campestri* (1788; "Rural Poetry"). Both showed a sensitivity to nature and the influence of the contemporary English poets Thomas Gray and Edward Young. A stay in Paris inspired the poem "La Francia" (1789) and a prose satire on political conditions in Europe, *Abaritte* (1790). Disillusioned by the French Revolution's Reign of Terror, Pindemonte left for London, Berlin, and Vienna. On his return to Italy his *Prose campestri,* a companion volume to the earlier poetry, was published (1794).

In 1805 Pindemonte began his translation of the *Odyssey;* it was published as *Odissea* (1822). Pindemonte also wrote two tragedies and some moralistic letters and sermons.

His older brother Giovanni wrote lyric poetry and popular tragedies.

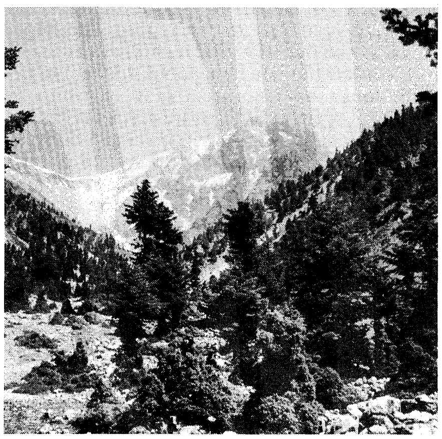
Pindus Mountains, Modern Greek OROSEIRÁ PÍNDHOU, principal range and backbone of mainland Greece, trending north-northwest–south-southeast from Albania to central Greece north of the Peloponnese.

In antiquity, the name Pindus applied to ranges south of the Aracynthus (Zygós) Pass west of Thessaly. Occasionally the Pindus is said to extend into Albania but also to include the Tymphrestos (Timfristós) massif and even the Gióna massif north of Amphissa in the *nomós* (department) of Phocis (Fokís). The highest point of the range is 8,651 feet (2,637 m) in the Smólikas massif, near the Albanian border.

An extension of the calcareous Dinaric range of the Balkans, the core of the Pindus appears to comprise metamorphic and volcanic rocks: schists, serpentines, granite, and jasper. The northern parts, less elevated, have folded Balkan characteristics. Lacking uniformity, the Pindus consists largely of a series of small ranges separated by transverse valleys eroded from limestones that on the eastern slopes often are overlain by geologically younger sandy and marl deposits. The result is often wild, precipitous slopes that afford few passes; the principal one is the Métsovo (Katára pass; 5,593 feet [1,705 m]), a historic defile that carries the highway from the Epirus to Thessaly.

The southern limits of the Pindus are generally considered to be the Tymphrestos Mountains northeast of Karpenísion. From the Albanian border, the local massifs are the Grámmos and Vóïon, Tímfi, Smolikas, Lingos, Lákmos (the latter rising at Peristéri to 7,529 feet [2,295 m]), and the Athamánon, between the Árakhthos and Achelous rivers, rising at Tzoumérka to 8,100 feet (2,469 m).

Forested with oak, fir, beech, and pine, the Pindus creates a barrier for the westerly weather fronts, which puts the Thessalian plain to the east in a rain shadow. The mountains, snowcapped in winter, receive heavy rainfall that feeds such rivers as the Achelous and Mégdhova on the western slopes and the Piniós and Aliakmon on the eastern.

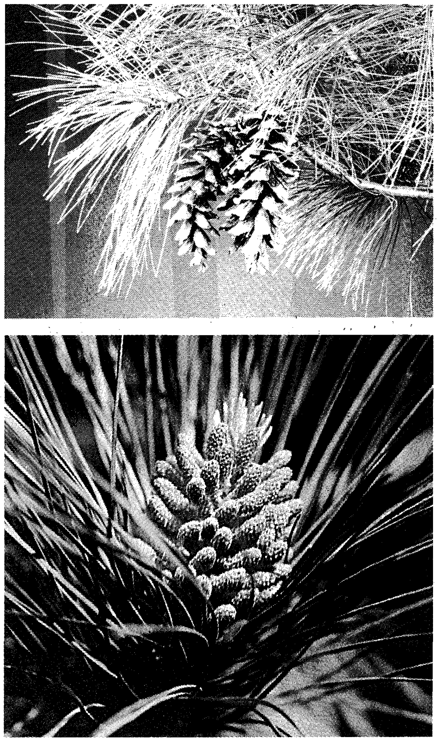

Mount Tymphrestos in the southern Pindus range, Greece
Anthony J. Huxley—EB Inc.

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

pine, any of about 90 species of ornamental and timber evergreen conifers of the genus *Pinus* (family Pinaceae), distributed throughout the world but native primarily to northern temperate regions.

Young trees are usually conical, with whorls of horizontal branches; older trees may have round, flat, or spreading crowns. Most species have thick, rough, furrowed bark. Pine trees can tolerate drought but require full sunlight and clean air for good growth and reproduction.

Pines have two types of branches, long shoots and short shoots, and three types of leaves, primordial, scale, and adult. Seedling plants bear the lance-shaped, spirally arranged primordial leaves; the triangular-scale leaves, also lance-shaped, are borne on the long shoots of older trees. Both long and short shoots develop in the axils of the deciduous scale leaves. The needlelike, photosynthetic adult leaves, with two or more resin canals, are borne in fascicles (bundles) of two to five (rarely, up to eight or solitary) at the tip of each short shoot; they remain on the tree 2 to 17 years.


(Top) Mature seed-bearing female cones of white pine (*Pinus strobus*) and (bottom) cluster of pollen-bearing male cones of Austrian (black) pine (*Pinus nigra*)
Grant Heilman—EB Inc.

Male cones are covered with many fertile scales, each of which bears two pollen sacs. Female cones, borne on the same tree, have several spirally arranged bracts (modified leaves), each of which is located below a scale with two ovules (potential seeds). In spring or early summer the pollen sacs release pollen through longitudinal slits; each grain has two air bladders for wind dispersal. The scales on the female cones open to receive the pollen and then close; actual fertilization takes place late the following spring. After fertilization, the woody female cone develops over a two- to three-year period. In some species, the cones open at maturity and the seeds are released; in others the cones remain closed for several years until opened by rotting, by food-seeking animals, or by fire. In some pines the scale bearing the nutlike seed may be expanded to form a wing for airborne dispersal.

Pines are softwoods, but commercially they may be designated as soft pines or hard pines. Soft pines, such as white, sugar, and piñon pines, have relatively soft timber, needles in bundles of five (rarely, one to four), stalked cones with scales lacking prickles, and little resin. Their wood is close-grained, with thin, nearly white sapwood; the sheaths of the leaf clusters are deciduous, and the leaves contain a single fibrovascular bundle. Hard pines, such as Scots, Corsican, and loblolly pines, have relatively hard timber, needles in bundles of two or three (rarely, five to eight), cone scales with prickles, and large amounts of resin. Their wood is coarse-grained and usually dark-coloured, with pale, often thick sapwood; the sheaths of the leaf clusters are persistent, and the leaves have two fibrovascular bundles.

The chief value of pines is in the construction and paper-products industries, but they are also sources of turpentine, rosin, oils, and wood tars (naval stores); longleaf, slash, cluster, and Chir pines are cut for these materials. Charcoal, lampblack, and fuel gases are distillation by-products. Pine-leaf oil, used medicinally, is a distillation product of the leaves. Edible pine seeds are sold commercially as pine nuts, piñons, or pignons, produced by stone, Armand, Siberian, piñon, Torrey, Coulter, and digger pines. Many species of pines are cultivated as ornamentals, including black, white, Himalayan, and stone pines; others, such as Scots, Corsican, cluster, and knobcone pines, are planted in reforestation projects or for windbreaks.

Pines are susceptible to several fungal diseases, among them white-pine blister rust, and are attacked by many insects, such as sawflies, weevils, bark beetles, and tip moths. Pine forests often suffer severe fire damage, being very combustible because of their high resin content.

Many botanists consider the genus *Pinus* to contain two subgenera. *Haploxylon,* or soft, pines have one fibrovascular bundle; *Diploxylon,* or hard, pines have two.

Many pines have both lumber trade names and several common names. Numerous trees commonly called pines are not true pines but belong to other genera in the family Pinaceae or to other families of conifers.

Major Eurasian pines. The Scots pine (*P. sylvestris*) of northern Europe, when grown under optimum conditions, attains a height of 20 to 40 m (70 to 130 feet). It is conical in youth, acquiring a mushroom crown in maturity, and has a straight trunk as much as a metre in diameter, fiery red-brown bark, and gnarled, twisted boughs densely clothed with blue-green foliage at the extremities. *P sylvestris* occurs in varying abundance from Finland and Sweden to the mountains of Spain and the higher slopes of Mount Etna and, longitudinally, from the shores of the North Sea to Siberia. Abundant in the Scandinavian peninsula, it is the fir (*fur, fura*) of the old Norsemen and still retains that name in Great Britain, although it is a true pine. Economically it is valued for timber but also for turpentine and tar.

Closely allied to the Scots pine—and perhaps to be regarded as a mere alpine form of that species—is the dwarf *P. pumilio,* a recumbent bush, generally only a metre or two high, but with long zig-zag stems that root occasionally at the kneelike bends where they rest upon the ground. It abounds in the Bavarian and Tirolese Alps.

P. laricio, the Corsican pine, grows to a height of 30 or even 45 m, with a straight trunk and branches in regular whorls, forming in a large tree a pyramidal head. This pine abounds in Corsica and is also found in Spain, southern France, and Greece.

The black, or Austrian, pine (*P. nigra)* derives its name from the sombre aspect of its dark green, sharp, rigid, rather long leaves. The tree, up to 30 m tall, displays a deeply fissured bark and light brown branches. This species, widely cultivated for ornament, is native to Europe and western Asia.

The cluster, or pinaster (*P. pinaster*), a vigorous grower in coastal sand, has been cultivated extensively for the purpose of stabilizing sand drifts, especially on the dunes of the Bay of Biscay and the Mediterranean. Growing to a height of from 12 to 24 m, the deeply furrowed trunk occasionally reaches a diameter of a metre or more at the base. Forests of pinaster, apart from the production of timber, have great economic value as a source of turpentine.

P. pinea is the stone pine of Italy. Its spreading, rounded canopy of light green foliage, supported on a tall and often branchless trunk, forms a striking feature of the landscape of Italy, as well as of some other Mediterranean lands. The cones have been prized from the ancient days of Rome for their edible seeds (pignons), which are still used for food.

Similar to *P. pinea* is *P. griffithi,* the Himalayan, or blue, pine, which differs chiefly in its longer cones and drooping, glaucous foliage. It grows in Kumaeon and Bhutan and on some of the Nepal ranges, where it attains large dimensions.

The Eurasian stone pine (*P. cembra*) abounds on the Alps, the Carpathians, and the Siberian ranges. The oily seeds, like those of *P. pinea,* are eaten by the inhabitants of the Alps and Siberia and yield a fine oil used for food. The wood is remarkably even-grained and is used by Swiss woodcarvers.

Major North American pines. The eastern white pine (*P. strobus*), known also as Weymouth pine, is one of the most valuable of North American timber trees because of its large size and the soft, even grain of its white wood. It once formed extensive forests from Newfoundland to Manitoba, from Minnesota to Maine and southward in the mountains to Georgia, but it has been cut intensively for so long that by the second half of the 20th century very few old trees remained. On deep rich soil *P. strobus* attains a height of 60 m and a trunk diameter of 1 to 1.5 m. The western white pine (*P. monticola*) grows in the mountains of the northwestern United States and British Columbia, has light brown wood, and is extensively cut for lumber.

The sugar pine (*P. lambertiana*) of California is the largest of known pines, often 60 to 70 m tall and with a trunk diameter of 2 or even 3.5 m. Its crown is pyramidal, with horizontal or slightly drooping branches.

North American stone pines are typically timberline species and are more important as protectors of valuable watersheds than for the timber they produce. The whitebark pine (*P. albicaulis*) extends along mountain slopes from British Columbia to California and eastward to Montana and Wyoming. The Mexican white pine (*P. ayacahuite*) attains its northern limits in the southwestern United States.

The single-leaf piñon (*P. monophylla*) occurs sporadically through northern Mexico and the southwestern United States. The Parry piñon (*P. quadrifolia*) is the four-needle piñon of southern California and northern Baja California. Nut pine (*P. edulis*) is the most widely distributed tree of this nut group. The seeds of the group are large and tasty and are sold in markets as pine nuts.

Longleaf pine (*P. palustris*) is the most notable yellow pine of the southern United States; it abounds on sandy soils from the Carolinas and Florida westward to Louisiana and Texas. The most marked features of the tree are its long, tufted foliage and its tall, columnar trunk, sometimes 35 m high, which furnishes one of the most valued pine timbers. Loblolly pine (*P. taeda*), shortleaf pine (*P. echinata*), and slash pine (*P. caribaea*) are other very important timber trees in the southern United States. The last-named extends over the Florida Keys to several islands in the Caribbean.

Ponderosa, western yellow, or bull pine (*P. ponderosa*), which grows from 45 to 60 m high, with a massive trunk 1.5 to 2.5 m in diameter, is noted for its soft, easily worked wood. It is the most widely distributed American pine, being found in the mountain forests of western North America from British Columbia to South Dakota and south to Texas and Mexico.

The beautiful Monterey pine (*P. radiata*), found sparingly along the California coast, is distinguished by the brilliant colour of its foliage. The Torrey pine (*P. torreyana*) is found only in a narrow strip along the coast near San Diego, Calif., and on Santa Rosa Island and is the least widely distributed of all known pines.

The pitch pine (*P. rigida*), found from the coast of Massachusetts southwestward throughout the Appalachian region, is a tree of from 12 to 15 m in height, with rugged trunk, occasionally a metre in diameter. The tree is one of the few pines that will flourish in salt marshes.

Pine Bluff, city, seat (1832) of Jefferson county, central Arkansas, U.S., on high bluffs overlooking the Arkansas River. Settled in 1819 as a trading post by Joseph Bonne and known as Mount Marie, it was renamed in 1832 for its forest of giant pines. It was the scene of an American Civil War engagement (Oct. 25, 1863) when a Confederate force under General John S. Marmaduke was repulsed by a Federal brigade under Colonel Powell Clayton, later a governor and U.S. senator. The city is an industrial, rail, and marketing centre and a river port. Cotton, paper, lumber, and archery supplies are basic to its economy. It is the seat of the University of Arkansas at Pine Bluff (formerly Arkansas Agricultural, Mechanical and Normal College [1873]) and a vocational technical school. Pine Bluff Arsenal (15,000 acres [6,100 hectares]) includes chemical- and biological-warfare laboratories. Inc. town, 1839; city, 1846. Pop. (1988 est.) 62,528.

Pine Falls, village, southeastern Manitoba, Canada, on the Winnipeg River, near its influx into Lake Winnipeg. It originated around a paper mill built in 1925 and was sustained by the arrival of a railroad branch line from Winnipeg (60 miles [100 km] southwest) in 1926. The site, within Fort Alexander Indian Reserve, was leased from the Department of Indian Affairs, and the Manitoba Pulp and Paper Company, which planned the village, is the administrator and chief employer of the community. Pine Falls is now a service centre for a lumbering and trapping region. Immediately to the east is Manitoba Hydro's Pine Falls power plant, which supplies electricity to metropolitan Winnipeg. Belair Provincial Forest and Grand Beach Provincial Park (9.5 square miles [25 square km]) are nearby. Pop (1981) 885.

Pine Mountain, ridge on the Cumberland Plateau, a section of the Appalachian Mountains in the United States, extending for 125 miles (200 km) across southeastern Kentucky, along the Virginia border, and into northern Tennessee. With average heights of 2,100 to 2,800 feet (640 to 850 m), the ridge rises to Big Black Mountain (4,145 feet [1,263 m]), the highest point in Kentucky. A scenic highway crosses a section of the wooded ridge, which is partly within a division of the Jefferson National Forest.

pine mouse, any of several burrowing rodents, species of voles. *See* vole.

pine oil, essential oil consisting of a colourless to light amber liquid of characteristic odour obtained from pine trees, or a synthetic oil similar in aroma and other properties. Pine oil is used as a solvent for gums, resins, and other substances. It has germicidal properties and is employed medically as a principal constituent of general disinfectants. It is also used in odorants, insecticides, detergents, wetting and emulsifying agents, wax preparations, and antifoaming agents and in textile scouring and the flotation process for refining lead and zinc ores.

Pitch-soaked wood of the pine tree, principally *Pinus palustris* but also certain other species of the family Pinaceae, is subjected to steam distillation, solvent extraction followed by steam distillation, or destructive distillation to obtain the pine oil, which boils at 200°–220° C (390°–430° F).

A variety of similar pine oils are obtained by distillation of cones and needles of various species of pines or by extraction from the stumps using solvents and steam. Synthetic pine oil is produced by conversion of terpene hydrocarbons into terpene alcohols.

Chemically, pine oils consist principally of cyclic terpene alcohols and are used in the manufacture of chemicals. Pine oil is insoluble in water but dissolves in alcohol and other organic solvents.

pine weevil, any wood-boring beetle of the insect family Curculionidae (order Coleoptera). Their most unusual physical characteristic is an elongated beak, or snout.

The white pine weevil (*Pissodes strobi*) of North America kills the central growth shoot of white pine trees, forcing one of the side shoots to take over the upward growth of the tree. This results in bends in the tree trunk and reduces its value as lumber.

pineal gland, also called PINEAL BODY, or EPIPHYSIS CEREBRI, an endocrine gland found in vertebrates that regulates the production of the hormone melatonin. Though it is not part of the brain, the pineal gland develops from the roof of the diencephalon, a section of the brain. In some lower vertebrates the gland has a well-developed eyelike structure; in others, though not organized as an eye, it functions as a light receptor. Studies that were carried out in the 1980s suggested that the pineal gland was the evolutionary forerunner of the modern eye.

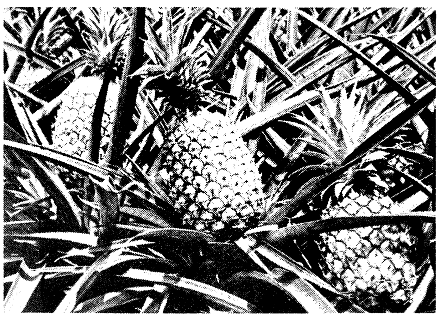
The pineal gland is located within the third cerebral ventricle along the midline of the brain. Its name is derived from its shape, which is like that of a pine cone (Latin: *pinea*). In the adult human, it is about 0.64 cm (0.25 inch) long and is pinkish gray or white in colour. It weighs little more than 0.1 gram. The gland is large in children and begins to shrink with the onset of puberty. In adults, small deposits of such minerals as calcium make the pineal body visible on X rays.

The apparent endocrine function of the gland is to elaborate the hormone melatonin. Studies of the pineal body in a number of vertebrates have conclusively proved that the pineal plays a major role not only in sexual development but also in hibernation and metabolism and seasonal breeding. In humans, however, its actual function is not understood very well; though humans have not responded as predictably to experimentation as have the lower vertebrates, evidence has suggested that the pineal gland plays a significant role in sexual maturation (the abundant production of melatonin in young children is believed to inhibit sexual development), circadian rhythm and sleep induction (secretion of melatonin is elevated at night), and so-called seasonal affective disease and depression (decreased daylight makes for longer periods of melatonin production).

pineapple (*Ananas comosus*), fruit-bearing plant of the family Bromeliaceae, native to tropical and subtropical America but introduced elsewhere. The pineapple plant resembles the agave or some yuccas in general appearance. It has from 30 to 40 stiff, succulent leaves closely spaced in a rosette on a thick, fleshy stem. With commercial varieties, a determinate inflorescence forms about 15 to 20 months after planting on a flower stalk 100–150 mm (4–6 inches) in length. The originally separate lavender flowers, together with their bracts, each attached to a central axis core, become fleshy and fuse to form the pineapple fruit, which ripens five to six months after flowering begins. Fruits of commercial varieties range from 1 to 2 kg (2 to 4 pounds) in weight. The earliest written references to pineapple are by Columbus, Gonzalo Fernández de Oviedo y Valdés, and Sir Walter Raleigh, who found pineapple growing in the West Indies, where it was used for food and wine making.

The Portuguese were apparently responsible for early dissemination of the pineapple. They introduced it to Saint Helena shortly after they discovered that island in 1502. Soon after, they carried it to Africa and, by about 1550, to India. Before the end of the 16th century, cultivation of the plant had spread over most of the tropical areas of the world, including some of the islands of the South Pacific.

When pineapple is cultivated on modern plantations, an asphalt-impregnated mulch paper is usually first laid on well-tilled soil in rows, with the edges covered to anchor the strips of paper. The pineapple propagating pieces are inserted through the paper into the soil, so spaced as to give a population of 15,000–20,000 plants per acre. The pineapple has become a characteristic ingredient in the meat, vegetable, fish, and rice dishes of what



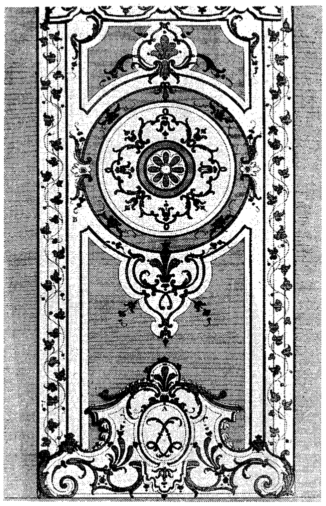
Pineapple (*Ananas comosus*)
By courtesy of Dole Company

is loosely termed Polynesian cuisine, a blend of various Oriental styles of cooking. The fruit is eaten fresh where available and in canned form worldwide. In the United States and in Europe it is sometimes used as a pastry filling or in baked desserts.

Total world production of pineapples ordinarily averages about 8,300,000 metric tons annually, of which an estimated 20 percent is produced in Thailand, which during the 1970s replaced the former leading producer, the Hawaiian Islands. Other areas of substantial production include the Philippines, China, Brazil, Mexico, Côte d'Ivoire, India, and Taiwan.

Pineau, Nicolas (b. Oct. 8, 1684, Paris—d. April 24, 1754, Paris), French wood-carver and interior designer, a leader in the development of interior decorating in the light, asymmetric, lavishly decorated Rococo style.

After study with the architects François



Etching of a design for a counterpane by Pineau, *c.* 1740
By courtesy of the Victoria and Albert Museum, London

Mansart and Germain Boffrand, Pineau began his career as a carver of woodwork. His father, Jean-Baptiste Pineau, was a sculptor in wood, and his son, Dominique (1718–86), also became a wood sculptor.

One of a group of French artisans who were visiting the newly established city of St. Petersburg (now Leningrad) in 1716 at the invitation of Peter the Great, Pineau remained in Russia until about 1728, carving the tsar's cabinet in the Peterhof palace and also serving as an architect and interior designer. Returning to Paris, he became an important designer, launching the vogue for Rococo rooms in private dwellings.

Pineau's works are characterized by shallow recesses with rounded corners and ornamentation employing shell motifs, leafy scrolls, and classical busts in medallions. Later interior designers and architects were influenced by his engravings.

pinecone fish, any member of either of two genera of fishes (*Cleipodus* and *Monocentris*) belonging to the family Monocentridae (order Beryciformes), found in deepwater marine habitats of the Indo-Pacific region. The common name comes from the characteristically oval body covered with enlarged, platelike scales, which thus resembles a pinecone. Luminescent organs occur on the lower jaw.

The Japanese pinecone fish (*M. japonicus*) normally reaches a length of 13 cm (5 inches) and travels in schools near the ocean bottom. Although small, it is commercially important as a food fish and as a saltwater aquarium fish.

Pinel, Philippe (b. April 20, 1745, Saint-André, Tarn, Fr.—d. Oct. 25, 1826, Paris), French physician who pioneered in the humane treatment of the mentally ill.

Arriving in Paris (1778), he supported himself for a number of years by translating scientific and medical works and by teaching mathematics. During that period he also began visiting privately confined mental patients and writing articles on his observations. In 1792 he became the chief physician at the Paris asylum for men, Bicêtre, and made his first bold reform by unchaining patients, many of whom had been restrained for 30 to 40 years. He did the same for the female inmates of Salpêtrière when he became the director there in 1794.

Discarding the long-popular equation of mental illness with demoniacal possession, Pinel regarded mental illness as the result of excessive exposure to social and psychological stresses and, in some measure, of heredity and physiological damage. In *Nosographie philosophique* (1798; "Philosophical Classification of Diseases") he distinguished various psychoses and described, among other phenomena, hallucination, withdrawal, and a variety of other symptoms.

Pinel did away with such treatments as bleeding, purging, and blistering and favoured a therapy that included close and friendly contact with the patient, discussion of personal difficulties, and a program of purposeful activities. His *Traité médico-philosophique sur l'aliénation mentale ou la manie* (1801;

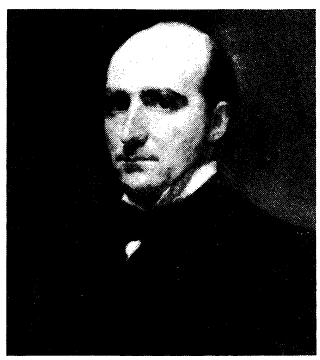
Pinel, engraving by Pierre-Roch Vigneron
Giraudon—Art Resource/EB Inc.

"Medico-Philosophical Treatise on Mental Alienation or Mania") discusses his psychologically oriented approach.

pinene, either of two colourless liquid hydrocarbons, α-pinene and β-pinene, occurring as major components of the essential oil of pine trees and used as a chemical raw material. Both compounds belong to the isoprenoid series and have the molecular formula $C_{10}H_{16}$. They often occur together and are separated by fractional distillation.

The principal source of α-pinene is turpentine obtained in the sulfate process for making paper. The commercial product is 90–95 percent pure. Large amounts of α-pinene are converted to synthetic pine oil or to camphene, which is chlorinated to toxaphene, an insecticide, or treated with acetic acid to form isobornyl acetate, a perfume with a pine-needle aroma and an intermediate in synthetic camphor manufacture.

Pinero, Sir Arthur Wing (b. May 24, 1855, London—d. Nov. 23, 1934, London), a leading playwright of the late Victorian and Edwardian eras in England who made an important contribution toward creating a self-respecting theatre by helping to found a "social" drama that drew a fashionable audience. It is



Pinero, detail of an oil painting by J. Mordecai, 1891; in the National Portrait Gallery, London
By courtesy of the National Portrait Gallery, London

his farces—literate, superbly constructed, with a precise, clockwork inevitability of plot and a brilliant use of coincidence—that have proved to be of permanent theatrical value.

Born into an English family descended from Portuguese Jews, Pinero abandoned legal studies at age 19 to become an actor; and, though still a young man, he played older character parts for the leading theatre company headed by Henry Irving. His first play, *£200 a Year,* was produced in 1877. His best farces, such as *The Magistrate* (1885), *The Schoolmistress* (1886), and *Dandy Dick* (1887), were written for the Royal Court Theatre in London. They combine wildly improbable events with likable characters and a consistently amusing style. Pinero was at the same time studying serious drama by adapting plays from the French (including *The Iron Master,* 1884, and *Mayfair,* 1885) and also mining a profitable vein of sentiment of his own, as in *The Squire* (1881) and *Sweet Lavender* (1888). The two elements fused in *The Profligate* (1889) and—most sensationally—in *The Second Mrs. Tanqueray* (1893), which established Pinero as an important playwright. This was the first of several plays depicting women battling with their situation in society. These plays not only created good parts for actresses but also demanded sympathy for women, who were judged by stricter standards than men in Victorian society. In a less serious vein, *Trelawny of the "Wells"* (written for the Royal Court Theatre and produced in 1898) portrayed theatrical company life in the old style of the 1860s—already then a vanishing tradition—and *The Gay Lord Quex* (1899) was about a theatrical rake of no placeable period but having great panache. Pinero was knighted in 1909.

Pinerolo, town, Torino province, Piemonte (Piedmont) region, northwestern Italy, at the entrance to the Valle del Chisone, at the foot of the Alps, southwest of Turin. First mentioned in 996 as a possession of Torino, it belonged to the nearby Benedictine abbey of Sta. Maria in 1078. Under the House of Savoy from 1246, it was the capital (1295–1418) of the princes of Acaia, a subsidiary line. The town was occupied by the French in 1536–74, 1631–96, and 1801–14, and its fortress was used during the 17th century as a state prison for such political prisoners as the Duc de Lauzun, enemy of Louis XIV's mistress Mme de Montespan; Nicolas Fouquet, Louis's embezzling finance minister; and the mysterious "Man in the Iron Mask," whose story is best known from one of the novels of Alexandre Dumas *père.* Pinerolo became a bishop's see in 1748.

Notable buildings include the 15th–16th-century S. Donato's cathedral (founded 1044), the church of S. Maurizio (1334–1490; restored), the palace of the princes of Acaia (1318; later modernized), and remains of the old fortifications.

Pinerolo is a rail junction with textile, metal, chemical, printing, and food industries. Pop. (1981 prelim.) mun., 35,862.

Pines, Isle of (Cuba): *see* Juventud, Isla de la.

Pines, Isle of (New Caledonia): *see* Pins, Île des.

Pinetown, residential and industrial town, Natal, South Africa. Pinetown is situated at an elevation of 1,000 to 1,300 ft (305 to 395 m) in the hills adjoining Durban on the northwest. First laid out in 1847 and later named after Sir Benjamin Pine, governor of Natal (1873–75), Pinetown did not officially become a town until 1948. It is now an important industrial centre with factories producing leather goods, concrete products, corrugated containers, plywood products, aluminum products, and confectionery. Much of the population commutes to work in Durban, and a sizable minority of its population is Indian. Pinetown lies on the national road and railway from Durban to Pietermaritzburg. Pop. (1983 est.) mun., 86,000.

P'ing-ch'iao (China): *see* Hsin-yang.

Ping Di (Chinese emperor): *see* P'ing Ti.

P'ing-hsiang, Pinyin PINGXIANG, city in western Kiangsi *sheng* (province), China. It is a prefecture-level municipality (*shih*). P'ing-hsiang is situated on the borders of Hunan Province in the midst of the Wu-kung Shan (mountains) on the upper waters of the Lu Shui (river), on what has always been a major route between the city of Ch'ang-sha in Hunan Province and Nan-ch'ang in Kiangsi.

The county was established in AD 267 and has existed ever since, usually being dependent on Yüan-chou (now I-ch'un). For a brief period (1295–1367) it was an independent prefecture. Its modern importance began with the discovery of rich coal deposits there at the end of the 19th century by German experts employed by the Han-yang Iron Works in Hupeh Province, which was urgently seeking a source of coking coal. A railway was built during 1903–05 to transport the coal, and coke ovens were installed in the city. The depressed market for iron after World War I, however, led to the decline and eventual closing of the ironworks, so that demand for P'ing-hsiang coal and coke fell dramatically, the mines closing down for a time in 1925–26. In the 1930s production was only about 20 percent of what it had been during the peak period.

After much neglect and destruction during World War II, the mines around P'ing-hsiang were modernized in the 1950s, and by the 1970s the city had again become a major mining centre. In the late 1950s a large iron and steel industry, producing pig iron and ingot steel, was established there. P'ing-hsiang also has a ceramic industry. It is on the main railway line from Nan-ch'ang to Ch'ang-sha. Pop. (mid-1970s est.) 100,000–300,000.

P'ing-hsiang, Pinyin PINGXIANG, city in southwestern Kwangsi Chuang *tzu-chih-ch'ü* (autonomous region), China. The city is a county-level municipality (*shih*) on the border of Vietnam in Nan-ning *ti-ch'ü* (prefecture). Founded as a military outpost under the name P'ing-hsiang during the Sung dynasties (960–1279), under the Ming dynasty (1368–1644) it became a county (*hsien*) and later a prefecture (*fu*); it was, however, little more than an administrative outpost among non-Chinese tribesmen. The Ch'ing dynasty (1644–1911/12) made it a subprefecture. P'ing-hsiang's modern growth stemmed from the railway from Nan-ning, which provides a through route from central China to Vietnam, crossing the border a few miles to the south at Yu-i-kuan. Construction of this line was begun in 1938 by the French, who completed it as far as Ning-ming; but, following the Japanese occupation of Nan-ning, work was abandoned in 1943–44, and much of the track was dismantled. The line was completed in 1951 and linked with the Vietnamese rail system in 1955. After this, P'ing-hsiang rapidly grew into a commercial centre for international trade with Vietnam; it also developed some small-scale industries. A considerable part of Sino-Vietnamese trade passes through P'ing-hsiang because the rail link is superior to the older line that runs through Yunnan Province and also provides a direct route to Wu-han as well as connections to Kweichow and Szechwan provinces and to the Canton area. Pop. (mid-1970s est.) 10,000–50,000.

Ping Hsin (Chinese author): *see* Bing Xin.

P'ing-liang, Pinyin PINGLIANG, town in P'ing-liang *ti-ch'ü* (prefecture), eastern Kansu *sheng* (province), north central China, near the borders of Ningsia Hui Autonomous Region and Shensi Province. Located in the eastern Kansu loesslands, the town is situated in the upper valley of the Ching Ho (river), a tributary of the Wei Ho. Wheat is the chief crop in the area; other economic activities include wool and tobacco processing. P'ing-liang served as the transport centre by road for the eastern Kansu loesslands until the completion of the railroad between Hsien-yang (Shensi) and Lan-chou. It lost its city status in 1964. Pop. (mid-1970s est.) 50,000–100,000.

Ping-Pong: *see* table tennis.

P'ing Ti, Pinyin PING DI (fl. 8 BC–AD 8), last ruling emperor of China's Western, or Former Han, dynasty.

P'ing Ti was placed on the throne in 1 BC by the powerful minister Wang Mang, whose daughter he married five years later. Though proof is lacking, it has been claimed that P'ing Ti was poisoned by his father-in-law. In any case, P'ing Ti's death allowed Wang to assume the title of regent to a child emperor; in AD 9, Wang finally set aside the Han dynasty altogether and established himself as emperor of the Hsin dynasty.

P'ing-tung, southernmost *hsien* (county) of Taiwan, occupying an area of 1,072 sq mi (2,776 sq km). It is bordered by Kao-hsiung *hsien* (northwest), T'ai-tung *hsien* (northeast), and by the Luzon Strait (southwest). The Central Range (2,300 ft to 10,000 ft [700 m to 3,000 m] above sea level) is the source of the Hsia-tan, Kao-p'ing, and Wu-lo rivers and extends over the southeastern part of the region. Sugarcane, paddy rice, sweet potatoes, tobacco, bananas, and pineapples are grown in the irrigated, alluvial coastal plains of the county. P'ing-tung *hsien* is the centre of sugar refining in Taiwan. Its industries manufacture metal goods, machinery, and chemicals and produce alcoholic beverages and canned food. P'ing-tung city, the administrative seat, has a large military base. K'en-ting Kung-yüan (Tropical Botanical Forest Park) at Heng-ch'un covers an area of 100 ac (40 ha) and has one of the largest experimental forests in southeast Asia. A 19-sq-mi area in Heng-ch'un Pan-tao (peninsula) is being developed as Taiwan's first National Scenic Area and as the largest forest vacation area in southern Taiwan. The Haucha model aborigine village is at Wu-t'ai. The San-ti-men Ch'iao (bridge) on the Wu-lo Ch'i (river) is in the north, and the ancient Shih-men Battlefield and the O-luan-pi Lighthouse (built 1882), one of the largest in southeast Asia, are in the south. Pop. (1983 est.) 896,966.

P'ing-tung, also called (until 1920) AKOW, *shih* (municipality) and seat of P'ing-tung *hsien* (county), southwestern Taiwan. It is located 13 mi (21 km) northeast of Kao-hsiung city, in the southern part of the western plain. Founded in the early 18th century, the city is situated west of the Kao-p'ing Hsi (river). It is in an agricultural region that produces sugarcane, rice, bananas, tobacco, and fruits. P'ing-tung city is one of Taiwan's leading sugar-refining centres. Other industrial products include metal goods, machinery, chemicals, and alcoholic beverages. The South Link railway connects P'ing-tung city with the cities of T'ai-tung to the east and Kao-hsiung to the west; the city is connected by highway with O-luan-pi on the southern tip of the island. P'ing-tung city is the seat of the Taiwan Provincial Institute of Agriculture (founded 1954) and has junior colleges for teacher training, pharmacology, nursing, and technology. San-ti-men Ch'iao (bridge) is about 9 mi northeast of the city. Pop. (1982 est.) 189,347.

pingo, dome-shaped hill formed in a permafrost area when the hydrostatic pressure of freezing groundwater causes the upheaval of a

Ibyuk pingo near Tuktoyaktuk in the Mackenzie River Delta, N.W.Terr.; it is 140 feet high

J. Ross Mackay

layer of frozen ground. Pingos may be up to 90 metres (300 feet) high and over 800 metres ($^1/_2$ mile) across and are usually circular or oval. The core, which may be only slightly smaller than the pingo itself, consists of a lens of clear, injected ice. Modern pingos occur in the continental tundras and are generally restricted to latitudes of 65° to 75° N. Rupture of the overlying material at the top of the pingo exposes the ice to melting and may create a smaller crater and lake. Two types are recognized, the open-system pingo and the closed-system pingo.

The open-system pingo forms in regions of discontinuous or thin permafrost. Artesian pressure builds up under the permafrost layer, and as the water rises, pushing up the overlying material, it freezes in a lens shape. This variety of pingo is most frequently found in the alluvial material of a mountainous or hilly area.

The closed-system pingo forms in a shallow lake when advancing permafrost generates hydrostatic pressure under the lake basin. The confined mass of saturated soil freezes, pushing the overlying material upward as it expands.

Scars of former pingos have been found in areas near the edges of former Pleistocene ice sheets. Because pingos form under specific conditions, they serve as good indicators of climatic change.

pinguecula, yellowish nodule in the conjunctiva at the front of the eye, usually but not always on the nasal side. The conjunctiva is the mucous membrane that lines the eyelid and extends over part of the surface of the eyeball. Pinguecula occurs in elderly persons and is thought to represent degeneration in the conjunctiva as a result of exposure to wind and dust. The condition does not require medical or surgical treatment.

Pingxiang (China): *see* P'ing-hsiang.

Pinilla, Gustavo Rojas: *see* Rojas Pinilla, Gustavo.

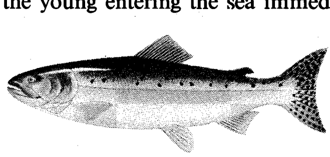
pinion: *see* rack and pinion.

Piniós River, Modern Greek PINIÓS POTAMÓS, also called PENEUS RIVER, principal stream of Thessaly, Greece, rising in the Óros (mountains) Lákmos of the Pindus Mountains just east of Métsovon in the *nomós* (department) of Tríkala; it is navigable in its lower course. In prehistoric times the Piniós formed a great lake before it broke through the Vale of Tempe. It now flows 127 mi (205 km) through the mountains and plains of Thessaly, thrusting itself through the Vale of Tempe between the Olympus and Ossa massifs and debouching at the entrance to the Thermaïkós Kólpos (gulf) of the western Aegean Sea. Entering the western Thessalian plain, it receives the Enipévs and immediately winds through the saddle of low hills between the Zarkou Mountains on the north and the Mavrovoúni outliers that divide the Thessalian plain into two distinct parts. Other tributaries include the Lithaíos and the Titarísios.

pink, any of several flowering plants of the genus *Dianthus* in the pink family (Caryophyllaceae), grown widely in garden borders. The approximately 300 species in the genus are natives of the Eastern Hemisphere and are found chiefly in the Mediterranean region. They are mostly short herbaceous perennials, many of which are tufted or mat-forming hardy evergreens, often with very showy flowers. Some annual forms also exist. Especially noteworthy are the fragrant-flowered grass, or cottage, pink (*D. plumarius*); maiden, or meadow, pink (*D. deltoides*); and rainbow, or China, pink (*D. chinensis*). Most pinks are suited to rock gardens. The small but showy and often fragrant flowers are mostly pink to deep rose, some being red, purple, white, or yellow. Pinks are widely grown in American and European gardens, being of relatively easy culture. Fine modern varieties of both the greenhouse and hardy types of carnation are largely grown commercially. Both annual and perennial *Dianthus* species may be grown from seed sown in the spring in ordinary moist garden soil in a sunny location. The perennials will bloom the following summer and may be increased by cuttings or division of clumps.

Related plants of the genus *Dianthus* are also sometimes referred to as pinks. The popular carnation (*q.v.*), for example, is often called clove pink in reference to its spicy scent, and sweet William (*q.v.*), a garden favourite, is often called bunch pink.

pink salmon, also called HUMPBACK SALMON (*Oncorhynchus gorbuscha*), North Pacific food fish, family Salmonidae, weighing about 2 kilograms ($4^1/_2$ pounds) and marked with large, irregular spots. It often spawns on tidal flats, the young entering the sea immediately



Pink salmon (*Oncorhynchus gorbuscha*)

Painted especially for *Encyclopaedia Britannica* by Tom Dolan, under the supervision of Loren P. Woods, Chicago Natural History Museum

after hatching. The alternative name humpback salmon refers to the hump that develops on the back of the breeding male. *See also* salmon.

Pinkerton, Allan (b. Aug. 25, 1819, Glasgow—d. July 1, 1884, Chicago), detective and founder of a famous American private detective agency.

Pinkerton was the son of a police sergeant. After completing his apprenticeship to a cooper, he emigrated to the United States in 1842 and settled in Chicago. Moving the next year to the nearby town of Dundee in Kane County, he set up a cooper's shop there. While cutting wood on a deserted island one day, he discovered and later captured a gang of counterfeiters. Following this and other similar achievements, he was appointed deputy sheriff of Kane County in 1846 and soon afterward deputy sheriff of Cook County, with headquarters in Chicago.

In 1850 Pinkerton resigned from Chicago's new police force in order to organize a private detective agency that specialized in railway theft cases. The Pinkerton National Detective Agency became one of the most famous organizations of its kind. Its successes included capture of the principals in a $700,000 Adams Express Company theft in 1866 and the thwarting of an assassination plot against President-elect Lincoln in February 1861 in Baltimore. In 1861, working for the Union during the Civil War, Pinkerton, under the name E.J. Allen, headed an organization whose purpose it was to obtain military information in the Southern states.

After the Civil War Pinkerton resumed the management of his detective agency. From 1873 to 1876 one of his detectives, James McParlan, lived among the Molly Maguires in Pennsylvania and secured evidence that led to the breaking up of this organization of coal miners supposedly engaged in terrorism. During the strikes of 1877 the Pinkerton Agency's harsh policy toward labour unions caused it to be severely criticized in labour circles, although Pinkerton asserted he was helping workingmen by opposing labour unions. Pinkerton wrote *The Molly Maguires and the Detectives* (1877); *The Spy of the Rebellion* (1883), his account of Lincoln's journey to Washington in 1861; and *Thirty Years a Detective* (1884).

pinkeye (veterinary medicine): *see* bovine infectious keratoconjunctivitis.

Pinkham, Lydia E(stes) (b. Feb. 9, 1819, Lynn, Mass., U.S.—d. May 17, 1883, Lynn), successful American patent-medicine proprietor who claimed that her Vegetable Compound could cure any "female complaint" from nervous prostration to a prolapsed uterus.

Pinkham first began making her medicine as a home remedy, which she freely shared with neighbours. The compound was a blend of ground herbs such as true unicorn root (*Aletris farinosa*) and pleurisy root (*Asclepias tuberosa*), with an alcoholic content of 18 percent. The label explained that the alcohol was "used solely as a solvent and preservative."

In 1875, after women from other towns began coming to buy the compound, for $1 a bottle, the Pinkham family decided to go into business. Mrs. Pinkham wrote handbills for her sons to distribute with slogans like, "Only a woman can understand a woman's ills." It was her son Daniel who, in 1879, had the idea of using his mother's picture in newspaper advertisements to emphasize the homemade quality of the compound. His strategy succeeded, and continued heavy advertising made the face of the "savior of her sex," as the ads described her, one of the best known in the country. Although medical proof was never found to substantiate the claimed therapeutic effects of the compound, it quickly gained acceptance with women, many of whom were hesitant to consult male physicians about "female problems." During her life, the business expanded from a cellar kitchen, in which she mixed the formula herself, to a laboratory that brewed, bottled, and shipped enough compound to gross just under $300,000 a year.

In pamphlets and ads, she invited women to write to her for advice, which they did in increasing numbers. Pinkham established a Department of Advice with an all-female staff to respond to the hundred letters a day that she reported receiving. Prompted by the ignorance of many who wrote to her, she also wrote and printed a facts-of-life manual for women. In it she described the female reproductive system from puberty through childbearing and menopause. The book was issued under various titles and distributed free.

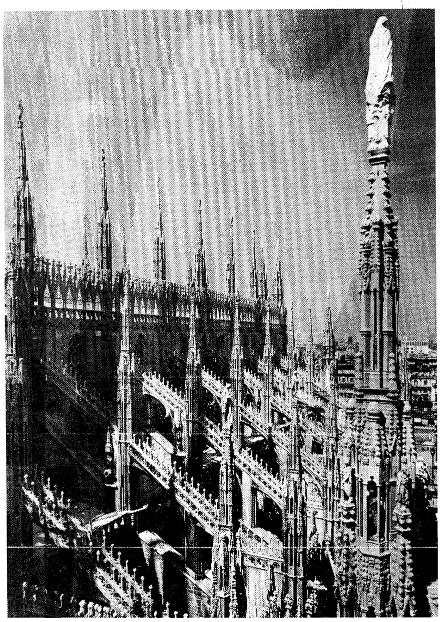
Not until the 1920s, when faced with increasing federal regulation of drugs and advertising, did the Lydia E. Pinkham Medicine Co. reduce both its claims for the compound and the alcoholic content of the product.

Pinkney, William (b. March 17, 1764, Annapolis, Md.—d. Feb. 25, 1822, Washington, D.C.), U.S. statesman and diplomat, considered one of the foremost lawyers of his day.

A member of the Maryland convention that ratified the federal Constitution in 1788, Pinkney himself voted against ratification. He served in the Maryland state legislature (1788–92; 1795) and on the state's Executive Council (1792–95). From 1796 to 1804 he represented the United States as a commissioner to negotiate an agreement with Great Britain concerning American maritime losses, and he served as U.S. minister to Great Britain from 1807 to 1811.

Pinkney was U.S. attorney general (1811–14) under President James Madison, served in the House of Representatives (1815–16), and was minister to Russia (1816–18). From 1819 to 1822 he was a member of the U.S. Senate, where he became a champion of the slave states. He successfully argued many important cases before the Supreme Court, including *McCulloch* v. *Maryland* (1819), in which the power of Congress to charter the Bank of the United States was upheld.

pinnacle, in architecture, vertical ornament of pyramidal or conical shape, crowning a buttress, spire, or other architectural member. A pinnacle is distinguished from a finial by its greater size and complexity and from a tower



Pinnacles on the flying buttresses and parapet of the Cathedral of Milan, about 1385–1485
A.F. Kersting

or spire by its smaller size and subordinate architectural role. A tower may be decorated with pinnacles, each one capped by a finial.

Simple pinnacles were used on Romanesque churches, especially to mask the abrupt transition from square tower to polygonal spire; but they were far more prominent in developed Gothic architecture and decoration, in which they were used to give vertical emphasis and to break up hard outlines. They appeared at every major corner of a building, flanked gables, and decorated parapets and buttresses. Some of the most striking pinnacles crown the piers of flying buttresses, on which, although primarily decorative, they enhance the stability of the buttresses, helping to counteract the lateral thrust of the vault. The buttress pinnacles around the choir of Notre-Dame at Paris and the magnificent 80-foot (24-metre) pinnacles at Reims Cathedral (13th century) are representative examples.

In the 18th, 19th, and 20th centuries, pinnacles were often used in eclectic architecture. Notable examples include London's Houses of Parliament (begun 1840) and the Woolworth Building in New York City (1913).

pinniped (suborder Pinnipedia), any of various families of aquatic, fin-footed mammals in the order Carnivora, often considered a separate order. There are three existing families of pinnipeds: Odobenidae (*see* walrus) and Phocidae and Otariidae (*see* seal).

Pinochet (Ugarte), Augusto (b. Nov. 25, 1915, Valparaiso, Chile), leader of the military junta that overthrew the Marxist government of President Salvador Allende of Chile on Sept. 11, 1973. He subsequently headed Chile's military government (1974–90).

Pinochet, a graduate of the military academy in Santiago (1936), was a career military officer who was appointed army commander in chief by President Allende 18 days before the coup. He planned and led the military coup in which Allende died. Pinochet was named president of the victorious junta's governing council, and he immediately moved to crush Chile's liberal opposition, arresting approximately 130,000 individuals in a three-year period. In June 1974 Pinochet assumed sole power, relegating the rest of the junta to an advisory role and dropping plans to rotate the presidency among its members.

Pinochet was determined to extirpate leftism in Chile and to reassert the primacy of free-market policies in the country's economy. His junta was widely condemned for its harsh suppression of dissent at the same time that its reversal of the Allende government's socialist policies resulted in a lower rate of inflation and an economic boom in the period from 1976 to 1979. A modest political liberalization began in 1978, after the regime announced that, in a plebiscite, 75 percent of the electorate had endorsed Pinochet's rule.

A new constitution went into effect in March 1981. Under its terms, the military junta's candidate for president, Pinochet, would serve as president for another eight-year term, and in 1989 the military's candidate would be submitted to a national referendum for either approval or rejection by a majority of the voters. During Pinochet's 1980–88 term, his free-market policies were generally credited with maintaining a low rate of inflation and an acceptable rate of economic growth despite a severe recession in 1980–83. Pinochet continued to maintain tight controls over the political opposition, but he fulfilled his constitutional obligation to hold the plebiscite scheduled for 1989. The actual plebiscite, held in October 1988, resulted in a "no" vote of 55 percent to a "yes" vote of 43 percent for Pinochet's continuation as president. Thus rejected by the electorate, Pinochet remained in office until after free elections installed a new president, the Christian Democrat Patricio Aylwin, on March 11, 1990.

pinochle, card game derived from bezique and most often played in North America. One popular version is auction pinochle, a three-handed game using two packs of 24 cards ranking ace, 10, king, queen, jack, and 9 of each suit. Each player is dealt 15 cards, 3 at a time; after the first 3 are dealt, 3 are dealt to the table to form the widow. Bidding goes clockwise from the dealer's left. The lowest bid is generally 300. Bids reflect the player's estimate of the number of points he may earn through melds and by taking high-card points in tricks. The high bidder names trump, takes the widow, discards three cards after melds are displayed, and tries to score the amount of his bid, while the others try to defeat him.

Before play begins, the bidder displays melds made up from his hand and the widow. The common melds and their point values are:

Pinochle (queen of spades and jack of diamonds)	40
Dix (9 of trump)	10
Four aces (one in each suit)	100
Four kings (one in each suit)	80
Four queens (one in each suit)	60
Four jacks (one in each suit)	40
Marriage (king and queen in a side suit)	20
Royal marriage (king and queen of trump)	40
Royal flush (ace through jack of trump)	150

Values of cards in auction pinochle are ace (11), 10 (10), king (4), queen (3), jack (2), and 9 (0). If two identical cards are played to a trick, the first beats the second. Points are scored for (a) capturing counting cards in tricks, plus 10 for winning the last trick, and (b) holding various melds at the outset of the game. The king or queen melded in a royal marriage may not also be melded in a royal flush, or vice versa. The 9 of trumps (called the dix) is worth 10 points: to the dealer if turned as trump, to a player by melding it or displaying it after winning a trick. The dix is then exchanged for the turned trump.

At any point up to the play of the first trick, the bidder may concede without further play, or his opponents may concede. To start play, the bidder leads to the first trick; others follow suit, or, if unable to follow, they must trump. If trump is led, the others must, if possible, play a higher trump.

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

pinocytosis, a process by which liquid droplets are ingested by living cells. Pinocytosis is also common among many microorganisms. Rather than passing as individual molecules through the cell membrane without disrupting it, the droplet first becomes bound, or adsorbed, on the cell membrane, which then invaginates (forms a pocket) and pinches off to form a vesicle, or vacuole, in the cytoplasm. It is believed that a vesicle may carry extracellular fluid to the opposite side of the cell, where it undergoes reverse pinocytosis. A droplet of fluid could thus be transported through the cell without disturbing its cytoplasm. Alternatively, intracellular digestion of the vacuole wall would permit the droplet to mix with the cytoplasm. *See also* phagocytosis.

Pinos, Isla de (Cuba): *see* Juventud, Isla de la.

Pins, Île des, English ISLE OF PINES, also called KUNIE ISLAND, island in the southwest-ern Pacific Ocean, within the French overseas territory of New Caledonia. With an area of 59 square miles (152 square km), it is forested with pinelike coniferous trees of the genus *Araucaria cooki* (hence its name) and is rugged, rising to Nga Peak (870 feet [265 m]). The island was once a penal colony but by the 1970s had a growing tourist trade. Exports include shrimp and oysters. The main town and administrative centre is Vao, on the south coast. Pop. (1983) 1,288.

Pinsk, city, Brest *oblast* (province), Belorussia, U.S.S.R., situated at the confluence of the Pina and Pripyat rivers. Pinsk was first mentioned in 1097 and was the seat of a Russian princedom. It passed under Lithuanian rule (13th–16th century), then Polish (1569–1793), Russian (1793–World War I), Polish again (1920–39), and then Soviet (with German occupation during 1941–44). Pinsk lies at the eastern end of the Dneprovsko-Bugsky Canal and is a significant river port. There are woodworking industries, metalworking, manufacture of artificial leather, and shipbuilding and repair yards. Pop. (1989 prelim.) 119,000.

Pinsker, Leo, original name JUDAH LEIB PINSKER (b. 1821, Tomaszów, Pol., Russian Empire [now in Poland]—d. Dec. 21, 1891, Odessa, Russian Empire [now in the Ukraine, U.S.S.R.]), Russian-Polish physician, polemicist, and pioneer Jewish nationalist, who was a forerunner of Theodor Herzl and other major political Zionists.

While conducting a medical practice in Odessa, Pinsker maintained a deep interest in Jewish community affairs. He joined the Society for the Promotion of Culture Among the

Jews of Russia, an assimilationist organization founded in 1863. He advocated secular education for Jews and the translation of the Bible and Hebrew prayer books into Russian. A pogrom in Odessa in 1871 shook but did not destroy his beliefs; in 1881, however, another severe pogrom broke out in Odessa, not only ignored but even abetted by the government and defended by the press. His assimilationist beliefs were shattered, and he turned to Jewish nationalism.

In 1882 Pinsker anonymously published in German an incisive, embittered, and impassioned pamphlet, "Auto-Emanzipation. Ein Mahnruf an seine Stammesgenossen. Von einem russischen Juden" ("Self-Emancipation. A Warning Addressed to His Brethren. By a Russian Jew"; *Auto-Emancipation*, 1884), which provoked strong reactions, both critical and commendatory, from Jewish leaders. In the pamphlet he contended that the only restorative for Jewish dignity and spiritual health lay in a Jewish homeland.

Pinsker's authorship was soon discovered, and a newly formed Zionist group, Ḥibbat Ẕiyyon (Love of Zion), made him one of its leaders. In 1884 he convened the Kattowitz (Katowice, Pol.) Conference, which established a permanent committee with headquarters in Odessa. Although Ḥibbat Ẕiyyon (later Ḥovevei Ẕiyyon [Lovers of Zion]) was crippled by lack of funds, it did establish a few colonies in Palestine and founded the Society for the Support of Jewish Agriculturists and Handicraftsmen in Syria and Palestine.

Pinski, David, Pinski also spelled PINSKY (b. April 5, 1872, Mogilyov on the Dnepr, Russia—d. Aug. 11, 1959, Haifa, Israel), Yiddish playwright, novelist, and editor.

Reared in Moscow, Vitebsk, and Vienna, Pinski moved as a young man to Warsaw, where he became a friend of the leading Yiddish writer, Isaac Peretz. It was also in Warsaw that Pinski began his lifelong associations with the Jewish workers' movement. His first short story, "Der Groyser Mentshenfraynd" ("The Great Philanthropist") was published in 1894. He edited a Yiddish anthology, *Literatur un Lebn* ("Literature and Life"), and travelled to Berlin to further his studies. In 1899 he emigrated to the United States, where he wrote for and edited several Jewish labour periodicals. After the Kishinev pogrom of 1903 in Russia, he also became involved in the Zionist labour movement. From 1920 to 1922 he was president of the Jewish National Workers' Alliance, and he was president of the Jewish Culture Society from 1930 to 1953. In 1949 he moved to Haifa, Israel, and his home became a gathering place for young Yiddish writers.

Pinski's most successful work was the comic play *Der Oitzer* ("The Treasure"), which was performed in New York City and Germany. His play *Der Eybiker Yid* (1926, "The Eternal Jew") was performed in Moscow by the Hebrew troupe Habima in 1919. His novels include *Dos Hoyz fun Noyakh Edon* (1913; *The Generations of Noah Edon,* 1931), which portrays the deterioration of Jewishness in America and argues against assimilation.

pint, unit of capacity in the British Imperial and U.S. Customary systems of measurement. In the British system the units for dry measure and liquid measure are identical; the single British pint is equal to 34.68 cubic inches (568.41 cubic centimetres). In the United States the unit for dry measure is slightly different from that for liquid measure; a U.S. dry pint is 33.6 cubic inches (550.6 cubic centimetres), while a U.S. liquid pint is 28.9 cubic inches (473.2 cubic centimetres). In each system, two cups make a pint, and two pints equal a quart.

A U.S. liquid pint holds 1.042 pounds of water at room temperature, a fact that gave rise to the saying "a pint's a pound the world around." The pint has been a common unit of measure in Great Britain since the 14th century. The actual volume of the pint, however, has varied considerably over the years; in medieval times it held about the equivalent of the modern quart.

pinta, chronic tropical skin disease characterized initially by the appearance of dry, scaly papular lesions followed after several years by abnormally coloured patches called pintides. The pintides may be white, where pigment cells have been destroyed by the disease, or blue, red, or pink. The disease is native to Central and South America and is caused by infection with *Treponema carateum,* an organism that is indistinguishable from that of syphilis. There is some evidence of a degree of cross-immunity between the two diseases, and the treatment of both is the same. Unlike syphilis, however, pinta has little effect on the general health of the patient and is transmitted by nonvenereal contact.

Pinta, Isla, English PINTA ISLAND, also called ABINGDON ISLAND, one of the northernmost of the Galápagos Islands, in the eastern Pacific Ocean, 600 mi (965 km) west of Ecuador, which administers the Galápagos. It is an uninhabited island with an area of 20 sq mi (52 sq km).

pintail, any of three species of sleek, long-tailed, long-necked dabbling ducks of the genus *Anas* (family Anatidae); they are swift fliers and popular game birds. The common, or northern, pintail (*A. acuta*), widespread in the Northern Hemisphere, is a long-distance flier; some Alaskan birds winter as far away as Hawaii. Pairs form at the wintering ground, and the males follow the females back to their summer range. The common pintail is 66 centimetres (26 inches) long and weighs about 900 grams (2 pounds). The male has a brown head and throat, white breast, and gray back. The black tail is distinctive for its long central feathers. The female is mottled brown. About eight olive-coloured eggs are laid in a nest in sparsely vegetated areas. The preferred diet is seeds. The brown pintail (*A. georgica*), also called the yellow-billed pintail, and the Bahama, or white-cheeked, pintail (*A. bahamensis*) are primarily South American species.

Pinter, Harold (b. Oct. 10, 1930, London), playwright who achieved international renown as one of the most complex and challenging post-World War II dramatists. His plays are noted for their use of understatement, small talk, reticence—and even silence—to convey the substance of a character's thought, which often lies several layers beneath, and contradicts, his speech.

The son of a Jewish tailor, Pinter grew up in London's East End in a working-class area and was exposed early to the violence that is a brooding presence in his plays. As a child during World War II, he was evacuated more than once but lived in London during some of the worst of the bombing. He was confirmed in his insecurity after the war by encounters with Fascist toughs.

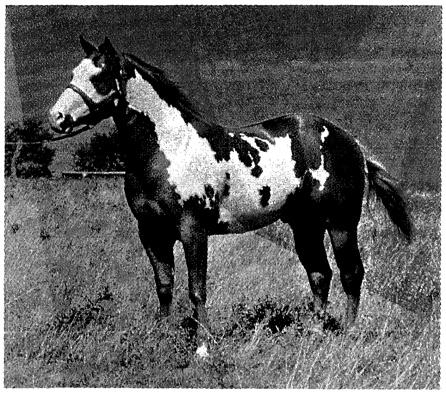
He studied acting at the Royal Academy of Dramatic Art but left after two terms. Called up for military service at 18, he declared himself a conscientious objector, underwent two court trials, and was eventually fined. In 1950 his poems began to appear in *Poetry London,* and the next year he resumed acting classes at the Central School of Speech Training and Dramatic Art, London.

Pinter toured Ireland with an acting company in 1951–52 (a period he writes of in his memoir, *Mac,* 1968) and from 1954 to 1957 acted under the name David Baron in provincial repertory theatres. In 1956 he married an actress, Vivien Merchant, who became an accomplished interpreter of his plays. *The Room* (performed 1957) was his first play, a one-act drama that established the mood of comic menace that was to figure largely in his early plays. His first full-length play, *The Birthday Party* (1958; filmed 1968), puzzled the London audiences and lasted only a week, but later it was televised and revived successfully on the stage.

Pinter's reputation was secured by his second full-length play, *The Caretaker* (1960; filmed 1963), in which a former mental patient brings a tramp to the house he shares with his brother. The play established Pinter as more than just another practitioner of the currently popular Theatre of the Absurd. *The Homecoming* (1965) focusses on the return to his East End London home of a man who has become a university professor in the United States and brings his wife to meet his family. Such later plays as *Landscape* (1969), *Silence* (1969), *Night* (1969), and *Old Times* (1971) virtually did away with physical activity on the stage. Later successes included *No Man's Land* (1975) and *Betrayal* (1978). From the 1970s on, Pinter did much directing, both of his own and others' works. His *Poems and Prose 1941–1977* was published in 1978.

Pinter also wrote radio and television dramas and screenplays, including *The Servant* (1962), *The Go-Between* (1971), *The Last Tycoon* (1974), *The Proust Screenplay: A la cherche du Temp Perdu* (1977), and *The French Lieutenant's Woman* (1981).

Pinto (Spanish: Painted), a spotted horse; the Pinto has also been called paint, particoloured, pied, piebald, calico, and skewbald, terms sometimes used to describe variations in colour and markings. The Indian ponies of the western United States were often Pintos, and the type was often considered of poor quality. The pure-breed associations usually refuse to register horses with pinto colouring. The colour does not determine the type of horse, however, and many fine Pintos have been developed. The Pinto Horse Association, organized in 1956, recognizes colour patterns called overo (white spreading irregularly up from the belly, mixed with a darker colour) and tobiano (white spreading down from the back in smooth, clean-cut patterns).



Sorrel and white Pinto
Margie Spence

Pinto, Fernão Mendes (b. *c.* 1510, Monte-mor-o-Velho, Port.—d. July 8, 1583, Almada, near Lisbon), Portuguese adventurer and author of the *Peregrinação* (1614, "Peregrination"; *The Voyages and Adventures of Fernand Mendez Pinto,* trans. H. Cogan, 1969), a literary masterpiece depicting the impression made on a European by Asian civilization, notably that of China, in the 16th century.

He went to India in 1537 and later claimed to have travelled, fought, and traded in almost every part of Asia during the next 21 years and also to have experienced drastic reversals of fortune, having been made "13 times a prisoner and 17 a slave." In China, for example, he was convicted of plundering royal tombs and, as punishment, had his thumbs severed and was sentenced to a year of hard labour on construction of the Great Wall. The *Peregrinação* was written after Pinto's return to Portugal in 1558. He settled in Almada, married, and received a pension from King Philip.

Pinturicchio, original name BERNARDINO DI BETTO DI BIAGO (b. *c.* 1454, Perugia, Romagna—d. Dec. 11, 1513, Siena, Republic of Siena), early Italian Renaissance painter known for his highly decorative frescoes.

By 1481 Pinturicchio was associated with the Umbrian artist Perugino, whose influence on him was to be permanent. It is generally agreed that he assisted Perugino on some of the fres-

Detail of "The Dispute of St. Catherine," fresco by Pinturicchio, 1492–94; in the Borgia Apartment of the Vatican
SCALA—Art Resource/EB Inc.

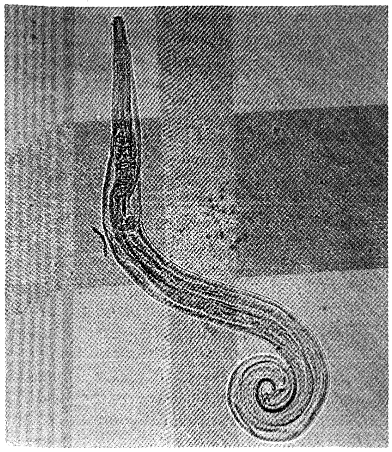
coes ("Journey of Moses" and the "Baptism of Christ") in the Sistine Chapel in the Vatican (1481/82). In the 1480s he worked in the Bufalini Chapel in Sta. Maria in Aracoeli and in Sta. Maria del Popolo (both in Rome).

Pinturicchio's most important work of this period was the decoration of the suite of six rooms in the Vatican known as the Appartamento Borgia for Pope Alexander VI between 1492 and 1494. In these frescoes he retains Perugino's figure types but lacks his clarity of conception. Instead, Pinturicchio relies on brilliant, often jarring colours, gilding, and ancient Roman ornamental motifs.

Pinturicchio's last major works were the 10 scenes from the life of Pope Pius II painted (1503–08) in fresco in the Piccolomini Library of Siena cathedral. In these, space, colour, and detail are handled with a crisp proficiency that may have influenced Raphael.

pinworm, also called SEAT WORM, or THREADWORM (*Enterobius,* or *Oxyuris, vermicularis*), worm of the class Oxyuroidea (phylum Aschelminthes). Pinworms are common human intestinal parasites, especially in children. They are also found in other vertebrates. Male pinworms are 2 to 5 millimetres (about 0.08 to 0.2 inch) long; females range in length from 8 to 13 millimetres. The long tails of the worms give them a pinlike appearance.

Pinworms usually occur in the large intestine but sometimes are found in the small intestine, the stomach, or farther up the gastrointestinal tract. After the eggs are fertilized by the male, the female travels to the anus, deposits the eggs on the skin near the anal opening, and usually dies. Movements of the



Pinworm (*Enterobius vermicularis*)
Walter Dawn

worm on the skin cause itching. Eggs, transferred beneath the fingernails by scratching, are passed to the mouth, from which the eggs or larvae make their way to the intestine. The life cycle requires 15 to 43 days.

Pinxton porcelain, English porcelain produced in Derbyshire from 1796 to 1813. The factory was established by John Coke (who had lived in Dresden, Ger.) with the help of William Billingsley, who had worked as a painter at Derby. Billingsley remained at Pinxton until 1801, concentrating on the production of the porcelain rather than its decoration. He made a ware that contained bone ash, was granular yet transparent, and had a brilliant glaze. He had probably obtained the formula from the Chelsea painter Zachariah Boreman. Pinxton produced only domestic and table ware. In 1804 the factory was taken

Pinxton porcelain goblet by William Billingsley, Derbyshire, England, *c.* 1800; in the Victoria and Albert Museum, London
By courtesy of the Victoria and Albert Museum, London; photograph, EB Inc.

over by John Cutts; the wares produced thereafter were inferior to those of Billingsley.

Pinyin romanization, also spelled PIN-YIN, also called CHINESE PHONETIC ALPHABET, Chinese (Pinyin) HANYU PINYIN WENZI (Chinese-language combining-sounds alphabet), system of romanization for the Chinese written language based on the pronunciation of the Peking dialect of Mandarin Chinese. The gradual acceptance of Pinyin as the official transcription used in the People's Republic of China signalled a commitment to promote the use of the Peking dialect as the national standard, to standardize pronunciation among national minorities, and to end the confusion in romanizing and alphabetizing Chinese characters.

National script reform began in 1913 with the creation of the National Phonetic Alphabet based on Chinese characters. Several attempts were made in the 1920s and '30s to devise and promote a Latin alphabet for the Chinese language, but with little concrete success. After the Communist takeover of China in 1949, work on a comprehensive script reform was begun. After considering and rejecting proposals for the use of either Chinese characters or the Cyrillic alphabet, the Latin alphabet was chosen for use. The resulting Chinese Phonetic Alphabet was adopted by the Committee on Language Reform in 1956 and modified in 1958.

Pinyin was not intended to replace the Chinese characters but to help teach pronunciation and popularize the Peking dialect. The adoption of Pinyin also made it possible to standardize the spelling of Chinese personal and place names abroad. Beginning on Jan. 1, 1979, the State Council of the People's Republic of China for Romanization prescribed that all translated diplomatic and foreign language publications employ Pinyin in English-speaking countries and Lessing in German-speaking countries. Chinese-language lessons for foreigners are conducted in Pinyin, and it is used for telegraphic codes, the Central Broadcasting System, braille for the blind, finger-spelling for the deaf, dictionaries, and indexes. Pinyin replaced the traditional writing systems of several ethnic minorities in China and is used to document the previously unwritten languages of many more. Some interesting features of Pinyin are the clear and consistent way that distinctions are drawn between aspirated and unaspirated consonants (*p, t, c, ch,* and *k* are aspirated and *b, d, z, zh,* and *g* are their unaspirated equivalents) and the use of digraphs (*zh, ch,* and *sh*) for retroflex consonants. Pinyin also dispenses with the use of hyphens and reduces use of the juncture symbol (') to a minimum. For tables of romanization equivalents in Pinyin and Wade–Giles, *see* pages 460–461.

Pinza, Ezio (Fortunato) (b. May 18, 1892, Rome—d. May 9, 1957, Stamford, Conn., U.S.), operatic bass and actor.

Pinza studied civil engineering before turning, at his father's urging, to singing. At 18 he sang Oroveso in Bellini's *Norma* at Cremona. His vocal studies at the Conservatory of Bologna were interrupted by army service during World War I. He made his Rome debut in 1920 as King Mark in Richard Wagner's *Tristan und Isolde.* He then sang for three years at La Scala in Milan, where in 1924 he sang Tigellino in the premiere of Arrigo Boito's *Nerone.* In 1926 he made his New York City debut at the Metropolitan as Pontifex Maximus in Gaspare Spontini's *La vestale,* and for the next 22 years he was that company's leading bass. He was admired for his commanding presence and sonorous voice and appeared in such varied roles as Boris Godunov, Figaro, and Don Giovanni.

In 1949, at the peak of his operatic fame, Pinza left the Metropolitan to star in Rodgers and Hammerstein's Broadway musical *South Pacific;* his success launched a new career for him in musical comedy, motion pictures, radio, and television. His recordings were also enormously popular.

Pinzón, Martín Alonso and Vicente Yáñez (respectively, b. *c.* 1441, Palos, Seville—d. 1493, Palos; b. *c.* 1460?, Palos—d. *c.* 1523?), brothers from a family of Spanish shipowners and navigators who took part in Christopher Columbus' first voyage to America.

Martín, part owner of the "Pinta" and "Niña," helped prepare them, procured crews for the expedition of 1492, and commanded the "Pinta," on which his brother Francisco was pilot. His suggestion to change course on October 7 brought the fleet to a landfall in the Bahamas on October 12. Near Cuba, however, he left the fleet, to search for the land of gold and spices. He rejoined Columbus a few months later but, returning with the fleet to Spain, he left once again, hoping to be the first to arrive with news of the discoveries. Columbus reached Spain first, however, and Martín is remembered only for his disloyalty.

Vicente commanded the "Niña" in 1492–93 and remained with Columbus throughout the expedition. A successful and capable explorer in his own right, he sailed early in 1500 and landed on the Brazilian coast at Cabo (cape) de Santo Agostinho. He probably rounded Cabo São Roque and then turned north; he discovered the Amazon Estuary and went as far as Costa Rica. He was made the governor of his newly discovered lands but did not take possession. In 1508, commissioned to discover a passage to the Spice Islands, he sailed with Juan Díaz de Solís along the coast of Central America. Historians are not sure whether he discovered Honduras and Yucatán on this voyage or went south to Venezuela and Brazil. Trouble developed with Díaz de Solís, and they returned to Spain in August 1509. No records exist of Vicente after 1523.

Pinzón Island, also called DUNCAN ISLAND, one of the Galápagos Islands, in the eastern Pacific Ocean, about 600 mi (965 km) west of Ecuador. It has an area of about 7 sq mi (18 sq km) and is flanked on the west by five small islets known as Guy Fawkes Island. The relief is made up of cactus-studded littoral and several volcanic craters, the highest rising to 1,300 ft (400 m). Originally named for Sir Anthony Dean (Deane), an English shipbuilder, the name was changed in the 18th century to honour the English admiral Viscount Duncan. The official Ecuadorian name is Isla Pinzón. It has a large marine tortoise reserve, as well as a seal rookery, but no human population.

Pio Nono (pope): *see* Pius IX.

Piombino, town, Livorno province, Toscana (Tuscany) region, central Italy, at the tip of the Piombino promontory below Monte Massoncello, opposite the island of Elba. Once a possession of the archbishops of Pisa, it was declared a princedom in 1594 and was variously owned or occupied before becoming part of the Kingdom of Italy in 1861. Nearby Populonia has Etruscan, Roman, and medieval remains. An old seaport with significant shipping traffic, Piombino has ironworks and steelworks and provides passenger and car ferry service to Elba; it is connected by branch railway with Campiglia Marittima on the main Rome–Genoa line. Pop. (1981 prelim.) mun., 39,389.

Piombo, Sebastiano del (Italian painter): *see* Sebastiano del Piombo.

pion, subatomic particle that constitutes the lightest form of meson (*q.v.*).

Pioneer, any of the first series of unmanned U.S. deep-space probes designed chiefly for interplanetary study. With the exception of Pioneer 1, which was launched into lunar orbit on Oct. 11, 1958, all other probes in the series were sent to explore planetary bodies or to measure various interplanetary particle and magnetic field effects. Pioneer 6 (1965), for example, was injected into solar orbit to determine space conditions between the Earth and Venus. It transmitted much data on the solar wind and solar cosmic rays in addition to measuring the Sun's corona and the tail of Comet Kohoutek. Pioneer 10 (1972) flew by Jupiter in December 1973, the first space probe to do so, and discovered its huge magnetic tail, an extension of the planet's magnetosphere. Pioneer 11 (1973), also called Pioneer-Saturn, passed by Jupiter in December 1974 and flew within about 13,000 miles (20,900 kilometres) of Saturn in September 1979. It transmitted data and photographs that enabled Earth-based scientists to identify two additional rings around the planet and the presence of radiation belts within its magnetosphere. Pioneer Venus 1 and Pioneer Venus 2 (1978) began orbiting Venus in December 1978. The first of these twin spacecraft sent back radio observations of the planet's lower atmosphere, and the second made radar photographs that revealed enormous mountains and deep basins on its surface.

Pioneers, Russian PIONERY, Soviet organization for youth aged 9 to 14, closely associated with the Komsomol (*q.v.*) for youth aged 14 to 28.

Piotrków Trybunalski, *województwo* (province), central Poland, established 1975, comprising an area of 2,419 sq mi (6,266 sq km). It is bordered by the provinces of Łódź and Skierniewice on the north, Radom and Kielce on the east, Częstochowa on the south, and Sieradz on the west. Piotrków Trybunalski (*q.v.*) city is the provincial capital. Other major industrial towns in the province include Tomaszów Mazowiecki and Radomsko. The province is drained by the Pilica and Widawka rivers and has a rich alluvial soil. Agriculture is the main economic activity; rye, wheat, and potatoes are the principal crops. Pop. (1982 est.) 613,000.

Piotrków Trybunalski, city, capital of Piotrków Trybunalski *województwo* (province), central Poland, in the Łódź highlands. It is a manufacturing centre containing textile (principally cotton) mills, woodworks, and glassworks and lies on the Warsaw–Katowice rail line. First chronicled in the 13th century, it obtained town rights in that century. In 1578 it became the seat of the Polish tribunal, after which it is named, and the meeting place of the diets (assemblies) and synods. Industry developed during the 19th century, with new mills constructed after World War II. The city contains the Piotrków Regional Museum. Pop. (1982 est.) 73,700.

Piozzi, Hester Lynch, *née* SALUSBURY, also called (1763–84) HARRIET LYNCH THRALE, byname MRS. THRALE (b. Jan. 27, 1740, Bodvel, Carnarvonshire, Wales—d. May 2, 1821, Clifton, Bristol, Eng.), English writer and friend of Samuel Johnson.

In 1763 she married a wealthy brewer named Henry Thrale. In January 1765 Samuel Johnson was brought to dinner, and the next year, following a severe illness, Johnson spent most of the summer in the country with the Thrales. Gradually, he became part of the family circle, living about half the time in their homes. A succession of distinguished visitors came there to see him, as well as to eat Thrale's excellent dinners and to listen to Mrs. Thrale's amusing chatter.

Hester Lynch Piozzi, drawing by George Dance, 1793; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

In 1781 Thrale died, and his wife was left a wealthy widow. To everyone's dismay, she fell in love with her daughter's music master, Gabriel Piozzi, an Italian singer and composer, married him in 1784, and set off for Italy on a honeymoon. Dr. Johnson openly disapproved. The resulting estrangement saddened his last months of life.

When news reached her of Johnson's death, she hastily compiled and sent back to England copy for *Anecdotes of the late Samuel Johnson, LL.D., during the last Twenty Years of his Life* (1786), which thrust her into open rivalry with James Boswell. The breach was further widened when, after her return to England in 1787, she brought out a two-volume edition of *Letters to and from the late Samuel Johnson, LL.D.* (1788). Although less accurate in some details than Boswell's, her accounts show other aspects of Johnson's character, especially the more human and affectionate side of his nature.

When many old friends remained aloof, Mrs. Piozzi drew around her a new artistic circle, including the actress Sarah Siddons. Her pen remained active, and thousands of her entertaining, gossipy letters have survived. She retained to the end her unflagging vivacity and zest for life. The standard authorities remain J.L. Clifford's *Hester Lynch Piozzi* (*Mrs. Thrale*) (1941); and *Thraliana* (her journal kept sporadically between 1776 and 1809), ed. by K.C. Balderston, 2 vols. (1942). *The Thrales of Streatham Park*, ed. by Mary Hyde, including an unpublished journal of Hester's (1766–78) and a biography, was published in 1977.

pipa (musical instrument): *see* p'i-p'a.

pipal, also spelled PEEPUL (species of fig tree): *see* Bo tree.

pipe, in music, specifically, the three-holed flute played with a tabor drum (*see* pipe and tabor); generically, aerophonic (wind) instruments consisting of pipes, either flutes or reed pipes (as a clarinet), and also the reed and flue pipes of organs. A pipe's pitch depends on its length, a long pipe having a low pitch. Pipes stopped at one end sound an octave lower than open pipes of equal length. Additional notes are obtained by using fingerholes to alter the length of the air column enclosed by the pipe or by vigorously overblowing, forcing the air column to vibrate in segments and sound overtones (harmonics) of the fundamental pitch.

In reed pipes and organ reed pipes a vibrating reed causes the column of air in the pipe to vibrate. In flutes and organ flue pipes a stream of air passing a sharp edge sets up vibrations in the pipe's air column. *See also* flute; fipple flute; reed instrument.

pipe, also called TOBACCO PIPE, hollow bowl used for smoking tobacco; it is equipped with a hollow stem through which smoke is drawn into the mouth. The bowl can be made of such materials as clay, corncob, meerschaum (a mineral composed of magnesia, silica, and water), and most importantly, briar-wood, the root of a species of heather.

The smoking of tobacco through a pipe is indigenous to the Americas and derives from the religious ceremonies of ancient priests in Mexico. Farther north, American Indians developed ceremonial pipes, the chief of these being the calumet, or pipe of peace. Such pipes had marble or red steatite (or pipestone) bowls and ash stems about 30 to 40 inches long and were decorated with hair and feathers. The practice of pipe smoking reached Europe through sailors who had encountered it in the New World.

pipe and tabor, three-holed fipple, or whistle, flute played along with a small snare drum.

The player holds the pipe with his left hand, stopping the holes with the thumb and the first and second fingers; the other two fingers support the instrument. A scale is obtained by overblowing, using the second to the fourth harmonics; the gaps between the harmonics are filled by uncovering the finger holes. The tabor, suspended from the player's left wrist or elbow, is beaten with the right hand to provide rhythmic accompaniment.

Mention of the pipe and tabor first occurs in the Middle Ages, as an ensemble providing music for court dances. By the 17th century its popularity began to decline, and it survived primarily as a folk instrument. In Provence and Spain, where players of great virtuosity accompany regional dances, the tradition of playing remains unbroken. In England, where pipe and tabor playing was associated with the Morris dancers, the tradition was broken at the end of the 19th century; the 20th-century renewal of interest in English folk music stimulated a revival.

Pipe Rolls, also called GREAT ROLLS OF THE EXCHEQUER, the oldest and longest series of English public records and a valuable source for the financial and administrative history of medieval England. Apart from an isolated survival from 1130, they begin in 1156 and continue with few breaks until 1832. Their name probably derives from the fact that the sheepskin rolls, when stored in their presses, resemble a stack of pipes.

The rolls contain the yearly accounts of the sheriffs, who were the chief financial officers for individual counties. The rolls sometimes also contained the accounts of other royal officials. Royal income from feudal dues, judicial fees, and other sources is balanced against the expenses of the crown's officers, providing a basis for the calculation of the king's revenue. As new accounting offices were set up to handle revenue, the Exchequer accounts diminished in importance. In 1883 a Pipe Roll Society was founded and began publishing all the rolls.

pipe vine: *see* Dutchman's-pipe.

pipefish, any of more than 150 species of elongated fishes allied to the sea horses, in the family Syngnathidae (order Gasterosteiformes). Pipefishes are very slender, long-bodied fishes covered, like sea horses, with rings of bony armour. They have long, tubular snouts and small mouths, a single dorsal fin, and, usually, a small tail fin. Depending on the species, they may range in length from about 2.5 to 50 cm (1 to 20 inches).

Pipefishes are found in warm regions and are primarily marine, although some live in or enter fresh water. They are weak, slow swimmers and usually live in beds of seaweed, eelgrass, or other aquatic plants among which they can feed and hide. They feed by sucking their prey (small aquatic organisms) rapidly into their mouths. Their reproductive

Chinese romanizations: Pinyin to Wade–Giles conversions

Pinyin	Wade–Giles
a	a
ai	ai
an	an
ang	ang
ao	ao
ba	pa
bai	pai
ban	pan
bang	pang
bao	pao
bei	pei
ben	pen
beng	peng
bi	pi
bian	pien
biao	piao
bie	pieh
bin	pin
bing	ping
bo	po
bu	pu
ca	ts'a
cai	ts'ai
can	ts'an
cang	ts'ang
cao	ts'ao
ce	ts'e
cei	*
cen	ts'en
ceng	ts'eng
cha	ch'a
chai	ch'ai
chan	ch'an
chang	ch'ang
chao	ch'ao
che	ch'e
chen	ch'en
cheng	ch'eng
chi	ch'ih
chong	ch'ung
chou	ch'ou
chu	ch'u
chua	ch'ua
chuai	ch'uai
chuan	ch'uan
chuang	ch'uang
chui	ch'ui
chun	ch'un
chuo	ch'o
ci	tz'u
cong	ts'ung
cou	ts'ou
cu	ts'u
cuan	ts'uan
cui	ts'ui
cun	ts'un
cuo	ts'o
da	ta
dai	tai

Pinyin	Wade–Giles
dan	tan
dang	tang
dao	tao
de	te
dei	*
den	*
deng	teng
di	ti
dian	tien
diao	tiao
die	tieh
ding	ting
diu	tiu
dong	tung
dou	tou
du	tu
duan	tuan
dui	tui
dun	tun
duo	to
e	ê, o
ê	eh
en	en
eng	êng
er	erh
fa	fa
fan	fan
fang	fang
fei	fei
fen	fen
feng	feng
fo	fo
fou	fou
fu	fu
ga	ka
gai	kai
gan	kan
gang	kang
gao	kao
ge	ko
gei	kei
gen	ken
geng	keng
gong	kung
gou	kou
gu	ku
gua	kua
guai	kuai
guan	kuan
guang	kuang
gui	kuei
gun	kun
guo	kuo
ha	ha
hai	hai
han	han
hang	hang
hao	hao

Pinyin	Wade–Giles
he	ho
hei	hei
hen	hen
heng	heng
hong	hung
hou	hou
hu	hu
hua	hua
huai	huai
huan	huan
huang	huang
hui	hui
hun	hun
huo	huo
ji	chi
jia	chia
jian	chien
jiang	chiang
jiao	chiao
jie	chieh
jin	chin
jing	ching
jiong	chiung
jiu	chiu
ju	chü
juan	chüan
jue	chüeh
jun	chün
ka	k'a
kai	k'ai
kan	k'an
kang	k'ang
kao	k'ao
ke	k'o
kei	k'ei
ken	k'en
keng	k'eng
kong	k'ung
kou	k'ou
ku	k'u
kua	k'ua
kuai	k'uai
kuan	k'uan
kuang	k'uang
kui	k'uei
kun	k'un
kuo	k'uo
la	la
lai	lai
lan	lan
lang	lang
lao	lao
le	le
lei	lei
leng	leng
li	li
lia	lia
lian	lien
liang	liang

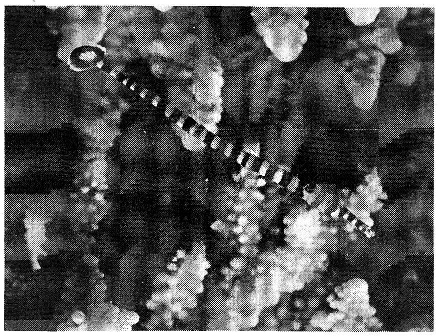
Pinyin	Wade–Giles
liao	liao
lie	lieh
lin	lin
ling	ling
liu	liu
lo	*
long	lung
lou	lou
lu	lu
lü	lü
luan	luan, lüan
lüe	lüeh
lun	lun
luo	lo
ma	ma
mai	mai
man	man
mang	mang
mao	mao
me	*
mei	mei
men	men
meng	meng
mi	mi
mian	mien
miao	miao
mie	mieh
min	min
ming	ming
miu	miu
mo	mo
mou	mou
mu	mu
na	na
nai	nai
nan	nan
nang	nang
nao	nao
ne	*
nei	nei
nen	nen
neng	neng
ni	ni
nian	nien
niang	niang
niao	niao
nie	nieh
nin	nin
ning	ning
niu	niu
nong	nung
nou	nou
nu	nu
nü	nü
nuan	nuan
nüe	nüeh
nuo	no
o	wo
ou	ou

Pinyin	Wade–Giles
pa	p'a
pai	p'ai
pan	p'an
pang	p'ang
pao	p'ao
pei	p'ei
pen	p'en
peng	p'eng
pi	p'i
pian	p'ien
piao	p'iao
pie	p'ieh
pin	p'in
ping	p'ing
po	p'o
pou	p'ou
pu	p'u
qi	ch'i
qia	ch'ia
qian	ch'ien
qiang	ch'iang
qiao	ch'iao
qie	ch'ieh
qin	ch'in
qing	ch'ing
qiong	ch'iung
qiu	ch'iu
qu	ch'ü
quan	ch'üan
que	ch'üeh
qun	ch'ün
ran	jan
rang	jang
rao	jao
re	je
ren	jen
reng	jeng
ri	jih
rong	jung
rou	jou
ru	ju
rua	*
ruan	juan
rui	jui
run	jun
ruo	jo
sa	sa
sai	sai
san	san
sang	sang
sao	sao
se	se
sen	sen
seng	seng
sha	sha
shai	shai
shan	shan
shang	shang
shao	shao

Pinyin	Wade–Giles
she	she
shei	shei
shen	shen
sheng	sheng
shi	shih
shou	shou
shu	shu
shua	shua
shuai	shuai
shuan	shuan
shuang	shuang
shui	shui
shun	shun
shuo	shuo
si	szu, ssu
song	sung
sou	sou
su	su
suan	suan
sui	sui
sun	sun
suo	so
ta	t'a
tai	t'ai
tan	t'an
tang	t'ang
tao	t'ao
te	t'e
tei	*
teng	t'eng
ti	t'i
tian	t'ien
tiao	t'iao
tie	t'ieh
ting	t'ing
tong	t'ung
tou	t'ou
tu	t'u
tuan	t'uan
tui	t'ui
tun	t'un
tuo	t'o
wa	wa
wai	wai
wan	wan
wang	wang
wei	wei
wen	wen
weng	weng
wo	wo
wu	wu
xi	hsi
xia	hsia
xian	hsien
xiang	hsiang
xiao	hsiao
xie	hsieh
xin	hsin
xing	hsing

Pinyin	Wade–Giles
xiong	hsiung
xiu	hsiu
xu	hsü
xuan	hsüan
xue	hsüeh
xun	hsün
ya	ya
yan	yen
yang	yang
yao	yao
ye	yeh
yi	i
yin	yin
ying	ying
yo	*
yong	yung
you	yu
yu	yü
yuan	yüan
yue	yüeh, yo
yun	yün
za	tsa
zai	tsai
zan	tsan
zang	tsang
zao	tsao
ze	tse
zei	tsei
zen	tsen
zeng	tseng
zha	cha
zhai	chai
zhan	chan
zhang	chang
zhao	chao
zhe	che
zhei	*
zhen	chen
zheng	cheng
zhi	chih
zhong	chung
zhou	chou
zhu	chu
zhua	chua
zhuai	chuai
zhuan	chuan
zhuang	chuang
zhui	chui
zhun	chun
zhuo	cho
zi	tzu
zong	tsung
zou	tsou
zu	tsu
zuan	tsuan
zui	tsui
zun	tsun
zuo	tso

*Oral or dialectal syllable with no official Wade–Giles equivalent.



Banded pipefish (*Dunkerocampus caulleryi*)
Douglas Faulkner

behaviour, like that of sea horses, is distinctive in that the male, not the female, carries the fertilized eggs until they hatch. Among pipefishes, the eggs may be stuck to the surface of the body, embedded in a spongy area, or carried in a brood pouch. The brood pouch is derived from lengthwise folds of skin and, depending on the species, affords varying degrees of coverage for the incubating eggs.

Related to the pipefishes are the ghost pipefishes of the family Solenostomidae. These are small, rare, Indo-Pacific fishes with long snouts and enlarged fins. In this species the female's brood pouch is formed by the union of the ventral fins.

pipeline, line of pipe equipped with pumps and valves and other control devices for moving liquids, gases, and slurries (fine particles suspended in liquid). Pipeline sizes vary from the 2-inch- (5-centimetre-) diameter lines used in oil-well gathering systems to lines 30 feet (9 m) across in high-volume water and sewage networks. Pipelines usually consist of sections of pipe made of metal (*e.g.,* steel, cast iron, and aluminum), though some are constructed of concrete, clay products, and occasionally plastics. The sections are welded together and, in most cases, laid underground.

Various cleaning measures are undertaken to reduce the corrosion that often occurs in pipelines. These include maintaining a negative electrical charge throughout the pipe (cathodic protection); lining the interior with paints and coatings of plastic and rubber; fibreglass, asphalt, and felt wrappings; the injection of corrosion-inhibiting chemicals into the cargo; and periodic cleaning. Pipelines are also cleaned by passing devices called "pigs" through them. A pig may be simply a ball of the same size as the pipe's diameter, which scrapes the pipe's interior clean as it is propelled along by the flowing cargo. It may also be a complex scrubbing machine inserted through a special opening.

Piper, Carl, Greve (Count) (b. July 29, 1647, Stockholm—d. May 29, 1716, Nöteborg, Fin.), Swedish statesman who served as King Charles XII's leading minister during the Great Northern War (1700–21).

Chinese romanizations: Wade–Giles to Pinyin conversions

Wade–Giles	Pinyin	Wade–Giles	Pinyin	Wade–Giles	Pinyin	Wade–Giles	Pinyin	Wade–Giles	Pinyin	Wade–Giles	Pinyin	Wade–Giles	Pinyin
a	a	chui	zhui	je	re	lien	lian	pan	ban	sung	song	t'u	tu
ai	ai	ch'ui	chui	jen	ren	lin	lin	p'an	pan	szu, ssu	si	tuan	duan
an	an	chun	zhun	jeng	reng	ling	ling	pang	bang			t'uan	tuan
ang	ang	chün	jun	jih	ri	liu	liu	p'ang	pang	ta	da	tui	dui
ao	ao	ch'un	chun	jo	ruo	lo	luo	pao	bao	t'a	ta	t'ui	tui
		ch'ün	qun	jou	rou	lou	lou	p'ao	pao	tai	dai	tun	dun
cha	zha	chung	zhong	ju	ru	lu	lu	pei	bei	t'ai	tai	t'un	tun
ch'a	cha	ch'ung	chong	juan	ruan	lü	lü	p'ei	pei	tan	dan	tung	dong
chai	zhai			jui	rui	luan	luan	pen	ben	t'an	tan	t'ung	tong
ch'ai	chai	ê	e	jun	run	lüan	luan	p'en	pen	tang	dang	tzu	zi
chan	zhan	eh	ê	jung	rong	lüeh	lüe	peng	beng	t'ang	tang	tz'u	ci
ch'an	chan	en	en			lun	lun	p'eng	peng	tao	dao		
chang	zhang	êng	eng	ka	ga	lung	long	pi	bi	t'ao	tao	wa	wa
ch'ang	chang	erh	er	k'a	ka			p'i	pi	te	de	wai	wai
chao	zhao			kai	gai	ma	ma	piao	biao	t'e	te	wan	wan
ch'ao	chao	fa	fa	k'ai	kai	mai	mai	p'iao	piao	teng	deng	wang	wang
che	zhe	fan	fan	kan	gan	man	man	pieh	bie	t'eng	teng	wei	wei
ch'e	che	fang	fang	k'an	kan	mang	mang	p'ieh	pie	ti	di	wen	wen
chen	zhen	fei	fei	kang	gang	mao	mao	pien	bian	t'i	ti	weng	weng
ch'en	chen	fen	fen	k'ang	kang	mei	mei	p'ien	pian	tiao	diao	wo	wo
cheng	zheng	feng	feng	kao	gao	men	men	pin	bin	t'iao	tiao	wu	wu
ch'eng	cheng	fo	fo	k'ao	kao	meng	meng	p'in	pin	tieh	die		
chi	ji	fou	fou	kei	gei	mi	mi	ping	bing	t'ieh	tie	ya	ya
ch'i	qi	fu	fu	k'ei	kei	miao	miao	p'ing	ping	tien	dian	yai	ya
chia	jia			ken	gen	mieh	mie	po	bo	t'ien	tian	yang	yang
ch'ia	qia	ha	ha	k'en	ken	mien	mian	p'o	po	ting	ding	yao	yao
chiang	jiang	hai	hai	keng	geng	min	min	p'ou	pou	t'ing	ting	yeh	ye
ch'iang	qiang	han	han	k'eng	keng	ming	ming	pu	bu	tiu	diu	yen	yan
chiao	jiao	hang	hang	ko	ge	miu	miu	p'u	pu	to	duo	yin	yin
ch'iao	qiao	hao	hao	k'o	ke	mo	mo			t'o	tuo	ying	ying
chieh	jie	hei	hei	kou	gou	mou	mou	sa	sa	tou	dou	yo	yue
ch'ieh	qie	hen	hen	k'ou	kou	mu	mu	sai	sai	t'ou	tou	yu	you
chien	jian	heng	heng	ku	gu			san	san	tsa	za	yü	yu
ch'ien	qian	ho	he	k'u	ku	na	na	sang	sang	ts'a	ca	yüan	yuan
chih	zhi	hou	hou	kua	gua	nai	nai	sao	sao	tsai	zai	yüeh	yue
ch'ih	chi	hsi	xi	k'ua	kua	nan	nan	se	se	ts'ai	cai	yün	yun
chin	jin	hsia	xia	kuai	guai	nang	nang	sen	sen	tsan	zan	yung	yong
ch'in	qin	hsiang	xiang	k'uai	kuai	nao	nao	seng	seng	ts'an	can		
ching	jing	hsiao	xiao	kuan	guan	nei	nei	sha	sha	tsang	zang		
ch'ing	qing	hsieh	xie	k'uan	kuan	nen	nen	shai	shai	ts'ang	cang		
chiu	jiu	hsien	xian	kuang	guang	neng	neng	shan	shan	tsao	zao		
ch'iu	qiu	hsin	xin	k'uang	kuang	ni	ni	shang	shang	ts'ao	cao		
chiung	jiong	hsing	xing	kuei	gui	niang	niang	shao	shao	tse	ze		
ch'iung	qiong	hsiu	xiu	k'uei	kui	niao	niao	she	she	ts'e	ce		
cho	zhuo	hsiung	xiong	kun	gun	nieh	nie	shei	shei	tsei	zei		
ch'o	chuo	hsü	xu	k'un	kun	nien	nian	shen	shen	tsen	zen		
chou	zhou	hsüan	xuan	kung	gong	nin	nin	sheng	sheng	ts'en	cen		
ch'ou	chou	hsüeh	xue	k'ung	kong	ning	ning	shih	shi	tseng	zeng		
chu	zhu	hsün	xun	kuo	guo	niu	niu	shou	shou	ts'eng	ceng		
chü	ju	hu	hu	k'uo	kuo	no	nuo	shu	shu	tso	zuo		
ch'u	chu	hua	hua			nou	nou	shua	shua	ts'o	cuo		
ch'ü	qu	huai	huai	la	la	nu	nu	shuai	shuai	tsou	zou		
chua	zhua	huan	huan	lai	lai	nü	nü	shuan	shuan	ts'ou	cou		
ch'ua	chua	huang	huang	lan	lan	nuan	nuan	shuang	shuang	tsu	zu		
chuai	zhuai	hui	hui	lang	lang	nüeh	nüe	shui	shui	ts'u	cu		
ch'uai	chuai	hun	hun	lao	lao	nung	nong	shun	shun	tsuan	zuan		
chuan	zhuan	hung	hong	le	le			shuo	shuo	ts'uan	cuan		
chüan	juan	huo	huo	lei	lei	o	e	so	suo	tsui	zui		
ch'uan	chuan			leng	leng	ou	ou	sou	sou	ts'ui	cui		
ch'üan	quan	i	yi	li	li			ssu, szu	si	tsun	zun		
chuang	zhuang			lia	lia	pa	ba	su	su	ts'un	cun		
ch'uang	chuang	jan	ran	liang	liang	p'a	pa	suan	suan	tsung	zong		
chüeh	jue	jang	rang	liao	liao	pai	bai	sui	sui	ts'ung	cong		
ch'üeh	que	jao	rao	lieh	lie	p'ai	pai	sun	sun	tu	du		

Piper was of lesser noble background. He became an official in the Swedish chancellery's department of home affairs under King Charles XI but reached the heights of Swedish government in 1697, when the newly crowned Charles XII raised him to a countship and appointed him to the council of state.

Piper was the only high councillor to accompany Charles in the field during the Great Northern War. While he approved, along with the other field advisers, a decision to invade Russia, Piper later strongly opposed Charles's determination to remain there following early setbacks.

Piper was captured during the Battle of Połtava (July 1709), and he remained a prisoner of the Russians until his death in 1716, despite Charles's repeated efforts to win his freedom through prisoner exchanges.

Piper, William T(homas) (b. Jan. 8, 1881, Knapps Creek, N.Y., U.S.—d. Jan. 15, 1970, Lock Haven, Pa.), manufacturer of small aircraft, best known for the Piper Cub, a practicable two-seater that became the most popular family aircraft. He earned the sobriquet "the Henry Ford of Aviation" for his efforts to popularize air travel.

Piper was graduated from Harvard University in 1903 and worked as a construction superintendent until 1914 and as an oil producer from that year. The Piper Aircraft Corporation was founded in 1929. Piper served as its president until his death. Piper learned to fly in 1931, and in 1945, at age 73, he received certification to pilot twin-engine aircraft.

In World War II, Piper delivered more than 5,600 Piper Cubs, long popular as a training plane, to the U.S. government for use as special personnel planes, for photo-reconaissance, and as artillery spotters. Because of their low landing speed (20 mph) and high manoeuvrability, the Pipers easily eluded enemy fighters.

In addition to the Piper Cub, the company manufactured light- to medium-size aircraft for use as business planes.

Piperaceae, the pepper family in the order Piperales, commercially important particularly because of *Piper nigrum*, the source of black pepper. The family comprises about 10 genera, of which 2, *Piper* (about 1,000 species) and *Peperomia* (*q.v.*; more than 500 species), are the most important. The plants grow as herbs, vines, shrubs, and trees and are widely distributed throughout the tropics and subtropics.

The leaves of Piperaceae, which have a pungent flavour, grow singly. The numerous flowers, lacking sepals and petals, are crowded in dense spikes. *Piper* species are mostly shrubs, woody vines, and small trees. Many are used in medicines and in food and beverages as spices and seasonings. *Piper nigrum* is a 30 foot (9 metre) woody climber native to southern India and to Sri Lanka; it is cultivated in most tropical regions where soil moisture is constant and temperatures are reliably warm. The pungency of *Piper* peppers is attributed to chavicine, a resin. Also present are the alkaloids piperine (which lends pungency to brandy) and piperidine. An essential oil distilled from peppercorns is used to make meat sauces. *P. cubeba*, of particular importance in Southeast Asia, is the source of cubeb, used in various medicines and for flavouring cigarettes and bitters. In the Orient, chewing the leaves of the betel (*q.v.*) pepper, *P. betle*, with slices of betel nut and lime, is widely practiced for its mildly stimulating effect. An intoxicating drink of Polynesia, variously known as kava, kawakawa, aiva, and yagona, is made from the root of *P. methysticum*. *Peperomia* species mostly grow as low herbs, although a few grow on trees as epiphytes. Several soil-growing species are cultivated for their attractive foliage. The young leaves and stems of *P. vividispica* are used as food in Central and South America.

Piperales, order of flowering plants comprising of about 15 genera and approximately 3,000 species in two families. It belongs to the class known as dicotyledon (*q.v.*; characterized by two seed leaves). The pepper family, Piperaceae (*q.v.*), is widely distributed in the tropics of both hemispheres and is the source of pepper.

A brief treatment of Piperales follows. For full treatment, *see* MACROPAEDIA: Angiosperms.

Inflorescences (flower clusters) of the Piperales are slender, spike-like, and covered with inconspicuous, closely-appressed flowers. In the Saururaceae, the elongate cluster bends at its tip to suggest the fanciful appellation "lizard's tail." Other features common to most species of this order include simple leaves, lack of sepals and petals, bisexual flowers (stamens and pistil in the same flower), and presence of one ovule per ovary chamber.

The lizard's-tail family, Saururaceae, with only five genera and seven species, is native to North America and Southeast Asia. Its members are aromatic herbs, with creeping rhizomes (horizontal stems), inhabiting wet areas.

Fragmentation of rhizomes in the lizard's-tail family assures vegetative propagation, but reproduction by seeds is the main method of species dispersal in both families of the Piperales order.

Even though individual flowers are small, floral spikes are showy in several species owing to the expanded, colourful bract that arises below each flower. Stamens usually number six, and the ovary chambers vary from one in the Piperaceae to several in the Saururaceae. This characteristic and the lack of wood in the Saururaceae distinguish the two families structurally. In a few species, stamens and pistils appear in different flowers.

Seeds and fruits form in the usual manner of dicots. The drupe is the prevailing fruit type in the pepper family, whereas a dry, closed fruit characterizes the lizard's-tail family.

piperazine, also called HEXAHYDROPYRAZINE, anthelmintic drug, or worming agent, effective against intestinal roundworm infection in man and domestic animals (including poultry) and against pinworm infection in man. It is administered orally, in repeated doses, usually as the citrate salt. Its action causes worms to be eliminated with normal stool.

piperine, an organic compound classed either with the lipid family (a group consisting of fats and fatlike substances) or with the alkaloids, a family of nitrogenous compounds with marked physiological properties. It is one of the sharp-tasting constituents of the fruit of the pepper vine (*Piper nigrum*).

Piperine constitutes approximately 5–9 percent of commercial black or white pepper. It was first isolated in 1820, and its chemical constitution was established by laboratory syntheses in 1882 and 1894.

The sharp flavour of freshly ground pepper is attributed to the compound chavicine, a geometrical isomer (having the same molecular formula but differing in structure) of piperine. The loss of pungency of ground pepper on storage is associated with slow transformation of chavicine into piperine.

Pipestone, city, seat of Pipestone County, southwestern Minnesota, U.S., on Coteau des Prairies, near the South Dakota line. Laid out in 1876, it developed with the coming of the railroads (1879–84), was incorporated (1901), and is the business centre for a mixed-farming area.

The Pipestone National Monument, immediately northwest, has quarries of a reddish-coloured stone that was used by Plains Indians to make ceremonial peace pipes (*see* sacred pipe). The site, considered sacrosanct, was long fought over before being declared neutral ground. The stone (named catlinite for George Catlin, an artist) is reserved for the Indians who quarry it under special permits issued by the National Park Service. Longfellow popularized the quarries in *The Song of Hiawatha*, and the city has a Hiawatha Club and stages an annual pageant. Pop. (1980) 4,887.

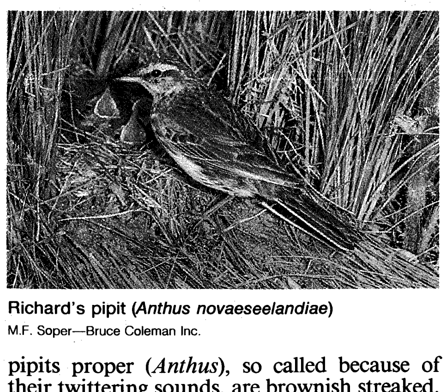
Pipino (Italian personal name): *see under* Pepin.

Pipiolo and Pelucón (Spanish: "novice" or "greenhorn," and "bigwig," respectively), members of the two political partisan groups active in Chilean politics for about a century after national independence was achieved in the 1820s. The Pipiolos were liberals and the Pelucones conservatives. Between 1830 and 1861 the Pelucones were ascendant. Between 1861 and 1891 both groups realigned and splintered; the liberal coalitions acquired the upper hand and used their strength to gradually reduce executive power in favour of congressional power. By the 1890s both liberals and conservatives represented mostly wealthy, vested interests, and after 1900 they were challenged by new middle and working class parties.

pipistrelle (*Pipistrellus*), any of about 40 to 50 species of bats of the common bat family, Vespertilionidae, found in almost all parts of the world. Pipistrelles are grayish, brown, reddish, or black bats about 3.5–10 centimetres (1.4–4 inches) long, not including the 2.5–6-cm tail. Erratic fliers, they appear before most other bats in the evening and sometimes fly about even during the day. Representatives include *P. pipistrellus* of Eurasia and the eastern (*P. subflavus*) and western (*P. hesperus*) pipistrelles of North America.

pipit, also called FIELDLARK, or TITLARK, any of about 50 species of small, slender-bodied ground birds of the family Motacillidae (order Passeriformes), found worldwide except in polar regions and on some islands.

Members range in size from 12.5 to 23 centimetres (5 to 9 inches) long. They have thin, pointed bills, pointed wings, and elongated hindtoes and claws. These trim birds walk and run rapidly (but never hop), seeking out insects along the ground. Their flight is strongly undulating, like that of many finches. The pipits proper (*Anthus*), so called because of their twittering sounds, are brownish streaked. Wagtails (*Motacilla*), which continually pump their long tails up and down, are more boldly marked. Both groups have white outer tail feathers, which show best in flight. An unusual group, called longclaws (*Macronyx*), are found on African prairies.



Richard's pipit (*Anthus novaeseelandiae*)
M.F. Soper—Bruce Coleman Inc.

The Motacillidae belongs to the songbird suborder (Passeres).

Pippi, Giulio: *see* Giulio Romano.

Pippin (German personal name): *see under* Pepin.

Pippin, Horace (b. Feb. 22, 1888, West Chester, Pa., U.S.—d. July 6, 1946, West Chester), U.S. folk painter known for his primitivist depictions of black American life and on the horrors of war.

Pippin's childhood was spent in Goshen, N.Y., a town that sometimes appears in his paintings. There he drew horses at the local racetrack and, to the despair of his school teachers, preferred drawing to writing. He was variously employed as an ironworker, junk dealer, and porter, until World War I, when he served in the infantry. He was wounded in 1918 and discharged with a partially paralyzed right arm and classified as unfit to work. He settled in West Chester and eventually began to paint by burning designs into wood panels with a red hot poker and then filling in the outlined areas with paint.

"John Brown Going to His Hanging," oil painting by Pippin, *c.* 1942; in the Pennsylvania Academy of the Fine Arts, Philadelphia

By courtesy of the Pennsylvania Academy of the Fine Arts, Philadelphia

His first large canvas was an eloquent protest against war, "End of the War: Starting Home" (1931–34), which was followed by other antiwar pictures, such as "Shell Holes and Observation Balloon" and the many versions of "Holy Mountain." His most popular themes centred on the black American, such as his series entitled "Cabin in the Cotton" and his paintings of episodes in the life of the anti-slavery leader John Brown. After the art world discovered Pippin in 1937, these pictures particularly brought him wide acclaim as the greatest black painter of his time. Pippin also executed portraits and biblical subjects. His early works are characterized by their heavy impasto and restricted use of colour. His later works are more precisely painted in a bolder palette.

Pipridae (bird family): *see* manakin.

pipsissewa, any of certain evergreen, herbaceous plants of the genus *Chimaphila*, of the wintergreen family (Pyrolaceae), especially *C. umbellata* and *C. maculata.* The former, sometimes also called prince's pine, love-in-winter, and wintergreen (*q.v.*), occurs in North America from Canada to Mexico and in Europe and Japan. *C. maculata,* sometimes called striped pipsissewa, rheumatism root, dragon's tongue, and spotted wintergreen, occurs in North America from Canada to the southern United States. The name pipsissewa derives from a Cree Indian word referring to the diuretic properties of the leaves when eaten.

Pipsissewa (*Chimaphila umbellata*)

Mary W. Ferguson

Pipsissewas are woodland plants with leathery leaves and five-petalled, fragrant, pink or white flowers that grow in a sparse, terminal cluster. They arise from rhizomes (underground stems). Though difficult to cultivate, they are sometimes grown in gardens.

Chimaphila maculata grows 10–25 centimetres (4–10 inches) tall; the stem is more or less prostrate. The lance-shaped leaves are 2.5–7.5 cm long and have white spots along the veins. The nodding flowers are about 2.5 cm across. *C. umbellata* grows 12–30 cm tall. The leaves are somewhat broader than those of *C. maculata* and are not spotted. The flowers are about 2 cm across and appear throughout the summer.

Piqua, city, Miami County, western Ohio, U.S., on the Great Miami River, 28 mi (45 km) north of Dayton. The original Indian village of Piqua (the name of a Shawnee tribal group), near present-day Springfield, was destroyed by George Rogers Clark and his Kentucky volunteers in 1780. The Indians then moved to the present site, where they established two settlements, Upper and Lower Piqua. In 1794 Gen. "Mad" Anthony Wayne built Ft. Piqua near Upper Piqua, and from there the Indian chief Tecumseh departed in 1796 for the headwaters of the Whitewater in Indiana. A town called Washington was subsequently laid out on the site in 1807. Renamed Piqua in 1816, it developed as a flatboat river port trading in corn (maize), flour, bacon, and flax and was incorporated in 1823. The completion of the Miami and Erie Canal (1836) and the arrival of the railroads (1850s) gave impetus to its growth as an industrial community (manufactures include vehicle bodies, felt, oil-milling machinery, sportswear, and air vents). The Piqua Historical Area (174 ac [70 ha]) includes the John Johnston Farmhouse (1810–15), a restored section of the canal, and the Historic Indian Museum. Piqua is the seat of Edison State General and Technical College (1973). Inc. city, 1850. Pop. (1980) 20,480.

piqué work, decorative technique, usually employed on tortoiseshell, in which inlaid designs are created by means of small gold or silver pins. The art reached its highest point in 17th- and 18th-century France, particularly for the decoration of small tortoiseshell articles such as combs, patch boxes, and snuffboxes. By an adroit arrangement of the gold and silver pins, by placing them in small or large clusters, effects of light and shade could be created in the design. In the finest French work, the pins are placed so close to each other and with such accuracy that they appear to form a continuous line. Decorative motifs include chinoiserie scenes, geometric designs, and arabesques. In England, where the craft had been brought by the Huguenots at the end of the 17th century, Matthew Boulton in 1770 developed mechanical methods of producing piqué panels. Many of his designs show the influence of the Neoclassical designer Robert Adam. During the 19th century, piqué was widely employed for small tortoiseshell jewelry, much of it after 1872 being made by machine in Birmingham, Eng.

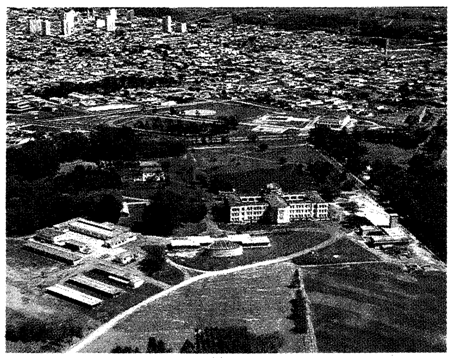
Piquet, card game known, under various names, since the 15th century, when it was played in France. Charles I of England gave the game its French nomenclature in honour of his French-born queen. Piquet is a game for two players, although there are variants for three and four. A pack of 32 cards is used, ranking ace (high), king, queen, jack, 10, 9, 8, and 7. Twelve cards are dealt to each player, two or three at a time. The remaining eight cards, the stock, are spread face down. A player who holds carte blanche (a hand with no court [face] card), announces it and scores 10 points. Players then discard and draw from the stock to improve their hands.

After the draw, players compare their holdings in each of three classes of scoring combinations. The classes are point, sequence, and set and are scored in that order. Only one player may score in each class. Point is the greatest number of cards in any one suit; sequence is the longest run of consecutive cards in one suit; and a set is three or four cards 10 or higher of the same rank.

Upon completion of the declarations, play begins: the nondealer leads first. Each lead requires the other to follow suit if able. The trick is won by the higher card of the suit led. There is no trump suit. A game is usually six deals.

Pīr Panjāl Range, part of the western Punjab Himalayas, lying in northwestern India and northern Pakistan and extending southeastward for more than 200 mi (320 km) from the Kishanganga to the upper Beās river. Rising sharply to an average elevation of more than 13,000 ft (4,000 m), it separates the Jammu Hills to the south from the Vale of Kashmir, beyond which lie the Great Himalayas. The major passes through the range include the Pīr Panjāl (11,462 ft) and Banihāl (8,985 ft); a highway tunnel near Banihāl Pass makes the Vale of Kashmir accessible to traffic from the south, even in winter. The mountains extending to the north of the Kishanganga River in Pakistan are sometimes considered part of the range.

Piracicaba, city, in the highlands of east central São Paulo state, Brazil, at 1,772 ft (540 m) above sea level on the Rio Tietê. Formerly called Santo Antônio de Piracicaba and Vila Nova da Constituição, the settlement was given town status in 1821 and made the seat of a municipality in 1856. The city is in the centre of the state's main sugarcane-producing area; cotton, rice, coffee, and other crops are also cultivated. In addition to sugar refineries, the city has distilleries, food-processing factories, and machinery plants. One of the state's chief agricultural colleges is nearby. Piracicaba is linked by road, rail, and air to São Paulo, the state capital, 85 mi (137 km) southeast. Pop. (1980 prelim.) 179,395.



Piracicaba, Braz., showing the Agricultural College (centre)

Plessner International

piracy, any robbery or other violent action, for private ends and without authorization by public authority, committed on the seas or in the air outside the normal jurisdiction of any state. Because piracy has been regarded as an offense against the law of nations, the public vessels of any state have been permitted to seize a pirate ship, to bring it into port, to try the crew (regardless of their nationality or domicile), and, if found guilty, to punish them and to confiscate the ship.

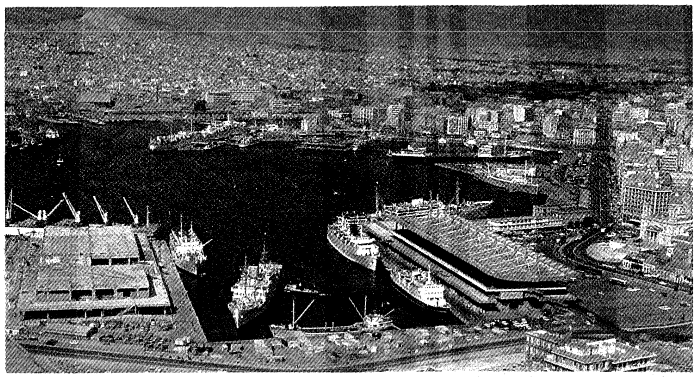
A key point in a definition of piracy according to international law is that the act takes place outside the normal jurisdiction of a state, without state authority, and that the intent is private, not political. Thus, although acts of unlawful warfare, acts of insurgents and revolutionists, mutiny, and slave trading have been defined as piracy by national laws of various countries or by special treaties, they are not, in most cases, piracy by the law of nations.

Piracy has occurred in all stages of history. In the ancient Mediterranean, piracy was often closely related to maritime commerce, and the Phoenicians appear to have engaged in both, as did the Greeks, Romans, and Carthaginians. In the Middle Ages, Vikings from the north and Moors from the south also engaged in piracy. At the conclusion of European wars during the Renaissance and after, naval vessels would be laid up and their crews disbanded. From among these men, pirates recruited their crews. A common source of piracy, for instance, was the privateer, a privately owned and armed ship commissioned by a government to make reprisals, to gain reparation for specified offenses in time of peace, or to prey upon the enemy in time of war, with the right of the officers and crew to share in prize money from captured vessels. The temptation was great to continue this profitable business after the war without authorization. During the Elizabethan wars with Spain in the late 16th century, treasure-laden Spanish galleons proceeding from Mexico into the Caribbean were a natural target for privateers, and the line between privateering and piracy became difficult to draw.

From the 16th to the 18th century, after the weakening of Turkish rule had resulted in the virtual independence of the Barbary States of North Africa, piracy became common in the Mediterranean. Morocco, Algiers, Tunis, and Tripoli so tolerated or even organized piracy that they came to be called pirate states. In the early 19th century they were suppressed by successive actions of American, British, and French forces.

The increased size of merchant vessels, the improved naval patrolling of most ocean highways, the regular administration of most islands and land areas of the world, and the general recognition by governments of piracy as an international offense resulted in a great decline in piracy in the 19th and 20th centuries. Piracy has, however, occurred in the 20th century in the South China Sea, and the practice of hijacking ships or airplanes has developed into a new form of piracy. *See also* hijacking.

Piraeus, Modern Greek PIRAIÉVS, city, the port of Athens and largest port in Greece, on Órmos Fálirou (Phaleron Bay), southwest of the metropolis by highway. The main harbour, Kántharos (ancient Cantharus), is embraced on the west by the small Ietionía peninsula, on the south by the main Akti peninsula (the Peraïki sector of the port), and on the east by Munychia (modern Kastélla), its highest point. The port has been rebuilt since the bombings of World War II. Its many new factories are mainly engineering and chemical support industries and shipyards. It is the terminal station for all the main Greek railways and is linked to Athens by electric railway and superhighway. It is the centre of all sea communication with the Greek islands.



The harbour at Piraeus, the port of Athens, on the Saronic Gulf, Greece
K. Honkanen—Ostman Agency

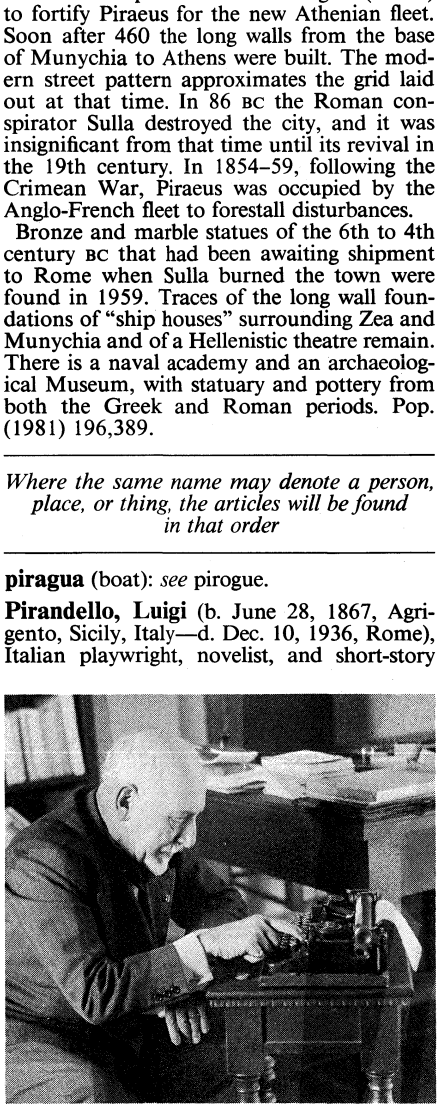
In the 7th and 6th centuries BC the Athenians used Phaleron Bay for mooring, since the present port was separated from the mainland by marshes. The Athenian statesman Themistocles persuaded his colleagues (*c.* 493) to fortify Piraeus for the new Athenian fleet. Soon after 460 the long walls from the base of Munychia to Athens were built. The modern street pattern approximates the grid laid out at that time. In 86 BC the Roman conspirator Sulla destroyed the city, and it was insignificant from that time until its revival in the 19th century. In 1854–59, following the Crimean War, Piraeus was occupied by the Anglo-French fleet to forestall disturbances.

Bronze and marble statues of the 6th to 4th century BC that had been awaiting shipment to Rome when Sulla burned the town were found in 1959. Traces of the long wall foundations of "ship houses" surrounding Zea and Munychia and of a Hellenistic theatre remain. There is a naval academy and an archaeological Museum, with statuary and pottery from both the Greek and Roman periods. Pop. (1981) 196,389.

Where the same name may denote a person, place, or thing, the articles will be found in that order

piragua (boat): *see* pirogue.

Pirandello, Luigi (b. June 28, 1867, Agrigento, Sicily, Italy—d. Dec. 10, 1936, Rome), Italian playwright, novelist, and short-story writer, winner of the 1934 Nobel Prize for Literature. With his invention of the "theatre within the theatre" (in *Sei personaggi in cerca d'autore* [*Six Characters in Search of an Author*]), he became an important innovator in modern drama.



Pirandello
By courtesy of the Italian Institute, London

Pirandello was the son of a sulfur merchant who wanted him to enter commerce. Pirandello, however, was not interested in business; he wanted to study. He first went to Palermo, the island's capital, and, in 1887, to the University of Rome. After a quarrel with the professor of classics, he went in the following year to the University of Bonn, Germany, where in 1891 he gained his doctorate in philology for a thesis on the dialect of Agrigento.

In 1894 his father arranged his marriage to Antonietta Portulano, the daughter of a business associate, a wealthy sulfur merchant. This marriage gave him financial independence, allowing him to live in Rome and to write. He had already published an early volume of verse, *Mal giocondo* (1889), which paid tribute to the poetic fashions set by Giosuè Carducci; and this was followed by other volumes of verse, including *Pasqua di Gea* (dedicated to Jenny Schulz-Lander, the love he had left behind in Bonn) and the translation of Goethe's *Römische Elegien* (*Elegie romane*). But his first significant works were short stories, at first contributed to periodicals without payment.

In 1903 a landslide shut down the sulfur mine in which his wife's and his father's capital was invested. Suddenly poor, Pirandello was forced to earn his living not only by writing but also by teaching Italian at a teacher's college in Rome. As a further result of the financial disaster, his wife developed a persecution mania, which manifested itself in a frenzied jealousy of her husband. His torment ended only with her removal to a sanatorium in 1919 (she died in 1959). It was this bitter experience that finally determined the theme of his most characteristic work, already perceptible in his early short stories—the exploration of the tightly closed world of the forever changeable human personality.

Pirandello's early narrative style stems from the *verismo* ("realism") of two distinguished Italian novelists of the late 19th century—Luigi Capuana and Giovanni Verga. The titles of Pirandello's early collections of short stories—*Amori senza amore* (1894; "Loves Without Love"), *Beffe della morte e della vita* (1902–03; "The Jests of Life and Death")—suggest the wry nature of his realism that is seen also in his first novels: *L'esclusa* (1901) and *Il turno* (1902). Success came with his third novel, often acclaimed as his best, *Il fu Mattia Pascal* (1904). Although the theme is not typically "Pirandellian," since the obstacles confronting its hero result from external circumstances, it already shows the acute psychological observation that was later to be directed toward the exploration of his characters' subconscious.

Pirandello's understanding of psychology was sharpened by reading such works as *Les altérations de la personnalité* (1892), by the French experimental psychologist Alfred Binet; and traces of its influence can be seen in the long essay *L'umorismo* (1908), in which he examines the principles of his art. Common to both books is the theory of the subconscious personality, which postulates that what a person knows, or thinks he knows, is the least part of what he is. Pirandello had begun to focus his writing on the themes of psychology even before he knew of the work of Sigmund Freud, the founder of psychoanalysis. The psychological themes used by Pirandello found their most complete expression in the volumes of short stories, *La trappola* (1915) and *E domani, lunedì . . .* (1917), and in such individual stories as "Una voce," "Pena di vivere così," and "Con altri occhi."

Meanwhile, he had been writing other novels, notably *I vecchi e i giovani* (1913) and *Uno, nessuno e centomila* (1925–26). Both are more typical than *Il fu Mattia Pascal.* The first, a historical novel reflecting the Sicily of the end of the 19th century and the general bitterness at the loss of the ideals of the Risorgimento (the movement that led to the unification of Italy), suffers from Pirandello's tendency to "discompose" rather than to "compose" (to use his own terms, in *L'umorismo*), so that individual episodes stand out at the expense of the work as a whole. *Uno, nessuno e centomila,* however, is at once the most original and the most typical of his novels. It is a surrealistic description of the consequences of the hero's discovery that his wife (and others) see him with quite different eyes than he does himself. Its exploration of the reality of personality is of a type better known from his plays.

He had first turned to the theatre in 1898 with *L'epilogo,* but the accidents that prevented its production until 1910 (when it was retitled *La morsa*) kept him from other than sporadic attempts at drama until the success of *Cosí è* (*se vi pare*) in 1917. This delay may have been fortunate for the development of his dramatic powers. *L'epilogo* does not greatly differ from other drama of its period, but *Cosí è* (*se vi pare*) began the series of plays that were to make him world famous in the 1920s. A demonstration, in dramatic terms, of the relativity of truth, and a rejection of the idea of any objective reality not at the mercy of individual vision, it anticipates Pirandello's two great plays, *Sei personaggi in cerca d'autore* (1921) and *Enrico IV* (1922). *Sei personaggi* is the most arresting presentation of the typical Pirandellian contrast between art, which is unchanging, and life, which is an inconstant flux. Characters that have been rejected by their author materialize on stage, throbbing with a more intense vitality than the real actors, who, inevitably, distort their drama as they attempt its presentation. And in *Enrico IV* the theme is madness, which lies just under the skin of ordinary life and is, perhaps, superior to ordinary life in its construction of a satisfying reality. The play finds dramatic strength in its hero's choice of retirement into unreality in preference to life in the uncertain world.

The production of the first of these two plays in Paris in 1923 made Pirandello widely known, and his work became one of the central influences on the French theatre; French drama from the existentialistic pessimism of Jean Anouilh and Jean-Paul Sartre to the absurdist comedy of Eugène Ionesco and Samuel Beckett is tinged with "Pirandellianism." His influence can also be detected in the drama of other countries, even in the religious verse dramas of T.S. Eliot.

In 1920 Pirandello said of his own art:

> I think that life is a very sad piece of buffoonery; because we have in ourselves, without being able to know why, wherefore or whence, the need to deceive ourselves constantly by creating a reality (one for each and never the same for all), which from time to time is discovered to be vain and illusory . . . My art is full of bitter compassion for all those who deceive themselves; but this compassion cannot fail to be followed by the ferocious derision of destiny which condemns man to deception.

This despairing outlook attained its most vigorous expression in Pirandello's plays, which were criticized at first for being too "cerebral" but later recognized for their underlying sensitivity and compassion. The plays reflect the *verismo* of Capuana and Verga in dealing mostly with people in modest circumstances, such as clerks, teachers, and lodginghouse keepers, but from whose vicissitudes he draws conclusions of general human significance.

The universal acclaim that followed *Sei personaggi* and *Enrico IV* sent Pirandello touring the world (1925–27) with his own company, the Teatro d'Arte in Rome. It also emboldened him to disfigure some of his later plays (*e.g., Ciascuno a suo modo* [1924]) by calling attention to himself, just as in some of the later short stories it is the surrealistic and fantastic elements that are accentuated.

After the dissolution, because of financial losses, of the Teatro d'Arte in 1928, Pirandello spent his remaining years in frequent and extensive travel. In his will he requested that there should be no public ceremony marking his death—only "a hearse of the poor, the horse and the coachman." (J.H.W.)

MAJOR WORKS. *Verse. Mal giocondo* (1889); *Pasqua di Gea* (1891); *Pier Gudrò* (1894); *Elegie renane* (1895); *Elegie romane* (1896), translations from Goethe's *Römische Elegien; Zampogna* (1901); *Scamandro* (1909), verse play; *Fuori di chiave* (1912).

Criticism. Arte e scienza (1908); *L'umorismo* (1908).

Short stories. The first book editions of collections of *novelle* include: *Amori senza amore* (1894); *Beffe della morte e della vita* (1902–03); *Quand'ero matto . . .* (1902); *Bianche e nere* (1904); *Erma Bifronte* (1906); *La vita nuda* (1910); *Terzetti* (1912); *Le due maschere* (1914); *La trappola* (1915); *Erba del nostro orto* (1915); *E domani, lunedì . . .* (1917); *Un cavallo nella luna* (1918); *Berecche e la guerra* (1919); and *Il carnevale dei morti* (1919). English translations have appeared in the following selections: *Horse in the Moon* (1932), contains *Un cavallo nella luna* and 11 other stories; *Better Think Twice About It!* [*Pensaci, Giacomino!*] *and Twelve Other Stories* (1933); *The Naked Truth* [*La vita nuda*], *and Eleven Other Stories* (1934, new ed. 1947); *A Character in Distress* (1938; U.S. title, *His Medals,* 1939), "La tragedia d'un personaggio" and 18 other stories; *Short Stories* (1959), translations of 22 stories, including "Pena di vivere cosí," "Such Is Life"; *Short Stories,* selected, translated, and introduced by Frederick May (1965), includes "Capannetta," "The Little Hut," Pirandello's earliest known prose work, and "La giara," "The Jar," probably his best known story.

Novels. L'esclusa (written 1893, published 1901; *The Outcast,* 1925); *Il turno* (written 1895, published 1902); *Il fu Mattia Pascal* (1904; *The Late Mattia Pascal,* 1923); *Suo marito,* later title *Giustino Roncella nato Boggiòlo* (1911); *I vecchi e i giovani* (1913; trans. by C.K. Scott-Moncrieff, *The Old and Young,* 1928); *Si gira . . .*, later title, *Quaderni di Serafino Gubbio operatore* (1916; trans. by Scott-Moncrieff, *Shoot! Si gira . . . the Notebooks of Serafino Gubbio, Cinematograph Operator,* 1927); *Uno, nessuno e centomila* (1925–26; *One, None and a Hundred Thousand,* 1933).

Plays. Pirandello wrote more than 50 plays. The following is a selection from the basic 31-volume Bemporad-Mondadori edition of the plays collected under the title *Maschere nude,* "Naked Masks" (1920–35): *Tutto per bene* (1920; *All for the Best,* 1960); *Sei personaggi in cerca d'autore* (1921; trans. by F. May, *Six Characters in Search of an Author,* 1954); *Enrico IV* (1922; *Henry IV,* trans. by F. May, 1960); *Vestire gli ignudi* (1923; *To Clothe the Naked,* 1962); *La vita che ti diedi* (1924; *The Life I Gave You,* 1959); *Ciascuno a suo modo* (1924; *Each in His Own Way,* 1924); *Cosí è (se vi pare)* (1925, first pub. 1918; *Right You Are [If You Think So],* trans. by F. May, 1960; by Eric Bentley as *Right You Are,* 1954); *Sagra del sigre della nave; L'altro figlio;* and *La giara* (1925; *Our Lord of the Ship; The House with the Column;* and *The Jar,* in *The One-Act Plays of Luigi Pirandello,* 1928); *Il piacere dell'onestà* (1925, first pub. 1918; *The Pleasure of Honesty,* in *To Clothe the Naked, and Two Other Plays,* 1962); *Il giuoco delle parti* (1925, first pub. 1919; *The Rules of the Game,* in *To Clothe the Naked, and Two Other Plays,* 1962); *All'uscita* (first pub. 1916); *Il dovere del medico* (first pub. 1912); *La morsa* (first pub. 1898 with the title *L'epilogo*); and *L'uomo dal fiore in bocca* (1926; *At the Gate; The Doctor's Duty; The Vise;* and *The Man with the Flower in His Mouth,* in *The One-Act Plays of Luigi Pirandello,* 1928); *Diana e la Tuda* (1927; *Diana and Tuda,* 1950); *La nuova colonia* (1928; *The New Colony,* in *The Mountain Giants and Other Plays,* 1958); *Lazzaro* (1929; *Lazarus,* 1952); *Questa sera si recita a soggetto* (1930; *Tonight We Improvise,* 1932); *Come tu mi vuoi* (1930; *As You Desire Me,* 1931); *Quando si è qualcuno* (1933; *When Someone Is Somebody,* in *The Mountain Giants and Other Plays,* 1958).

BIBLIOGRAPHY. *Editions.* The most complete edition of Pirandello's works is the so-called *edizione definitiva* in the series *I classici contemporanei italiani* (1956–60). It consists of the following volumes: *Novelle per un anno,* 2 vol. (1956–57); *Tutti i romanzi* (1957); *Maschere nude,* 2 vol. (1958); *Saggi, poesie, scritti varii* (1960).

Pirandello had planned to write 365 short stories, one for each day of the year, and himself began to edit the stories in a series entitled *Novelle per un anno;* the first volume appeared in 1922 and the 15th and last in 1937.

Bibliography. Manlio Lo Vecchio Musti, *Bibliografia di Pirandello,* 2nd ed. (1952).

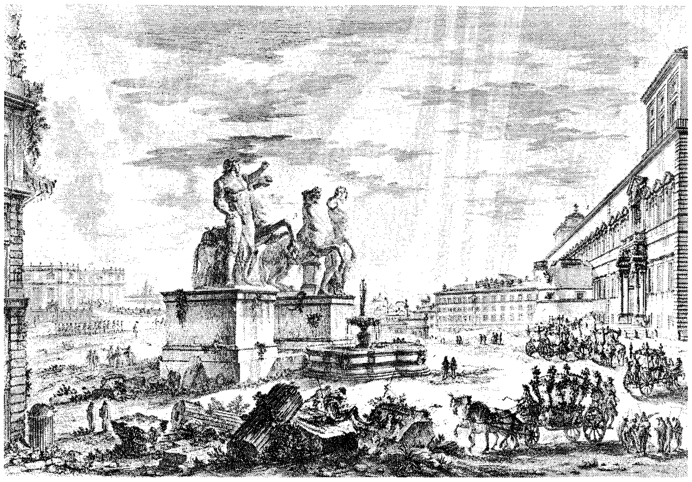
Biography. F.V. Nardelli, *L'uomo segreto: Vita e croci di Luigi Pirandello,* 3rd rev. ed. (1962), first written in 1932, with the collaboration of Pirandello himself, revealed the tortured background of Pirandello's life with Antonietta Portulano. It is fundamental for an understanding of the author, although from the circumstances of its writing, it appears now somewhat hero-worshipping in tone. Gaspare Giudice, *Luigi Pirandello* (1963; Eng. trans. 1975), presents the life and work of Pirandello in the setting of his time; it is probably the best general account of the author.

Criticism. W. Starkie, *Luigi Pirandello, 1867–1936,* 4th ed. (1967), a very personal, critical account, with extracts and synopses, of Pirandello's work in the context of European literature; Thomas Bishop, *Pirandello and the French Theater* (1960), a useful discussion of Pirandello's ideas, and an account of his lasting influence on the French theatre; J.H. Whitfield, "Pirandello and T.S. Eliot: An Essay in Counterpoint," in *English Miscellany* (1958), a study not of influences but of affinities and contrasts, not always expected; and "Pirandello and the Question-Mark of the Twentieth Century," in *A Short History of Italian Literature,* 2nd ed. (1969), a thumbnail account of Pirandello's work and importance; Glauco Cambon (ed.), *Pirandello: A Collection of Critical Essays* (1967), a helpful set of discussions of various aspects of Pirandello criticism; Oscar Budel, *Pirandello,* 2nd ed. (1969), a little book that will be more useful to those who already have some idea of the European background of Pirandello.

Piranesi, Giovanni Battista, also called GIAMBATTISTA PIRANESI (b. Oct. 4, 1720, Mestre, near Venice—d. Nov. 9, 1778, Rome), Italian draftsman, printmaker, architect, and art theorist, whose large prints depicting the buildings of classical and postclassical Rome and its vicinity contributed considerably to Rome's fame and to the growth of classical archaeology and to the Neoclassical movement in art.

At the age of 20 Piranesi went to Rome as a draftsman for the Venetian ambassador. He studied with leading printmakers of the day and settled permanently in Rome in 1745. It was during this period that he developed his highly original etching technique, producing rich textures and bold contrasts of light and shadow by means of intricate, repeated bitings of the copperplate.

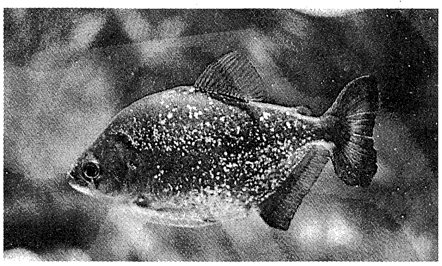
Piranesi created about 2,000 plates in his lifetime. The "Prisons" (*Carceri d'Invenzioni*) of *c.* 1745 are his finest early prints; they depict ancient Roman or Baroque ruins converted into fantastic, visionary dungeons filled with mysterious scaffolding and instruments of torture. Among his best mature prints are the series *Antichità Romane* (1756), the *Vedute di Roma* (appearing as single prints be-



"Veduta di Piazza Cavello," drawing from the series *Vedute di Roma* by Piranesi, *c.* 1748–60; in the British Museum
By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

tween 1748 and 1778), and the views of the Greek temples at Paestum (1777–78). His unparalleled accuracy of depiction, his personal expression of the structures' dramatic and romantic grandeur, and his technical mastery made these prints some of the most original and impressive representations of architecture to be found in Western art.

piranha, also called CARIBE, or PIRAYA, any of several species of carnivorous fishes of the genus *Serrasalmus*, in the characin family, Characidae, renowned for their voracity and reputed ferocity. Piranhas are abundant in rivers of eastern and central South America. Potentially one of the most dangerous species, *S. nattereri* attains a maximum length of about 60 centimetres (2 feet), but most species are smaller. Piranhas vary in colour: some are silvery with orange belly and throat, others are almost completely black. All have deep bodies, saw-edged bellies, and large, blunt heads with strong jaws bearing triangular, razor-sharp teeth that close in a scissor-like bite. Piranhas travel in groups and usually prey on other fishes. They are attracted to the scent of



Piranha (*Serrasalmus*)
Jim Annan—Annan Photo Features

blood and can reduce even a large animal to a skeleton in a short time.

pirarucu, also called ARAPAIMA, or PAICHE (*Arapaima gigas*), species of South American fish in the family Osteoglossidae (order Osteoglossiformes), one of the largest freshwater fishes in the world, attaining a length of 4.5 metres (14 feet). They belong to a group of fishes having primitive characteristics and an ancient fossil record. The pirarucu possesses a tail that appears unusually full and rounded because of the proximity of both dorsal and anal fins to the tail fin. The air bladder functions to permit limited air breathing.

pirate: *see* piracy.

pirate perch (*Aphredoderus sayanus*), freshwater fish, sole member of the family Aphredoderidae, found in weedy or muddy creeks, rivers, and lakes of eastern North America. Noteworthy is the peculiar position of its anus, which is located near the anal fin when the fish is young but gradually moves forward, to the throat, as the fish matures. The fish is small, greenish, and about 10 to 12.5 centimetres (4 to 5 inches) long. It is of no economic significance.

pirate spider, also called SPIDER-HUNTING SPIDER, any member of the family Mimetidae (order Araneida), noted for its habit of eating

Pirate spider (*Pirata piraticus*)
D.W. Greenslade—Ardea Photographics

other spiders. The approximately 100 species are distributed worldwide. They are characterized by a row of sharp bristles on the first pair of legs. Pirate spiders do not build nests or webs. They move slowly on low plants or among leaf litter.

Piratininga, city, São Paulo state, southeastern Brazil. Formerly called Patrimônio dos Inocentes, it was founded by the Portuguese explorer Martim Afonso de Sousa in 1532 and was colonized by Jesuits in 1554. In 1681 it succeeded São Vicente, on the coast near present-day Santos, as capital of the captaincy. Piratininga achieved city status in 1907 and became the seat of a municipality in 1913. Coffee growing and livestock raising are the main economic activities in the area. Rice, cotton, *feijão* (beans), and corn (maize) are also cultivated. Factories process coffee, cotton, rice, garlic, silk, and wine. Pop. (1980 prelim.) 5,833.

Pire, Dominique (Georges) (b. Feb. 10, 1910, Dinant, Belg.—d. Jan. 30, 1969, Louvain), Belgian cleric and educator who was awarded the Nobel Prize for Peace in 1958 for his aid to displaced persons in Europe after World War II.

Pire entered the Dominican Monastery of La Sarte, Huy, Belg., in 1928 and was ordained in 1934. From 1932 to 1936 he studied at the Dominican university in Rome and obtained his doctorate there in 1936. He returned to the Monastery of La Sarte to teach moral philosophy (1937–47). He was active in the World War II resistance movement and later became deeply involved in the enormous refugee problem. In 1949 he founded the Aide aux Personnes Déplacées, which sought to guarantee moral and material aid to displaced persons, regardless of their nationality or religion, and soon had branches throughout Europe. Between 1950 and 1954, Pire founded four "homes of welcome" in Belgium for aged refugees. Seven European "villages" were subsequently founded in Germany, Belgium, and Austria (1956–62). Pire also initiated the system of sponsors that allowed a refugee to be helped by a person in another country.

After accepting the Nobel Prize for Peace, Pire established (1960) in Huy the Mahatma Gandhi International Peace Centre, later known as the University of Peace, for instructing youths in the principles and practice of peace. He was also the founder of the World Friendships (to promote better understanding between races) and the World Sponsorships (to aid African and Asian refugees). Pire's *Bâtir la paix* (*Building Peace*) appeared in 1966.

Pirelli FAMILY, an Italian family of industrialists who contributed to the development of production and commerce in rubber goods, electric wire, and electric cable.

Giovanni Battista Pirelli (b. Dec. 27, 1848, Varenna, Como, Austrian Empire—d. Oct. 20, 1932, Milan) was educated in Milan, and it was there in 1872 that he started a small rubber factory, which was the first in Italy and one of the first in all of Europe. It pioneered the manufacture of electric cable (1884) and in 1899 began producing automobile tires. In 1902 the company began its foreign expansion by starting a subsidiary factory in Spain.

His two sons, Piero (b. Jan. 27, 1881, Milan—d. Aug. 7, 1956, Milan) and Alberto (b. April 28, 1882, Milan—d. Oct. 19, 1971, Casciano, Italy), joined the business in 1904. Factories were started—under the Société Internationale Pirelli of Basel, Switz.—in Great Britain, other European countries, Turkey, and the Americas; and eventually the Pirelli groups together employed more than 55,000 people. Piero Pirelli, chairman from 1932, greatly assisted the development of the Italian telephone service. His brother, Alberto, who was chairman from 1956 until his retirement in 1965, also was active in international affairs. He was a member of the Supreme Economic Committee of Versailles (1919), Italian dele-

Giovanni Pirelli, 1923
By courtesy of Pirelli Ltd., London

gate to the first International Labour Office of Geneva (1920–22), a member of the League of Nations economic committee (1923–27), and a leading negotiator on war reparations and debts for the Dawes and Young committees (1924, 1929). He became a minister plenipotentiary in 1924 and a minister of state in 1938.

Pirelli SpA, international holding company and major Italian manufacturer of tires and other rubber products. It is headquartered in Milan. Three generations of the Pirelli family have managed the company since it was founded in 1872, at the outset of the rubber-tire industry. Nearly a century later, in 1971, the company merged with Dunlop Holdings, Ltd. (since 1981 a public limited company), a British tire maker also claiming a corporate history dating to the late 19th century. Under the terms of the merger, which brought together the resources of Europe's two largest tire and rubber companies, Dunlop–Pirelli Union operations were directed by a central coordinating committee that made policy recommendations pending the approval of both companies. At the same time, each company continued as a separate holding company and retained its existing trademarks. The union was not a success, however, and was dissolved in 1981. Some analysts attributed the breakup to nationalistic feelings on the part of both companies, stimulated by increasing competition in the industry from rising production costs that were linked to high oil prices.

A diversified company with operations in Europe, North and South America, the Middle East, and New Zealand, Pirelli sells more goods abroad than does any other Italian company. In addition to manufacturing tires, the company is also a major producer of metal cable and electrical equipment. One subsidiary specializes in making optical fibres for telecommunications cable. A major investor in the Fiat auto company of Italy, Pirelli contracted to make tires and rubber parts for cars made under Fiat license in the Soviet Union.

Pirenne, Henri (b. Dec. 23, 1862, Verviers, Belg.—d. Oct. 24, 1935, Eccle, near Brussels), Belgian educator and scholar, one of the most eminent scholars of the Middle Ages and of Belgian national development.

The son of a well-to-do industrialist, Pirenne studied for his doctorate (1883) at the University of Liège under the medievalist Godefroid Kurth and the historian of the Low Countries Paul Frédéricq. After attending the universities of Leipzig and Berlin and the École des Hautes Études in Paris, he began teaching paleography and diplomatics at the University of Liège in 1885. The following year he moved to the University of Ghent, where he remained until his retirement in 1930, as professor of medieval and Belgian history. He was imprisoned by the Germans (1916–18) for refusing to teach while they occupied Belgium. While in prison he composed from memory a history of Europe that was published after his death.

Pirenne's first important book was *Histoire de la constitution de la ville de Dinant au moyen âge* (1889; "History of the Constitution of the City of Dinant in the Middle Ages"), a study of medieval town life that became one of the major themes of his later works. His greatest work, *Histoire de Belgique,* 7 vol. (1900–32; "History of Belgium"), gained him international respect for his innovative approach to socioeconomic developments in town life and his contention that Belgian unity was not the result of ethnic identification or political centralization but instead emerged from the position of Belgium as a centre of industrial and intellectual commerce between Latin and Germanic cultures.

A series of lectures delivered at Princeton University in 1922 was published as *Medieval Cities* (1925), the classic exposition of Pirenne's analysis of the revival of urban centres and commercial activity during the late Middle Ages. In a work published posthumously, *Mahomet et Charlemagne* (1937), he set forth his now celebrated thesis that the Roman Empire and civilization declined not as a result of Germanic invaders, but rather because of Arab primacy in the Mediterranean by the 8th century. The decline of international trade and the disintegration of a money economy, he contended, brought about a regression to a less sophisticated, closed agricultural system based on a local subsistence economy and a stratified class system. His radical reinterpretation of the transition between Roman and medieval civilizations stimulated a great deal of criticism and controversy, particularly his almost exclusively economic interpretation of causation in history.

Pirenne's other works include *Origine des constitutions urbaines au moyen âge* (1895; "The Origins of the Constitutions of Medieval Cities"), *Les anciennes démocraties des Pays-Bas* (1910; "The Old Democracies of the Low Countries"), and *La Fin du moyen âge* (1931; "The End of the Middle Ages"). He also served as director of the Belgian Royal Commission on History and as the first president of the International Historical Congress, beginning at Brussels in 1923.

Pires, Diogo: *see* Molcho, Solomon.

Pírgos (Greece): *see* Pyrgos.

Piriatin (Ukrainian S.S.R.): *see* Piryatin.

Pirithous, also spelled PEIRITHOUS, in Greek mythology, the companion and helper of the hero Theseus in his many adventures, including the descent into Hades to carry off Persephone, the daughter of the goddess Demeter. They were detained in Hades until the Greek hero Heracles rescued Theseus but not Pirithous.

Pirithous originally belonged to the Lapiths, a northern mountain tribe, and probably his earliest legend was that of his marriage to Hippodamia (daughter of Butes the beemaster). The Centaurs, who had come to the wedding as guests, in drunken fury tried to violate the bride and her attendants; this led to the battle of the Lapiths and the Centaurs, a favourite subject of Greek art.

Pirkkalaiset (Scandinavian frontiersmen): *see* Birkarlar.

Pirmasens, city, Rhineland-Palatinate *Land* (state), southwestern Germany, near the French border. Named for St. Pirmin, who was supposed to have preached Christianity there in the 8th century, it originally belonged to the counts of Hanau-Lichtenberg but passed to Hesse-Darmstadt in 1736. Chartered in 1763, it was taken by the French in 1794 and passed to Bavaria in 1816. It was largely rebuilt after severe damage in World War II. An important shoe industry developed there in the 19th century; the city holds international shoe trade fairs and is the site of an internationally known technical school of shoemaking. It is the terminus of a branch of the railway linking Landau with Zweibrücken. Pop. (1989 est.) 47,102.

Pirmez, Octave (b. April 19, 1832, Châtelet, Belg.—d. May 1, 1883, Acoz), one of the outstanding Belgian men of letters of the period immediately before the literary revival of the 1880s. His works consist primarily of collections of essays, letters, and literary discussions; *e.g., Pensées et maximes* (1862; "Thoughts and Maxims") and *Heures de philosophie* (1873; "Hours of Thought").

A gentleman of private means, Pirmez led an uneventful life, interrupting the placid stays in his castle only for leisurely tours in France, Germany, and Italy. His temperament was retiring and reflective, and he was deeply influenced by such French writers as Rousseau and Chateaubriand, whose melancholy appealed to him, as did their love of nature.

Pirmez was deeply interested in Montaigne and Pascal, whose influence on the style and content of his maxims and philosophical notes is unmistakable. His view of man was pessimistic, for he considered that human reason was incapable of controlling sentiments and passions. The hallmark of Pirmez's work is its stylistic elegance and purity. There is little that is essentially Belgian about his writing, and the tradition within which he worked was already passing in France. But, over a period when there were very few distinguished Belgian authors, Pirmez was outstanding.

pirogue, Spanish PIRAGUA, in its simplest form, a dugout made from one log, but also a number of more elaborately fashioned boats, including various native canoes, the structure and appearance of which generally resemble those of a dugout. Widely distributed, the pirogue may be found as a fishing vessel in the Gulf of Mexico; as a shallow-draft boat that is used to manoeuvre through the Louisiana swamplands; and as a boat used by the Indians of Guyana. Pirogues may be broadened by constructing them from two curved pieces or deepened by affixing planks to their sides. *Compare* canoe.

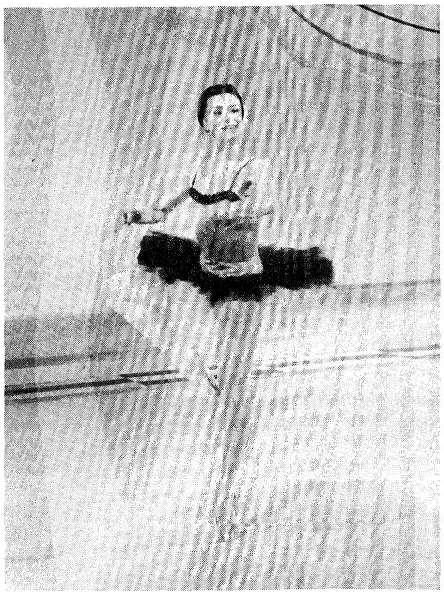
Piron, Alexis (b. July 19, 1689, Dijon, Fr.—d. Jan. 21, 1773, Paris), French dramatist and wit, famous for his epigrams and remembered for his comedy *La Métromanie* (1738). Piron was secretary to a banker and then studied law. He moved to Paris in 1719, where he worked as a copyist, struggling meanwhile to enter the world of letters. After *Arlequin Deucalion* (1722) and other successful pieces written for the popular Théâtres de la Foire, Piron produced *Les Fils ingrats* at the Comédie-Française in 1728. *La Métromanie,* a witty, urbane comedy portraying himself as a young poet intoxicated with literary aspirations, remains his most distinguished play; it was revived at the Comédie-Française until well into the 19th century. His tragedies included the moderately successful *Gustave Wasa* (1733). Having achieved a modest fame, Piron acquired noble patrons and the entree to several literary salons but continued to live an independent, carefree life and became known for his ready wit and his epigrams.

King Louis XV vetoed Piron's election to the Académie Française in 1753 because of the licentious *Ode à Priape*, which he had written as a young man. However, he was given a royal pension, and he took his revenge on the Académie in one of his most celebrated epigrams: Here lies Piron, who was nothing, Not even a member of the Academy.

piroplasmid, any protozoan of the class Piroplasmea, now generally classified with other sporozoan groups, although atypical in many ways. *See* sporozoan.

piroplasmosis (animal disease): *see* babesiasis.

pirouette (French: "to whirl about"), ballet turn in place on one leg. The pirouette is often done in spectacular series, which women usually perform on toe (pointe) and men on the ball of the foot (demi-pointe). In a *pirouette sur le cou-de-pied,* the raised foot rests on the supporting ankle; in a *pirouette à la seconde* or *grande pirouette,* it is extended in the second position at a 90° angle to the supporting leg. The leg may be held at the front (attitude), side (*à la seconde* or *grande pirouette*), or back (arabesque and attitude). The body may turn toward the raised leg (*en dehors:* "outside" or "backward") or the supporting leg (*en dedans:* "inside" or "forward").



Pirouette en dehors executed by Melissa Hayden; solo variation from "Don Quixote" pas de deux
Fred Fehl

Four and five pirouettes are now commonly performed, and up to 14 have been executed by 20th-century dancers.

Pirquet, Clemens, Freiherr von (baron of) (b. May 12, 1874, Vienna—d. Feb. 28, 1929, Vienna), Austrian physician who originated a skin test for tuberculosis that bears his name.

Von Pirquet attended the universities of Vienna, Königsberg, and Graz and graduated from Graz in 1900. He became a professor of pediatrics at Johns Hopkins University in Baltimore in 1908, a position he held for two years before returning to Austria.

In 1906 von Pirquet noticed that patients who had received injections of horse serum or smallpox vaccine usually had quicker, more severe reactions to second injections. He used the word allergy to describe the reactions. While studying the symptoms of cowpox vaccination, he also developed a new theory about the incubation time of infectious diseases and the formation of antibodies.

In Von Pirquet's skin test for tuberculosis, a drop of tuberculin is scratched into the surface of a small area of skin. The development of a red, raised area at the site of application, called Pirquet's reaction, indicates the presence of tuberculosis. In 1909 he published the results of a series of tuberculin tests of inhabitants of Vienna that showed that 70 percent of the children tested had been infected by tuberculosis by the age of 10 and more than 90 percent by the age of 14.

Pirrie (of Belfast), William James Pirrie, Viscount, also called (1909–21) BARON PIRRIE OF BELFAST (b. May 31, 1847, Quebec—d. June 7, 1924, at sea), Irish shipbuilder who controlled the largest ship-construction firm in the world and built the liner "Titanic."

In 1862 Pirrie became apprentice to the Belfast shipbuilding firm of Harland and Wolff. By the time he was 27 he had been made a partner and was soon left in almost exclusive control. He travelled widely to gain experience in ship design and to study practical shipping requirements. He contributed much to the burgeoning steel shipbuilding industry, and for many years the largest passenger liners in the world came from his yards, notably the "Olympic," the "Britannic," and the "Titanic." Pirrie was also prominent in the development of the diesel engine for marine propulsion.

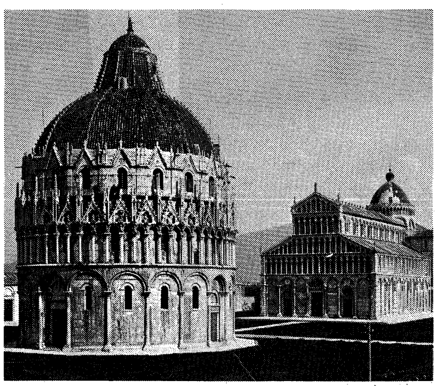
Pirrie
BBC Hulton Picture Library

Created a baron in 1906, Pirrie became a viscount in 1921. As comptroller general of merchant shipbuilding in 1918, he helped replace British shipping lost to submarine warfare. He was also mainly responsible for introducing the idea of standardizing ships, a principle that was adopted in Britain and the U.S. during World War II.

Pirrie's marriage was childless, and the peerage became extinct at his death.

Piryatin, also spelled PIRIATIN, city and centre of a *rayon* (district), Poltava *oblast* (administrative region), Ukrainian Soviet Socialist Republic, on the Uday River. Piryatin dates at least from 1155, when it is first documented, and was incorporated in 1781. Before the Revolution of 1917 it was an administrative centre and later became a railway junction. Today it has varied industries, including furniture, building materials, and foodstuffs. Pop. (1970) 16,000.

Pisa, capital of the province of Pisa, central Italy, in the region of Tuscany (Toscana). It is situated on the Arno River, about 6 mi (10 km) from the Ligurian Sea. Ancient Pisa, or Pisae, was possibly inhabited by the Ligurians before passing under Roman control as a naval base. It became a Roman colony shortly after 180 BC and by AD 313 had become a Christian bishopric.



Baptistery and cathedral, Pisa, Italy
Alinari—Art Resource/EB Inc.

During the Middle Ages it was a powerful Tuscan city-state and a flourishing commercial centre. In the 11th century Pisa not only exploited the products and markets of its large Tuscan hinterland but it also took the initiative against Muslim raiders; in 1016 the Pisans and Genoese drove the Saracens from Sardinia, and in 1063 the Pisan fleet sacked Muslim Palermo. Participation in the Crusades secured valuable commercial positions for Pisan traders in Syria. Pisa usually enjoyed the support of the German emperors in its long conflicts with Genoa at sea and with its Tuscan rivals, Lucca and Florence, on land. These struggles culminated in Pisa's defeat by the Genoese fleet at the decisive Battle of Meloria in 1284. Large quantities of merchandise continued to pass through the city until the 15th century, when silting, accompanied by changes in land levels and in the course of the river, made the movement of laden galleys up the Arno almost impossible.

Pisan prosperity was reflected in the characteristic *casatorre,* a tall inhabited tower usually built of brick and stone, and in the city's churches, particularly the grandiose and spectacular group of cathedral, baptistery, and campanile (the leaning tower). The cathedral and the baptistery were decorated by a succession of distinguished sculptors, including Guglielmo Pisano, who made the cathedral's first pulpit (1162); Bonanno Pisano, sculptor of its bronze doors (1180); Nicola Pisano, who carved the baptistery pulpit (1260); and Nicola's son Giovanni Pisano, sculptor of the existing cathedral pulpit (1310).

Internal struggles helped to bring about the occupation of Pisa by the Florentines in 1406. When French armies invaded Italy in 1494, Pisa temporarily reasserted its independence; the city sustained a series of wars and sieges until Florence reconquered it in 1509. Thereafter it declined as a provincial Tuscan town.

The birthplace of Galileo Galilei (1564–1642), Pisa remains the seat of an archbishopric and of a great university. It is also an important railway junction, and its light industries have brought prosperity. Widespread destruction in World War II diminished Pisa's charm, but tourists continued to flock there to see the world-famous leaning tower, now in some danger of collapse. Pop. (1983 est.) city, 104,554; province, 389,391.

Pisa, Council of, in Roman Catholic Church history, a council convened in 1409 with the intention of ending the Great Schism, when rival popes, each with his own Curia (bureaucracy), were set up in Rome and Avignon. This meeting, the result of concerted action by cardinals of both obediences, was well attended. It deposed the two existing pontiffs, who refused to cooperate, and elected a third, Alexander V. Western Christendom was therefore divided into three parties until the Council of Constance (1414–18) forced the three contending popes to resign and elected Oddone Colonna, a Pisan cardinal, as Pope Martin V. The Council of Pisa has never been regarded as valid by canonists or theologians.

Pisaca languages, also spelled PISACHA: *see* Dardic languages.

Pisanello, Il, original name ANTONIO PISANO (b. *c.* 1395, Pisa—d. 1455), Italian medalist and painter, an outstanding exponent of the International Gothic style. His early work suggests that he was the pupil of Stefano da Zevio, a Veronese artist. (He was wrongly called Vittore by Vasari and not until 1907 was his personal name verified as Antonio.)

Pisanello collaborated with Gentile da Fabriano on frescoes in the Doges' Palace in Venice (*c.* 1415–22) and in St. John Lateran in Rome (after 1427). After Gentile's death, Pisanello probably completed the Roman frescoes, known only through drawings, which show Gentile's great influence over the young Pisanello. His only surviving frescoes are an Annunciation at the tomb of Niccolò di Brenzoni in S. Fermo in Verona (*c.* 1423–24) and the legend of St. George in the Pellegrini Chapel in S. Anastasia, Verona (*c.* 1433–38). These works are characterized by the curvilinear design, calligraphic draperies, and decorative detail typical of the International Gothic style from which Pisanello never completely freed himself. Even a mature work such as his "St. Eustace" (National Gallery, London) is encrusted with rich detail that tends to work against spatial clarity. The "Madonna with SS. Anthony and George" (National Gallery) displays a simpler conception. It is dominated

"Madonna with SS. Anthony and George," painting by Antonio Pisanello, after 1422; in the National Gallery, London

By courtesy of the trustees of the National Gallery, London; photograph, J.R. Freeman & Co. Ltd.

by the monumental figures of the two saints and the bust of the Virgin in a mandorla, or almond-shaped aureole.

Pisanello's fame and his importance in court circles rested more upon his medals than upon his painting. They are thought to have resulted from his study of ancient Greek and Roman numismatic portraits. He had virtually no recent predecessors, and, with him, the art reached its highest point. His work includes the medal of the Greek emperor John VIII Palaeologus (1438), the wedding medal of Lionello d'Este (1444), Sigismondo Pandolfo Malatesta (1445), and the medal of Alfonso of Aragon (1448), generally cited as his most successful work in the genre. Most of Pisanello's painted portraits, such as the "Margherita Gonzaga" (*c.* 1438; Louvre, Paris), and "Lionello d'Este" (*c.* 1440; Accademia Carrara, Bergamo), show the sitter in profile (a convention of Pisanello's portrait medals) against a background of delicate, colourful flowers and butterflies.

Pisanello's drawings have been preserved in the Codex Vallardi (Louvre, Paris). This is the only instance in which the drawings of a 15th-century workshop have been preserved virtually intact. They are of unique value, therefore, for the study of the style and techniques of draftsmanship of the period. Pisanello uses a large variety of techniques and materials to produce masterful drawings (some coloured) of animals, plants, costume design, and perspective studies. His drawings of various views of horses are particularly well known. He was one of the first 15th-century artists to draw from life instead of adhering to the medieval tradition of copying the drawings of others. The drawings reveal Pisanello's breadth of interest and his sensitive eye. They combine delicately rendered Early Renaissance naturalism with the beauty of Late Gothic line and are one of his most important contributions to the history of art.

Pisani, Niccolò (fl. 14th century), Venetian admiral, renowned for his victories in the third war between the feuding republics of Venice and Genoa (1350–55).

In 1350 Pisani led a squadron to Constantinople (now Istanbul) to conclude an alliance with the Byzantines. At the mouth of the Bosporus he engaged in a fierce battle with the Genoese, defeating the distinguished admiral Paganino Doria (1352). A year later, surprising the Genoese fleet, he sank 33 enemy galleys and took 4,500 prisoners, who were later executed. In November 1354, however, Doria surprised him at Portolungo, near Greece. The Genoese admiral's audacity and tactical skill enabled him to capture Pisani and his entire fleet. Pisani was released when the two cities made peace (May 1355), and he spent the rest of his life in obscurity.

Pisani, Vettore (b. 1324, Venice—d. Aug. 15, 1380, Manfredonia, Apulia, Kingdom of Naples), Venetian admiral, victor in a decisive battle in the fourth war between the maritime republics of Venice and Genoa.

Pisani joined his father Niccolò during the third war with Genoa (1350–55) and later distinguished himself in a war against Hungary. Named captain and senator, he led a squadron against the Aragonese fleet and the pirates in the waters near Sicily.

In 1378 he was given command of the Venetian fleet, which he directed to victory over the Genoan fleet at the Capo d'Anzio (May 1378). He later held the Genoan fleet on the Adriatic in check, after sacking Cattaro (modern Kotor, Yugos.) and destroying the port of Sebenico (modern Šibenik, Yugos.). Eventually, however, he and his fleet were captured by the enemy at Pola (modern Pula, Yugos.; May 1379). On his return to Venice, he was imprisoned, but popular protest secured his release. Given command once again of the Venetian fleet, he blockaded the port of Chioggia, occupied by the Genoans, who were finally compelled to surrender, turning over to Pisani some 19 galleys and more than 4,000 prisoners. Dispatched to confront another Genoan squadron in the Adriatic, Pisani fell ill and died.

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Pisano, Andrea, also called ANDREA DA PONTEDERA, (b. *c.* 1270–90, Pontedera, near Pisa—d. *c.* 1348–49, Orvieto, Papal States), one of the most important Italian sculptors of the 14th century whose chief works were executed in Florence, where he came under the influence of Giotto. Andrea is recorded as the author of the earliest of three bronze doors for the baptistery of the cathedral of Florence, which, completed in 1336, has 20 quatrefoil panels with scenes from the life of St. John the Baptist and 8 with figures of the virtues. The figures are gilded and set against a smooth bronze surface.

"The Baptism of Christ," bronze panel from the south door of the Baptistery, Florence, by Andrea Pisano, completed 1336

Brogi—Alinari from Art Resource/EB Inc.

On the death of Giotto, in 1337, Andrea succeeded him as the chief architect in charge of the construction of the campanile (bell tower) of the cathedral of Florence, to which he added two stories adorned with panel reliefs. Most of the reliefs on the lower part, depicting the arts, sciences, and occupations of man and three scenes from Genesis, are generally attributed to Andrea and his studio. Statues in niches of the campanile (originally placed above the reliefs now in the cathedral museum), representing David and Solomon and two sibyls, have been attributed to Andrea, but this has been disputed. Two statuettes of Christ and Saint Reparata also in the cathedral's museum are generally considered his.

The iconography of the baptistery door was indebted to the mosaics on the interior of the building and to Giotto's frescoes in Sta. Croce. The composition of the door was influenced by that of the bronze doors of the cathedral of Pisa. Andrea's style is marked by a simplicity, restraint, and skillful arrangement of figures that places him in the front rank of the sculptors of the period.

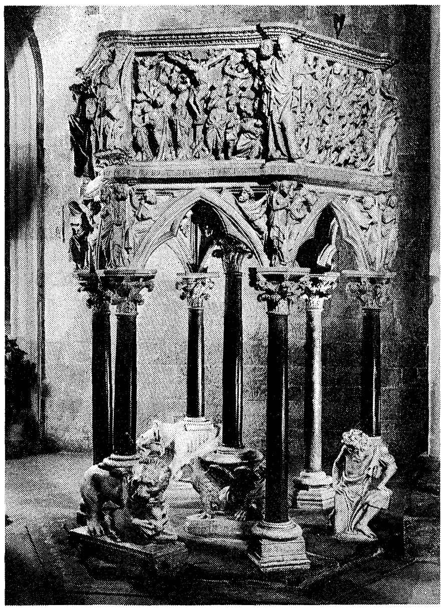
He is last recorded as superintending architect of the cathedral of Orvieto, in which office his son Nino succeeded him.

Pisano, Antonio: *see* Pisanello, Il.

Pisano, Giovanni (b. *c.* 1250, Pisa—d. after 1314, Siena?), sculptor, sometimes called the only true Gothic sculptor in Italy. He began his career under the classicist influence of his father, Nicola, and carried on this tradition after his father's death, continuously reintegrating the antique style into more northerly and contemporary Gothic forms.

Pisano began his career in his father Nicola Pisano's workshop and so thoroughly assimilated the ideas he found there that his early work is difficult to distinguish from that of his father. It was in the contract (1265) for the pulpit in the Siena cathedral that Pisano is first specifically mentioned as an assistant to his father. Since he was at that time not referred to as "magister," or independent master craftsman, Pisano must still have been in his teens. At any rate, by September 1285 he had rejected his Pisan citizenship and had become a resident of Siena. Around this time he began his work on the design and sculptural ornamentation of the facade for the cathedral of Siena which became, in its lavishness and ordering, the model for virtually all future Gothic facade decoration in central Italy. Unlike French examples, in which figural ornament pulsates over the entire facade, Pisano's designs for the Siena facade offer a much more architectural approach to the problem. The lower story is simply decorated with colonnettes (small columns) and a restrained foliate pattern, which follows the vertical movement of the colonnettes. Aside from the carved lintels over the doors, figural sculpture begins at the level of the arches over the entrances with slightly larger than life-size figures of prophets and sibyls and continues throughout the rest of the facade. Although each figure inhabits a discrete niche, agitated, forward-bending poses cause them to converse across the vast space of the facade and soften the otherwise clearly stated architectonic lines that order the structure. Recent research has emphasized particularly close relationships in design between the sculpture of the Siena facade and French foliate patterns and figural reliefs, especially from the cathedral at Auxerre. Since there are no known documentary references to Giovanni Pisano between 1268 and 1278, the possibility of a trip through France during these years seems extremely likely.

Next to the Siena cathedral facade, Pisano's pulpit in Pistoia, completed in 1301, is his greatest achievement. The five narrative reliefs of this pulpit roughly parallel the subject matter of his father Nicola's Pisa pulpit 40 years earlier, as does the overall architectural format, but the style pushes the expressive qualities innate in Nicola's Pisa pulpit to a new level of intensity. In the "Annunciation," the "Nativity," and the "Annunciation to the



Marble pulpit in the church of S. Andrea, Pistoia, Italy, by Giovanni Pisano, 1297–1301
SCALA—Art Resource/EB Inc.

Shepherds," the extreme agitation that characterizes all the reliefs for the Pistoia pulpit pulsates throughout the panel. Figures, animals, drapery, and landscape features are wrenched into physically impossible configurations; light shatters over the broken surfaces and deeply cut relief; and each figure responds convulsively to the individual situations in which he acts as a participant. What is critical to the change in style from the first Pisa pulpit reliefs to the Pistoia reliefs is a preference for an overall agitated and deeply cut surface as opposed to the earlier more massive and monumental organization of forms.

Pisano never repeated the frenzy of forms that covers the Pistoia pulpit. Instead he returned to the more stately, classical spirit that had been at the heart of his father's earliest work. The reasons for this cannot be documented, but they most likely stem in part from Giovanni's experience with Giotto's monumental and heroic style which was already in the ascendancy by the time that the Pistoia pulpit was completed. Pisano, in fact, carved a marble Madonna and Child for the Arena Chapel in Padua at approximately the same time that Giotto painted his profoundly moving fresco cycle there (*c.* 1305). In addition, the quasi-imperial political movements established by Pope Boniface VIII at the turn of the 14th century may also have prompted him to return to more overtly classical quotations.

From 1302 to 1310 Pisano again worked in Pisa, this time for a pulpit for the cathedral. In this pulpit, now badly reconstructed after having been disassembled, the relief style is considerably more docile than that of the Pistoia reliefs. His last recorded work was a tomb sculpture for Margaret of Luxembourg in Genoa in 1311 (fragments now in the Palazzo Bianco). He was last recorded in Siena in 1314, and it is presumed that he died shortly thereafter. If, as is clear from his work in Siena, Pisano was Italy's only Gothic sculptor, it is also true that he never lost sight of the heritage of classical Rome that underlies all of the artistic thinking of central Italy.

MAJOR WORKS. Fontana Maggiore (with Nicola Pisano) (1278; Perugia, Italy); external decoration of the Baptistery, Pisa (1278–85; Pisa); sculptural decoration of the facade, Siena cathedral (1284; Siena, Italy); pulpit (1297–1301; S. Andrea, Pistoia, Italy); pulpit (1302–11; Cathedral, Pisa); tomb of Margaret of Luxembourg (originally in S. Francesco di Casteletto, Genoa, but now destroyed, 1311; fragments in Palazzo Bianco, Genoa; Palazzo Rosso, Genoa).

Pisano, Nicola (b. *c.* 1220, Apulia?—d. 1278/84, Pisa?), sculptor whose work, along with that of his son Giovanni and other artists employed in their workshops, created a new sculptural style for the late 13th and the 14th centuries in Italy.

Pisano's origins are unclear. He is first recorded in 1260 in Pisa (or perhaps 1259, if corrections are made for the medieval Pisan calendar), but documents of 1266 twice call him "Master Nicola from Apulia," Apulia being the province located in the southeastern section of the Italian peninsula. While most scholars now accept an Apulian birth for Pisano, there is still little known about his artistic training. His sculptural training, in line with medieval practices, was probably obtained through an apprenticeship in an already established workshop. If he began his training in Apulia he would most likely have been taught by one of the army of craftsmen whom the Hohenstaufen emperor Frederick II had employed to decorate his vast new building projects. Frederick's artists consciously imitated an ancient Roman style of sculpture in order to give visual support to his role as the Holy Roman emperor. If on the other hand, Pisano had actually left Apulia before receiving his sculptural training, he might have apprenticed himself to either local Tuscan or Lombard workshops; strong echoes of both regional styles appear in his work.

Although no work can definitely be attributed to Pisano before his pulpit in the cathedral of Pisa (1259/60), the strong classical spirit that motivates its forms suggests more than simple first-hand experience and fascination with then visible ancient Roman sculpture. Quite specific formal motifs in the figures of the Pisa pulpit compare closely with sculptural fragments representing Jupiter and imperial advisers from Frederick's triumphal gateway over the Via Appia at Capua (now in the Museo Provinciale Campano in Capua) and argue persuasively for Pisano's training in the artistic workshops of the Emperor. Pisa's close alliance with the empire of Frederick II, even after Frederick's death in 1250, would

"Adoration of the Magi," detail of the marble pulpit in the Baptistery at Pisa, by Nicola Pisano, *c.* 1255–60
Alinari—Art Resource/EB Inc.

have provided good reasons both for his emigration to that city and for the rather sudden emergence of the overtly classicizing style of the pulpit which he carved.

The Pisa pulpit marks one of the extraordinary moments in the history of Western art when a new style, distinct from all its predecessors, though indebted to them, clearly asserted itself and opened new avenues for artistic expression drawing on the widest possible range of artistic motifs—Roman reliefs, early Christian fresco and mosaic decorations, and localized Tuscan and Lombard forms, as well as isolated motifs deriving from French Gothic sculpture and architecture, about which Pisano may have learned either by visiting French-influenced centres in Apulia or by an actual trip to France. He assimilated this encyclopaedic array of artistic expressions and transformed them into a brilliantly unified whole that gave new grandeur and new energy to his narratives and a new sense of direction to art in Tuscany from 1260 onward.

Pisano's style changed dramatically during the carving of the Pisa pulpit—from the amplitude of form and rhythmic fluency of movement evident in the relief panel of "The Presentation of Christ in the Temple," to a greatly more agitated treatment of the space and forms in which figures become smaller in relationship to the entire surface area of the relief and pile up on one another in a surface rather than a spatial organization. The figures themselves become more animated and are twisted to emphasize their dramatic potential more fully. Rather than being a rejection of Pisano's earliest known style, however, this later style in fact grew directly out of his concern for presenting the human emotional content of his subject matter. Some of this stylistic change, especially the last two reliefs from the Pisa pulpit, may also be attributable to apprentices or members of his workshop, including Giovanni Pisano, his son. Nicola Pisano's workshop, including Giovanni Pisano, Fra Guglielmo, and Arnolfo di Cambio, also shared in his next commissions, the pulpit for the cathedral of Siena, 1265–68, and the Fontana Maggiore in the main square of Perugia of 1278. In the Siena pulpit, the form of which is much like that of the Pisa pulpit, Pisano continued the investigations of expressive human figures which permeate the Pisan reliefs. Yet, although his authorship of the design is evident throughout the pulpit, the individual dispositions of the various assisting sculptors toward ancient Roman or Gothic forms is equally obvious; the separate strains of the two traditions that Pisano had so successfully united in the Pisa pulpit again reassert their independence at Siena. This uneasy relationship between the antique and the Gothic becomes increasingly clear at Perugia, where the 25-sided fountain mixes tales from Romulus and Remus with fables from Aesop, classical personifications of nearby places with representations of the liberal arts and the labours of the months, and contemporary historical figures with Old Testament characters and heraldic animals. The shifts in the style of the sculpture at Perugia were also influenced by the fact that single figures were employed rather than complex narratives as in Pisano's earlier work.

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Pisaurum (Italy): *see* Pesaro.

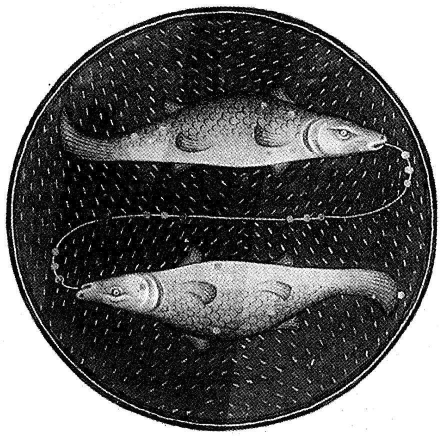
Piscataway (people): *see* Conoy.

Piscator, Erwin (b. Dec. 17, 1893, Ulm, Ger.—d. March 30, 1966, Starnberg, W.Ger.), theatrical producer and director famed for his ingenious Expressionistic staging techniques; the originator of the epic theatre style later developed by the German playwright Bertolt Brecht.

Having studied at the König school of dramatic art and the university, Piscator began as a volunteer at the Hoft Theater; he became in turn an actor and director. Working in Berlin during the Weimar Republic (1919–33), Piscator frankly used the theatre to convey radical political instruction. Though not a communist, he sympathized at the time with the German working-class parties. A bold innovator, he used films and newsreels to enlarge landscapes and convey mass events, and he employed many optical, acoustical, and mechanical devices to create an experience of total theatre. His passion for machinery could be self-defeating, for sometimes the blaring loudspeakers, flashing lights, air-raid sirens, and revolving sets prevented the viewers from getting the message. In exile during World War II, he headed the Dramatic Workshop of the New School for Social Research in New York City, from 1939 to 1951, when he returned to West Germany as director of West Berlin's Volksbühne. He continued to produce sensational works, such as Rolf Hochhuth's *Deputy,* a study of the role of Pope Pius XII during the Nazi era, and *The Investigation* by Peter Weiss, dealing with the mass murders at Auschwitz concentration camp.

John Willett's *The Theatre of Erwin Piscator: Half a Century of Politics in the Theatre* was published in 1979.

Pisces (Latin: Fishes), in astronomy, zodiacal constellation lying between Aries and Aquarius, at about 1 hour right ascension (the coordinate on the celestial sphere analogous to longitude on the Earth) and 15° north declination (angular distance north of the celestial equator). The vernal equinox, the point where the Sun's annual apparent path takes it north



Pisces, illumination from a Book of Hours, Italian, *c.* 1475; in the Pierpont Morgan Library, New York City (MS. G.14)

By courtesy of the Pierpont Morgan Library, New York, the Glazier Collection

of the celestial equator and from which celestial longitude and right ascension are measured, lies now in Pisces. The constellation contains only faint stars without any striking grouping.

In astrology, Pisces is the 12th sign of the zodiac, considered as governing the period *c.* February 19–*c.* March 20. Its representation as two fish tied together is usually related to the Greek myth of Aphrodite and Eros, who jumped into the river to escape the monster Typhon and changed into fish, or, alternatively, the two fish that carried them to safety.

piscina, in Roman times, an artificial reservoir used for swimming or as a fish pond. During the Middle Ages a piscina was a pool or tank in which fish were stored by monastic communities, for whose members fish was a staple item of diet.

Although never a calculated feature of gardens, existing ponds or fish stews (tanks) were sometimes later incorporated in decorative schemes. At Monticello, Thomas Jefferson's home near Charlottesville, Va., an original piscina has been restored.

A stone vessel having a drain that leads directly to the ground, located near an altar of a church, and used for disposing of water from ablutions is also known as a piscina.

Pisco, city, Ica department, southwestern Peru, Pacific port at the mouth of the Río Pisco. Founded in 1640 by Pedro Toledo y Leiva, it was devastated by an earthquake in 1682 and by a tidal wave in 1686. It was incorporated as a city in 1898. Pisco (Quechua Indian for "bird") is noted for its brandy made from muscat grapes. Other economic activities include subsistence farming, milling of cottonseed oil, textile manufacturing, and fishing. The Bahía (bay) de Paracas, to the south, sheltered by the Península Paracas, is a resort area. On the peninsula is the Paracas Necrópolis (pre-Inca ruins). Pop. (1981 prelim.) 55,604.

Pisemsky, Aleksey Feofilaktovich (b. March 23 [March 11, old style], 1821, Ramenye, Kostroma province, Russia—d. Feb. 2 [Jan. 21, O.S.], 1881, Moscow), novelist and playwright whom many critics rank with the great masters of Russian Realism, though his Realism borders on Naturalism and he lacks the philanthropic conscience that informs the work of his great contemporaries.

Pisemsky came from an impoverished noble family, attended Moscow University, and was a civil servant in his native province when his first stories attracted attention in reviews. In 1854 he moved to St. Petersburg, where his lack of refinement, reactionary opinions, and general failure to conform to the image of a cultured liberal gentleman estranged him from literary society. His best achievements are the novel *Tysyacha dush* (1858; "A Thousand Souls"), a memorable portrait of a "new man," Kalinovich, who marries, in spite of his love for another girl, the crippled heiress of "a thousand souls" (serfs) and climbs to the rank of provincial governor, a post he fills with impeccable integrity. Pisemsky's tragedy *Gorkaya sudbina* (1859; "A Bitter Lot"), is one of the masterpieces of the Russian theatre. Pisemsky was further estranged from his colleagues and public by a novel satirizing the radical younger generation, *Vzbalamuchennoye more* (1863; "The Stormy Sea"). The critical attacks directed against him by the radicals obscured his reputation.

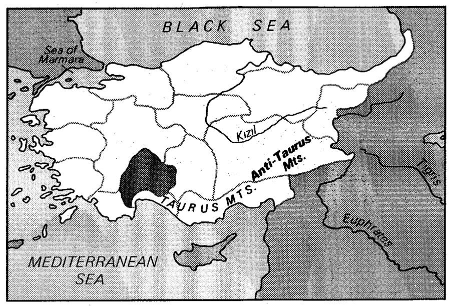
Pishīn, town and administrative headquarters of Pishīn district (once part of the former Quetta-Pishīn district), Quetta division, Baluchistan province, Pakistan. The present town, founded by the British as a military and civil station in 1883, is a market centre and has a noteworthy rest house with a fine garden. It is connected by road with nearby Quetta city.

Pishīn district is located north of Quetta district and fronts Afghanistan on the east and northeast. It comprises a series of long valleys 4,500–5,500 ft (1,370–1,680 m) above sea level enclosed by the Toba Kākar Range to the north; vegetation is sparse. The district is drained by the Pishīn Lora River and its tributaries. Crops grown in the valleys include wheat, barley, corn (maize), and potatoes; grapes, apples, apricots, and peaches are also economically important. Sheep and goats are herded. The main ethnic groups are Pashtun Kākaṛ and Tarīn. Wool, carpets, and sheepskin coats are locally produced; coal is mined. A major road and railway (completed 1888) connect Quetta city with Chaman, a commercial town, near the Afghanistan border. The railway runs through the Khojak tunnel (6,398 ft above sea level) in the Toba Kākar Range; it is one of the largest tunnels, with a length of 2.4 mi (3.9 km), in southern Asia. Pop. (1981 prelim.) town, 14,000; district, 374,000.

Pishpek (Kirgiz S.S.R.): *see* Frunze.

Pisides, Georgios: *see* George the Pisidian.

Pisidia, ancient region of southern Asia Minor, located north of Pamphylia and west of Isauria and Cilicia. Most of the district was composed of the abrupt, north–south-trending limestone ranges of the Taurus Mountains, providing refuge for a lawless population that stubbornly resisted successive conquerors. In



Pisidia

From W. Shepherd, *Historical Atlas,* Harper & Row, Publishers (Barnes & Noble Books), New York; revision copyright © 1964 by Barnes & Noble, Inc.

the 1st century BC the population was organized in small tribes or in groups of villages. The theocratic rule characteristic of ancient Phrygia seems also to have been practiced in Pisidia, where there is evidence of temples with large estates and slave labour.

On the death of King Amyntas (25 BC), most of Pisidia was incorporated in the Roman province of Galatia, though it was partly regrouped with Lycia and Pamphylia by Vespasian in AD 74. The advance of Roman civilization was at first slow, but in the 2nd century AD urbanization proceeded rapidly. After Diocletian's reorganization (*c.* AD 297) Pisidia was included in the Dioecesis Asiana, and in later Byzantine times it fell partly in the Thracesian and partly in the Anatolic theme (province).

Pisistratus (Athenian tyrant): *see* Peisistratus.

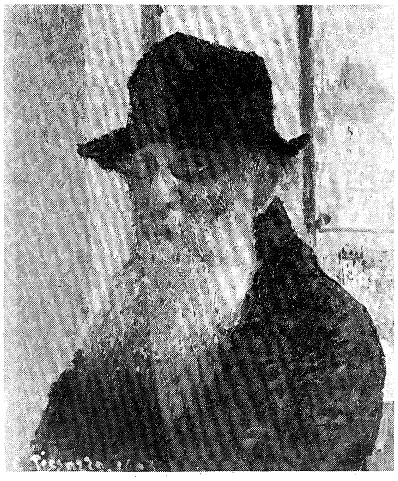
pisolite, spheroidal crystalline particle larger than 2 millimetres in diameter (*see* oölite).

Pissarro, Camille (b. July 10, 1830, St. Thomas, Danish West Indies—d. Nov. 13, 1903, Paris), French Impressionist painter, who endured prolonged financial hardship in keeping faith with the aims of Impressionism. Despite acute eye trouble, his later years were his most prolific. The Parisian and provincial scenes of this period include "Place du Théâtre Française" (1898) and "Bridge at Bruges" (1903).

Pissarro was the son of a prosperous Jewish merchant, Abraham Gabriel Pissarro, and Rachel Manzano-Pomié. At the age of 12 he left home for studies in Paris, where he showed an early interest in art. Returning to the West Indies after five years to work in his father's store, he began making sketches of the exotic island and its people. Because he was unable to obtain his father's permission to study art, he ran away to Caracas in 1853 and remained there for two years with the Danish painter Fritz Melbye. Finally, Pissarro's father relented, and in 1855 he returned to

France. His earliest canvases, dating from this period, are figure paintings and landscapes of the tropics and of the French countryside; although broadly painted, they show the careful observation of nature that was to remain a characteristic of his art throughout his life.

The uninspired academic teaching at the École des Beaux-Arts, where he was enrolled,



Pissarro, "Self-Portrait," oil painting, 1903; in the Tate Gallery, London

By courtesy of the trustees of the Tate Gallery, London

led Pissarro to seek out the painter Camille Corot, who permitted Pissarro to call himself Corot's "pupil" at a Salon exhibition in 1864. At this time Pissarro was also attracted to the rural, sentimental paintings of the Barbizon artist Jean-François Millet and to the works of Gustave Courbet, the leading proponent of everyday Realism. During the 1860s Pissarro participated in the famous Parisian Café Guerbois discussions, in which artists and writers exchanged ideas, and worked with the younger painters Auguste Renoir and Claude Monet. To escape the Franco-German War, in 1870 Pissarro fled to England; there he and Monet, who had also fled France, visited the museums, where they viewed British landscape paintings. It was in London that Pissarro married Julie Vellay, formerly his mother's maid, who had already borne him two of their seven children.

When Pissarro returned to France in 1871, he found his house in Louveciennes looted and a great number of his paintings destroyed. Soon he was to look for another house in Pontoise. (Because it was costly to live in Paris, Pissarro, like several of his painter friends, lived in villages not far from the city.) His surroundings formed the theme of his art for some 30 years and were always carefully chosen: "I require a spot that has beauty!" At Pontoise he was joined by Paul Cézanne in 1872, and the two of them painted out-of-doors, even in the middle of winter.

Pissarro's paintings are never dramatic; on the contrary, his leading motifs during the 1870s and 1880s are simply houses, factories, trees, haystacks, fields, labouring peasants, and river scenes. Forms do not dissolve but remain firm, and colours are strong; during the latter part of the 1870s his comma-like brushstrokes frequently recorded the sparkling scintillation of light, as in "Orchard with Flowering Fruit Trees, Springtime, Pontoise" (1877). Although his paintings were sold by the dealer Paul Durand-Ruel, who represented several of the Impressionists, Pissarro continued to experience financial hardships, which he described in letters to his eldest son, Lucien; this remarkable correspondence began in 1883 and lasted for 20 years.

In some of the letters to his son, Pissarro expressed dissatisfaction with his own work. Preoccupied by problems of style and technique, he eagerly embraced the Neo-Impressionist theories of Georges Seurat, whom he met in 1885 through the painter Paul Signac. Seurat's technique, consisting of meticulously painted small dots of juxtaposed colours, was adopted by Pissarro; for about five years he painted in this "divisionist" manner, a style which made his works unpopular with dealers, collectors, and even his old fellow artists. Overwhelmingly discouraged by their continuing state of poverty, Madame Pissarro considered drowning herself and their two youngest children. Finally, Pissarro abandoned the style, not, however, because of the opposition he met but because "it was impossible to be true to my sensations and consequently to render life and movement, impossible to be faithful to the effects, so random and so admirable, of nature. . . ." At about this time, also, there was an estrangement from Paul Gauguin, who had formerly worked at his side but now was involved with the new Symbolist movement.

A large and successful retrospective exhibition of Pissarro's paintings was held by Durand-Ruel in 1892, giving the artist greater financial stability, although by this time he was troubled by a chronic eye infection that frequently made it impossible for him to work out-of-doors. Both in 1893 and 1897 he took hotel rooms in Paris from which he painted 24 canvases of the city's streets by day and by night, in sun, rain, and fog. During the 1890s he also did a series of river scenes in Rouen, likewise depicting the various effects of nature. From 1900 until his death three years later, Pissarro continued working, mainly in Paris, Éragny, Dieppe, and Le Havre, with freshness of vision and increasing freedom in his technique. More than 1,600 works, consisting of oils, gouaches, temperas, pastels—and even paintings on fans and on porcelain—as well as nearly 200 fine prints, give testimony to the high quality of Pissarro's half century of work.

Pissarro was the only Impressionist painter who participated in all eight of the group's exhibitions. His kindness, warmth, wisdom, and encouraging words cast him in a fatherly role to struggling younger artists—Monet, Renoir, Cézanne, and Gauguin—who were exploring new means of personal expression. Despite financial burdens that continued until he reached his 60s, Pissarro never lost faith in the new art, believing that "one must be sure of success to the very end, for without that there is no hope!" (Mi.V.)

MAJOR WORKS. "The Hermitage at Pontoise" (*c.* 1867; Justin K. Thannhauser Collection, New York); "Still Life" (1867; Toledo Museum of Art, Ohio); "Jallais Hill, Pontoise (La Côte du Jallais, Pontoise)" (1867; Metropolitan Museum of Art, New York City); "Louveciennes, the Road to Versailles" (1870; Emil G. Bührle Collection, Zürich); "Lower Norwood, London, Snow" (1870; National Gallery, London); "Crystal Palace, London" (1871; Henry J. Fisher Collection, Greenwich, Conn.); "Quarry near Pontoise" (1874; Kunstmuseum, Basel, Switz.); "The Little Bridge" (1875; Städtische Kunsthalle Mannheim, Mannheim, Ger.); "Orchard with Flowering Fruit Trees, Springtime, Pontoise" (1877; Louvre, Paris); "The Red Roofs, View of a Village in Winter" (1877; Louvre); "Peasant Girl with a Stick" (1881; Louvre); "The Café au Lait" (1881; Art Institute of Chicago); "Towpath at Pontoise" (1882; Durand-Ruel Collection, Paris); "Île Lacroix, Rouen—Effect of Fog" (1888; Philadelphia Museum of Art); "Paris, the Boulevard Montmartre at Night" (1897; National Gallery, London); "Boulevard des Italiens, Morning, Sunlight" (1897; National Gallery of Art, Washington, D.C.); "Place du Théâtre Français" (1898; Minneapolis Institute of Arts, Minnesota); "Rue de l'Épicerie, Rouen—Morning, Gray Weather" (1898; Durand-Ruel Collection); "The Church of Saint-Jacques, Dieppe—Morning, Rainy Day" (1901; Nate B. and Frances Spingold Collection, New York); "Louvre from Pont Neuf" (1902; Sterling and Francine Clark Institute of Art, Williamstown, Mass.); "Bridge at Bruges" (1903; City Art Gallery, Manchester).

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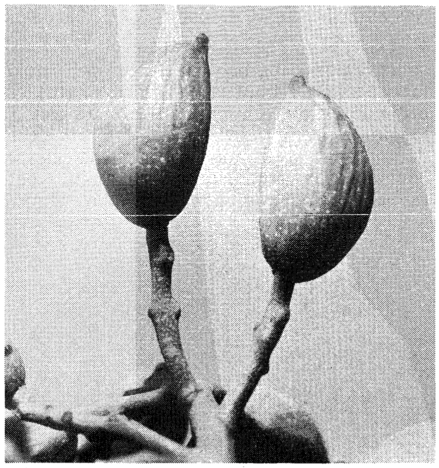
Pisseleu, Anne de: *see* Étampes, Anne de Pisseleu, duchesse d' (duchess of).

Pissevache Fall, waterfall on the Salanfe River, a tributary of the Rhône, in Valais canton, Switzerland, a short distance north of the village of Vernayaz. It attains its maximum flow in spring and summer and is best seen during the morning. The fall provides power for a hydroelectric power plant. It has a drop of 215 ft (65 m).

Pistacia, genus of flowering plants, of the cashew family (Anacardiaceae), comprising nine species of aromatic trees and shrubs native to Eurasia, with one species in southwest-



Pistachio fruits (*Pistacia vera*)

G. Tomsich—Photo Researchers

ern North America and another in the Canary Islands. The Chinese pistachio (*P. chinensis*) is a tall ornamental tree with scarlet fruits and colourful autumn foliage. The mastic tree (*P. lentiscus*) and turpentine tree, or terebinth (*P. terebinthus*), produce sweet-smelling gums used in medicine. Mastic also is used in liqueurs and varnishes. Commercial pistachio nuts are seeds from the fruit of *P. vera.* The nuts are extensively used as food and for yellowish-green colouring in confections.

Grown in dry lands in warm or temperate climates, the tree is believed indigenous to Iran; it is widely cultivated from Afghanistan to the Mediterranean region and to a limited extent in California. The tree has wide-spreading branches but rarely exceeds 9 metres (30 feet) in height. Each leaf has one to five pairs of thick, wide, leathery, pinnate leaflets; its small fruits are borne in clusters. The trees are usually dioecious (bearing either male or female flowers) and are pollinated largely by wind.

The white fruits are 1.5 to 2 centimetres (0.6 to 0.8 inch) long and tend to split at one side without discharging the nut, a greenish kernel enclosed in a thin, tightly adhering, reddish skin. The single, solid kernels have a pleasing mild resinous flavour. To ensure pollination and good yield, male trees are interplanted with female in a ratio of 1:5 or 1:6.

pistil, the female reproductive part of a flower. The pistil, centrally located, typically consists of a swollen base, the ovary, which contains the potential seeds, or ovules; a stalk, or style, arising from the ovary; and a pollen-receptive tip, the stigma, variously shaped and often sticky.

Differences in the composition and form of the pistil are useful in determining taxonomic relationships. There may be a single pistil, as in the lily, or several to many pistils, as in the buttercup. Each pistil is constructed of from one to many enrolled leaflike structures, or carpels. The carpel is a single megasporophyll, or modified seed-bearing leaf. A pistil then may be composed of one carpel (simple pistil), as in the sweet pea, or of two or more carpels (compound pistil) partially or completely joined, as in the mustard (two carpels) or lily (three carpels).

A flower that contains separate pistils (and therefore separate carpels) is termed apocarpous; if it contains a single pistil with two or more united carpels, it is syncarpous.

Pistils in the collective sense form the gynoecium, in distinction to the male reproductive parts, or androecium.

Pistoia, Latin PISTORIA, city, capital of Pistoia province, in the Toscana (Tuscany) region, north central Italy, located on the Ombrone River south of the Apennines and northwest of Florence. The town (recorded as Pistoria) was previously a site of Gallic, Ligurian, Etruscan, and Roman occupation and in 63 BC was the scene of the death in battle of the Roman demagogue Catiline. A bishopric from the 5th century and an early and vigorous free Italian commune from the late 11th century, it came under Florentine domination in 1329. In 1786 a famous Jansenist episcopal synod opposing devotion to the Sacred Heart of Jesus was convened there.

The medieval city centre is dominated by the 12th-century cathedral, with its freestanding bell tower (once a Lombard watchtower); the baptistery (begun 1337); the Palazzo Comunale (1294–1385); and the Palazzo Pretorio (1367). The cathedral contains the famous silver Altar of St. James, mentioned by the poet Dante. Churches include Giovanni Fuorcivitas (12th century; containing a Visitation in glazed terra-cotta by Andrea della Robbia), S. Andrea (12th century), S. Francesco al Prato (1294–1394), and the Madonna dell'Umiltà (1494–1519). The Ospedale del Ceppo (founded 1277) is noted for a frieze by Giovanni della Robbia.

Pistoia has several training schools and institutes. It is a road and rail junction and has tanning, shoemaking, ironworking, and glassmaking industries. Lace is also made; flowers are grown for sale and export.

The word pistol has been traditionally ascribed to Pistoia, where the weapon was possibly first manufactured in the early 15th century. Pop. (1983 est.) mun., 91,993; province 265,617.

Pistoia, Synod of, a diocesan meeting held in 1786 that was important in the history of Jansenism, a nonorthodox, pessimistic, and rigoristic movement in the Roman Catholic Church. The synod, presided over by Scipione de' Ricci, bishop of Pistoia-Prato, and under the patronage of Peter Leopold, grand duke of Tuscany (later the Holy Roman emperor Leopold II), was aimed at a reform of the Tuscan Church along the lines advocated by the Jansenists and the Gallicans, who sought to restrict the authority of the pope. The synod was attended by many priests who almost unanimously approved a series of decrees that were warmly approved by the Grand Duke and aroused the enthusiasm of Jansenists in many parts of Europe. At the insistence of Leopold, a national synod of Tuscan bishops then met at Florence (April 23, 1787); they, however, rejected the decrees of Pistoia. In 1794 Pope Pius VI condemned 85 propositions of Pistoia, and Ricci, who had resigned his see in 1790, subsequently recanted.

pistol, small firearm designed for one-hand use. According to most theories, pistols were first developed in Italy in the 14th century. The military advantages of a firearm that could be operated by one hand, leaving the other free for another weapon or for defense, were clear

Automatic .45-calibre pistol
By courtesy of Colt Industries

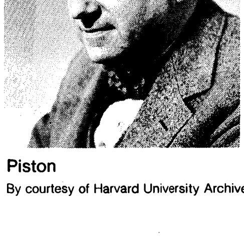
from the earliest days of gunpowder, and the pistol evolved simultaneously with its heavier counterpart, the shoulder weapon.

There are two important classes of pistol: revolvers and automatics. Revolvers embody an element that revolves; in early revolvers, sheaves or bundles of tubes serving as barrels were revolved by hand to allow more than one shot without reloading. The modern revolver employs a short, many-chambered cylinder positioned behind a single barrel so that the cartridge in each chamber is brought successively in alignment with the barrel. Pulling the trigger revolves the cylinder, brings a fresh cartridge in line with the hammer, locks the cylinder in place, and releases the hammer to discharge the cartridge.

Automatic pistols have their mechanism actuated by the energy of recoil when a bullet is fired; cartridges are fed into the mechanism through a magazine in the butt of the pistol. Though devotees of the automatic pistol have predicted the decline and disappearance of the revolver, there is little evidence that this is happening. Both weapons are used by the military in many countries. Police use varies, with the revolver favoured in the U.S., the automatic elsewhere. Both types are used extensively for sport and target shooting.

Piston, Walter (Hamor) (b. Jan. 20, 1894, Rockland, Maine, U.S.—d. Nov. 12, 1976, Belmont, Mass.), composer noted for his symphonic and chamber music and his influence in the development of the 20th-century Neoclassical style in the United States.

After graduating from the Massachusetts School of Art, Piston studied music at Harvard



Piston
By courtesy of Harvard University Archives

University and in Paris with Nadia Boulanger and Paul Dukas (1924–26). On his return to the U.S. he taught at Harvard, becoming professor of music in 1944 and retiring in 1960. Highly regarded as a teacher, he wielded considerable influence on contemporary American music through his students, who included Leonard Bernstein. He published four important textbooks, *Principles of Harmonic Analysis* (1933), *Harmony* (1941), *Counterpoint* (1947), and *Orchestration* (1955). His style of composition is Neoclassical, with occasional Romantic overtones, and is noted for its structural strength and rhythmic vivacity. His program music includes the orchestral suite *Three New England Sketches* (1959); his only composition for the theatre is the ballet *The Incredible Flutist* (1938). He composed eight symphonies, the third (1947) and seventh (1960) of which were awarded Pulitzer Prizes. He also wrote two violin concerti, a viola concerto, a concerto for two pianos, a *Capriccio* for harp and string orchestra (1963), a concerto for clarinet, the *Lincoln Center Festival Overture* (1962), and a concerto for string quartet and orchestra (1974). His chamber music includes five string quartets, a quintet for piano and string quartet, and a wind quintet.

piston and cylinder, in mechanical engineering, sliding cylinder with a closed head (the piston) that is moved reciprocally in a slightly larger cylindrical chamber (the cylinder) by or against pressure of a fluid, as in an engine or pump. The cylinder of a steam engine (*q.v.*) is closed by plates at both ends, with provision for the piston rod, which is rigidly attached to the piston, to pass through one of the end cover plates by means of a gland and stuffing box (steam-tight joint).

The cylinder of an internal-combustion engine is closed at one end by a plate called the head and open at the other end to permit free oscillation of the connecting rod, which joins the piston to the crankshaft. The cylinder head contains the spark plugs on spark-ignition (gasoline) engines and usually the fuel nozzle on compression-ignition (diesel) engines; on some engines the valves that control the admission of fresh fuel and the escape of burned fuel are also located in the head.

On most engines the cylinders are smoothly finished holes in the main structural component of the engine known as the block, which is usually made of cast iron or aluminum. On some engines the cylinders are lined with sleeves (liners) that can be replaced when worn. Aluminum blocks use centrifugally cast iron liners that are placed in the mold when the aluminum is being cast; these liners are not replaceable but can be rebored.

Pistons are usually equipped with piston rings. These are circular metal rings that fit into grooves in the piston walls and assure a snug fit of the piston inside the cylinder. They help provide a seal to prevent leakage of compressed gases around the piston and to prevent lubricating oil from entering the combustion chamber.

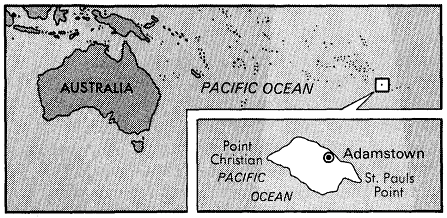
An important characteristic of an internal-combustion engine is its compression ratio, defined as the total volume of the combustion chamber with the piston fully extended (maximum volume) divided by the total volume with the piston fully compressed (minimum volume). The actual compression ratio in practice is somewhat less. Higher compression ratios usually provide better engine performance, but they require a fuel with better antiknock characteristics.

Closely associated with the compression ratio is a characteristic known as the displacement—*i.e.,* the change in volume (measured in cubic inches or cubic centimetres) of the combustion chamber that takes place as the piston moves from one extreme to the other. The displacement is related to the horsepower rating of an engine.

pit bull terrier, fighting dog developed in 19th-century England out of the bulldog and a terrier. *See* Staffordshire terrier.

pit organ, a temperature-sensitive organ in the head of venomous snakes of the subfamily Crotalinae, family Viperidae. Crotalines, known collectively as pit vipers, include rattlesnakes, moccasins, fer-de-lance, and a number of other New World vipers, as well as a few Old World species. The pit organs are located on each side of the face, somewhat below a line from the eye to the nostril. They function in the detection of the small, warm-blooded animals on which the snakes feed, and they aid in orienting the snake's strike.

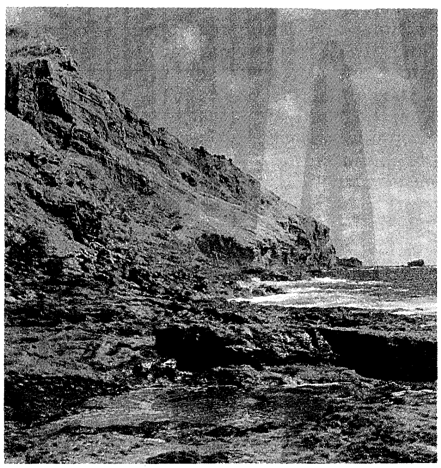
Pitcairn Island, isolated, volcanic formation in the south-central Pacific Ocean, 1,350 miles (2,170 km) southeast of Tahiti. With the uninhabited dependent islands of Oeno, Henderson, and Ducie, it constitutes the British colony of Pitcairn Island. The main island,



Pitcairn Island

with an area of about 2 square miles (5 square km), is a rugged half crater rising to 1,100 feet (about 300 m), girded by precipitous coastal cliffs. The climate is subtropical with an adequate rainfall, and the soil is fertile.

Discovered in 1767 by a British naval officer, Philip Carteret, Pitcairn is named for the sailor who first sighted it. Its population is descended from the mutineers of the British ship HMS *Bounty* and their Tahitian Polynesian consorts. On a voyage from Tahiti to the West Indies with a cargo of breadfruit saplings, the crew, led by the first mate, Fletcher Christian, mutinied and set their captain, William Bligh, and a number of loyal sailors adrift and set course for the Austral Islands. The mutineers and their Tahitian companions eventually reached uninhabited Pitcairn (1790), went ashore, and then burned the ship. The island community survived in obscurity until discovered by American whalers in 1808. Resettled



The rugged coast at Bounty Bay, Pitcairn Island
Peter J. Anerine—Shostal/EB Inc.

on Tahiti (1831), many islanders grew dissatisfied and returned to Pitcairn. Thereafter, the island became a port of call for whalers and passenger ships steaming between the United States and Australia. In 1856, because of overpopulation, some of the islanders were removed to Norfolk Island, and to this day the mutineers' descendants remain divided between the two places.

Adamstown, the chief settlement, is on the north coast near Bounty Bay, one of the few places where the island-made longboats can land. The islanders subsist on fishing, garden produce, and crops (including sweet potatoes, sugarcane, taro, oranges, bananas, and coffee). The sale of postage stamps and carved curios to passing ships brings cash income. Absentee land ownership and overpopulation have been persistent problems. The islanders have been Seventh-day Adventists since 1887.

In 1898 the settlement was placed under the jurisdiction of the British High Commissioner for the Western Pacific. In 1952 administrative responsibility was transferred to the governor of the British crown colony of Fiji. When Fiji became independent in 1970, the British High Commissioner in New Zealand assumed administrative control as governor of Pitcairn, carrying out his duties through a locally elected island council. Pop. (1983) 61.

pitch, in music, position of a single sound in the complete range of sound. Sounds are higher or lower in pitch according to the frequency of vibration of the sound waves producing them. A high frequency (*e.g.,* 880 hertz [cycles per second]) is perceived as a high pitch; a low frequency (*e.g.,* 55 Hz) as a low pitch.

In Western music, standard pitches have long been used to facilitate tuning. Usually a' above middle C (c') is taken as a referent pitch. The current standard pitch of $a' = 440$ Hz was adopted in 1939. For some eighty years previous, a' had been set at 435 Hz. A confusing variety of pitches prevailed until the 19th century, when the continual rise in pitch made some international agreement a matter of practical necessity.

In the mid-17th century, the Hotteterres, Parisian instrument makers, remodeled the entire woodwind family. They used the Paris organ pitch of about $a' = 415$, or a semitone below $a' = 440$. This new, or Baroque, pitch, called *Kammerton* ("chamber pitch") in Germany, was thus one tone below the old Renaissance woodwind pitch, or *Chorton* ("choir pitch").

After about 1760 the conventional pitch rose, reaching $a' = 440$ by about 1820. By the latter half of the 19th century, it reached the "Old Philharmonic Pitch" of about $a' = 453$. The inconvenience of this high pitch became apparent, for it strained singers' voices and made wind instruments quickly out of date. An international commission met in Paris in 1858–59 and adopted a compromise pitch called diapason normal (known in the United States as "French pitch," or "international pitch") at $a' = 435$. England, in 1896, adopted the "New Philharmonic Pitch" at $a' = 439$ and, in 1939, adopted the U.S. standard pitch of $a' = 440$. In the mid-20th century, pitch again tended to creep upward as some European woodwind builders used the pitch $a' = 444$.

When frequency numbers are not used for a particular pitch, say D or B, a system of lowercase and capital letters indicates the octave in which it occurs. The notes in the octave below middle C are indicated by lowercase letters from c to b; the notes of the second octave below middle C are shown as C, D, . . . B; the notes of the next lower octave as C_1, D_1, . . . B_1. Middle C is shown as c', and the notes in the octave above middle C as d', e', . . . b'. The C above middle C is shown as c'', and the next higher C as c'''.

Absolute, or perfect, pitch is the ability to identify by ear any note at some standard pitch or to sing a specified note, say $G\sharp$, at will. Fully developed absolute pitch is uncommon. It appears early in childhood and is apparently an acute form of memory of sounds of a particular instrument, such as the home piano. Some musicians slowly acquire a degree of absolute pitch, if only for the familiar $a' = 440$.

pitch, in speech, the relative highness or lowness of a tone as perceived by the ear, which depends on the number of vibrations per second produced by the vocal cords. Pitch is the main acoustic correlate of tone and intonation (*qq.v.*).

pitch, in the chemical-process industries, the black or dark-brown residue obtained by distilling coal tar, wood tar, fats, fatty acids, or fatty oils.

Coal tar pitch is a soft to hard and brittle substance containing chiefly aromatic resinous compounds along with aromatic and other hydrocarbons and their derivatives; it is used chiefly as road tar, in waterproofing roofs and other structures, and to make electrodes.

Wood tar pitch is a bright, lustrous substance containing resin acids; it is used chiefly in the manufacture of plastics and insulating materials and in caulking seams.

The pitches derived from fats, fatty acids, or fatty oils by distillation are usually soft substances containing polymers and decomposition products; they are used chiefly in varnishes and paints and in floor coverings.

pitch lake, large surface deposit of natural asphalt, a mixture of heavy oils that is left after the lighter, more volatile components of a crude-oil seepage have evaporated. An example is Guanoco Lake in Venezuela, which covers over 445 hectares (1,100 acres) and contains an estimated 6,000,000 tons of asphalt. It was used as a commercial source of asphalt from 1891 to 1935. Smaller deposits occur commonly where Tertiary marine sediments outcrop on the surface; an example is the tar pits at Rancho La Brea in Los Angeles (*brea* and "tar" are synonymous with "semisolid asphalt"). Although most pitch lakes are fossils of formerly active seeps, some, such as Pitch Lake on the island of Trinidad, continue to be supplied with fresh crude oil seeping from a subterranean source. Pitch Lake covers 47 hectares (115 acres) and contains an estimated 6,700,000 tons of asphalt. The asphalt is a major export of Trinidad and Tobago and is used mostly for road building.

pitchblende, amorphous, black, pitchy form of the crystalline uranium oxide mineral uraninite (*q.v.*); it is one of the primary mineral ores of uranium, containing 50–80 percent of that element. Three chemical elements were first discovered in pitchblende: uranium by the German chemist Martin Klaproth in 1789, and polonium and radium by the French scientists Pierre and Marie Curie in 1898. Deposits, frequently in association with uraninite or with secondary uranium minerals, are known in Zaire; Czechoslovakia; England; the Northwest Territories and Saskatchewan in Canada; and Arizona, Colorado, Montana, New Mexico, and Utah in the United States.

Pitcher, Molly, byname of MARY MCCAULY (b. *c.* 1753—d. Jan. 22, 1832, Carlisle, Pa., U.S.), heroine of the Battle of Monmouth during the U.S. War of Independence.

Molly's original surname is unknown, though she is thought to have been Irish. Military records indicate that her first husband, William Hays, enlisted as a gunner in a Pennsylvania artillery regiment in 1777. Molly was with him at the Battle of Monmouth (N.J.) on June 28, 1778, carrying a pitcher back and forth from a well so that the exhausted and wounded American soldiers could have water—hence her nickname, "Molly Pitcher."

Popular legend has it that, when Hays eventually collapsed from the scorching heat that day, Molly took her husband's place at the cannon, serving heroically for the remainder of the battle.

Hays was discharged shortly after the war, and in 1783 they went to Carlisle, where Hays became a barber. Hays died about five years later, and in 1793 Mary wedded John McCauly. Her second husband died in about 1813, and thereafter Mary was employed largely as a nurse. On Feb. 21, 1822, Pennsylvania awarded her an annual pension of $40 in recognition of her heroism at Monmouth. Monuments near the battle site and at her grave also recognize her contribution to American independence.

It had been previously believed that her original name was Mary Ludwig, that she was of German immigrant stock, and that her first husband was John Casper Hays.

BIBLIOGRAPHY. Samuel Stelle Smith's documented biographical study, *A Molly Pitcher Chronology,* was published in 1972.

pitcher plant, any carnivorous plant with pitcher-shaped leaves. Old World pitcher plants are members of the family Nepenthaceae (order Nepenthales; *q.v.*). New World pitcher plants belong to the family Sarraceniaceae (order Sarraceniales; *q.v.*). The flycatcher plant (*Cephalotus follicularis*) of southwestern Australia is the only species of the family Cephalotaceae (order Saxifragales). Another pitcher plant is *Dischidia rafflesiana,* of the family Asclepiadaceae (*q.v.*). Pitcher plants are found in a wide range of habitats, from pine barrens to sandy coastal swamps.

Common pitcher plant (*Sarracenia purpurea*)
Walter Chandoha

The name pitcher plant most commonly refers to members of the family Sarraceniaceae, especially the eight or nine species comprising the genus *Sarracenia,* native to eastern North America. The other two genera in the family are the cobra plant (*q.v.; Darlingtonia*), native to northwestern North America, and *Heliamphora,* native to South America.

Pitcher plants of the genus *Sarracenia* have unusual tubular leaves that are shaped like urns, trumpets, or small pitchers. Insects are attracted to the mouth of the pitcher by a trail of nectar-secreting glands that extend downward along the lip to the interior of the pitcher. The lip is covered with stiff, downward-pointing hairs that are not easy for an insect to climb upward on once it has partly descended to gather nectar. Just below the lip, in the steepest part of the pitcher's throat, is a very smooth area without hairs. Like a greased slide, this zone sends the insect (who by then is trying to escape by unsuccessfully climbing upward) tumbling down into the liquid pool at the bottom of the pitcher, where it quickly becomes submersed and drowns. The insect is then digested by an enzyme secreted within the leaf.

The purple, or common, pitcher plant (*S. purpurea*) has heavily veined, green to reddish, flaring, juglike leaves that bear downward-pointing bristles. Its flowers are purple-red. The parrot's head pitcher plant (*S. psittacina*) has small, fat, red-veined leaves that are topped by beaklike lids. It bears dark red flowers. The sweet pitcher plant (*S. rubra*) produces dull red, violet-scented flowers. The crimson pitcher plant (*S. leucophylla; S. drummondii* of some authorities) has white, trumpet-shaped pitchers with ruffled, upright hoods and scarlet flowers. The yellow pitcher plant (*S. flava*), also known as trumpets, has bright yellow flowers and a long, green, trumpet-shaped leaf the lid of which is held upright.

Different species of pitcher plants cross-fertilize easily, so that the number of species varies according to the authority consulted.

pitchstone, a natural glass with a conchoidal fracture (like glass), a resinous lustre, and a mottled, streaked, or uniform brown, red, green, gray, or black colour. It is formed by the rapid cooling of viscous lava or magma.

Most pitchstone occurs as dikes or marginal phases of dikes and therefore may grade into porphyry. Pitchstone porphyry (vitrophyre) consists of a glassy base (groundmass) enclosing abundant large crystals (phenocrysts) of such minerals as quartz, alkali feldspar, and plagioclase, as well as fewer crystals of pyroxene or hornblende. Pitchstone may reveal evidence of fluid flow by the presence of wavy streaks and trains of crystals; in pitchstone dikes, the lines and layers of flowage are oriented parallel to the dike walls.

Pitchstone is a rhyolite. Pitchstone has a chemical composition, index of refraction, and specific gravity similar to those of obsidian but is distinguished by a dull, rather than vitreous, lustre. Like obsidian it is translucent on thin edges, but it is much richer in microscopic embryonic crystal growths (crystallites), the abundance of which is generally believed to account for the duller lustre. Of all the glassy rocks, pitchstone is the richest in water, generally containing 4 to 10 percent by weight; most of this water may have been absorbed from the sea or wet sediments into which the pitchstone was intruded. Some lavas and magmas appear to have congealed partly as glass and partly as crystalline material; water driven out from those portions undergoing crystallization may have been trapped or taken up by the glassy portions to form pitchstone. Pitchstone is unstable, and its conversion to a very fine-grained crystalline aggregate resembles the devitrification of obsidian.

Piteå, town and port, *län* (county) of Norrbotten, northern Sweden. It lies along the Pite River near its outlet on the Gulf of Bothnia. The town was originally chartered at Öjebyn in 1621, but after a fire in 1666 it was moved to its present location. Lying in a forest-rich area, it is a centre for shipping timber and wallboard, and among its industries are sawmilling and others connected with forestry; there is also metalworking. Although it was burned by the Russians in 1716 and again in 1721, there are still many buildings predating that time, notably a church (1684–86). Pop. (1987 est.) mun., 38,688.

piteira (fibre): *see* Mauritius hemp.

Piteşti, city, capital of Argeş *judeţ* (county), south-central Romania. It lies 70 miles (110 km) northwest of Bucharest and is situated in the Argeş River valley, there sheltered by surrounding hills. Piteşti developed in the Middle Ages as a trading centre between the mountainous Transylvania region and the Danube Plain. It is first documented in 1388, though Roman coins and relics have been found in the area. Before 1939 the only industry was a textile mill at Găvana, a suburb; but from 1960 to 1970 an industrial district was built northwest of the city proper. Automobile production has become the most important industry; other manufactures include footwear

Local People's Council headquarters, Piteşti, Rom.
Art Resource—EB Inc.

and wood and metal products. Pop. (1985 est.) 146,915.

Pithecanthropus, former genus name assigned to fossil hominids including Java man (*q.v.*) and Peking man (*q.v.*), both now classified as *Homo erectus.*

Pithom, Egyptian PER-ATUM, or PER TUM ("Estate of Atum"), probably modern TALL AL-MASKHŪṬAH, ancient Egyptian city located near Ismailia in al-Ismāʿīlīyah *muḥāfaẓah* (governorate). Mentioned in the Bible (Exodus 1:11) as one of the treasure cities built for the pharaoh by the Hebrews, it was known to have been enlarged by the Ramesside pharaohs, especially by Ramses II (reigned 1279–13 BC), in whose reign the Exodus of the Hebrews may have taken place. The site has yielded sphinxes and statues of Ramses II and the best-preserved of the trilingual stelae that commemorated Darius I the Great's completion of the Nile-Red Sea Canal.

Pithoragarh, town, northern Uttar Pradesh state, northern India. It lies east of Almora, on a ridge of the Himalayan foothills. The surrounding area lies entirely within the Himalayan Range and is bordered by Nepal to the east and China to the north. Rice, barley, and wheat are grown. Pop. (1981) town, 17,657.

Pithou, Pierre (b. Nov. 1, 1539, Troyes, Fr.—d. Nov. 1, 1596, Nogent-sur-Seine), lawyer and historian who was one of the first French scholars to collect and analyze source material of France's history.

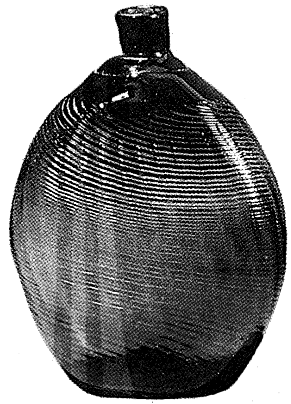
Reared as a Calvinist, Pithou received his lawyer's robes at Paris (1560) after he had earned recognition by his essays on Roman laws. On the outbreak of the Second War of Religion against the Protestants in 1567, he fled to Sedan and later to Basel, returning to France after the Edict of Pacification (1570). After the massacre of the Huguenots (1572), he converted to Catholicism in 1573 and was named procurer general (1579) for a temporary court set up by King Henry III to render justice in the province of Guyenne.

When the Holy League for the extermination of Protestantism prevented Pithou from practicing law, he devoted himself to his researches on the history and discipline of the church. Sympathetic to the royal cause, he helped in producing *Satire Ménippée* (1594), a polemical tract that did much to damage the cause of the League. In the same year, he was appointed procurer general for the parliament at Paris. On the order of King Henry IV, he wrote *Les Libertés de l'église gallicane* (1594; "Liberties of the Gallican Church"), a work echoing the position of the French legal scholars in the conflict between the government and the Holy See; it became the basis for the declaration of the French clergy (1682) concerning the authority of the pope.

Pithou's other historical works are *Leges Wisigothorum* (1579; "Laws of the Visigoths"), the first publication of the laws of the Visigoths, and *Annales Francorum* (1588; "Annals of the Franks").

Pitkin glass, a glassware originating from a glasshouse established by the Pitkin family in East Hartford (now Manchester), Conn., in 1783 and active until *c.* 1830.

The product's fame rests almost entirely on so-called Pitkin flasks, which were much



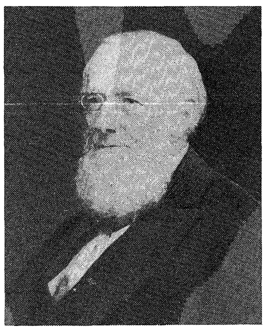
Pitkin flask made in the eastern United States, *c.* 1820; in the Brooklyn Museum, New York

By courtesy of the Brooklyn Museum, gift of Mr. & Mrs. A. L. Chapins in memory of Louis Chardon

sought by collectors in the 1920s. These flasks, which vary in colour from green to aquamarine and amber, were a kind of pocket bottle molded with a swirl or ribbed pattern. Pitkin flasks made in the Eastern glasshouses are generally olive green or amber, whereas those made in Ohio or Pennsylvania either vary from green to aquamarine or are amber and are somewhat rounder.

Pitman, Sir Isaac (b. Jan. 4, 1813, Trowbridge, Wiltshire, Eng.—d. Jan. 12, 1897, Somerset), English educator and inventor of the shorthand system named for him.

After clerking in a textile mill, Pitman entered a training college for teachers (1831) and



Pitman, detail of an oil painting by A.S. Cope; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

taught in elementary schools for 11 years before opening his own private school in Bath. Earlier he had taken up Samuel Taylor's system of shorthand and become interested in developing shorthand based on sound. In 1837, at the suggestion of publisher Samuel Bagster, Pitman wrote *Stenographic Sound Hand,* which Bagster published at a low price for widest possible distribution. To encourage the adoption of his system, Pitman established a Phonetic Institute and a *Phonetic Journal* at Bath. He also printed standard works in shorthand, and his book *Phonography* (1840) went through many editions. He was an enthusiastic spelling reformer and adopted a phonetic system that he tried to bring into general use. In 1894 he was knighted.

Pitman shorthand, system of rapid writing based on the sounds of words (*i.e.,* the phonetic principle) rather than on conventional spellings. Invented by Sir Isaac Pitman, an English educator, the Pitman shorthand method was first published in 1837 as *Stenographic Sound Hand.* Pitman's system classifies the sounds of a language into basic groups and makes use of simple abbreviations for rapidity. Consonants are drawn from simple geometrical forms, straight lines, and shallow curves. As far as possible they are paired; thus, a light slanted line stands for *p* and a heavier slanted line for *b,* a light vertical line stands for *t* and a heavier one for *d,* and so on. Vowels are indicated by disjoined dots and dashes that are placed in specific positions relative to the consonants and the line of writing. The system makes use of circles, loops, and hooks for sounds frequently used in consonant combinations and syllables (*e.g.,* for *s, st, str, spr,* and *-ter, -der, -tion*). Syllables are also added by halving or doubling the length of a consonant stroke.

Pitman shorthand was introduced into the United States in 1852; among the many languages to which it has been adapted are Hindi, Hebrew, Arabic, Persian, German, French, Spanish, and Dutch.

Pitney, Mahlon (b. Feb. 5, 1858, Morristown, N.J., U.S.—d. Dec. 9, 1924, Washington, D.C.), associate justice of the United States Supreme Court (1912–22).

After graduating from the College of New Jersey (now Princeton University), Pitney studied law with his father and took over his father's practice when the latter was appointed vice chancellor of New Jersey in 1889. In 1894 Pitney was elected to the U.S. Congress, in which he served until 1899, followed by a term in the New Jersey state Senate and, in 1901, an appointment to the state Supreme Court. In 1908 he became the state's chancellor. In 1912 Pres. William Howard Taft named Pitney to the U.S. Supreme Court to succeed John Marshall Harlan, Sr.

Pitney's opinions were characterized by his conservative interpretations and meticulous care. He made his most important contributions in the area of labour law. His opinions in *Hitckman Coal and Coke Co.* v. *Mitchell* (1917) and *Duplex Printing Co.* v. *Deering* (1921), which limited the rights of workers to collective bargaining, were elaborations of his earlier opinion in *Coppage* v. *Kansas,* in which the court struck down a Kansas statute prohibiting an employer from preventing union membership among his employees by force or coercion. Another memorable opinion, in *Frank* v. *Mangum,* drew vigorous dissent from Justice Oliver Wendell Holmes on the grounds that it validated mob law. Pitney resigned from the court on Dec. 31, 1922.

Pitoëff, Georges (b. Sept. 4, 1884, Tiflis, Russia—d. Sept. 17, 1939, Geneva), Russian-born director and producer, noted for his popularization in France of the works of contemporary foreign playwrights, especially Pirandello, Shaw, Chekhov, Schnitzler, and O'Neill. He was a member of the Cartel des Quatre (Group of Four), a group including Louis Jouvet, Charles Dullin, and Gaston Baty, dedicated to rejuvenating the French theatre.

Pitoëff formed his first professional theatrical company in 1915 in Geneva and took it on tour to Paris. After World War I he returned to Paris. There, Pitoëff and his company performed in various theatres, including that of actor-producer Jacques Copeau, from 1922 to 1934, when they were finally established at the Théâtre des Mathurins. Pitoëff's work, which included the first successful French production of Pirandello's *Six Characters in Search of an Author* and a notable revival of Shaw's *Saint Joan* among his nearly 200 productions, demonstrated his skills at adapting, translating, designing, directing, and acting, although in the latter activity he was limited by his strong accent. He was eclectic in his choice of scripts but consistent in his direction, which sought to reveal with simplicity the essential ideas of each play. After his death, his wife, the actress Ludmilla Pitoëff, led the company.

Pitot, Henri (b. May 3, 1695, Aramon, Fr.—d. Dec. 27, 1771, Aramon), French hydraulic engineer and inventor of the pitot tube, which measures flow velocity.

Beginning his career as a mathematician and astronomer, Pitot won election to the Academy of Sciences in 1724. He became interested in the problem of flow of water in rivers and canals and discovered that much contemporary theory was erroneous—for example, the idea that the velocity of flowing water increased with depth. He devised a tube, with an opening facing the flow, that provided a convenient and reasonably accurate measurement of flow velocity and that has found wide application ever since (*e.g.,* in anemometers for measuring wind speed). Appointed chief engineer for Languedoc, he performed a variety of maintenance and construction works on canals, bridges, and drainage projects. His major work was construction of an aqueduct for the city of Montpellier (1753–86), including a stone-arch Roman-type section a kilometre (more than 1/2 mile) in length.

pitṛ, also spelled PITṚI (Sanskrit: "father"), plural PITAṚAS, PITṚS, or PITṚIS, in Hinduism, any of the spirits of the dead ancestors or of all the dead who have been cremated or buried in accordance with the proper rites. In the Vedas, the sacred scriptures of ancient India, the "fathers" were considered to be immortal like the gods and to share in the sacrifice, though they received different offerings. The "way of the fathers," characterized by observance of the traditional duties of sacrifice, almsgiving, and the practice of austerities that lead to rebirth, came to be distinguished from the "way of the gods," which was a way of faith directed toward the goal of liberation from rebirth.

Pitt, Thomas, byname DIAMOND PITT (b. July 5, 1653, Blandford St. Mary, Dorset, Eng.—d. April 28, 1726, Swallowfield, Berkshire), British merchant whose involvement in the East India trade brought him into conflict with the English East India Company; later, the company made him governor of Madras, India. Pitt was the grandfather of William Pitt, the Elder, the great 18th-century British statesman.

Without receiving permission from the East India Company, Pitt began to trade out of

Thomas Pitt, detail of a print after an oil painting by Sir Godfrey Kneller

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

Balasore, India, in 1674. The company retaliated by having him arrested (1683) and fined (1687). Nevertheless, he was elected to Parliament in 1689 and 1690, when he bought the manor of Old Sarum, thereby securing control of this parliamentary seat for his family.

In 1693 Pitt embarked on another trading venture in the East. Failing to put an end to his activities, the East India Company took him into its service in 1694 and appointed him president of Fort St. George, Madras, three years later. Dismissed from his post in 1709, he returned to England and resumed his seat for Old Sarum. In 1717 he sold an extremely valuable diamond to Philippe II, duc d'Orléans, regent of France; now known as the "Regent," the jewel is in the Louvre, Paris. Sir Cornelius Neale Dalton's *Life of Thomas Pitt* was published in 1915.

Pitt, William, THE ELDER, also called (from 1766) 1ST EARL OF CHATHAM, VISCOUNT PITT OF BURTON-PYNSENT, byname THE GREAT COMMONER (b. Nov. 15, 1708, London—d. May 11, 1778, Hayes, Kent, Eng.), British statesman, twice virtual prime minister (1756–61, 1766–68), who secured the transformation of his country into an imperial power.

William Pitt, the Elder, detail of a painting from the studio of W. Hoare, 1754; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

Background and education. Pitt was born in London of a distinguished family. His mother, Lady Harriet Villiers, daughter of Viscount Grandison, belonged to the Anglo-Irish nobility; his father, Robert Pitt, member of Parliament, was the son of Thomas ("Diamond") Pitt, governor of the East India Company's "factory" at Madras, India, where he made a vast fortune and secured one of the world's largest diamonds (sold in 1717 to the regent of France). "Diamond" Pitt had returned from India with a despotic temper made devilish with spleen and gout; he quarrelled violently with his wife and declared war on "that hellish confusion that is my family," but he treated his grandson William with affection. Father Robert was mean and cantankerous, and the Villiers blood was notoriously unstable. William inherited the gout, as well as a haughty temper and a strain of manic depression.

Such was the background and the smoky, explosive inheritance that was suddenly to blaze into genius. But William's passionate temper and Pitt truculence had to be disciplined, so he was sent to Eton College, where he acquired social polish and learned to be aloof and yet agreeable, to be politely insolent. Delicate health and the early onset of gout deprived him of field sports and hunting, but he learned to ride with a good seat and take his port wine, and he enjoyed the select company of clever and well-connected friends—the two Grenvilles (one to be Earl Temple; the other, George, to be first minister to George III), George Lyttelton, Charles Pratt (to become a follower of Pitt and, as the 1st Earl Camden, a member of his 1766 ministry), and other men who would later become influential in politics, as well as Henry Fielding, author of *Tom Jones*. But Pitt hated the brutal harshness of Eton and determined to have his own sons educated at home. He continued his education at Trinity College, Oxford, but left after a year without taking a degree. He then spent several months at the University of Utrecht in the Netherlands, probably studying law.

His classical education made him think, act, and speak in the grand Roman manner. His favourite poet was Virgil, and he never forgot the patriotic lessons of Roman history; he constantly read Cicero, the golden-tongued orator who could yet lash offenders with his indignation. Later, in Parliament, his organ-like voice could be distinctly heard outside the House. This voice, perfect timing, and splendid gestures were worthy of David Garrick, the greatest actor of the day and a personal friend; Pitt's lean, tall, commanding figure, combined with a Roman beaky nose and hawklike eyes—large and gray but turning black when he was roused—overwhelmed all onlookers. To his countrymen he was to become almost a divine portent, a voice from the Delphic oracle.

For the present, possessed of a mere £100 a year, he nevertheless rejected the church, a younger son's last resort as a career. While he was vegetating on a small family property in Cornwall, which he called a "cursed hiding-place" in one of his many letters to his adored sister and confidante, clever Nan (Ann) Pitt, help came from a politically powerful millionaire nobleman, Lord Cobham, who lived in splendour in a palatial mansion and vast park at Stowe, in Buckinghamshire, to which William and his friends paid visits. Cobham sent William abroad on "The Grand Tour" of Europe (only France and Switzerland were visited, however) and later bought him a cornetcy—a commission—in his own regiment of horse (1731).

Early political career. In 1735 Pitt was offered one of the "pocket" boroughs his brother controlled, Old Sarum in Wiltshire, and entered Parliament. He belonged to the small group known as "Cobham's cubs" and the "boy patriots," the connection of family friends and place hunters whom Cobham was mobilizing to oppose the ministry of Sir Robert Walpole (later the 1st earl of Orford). Walpole had governed England since 1720, monopolizing patronage, and had—they thought—become too ready to compromise in foreign affairs for the sake of peace. The "patriots" joined other discontented Whigs such as John Carteret (later Earl Granville) and William Pulteney (later the 1st earl of Bath) to rally opposition forces behind Frederick Louis, prince of Wales, who was vehemently estranged from his father, King George II.

There were no formal political parties in the 18th century, and political power, together with the financial opportunities it brought, was a gift of patronage from a handful of landowning family oligarchies and from the monarch himself; nor was there a formal opposition in Parliament, and opposition to the king's ministry was regarded as factious and even traitorous. Pitt's maiden speech in Parliament was so critical of the ministry that it provoked Walpole to deprive him of his military commission, to "muzzle this terrible young cornet of horse."

In 1737 the Prince of Wales made Pitt one of his court officials with a salary of £400 a year. He was still a relatively poor dependent of a powerful Whig clan but already showed an independence of mind and a readiness to appeal to public opinion outside Parliament that were new in English political life: when Walpole dismissed him from his cornetcy, he ostentatiously drove about London in a one-horse chaise to underline his poverty. His talents as an orator had already become clear. He repeatedly referred to the "voice of England," which had to be sought outside Parliament because Parliament was so packed with placemen and sinecurists. He claimed to speak for the commercial interests and even for the colonies overseas, the latter scarcely represented in the Commons. He was using arguments that carried far beyond the close interests of the Whig families; but he made lasting and valuable friendship with the rich sugar planter-aldermen of the City of London in his opposition to Walpole's cautious handling of the disputes with Spain over West Indian trade.

Walpole at last fell from power in 1742 and was replaced by a ministry that included his old colleagues Thomas Pelham-Holles, the 1st duke of Newcastle, and Philip Yorke, the 1st earl of Hardwicke, with Carteret as secretary of state. Pulteney was silenced by the grant of a peerage. The "boy patriots," of whom Pitt was the acknowledged leader, were still excluded. They opposed Carteret even more vigorously than they had Walpole. In the War of the Austrian Succession (1740–48), Pitt, a former warmonger, now vigorously opposed the sending of men and subsidies to check the French by protecting Hanover (the King's territory in Germany) and condemned Carteret as a "Hanover troop minister": for this he was never forgiven by his sovereign.

Pitt insisted that French power should be opposed at sea and in its colonial possessions, not on the Continent. When Carteret was forced to resign in 1744, Newcastle and his brother Henry Pelham took office and wanted to include Pitt in their ministry, but George II refused to accept him, though he did accept Cobham, Lyttelton, and Grenville. It was at this time that Pitt first appeared in Parliament swathed in bandages, on crutches, and with a huge gout boot on his foot, parading his illness. But, in the Jacobite rising of 1745 (the Forty-five Rebellion), Pitt gained new stature as the one effective statesman.

In February 1746 the King agreed to appoint Pitt joint vice treasurer of Ireland at £3,000 a year, and two months later he became paymaster general of the forces; he bowed very low as he kissed the King's hands, but George wept with rage. The post of paymaster was one of the most sought after in government, with ample opportunity for corruption. There was an outcry from Pitt's friends, who suspected he had been bought, but he proceeded to show both his contempt for moneymaking and his integrity as an honest but comparatively poor man by ostentatiously refusing to take for himself any more than the official salary of more than £4,000 a year: he put the interest that paymasters before had appropriated to themselves, together with the accounts of the paymaster's funds, into the Bank of England and won the people's hearts again. He introduced many reforms into the administration, and, though he supported the Pelhams' alliance with Hanover (which was a change of tack), he tried also to strengthen British naval power.

A legacy of £10,000 from the old duchess of Marlborough at this time, left to Pitt "for the noble defence he has made for the support of the laws of England, and to prevent the ruin of his country," enabled him to indulge in more lavish expenditure and generosity. He spent a good deal on landscape gardening and bought a new property near London. After a furious quarrel, he became estranged from his sister Nan, who had been his hostess for years.

When Henry Pelham died in office in 1754, Pitt hoped for advancement, but, after much reshuffling and intrigue, Newcastle and Henry Fox (later 1st Baron Holland) abandoned him for the sake of expediency. He then became ill and retired to a new house at Bath, groaning "I wish for nothing but a decent and innocent retreat, not to afford the world the ridiculous spectacle of being passed by every boat that navigates the river." An invalid and an aging bachelor, he suddenly fell in love with Lady Hester Grenville, became engaged at once, and was married by November 1754. She was 33 and he 46, and she adored him, possibly from the times in her childhood when he had visited Stowe with her brothers. She was attractive, clever, patient, and eminently practical—particularly about money, arranging mortgages, satisfying creditors, and pouring away her own fortune, in his last years of grandiose extravagance, to protect him.

It proved to be an ideally happy marriage with a well-ordered, loving home and family ("the infantry" Pitt called them); later he was to be found making hay with them at Hayes Place, his house in Kent, going for picnics, and chasing butterflies. He magically became healthy and happy, ready for his last big parliamentary fight for high office. But first, because of his attacks on Newcastle's ministry, he was dismissed, penniless, from the pay office in 1755. His brother-in-law Earl Temple helped with an annuity of £1,000.

Leadership during Seven Years' War. The outbreak of the Seven Years' War gave Pitt his supreme opportunity for statesmanship. The war began with heavy losses and considerable confusion of policy. The popular demand for Pitt became irresistible, and he declared, "I am sure I can save this country, and nobody else can." In November 1756 he formed a ministry that excluded Newcastle, with the Duke of Devonshire as its nominal head. In June 1757 Newcastle returned to office on the understanding that he should control all the patronage and leave Pitt to conduct the war.

Pitt determined that it should be in every sense a national war and a war at sea. He revived the militia, reequipped and reorganized the navy, and sought to unite all parties and public opinion behind a coherent and intelligible war policy. He seized upon America and India as the main objects of British strategy: he sent his main expeditions to America, to ensure the conquest of Canada, and supported the East India Company and its "heaven-born general," Robert Clive, in their struggle against the French East India Company.

He subsidized and reinforced the armies of Frederick the Great of Prussia to engage the French on the Continent, while the British Navy harassed the French on their own coasts, in the West Indies, and in Africa. Choosing good generals and admirals, he inspired them with a new spirit of dash and enterprise. His hand, eye, and voice were everywhere. By 1759, the "year of victories," Horace Walpole, man of letters and son of Sir Robert Walpole, wrote with reluctant admiration, "Our bells are worn out threadbare with ringing for Victories." Pitt, the "Great Commoner," was known and feared throughout the world. This resolute and concerted policy was too much for Bourbon France, and, by the terms of the Treaty of Paris in 1763, Great Britain remained supreme in North America and India, held Minorca as a Mediterranean base, and won territory in Africa and the West Indies.

Pitt had given Britain a new empire besides preserving and consolidating the old. But, before the war ended, he had been forced to resign. In 1760 George III came to the throne resolved, as was his chief adviser, the Earl of Bute, to end the war. When Pitt failed to persuade his colleagues to declare war on Spain to forestall its entry into hostilities, he resigned in October 1761. He alone was not tired of war. He never considered its carnage or the ruin facing a bankrupt country. He had tended to concentrate the whole conduct of government into his own hands and worked with furious energy. His haughty manner, which alienated many, and his high-handed treatment of affairs had earned him respect and admiration but little friendship.

When his resignation was accompanied by a peerage for Hester and an annuity to her of £3,000, there was again an outburst of abuse and scurrility. Just as when he had accepted the pay office, this acceptance of a peerage and a pension for his wife seemed to be the result of a political bargain. As rewards for his immense services they were meagre enough, but it was some measure of his unique reputation for highminded disinterestedness that his accepting them should provoke so much bitter disillusionment. His effigy was burned, and Hester was reviled as Lady Cheat'em. Pitt attacked the terms of the Treaty of Paris as an inadequate recognition of Great Britain's worldwide success. But, though his popular appeal was soon restored, his career as war minister was over.

Last years. Pitt fell back on his gout and his gardening. In 1765 an admirer left him a splendid estate at Burton Pynsent in Somerset, where he planted avenues of noble trees. He was frequently at Bath, where they stood up in the Pump Room when he drank the water. He now had the attacks of "gout in the head" that led to bouts of insanity.

When Bute resigned in 1763, he was succeeded by George Grenville, and Pitt's attacks on the administration completed a breach between the two brothers-in-law. Pitt was becoming a champion of liberty, condemning the high-handed action taken by the ministry against a member of Parliament, John Wilkes, whose paper, the *North Briton,* had attacked the King's speech at the opening of Parliament and who eventually had to flee abroad. Inactive in 1764 and 1765, Pitt reentered the stage in January 1766 to deliver a passionate plea for imperial liberty on behalf of the American colonists who had resisted the Stamp Act and to demand that act's repeal.

In July the King asked him to form a ministry drawn from all sections of the houses of Parliament. Pitt's judgment and wisdom were impaired at this time, and, never having paid attention to manoeuvring among political connections, he found it difficult to form a coherent ministry. It was a fiasco rightly called a "tessellated pavement" by his political opponent Edmund Burke. Pitt himself chose the secondary post of lord privy seal, for which he was created earl of Chatham, but this meant abandoning the House of Commons and the possibility of influencing it directly by his oratory there. The "Great Commoner" retired to the Lords and fell ill for another two years, leaving a rudderless government, under the luckless duke of Grafton and Charles Townshend, to abandon his policies. Engulfed in a black fit of insanity, Pitt withdrew completely and in 1768 resigned office. He acquired a group of followers in the House of Commons and, in an alliance with Lord Rockingham's group of opposition Whigs, offered a threat to Lord North's ministry, but this opposition was, in the end, without results.

Pitt's last years were clouded by illness, yet he was to reappear in the House of Lords—with ever greater difficulty—as an elder statesman. He continued to plead for generous treatment of the American colonists though he did not wish to grant them independence, partly for fear of their falling into the hands of France; in 1775 he hurriedly introduced a bill designed to suspend repressive measures at Boston and to maintain the legislative authority of Parliament over the Colonies while using the Continental Congress established at Philadelphia as a body for assessing the monetary contributions of each colony. Although the bill was summarily rejected, it indicates how Pitt would have handled the American problem. His last speech, against any diminution of an empire based on freedom, closed a political career that had become devoted to a reconciliation of imperial power with constitutional liberty. Pitt died on May 11, 1778, falling back into the arms of his son William who was reading to him the passage in Homer's *Iliad* on Hector's farewell. He was buried in Westminster Abbey with all the funeral pomp he could have desired and with public grief.

(V.M.W.)

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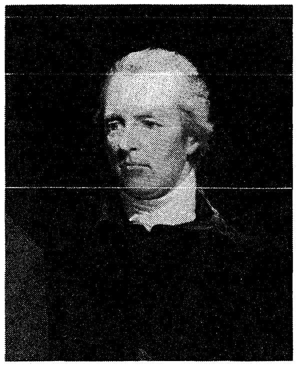
Pitt, William, THE YOUNGER (b. May 28, 1759, Hayes, Kent, Eng.—d. Jan. 23, 1806, London), British prime minister (1783–1801, 1804–06) during the French Revolutionary and Napoleonic wars. He had considerable influence in strengthening the office of the prime minister.

Early life. William Pitt was the second son of William Pitt, 1st earl of Chatham, a famous statesman of the mid-18th century, whose energy contributed much to Britain's successful prosecution of the Seven Years' War (1756–63) with France. His mother was Lady Hester Grenville, sister of George Grenville (who headed the government from 1763 to 1765). Both because he was extremely delicate and because his father disliked public schools, he was educated at home. He was a precocious boy and went to Pembroke Hall, Cambridge, at the age of 14. Because of persistent ill health, he made use in 1776 of the antiquated privilege that allowed noblemen's sons to graduate without examination. Left, after his father's death in 1778, with an income of less than £300 a year, he was called to the bar in 1780 and joined the western assize circuit. In September 1780, because of his youth, he failed to secure election to Parliament for Cambridge University but four months later was provided with a seat for Appleby in Westmorland, on condition that he should resign it should his views and those of his patron diverge. Pitt made a successful maiden speech and, in March 1782, when it was clear that a new ministry would soon be formed, announced with astonishing self-confidence that he had no intention of accepting a subordinate position.



William Pitt, the Younger, detail of an oil painting by John Hoppner; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

Under Lord Shelburne, who succeeded as prime minister in July 1782, Pitt became chancellor of the Exchequer. With Shelburne's consent, Pitt, in February 1783, sought a compact with Charles James Fox, who had gone into opposition, but Fox absolutely refused to serve under Shelburne. According to his contemporary biographer, his form tutor and friend George Tomline, Pitt then replied that he had not come there to betray Lord Shelburne. This interview marked the beginning of the long political duel between Pitt and Fox and also rapidly brought to an end Shelburne's ministry, since Fox now surprisingly allied himself with Lord North, a politician who had always been willing to work in accordance with the King's wishes, and defeated Shelburne. King George III, unwilling to accept the coalition that would give office to Fox, whom he hated, invited Pitt to form a government; but Pitt declined, knowing he would not have a majority in the House of Commons, and the King had to commission Fox and North. To embarrass the new government, which, under the nominal premiership of the Duke of Portland, consisted of an admixture of reformers and anti-reformers, Pitt brought forward the question of parliamentary reform, with which he had already once, a year earlier, concerned himself. He suggested no extension of the franchise but recommended measures to prevent bribery and to make the representation more realistic. Although his resolutions were defeated, reformers now looked to him, rather than to Fox, as their parliamentary leader.

Pitt's first ministry, 1783–1801. In December 1783, after the defeat in the House of Lords of Fox's East India Bill, George III at once took the opportunity to dismiss the coalition and asked Pitt to form a government. Pitt clearly did not take the premiership as the King's tool, for his first step was to try, on his own terms, to include Fox and his friends in the new ministry. But Fox would not consent to join a government from which his ally Lord North would have been excluded.

When Parliament reassembled in January 1784, the government was at once defeated by 39 votes on a virtual motion of censure, but Pitt refused to resign, and George III was prepared to abdicate rather than again surrender to the Fox–North coalition. Pitt admitted that his situation was without precedent but denied that he was prime minister through backstairs influence. He hung on, and gradually the coalition's majority in Parliament began to crumble; many members, fearing the loss of their seats at a general election, went over to Pitt's side during February and March, doubtless in the hope that he would gain a majority in the existing house sufficient to make a dissolution unnecessary. By March 8 the majority against him was one vote, and on March 25 Parliament was dissolved.

No 18th-century government lost a general election, and Pitt's success in 1784 was never in doubt. The "influence of the Crown" ensured that the new House of Commons was chosen by the Treasury. Patronage and corruption gave Pitt a majority, and secret service money paid election bills. Although public opinion aided Pitt in the open constituencies, it is nevertheless misleading to say that he was "the choice of the people"; he was the dispenser of royal patronage. Pitt himself was returned for the University of Cambridge; only once again (1790), at subsequent elections, did he have to stand a contest.

When Pitt became prime minister, the national credit was impaired by the heavy cost of the American Revolution. The debt was about £250,000,000, a staggering amount for those days. Pitt imposed new taxes to wipe out the deficit, checked smuggling by reducing the high duties that encouraged it, and reduced frauds in the revenue by establishing an improved system of auditing. He also simplified customs and excise duties, bringing them into a single consolidated fund, out of which all public creditors were to be paid. In 1786 he introduced a sinking fund on a new principle: an annual surplus of £1,000,000 was to be appropriated to the purchase of stock and allowed to accumulate at compound interest for 28 years, by which time the income from it would amount to £4,000,000 a year. In 1792 another act provided that a sinking fund of 1 percent should be attached to every new loan, which would thereby be redeemed within 45 years. The system worked reasonably well in peacetime because there was an annual surplus of revenue, but, after the outbreak of war in 1793, the government redeemed debt bearing a low interest by fresh borrowing at a higher rate of interest.

Fox's East India Bill had been defeated, but the problems it was designed to solve remained. Britain's increased possessions in India made it necessary for the administration there to be supervised by the government rather than be left in the hands of the commercial East India Company. Pitt, therefore, introduced his own East India bill (1784). He set up a new government department, the Board of Control, to supervise the directors of the company. He also ended an inappropriate division of authority in India by making the governor general supreme over the subordinate governments of Bombay and Madras. In 1786 a supplementary act increased the authority of the governor general over his own council. Warren Hastings, governor general of Bengal since 1773, returned home in 1785, having greatly strengthened British power in India, only to undergo the ordeal of an impeachment for his conduct. Pitt honestly believed that there was a case against Hastings and, determined that the British name should be freed from the suspicion of injustice or oppression in the government of Asian peoples, supported the demand for an inquiry. But those who conducted the impeachment acted with unwarrantable rancour; the trial dragged on for seven years and, although Hastings was finally acquitted, the expenses almost ruined him.

Another imperial problem with which Pitt had to deal was that of the future of Canada. By the Constitutional Act of 1791 the then province of Quebec was divided into a predominantly French province of Lower Canada and a predominantly English province of Upper Canada. Pitt, who was in office when men were first transported to Australia, never regarded that country as anything more than a convict settlement.

Pitt's foreign policy was only moderately successful. In 1788 he made alliances with Prussia and with Holland, aimed at restricting French influence. But, in effect, the alliance served only one useful purpose: Prussia's diplomatic support enabled Pitt in 1790 to triumph over the Spanish without having to go to war in the Nootka Sound dispute. Thus, the Spanish claim to a monopoly of trade and settlement on the western seaboard of North America was finally destroyed. Pitt's intervention in eastern Europe, however, bore no such marks of triumph. Catherine II of Russia was bent on establishing her supremacy in the Black Sea. In March 1791 Pitt sent her an ultimatum demanding the restoration to the Sultan of all conquests except the Crimea. But his policy of bolstering up the Turkish Empire was supported neither by the entire Cabinet nor by public opinion, and the government, badly shaken, had to reverse its policy.

Although the British government clung to neutrality as long as possible, in face of the European wars started by the leaders of the French Revolution, war proved unavoidable. It was not the execution of the French king Louis XVI in January 1793 that made a continuation of peace impossible but it was the provocative French decrees of late 1792, which authorized their armies to violate neutral territory and which promised military assistance to any European people wishing to depose its rulers. The French, confident of victory after their successes against the Austro-Prussian forces and believing that England was ripe for revolution, declared war on England and Holland on Feb. 1, 1793. Pitt refused to intervene to restore the French monarchy. He fought to protect Britain's vital commercial and colonial interests.

The French Revolution had revived the agitation for parliamentary reform, dormant since a bill introduced by Pitt in 1785 had been defeated, but the cause of reform was soon discredited because its advocates were thought to approve of the violence in France. The unwise demonstrations of the radicals caused the government to have recourse to repressive legislation. In May 1792 a proclamation against seditious publications was issued; and the Habeas Corpus Act, which normally prevented the detention of persons without trial, was suspended in 1794 and remained so until 1801.

The French Revolution had disastrous repercussions in Ireland, too, creating new hatreds to exacerbate the old religious feuds and a rebellion in 1798. As early as 1792 Pitt had held that an ultimate union of the two countries was the only solution of the Irish religious problem; the events of 1798 convinced him that union was most urgently necessary. Large-scale corruption carried the measure through the Irish Parliament, but opposition from Pitt's Cabinet and particularly from the King prevented him from carrying his supplementary proposals—Catholic emancipation and state provision for Catholic and Dissenting clergy. As a result, Pitt resigned on Feb. 3, 1801, and his friend Henry Addington formed a government. The crisis again drove the King insane, and after his recovery in March he accused Pitt of having caused his illness. Pitt replied that he would never again press the Catholic question during the King's reign.

Patriotic motives induced Pitt to support the new ministry, but for several months during the session of 1802–03 he never attended Parliament, living in Walmer Castle, where, holding the ancient office of warden of the Cinque Ports, he organized a local volunteer force. In March 1803 Addington invited Pitt to join the government, but Pitt made it clear that he would return only as prime minister. War broke out again in May 1803, and by 1804 Pitt was increasingly critical of the government's financial polity and its measures to meet the growing danger of invasion. Addington's majority fell steadily, and he decided to resign. On April 30 Pitt was informed that the King wished him to plan a new ministry. Pitt replied that a nonparty government was desirable but fell in with the King's determination that Fox be excluded.

Pitt's second ministry, 1804–06. Pitt's second ministry was weaker than the first, for the Addington group, as well as others, went into opposition. The Third Coalition against Napoleon's France—an alliance with Russia, Sweden, and Austria engineered by Pitt—collapsed after the battles of Ulm and Austerlitz in 1805, and the year closed in disaster, in spite of Nelson's victory at Trafalgar in October, which ended the invasion threat and ensured Britain's naval supremacy for the rest of the war. Pitt's health, never robust, was now failing. He made his last public speech at the Guildhall in London on Nov. 9, 1805. By Jan. 15, 1806, some of his colleagues were determined to force him to resign as the only means of saving his life, and the King was thinking about his successor. He died a few weeks later and was buried in Westminster Abbey on February 22. A motion for a grant of £40,000 to pay his debts was unanimously carried in the Commons. Earlier (1801), his friends had raised £12,000 in order to relieve him from embarrassment. Careless to a fault about money and engrossed with public affairs, he had allowed his large official income to be squandered by irresponsible servants and tradesmen.

Private life and character. Though eloquent and forceful in Parliament and Cabinet, Pitt made no impact in society and altogether lacked the common touch. He was always notably withdrawn. He never married. He had few friends. Even members of the government complained of his inaccessibility. In 1801 his resignation from office caused extraordinarily little sensation; a contemporary wrote that "nobody speaks of him; no addresses, no subscriptions, no stir of any kind any where." Long before his death, bodily infirmities, increased by his addiction to port, curtailed his working day.

Pitt's experience was remarkably limited. He never set foot in Scotland or Ireland; the greater part even of England was unknown to him. He was once in France—for a few weeks. He never came into touch with men of letters or original thinkers; in his official patronage he neglected literature, science, and the arts. He was long overconfident of success in every cause he espoused; in the end only the weight of ill health and Napoleon's great victories of 1805 began to shatter his optimism. Although at first connected with the movement for parliamentary reform, he made no attempts to reintroduce the issue after the failure of his bill in 1785. He made no effort to deal with the social problems caused by the Industrial Revolution; and in all his long years of office, nothing was done to reform the barbarous criminal law, the harsh game laws, prison administration, and local government. Nevertheless, by reason of his superb debating powers he dominated the House of Commons, even in that age of notable oratory. His conduct in Parliament had a mixture of prudence, firmness, and transcendent ability never before seen and hardly ever again surpassed.

Historical importance. The constitutional significance of Pitt's career has often been misunderstood. He was not a prime minister of the modern type. At no time was he the leader of a well-organized, coherent party commanding a majority of the House of Commons, which itself owed its existence to the will of the electorate. He was not at all the choice of the country; he was the nominee of the King, and he retained office only as long as he retained the King's confidence. He had to resign in 1801 because his Irish policy was not acceptable to George III. Even though the inadequacy as a wartime prime minister of his successor made Pitt's return to office almost inevitable three years later, Pitt did not return on his own terms but on the King's. He was more dependent on the King's favour than he was on the support of the House of Commons. His most serious crisis came in the winter of 1788–89, when, during George III's madness, Pitt lost the support of the crown. Had the dissolute Prince of Wales, who favoured the opposition, become regent, Pitt would certainly have been dismissed. Without the support of the crown, neither he nor anyone else could remain long in office. Moreover, there were obvious limitations to his absolute authority in the Cabinet, where various colleagues opposed him on all the great questions of the day. And, finally, Pitt had to deal with a sovereign of narrow intellect and with intense and irrational prejudices—though, indeed, these were shared by a great many of George III's subjects.

Although Pitt's supremacy in the Cabinet has often been exaggerated, the necessity for a prime minster who would supervise and coordinate the work of the various departments and possess the chief confidence of the king was never again questioned after his ministries. Pitt's achievement of this status, while depending upon his forcefulness of character, was only made possible by his long tenure of office. His total of 19 years in power exceeded by almost 7 years the tenure of office, earlier in the 18th century, of Sir Robert Walpole, often regarded as "the first" British prime minister, and that of Lord North, nearer Pitt's own time.

It is sometimes claimed that Pitt emerged as the leader of a new Tory Party. Certainly, as a minister who accepted the royal prerogative, he represented the traditions of the Tory, or Court, Party, as distinct from those of the Whigs, who sought to dictate to the crown the choice of its servants; but he was far from being a great party leader commanding the votes of a majority in the House of Commons. He had a personal following of little more than 50. In spite of persistent efforts, great speeches, and the support of powerful and eloquent members, he failed to pass a slave trade abolition bill, a parliamentary reform bill, and Catholic relief bills.

(A.As./Ed.)

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Pitt diamond: *see* Regent diamond.

Pitt Island (Kiribati): *see* Butaritari Atoll.

Pitt-Rivers, Augustus Henry Lane-Fox (b. April 14, 1827, Hope Hall, Yorkshire, Eng.—d. May 4, 1900, Rushmore, Wiltshire), archaeologist often called the "father of British archaeology," who stressed the need for total excavation of sites, thorough stratigraphic observation and recording, and prompt and complete publication. Like Sir Flinders Petrie, Pitt-Rivers adopted a sociological approach to the study of excavated objects and emphasized the instructional value of common artifacts.

Pitt-Rivers, detail from a drawing by C.W. Walton, *c.* 1850; in the Pitt-Rivers Museum, Oxford
By courtesy of the Pitt-Rivers Museum, Oxford

An army officer for most of his life, Pitt-Rivers retired from the military in 1882 and in the following year embarked on a series of excavations of prehistoric, Roman, and Saxon sites on his 29,000-acre estate in Wiltshire. His large-scale excavations, models of organization and painstaking care, unearthed villages, camps, cemeteries, and barrows (burial mounds) at sites such as Woodcutts, Rotherley, South Lodge, Bokerly Dyke, and Wansdyke.

His efforts resulted in one of the classics of archaeology, the richly illustrated *Excavations in Cranborne Chase,* 5 vol. (1887–1903), which Pitt-Rivers printed privately. He also observed a similarity between the stone implements used in Europe when certain rhinoceroses and mammoths roamed there and the implements characteristic of the dawning stages of Egyptian culture.

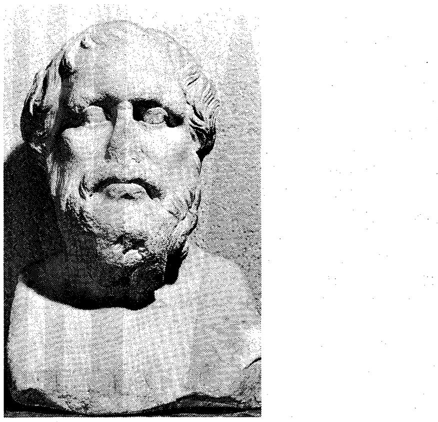
Where the same name may denote a person, place, or thing, the articles will be found in that order

pitta, any of about 23 species of Old World birds of the genus *Pitta* constituting the family Pittidae. All are stub tailed, long legged, and short necked. They have a rather stout bill and are 15–27 centimetres (6–10½ inches) in length. Pittas faintly resemble thrushes and are sometimes known as jewelthrushes. The sexes may be alike or unlike in appearance. Most species are found in the Indo-Malayan region, some ranging to the Solomon Islands; four occur in Australia, two in Africa. The Indian pitta (*P. brachyura*) is typically colourful, wearing shimmering blue, yellow, green, red, black, and white. The blue-winged pitta (*P. moluccensis*) is common in tropical Africa and from Burma to Sumatra. *P. nympha,* also called blue-winged pitta, is found in Japan, Korea, and eastern China.

Indian pitta (*Pitta brachyura*)
Tierbilder Okapia, Frankfurt am Main

Pittas are shy birds of forest or scrubland, where they move rapidly in long hops, foraging for insects and snails in ground litter. Their call is usually a trill or a short whistle. Their nests, on or near the ground, tend to be large and roughly made.

Pittacus OF MYTILENE (b. *c.* 650 BC—d. *c.* 570), statesman and sage who is known as one of the Seven Wise Men of ancient Greece. He collaborated with the brothers of the poet Alcaeus in the overthrow of the tyrant Melanchrus (612/611?) and distinguished himself as a commander in the war against Athens for Sigium, killing the Athenian commander, Phrynon, single-handedly. He was elected *aisymnetes* (dictator appointed during times of internal strife) by the Mytileneans (*c.* 590 BC) and served in that post for 10 years. Diogenes Laërtius quotes a number



Pittacus, herm; in the Louvre, Paris
By courtesy of the Musee du Louvre, Paris; photograph, Cliche Musees Nationaux

of sayings ascribed to him (mostly moral or political maxims) and five lines of lyric verse, as well as a spurious letter to Croesus.

pitted shell turtle, also called FLY RIVER TURTLE, or NEW GUINEA PLATELESS TURTLE (species *Carettochelys insculpta*), any member of a single species in the turtle family Carettochelyidae. The species lives in rivers in southern New Guinea and in a limited region in northern Australia. A combination of characteristics separates *C. insculpta* from other turtles, including a leathery shell with no scutes and sea turtlelike flippers. Little is known of the ecology of this species.

Pittosporaceae, family of nine genera of trees, shrubs, or vinelike plants, in the order Saxifragales, distributed from tropical Africa to the Pacific islands. Members of the family have long, leathery, evergreen leaves; resin in stem ducts; and white, blue, yellow, or reddish flowers. Species of the genus *Pittosporum* are commonly known as Australian laurel. Tobira, or house-blooming mock orange (*P. tobira*), is a popular aromatic hedge plant in warm climates but a handsome indoor plant elsewhere. Karo (*P. crassifolium*) often is planted as a windbreak on seacoasts. The genera *Hymenosporum, Bursaria,* and *Sollya* also contain ornamental species.

Tobira (*Pittosporum tobira*)
Javier Palaus Soler—Ostman Agency

Pittsburg, city, Crawford county, southeastern Kansas, U.S., near the Missouri border. Laid out in 1876, it developed as a coal-mining town and railroad centre and was named after Pittsburgh, Pa. Besides strip coal-mining operations, it has large plants producing coal preparation equipment and ammonium nitrate. Pittsburg State University was founded in 1903. The city is also the site of the Personal Census Service Branch of the U.S. Bureau of the Census. Inc. 1880. Pop. (1988 est.) 18,288.

Pittsburg Landing, Battle of: *see* Shiloh, Battle of.

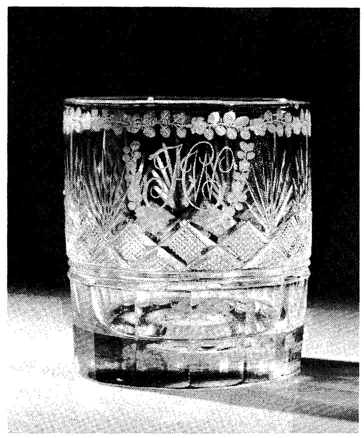
Pittsburgh, city, seat (1788) of Allegheny county, southwestern Pennsylvania, U.S., at the confluence of the Allegheny and Monongahela rivers, which unite at the point of the "Golden Triangle" (the business district) to form the Ohio River. A city of hills, parks, and valleys, it is the centre of an urban industrial complex that includes the cities of Aliquippa, McKeesport, New Kensington, Washington, and Wilkinsburg.

The conflict between the British and French over territorial claims in the area was settled in 1758, when General John Forbes and his British and colonial army expelled the French from Fort Duquesne (built 1754). Forbes named the site for the British statesman William Pitt the Elder. To assure their dominance at the source of the Ohio, the British built Fort Pitt (1761). After the defeat of Pontiac's Indian forces (1763), a later settlement with Indian tribes by the Penn family, and the end of a boundary dispute between Pennsylvania and Virginia, settlers began arriving. Pittsburgh was laid out (1764) by John Campbell in the area around the fort (now the Golden Triangle). Following the Revolutionary War, the town became an outfitting point for settlers traveling down the Ohio River.

Its strategic location and wealth of natural resources spurred its commercial and industrial growth in the 19th century. A blast furnace, erected by George Anschutz about 1792, was the forerunner of the iron and steel industry. The Pennsylvania Canal and the Portage Railroad, both completed in 1834, opened vital markets for trade and shipping. Industrial magnates such as Andrew Carnegie, Henry Clay Frick, and Thomas Mellon built their steel empires in Pittsburgh, which became the focus of historic friction between labour and management. There, the American Federation of Labor was born (1881). Pittsburgh is now one of the nation's largest inland river ports and a leading transportation centre. By the late 1970s and early '80s, the steel industry, Pittsburgh's economic foundation for over a century, virtually disappeared, as a result of foreign competition and decreased demand. Many of the surrounding mill towns were laid waste by unemployment. Pittsburgh, however, managed to thrive, through more emphasis on light industries and on such other industries as petroleum, glass, electrical equipment, machinery, and coal, coke, and chemical products. More than 150 industrial research laboratories are in the area.

Since World War II, the city has undergone an extensive redevelopment program with emphasis on smoke-pollution control, flood prevention, and sewage disposal. In 1957 it became the first American city to generate electricity by atomic energy. Much of the Golden Triangle has been rebuilt and includes the Civic Arena, Point State Park (site of Fort Pitt Blockhouse), and the Gateway Center (site of several skyscrapers and a garden). The University of Pittsburgh was chartered in 1787. Other educational institutions include Carnegie-Mellon University (1900), Duquesne University (1878), and Chatham (1869), Carlow (1929), Point Park (1933), and Allegheny County Community (1966) colleges. Carnegie Institute has a 2,000,000-volume library, museums of fine arts and natural history, and the Carnegie Music Hall. The Phipps Conservatory and Buhl Planetarium are also there. Three Rivers Stadium is the home of the Pittsburgh Pirates (baseball) and Steelers (football). Inc. borough, 1794; city, 1816. Pop. (1988 est.) city, 387,190; Pittsburgh-Beaver Valley metropolitan area (CMSA), 2,284,100.

Pittsburgh glass, American glassware produced from the end of the 18th century at numerous factories in that Pennsylvania city. Pittsburgh had the twin advantages of proximity to a source of cheap fuel (coal) and access to a good waterways system, which afforded an inexpensive means of distribution; thus, of the 50 glasshouses that sprang up in Pennsylvania between 1763 and 1850, 40 or more were situated in Pittsburgh (although of these only 14 produced flint glass, a type of clear crystal, the other 26 making strictly utilitarian items such as windowpanes and cider, beer, and whiskey bottles).



Pittsburgh glass tumbler, Pittsburgh Flint Glass Works of Bakewell, Page and Bakewell, Pa., *c.* 1824; in the Corning Museum of Glass, Corning, N.Y.
By courtesy of the Corning Museum of Glass, Corning, N.Y.

Pittsburgh Plate Glass Company: *see* PPG Industries, Inc.

Pittsfield, city, seat (1761) of Berkshire county, western Massachusetts, U.S., on the headstreams of the Housatonic River, in the Berkshire Hills, 58 miles (93 km) northwest of Springfield. Settled in the 1740s as the Pontoosuc Plantation, it was incorporated as a town in 1761 and named for the English prime minister William Pitt. It developed from a farming to an industrial community during the early 19th century because of abundant waterpower. Manufactures now include electrical machinery, ordnance supplies, paper, textiles, plastics, and foundry products. The insurance business is also prominent.

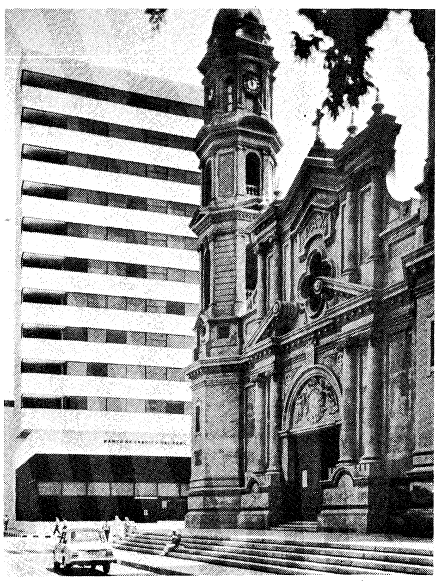
The city is a tourist base for the Berkshire Hills (including Pittsfield State Forest, lakes, ski resorts, and state parks). Herman Melville lived there and completed *Moby Dick* at his "Arrowhead" house; the Berkshire Athenaeum stores Melville memorabilia. Tanglewood, at Lenox, 6 miles (10 km) south, is the summer home of the Boston Symphony Orchestra. The city is the site of Berkshire Community College (established 1960). The restored Hancock Shaker Village is 5 miles (8 km) west. Inc. city, 1890. Pop. (1986 est.) city, 49,580; (1988 est.) metropolitan area (MSA), 79,300.

pituitary gland, also called HYPOPHYSIS, one of the endocrine (ductless) glands that secrete their hormones directly into the bloodstream. The term hypophysis (from the Greek, "lying under") refers to the gland's position on the underside of the vertebrate brain. Until the late 19th century the human pituitary was thought to be a vestigial organ, but it is now known to play a major part in the regulation of endocrine functions.

The pituitary is divided into two lobes: the anterior, or adenohypophysis, which is derived from an upward outpouching of the roof of the mouth (Rathke's pouch), and the posterior, or neurohypophysis, which is derived from embryonic nerve tissues. Most of the pituitary hormones are secreted by the anterior lobe and cause the production or release of hormone from other endocrine glands. The thyroid-stimulating hormone (TSH) stimulates the growth of the thyroid gland and release of its hormone; the adrenocorticotropic hormone (ACTH) regulates the endocrine activities of the cortex of the adrenal glands, which produces cortisol; follicle-stimulating hormone (FSH) promotes secretion of the female hormone estrogen and the development of egg and sperm cells; luteinizing hormone releases estrogen, progestin, and the male hormone testosterone; and growth hormone, or somatotropin, stimulates a variety of systems involved in the growth of the individual. The two other anterior pituitary hormones do not act on endocrine glands but directly affect specific tissues. They are prolactin, which causes breast development and milk production, and melanocyte-stimulating hormone (MSH), which stimulates pigment cells. The parent hormone of MSH, lipoprotein, also gives rise to chemical compounds, called enkephalins and endorphins, that have an effect on brain cells similar to that of opiates such as morphine.

The posterior lobe, or neurohypophysis, is connected to the anterior lobe by a portal vein, through which the hormones that control pituitary function are transmitted. These hormones originate in the hypothalamus of the brain and are stored in the neurohypophysis until needed. The neurohypophysis also releases two hormones that act elsewhere in the body: oxytocin, which causes contraction of the uterus and milk secretion in female mammals and lowers blood pressure in birds; and vasopressin, also called antidiuretic hormone (ADH), which raises blood pressure by causing the contraction of blood vessels and increases reabsorption of water from the kidneys.

Piura, department (formed 1861) of northern Peru, consisting of coastal desert, particularly in the west and south, and low, forested Andes in the east. Its area of 14,055 sq mi (36,403 sq km) is drained by the Río Chira, in the north, and the Río Piura, in the south. The irrigated valleys of these two rivers are used chiefly for the production of cotton. Upstream on the Río Piura, sugarcane, rice, tobacco, and corn (maize) are grown. Cattle are grazed in the mountains and fattened on lowland irrigated pastures. Piura is also important for the production of petroleum. The Brea–Parinas fields, Peru's major oil-producing region, form a belt about 80 mi (130 km) long on either side of the community of Talara, site of an oil refinery in northwest Piura. The Pan-American Highway traverses the desert, passing through the departmental capital, Piura (*q.v.*). Other roads connect Piura city and the oil fields with seaports and penetrate the mountains. Piura city and Talara are also accessible by air. Pop. (1981) 1,125,865.



A modern office building and the cathedral, Piura city, Peru

Walter Aguiar—EB Inc.

Piura, capital of Piura province and department, northwestern Peru, on the Río Piura in the warm coastal desert. San Miguel de Piura was the first city founded (1532) in Peru by the conquistador Francisco Pizarro. The site chosen proved unhealthful, and several locations were occupied before settlement of the present site in 1588. Piura retains a colonial flavour, especially in the church of San Francisco. It is the commercial centre of northwestern Peru, which produces cotton, rice, and sugarcane. In and around Piura are cotton gins and cottonseed-oil mills, in addition to various small manufacturing plants. The city is accessible by the Pan-American Highway, by air, and by sea through the coastal town of Paita, 40 mi (65 km) west. Pop. (1981) city, 186,354; province, 413,688.

Pius, name of Roman Catholic popes grouped below chronologically and indicated by the symbol •.

• Pius I, SAINT (b. Aquileia, Venetia—d. 155, Rome; feast day July 11), Latin pope from *c.* 140 to 155.

Pius was a slave, according to his supposed brother, the apostolic father Hermas. As pope, Pius combatted Gnosticism—a religious movement teaching that matter is evil and that emancipation comes through spiritual truth attained only by revelatory esoteric knowledge—and the Marcionites, followers of a heretical Christianity proposing especially a doctrine of two gods as taught by the semi-Gnostic Marcion, whom Pius is believed to have excommunicated in 144/150. The claim that Pius was martyred is unsubstantiated.

• Pius II, original name ENEA SILVIO PICCOLOMINI (b. Oct. 18, 1405, Corsignano, Republic of Siena—d. Aug. 14/15, 1464, Ancona, Papal States), outstanding Italian humanist and astute politician who as pope (reigned 1458–64) tried to unite Europe in a crusade against the Turks at a time when they threatened to overrun all of Europe. He wrote voluminously about the events of his day.

Pius II, bronze medal by Andrea Guacialoti; in the Samuel H. Kress Collection, National Gallery of Art, Washington, D.C.

By courtesy of the National Gallery of Art, Washington, D.C., Samuel H. Kress Collection

Early life and career. Enea Silvio Piccolomini was born near Siena, Italy, into a noble family in very reduced circumstances. He acquired his humanistic education by assiduous work under unfavourable conditions. To earn a living he became secretary to Cardinal Domenico Capranica and went with him to the Council of Basel, a meeting of bishops concerned with church reform (1431–37), which was already at loggerheads with Pope Eugenius IV. With Cardinal Niccolò Albergati he visited many European countries on a diplomatic mission. On returning to Basel in 1436, he became an official of the council, which gave him opportunities to show his great skill as an orator. He became secretary to the antipope Felix V, elected on Nov. 5, 1439, by the remnant of bishops at Basel, who refused to obey Pope Eugenius' order to transfer the council to Ferrara and Florence.

As representative of the Basel remnant at the Diet (imperial assembly) of Frankfurt, he attracted the attention of Frederick III of Austria, who invited him to Vienna (1442) and made him imperial poet laureate and his private secretary. Thereupon, he broke his connection with the antipope in 1445 and was absolved of the ban of excommunication that he had been under. A serious illness is said to have led him to amend his dissolute life (he was the father of several illegitimate children). In Frederick's name he proposed to end the rivalry between the papal council at Florence and the rebellious council at Basel by summoning a third council but could persuade neither Eugenius nor the bishops at Basel. Hitherto a layman, Enea received sacred orders in 1446. He next managed to calm the storm raised by Eugenius' deposition of two of the German archbishop electors and was chiefly responsible for reconciling the German princes with the Pope and for Frederick's withdrawal of support for the council at Basel.

Made bishop of Trieste by the new pope, Nicholas V, in 1447, he continued his successful mediation between the German states and the Holy See, explaining in a "letter of retractation" his change of role from supporting Basel to being advocate of the papacy. He was transferred in 1449 to the see of Siena, where he was still able to be of service to King Frederick by negotiating his marriage with a Portuguese princess and arranging his coronation as Holy Roman emperor in Rome by Nicholas V (1452). Nicholas' successor, Calixtus III (1455–58), made Enea cardinal-priest of Sta. Sabina as a reward for negotiating peace with Alfonso V, king of Aragon and Naples, and persuading him to cooperate in the crusade against the Turks that Calixtus was energetically promoting.

Pontificate. On Calixtus' death Enea Silvio was elected pope as Pius II (Aug. 19, 1458). As pope he had one main purpose: to organize a grand crusade to drive back the Turks, who, having captured Constantinople in 1453, were threatening to overrun the rest of Europe. He summoned the Christian princes to a congress in Mantua to study and meet the danger. When he arrived on the appointed day, June 1, 1459, he was alone. Very gradually some came but only to squabble for advantages to themselves.

The patient diplomacy of the Pope achieved little. A condition for success was to restore peace to the West. In Italy, Pius slowly regained control of the Papal States. His negotiations with France for the repeal of the Pragmatic Sanction of Bourges (of 1438, which made France largely independent of the papacy in ecclesiastical jurisdiction) failed with King Charles VII but succeeded with his son Louis XI (1461). The Greek cardinal Bessarion was sent to Germany (1460) to promote the crusade, but local feuds and wars blocked his efforts. He was equally unsuccessful in Vienna and returned to Rome in the following year but had some success later in Venice. Wars in the Tyrol and discord in Bohemia increased the general unrest. A lull in some hostilities and promises of support from the emperor Frederick and Philip the Good, duke of Burgundy, encouraged the intrepid but sick pope to proclaim in October 1463 a crusade, which he himself would lead. Pius left Rome on June 18, 1464, for the rendezvous of the armies in Ancona, an Adriatic seaport on the east coast of Italy, where he arrived to find nearly no one. Two Venetian ships arrived on

August 11. Pius died during the night of August 14–15. His heart was interred at Ancona, still facing, as it were, the infidel East. His body was taken to Rome and there buried in St. Peter's; it was transferred to the church of S. Andrea della Valle when the new St. Peter's was being built.

Achievements. Pope Pius II's great knowledge of conditions in Germany and elsewhere inspired a scheme of wide church reform, but the political conditions of the time and the resistance of the various vested interests rendered its application impossible. He did what he could, particularly by encouraging the movements toward strict observance of the rules of life within religious orders. On the whole, he created worthy cardinals, and on Jan. 17, 1460, he issued a bull condemning appeals from a pope to a general (ecumenical) council of the church. A voluminous writer about the events he had participated in, he wrote also general history and geography, poetry, and at least one scurrilous novel (*The Tale of Two Lovers*). As pope he was a patron of humanists but not to excess either in the use of money or in being complacent about their morals. (J.Gi.)

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English translations. His novel *De duobus amantibus* was much translated (first Eng. trans., *The Goodly History of the . . . Ladye Lucres of Scene in Tuskan,* 1560; later Eng. trans., *The Tale of Two Lovers,* by F. Grierson, 1929). "The Commentaries of Pius II," ed. by F.A. Gragg and L.C. Gabel, were published in *Smith College Studies in History,* vol. 22, 25, 30, 35, and 43, abbreviated into the autobiographical account *Memoirs of a Renaissance Pope* (1959, reprinted 1961). The *De gestis Concilii Basiliensis commentariorum libri II,* ed. by D. Hay and W.K. Smith (1967), was written in 1440 supporting conciliarism.

Lives. B. Platyna, *Vita Pii II in RIS* (Rerum italicarum scriptores), vol. 3, pp. 246–263, by a contemporary curial official; R.J. Mitchell, *The Laurels and the Tiara: Pope Pius II, 1458–1464* (1962); G. Paparelli, *Enea Silvio Piccolomini, Pio II* (1950).

• **Pius III,** original name FRANCESCO TODESCHINI PICCOLOMINI (b. *c.* 1440, Siena, Republic of Siena—d. Oct. 18, 1503, Rome), Italian pope during 1503.

He was made archbishop of Siena and cardinal deacon in 1460 by his uncle, Pope Pius II (formerly Cardinal Aneas Silvius Piccolomini), who permitted him to assume the name and arms of the Piccolomini. He was employed by subsequent popes in several im-

Pius III, contemporary medallion; in the coin collection of the Vatican Library
Leonard von Matt—EB Inc.

portant legations, as by Paul II at the Diet of Regensburg (1471) and by Innocent VIII to restore ecclesiastical authority in the Italian compartimento of Umbria.

He opposed the flagrant nepotism of Pope Alexander VI, after whose death Cesare Borgia, Alexander's son, seized the Vatican with his troops in an attempt to control the conclave. Protected by the Romans, the cardinals gathered in the Church of the Minerva, and on Sept. 22, 1503, elected Francesco, who took the name of Pius. He was consecrated on the following October 1 but died soon after. In honour of Pius II he founded the Piccolomini Library adjoining the Siena Cathedral.

• **Pius IV,** original name GIOVANNI ANGELO DE' MEDICI (b. March 31, 1499, Milan—d. Dec. 9, 1565, Rome), Italian pope (1559–65) who concluded the Council of Trent.

Pius IV, contemporary medallion; in the coin collection of the Vatican Library
Leonard von Matt—EB Inc.

A canon lawyer, in 1545 he was ordained and consecrated archbishop of Ragusa and in 1547 was appointed papal vice legate for Bologna. He was made cardinal priest in 1549.

After a long conclave Giovanni was elected pope on Dec. 25, 1559, as Pius IV. Though he had long agreed with those who saw a need for definite reforms, particularly of nepotism, in the Curia, he called his own nephew Charles Borromeo, to Rome, where he created him cardinal deacon in 1560. Pius nevertheless took prompt action to bring Cardinal Carlo Carafa, his brother, Giovanni, and Pope Paul IV's nephews to trial, which resulted in their controversial execution on March 6, 1561. He concurrently collaborated with Borromeo in composing crucial letters appealing to Europe's Roman Catholic princes to resume the Council of Trent, which had been suspended since 1552.

Despite the peace between France and Spain, many obstacles stood in the way of the council. The Holy Roman emperor Ferdinand I, still hoping for the return of the Lutherans to the Roman Church, sympathized with doctrinal concessions in their favour; King Philip II of Spain, on the contrary, opposed any change and was cool toward reopening the council, and the Roman Curia was totally opposed to any doctrinal change, though willing to discuss the reform of abuses. Pius was prepared to concede communion in both kinds and perhaps also clerical marriage. He especially hoped to prevent France from following Germany into apostasy.

Pius' bull of convocation was issued on Nov. 29, 1560; the opening session took place on Jan. 18, 1562. A year was spent in overcoming major differences, and the outcome was an almost unmitigated triumph for the papacy. With Borromeo as his chief adviser, Pius' conciliatory attitude calmed imperial opposition. The effective reforms of the council gradually restored the pastoral efficiency of the Roman Catholic Church and represented the middle-of-the-road conservative Catholics. The council was dissolved on Dec. 4, 1563, and Pius confirmed its decrees and definitions in his bull *Benedictus Deus* (Jan. 26, 1564); on the following November 3, he published a summary of doctrine generally known as the *Professio Fidei Tridentina* ("Tridentine Profession of the Faith"), imposing it on the bishops as obligatory.

Several important works that the council recommended or initiated but could not effectually carry out were given to Pius for completion; among these were drafting the *Index of Forbidden Books* and reforming the catechism, missal, and breviary. In 1564 he made Borromeo cardinal priest, designating him chief reformer of the Curia and head of the Consulta, thus making him secretary of state. Under the direction of Borromeo, the catechism was completed some months after the Pope's death. Pius also encouraged St. Teresa of Ávila's celebrated Carmelite reform and reduced the powers of the Inquisition. Having revived the Roman university, he launched an energetic building program, patronizing Michelangelo.

Pius did not long outlive the conclusion of the legal enactment of the Counter-Reformation, and his desire for a continued endeavour to reconvert the German Protestants died with him. During his last days the stiff taxation needed for his reform caused a conspiracy against him.

• **Pius V,** SAINT, original name ANTONIO GHISLIERI (b. Jan. 17, 1504, Bosco, Duchy of Milan—d. May 1, 1572, Rome; canonized May 22, 1712; feast day May 5), Italian ascetic, reformer, and relentless persecutor

Pius V, contemporary medallion; in the coin collection of the Vatican Library
Leonard von Matt—EB Inc.

of heretics, whose papacy (1566–72) marked one of the most austere periods in Roman Catholic Church history. During his reign, the Inquisition was successful in eliminating Protestantism in Italy, and the decrees of the Council of Trent (1545–63) were put into effect.

Early life and career. Pius V, born Antonio Ghislieri, came from a poor family in northern Italy. He was a shepherd until the age of 14, when he became a Dominican friar. His first important appointment was as inquisitor, a high office of the Inquisition, then the Roman Catholic Church's judicial system for discovering, examining, and punishing heretics. Ghislieri's methods, prompted by excessive zeal, provoked such opposition from his bishop's officials as well as his chapter that he was recalled in 1550. The chief inquisitor in Rome, Giovanni Pietro Carafa, convinced of his value, sent him on a mission to Lombardy and, in 1551, appointed him commissary general of the Roman Inquisition. When Carafa became pope (as Paul IV), Ghislieri was made bishop of Nepi and Sutri (1556), cardinal (1557), and finally grand inquisitor of the Roman Church (1558). He was continued in this office by Pius IV, whom, however, he antagonized by his censoriousness and obstinacy.

Papal reforms. After the death of Pius IV, the adherents of strict religious rules, led by Cardinal (later St.) Charles Borromeo, the nephew of Pius IV, had no difficulty making him pope (Jan. 7, 1566). Retaining his ascetic mode of life, Pius immediately began the work of reform. Decrees and ordinances were issued rapidly; the papal court became a model of sobriety; prostitutes were driven from the city or confined to a certain quarter; penalties were fixed for Sunday desecration, profanity, and animal baiting; clerics holding benefices were required to spend definite periods in their administrative districts; members of convents were compelled to live in strict seclusion according to their vows; instruction in the catechism, the short manual outlining the principles of Catholicism, was ordered. A new catechism appeared in 1566, followed by an improved breviary (the daily prayers for clergy and nuns [1568]) and an improved missal (a book containing the prayers and responses for celebrating the mass [1507]). The use of indulgences—*i.e.,* the remission of temporal punishment due for sin—and dispensations from vows was restricted, and the whole system of penance was reformed.

Pius was an avowed enemy of nepotism. Though it is true that he made one nephew cardinal, he was allowed to have no influence, and the rest of the family was kept at a distance. By the constitution *Admonet Nos* (March 29, 1567), he forbade the reinvestiture of fiefs—those landed estates held under feudal tenure that were intended to revert to the Holy See—and bound the cardinals by oath to observe it. In March 1569 Pius ordered the expulsion of the Jews from the States of the Church, though for commercial reasons they were allowed to remain under humiliating conditions in Rome and Ancona. In February 1571 the Humiliati, a corrupt monastic order of Milan, was suppressed on account of an attempt upon the life of the archbishop, Cardinal Borromeo.

The rules governing the Inquisition were sharpened; old charges, long suspended, were revived; rank offered no protection but rather exposed its possessor to fiercer attack. None was pursued more relentlessly than the intellectuals, among whom many of the Protestant doctrines had found acceptance. Princes and states withdrew their protection of heretics and courted the favour of the Holy See by surrendering distinguished offenders. Philip II of Spain in 1566 surrendered Bartolomé de Carranza, the Spanish theologian and former confessor to Queen Mary of England, and Cosimo de Medici in 1567 gave up Pietro Carnesecchi, the Florentine heretic who had been suspected even during Paul IV's papacy (receiving two years later as a reward the title of grand duke of Tuscany). In March 1571 the special Congregation of the Index, a list of books condemned as dangers to faith and morals, was established distinct from the Inquisition, and hundreds of printers took flight to Switzerland and Germany. The regret of Pius was that he had sometimes been too lenient. He encouraged Philip II of Spain to use the most ruthless tyranny to preserve his Dutch subjects in the Catholic faith and sent troops to France to help Catherine de Médicis repress the Huguenots; he protested against the tolerance shown by the Holy Roman emperor Rudolf II.

Influence. In all this work, Pius confirmed Borromeo's belief that a spiritually minded pope was above all else necessary if the decrees of the Council of Trent (1545–63) that were intended to rebut Protestant doctrines and to reform Catholicism were to be put into practical effect. The moral standing of the papacy was greatly raised, its effectiveness was immensely increased by the obliteration of heresy in Italy, and the morale of the church was much improved by the insistence on interpreting church doctrine according to precepts established at the council. Yet it is uncertain how much of this improvement was due to Pius' continuous use of the Inquisition. Some credit belongs to the new generation of higher and lower clergy in the several provinces whose attitude was so different from that of their predecessors. The council left him to finish the reform of the missal and breviary, but he left the medieval canon virtually unchanged, as it remained until 1970.

Moreover, Pius' policy had practical disadvantages. It took too little account of the wishes of secular rulers at a time when their support was essential for the defense of the church against heresy. He excommunicated Elizabeth I of England and declared her a usurper (Feb. 25, 1570) without possessing the means to enforce his judgment, and he antagonized not only England but Spain, France, and the Holy Roman Empire as well. Much more successful was his organization of a crusade against the Turks, which resulted in a decisive naval victory of Lepanto (Oct. 7, 1571). He made October the month of the rosary because of his victory. (I.F.B./D.Wo.)

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• **Pius VI,** original name GIANNANGELO BRASCHI (b. Dec. 25, 1717, Cesena, Papal States—d. Aug. 29, 1799, Valence, Fr.), Italian pope from 1775 to 1799, whose tragic pontificate was the longest of the 18th century.

He held various papal administrative positions before being ordained priest in 1758.

Pius VI, detail from a portrait by Pompeo Girolamo Battoni
By courtesy of the National Gallery of Ireland, Dublin

Progressing rapidly, he became treasurer of the apostolic chamber under Pope Clement XIII in 1766, and in 1773 was made cardinal by Pope Clement XIV, after whose death a four-month conclave elected Braschi on Feb. 15, 1775.

The church needed spiritual and institutional reform, and the papacy was nearly stripped of power and influence. The religious orders, the essential medium of papal influence in the church, were under attack by the protagonists of the Enlightenment; and the royal leaders of Catholic Europe, the pope's traditional allies, were now indifferent to papal interests, being concerned only with the possibilities of using the national churches in their schemes for administrative reform.

In October 1781 the Holy Roman emperor Joseph II inaugurated his reforming Edict of Toleration, whereby non-Catholic minorities received considerable religious toleration, "unnecessary" monasteries were dissolved, diocesan boundaries were redrawn, and seminaries were placed under state control. Further detailed reforms were intended to abolish such practices as festivals and superstitious reverences that were not considered in keeping with the Enlightenment. Pius intervened in 1782 by personally visiting Vienna but failed to secure any concessions. Joseph's application of Febronianism, an ecclesiastical doctrine that advocated restriction of papal power, subsequently became known as Josephinism. Meanwhile, the church in the Habsburg dominions remained wealthy and influential but subordinate to the state.

The French issue was equally overwhelming. Preliminaries to the Revolution were occurring, and the new government turned to the church's wealth, which it confiscated as a direct backing for its currency. Under the Civil Constitution of the Clergy (1790), France intended to force a reform of the French Church, thus causing a major conflict between Rome and the Revolution, whose scheme resembled Joseph's designs. Pius took no immediate action, but when an oath of fidelity to the new regime was demanded from the clergy, he formally denounced the Civil Constitution and the Revolution on March 10, 1791. The French Church was completely split.

Pius was on good terms with the allies against France in 1793 and felt that he could rely on them, but in 1796 his territory was invaded after the last Austrian defeat by Napoleon, who forced the Pope to sign a peace treaty at Tolentino on Feb. 19, 1797. In the following December, a riot in Rome led to French occupation of that city on Feb. 15, 1798, and the proclamation of a republic by a group of Italian patriots. Pius and the Curia were expelled from Rome, and in March 1799 he was seized by the French. Aged and physically crippled, he died a prisoner.

• **Pius VII,** original name BARNABA GREGORIO CHIARAMONTI (b. Aug. 14, 1742, Cesena, Papal States—d. Aug. 20, 1823, Rome), Italian pope from 1800 to 1823, whose dramatic conflicts with Napoleon led to a restoration of the church after the armies of the French Revolution had devastated the papacy under Pius VI.

He became a Benedictine at Cesena in 1758 and was made cardinal and bishop of Imola, Papal States, in 1785 by Pius VI, whose death in French captivity marked a collapse of the church's central administration. Under Austrian protection at Venice, a 14-week conclave elected Chiaramonti on March 14, 1800.

Pius wanted to make peace with Napoleon and to reach a prompt compromise with the Revolution insofar as it was compatible with the principles of the church. Overriding some shocked opposition within his entourage, he made a bold decision and negotiated the celebrated Concordat of 1801 with Napoleon, which established complete reorganization of the dioceses and declared Roman Catholicism France's chief religion. Pius renounced the ecclesiastical property that had been secularized and asked surviving bishops to resign their French sees. In 1802, however, certain Organic Articles were appended to the Concordat by a French unilateral action, forbidding the exercise of any papal jurisdiction in France without the permission of the government. Pius protested and in 1804 tried to use the occasion of his formal consecration of Napoleon (Paris, December 2) to have the articles modified. He was unsuccessful, and thenceforth relations between Pius and Napoleon rapidly deteriorated. Rome was occupied by French troops in 1808, and Napoleon declared the Papal States annexed to France (1809). Pius bravely excommunicated the invaders on June 10, 1809, and was taken prisoner the following July, remaining in exile until the invasion of France by the allies in 1814.

The Emperor's bullying of Pius aroused a far-reaching sympathy and respect for the Pope, especially among northern Catholics, who helped align Pius with the allies who eventually defeated Napoleon. In June 1812 Napoleon transferred Pius to Fontainebleau, where he forced the Pope to sign a humiliating concordat on Jan. 25, 1813, which Pius renounced two months later.

Released in 1814, Pius was greatly acclaimed en route to Rome. The Congress of Vienna (1814–15) restituted nearly all the Papal States, and in 1815 Rome was formally restored to Pius, who then sought to reestablish the church on traditional foundations. Politically, Pius followed a flexible line. In France and Spain he cooperated with the counterrevolution. But after some hesitation, he recognized the new Latin-American republics that had revolted against Spain, and he did not appeal to new ideas of liberty in Germany and in Austria, where Francis I maintained Josephinism, an extreme application of restricting papal power.

Ecclesiastically, Pius revived the Society of Jesus (1814) and encouraged the religious orders to reorganize themselves. Unlike many of his 18th-century predecessors, he showed great concern for doctrine and issued stern condemnations of church enemies, especially against Freemasons. In the tradition of the Humanist popes, he sponsored educational reform and the establishment of Rome as a cultural centre. Despite his efforts to adapt the papacy to the political, intellectual, and social conditions of the modern world, the reinstatement of authoritarianism in the Papal States was inevitable, and a "government by priests" followed his death. Ernesto Vercesi's *Pio VII, Napoleone e le Restaurazione* was published in 1933.

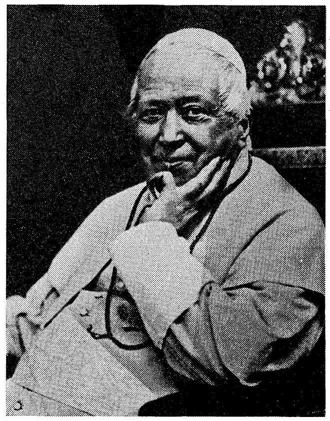
• **Pius VIII,** original name FRANCESCO SAVERIO CASTIGLIONI (b. Nov. 20, 1761, Cingoli, Papal States—d. Nov. 30, 1830, Rome), Italian pope from March 1829 to November 1830.

Versed in canon law, he became vicar general at Anagni, and later at Fano, until 1800, when he was made bishop of Montalto by Pope Pius VII. He was imprisoned in 1808 during the French domination of Italy for refusing to take the oath of allegiance to Napoleon. In 1816 he was elevated to cardinal and appointed bishop of Cesena. He subsequently became bishop of Frascati and grand penitentiary (1821), a leading role in the Curia. Despite his ill health, Francesco, the candidate of France, was elected Pope Leo XII's successor on March 31, 1829, and was crowned on the following April 5.

Pius VIII, detail from a monument by Pietro Tenerani; in St. Peter's, Rome
Alinari—Art Resource/EB Inc.

In strictly ecclesiastical matters, Pius, a disciple of Pius VII, was generally broad-minded and conciliatory; he delegated foreign policy to his secretary of state, Cardinal Giuseppe Albani. Considered to be somewhat liberal, Pius accepted the July Revolution (1830) in France that deposed Charles X in favour of Louis-Philippe. Pius encouraged French ecclesiastics to endorse the new regime, hoping it would secure amiable ties with the papacy. He approved the decrees of the Council of Baltimore (October 1829), the first formal meeting of U.S. bishops.

• **Pius IX,** original name GIOVANNI MARIA MASTAI-FERRETTI (b. May 13, 1792, Senigallia, Papal States—d. Feb. 7, 1878, Rome), Italian head of the Roman Catholic Church whose pontificate (1846–78) was the longest in history and was marked by a transition from liberalism to conservatism. Notable events of his reign included the declaration of the dogma of the Immaculate Conception (1854) and the sessions of the first Vatican Council (1869–70), during which the doctrine of papal infallibility was authoritatively defined.



Pius IX
Felici

Prepontifical life and early reign. Pius IX was the fourth son of Girolamo Mastai-Ferretti, gonfalonier of Senigallia, and the countess Caterina Solazzi. He first came into prominence as archbishop of Spoleto from 1827 to 1832, a time of revolutionary disturbance. He was made bishop of the important diocese of Imola in 1832, but it was not until 1840 that he received the hat, as cardinal priest of SS. Piero e Marcellino. He was not, in 1846, the most prominent liberal candidate likely to succeed Gregory XVI; but it took the conclave only two days to determine his election and so prevent that of the conservative Luigi Lambruschini. He took the name of Pius in deference to the memory of Pius VII, who had been his friend and who had, like him, been bishop of Imola. The choice was in some sense prophetic, for "Pio Nono," as his predecessor had done, began his career as a supporter of liberal ideas only to learn from bitter experience that liberals often tended to be anticlerical. In 1846, however, all this lay in the future and Europe was agog at the unusual spectacle of a liberal pope.

The new pope was confronted by a difficult situation. All Europe, save perhaps Metternich of Austria, considered that the Papal States stood in urgent need of reform. A memorandum of 1831 by the French, Austrian, Russian, and Prussian ambassadors in Rome had suggested that councils should be elected to assist in local government, that a central body, composed partly of elected representatives, control finance, and that the dominant position held by the clergy in the administration and in the judicial system be terminated. Liberal opinion clung to these measures as absolutely essential throughout the pontificate of Gregory XVI. In addition, the papacy was constantly under attack by Italian nationalists as one of the instruments through which Austria maintained its domination over the peninsula.

The Revolutions of 1848. The year of revolutions began in Sicily; soon all Europe was ablaze and Pius was faced with demands, both liberal and nationalist, much beyond what he had been prepared to grant. On March 14 he was compelled to grant a constitution establishing a two-chamber parliament with full legislative and fiscal powers subject only to the pope's personal veto. On March 23 Charles Albert of Sardinia declared war on Austria. For a time Pius continued to endeavour to steer a middle course, claiming in his address to the cardinals of April 29 that he was a disinterested spectator of the revolutionary activities sweeping Italy and that his program of reform was merely the fulfillment of the program long pressed upon the papacy by the powers. In the atmosphere of the time such sentiments were judged as displaying absolute hostility to the national cause, and the papacy was never again able to appear in Italy as anything other than a bulwark of reaction.

To prevent revolution from breaking out in Rome itself, Pius consented to the appointment of popular ministries, but none of the appointees was able to control the situation. A steadily deteriorating situation culminated in the assassination of one of them on November 15. A radical ministry was appointed; when the Swiss guards were disbanded the Pope was a virtual prisoner. On November 24–25, with the aid of the French and Bavarian ambassadors, he fled to Gaeta in the kingdom of Naples. In his absence, elections were held for a constituent assembly; this, on Feb. 9, 1849, declared the temporal power at an end and a democratic republic to be established. The papacy thereupon issued a formal appeal to the rulers of France, Austria, Spain, and Naples for assistance. Although it was generally considered that the Pope's restoration could take place only with some sort of undertaking to maintain constitutional government in the Papal States, and although Louis-Napoleon, the newly elected president of France, was in favour of such a policy, Pius held out against any concessions and asserted his determination to exercise his temporal power without any restrictions whatsoever. The upshot of a period of military and diplomatic manoeuvres on the part of France and Austria was the unconditional restoration of papal rule, and Pius returned to his capital on April 12, 1850.

The Roman question. It has often been asserted that Pius returned to Rome a changed man, that the former liberal had become a narrow reactionary. That his policy had changed there is no doubt, but his fundamental attitude remained the same. The interests of the church had always been his first concern. He had been prepared to countenance both nationalism and liberalism while they left the church intact, but experience had taught him that both led to revolution, which he had never been prepared to countenance. Furthermore, political concessions on his part had led to attacks on his spiritual power, and he considered that it could be protected only by his continued exercise of a temporal authority. Once these two aspects of his dominion had become indissolubly linked, it is easy to see why Pius considered himself obliged to oppose any alteration of his position as a temporal ruler.

In 1846 Pius had considered that a new departure was necessary to meet the legitimate demands for reform within the Papal States and perhaps also those for a change in the Italian system of states. Most of the administrative reforms carried out immediately after Pius' accession remained, and the papal territories benefitted from the general increase in European prosperity after 1850. But constitutional government was never restored; the amnesty granted on the Pope's return was so riddled with exceptions as to be worthless; and to all expressions of national sentiment the papacy was utterly hostile. It was not that papal government was tyrannical but that it formed an absolute barrier in the way of Italian unification upon which politically minded Italians were set.

On Sept. 20, 1870, Italian troops occupied Rome, and in October a plebiscite was held in which an overwhelming majority of the votes cast were for the incorporation of Rome in the kingdom of Italy. Pius remained for the rest of his days a prisoner, as he regarded himself, in the Vatican. He refused any intercourse with the Italian government, so that their relations rested upon a law passed by the Italian parliament in November. The sovereignty of the pope was declared to be untouched by the loss of his dominion in compensation for which he was to receive an annual sum of money. He was to be entitled to conduct his own diplomatic relations with other powers and to have exclusive authority within the Vatican itself and a small district around it. In the rest of Italy, church and state were to be separated. So, though the papacy did not formally recognize the fact until the concordat of 1929, the Roman question had been settled.

Ultramontanism. Important as the events just described were for the papacy, the doctrinal developments of Pius' pontificate, which spring directly out of these political disasters, constitute its most significant contribution. Ultramontanism began with Joseph de Maistre, as a reaction against Gallicanism and against Josephinism, seeking to free the church from the chains of secular control by binding it more closely with the papacy. H.-F.-R. de Lamennais developed it by suggesting that the church would benefit from a general increase in political freedom. Gregory XVI condemned Lamennais's teaching because he saw that freedom might mean freedom to deny religion altogether. Pius IX decided in 1846 to experiment with liberalism but later became convinced that Gregory XVI had rightly suspected it. Nevertheless, if Italy taught Pius one lesson, developments in France, where the church prospered more under the liberal regime of Louis-Philippe than it had under the clerical Charles X, suggested quite the opposite conclusions to the liberal Catholics there, whose spokesman was Charles de Montalembert. On the other hand, the coming of the Second Empire stimulated the party led by Louis Veuillot, whose Ultramontanism was of the older sort, completely divorced from liberalism and seeking freedom for the church in an authoritarian state that would guard it against revolution.

For a period after 1850, Pius' policy took little heed of either brand of Ultramontanism. Cardinal Giacomo Antonelli, the papal secretary of state, followed the paths of Consalvi, Pius VII's secretary of state, in seeking to procure more favourable concordats with Catholic rulers. Such agreements might be politically valuable but were no defense against intellectual anticlericalism, and Pius became increasingly convinced that the real danger to the church lay in the modern secular ideas that the liberal Catholics were endeavouring to incorporate into its doctrines. The events of 1860 finally convinced him that the notion of a "free church in a free state" was a snare. The encyclical *Jamdudum Cernimus* (1861) denounced not only Piedmontese aggression but all modern political doctrines. The Risorgimento not only convinced Pius that liberalism in the church must be destroyed but also placed the liberal Catholics in the difficult position of appearing to support those who had caused him so much distress. The alternative to Montalembert's doctrine was no longer an unconditional attachment to the principles of the ancien régime but a new kind of Ultramontanism, asserting the need for concentrating church authority in the pope's hands. The ground was being prepared for the first Vatican Council and the doctrine of papal infallibility.

But first the strong liberal party in the Catholic Church had to be defeated. In 1863 Montalembert was invited to address a large Catholic congress at Malines, and he took the opportunity to defend the concept of a free church in a free state and to condemn intolerance in principle. Pius was content in reply to point out that on these two points he was running counter to authoritative pronouncements of Pius VI and Gregory XVI. This was sufficient to deter Montalembert from accepting a second invitation to Malines in 1864, but his supporter F.-A.-P. Dupanloup proved an able substitute. Meanwhile, at a congress at Munich in 1863, J.J.I. von Döllinger had pleaded for the right of a scholar to pursue independent inquiry. It was clear to everyone that the church stood in need of authoritative pronouncements about its relations with the state and with modern society, and discussion began about the possibility of calling an ecumenical council for this purpose. But once again the Roman question intervened decisively in the struggle.

On Sept. 15, 1864, the French and Italian governments came to an agreement whereby the French garrison was to be withdrawn from Rome within two years. In fact, it was not finally withdrawn until the outbreak of the Franco-German War, but the conclusion of the September convention was sufficient to make Pius decide to take immediate action against liberalism. On Dec. 8, 1864, he issued the encyclical *Quanta Cura* with, attached to it, the famous *Syllabus* listing 80 of the "principal errors of our times." As the errors listed had already been condemned in allocutions, encyclicals, and other apostolic letters, the *Syllabus* said nothing new and so could not be contested. Its importance lay in the fact that it published to the world what had previously been preached in the main only to the bishops, and that it made general what had been previously specific denunciations concerned with particular events. Thus perhaps the most famous article, the 80th, stigmatizing as an error the view that "the Roman Pontiff can and should reconcile himself to and agree with progress, liberalism, and modern civilization," sought its authority in the pope's refusal, in *Jamdudum Cernimus,* to have any dealings with the new Italian kingdom. On both scores, the *Syllabus* undermined the liberal Catholics' position, for it destroyed their following among intellectuals and placed their program out of court.

Though Dupanloup tried to explain away the *Syllabus* by insisting upon its context and by stressing its purely negative aspect, the *Syllabus* nevertheless dealt a mortal blow at liberal Catholicism, which ceased after 1864 to be the main issue taxing Catholic controversialists. While some of Louis Veuillot's followers hoped that at the forthcoming council a positive statement of the orthodox doctrine of the position of the church in society would replace the negative denunciations of the *Syllabus,* the majority looked upon that battle as won and so turned to the question of defining the pope's infallibility, the keystone of the neo-Ultramontane program of centralizing the authority of the church in Rome so as to escape from the control of the secular state.

The Vatican Council. In the doctrine of papal infallibility itself there was nothing new. It had been employed to define, on Dec. 8, 1854, the dogma of the Immaculate Conception, which asserted that the freeing of the Virgin Mary from all taint of original sin had occurred at the moment of her conception. The Pope had previously made extensive inquiries among the bishops and other divines and there was little opposition to such an exercise of his undoubted prerogative. When, however, at a gathering of bishops and other dignitaries of the church in Rome in 1862 and again at another in 1867 it had been suggested that the doctrine of infallibility should be authoritatively defined, Dupanloup had led a successful opposition to the project. It was objected that such a definition was inopportune, tending to widen the breach between the church and modern society, and that it would present a one-sided view of the source of authority in the church; for while the pope possessed powers issuing directly from God, so too did the bishops, for instance, whose ordinary jurisdiction arose, not out of their nomination or institution but equally from divine origin; so that the pope's powers ought not to be defined without reference to other aspects of the nature of the church. The criticism that must attach to Pius is that he allowed the council to put aside discussion on the wider issue, which was its original program, in favour of the narrower definition. This was, of course, precisely what the Ultramontane party desired. The Ultramontanes, indeed, undoubtedly possessed the backing of by far the greater part of the church, partly because of the reaction engendered by the political misfortunes of the last decade, partly because of the immense prestige enjoyed by Pius as a result of his long and tragic pontificate, but to a larger extent because of the contemporary movement away from intellectualism and in favour of devotional religion.

The first Vatican Council opened on Dec. 8, 1869. The opposition, consisting of the German, French, and U.S. bishops, was strong enough to prevent a definition of the doctrines and nature of the church on the lines suggested by the *Syllabus;* but the Ultramontane party brought forward the question of infallibility, upon which their position was much stronger. Pius intervened decisively to alter the procedure of the council on Feb. 20, 1870, and again on April 29. The outcome was to postpone all deliberation except that upon infallibility. The decisive vote came on July 13 when 451 voted for it, 88 against it, and 62 in favour of some amendment. Thereupon the minority left Rome and the final definition was carried on July 18 by 533 votes to 2. Infallibility was confined to those occasions upon which the pope made pronouncements *ex cathedra.*

Pius reigned for another eight years, during which he became further estranged from the Italian government and witnessed a general outbreak of anticlericalism in western Europe. In Germany this culminated in Bismarck's *Kulturkampf,* which Pius condemned in the encyclical *Quod Nunquam* of Feb. 5, 1875, leaving the solution of the problem to his successor. Pius died three years later, having seen in his long pontificate the creation of the modern papacy.

Evaluation of his pontificate. The exact responsibility of Pius for the events of his pontificate is still a matter for controversy. The result is clearer. Church and state were finally separated, authority in the church was centralized in Rome, and the church was ranged in opposition to the dominant political forces.

Perhaps the most damaging criticism of Pius is that he assumed almost the sole direction of events while never appreciating their significance. The great events of his pontificate occurred despite him rather than because of him. Thus he condemned in the *Syllabus* that very separation of church and state which it was the work of the first Vatican Council—to which for the first time the secular Catholic rulers were not invited—to secure. At one time or another Pius was served by the leaders of all the important movements of his century, by liberal cardinals, by ecclesiastical statesmen, and by the ascetic H.E. Manning, a convert from Protestantism. Yet it is unfair to say that he changed his political principles; rather he never possessed any, save in his personal religious life, that were not rather naive, and so he was always open to be guided by experience. In view, however, of the benefit that has accrued to the church from the loss of the temporal power, it should at least be asked whether it was not Pius' determination to maintain it at all costs that contributed most to the temporal power's being lost.

(I.F.B./D.Wo./Ed.)

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Articles are alphabetized word by word, not letter by letter

• **Pius X,** SAINT, original name GIUSEPPE MELCHIORRE SARTO (b. June 2, 1835, Riese, Venetia, Austrian Empire—d. Aug. 20, 1914, Rome; canonized May 29, 1954; feast day September 3), Italian pope from 1903 to 1914, whose staunch political and religious conservatism dominated the early 20th-century church.

Ordained in 1858, he became a parish priest in the Italian region of Venetia. Pope Leo XIII made him bishop of Mantua (1884) and in 1893 cardinal and patriarch of Venice. He was elected pope on Aug. 4, 1903.

Tepid toward Leo's social reforms, Pius decided to concentrate on apostolic problems and to make the defense of Roman Catholicism his cause. Three aspects of his policy particularly aroused bitter controversy: the repression of Modernism, a contemporary intellectual movement seeking to reinterpret traditional Catholic teaching in the light of 19th-century philosophical, historical, and psychological theories; his reaction against Christian Democrats; and his attitude toward separation of church and state in France.

Because Modernism tended to ignore certain traditional values in order to achieve its ends, Pius placed several Modernist books on the *Index of Forbidden Books* and issued (1907) the decree *Lamentabili Sane Exitu* (*On a Deplorable Outcome*) and the encyclical *Pascendi Dominici Gregis* (*Feeding the Lord's Flocks*), rejecting Modernist teachings and suggesting remedies to extirpate it. He also urged immediate compliance with his strict censorship program. On Sept. 1, 1910, he ordered that all teachers in seminaries and clerics before ordination take an oath denouncing Modernism and supporting *Lamentabili* and *Pascendi.*

Pius led the reaction against Christian Democracy because he could not tolerate the idea of some Catholics making their social work a matter independent of the hierarchy and conducting it in an increasingly political direction. He opposed the contemporary trend in European countries where Christians reacted against doctrines of materialism by forming their own social movements or popular action groups. Accordingly, he formally condemned the Italian priest Romolo Murri's popular action movement in 1903 and the pioneering Christian Democrat Marc Sangnier's Sillon movement in France. The Sillon broke from the church, whose authority it challenged.

On Pius' accession, the separation of church and state in France was already visible, and the break was inevitable, occurring amid a growing anticlericalism in France. In 1905 the French formally separated church from state, an act condemned by Pius on Feb. 11, 1906. Most of the French bishops were willing to try the new French legislation, which safeguarded all that could still be preserved of the church's material interests, but Pius rejected the compromise.

Some of his directives, though outmoded by later social developments, mark him as one of the forerunners of Catholic Action—*i.e.,* the organization of the laity for special and direct collaboration in the church's apostolic work. His eucharistic decrees eased the regulations governing daily communion, and his revival of the Gregorian plainsong and his recasting of the breviary and of the missal were important liturgical reforms. His decision to adapt and systematize canon law led to the publication of the new code in 1917, effective in 1918. His reorganization of the Curia modernized the church's central administration, including a codification of the conclave.

F.A.M. Forbes's *Life of Pius X* was published in 1918.

• **Pius XI,** original name AMBROGIO DAMIANO ACHILLE RATTI (b. May 31, 1857, Desio, Lombardy, Austrian Empire—d. Feb. 10, 1939, Rome), Italian pope from 1922 to 1939, one of the most important modern pontiffs whose motto "the peace of Christ in the

Pius XI
Felici

Kingdom of Christ" illustrated his work to construct a new Christendom based on world peace.

Ordained in 1879, he became a scholar, a paleographer, and prefect of the Vatican library. Nuncio to Poland in 1919, he was made cardinal and archbishop of Milan in 1921 by Pope Benedict XV, whom he was elected to succeed on Feb. 6, 1922.

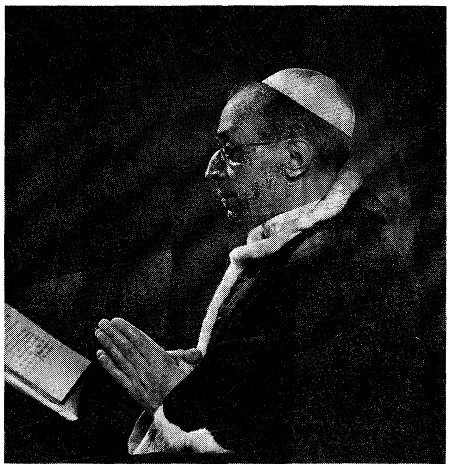
Pius' pontificate soon witnessed the rise to power of Benito Mussolini, who signed (Feb. 11, 1929) with him the Lateran Treaty that allowed the existence of the independent Vatican City state, over which the pope ruled. The papacy, in turn, recognized the establishment of the kingdom of Italy and announced permanent neutrality in military and diplomatic conflicts of the world. Pius further agreed that a pope would intervene in foreign affairs not as head of a sovereign state but as head of the church. Concurrently, a concordat established the validity of church marriage in Italy, provided compulsory religious instruction for Catholic schoolchildren, and declared Roman Catholicism to be Italy's exclusive religion.

Pius' role in these negotiations was considerable, their success owing much to his appreciation of the interests of the church and of contemporary political realities. With the aid of his secretaries of state, cardinals Gasparri (1922–30) and Pacelli (1930–39), he concluded concordats that strengthened and united Catholicism in countries suffering the aftereffects of World War I, including Latvia (1922), Poland (1925), Romania and Lithuania (1927), Prussia (1929), Austria and Germany (1933). Unfortunately, World War II ruined several of these treaties. He reached an agreement allowing the church to resume religious services in Mexico, where severe persecutions prompted the encyclical of 1926, and he made another agreement (1933), though short-lived, with Adolf Hitler's newly formed Nazi government in Germany, hoping to alleviate the difficulties confronting German Catholics. From 1933 to 1936 he wrote several protests against the Third Reich, and his attitude toward Fascist Italy changed dramatically after Nazi racial attitudes were introduced into Italy in 1938.

A learned humanist, Pius founded research establishments and institutes of higher education, including the Pontifical Institute of Christian Archaeology (1925) and the Pontifical Academy of Science (1936). He made great efforts to organize the laity, first in Italy and then throughout the whole church, calling for "specialized movements" and particularly encouraging Catholic Action (the "Jocists"), a Christian youth organization for the working classes. In 1922 he had defined Catholic Action as "the participation of the laity in the apostolate of the Church's hierarchy."

Surpassing his predecessors in support of overseas missions, he required every religious order to engage actively in this work, with the result that missionaries doubled their number during his pontificate. Most significant was his consecration of the first Chinese bishops, in 1926. He equally encouraged historians and liturgiologists to study Eastern Christianity, inaugurating the work of codifying Eastern canon law. In 1930 he witnessed the reunion of the Syro-Melankarese Christians (of southern India) with Rome. His response to the ecumenical movement was negative toward Protestantism, however, as revealed in an encyclical of 1928. Philip Hughes's *Pope Pius the Eleventh* was published in 1937, followed by Zsolt Aradi's *Pius XI: The Pope and the Man* in 1958.

• **Pius XII,** original name EUGENIO MARIA GIUSEPPE GIOVANNI PACELLI (b. March 2, 1876, Rome—d. Oct. 9, 1958, Castel Gandolfo, Italy), Italian head of the Roman Catholic Church during World War II and the years of postwar reconstruction (reigned 1939–58), who dealt with contemporary moral and theological issues in innumerable addresses and in several encyclicals. His ideas on in-



Pius XII, photograph by Yousuf Karsh

ternational structures and reforms in liturgy and biblical studies were important, but his conduct during World War II has been the subject of controversy.

Early life and career. Eugenio Pacelli was born in Rome. His family came from Tuscany and had supplied Vatican lawyers since 1819. Eugenio was educated at Roman day schools and studied for the priesthood at the Gregorian University there, though for reasons of health he soon lived at home, not at his college of Capranica. He was ordained in 1899. He was a successful student with a quick mind and an exceptional memory, although the theological formation then available at the Gregorian University was limited. It was in the subject of law that he made his mark and so passed into the Vatican Secretariat of State. There he rose rapidly and in 1917 was made archbishop and sent as nuncio—a diplomat—to the Bavarian Court to negotiate a concordat (a Vatican–state agreement). This done, he passed (1925) to Berlin with the same aim and remained there until he was named cardinal, by Pius XI, and recalled to Rome at the end of 1929 to become secretary of state. After 10 years in this office, during which he travelled on papal missions to North and South America and to France, he was elected pope in the shortest conclave since 1623.

Pontificate. These experiences are crucial in assessing Pacelli's pontificate. He grew up in a home of deep piety and of devotion to the papacy but also in a Rome smarting from the loss of the papal states, a Rome still clerical, resentful, and suspicious of the secular world. He inherited a diplomatic tradition and technique centred on the principle of the concordat, which aims to preserve the church's privileges and freedom of action, even under regimes irreconcilable with Christian principles.

Fascism came to power in Italy (1922) during Pacelli's absence in Germany, and his brother, a lawyer, helped to fashion the concordat with the dictator Benito Mussolini—to achieve which the Catholic Popular Party and any chance of ousting Mussolini were sacrificed. This settlement of the Roman Question, which created the Vatican city-state (1929), satisfied Pius XI's ambition and that of many Italians but created many problems for the next 30 years in Pacelli's life, in relations both with the increasingly hostile dictatorship and with the uneasy democracy that succeeded it after the war.

Twelve years in Germany had made Pacelli fluent in German and had given him great love for the Germans. A tireless and methodical worker, he admired such virtues in the Germans and had many German helpers in the Vatican. But his deep knowledge of German affairs precluded illusions about Nazism, and the concordat with Hitler's Germany (1933), largely his work, was (he often said) a calculated risk, aimed at preserving a platform for Catholic life and ministry in a hostile German society.

His part in the anti-Nazi encyclical *Mit brennender Sorge* (1937; *With Burning Sorrow*), his dozens of other notes and memoranda to the German government as secretary of state, his frigid and outspoken reception of the Nazi foreign minister Joachim von Ribbentrop in Rome, his bitter reproach of the Austrian cardinal Theodor Innitzer's weakness in face of the Austro-German *Anschluss*—the union of Austria and Germany—in 1938, and finally the unfavourable German reception of his election as pope, all showed his true estimate of the German tyranny.

During the few months between his election and the outbreak of war, Pius XII turned his diplomatic gifts to preventing the catastrophe, but not in the spirit of appeasement—the Vatican had disliked the Munich Agreement (1938), by which Czechoslovakia was sacrificed to expanding German power by Britain and France. Pius especially strove to keep Italy neutral and was deeply saddened when he failed.

War years. The demands of war harmonized with Pius' austerity and immense capacity for work; they enhanced his exalted, almost dramatic, conception of his office. His untiring efforts to humanize war and to relieve suffering, anxiety, and grief, though they did not always receive Axis cooperation, have been generally applauded. In a notable series of Christmas broadcasts (1939–48), he looked firmly toward the postwar future and to the opportunities it would offer for a new order in which the international community would be given real expression, replacing the egoistic nationalism that had bred war.

There has been less agreement about Pius' conduct and utterance in relation to the war itself. Deeply conscious of paternal responsibilities that transcended nationalism, pledged to neutrality, obliged to condemn unchristian conduct and yet fearful of provoking reprisals on the defenseless, the Pope clearly suffered many agonies of indecision, aggravated by his dislike of strife. He has been charged with neglecting, in the interests of a calculated neutrality, to raise an authoritative voice in defense of the persecuted, Christian or Jewish. Others have claimed that protests would have aggravated Nazi policy without achieving any good result. Both approval and censure of his choices during these difficult years have often been facile and superficial: the deeper question may be asked whether the nuances, the hints, the oblique allusions of traditional diplomacy, which came naturally to him and which often seemed to him much clearer than they seemed to others, were any longer appropriate to the savagery and cynicism of a death struggle for world domination and of deliberate genocide. The problems of a neutrality that is not completely silent are never wholly surmountable, since causes are not morally neutral.

Later papal concerns. Though Pius refused to be drawn into any crusade against international Communism, he enacted severe measures against Catholics collaborating with Communists (1946), and the precarious balance between Christian Democrats and the extreme left in postwar Italy led him to encourage the Catholic Action leader Luigi Gedda, whose meddling in politics embarrassed the parliamentary Christian Democratic Party. Premier Alcide De Gasperi's successful protest against this (1949) earned him disfavour at the Vatican. When Pius' failing health left power in the hands of a "bureaucracy" of cardinals, including the autocratic head of the Holy Office, Alfredo Ottaviani, clerical interference in Italian public life reached a high pitch.

Many of Pius' innumerable addresses to specialist audiences dealt with urgent moral problems; by the end of his life he was moving toward outright rejection of modern war and doubted the justification of a war deterrent policy. In the field of marital relations, he made a number of pronouncements about the "safe period" without carrying discussion of birth regulation substantially beyond the position of his predecessor. Nor did he advance Catholic thinking or policy in the ecumenical field, though slight concessions were made in 1949.

Perhaps Pius' greatest utterance was the encyclical *Divino Afflante Spiritu* (1943; "With the Help of the Divine Spirit"), which gave fresh impetus and direction to Catholic biblical studies. These studies had been hampered by the inquisitorial atmosphere persisting since the days of crisis under Pius X over Modernism—a movement that sought, among other things, to apply modern methods of historical criticism to both the Bible and the life of Christ, but was vitiated by arbitrary philosophical assumptions. The encyclical welcomed most of the techniques of modern biblical scholarship.

Mediator Dei (1947; "Mediator of God") was a similar charter for the liturgical movement; he aimed at restoring a community character to public worship but mistrusted extravagant experiment. More conservative and suspicious views prevailed in *Humani Generis* (1950; "Of the Human Race"), touching on theological tendencies.

Pius' later ill health accentuated his solitary bent, increased the power of his conservative curia—the papal administrative bureaucracy—and aroused misgivings in some countries, not least in France, where Roman handling of the worker-priest problem—by sending worker-priests, who had been sharing the work and living conditions of labourers in order to extend their ministry, back to traditional religious tasks—caused deep resentment. When he died, at Castel Gandolfo in 1958, respectful mourning was worldwide, but Rome showed few signs of the revolution in church life around the corner. Though he was gifted and deeply spiritual, history is unlikely to place him among the great creative popes. (W.A.P.)

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Piute (people): *see* Paiute.

pivot area: *see* heartland.

pivot joint, also called ROTARY JOINT, or TROCHOID JOINT, in vertebrate anatomy, a joint that allows only rotary movement. It is exemplified by the joint between the atlas and the axis (first and second cervical vertebrae), directly under the skull, which allows for turning of the head. Pivot joints also provide for the movement of the bones of the forearm (radius and ulna) against the upper arm (humerus) at the elbow.

Pixérécourt, (René-Charles-) Guilbert de (b. Jan. 22, 1773, Nancy, Fr.—d. July 27, 1844, Nancy), astonishingly prolific dramatist who delighted popular audiences in Paris with a succession of more than a hundred plays during the first third of the 19th century. These were performed in the *théâtres des boulevards,* which were patronized by a far less exclusive audience than those of the official theatres and were less bound by convention. His greatest successes were melodramas—*e.g., Victor* (1798) and *Coelina* (1800). These are plays full of exciting incidents and local colour, with comedy and pathos juxtaposed, which invariably end with virtue saved and vice punished. Pixérécourt, who directed the production of his own plays, laid great stress on realistic scenery. With his melodramas Pixérécourt started a theatrical tradition that survived throughout the 19th century.

pixie, also spelled PIXY, in the folklore of southwestern England, tiny elflike spirit or mischievous fairy dressed in green who dances in the moonlight to the music of frogs and crickets. Its favourite pastimes are leading travelers astray and frightening young maidens. Pixies also delight in rapping on walls, blowing out candles, and playing in water. Pixies were first discussed at some length by Mrs. Anna Eliza Bray in *The Borders of the Tamar and the Tavy,* 3 vol. (1837).

Pixie, illustration by W. Measom from the 1853 edition of *A Peep at the Pixies,* by Mrs. Bray

By courtesy of the Folklore Society Library, University College, London; photograph, R.B. Fleming

Their prank of leading people astray gave rise to the terms pixie-led and pixilated to describe a person who becomes lost on a familiar road. It was later extended to mean any state of bewilderment or confusion.

Piye, formerly called PIANKHI (fl. 8th century BC), king of Cush (Kush, in the Sudan; *c.* 750–*c.* 719) who invaded Egypt from the south and ended the petty kingdoms of the 23rd dynasty (*c.* 823–*c.* 732 BC) in Lower Egypt. According to Egyptian tradition, his brother Shabaka founded the 25th dynasty, but Piye laid the foundations.

The kingdom of Cush, of which Piye was ruler, emerged out of the Egyptianized population of the Sudan near Mount Barkal, between the third and fourth Nile cataracts. The cult of the Egyptian god Amon Re was strongly entrenched among the Cushites, and a threat by Tefnakhte, a Libyan chieftain of the Delta, to Amon's homeland in Upper Egypt provoked Piye to move northward. Following a ritual visit to Thebes, Piye's forces met the Libyans' river fleet and defeated it. They then vanquished a land army near Heracleopolis, in Middle Egypt, and advanced to take Hermopolis, another Middle Egyptian stronghold of the Libyans, and Memphis, Egypt's ancient capital. Piye received the submission of several Delta potentates and, later, of the last representative of the 23rd dynasty. He then invaded the Delta, where more local rulers surrendered. Finally, Tefnakhte sent a message of submission, and Piye sent an emissary to obtain his oath of fealty. After some final submissions by holdouts, Piye sailed home to Mount Barkal with the spoils of his venture. He remained in his capital and was buried there; the great stela recounting his deeds also was found there and is dated in the 21st year of his reign.

piyyut, also spelled PIYUT, plural PIYYUTIM, or PIYUTIM, Hebrew PIYŪṬ ("liturgical poem"), one of several types of liturgical compositions or religious poems, some of which have been incorporated into Jewish liturgy and have become virtually indistinguishable from the mandatory service, especially on the Sabbath and on Jewish religious festivals.

Piyyutim were first composed in Palestine about the 4th or 5th century AD. It is not quite clear whether they arose merely as natural expressions of religious sentiments or as a deliberately disguised response to persecutions. In any case, piyyutim served a special purpose when, for example, a decree of Emperor Justinian (AD 553) forbade Talmudic studies and the teaching of the Bible. Since the liturgy itself was not proscribed, piyyutim were used to inculcate such fundamental precepts as observance of the Sabbath and religious festivals and to exhort the congregation to love the Torah, to believe in God, and to place its hope and trust in God's abiding providence. These religious poems also served as a reminder of times past when God showed he had not abandoned his chosen people.

The renowned Jewish philosopher Sa'adia ben Joseph (882–942) was an ardent advocate of piyyutim in Babylonia, but religious poetry met strong opposition there as an unnecessary innovation in the liturgy. Still, the piyyutim survived in Babylonia also because the common people responded to poetic songs that placed their suffering in a religious context.

During the Middle Ages, piyyutim were the most cultivated form of Hebrew literature, especially in Germany, France, Italy, and Spain. Rhyme was introduced in Spain, where piyyutim reached the height of their development. Among early masters of this poetry were Yose ben Yose, Yannai, and his pupil Eleazar Kalir, none of whose dates can be fixed with certainty.

As late as the 18th century, piyyutim continued to be written, but only rarely were these later poems made part of standard liturgies. In the 20th century new interest in the history of the piyyutim was generated by the discovery of some 800 of Yannai's compositions in the famous Cairo genizah (synagogue repository). The songs still have a unique appeal, and their continued use accounts for much of the diversity of different liturgies.

Pizarro, Francisco (b. *c.* 1475, Trujillo, Extremadura, Castile [Spain]—d. June 26, 1541, Lima), Spanish conqueror of the Inca Empire of Peru and founder of the city of Lima.

Early life. Pizarro was the illegitimate son of Captain Gonzalo Pizarro and Francisca González, a young girl of humble birth. He spent much of his early life in the home of his grandparents. According to legend he was for a time a swineherd, a not unlikely possibility since this was a common occupation of boys in that region. He doubtless participated in local manorial wars and, when these were ended, very probably went to fight in Italy. Certainly in 1502 he went to Hispaniola (modern Haiti and Dominican Republic) with the new governor of the Spanish colony.

Pizarro had little inclination toward the settled life of the colonizer, and in 1510 he enrolled in an expedition of the explorer Alonso de Ojeda to Urabá in Colombia. He appears to have been marked out as a hard, silent, and apparently unambitious man who could be trusted in difficult situations. Three years later, acting as captain, he participated in an expedition led by the explorer Vasco Núñez de Balboa that was credited with the European discovery of the Pacific. From 1519 to 1523 he was mayor and magistrate of the newly founded town of Panamá, accumulating a small fortune.

Francisco Pizarro, engraving by Crispijn van de Passe

By courtesy of the Metropolitan Museum of Art, New York City, Whittelsey Fund, 1951

Discovery and conquest of Peru. It was not until 1523, when he was some 48 years old, that Pizarro embarked upon the adventure that was to lead to his lasting fame. In partnership with a soldier, Diego de Almagro, and a priest, Hernando de Luque, he made preparations for a voyage of discovery and conquest down the west coast of South America. The initial period of exploration took place from 1524 to 1527, during which time Pizarro and his men endured many hardships. After eventually sighting a raft occupied by what appeared to be civilized Indians dressed in manufactured cloth, they decided to send Almagro back to Panama for reinforcements. The new governor of Panama, however, sent back orders that the expedition be abandoned in order that no more lives be lost. At this point Pizarro is reputed to have drawn a line on the ground with his sword, inviting those who desired wealth and glory to cross it. The "famous thirteen" who did cross the line continued their exploration of the coast as far as 9° S, obtaining distinct accounts of a great Indian empire as well as many Inca artifacts. They christened the new land Peru, probably a corruption of Virú, the name of a river.

Finding the governor of Panama still opposed to their now promising enterprise, the explorers decided that Pizarro should go to Spain to ask Charles in person for permission to undertake conquest. Sailing in the spring of 1528, Pizarro was in Seville at the same time as Hernán Cortés, conqueror of Mexico, and was able to win Charles over to his scheme. He was decorated, granted a coat of arms, and, in July 1529, made governor and captain general of the province of New Castile for a distance 600 miles south of Panama along the newly discovered coast. Pizarro was invested with all the authority and prerogatives of a viceroy, and Almagro and Luque were left in subordinate positions. All the "famous thirteen" received substantial rights and privileges in the new territories.

Joined by four of his brothers, Pizarro sailed for Panama in January 1530 and by January of the following year was ready to set off for Peru. He set sail with one ship, 180 men, and 37 horses, being joined later by two more ships. By April they had made contact with emissaries of Atahuallpa, emperor of the Incas, who was residing near the city of Cajamarca with an army of about 30,000 men. Somewhat scornful of Pizarro's small force, the Inca accepted a proposal that the two leaders meet in that city.

Arriving on November 15, Pizarro immediately set up his artillery and sent his brother Hernando and another Spaniard to request an interview. After a day of tense waiting, Atahuallpa, borne on a litter, entered the great square of Cajamarca with an escort of between 3,000 and 4,000 men, who were either unarmed or carrying short clubs and slings beneath their tunics. Pizarro sent out a priest, Vicente de Valverde, to exhort the Inca to accept Christianity and Charles V as his master. Atahuallpa disputed both the religion and the sovereignty of the Spaniards and, after examining a Bible offered by the priest, flung the book to the ground. Valverde reported these events to Pizarro, who immediately ordered an attack. The astonished Incas were cut down from all sides, Pizarro himself seizing Atahuallpa.

Atahuallpa was held as hostage and failed to win his release, though he fulfilled a promise to fill the chamber in which he was held with gold and silver. Accused of ordering the execution of his brother Huascar, a rival for the title of Inca, and of plotting to overthrow the Spaniards, Atahuallpa was put to death by strangulation on Aug. 29, 1533. With news of Atahuallpa's death, the Inca armies surrounding Cajamarca retreated, and Pizarro progressed toward Cuzco, the royal capital, which was occupied without a struggle in November 1533. The Spaniards declared Manco Capac, Huascar's brother, as Inca.

For the remainder of his life, Pizarro was engaged in consolidating the Spanish hold on Peru and in defending his and his brothers' share of the spoils. A certain enmity and rivalry developed between him and Almagro as a result of Pizarro's overriding powers from the king of Spain. This contravened a solemn agreement between the original three partners that the spoils of the expedition should be shared equally. Almagro at one stage seized Cuzco but was persuaded by Pizarro to depart for Chile, over which he had been granted extensive powers by the king. Disappointed by the poverty of that country, however, he returned to Peru, where he was made prisoner and later executed by Hernando Pizarro.

Francisco Pizarro, meanwhile, was in Lima, a city that he had founded in 1535 and to which he devoted the last two years of his life. Almagro's former adherents had grouped around Almagro's son in Lima, where they were confined and watched. Suspecting that they were to be eliminated, they decided to move first, attacking Pizarro's palace on June 26, 1541. Pizarro died that day a protracted death, drawing a cross of his own blood on the ground, kissing it, and crying "Jesus" as he fell. (M.B.G./Ed.)

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Pizarro, Gonzalo (b. 1502?, Trujillo, Spain—d. April 10, 1548, Cuzco, Peru), Spanish conqueror and explorer and leader of antiroyal forces in Peru. Pizarro is considered by some historians to be the leader of the first genuine struggle by colonists for independence from Spanish domination in America.

A half brother of Francisco Pizarro, with whom he fought during the conquest of Peru (1531–33), Gonzalo received for his services extensive land grants and was made governor of Quito in 1539. In 1541, with 200 Spaniards, some 4,000 Indians, and numerous horses and other animals, he led an expedition into the unexplored region east of Quito. After his lieutenant, Francisco de Orellana, left him in search of provisions, Pizarro and his men waited in vain for his return. Forced to eat their dogs and horses, they finally staggered back to Quito in August 1542. Only a few Spaniards and no Indians survived the disastrous expedition.

On his return, Pizarro learned that his half brother Francisco had been assassinated in 1541 and that he had been ordered to dismiss his men. The king of Spain had promulgated new laws restricting the privileges of the conquistadores and protecting the rights of the Indians. Objecting to these edicts, the Spaniards intended to fight for their prerogatives and acclaimed Pizarro as the governor of Peru. As the leader of the antiroyal forces, he took the field against the viceroy Blasco Núñez Vela, winning the Battle of Anaquito in 1546, and against the viceroy Pedro de la Gasca in 1548. Defeated and captured by de la Gasca on April 9 of that year, Pizarro was executed the following day.

pizza, dish of Neapolitan origin consisting of a flattened disk of bread dough topped with olive oil, tomatoes, and mozzarella cheese, baked quickly and served hot. Pizza is now eaten throughout Italy—Roman pizza omits tomatoes from the topping and adds onions and olives; the Ligurian pizza resembles the *pissaladière* of Provence in France, with olives, onions, and anchovies.

The popularity of pizza in the United States began with the Italian community in New York City; the first pizzeria appearing there in 1905. After World War II the pizza industry boomed; soon there was scarcely a hamlet without a pizzeria. In the United States sausage, bacon, or ground beef, mushrooms, peppers, shrimps, and even oysters are sometimes added.

PKU (metabolic disorder): *see* phenylketonuria.

PL Kyōdan, in full PERFECT LIBERTY KYŌDAN, religious group or church (Japanese: *kyōdan*) founded in Japan in 1946 by Miki Tokuchika. The movement, unique for the use of English words in its name, is based on the earlier Hito-no-michi sect. It is not affiliated, however, with any of the major religious traditions of Japan. In the late 20th century the group claimed more than 2.5 million adherents worldwide.

Headquarters of the sect are at Habikino, near Ōsaka. PL Kyōdan operates a hospital, a golf course, and other sports facilities. Considerable missionary activity is carried on in Japan and among Japanese living abroad.

PL Kyōdan teaches that the goal of man is joyful self-expression. Forgetting God brings misfortune and suffering, but the believer may pray that his troubles be transferred by divine mediation to his patriarch, who is strengthened for his vicarious suffering by the group's collective prayers.

Plaatje, Solomon Tshekiso (b. 1877, Boshof, Orange Free State, S.Af.—d. June 19, 1932, Kimberley?), linguist, journalist, politician, statesman, and writer whose mind and activities ranged widely both in literary and in African affairs. His native tongue was Tswana, the chief language of Botswana, but he also learned English, Afrikaans, High Dutch, German, French, Sotho, Zulu, and Xhosa.

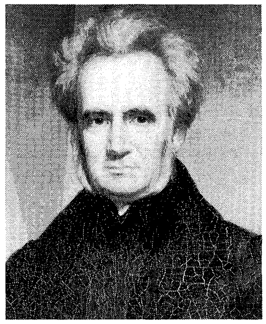
Plaatje used his knowledge of languages in his various roles as war correspondent during the South African War (1899–1902), editor of *Koranta ea Becoana* ("The Tswana Gazette") from 1901 to 1908, editor of *Tsala ea Batho* ("The Friend of the People") beginning in 1912, secretary-general of the South African Native National Congress and member of subsequent delegations to Europe, and contributor to various South African English-language newspapers and British journals. He traveled in Europe, Canada, and the United States with the intent of enlightening the public on the black African's situation in South Africa.

To preserve the traditional Bantu languages, stories, and poetry, Plaatje published his famous *Sechuana Proverbs and Their European Equivalents* (1916), the *Sechuana Phonetic Reader* (with the linguist Daniel Jones) in the same year, and the collection *Bantu Folk-Tales and Poems* at a later date. He also translated a number of Shakespeare's plays into Tswana. His novel *Mhudi* (1930), a story of love and war, is set in the 19th century. The characters are vivid and the style that of a traditional Bantu storyteller (a mixture of song and prose).

Near the end of Plaatje's life the people of Kimberley gave him a gift of land in recognition of his outstanding public service.

Place, Francis (b. Nov. 3, 1771, London—d. Jan. 1, 1854, London), British radical reformer, best-known for his successful campaign for the repeal in 1824 of the antiunion Combination Acts.

The son of a bailiff, Place was drawn into trade club and radical activity after suffering great hardships as a leather-breeches maker. In 1793 he organized an unsuccessful strike of the members of that trade. From 1794 to 1797 he was a member of the London Corresponding Society, one of the first working-class movements. He opened a tailoring shop in 1799 and rapidly became successful.



Place, detail of a portrait by Samuel Drummond, 1833; in the National Portrait Gallery, London

Place was already known as a radical politician when in 1814 he took up the campaign against the Combination Acts, passed in 1799 and 1800, prohibiting the organization of working-class trade associations. In 1824, through Joseph Hume, a member of Parliament, Place brought about the appointment of a parliamentary committee that reported in favour of repealing the acts. Place and Hume argued that repeal would leave the trade and employers' associations equal in status and that, with their legal equity established, it would no longer be necessary for the trade associations to exercise the right to bargain with employers. Manufacturers in turn favoured repeal, feeling that the acts contributed to their difficulty with labour. The repeal legislation passed. The immediate result, however, was an increase in trade unions and their activity. The government, alarmed, failed in its attempt to reverse the repeal, thanks to Place and his allies. In 1831 and 1832 Place rallied the supporters of the Reform Bill in London.

Place's only published book was *Illustrations and Proofs of the Principle of Population* (1822), but his manuscripts and press clippings, an excellent source of political information from 1790 to 1850, are in the British Museum.

placenta, in zoology, the vascular (supplied with blood vessels) organ in most mammals that unites the fetus to the uterus of the mother. It mediates the metabolic exchanges of the developing individual through an intimate association of embryonic tissues and of certain uterine tissues, serving the functions of nutrition, respiration, and excretion.

All of the fetal membranes function by adapting the developing fetus to the uterine environment. Lying in the chorionic cavity (a thin liquid-filled space) between two membranous envelopes (chorion and amnion) is a small balloon-like sac, yolk sac, or vitelline sac, attached by a delicate strand of tissue to the region where the umbilical cord (the structure connecting the fetus with the placenta) leaves the amnion. Two large arteries in the umbilical cord radiate from the attachment of the cord on the inner surface of the placenta and divide into small arteries that penetrate outward into the depths of the placenta through hundreds of branching and interlacing strands of tissue known as villi. The chorionic villi cause the mother's blood vessels in their vicinity to rupture, and the villi become bathed directly in maternal blood. The constant circulation of fetal and maternal blood and the very thin tissue separation of fetal blood in the capillaries from maternal blood bathing the villi provide a mechanism for efficient interchange of blood constituents between the maternal and fetal bloodstreams without (normally) allowing any opportunity for the blood of one to pour across into the blood vessels of the other.

Nutrients, oxygen, and antibodies (proteins formed in response to a foreign substance, or antigen), as well as other materials in the mother's blood, diffuse into the fetal blood in the capillaries of the villi, and nitrogenous wastes and carbon dioxide diffuse out of these capillaries into the maternal blood circulation. The purified and enriched blood in the capillaries of the villi is collected into fetal veins, which carry it back to the inner surface of the placenta and collect at the attachment of the cord to form the umbilical vein. This vein enters the cord alongside the two arteries and carries the blood back to the fetus, thus completing the circuit to and from the placenta.

placenta, plural PLACENTAS, or PLACENTAE, in botany, the surface of the carpel (highly modified leaf) to which the ovules (potential seeds) are attached. The placenta is usually located in a region corresponding somewhat to the margins of a leaf but is actually submarginal in position. The placentation, or arrangement of ovules within the ovary, is frequently of taxonomic value. Placentation is usually submarginal in a simple pistil (female sex organ). In a compound pistil, two or more carpels are used in various ways, placentation being parietal, carpels united by their adjacent margins and the ovules disposed along the inner ovary walls; axile, carpels folded inward and the ovules along the central axis of the ovary; free central, derived from the axile, with a central column bearing the ovules; basal, ovules positioned on a low column at the base of the ovary; or laminar, ovules scattered over the inner surfaces of carpels.

placenta accreta, abnormal adherence of the placenta to the wall of the uterus, so that it remains in the uterus after the baby has been delivered. Although uncommon, placenta accreta poses serious dangers to the mother. If complicated by coexisting placenta praevia (development of the placenta in an abnormally low position near the cervix), severe bleeding before labour is common. If placenta accreta arises on the site of a scar from a former cesarean section, the uterus may rupture during labour. Otherwise, depending on the firmness with which the placenta is anchored, it may be removed manually after the baby is delivered. If such removal is unsuccessful, an immediate total hysterectomy is usually indicated.

placenta praevia, implantation of the placenta at a point so low in the uterus that the placenta is close to the opening into the cervix or covers the opening, either partially or completely. The placenta is the temporary organ that develops during pregnancy to nourish the fetus and to carry away its wastes, and the cervix is the narrow lower portion of the uterus that projects into the vagina. Placenta praevia is suspected if there is painless bleeding during the last three months of pregnancy. The likelihood of the abnormality increases with the number of pregnancies of the individual woman and with the rapidity with which one pregnancy follows another. Untreated, the condition may result in early labour, delivery of a premature or stillborn child, and danger of death to the mother from bleeding. Treatment includes hospitalization, control of the bleeding and replacement of lost blood by transfusion, and delivery of the infant by cesarean section if the mother or the child would be endangered by delivery through the vagina.

placentae abruptio, premature separation of the placenta from its normal implantation site in the uterus. The placenta is the temporary organ that develops during pregnancy to nourish the fetus and carry away its wastes. Placentae abruptio occurs in the latter half of pregnancy and may be partial or complete. The separation causes bleeding, so extensive in cases of complete separation that replacement of the lost blood by transfusion is necessary. In instances of complete placentae abruptio, the infant dies unless delivered immediately. In partial separation the mother is given oxygen, and the infant is delivered as soon as it is safe to do so. The cause of placentae abruptio is not known. It is more common in women who have borne several children and in women suffering from high blood pressure.

placental infarction, formation of yellowish-white or bloodstained deposits of fibrin (a fibrous protein) on the surface or in the substance of the placenta, the temporary organ that develops during pregnancy to nourish the fetus and to carry away its wastes. Formation of placental infarcts is normal during the later stages of the organ's development. The term infarct, which usually signifies an area of dead tissue, is loosely used in this instance. Although extensive placental infarcts are sometimes present in stillbirths and in instances of premature separation of the placenta from its implantation site in the wall of the uterus, the infarcts are thought by most gynecologists and obstetricians not to be the causes of the other abnormalities.

placental mammal, any member of the mammalian infraclass Eutheria, characterized by the presence of a placenta, which facilitates exchange of nutrients and wastes between the blood of the mother and that of the fetus. Some consider the marsupials (infraclass Metatheria) to be placental mammals, but these animals have a less developed, less efficient type of placenta that limits the gestation period. The true placenta of the eutherian allows for a longer developmental period within the protection of the womb, a factor considered to have contributed to the evolutionary success of the eutherians.

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Placentia, town, southeastern Newfoundland, Canada, on the Avalon Peninsula and the east shore of Placentia Bay. Basque fishermen arrived in the 16th century and probably named the site for Plasencia, Spain. In 1662 the French permanently settled the place as Plaisance, which they strongly fortified for use as a base for attacks against the British-held St. John's, 67 mi (108 km) to the northeast. The old fortifications overlooking the town have been preserved as Castle Hill National Historic Site. Plaisance served as capital of the various French settlements in Terre-Neuve (Newfoundland) until the beginning of the British period (1713). Renamed Placentia, it was administered from Nova Scotia (1713–29) and after the fall of Quebec (1759) became the site of a British naval station. In 1941 the Atlantic Charter was signed by Roosevelt and Churchill aboard warships anchored in Placentia Bay. The town's economy is based on fishing and employment at a U.S. naval station in nearby Argentia. Inc. 1945. Pop. (1981) 2,204.

placer deposit, natural concentration of heavy minerals caused by the effect of gravity on moving particles. When heavy, stable minerals are freed from their matrix by weathering processes, they are slowly washed downslope into streams that quickly winnow the lighter matrix. Thus the heavy minerals become concentrated in stream, beach, and lag (residual) gravels and constitute workable ore deposits. Minerals that form placer deposits have high specific gravity, are chemically resistant to weathering, and are durable; such minerals include gold, platinum, cassiterite, magnetite, chromite, ilmenite, rutile, native copper, zircon, monazite, and various gemstones.

There are several varieties of placer deposits: stream, or alluvial, placers; eluvial placers; beach placers; and eolian placers. Stream placers, by far the most important, have yielded the most placer gold, cassiterite, platinum, and gemstones. Primitive mining probably began with such deposits, and their ease of mining and sometime great richness have made them the cause of some of the world's greatest gold and diamond "rushes." Stream placers depend on swiftly flowing water for their concentration. Because the ability to transport solid material varies approximately as the square of the velocity, the flow rate plays an important part; thus, where the velocity decreases, heavy minerals are deposited much more quickly than the light ones. Examples of stream placers include the rich gold deposits of Alaska and the Klondike, the platinum placers of the Urals, the tin (cassiterite) deposits of Malaya, Thailand, and Indonesia, and the diamond placers of the Republic of Zaire.

Eluvial placers form on hillslopes from weathered deposits. They are not acted on by streams but by rainfall and wind, which carry away the light materials; thus they may be considered intermediate in the formation of stream placers. Examples include the earlier worked gold deposits of Australia and the cassiterite placers of Malaysia.

Beach placers form on seashores where wave action and shore currents shift materials, the lighter more rapidly than the heavier, thus concentrating them. Among the examples of beach placers are the gold deposits of Nome, Alaska; the zircon sands of Brazil and Australia; the black sands (magnetite) of Oregon and California; and the diamond-bearing marine gravels of Namaqualand, South Africa.

Eolian placers may form in arid areas where wind, not water, acts as the concentrating agent, removing fine particles of the lighter dross. The gold deposits of some parts of the Australian desert are examples.

placer mining, oldest method of recovering gold from alluvial deposits—*i.e.,* gold-bearing sands and gravel that settle out from rapidly moving streams and rivers at points where they slow down. Placer mining takes advantage of gold's high density, which causes it to sink more rapidly from moving water than the lighter siliceous materials with which it is found. Though the basic principles of placer mining have not altered since early times, methods have improved considerably.

Panning, used by miners during the great gold strikes of the 19th century, employed a pan or a batea (a pan or basin with radial corrugations) in which a few handfuls of the gold-bearing soil or gravel and a large amount of water were placed. By swirling the contents of the pan, the miner washed the siliceous material over the side, leaving the gold and heavy materials behind.

An improvement over the pan and batea was the cradle, named for its resemblance to a child's cradle. As it was rocked, it sifted large quantities of ore. Gravel was shovelled onto a perforated iron plate, and water was poured over it, causing the finer material to drop onto the apron that distributed it across the riffles, pieces of wood or iron perpendicular to the bottom and sides of the cradle. As the material moved through the cradle, the gold was caught on the riffles, to be removed later.

Dredging became the most important placer mining method in the early 20th century and remains so today. Used worldwide is the bucket-ladder dredge, characterized by a continuous chain of buckets rotating around a rigid adjustable frame called the ladder. Paddock dredging, a later development, allows mining of placer deposits even if they are not in or near a riverbed. The dredge floats in its own pond that is continuously extended by digging at one end and simultaneously filled at the other end with waste, or tailings.

In sluicing or hydraulicking methods, a slightly sloping wooden trough called a box sluice, or a ditch cut in hard gravel or rock called a ground sluice, is used as a channel along which gold-bearing gravel is carried by a stream of water. Riffles placed transversely along the bottom of the sluice cause the water to eddy into small basins, retarding the current so that gold may settle and be trapped.

Placetas, city, east central Villa Clara province, central Cuba. Placetas is a commercial and manufacturing centre for the rich agricultural and pastoral hinterland. Tobacco, sugarcane, fruits, and cattle are processed in the city, while gold and asphalt are found in the vicinity. Goods are exported through the port of Caibarién or sent to Santa Clara via the central highway and major railroad. Pop. (1983 est.) 73,456.

Placide, Alexander (b. 1750, France—d. July 26, 1812, New York City), French-born U.S. dancer, mime, acrobat, and impresario who produced in the U.S. such diverse and novel entertainment as ballets, pantomime dramas, patriotic pageants, fencing matches, and bird imitations.

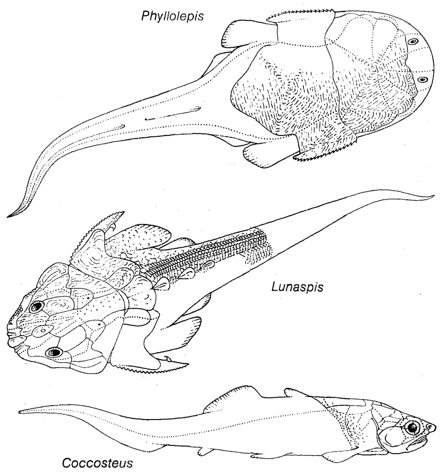
The son of travelling acrobats, Placide studied dance in Paris, had his first theatrical success as a tightrope walker at the court of Louis XVI, and toured Europe with his acrobat troupe. In Santo Domingo he met the dancer and choreographer Suzanne Theodore Vaillande (later Douvillier), who, though not his wife, appeared with him as "Madame Placide" when he performed a "dancing ballot" [*sic*] called *The Bird Catcher* in New York (1792). In 1794 Placide established a dance and pantomime company at the French (later City) Theatre in Charleston, S.C. There, with the choreographer Jean-Baptiste Francisqui and the dancers Jean-Baptiste Val, "Madame Placide," and the young Louis Duport, Placide produced such ballets as Jean-Georges Noverre's *Caprices de Galathée* and Maximilien Gardel's *Chercheuse d'esprit* (*Searchers for Spirit*). He also presented French actors in pantomime dramas and once used the local militia for a spectacle commemorating the Battle of Fort Moultrie. In 1798 he began producing in Savannah and Augusta, Ga. He married the actress and dancer Charlotte Sophia Wrighten in 1796; their son Henry (1799–1870) became one of the most popular U.S. actors of his generation.

Placidia, Aelia Galla (b. *c.* 390—d. Nov. 27, 450), Roman empress, the daughter of the emperor Theodosius I (ruled 379–395), sister of the Western emperor Flavius Honorius (ruled 393–423), wife of the Western emperor Constantius III (ruled 421), and mother of the Western emperor Valentinian III (ruled 425–455).

Captured in Rome when the city fell to the Goths in 410, she was carried off to Gaul and married (414) to the Visigothic chieftain Ataulphus, who was assassinated in 415. In 416 Galla Placidia was restored to the Romans, and the following year she was married to Constantius. She adorned Ravenna with a number of churches; the small chapel usually—though wrongly—known as the Mausoleum of Galla Placidia contains some of the finest examples of early Byzantine mosaics.

placoderm, any member of an extinct class (Placodermi) of primitive fishes known only from fossil remains. Placoderms existed throughout the Devonian period (408,000,000–360,000,000 years ago), but only two species persisted into the succeeding Carboniferous period. During the Devonian they were a dominant group, occurring in all continents except South America in a variety of marine and freshwater sediments.

Most placoderms were small or moderate in size, but a few may have reached a length of



Representative placoderms
By courtesy of E.A. Stensio

13 feet (4 metres). The name is derived from their characteristic armour of dermal, or skin, bones. This armour formed a head shield and a trunk shield, the two commonly connected by a paired joint in the neck region. The arrangement of bones is so different from that of modern fishes with bony skeletons that it is unlikely that the bones of the two groups are homologous (similar in origin).

The earliest placoderms were heavily armoured, bottom-dwelling (benthic) fishes; they were poor swimmers. Many later forms became highly specialized for this way of life. Others became adapted for fast swimming between the surface and the bottom (*i.e.,* were nektonic). The sluggish benthic placoderms had small, ventrally placed mouths and presumably fed on bottom detritus and small invertebrates. Fossil remains indicate that some species had heavy, blunt jaw plates adapted for crushing hard-shelled invertebrates, while others were able to open their jaws wide enough to swallow smaller fish.

The origin of the placoderms is unknown, although it is possible that they may have shared a common ancestor with the sharks, skates, and rays. Some authorities speculate that one order (Ptyctodontida) may have given rise to the modern class Holocephali, of which the chimaeras are the only living representatives.

Plafond (French: Ceiling), French card game popular in Europe in the 1920s, a predecessor of Contract Bridge. Trick values and scoring were as in Auction Bridge except that, as in Contract Bridge, only tricks bid and made counted toward game; overtricks scored 50 points each in the honour score, which did not count toward game score, and slams, bid or unbid, scored 100 points for small and 200 points for grand. In 1925–26 Harold S. Vanderbilt, expert Auction Bridge player, revised the scoring table and added the factor of vulnerability. His changes were incorporated into the game of Contract Bridge, which replaced Plafond in popularity in the 1930s.

plagiarism, the act of taking the writings of another person and passing them off as one's own. The fraudulence is closely related to forgery and piracy—practices generally in violation of copyright laws.

If only thoughts are duplicated, expressed in different words, there is no breach of contract. Also, there is no breach if it can be proved that the duplicated wordage was arrived at independently.

plagioclase, any member of the series of abundant feldspar minerals usually occurring as light-coloured, glassy, transparent to translucent, brittle crystals. Plagioclase is a mixture of albite (*Ab*), or sodium aluminosilicate ($NaAlSi_3O_8$), and anorthite (*An*), or calcium aluminosilicate ($CaAl_2Si_2O_8$); the two intermingle and form a continuous chemical range (called a solid-solution series) between albite and anorthite (the end-members of the series). Intermediate members are homogeneous mixtures of the pure end-members. Divided according to their composition, the members of the plagioclase series are named in the Table.

Most of the crystals of the members of this series exhibit microscopic, repeated lamellar albite twinning; this produces the fine parallel striations observed on some surfaces. The twinning sometimes causes an iridescence, usually blue or green, that may arise either from reflection or diffraction at the edges of the lamellae, or from diffusion by adjoining areas with different optical properties.

Plagioclase is used in the manufacture of glass and ceramics; the iridescent varieties peristerite and labradorite are valued as gemstones or ornamental material. The primary importance of plagioclase, however, derives from its role in rock formation. Oligoclase, the most common plagioclase, occurs in granite, diorite, and other acidic igneous rocks and in some metamorphic rocks; notable occurrences are at Aust-Agder, Norway, and Fine, N.Y., United States. Andesine, less common, occurs in many granular and volcanic rocks with medium silica content, as in Marmato, Colom., and Bodenmais, Bavaria, Ger. The rarest plagioclase is bytownite, which occurs in basic igneous rocks and in stony meteorites. For detailed physical properties of the plagioclase series, *see* feldspar (table).

Composition of the plagioclase minerals

mineral	composition (in percent)
albite	100–90 *Ab*; 0–10 *An*
oligoclase	90–70 *Ab*; 10–30 *An*
andesine	70–50 *Ab*; 30–50 *An*
labradorite	50–30 *Ab*; 50–70 *An*
bytownite	30–10 *Ab*; 70–90 *An*
anorthite	10–0 *Ab*; 90–100 *An*

plague, an infectious fever caused by the bacillus *Yersinia pestis,* transmitted by the rat flea. It is primarily a disease of rodents, and epidemics in human beings originate in contact with the fleas of infected rodents. The disease in man has three clinical forms: bubonic, characterized by swelling of the lymph nodes (buboes); pneumonic, in which the lungs are extensively involved; and septicemic, in which the bloodstream is so invaded by *Yersinia* that death ensues before the bubonic or pneumonic forms have had time to appear. Plague as spread from rats to man in crowded urban areas is sometimes called murine (rat) or urban plague; plague in desert or rural areas where the human population is sparse but the wild rodent population large and infected may be called sylvatic (woodland) or campestral (field).

In the 14th century, when this disease was known as the Black Death (*q.v.*), some plague infections were bubonic and some were pneumonic. The number of deaths was enormous, reaching in various parts of Europe two-thirds or three-fourths of the population in the first pestilence. It has been calculated that one-fourth of the population of Europe, or 25,000,000 persons, died from plague during the great epidemic.

The Great Plague of London in 1664–65 resulted in more than 70,000 deaths in a population estimated at 460,000. An outbreak in Canton and Hong Kong in 1894 left 80,000 to 100,000 dead, and within 20 years the disease spread from the southern Chinese ports throughout the whole world, resulting in more than 10,000,000 deaths.

Plague is primarily a disease of rodents, and man enters only accidentally into the usual cycle. This cycle—rodent–flea–rodent—as a rule is enzootic (present in an animal community at all times but occurring in only small numbers of cases), but under certain environmental conditions it reaches epizootic proportions (affecting many animals in any region at the same time). In some areas plague-infected rats from ships spread the infection in ports, where it became epizootic.

Spread of the infection among domestic rodents in the vicinity of human habitations creates conditions favourable for outbreaks of human plague, for when an epizootic outbreak reduces the rodent population, fleas from the dead animals fail to find another rodent host and thus begin to infest man. At first the cases are sporadic, but under suitable conditions large numbers of persons may be included.

The illness in man varies within the widest limits, exhibiting all gradations of severity from mere indisposition to violent death. The mild infections are almost always bubonic; pneumonic and septicemic plague are invariably severe and almost always fatal unless treated. The incubation period is usually three to six days but may be as short as 36 hours or as long as 10 days. As a rule the onset is sudden and well marked.

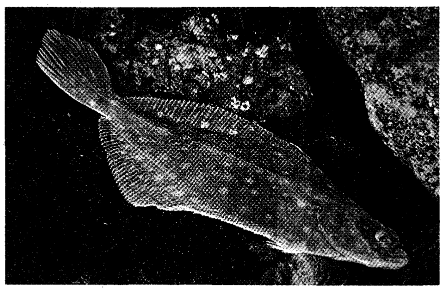
Bubonic plague constitutes about three-fourths of plague cases. Typically, bubonic plague starts with shivering, then vomiting, headache, giddiness, intolerance to light; pain in the back and limbs; sleeplessness, apathy, or delirium. The temperature rises rapidly to 104° F (40° C) or higher and frequently falls two or three degrees on the second or third day, with marked prostration. Constipation is usual; diarrhea is a grave sign. Most characteristic is the early appearance of buboes, which are usually distributed in the groin and armpits. Bubonic plague is not directly infectious from man to man; the bacillus is carried from one person to another by the flea.

In pneumonic plague the physical signs are those of bronchopneumonia; edema (filling with fluid) of the lungs soon follows; and death occurs in three or four days. Septicemic plague is marked by prostration and brain damage; death may occur within 24 hours. Septicemic plague may prove fatal before there is time for pneumonia to develop. If, however, pneumonia does occur, the patient becomes highly infectious. His contacts will contract pneumonic, not bubonic, plague. Pneumonic plague is nearly always fatal.

Treatment is primarily with streptomycin, tetracycline, and sulfonamides. Penicillin is without effect against plague.

The suppression of epidemic plague is attempted by appropriate sanitary measures directed simultaneously against fleas and rodents and isolation of the sick and the handling with greatest caution of all infectious material. A vaccine is available and may be used in endemic areas for people likely to be exposed to rodents and their fleas.

plaice (*Pleuronectes platessa*), commercially valuable European flatfish of the family Pleuronectidae. The plaice, like others of its family, normally has both eyes on the right side of



Plaice (*Pleuronectes platessa*)
Jacques Six

the head. It also has about four to seven bony bumps near its eyes. It reaches a maximum length of about 90 centimetres (36 inches) and is strikingly coloured, with red or orange spots on a brown background.

Another North Atlantic member of the family Pleuronectidae is the American plaice (*Hippoglossoides platessoides*). It is found both in Europe, where it is called the rough dab, and in America. It is a reddish or brownish fish and grows to about 60 centimetres long.

Plaid Cymru (Welsh: Party of Wales), English byname WELSH NATIONALIST PARTY, a political party founded in August 1925 and seeking self-government for Wales and preservation of the Welsh language and culture. Plaid Cymru seeks dominion status for Wales, which would give Wales a seat in the United Nations and a place in international life. The party majority favours devolution, which would include a Welsh parliament and maintenance of links with the United Kingdom. A minority calls for independence. A referendum in 1979 showed that 20 percent of Welsh voters favoured devolution, the same percentage as the proportion of native Welsh speakers. The party's social policies, with their emphasis on decentralization and cooperation, reflect Welsh political tradition.

When J.E. Jones was appointed general secretary in 1930, its membership was about 500, but by 1980 it was 30,000 which included working-class elements brought in by the economic crisis in Wales. L.E. Valentine was the party's first president, but during the 1930s its policy was developed mainly under the leadership of Saunders Lewis. In 1966, in a by-election, the party won its first seat in the House of Commons. Though the seat was lost in 1970, the party took three seats in 1974 and two in 1979 and again in 1983. The party is also represented in local governments and councils.

plain, any relatively level area of the Earth's surface exhibiting gentle slopes and small local relief. Plains vary widely in size. The smallest occupy only a few hectares, whereas the largest cover hundreds of thousands of square kilometres—as, for example, the Great Plains of North America and the expanse of gently undulating land that sweeps from the Pyrenees Range on the French–Spanish border across northern Europe and Asia almost halfway around the world nearly to the Bering Sea.

Occupying slightly more than one-third of the terrestrial surface, plains are found on all continents except Antarctica. They occur north of the Arctic circle, in the tropics, and in the middle latitudes. Corresponding to their broad geographical distribution, the plains of the world show considerable variation in vegetation. Some are tree covered and others are grassy. Still others support scrub brush and bunch grass, while a few, which are nearly waterless deserts, have only the most sparse and scanty plant life. *See* Pampa; prairie.

The major plains of North America, South America, Europe, and Asia occur in the continental interiors, but broad extensions of some of these flat lands reach the Atlantic coast. The largest plains of Africa occupy a vast portion of the Sahara and extend southward into the Congo and Kalahari basins. Most of the interior of Australia, from the mountains along the eastern margin to the plateaus in the far west, is one vast desert plain.

The majority of the world's most extensive plains were formed as a result of the dominance of erosional and depositional processes over tectonic activity—*e.g.,* uplift or subsidence of the Earth's crust. By contrast, a large number of smaller plains developed in areas where crustal deformation was quite intense. Most of these consist of depressed crustal segments that have been partly filled by sand, clay, and rock debris deposited by streams from adjoining highlands.

With certain exceptions, plains have become the sites of major centres of population, industry, commerce, and transportation. Their flat surfaces are easily cultivated and usually contain the most productive soil. Moreover, such areas of low relief present few obstacles to land transportation, and the rivers running across them are generally much easier to navigate than are those of rougher terrain.

plain, abyssal (deep-sea formation): *see* abyssal plain.

Plain, The, French LA PLAINE, in the French Revolution, the deputies of the centre in the National Convention who were the numerical majority. At first, such Plain leaders as Abbé Sieyès and Bertrand Barère backed the moderate Girondins but later gradually turned to the more radical Montagnards, joining the regicides in casting many votes for the execution of Louis XVI in January 1793. Both sides thus courted the favour of The Plain, whose majority support was essential. In July 1794 their numbers succeeded in helping to overthrow Robespierre and other extreme Jacobins. In November 1799, Sieyès was a leader in the coup that overthrew the Directory and brought Napoleon Bonaparte to power.

plain stitch, also called JERSEY STITCH, FLAT STITCH, or STOCKINETTE STITCH, basic knitting stitch in which each loop is drawn through other loops to the right side of the fabric. The loops form vertical rows, or wales, on the fabric face, giving it a sheen, and crosswise rows, or courses, on the back.

Plain-stitch knitting is a filling knit construction and can be made by hand and on both flat and circular knitting machines. The fabric produced is flatter and lighter in weight than other knit types, with more stretch in the width than in the length. The plain stitch is used for underwear, hosiery, T-shirts, gloves, and sweaters.

plain weave, also called TABBY WEAVE, simplest and most common of the three basic textile weaves. It is made by passing each filling yarn over and under each warp yarn, with each row alternating, producing a high number of intersections. Plain-weave fabrics that are not printed or given a surface finish have no right or wrong side. They do not ravel easily but tend to wrinkle and have less absorbency than other weaves.

The visual effect of plain weave may be varied by combining yarns of different origins, thickness, texture, twist, or colour. Fabrics range in weight from sheer to heavy and include such types as organdy, muslin, taffeta, shantung, canvas, and tweed. Variations of the plain weave include the rib weave, with either warp or filling yarns heavier, as in dimity and bengaline, and the basket weave, in which two or more filling yards, or a single heavier yard, pass alternately over and under two or more warp yarns, as in oxford shirting and monk's cloth.

plainchant, also called PLAINSONG, the Gregorian chant (*q.v.*) and, by extension, other similar religious chants. The word derives from the 13th-century Latin term *cantus planus* ("plain song"), which referred to the unmeasured rhythm and monophony (single line of melody) of Gregorian chant, as distinguished from the measured rhythm of polyphonic (multipart) music, which was called *cantus mensuratus* or *figuratus* ("measured" or "figured" song).

Its principal other application is to ancient Christian music with the same unmeasured rhythm and monophony—in the West, Ambrosian, Gallican, and Mozarabic chants (*qq.v.*); in the East, Byzantine, Syrian, Coptic, Ethiopian, and Armenian chants (*qq.v.*). It may also refer to similar non-Christian religious music, such as Jewish and Hindu chants.

Plainfield, city, Union County, New Jersey, U.S., at the base of the Watchung Mountains. The site was settled as Milltown, named for its large gristmill, in the 18th century and was incorporated as a township in 1847. Although now primarily a residential southwestern suburb of New York City, it is a focal point for a number of surrounding towns including North and South Plainfield, Scotch Plains, and Watchung. It has developed some major industries, including the manufacture of printing machinery, aircraft parts, electronic equipment, and glue. Drake House Museum (1746) served as Gen. George Washington's headquarters in 1777 and now houses the Historical Society of Plainfield and North Plainfield. Inc. city, 1869. Pop. (1980) 45,555.

Plains, town, Sumter County, southwest central Georgia, U.S., 10 mi (16 km) west-southwest of Americus. A post office was established there in 1839, and when the railroad was built in 1885 several local settlements, including Magnolia Springs (or Village) and the Plains of Dura (named for the biblical plain near Babylon), regrouped to form Plains, which was incorporated in 1896. The town became a tourist attraction in the late 1970s as the hometown of Jimmy Carter, 39th president of the United States. Pop. (1980) 651.

Plains Indian, also called BUFFALO INDIAN, member of an aboriginal people formerly inhabiting the Great Plains of what is now the central United States and south-central Canada, between the Mississippi River and the Rocky Mountains. The Plains Indians included groups speaking Algonkian, Siouan, Caddoan, Uto-Aztecan, Athabascan, and Kiowa-Tanoan languages.

A brief treatment of the Plains Indians follows. For full treatment, *see* MACROPAEDIA: American Indians.

Most of the Plains Indians were nomadic big-game hunters, and their primary game was the American bison, or buffalo, which supplied them with food, shelter, clothing, and bone tools. Other game included antelope, deer, and elk. Hunting, usually a tribal activity, involved driving the game down a cliff or into a corral or encircling it by fire. These nomadic tribes were made up of smaller local units called bands, which came together only for the summer communal hunt or for major religious ceremonies. The Teton Dakota and Cheyenne were typical nomadic tribes.

A few tribes, though mainly nomadic, practiced horticulture, produced pottery, and resided in fixed villages for part of the year. These semisedentary tribes spent part of the time planting and harvesting crops, which consisted of corn (maize), beans, squash, and sunflowers. The Pawnee, Mandan, Hidatsa, and Arikara were typical semisedentary tribes.

There were no hereditary social classes among the Plains Indians, although wealth and standing could be won through prowess at war, generosity to the poor, sharing goods with relatives, and lavish hospitality. Because individualism and violent experience were highly valued by almost every tribe, military organizations and clubs were often established in order to channel intratribal aggressiveness. Women participated in many of these associations, although they had their own societies among the Mandan and Hidatsa.

Local bands and villages were composed of families and kinship groups, which could be patrilineal (as among the Iowa, Kansa, Omaha, Osage, and Ponca), matrilineal (as among the Hidatsa, Mandan, and Crow), or both. Marriages were generally monogamous and were ordinarily arranged between the families of the bride and groom. Children were trained for adulthood as part of their play, and relatives often played important roles in their upbringing. Boys were given bows and arrows at a very early age, while girls were taught domestic skills by their mothers.

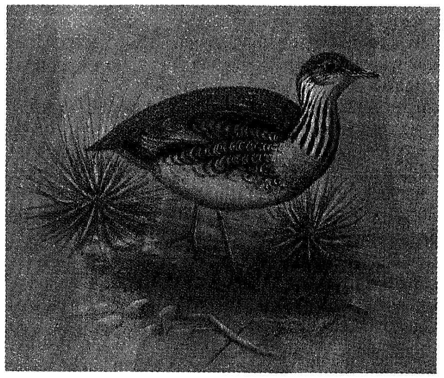
Before the appearance of European explorers, Indian tools were made of bone, horn, antler, and stone. Animal skins were used for clothing, receptacles of various kinds, and tepees, which were portable, cone-shaped tents. Basketry and pottery were known among the semisedentary tribes. Until horses were introduced by the Spaniards, dogs were probably the only domesticated animals. The introduction of the horse had a profound impact on Plains life, revolutionizing the hunt and warfare and providing a valuable commodity for both trade and theft, which latter in turn stimulated warfare.

Although some tribes, such as the Atsina, believed in a supreme deity, other tribes, such as the Crow, did not. However, rituals ranging from simple rites to ceremonies lasting weeks were common to almost all of the Plains Indians. Each tribe had a medicine man, or shaman, who was responsible for such activities as curing illness and locating enemies, game, or lost objects. Much importance was attached to visions, and success in life was attributed to the intervention of friendly spirits.

The culture of the Plains Indians changed radically as white settlers moved into the region. Systems of status and rank collapsed when the buffalo was virtually exterminated in the late 19th century, and native crafts declined as manufactured articles, such as metal utensils and cloth, were introduced. Even greater disturbances resulted when the Indians were placed on reservations. Nomadic groups found cattle a poor replacement for buffalo, and semisedentary groups, who considered cultivation to be women's work, resisted the change in the division of labour brought on by the introduction of the plow. Misunderstandings arose when matrilineal groups had to adopt father-son inheritance lines, and confusion resulted when government officials tried to list Indian families by surnames, which they did not possess. Although the Indians resisted such changes, they were ultimately overwhelmed, and those Indians who did manage to adapt to the white man's culture often found themselves in a difficult position among their own people.

Plains of ———: *see under* substantive word (*e.g.*, Abraham, Plains of).

plains wanderer, also called COLLARED HEMIPODE (*Pedionomus torquatus*), Australian bird resembling a tiny quail. It has a mottled reddish brown body and a collar of black spots against a white throat. The plains wanderer



Plains wanderer (*Pedionomus torquatus*)
Painting by Murrell Butler

constitutes the family Pedionomidae (order Gruiformes) but is placed by some authorities in the button quail family (Turnicidae). They inhabit dry grasslands. Unlike other hemipodes, the plains wanderer does not have a crouching posture.

plainsong (music): *see* plainchant.

Plainview, city, seat (1888) of Hale County, northwestern Texas, U.S., on the High Plains between Amarillo and Lubbock (40 mi [64 km] south). The site was surveyed in 1887 by Z.T. Maxwell and E.L. Lowe, who named it Plainview because of the unbroken view to the horizon. The settlement remained a trading post for cattlemen until the railroad arrived in 1907, when it was incorporated as a city. On Running Water Draw, it is now a service centre for extensive farmlands, irrigated by thousands of wells and growing chiefly wheat, cotton, castor beans, grain sorghums, and vegetables. Industries are farm based and include meat-packing and the manufacture of irrigation equipment. It is the seat of Wayland Baptist College (1909). Pop. (1980) 22,187.

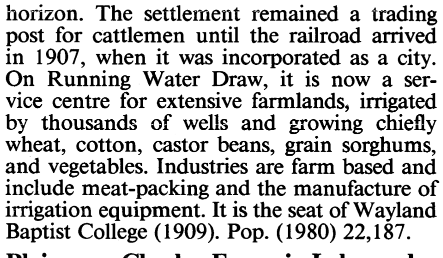
Plaisance, Charles-François Lebrun, duc de (duke of): *see* Lebrun, Charles-François.

Plaisancian Stage: *see* Piacenzan Stage.

Planalto Central (Brazil): *see* Brazilian Highlands.

planarian, any of a group of widely distributed, mostly free-living flatworms of the invertebrate class Turbellaria (phylum Platyhelminthes). *Planaria* is the name of one genus, but the name planarian is used to designate any member of the family Planariidae and related families.

Most planarians occur in fresh water and are sometimes seen in large masses; some species are marine, others are terrestrial. Some forms are parasitic; *i.e.,* they obtain nourishment from the body of another living animal.



Planarian (*Dugesia*)
William H. Amos—Helen Wholberg, Inc.

The body, when elongated, is soft, leaf-shaped, and ciliated. The spade-shaped head has two eyes and sometimes tentacles. The tail is pointed. The mouth is on the ventral, or lower, side, often more than half-way toward the tail. A body cavity, or coelom, is absent. The pharynx, which may be protruded from the mouth, ends in an intestine that is usually blind. The length is usually about 3 to 15 mm (0.1 to 0.6 inch); some grow to more than 30 cm (about 1 foot) long. Tropical species are often brightly coloured. Members of the North American genus *Dugesia* are black, gray, or brown.

Planarians swim with an undulating motion or creep like slugs. Most are carnivorous night feeders. They eat protozoans, tiny snails, and worms. All are hermaphroditic; *i.e.,* functional reproductive organs of both sexes occur in the same individual. The reproductive organs begin to develop in early autumn. Cocoons containing fertilized eggs are laid in spring. Fully developed young emerge and develop without metamorphosis (*i.e.,* radical change). In *Planocera* a larval stage is passed in the egg case. In some species, the organism in the cocoon divides into two parts, each of which develops into a complete individual. New individuals, called buds, form at the tail end of others in the genus *Microstomum* and may remain attached to the parent for some time; chains formed of three or four buds sometimes occur. Because of their remarkable ability to regenerate lost parts, planarians are often used experimentally in the laboratory.

Planasia (Italy): *see* Pianosa Island.

Planck, Max (Karl Ernst Ludwig) (b. April 23, 1858, Kiel, Schleswig [Germany]—d. Oct. 4, 1947, Göttingen, W.Ger.), theoretical physicist who originated quantum theory. For that achievement he was awarded the Nobel Prize for Physics in 1918.

A brief account of the life and works of Max Planck follows; for a full biography, *see* MACROPAEDIA: Planck.

Planck—whose forebears were scholars, lawyers, and public servants—was sent to the Maximilian Gymnasium in Munich, where he chose science as a career over his other great love, music. He went to Berlin to study with H.L.F. von Helmholtz and G.R. Kirchhoff but returned to Munich to take his doctorate in 1879 on the second law of thermodynamics. He became *Privat-Dozent* at the University of Munich in 1880 and extraordinary professor of theoretical physics at Kiel in 1885. Two years later he was made professor of theoretical physics at Berlin, where he lived for the rest of his life. In 1930 he had become president of the Kaiser Wilhelm Society in Berlin (after World War II, the Max Planck Society).

In 1900 Planck formulated the correct mathematical description of thermal radiation from a perfect absorber (blackbody) and showed that the formulation required a discontinuous process of emission or absorption involving discrete quantities of energy. Those discoveries initiated the field of quantum physics and earned for Planck the Nobel Prize.

Planck's constant (symbol h), fundamental physical constant characteristic of the mathematical formulations of quantum mechanics, which describes the behaviour of particles and waves on the atomic scale, including the particle aspect of light. The German physicist Max Planck introduced the constant in 1900 in his accurate formulation of the distribution of the radiation emitted by a blackbody, or perfect absorber of radiant energy (*see* Planck's radiation law). The significance of Planck's constant in this context is that radiation, such as light, is emitted, transmitted, and absorbed in discrete energy packets, or quanta, determined by the frequency of the radiation and the value of Planck's constant. The energy E of each quantum, or each photon, equals Planck's constant h times the radiation frequency symbolized by the Greek letter nu, ν, or simply $E = h\nu$. A modified form of Planck's constant called h-bar ($\hbar$), or Dirac h, frequently appears in the formulations of quantum mechanics, in which $\hbar$ equals h divided by 2π.

The dimension of Planck's constant is the product of energy multiplied by time, a quantity called action. Planck's constant is often defined, therefore, as the elementary quantum of action. Its value in metre-kilogram-second units is $6.6260755 \times 10^{-34}$ joule-second.

Planck's radiation law, a mathematical relationship formulated in 1900 by Max Planck, a German physicist, to explain the spectral-energy distribution of radiation emitted by a blackbody (a hypothetical body that completely absorbs all radiant energy falling upon it, reaches some equilibrium temperature, and then reemits that energy as quickly as it absorbs it). Planck assumed that the sources of radiation are atoms in a state of oscillation and that the vibrational energy of each oscillator may have any of a series of discrete values but never any value between. Planck further assumed that when an oscillator changes from a state of energy E_1 to a state of lower energy E_2, the discrete amount of energy $E_1 - E_2$ is emitted as a photon, or quantum of radiation. The energy of this quantum is equal to the product of the frequency of the radiation, symbolized by the Greek letter nu, ν, and a constant, h, now called Planck's constant; *i.e.,* $E_1 - E_2 = h\nu$.

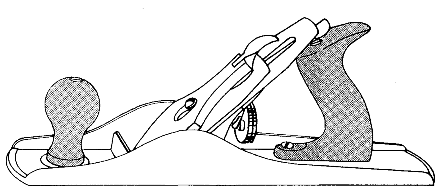
Planck's law for the energy E_λ radiated per unit volume by a cavity of a blackbody in the wavelength interval λ to $\lambda + \Delta\lambda$ ($\Delta\lambda$ denotes an increment of wavelength) can be written in terms of Planck's constant (h), the speed of light (c), the Boltzmann constant (k), and the absolute temperature (T):

$$E_\lambda = \frac{8\pi hc}{\lambda^5} \times \frac{1}{\exp(hc/kT\lambda) - 1}.$$

The wavelength of the emitted radiation is inversely proportional to its frequency, or $\lambda = c/\nu$. The value of Planck's constant is found to be $6.6260755 \times 10^{-34}$ joule-second.

For a blackbody at temperatures up to several hundred degrees, the majority of the radiation is in the infrared region of the electromagnetic spectrum. At increasingly higher temperatures, the total radiated energy increases, and the intensity peak of the emitted spectrum shifts to shorter wavelengths so that a significant portion is radiated as visible light.

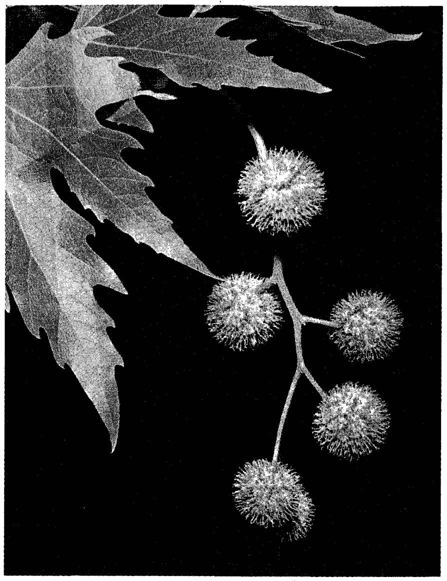
plane, in carpentry, tool made in a wide variety of sizes, used for removing rough surfaces on wood and for reducing it to size. An iron-soled carpenter's plane, found on the site of a Roman town, near Silchester,



Carpenter's hand plane

Hampshire, Eng., dates from before AD 400. Many European guild craftsmen of the Middle Ages worked with beautifully decorated metal planes. Planes today are mostly machine-made, of wood and steel. Plow, or grooving, planes are used for forming channels or grooves; a wide variety of special models are employed for running moldings.

plane tree, any of the 10 species of the genus *Platanus,* the only genus of the family Platanaceae. These large trees are native in North America, eastern Europe, and Asia and are characterized by scaling bark; large, deciduous, usually palmately lobed leaves; and globose heads of flower and seed. The plane trees bear flowers of both sexes on the same tree but in different clusters. The sycamore maple (*Acer pseudoplatanus*), often called sycamore, plane, or mock plane, is distinct (*see* maple).



Leaves and seedballs of the Oriental plane tree (*Platanus orientalis*)
A to Z Botanical Collection—EB Inc.

The American plane tree, or sycamore (*P. occidentalis*), also known as buttonwood, buttonball, or whitewood, is the tallest, sometimes reaching a height of more than 50 m (160 feet). Its pendent, smooth, ball-shaped seed clusters usually dangle singly and often persist after leaf fall. Native from southeastern Europe to India, the Oriental plane (*P. orientalis*) reaches 30 m (100 feet) with huge, often squat boles—some measuring nearly 10 m in circumference (about 10 feet in diameter). Its bristly seedballs hang in clusters of two to six. The London plane (*P. acerifolia*), a hybrid between the American and the Oriental planes, combines characteristics of both in varying degrees. It is a little shorter and more squat than the American tree and usually has bristly, paired seedballs. There are variegated forms of London plane. The California sycamore (*P. racemosa*), about 25 m (80 feet) tall, has contorted branches, thick leaves, and bristly seedballs in groups of two to seven.

The London plane is planted widely in cities for its resistance to air pollution and to diseases that more readily affect other plane trees. All planes grow rapidly and furnish quick shade. Many are picturesque in winter for their patchy bark: as the outer bark flakes off, inner bark shows up in shades of white, gray, green, and yellow.

planer, metal-cutting machine in which the workpiece is firmly attached to a horizontal table that moves back and forth under a single-point cutting tool. The tool-holding device is mounted on a crossrail so that the tool can be fed (moved) across the table in small, discrete, sideward movements at the end of each pass of the table. Since the cutting tool can be moved at almost any angle, a wide variety of grooves and surfaces can be generated. The length and speed of its table travel also may be adjusted.

Mechanical planers, or surfacers, also are used for smoothing wood to an even thickness. The planer consists of a frame, a bed that can be moved up and down, feed rolls, a feeding mechanism, and a cylindrical cutting head holding three or more knives that pare off the excess wood. Models range from the single planer, which smooths one surface of a board at a time, to machines that can finish several surfaces simultaneously. Planer sizes are indicated by the width of work that can be accommodated, ranging from 18 to 50 inches (about 45 to 125 centimetres).

planet (Greek *planētes,* "wanderers"), any body (except a comet, meteoroid, or satellite) revolving in an orbit around the Sun or around some other star. (*See also* individual articles on the solar system's major planets, listed below.) The nine major planets known to revolve around the Sun are (in order of increasing distance from it): Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, and Pluto. The inner four are sometimes called the terrestrial planets; and the term giant planets denotes the group Jupiter–Neptune. Between these groups is a belt of numerous, very small bodies called asteroids, or sometimes the minor planets.

In primitive astronomy the term planet was applied to the seven celestial bodies that were observed to move appreciably against the background of the apparently fixed stars. These included the Sun and Moon, as well as the five true planets (Mercury, Venus, Mars, Jupiter, and Saturn) readily visible as celestial wanderers before the invention of the telescope. The names of these seven bodies are still connected, in some languages, with the days of the week.

In astrology great importance is placed on the positions of the various planets in the 12 constellations of the zodiac, the belt around the sky in which the movements of Sun, Moon, and planets are confined.

Deviations in the proper motions—motions relative to the background of apparently fixed, distant stars—of several nearby stars indicate that they may be accompanied by dark, planet-like bodies too faint to be seen directly from the Earth.

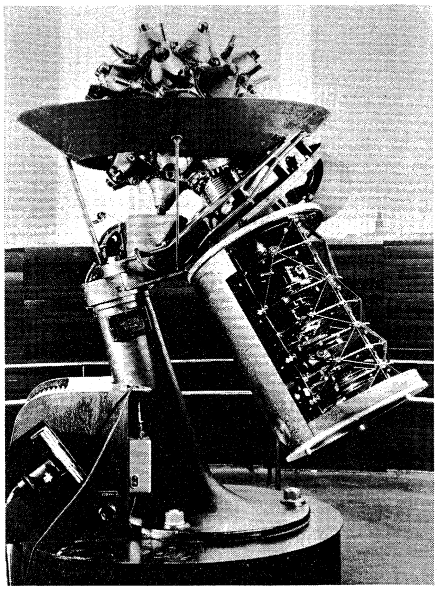
Where the same name may denote a person, place, or thing, the articles will be found in that order

Planet X, supposed planet of the solar system 10th in distance outward from the Sun, surmised on the basis of calculations of its effect on the orbits of Halley's Comet and of the planets Neptune and Pluto.

At the time its existence was proposed (1972), the planet was stated to be located in the direction of the constellation Cassiopeia. Planet X was calculated to have a mass approximately three times that of Saturn and a period of revolution around the Sun of about 500 years; its orbit was believed to be inclined to the ecliptic (the plane of the Earth's orbit) at 120°.

Within a year after the proposal of Planet X, other astronomers demonstrated that a body with the suggested mass and orbit would have perturbed the orbits of the known outer planets by amounts wholly incompatible with the observed paths. In addition, they showed that if the density and the albedo (reflective power) of Planet X had plausible values, it should be visible by standard astronomical techniques. Careful examination of photographic records disclosed no evidence of Planet X.

planetarium, institution devoted to popular education in astronomy and related fields, especially space science, and in which the principal teaching arrangement is a hemispherical screen onto which images of celestial objects as seen from Earth are projected from an instrument also known as a planetarium, or planetarium projector. The term was originally used to describe teaching or exhibit devices designed to portray the orbital motions of the planets and their satellites. Such devices consisted of small globes, representing the planets, that were mounted on wire rods supported and geared at a central pedestal, with a globe for the Sun at the top. Many included the major satellites known at the time of construction. Also called orreries (after the English sponsor of one built in 1712), these devices could be quite elaborate and accurate (*see* orrery).



First modern planetarium projector, built by the Carl Zeiss firm in 1923

By courtesy of Carl Zeiss, Oberkochen, Ger.

Planetarium installations vary greatly. Some have extensive exhibit space, museum collections, and sizable professional and support staffs. The projection dome may have a diameter of 25 metres (82 feet) or more and a seating capacity in excess of 600. Others are large enough to accommodate only a small group of people and might better be described as teaching aids than as institutions.

At the heart of every planetarium is the projection instrument. Here, too, the range is great. Perhaps the best known name in the field is Zeiss; since World War II, projectors have been constructed in a new Zeiss factory in Oberkochen, Ger., as well as in the original Zeiss plant at Jena, Ger., where the first projector was built in 1923. Modern Zeiss instruments are large, technically advanced combinations of lenses, lights, gears, and motors designed to place the planets, Sun, and Moon in their correct locations among the stars for thousands of years past and future. Star images are projected from two spherical units, one for the northern sky and one for the southern sky, while images of the other celestial objects are projected from separate devices supported in a latticework cage between the star balls. The goal is to create a highly realistic artificial sky. Auxiliary projectors produce horizon scenes, the Milky Way, comets, meteors, and the reference lines used for teaching descriptive astronomy and celestial navigation.

Other planetarium projectors are less complex but accomplish the same purpose of creating an artificial sky that can be used for teaching purposes. Manufacturers in Japan and the United States compete with Zeiss, producing an array of instruments appropriate for a variety of dome sizes and for different purposes.

In a typical planetarium, demonstrations—or sky shows, as they are commonly called—are offered to the public on a regular schedule. The astronomy theme is often embellished by music, special effects of all kinds, and a narration that is usually prepared in advance and taped by a professional skilled in this type of dramatic interpretation. There is a trend toward automation of the program to assure that all visitors experience essentially similar presentations on the current theme.

When the first planetarium was opened at the Deutsches Museum in Munich in 1923, it was described as a "schoolroom under the vault of the heavens." Special sky shows for school children remain an essential part of the program in nearly every installation, with the content often integrated with the science curriculum of the local schools. Lectures in the basics of descriptive astronomy are given to college classes, and the facilities are commonly used for courses or lectures in a continuing-education program, sometimes for credit by arrangement with a local college or university.

Although concentric seating around the central projector in the domed theatre remains the most common arrangement, there have been experiments with unidirectional seating. Horizons have been tilted in the construction of some theatres to give audiences a more objective view of the artificial sky. A recent trend in "space theatres" places emphasis on wide-angle motion pictures in a tilted or distorted hemisphere, with projected star fields in a secondary role. Cathode-ray projection systems currently being developed may eventually replace the optical–mechanical planetarium projector. Such electronically controlled systems are readily integrated with computer data banks and have the potential for creating many variations on traditional projected patterns. By taking into account star distances, for example, the system can create the illusion of flying through space among the stars while it maintains an accurate representation of the surroundings from any new perspective.

planetary nebula, any of a class of bright nebulae that may somewhat resemble planets when viewed through a small telescope but are in fact expanding clouds of fluorescent gas far outside the solar system (*see* nebula).

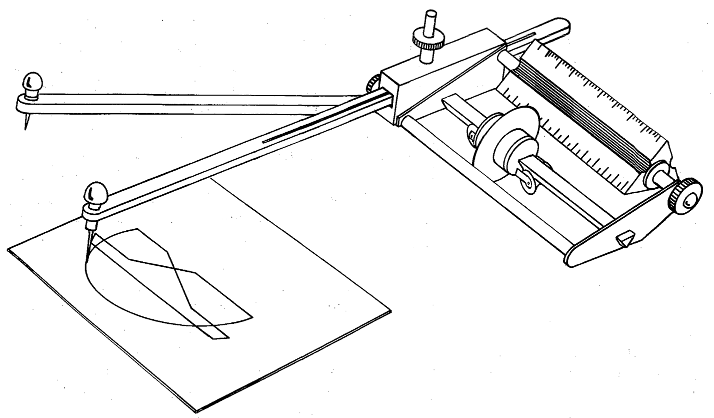
planetesimal, one of a class of hypothetical primitive particles or little bodies that eventually coalesced to form the planets after condensing from gaseous matter early in the history of the solar system. The planetesimal theory was first proposed by the U.S. geologist Thomas Chrowder Chamberlin and the U.S. astronomer Forest Ray Moulton in 1906. Hypotheses of the origin of the solar system involving near-collisions between stars were widely accepted in the early decades of the 20th century but have been superseded by the nebular hypothesis that the planets formed from the same gas cloud that condensed to make the Sun. *See also* protoplanet.

planetoid (astronomy): *see* asteroid.

planigale, common and genus name for certain species of tiny mouselike marsupial animals. *See* marsupial mouse.

planimeter, mathematical instrument for directly measuring the area bounded by an irregular curve, and hence the value of a definite integral (*see* the illustration).

The first such instrument, employing a disk-and-wheel principle to integrate, was invented in 1814 by J.H. Hermann, a Bavarian engineer. Improved mechanisms were invented by the British mathematical physicist James Clerk Maxwell (1855) and the Scottish engineer James Thomson (1876). So far as is known, Maxwell never actually built a working model of his invention, which he called a platometer, but Thomson's principle was not only applied in planimeters but adapted by his brother, the physicist William Thomson (later 1st Baron Kelvin), for a machine used in harmonic analysis of tides. A practical, in-



The Willis planimeter

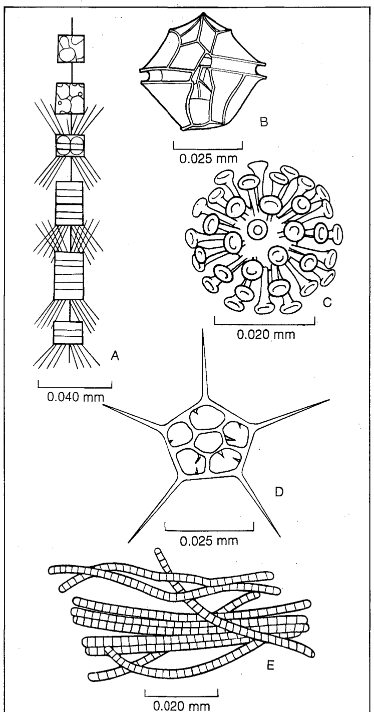
expensive polar planimeter was invented by the Swiss mathematician Jacob Amsler about 1854. It consists of a pole arm, or bar, which has a weight at one end, and a tracer arm, the end of which has a point that the operator guides around the boundary of the area in question. Both arms rest in a carriage that moves as the tracer arm is moved; a vernier wheel within the carriage provides directly the area that is measured, calibration of vernier and area units being undertaken at the outset. *See also* integrator.

plankton, marine and freshwater organisms, which, because they are nonmotile or because they are too small or too weak to swim against the current, exist in a drifting, floating state. The term plankton is a collective name for all such organisms and includes certain algae, bacteria, protozoans, crustaceans, mollusks, and coelenterates, as well as representatives from almost every other phylum of animals. Plankton is distinguished from nekton, which is composed of strong-swimming animals, and from benthos, which include sessile, creeping, and burrowing organisms on the seafloor. Large floating seaweeds (for example, *Sargassum,* which constitutes the Sargasso Sea) and various related multicellular algae are not considered plankton but pleuston. Organisms resting or swimming on the surface film of the water are called neuston (*e.g.,* the alga *Ochromonas*).

Plankton is the productive base of both marine and freshwater ecosystems, providing food for larger animals and indirectly for humans, whose fisheries depend upon plankton. As a human resource, plankton has only begun to be developed and exploited. It may in time be the chief food supply of the world, in view of its high biological productivity and wide extent. It has been demonstrated on several occasions that large-scale cultures of algae are technically feasible. The unicellular green alga *Chorella* has been used particularly in this connection. Through ample culture conditions, production is directed toward protein content greater than 50 percent. Although this protein has a suitable balance of essential amino acids, its low degree of digestibility prevents practical use. Phytoplankton may become increasingly important in space travel as a source for food and for gas exchange. The carbon dioxide released during respiration of spacecraft personnel would be transformed into organic substances by the algae, while the oxygen liberated during this process would support human respiration.

The plantlike community of plankton is called phytoplankton, and the animallike community is known as zooplankton. This convenient division is not without fault, for strictly speaking, many planktonic organisms are neither clearly plant nor animal but rather are better described as protists. When size is used as a criterion, plankton can be subdivided into macroplankton, microplankton, and nannoplankton, though no sharp lines can be drawn between these categories. Macroplankton can be collected with a coarse net, and morphological details of individual organisms are easily discernible. These forms, one millimetre or more in length, ordinarily do not include phytoplankton. Microplankton (also called net plankton) is composed of organisms between 0.05 and 1 mm in size and is a mixture of phytoplankton and zooplankton. The lower limit of its size range is fixed by the aperture of the finest cloth used for plankton nets. Nannoplankton (dwarf plankton) passes through all nets and consists of forms of a size less than 0.05 mm. Phytoplanktonic organisms dominate the nannoplankton.

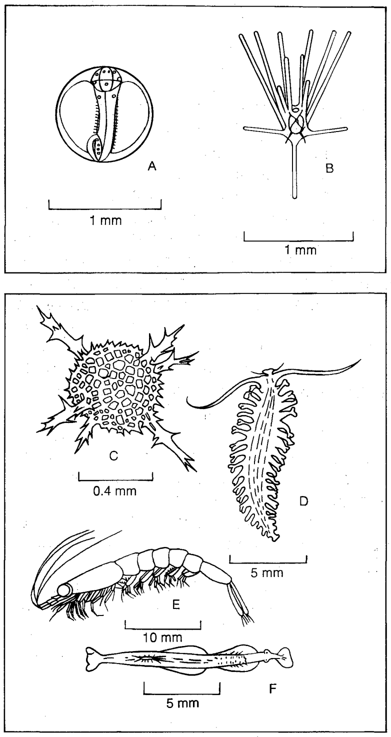
The chief components of marine phytoplankton are found within the algal groups and



Representative types of marine phytoplankton
(A) Diatom (*Thalassiosira*), (B) dinoflagellate (*Gonyaulax*), (C) Coccolithophorid (*Discosphaera*), (D) silicoflagellate (*Distephanus*), (E) blue-green alga (*Trichodesmium*)

include diatoms, dinoflagellates and coccolithophorids. Silicoflagellates, cryptomonads, and green algae are found in most plankton samples. Freshwater phytoplankton, usually rich in green algae, also includes diatoms, blue-green algae, and true flagellates.

The zooplankton is divided into two groups. Temporary plankton consists of planktonic eggs and larvae of members of the benthos and nekton; permanent plankton includes all animals that live their complete life cycles in a floating state. The temporary plankton, particularly abundant in coastal areas, is characteristically seasonal in occurrence, though variations in spawning time of different species ensure its presence in all seasons. Represen-



Representative types of (top) temporary and (bottom) permanent zooplankton
(A) Flounder eggs with embryo, (B) pluteus larva of sea urchin, (C) radiolarian, (D) annelid (*Tomopteris*), (E) crustacean (*Euphausia*), (F) arrowworm (*Sagitta*)

tatives from nearly every phylum of the animal kingdom are found in the permanent plankton. Among the protozoans, planktonic foraminiferans and radiolarians are so abundant and widespread that their skeletons constitute the bulk of bottom sediments over wide ocean areas. They are absent in fresh water. The ciliate protozoans are represented mainly by the tintinnids, which are between 20 and 640 microns in size and sometimes occur in vast numbers. Among the planktonic coelenterates are the beautiful siphonophores (*e.g., Physalia,* the Portuguese man-of-war) and the jellyfishes. Planktonic ctenophores, called comb jellies, or sea walnuts, are also common. Freshwater rotifers may be present in plankton in vast numbers during the warmer seasons. A group of organisms that can be found at all latitudes, both in surface water and at great depths, are the marine arrowworms (*e.g., Sagitta*), important planktonic predators. Oysters, mussels, other marine bivalves, and snails begin life as planktonic larvae. The wing snails (Pteropoda) spend their entire life cycles as plankton.

Crustaceans are the most important members of the zooplankton. They are the marine counterparts of insects on land; on land, as in the sea, the arthropods are the most diverse and numerous of all animal phyla. The copepod *Calanus finmarchicus* is important as food for the herring, and the euphausiid *Euphausia superba,* commonly known as krill, is the main food source for blue and fin whales in the Antarctic Ocean. These whales, particularly blue and finback whales, migrate to waters where spawning of these crustaceans occurs; and the rapid growth of these large mammals, feeding entirely on plankton, is impressive.

There is a pronounced tendency for zooplankton to perform diurnal vertical migrations in both lakes and the sea. This migratory behaviour varies with stages in the life cycle, seasons of the year, latitude, hydrographic structure, and meteorological conditions. Generally, the animals ascend toward the surface at sunset from daytime depths. At midnight, if there is no optical stimulus (*e.g.,* moon, artificial light), some of the animals return to the daytime depths, then approach the surface once again just before dawn. As the sun rises, all descend to their daytime level.

Bacteria and fungi found in water belong by definition to plankton, but because of special techniques required for sampling and identification, they usually are considered separately. These organisms are important in the transformation of dead organic materials to inorganic plant nutrients. Some of these marine and freshwater microorganisms (including blue-green algae) fix molecular nitrogen from water containing dissolved air, forming ammonia or related nutrients important for phytoplankton growth. Although little is known about the extent of nitrogen fixation, bacteria and fungi always are found in water samples. A peculiar situation exists in the Black Sea, where water below 130–180 m contains hydrogen sulfide and no oxygen. Under these conditions only bacteria are found.

The productivity of an area is dependent upon the availability of nutrients and water-stability conditions. Currents that flow near continents are important to plankton production in an area. The California Current (a continuation of the Kuroshio Drift from Japan) causes an outland transport of water and combines with a compensating nutrient-rich current along the coast of California to make this area highly productive. The same situation exists along the west coast of southern Africa, which is influenced by the Benguela Current, and off the west coast of South America, influenced by the Peru Current.

In the sea an adequate supply of nutrients, including carbon dioxide, enables phytoplankton and benthic algae to transform the light energy of the Sun into energy-rich chemical components through photosynthesis. The bottom-dwelling algae are responsible for about 2 percent of the primary production in the ocean; the remaining 98 percent is attributable to phytoplankton. Most of the phytoplankton serves as food for zooplankton, but some of it is carried below the light zone. After death, this phytoplankton undergoes chemical mineralization, bacterial breakdown, or transformation into sediments. Phytoplankton production usually is greatest from 5 to 10 m below the surface of the water. High light intensity and the lack of nutrient in the regions above a depth of 5 m may be the causes for suboptimal photosynthesis. Although bacteria are found at all depths, they are most abundant either immediately below great phytoplankton populations or just above the bottom.

Zooplankton is used directly as food by fish (*e.g.,* herring) or mammals (*e.g.,* whales); but several food chains usually have been passed before plankton is available for human consumption. Because each step in the chain is calculated as a 90 percent loss of the original energy obtained from the Sun, there is considerable energy lost as the number of components in the food chain increases.

planned parenthood, also called FAMILY PLANNING, practice of measures designed to regulate the number and spacing of children within a family.

The history of concern over the uncontrolled growth of populations is as old as recorded history, but it was not until about the 1950s that fears over a rapidly expanding world population came to be combined with fertility practices on the family level. During the 19th century, attempts to educate the public about methods of birth control and the social and economic consequences of sexual ignorance were largely unsuccessful. In the United States it was such persons as Margaret Sanger who eventually overcame initial public resistance. Undeterred by both legal and religious opposition to her activities, Sanger established the first birth control clinic and published scientific information on sex and family planning. Supported by the efforts of Sanger and others—such as Aletta Jacobs in The Netherlands, Marie Stopes in England, and Dhanvanthis Rama Rau in India—clinics for family planning and health care were established in many countries of the world.

Among the associations that are involved in planned parenthood services are The United Nations Fund for Population Activities (UNFPA), the World Health Organization (WHO), and the World Bank. In the United States, the major family planning organization is the Planned Parenthood Federation of America (PPFA), which was formed in 1942 by the merger of Sanger's Birth Control Clinic Research Bureau (established 1923) and the American Birth Control League (established 1921). *See also* contraception; population (in human biology).

Plano, city, Collin and Denton counties, northern Texas, U.S., located about 16 miles (26 km) northeast of Dallas. It is situated in a region of blackland prairie and was first settled (1845–46) by a group called Peters' Colony. The community, originally called Fillmore, was granted a post office in 1851, and its name was changed to Plano. The railroad reached Plano in 1872, and, although the town was almost destroyed by fire in 1881, it continued to develop as a small agricultural centre in the midst of a cotton-producing and cattle-raising area. Plano's main population growth began in the 1960s. It is a financial and commercial centre, and its manufactures include compact discs, printed materials, metals, satellite communication equipment, and bakery equipment. Inc. 1873. Pop. (1988 est.) city, 118,782; Dallas-Fort Worth metropolitan area (CMSA), 3,768,100.

planography, any printing technique in which the printing and nonprinting areas of the plate are in a single plane, *i.e.,* at the same level. *See* offset printing.

plant (kingdom Plantae), multicellular, eukaryotic life form fundamentally characterized by (1) an almost exclusively photosynthetic mode of nutrition, in which the plant produces chemical energy (in the form of sugars) from water, minerals, and carbon dioxide with the aid of pigments and the radiant energy of the Sun, (2) essentially unlimited growth at localized regions of cell divisions called meristems, (3) cells that contain cellulose in their walls and are therefore more or less rigid, (4) the absence of organs of locomotion, resulting in a more or less stationary existence, (5) the absence of sensory and nervous systems, and (6) life histories that show an alternation of haploid and diploid generations (the dominance of one over the other is taxonomically significant).

No definition of the kingdom completely excludes all nonplant organisms or even includes all plants. There are many plants, for example, that are not green and do not produce their own food by photosynthesis but are parasitic on other living plants; others are saprophytic, obtaining their food from dead organic matter. Many animals possess plantlike characteristics, such as the lack of mobility (*e.g.,* sponges) or the presence of a plantlike growth form (*e.g.,* some corals and bryozoans), but in general such animals lack the other characteristics of plants cited earlier and, therefore, cause little confusion. In the past, classification systems have been devised that place such difficult groups as protozoans, bacteria, algae, slime molds, and fungi in the plant kingdom, but morphological and physiological differences between these organisms and plants have caused most scientists to classify them outside the plant kingdom.

Plants are treated in a number of articles in the MACROPAEDIA. For a basic description and analysis, *see* Plants. For descriptions of the various classes and orders of plants, *see* Angiosperms; Bryophytes; Ferns and Other Lower Vascular Plants; Gymnosperms; Trees. For discussions of plants in relation to the biosphere, *see* Biosphere; Growth and Development, Biological; Photosynthesis. For the study of plants, *see* Biological Sciences. *See also* Gardening and Horticulture; Agriculture.

For a description of the place of plants in the circle of learning and for a list of both MACROPAEDIA and MICROPAEDIA articles on the subject, *see* PROPAEDIA: Part Three.

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first

plant breeding, the practical application of genetic principles in agriculture and horticulture to produce plants more useful to humans. Although scientific plant breeding is essentially a 20th-century development, selective cultivation by ancient agriculturists effected a major and rapid evolutionary change in many plants from the wild to the domesticated state.

A brief treatment of plant breeding follows. For full treatment, *see* MACROPAEDIA: Farming and Agricultural Technology.

Not until the mid-18th century was the sexual nature of plants incontrovertibly demonstrated, and the term "plant breeding" did not become widely used until after 1900. Thereafter the intentional breeding of superior plants spread quickly; by the mid-20th century the breeding of field and horticultural crops was so standardized that it was largely in the hands of experts, much of it centred in a few large agronomic and horticultural institutions operated mostly at government expense.

For a variety of reasons the breeding of new and superior ornamental plants, though carried on in part by scientists and by tradesmen, was largely in the hands of gifted amateurs. As the result of their efforts, thousands of new varieties of dahlia, rose, African violet, peony, narcissus, and other plants came into being.

Any successful plant-breeding program must be based upon a sound understanding of the exact mode of reproduction of that plant. Plants reproduce in two ways: vegetatively (that is, asexually), through the growth and development of a small portion (bulbs, tubers, etc.) of the original plant; and sexually, through the flower and seed. Even for those plants in which vegetative reproduction is not highly developed under natural conditions, the artificial rooting of cuttings and the grafting of roots and of stems make it possible to disseminate pieces of a superior individual by vegetative means.

Different kinds of plants vary not only in the extent to which they may be propagated sexually but also in the degree to which they are naturally inbred or outbred. Among the higher plants, both extremes are found. Crops such as wheat, which are naturally very inbred, are almost completely self-pollinated. Others such as corn are mostly cross-pollinated under field conditions, though self-pollination is made possible by artificial means. Still others (many plums for instance) are naturally self-sterile and cannot be self-pollinated, though any particular flower may function effectively as either a male or a female in crosses with other plants.

Mass selection, in which each successive generation of a crop is grown from mixed seeds of the most desirable plants of the preceding generation, is perhaps the simplest and least expensive plant-breeding technique. Great success has been achieved with naturally self-fertilized species using pedigree or pure-line selection. Most of the older varieties of wheat, oats, barley, cotton, beans, and tomatoes have so arisen. However, as the ceiling of remaining variation is reached by selection, hybridization of pure lines is resorted to for further improvement.

Naturally cross-fertilized species are more difficult to handle, because any inbreeding necessary to fix desirable characters often leads to a decline in vigour. One may accordingly use continuous mass selection broadly, avoiding inbreeding. One may, on the other hand, use a combination of inbreeding and controlled hybridization to utilize the phenomenon of hybrid vigour as was done in hybrid corn improvement. *See also* hybrid.

plant bug, any member of two families of the insect order Heteroptera. The family Lygaeidae (*see* lygaeid bug) contains between about 3,000 and 5,000 species. One of the best known members, the chinch bug (*q.v.*), is an important crop pest.

The members of the family Miridae, one of the largest heteropteran families (about 8,000 species), are also called leaf bugs. They are brightly coloured and feed mostly on plant sap, causing serious crop damage. Plant bugs occur throughout the world and have been found north of the Arctic Circle. They are soft-bodied and small, under 10 millimetres (0.4 inch) long, and are easily identified by their four-segmented antennae and their beak.

Among the important species is the four-lined plant bug (*Poecilocapsus lineatus*), which feeds mainly on blueberries, currants, and gooseberries. This yellowish bug has four longitudinal black lines along its back and is about 8 mm long. It feeds on plant juices, producing brown spots on leaves and causing them to wither. The female deposits clusters of six to eight eggs, which hatch the following spring, in plant stems; there is one generation per year. This pest is controlled by pruning or burning contaminated plants.

The tarnished plant bug (*Lygus pratensis*), a well-known pest in North America, feeds on many plants, ranging from trees to grasses and cereals. It is about 6 mm long and is dark in colour—with yellow, black, and red markings. The use of insecticides and the elimination of hibernating spots (*e.g.,* trash piles) help to control this pest.

The apple red bug (*Lygus mendax*) is red and black and about 6 mm long. The front part of the thorax and the wings are usually red, and the posterior thorax and the inner edge of the wings are usually black. It is an important apple orchard pest that causes spotting of leaves and injures the fruit so that it is not marketable.

The garden fleahopper (*Halticus bractatus*) is a small, shiny black jumping bug about 2 mm long. The forewings of this short-winged leaf bug lack a membrane and resemble the hard forewings of a beetle. The fleahopper sucks the juices from garden plants. There are usually five generations every season.

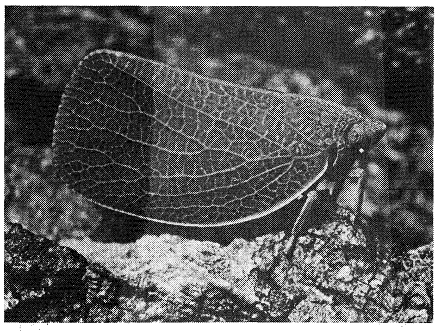
An important cotton pest is the cotton fleahopper (*Psallus seriatus*). The oval-shaped adult is about 3 mm long and pale green in colour, with four black spots on its body. It passes the winter in the egg stage in the plant tissues of weeds. In the spring after the eggs hatch, the nymphs eat the weeds; they then migrate to nearby cotton fields to feed on the cotton plant. Later, the cotton fleahoppers return to the weeds. The life cycle is short, about 22 days, so that there may be seven or eight generations each season. The cotton fleahopper can easily be controlled by insecticide sprays.

Helopeltis theivora is the tea blight bug of Southeast Asia. It is both common and highly destructive.

Although most plant bugs are plant pests, some are beneficial. *Cyrtorhynus mundulus* of Australia feeds on the sugarcane leafhopper's eggs. It has been introduced into certain regions (*e.g.,* Hawaii) as a control for this pest.

plant development: *see* development, plant.

plant hopper, any member of several insect families of the order Homoptera, easily recognized because of the hollow, enlarged head extension that may appear luminous (*see* lanternfly). Plant hoppers feed on plant juices



Plant hopper (*Acanalonia bivattata*)
Richard Parker

and excrete honeydew, a sweet by-product of digestion.

Plant hoppers, ranging in size from one centimetre (0.4 inch) in cooler climates to about five cm in the tropics, are not considered serious economic pests. Some species are covered with either a mealy substance or waxy filaments. Members of this family are variously known as fulgorid, lightning leafhopper, and mealy flata.

plant louse: *see* aphid.

plant virus, any of a number of agents that can cause plant disease. They are of considerable economic importance because many of them infect crop and ornamental plants. Many plant viruses are rodlike and can be extracted readily from plant tissue and crystallized. Most of them lack the fatty membrane found in many animal viruses, and all contain ribonucleic acid (RNA). Plant viruses are transmitted in many ways, the most important of which is through insect bites, primarily by aphids and plant hoppers. One of the most well-studied viruses, tobacco mosaic virus (TMV), is spread mechanically by abrasion with infected sap. Symptoms of virus infection include colour changes, dwarfing, and tissue distortion. The appearance of streaks of colour in certain tulips is caused by virus.

Plantagenet, HOUSE OF, also called HOUSE OF ANJOU, or ANGEVIN DYNASTY, royal house of England, that reigned from 1154 to 1485 and provided 14 kings, six of whom belonged to the cadet houses of Lancaster and York (*qq.v.*). The royal line descended from the union between Geoffrey, count of Anjou (d. 1151), and the empress Matilda, daughter of the English king Henry I. *See* the genealogical table on pages 500–501.

Although well-established, the surname Plantagenet has little historical justification. It seems to have originated as a nickname for Count Geoffrey and has been variously explained as referring to his practice of wearing a sprig of broom (Latin *genista*) in his hat or, more probably, to his habit of planting brooms to improve his hunting covers. It was not, however, a hereditary surname, and Geoffrey's descendants in England remained without one for more than 250 years, although surnames became universal outside the royal family.

Some historians apply the name House of Anjou, or Angevin Dynasty, to Henry II (who was also count of Anjou) and his 13 successors; other historians label only Henry II and his sons, Richard I and John, as the Angevin kings and, for want of a better name, label their successors, notably Edward I, Edward II, and Edward III, as Plantagenets. The first official use of the surname Plantagenet by any descendant of Count Geoffrey occurred in 1460, when Richard, duke of York, claimed the throne as "Richard Plantaginet."

Edward III's numerous children and their marriages greatly affected English history. Edward his heir, the "Black Prince," left an only son, who succeeded his grandfather as Richard II, on whose death (1399) this line became extinct. Lionel, the next surviving son of Edward III, left an only child, Philippa, who married the Earl of March, in whose heirs was the right to the succession. But John of Gaunt, the next son, who had married the heiress of Lancaster and had been created duke of Lancaster in consequence, refounded the Lancastrian line, which obtained the throne in the person of his only son by her, Henry IV, on the deposition of Richard II. The next son of Edward III, Edmund of Langley, who was created duke of York (1385), founded the Yorkist line, and was father of two sons, Edward, second duke, who was slain at Agincourt, and Richard, earl of Cambridge, who by marrying the granddaughter and eventual heiress of Lionel's daughter, Philippa, brought the right to the succession into the House of York.

Between their son and Henry VI (grandson of Henry IV) and the sons and heirs of these rivals was fought out the dynastic struggle known as the Wars of the Roses, which proved fatal to several members of both houses. It did not end until the last Yorkist king, Richard III, was defeated at Bosworth Field in 1485 by Henry Tudor, who became Henry VII and founder of the House of Tudor.

The legitimate male issue of the Plantagenet line became extinct with the execution in 1499 of Edward, earl of Warwick, grandson of Richard, duke of York.

Plantagenet, Edmund: *see* Kent, Edmund Plantagenet, 1st earl of.

Plantago, one of three genera in the family Plantaginaceae (order Scrophulariales) with

Greater plantain (*Plantago major*)
Ingmar Holmasen

House of Plantagenet
(Showing connections with the royal houses of France, Scotland, etc.)

Emperor Henry V (1086–1125) (1) = Matilda (1102–67) (2) = Geoffrey IV Plantagenet (1113–51) count of Anjou

Constance (d. 1160) dau. of Alfonso VII of Castile (2) = Louis VII (*c.* 1120–80) king of France (1) = Eleanor of Aquitaine (*c.* 1122–1204) (2) = HENRY II (1133–89) king of England 1154–89

Geoffrey (1134–57)

William (1136–63)

William (1153–56)

Henry FitzHenry (1155–83) = Margaret (d. 1198) dau. of Louis VII and Constance of Castile

RICHARD I (1157–99) king of England 1189–99 = Berengaria of Navarre (1163–1230)

Geoffrey (1158–86) = Constance (d. 1201) dau. of Conan IV of Brittany

JOHN (1167–1216) king of England 1199–1216 (1) = Isabella of Gloucester (d. 1217) (2) = Isabella of Angoulême (d. 1246)

Matilda (1156–89) = Henry the Lion (d. 1195) duke of Saxony and Bavaria

Eleanor (1161–1214) = Alfonso VIII of Castile (1155–1214)

Joan (1165–99) (1) = William II of Sicily (d. 1189) (2) = Raymond VI of Toulouse (d. 1222)

Arthur I (1187–1203) duke of Brittany

Eleanor (d. 1241)

Alexander II (1198–1249) king of Scotland (1) = Joan (1210–38); (2) = Mary de Coucy

HENRY III (1207–72) king of England 1216–72 = Eleanor (d. 1291) dau. of Raymond Berengar IV count of Provence

Richard (1209–72) earl of Cornwall (1) = Isabella (d. 1240) dau. of William Marshal earl of Pembroke (2) = Sanchia (d. 1261) dau. of Raymond Berengar IV of Provence

Isabella (1214–41) = Emperor Frederick II (1194–1250)

Eleanor (1215–75) (1) = William Marshal (d. 1231) earl of Pembroke (2) = Simon de Montfort (d. 1265) earl of Leicester

Alexander III (1241–86) king of Scotland = Margaret (1240–75)

EDWARD I (1239–1307) king of England 1272–1307 (1) = Eleanor of Castile (*see below right*) (2) = Margaret (d. 1317) dau. of Philip III of France

Beatrice (1242–75) = John II (d. 1305) duke of Brittany

Edmund (1245–96) "Crouchback" earl of Lancaster = Blanche of Artois (*see below right*)

5 children died young

Henry of Almain (1235–71)

Edmund (1249–1300) earl of Cornwall

Margaret (1261–83) = Eric II (1268–99) king of Norway

7 daughters and 3 sons, died young, including Alfonso (1273–84)

EDWARD II (1284–1327) king of England 1307–27 = Isabella of France (*see below right*)

Thomas of Brotherton (1300–38) earl of Norfolk

Edmund of Woodstock (1301–30) earl of Kent

Thomas (*c.* 1278–1322) 2nd earl of Lancaster

Henry (*c.* 1281–1345) 3rd earl of Lancaster = Maud Chaworth (d. *c.* 1322)

Margaret (1282/83–90) the Maid of Norway

EDWARD III (1312–77) king of England 1327–77 = Philippa of Hainaut (1314–69)

John (1316–36) earl of Cornwall

Eleanor (1318–55) = Rainald II (d. 1343) count of Gelre

Joanna (1321–62) = David II (1323/24–70/71) king of Scotland

Henry (*c.* 1300–61) 1st duke of Lancaster = Isabel Beaumont

Eleanor (d. 1372) = Richard (1307–76) earl of Arundel

Edward (1330–76) the Black Prince = Joan dau. of Edmund earl of Kent

Lionel of Antwerp (1338–68) duke of Clarence (1) = Elizabeth de Burgh (1332–62) (2) = Violanta Visconti (d. *c.* 1404)

Blanche dau. of Henry duke of Lancaster (*see right*) (1) = John of Gaunt (1340–99) duke of Lancaster (2) = Constance of Castile (d. 1394) (3) = Catherine Swynford (*c.* 1350–1403)

Edmund of Langley (*c.* 1342–1402) duke of York = Isabel of Castile (d. 1392)

Thomas of Woodstock (1355–97) duke of Gloucester

2 sons died young
5 daughters

RICHARD II (1367–1400) king of England 1377–99 (1) = Anne of Bohemia (1366–94) (2) = Isabella (1387–1406) dau. of Charles VI of France

Philippa (1355–81) = Edmund Mortimer (1351–81) 3rd earl of March

HENRY IV (1366–1413) king of England 1399–1413 (1) = Mary de Bohun (*c.* 1370–94) (2) = Joan of Navarre (*c.* 1370–1437)

John Beaufort (*c.* 1371–1410) earl of Somerset = Margaret dau. of Thomas earl of Kent

Henry (*c.* 1374–1447) cardinal bishop of Winchester

Thomas (d. 1426) duke of Exeter

Joan (d. 1440) (1) = Sir Robert Ferrers (2) = Ralph Neville (1364–1425) earl of Westmorland

See LANCASTER, HOUSE OF

Roger Mortimer (1374–98) 4th earl of March = Eleanor dau. of Thomas earl of Kent

HENRY V (1387–1422) king of England 1413–22 (1) = Catherine (1401–37) dau. of Charles VI of France (2) = Owen Tudor (*c.* 1400–61)

Thomas (1388–1421) duke of Clarence

John (1389–1435) duke of Bedford (1) = Jacquetta of Luxembourg (d. 1472) (2) = Sir Richard Woodville (d. 1469)

Humphrey (1390–1447) duke of Gloucester

John Beaufort (1404–44) 1st duke of Somerset = Margaret Beauchamp

Anne Mortimer (1388–before 1414) = Richard earl of Cambridge (*see above right*)

Edmund (1391–1425) 5th earl of March

HENRY VI (1421–71) king of England 1422–61, 1470–71 = Margaret of Anjou (1430–82)

Edmund Tudor (*c.* 1430–56) earl of Richmond = Margaret Beaufort (1443–1509)

EDWARD IV (1442–83) king of England 1461–70, 1471–83 = Elizabeth Woodville (1437–92) dau. of Sir Richard Woodville and Jacquetta of Luxembourg

George (1449–78) duke of Clarence = Isabel (1451–76) dau. of Richard Neville earl of Warwick

Edward (1453–71) = Anne Neville (*see above right*)

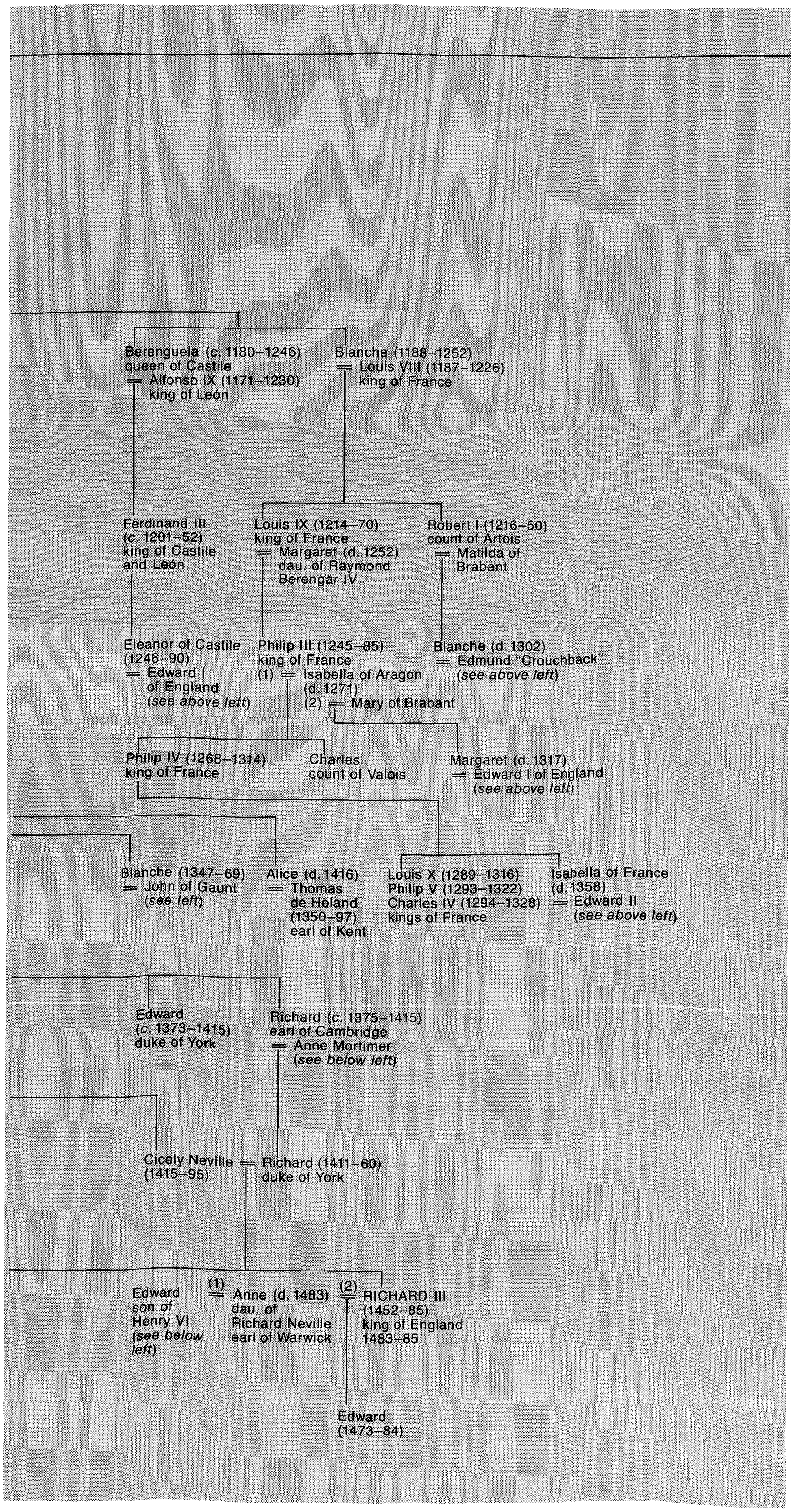
HENRY VII (1457–1509) king of England 1485–1509 = Elizabeth (1465–1503)

EDWARD V (1470–?83) king of England April–June 1483

Richard (1473–?83) duke of York

Margaret (1473–1541) countess of Salisbury = Sir Richard Pole (d. 1505)

Edward (1475–99) earl of Warwick



about 265 species. The small plants usually have a dense tuft of basal leaves and long, leafless stalks bearing a terminal spike of small flowers.

The greater plantain (*Plantago major*) provides seed spikes for bird food. Ribwort and hoary plantain (*P. lanceolata* and *P. media,* respectively) are troublesome weeds. By contrast, *psyllium* and *P. ovata* have been useful in medical science; they produce mucilaginous seeds, which have been used, for example, in laxative preparations known as psyllium, ispaghul, or spogel seeds.

plantain (*Musa paradisiaca*), plant of the banana (*q.v.*) family (Musaceae) closely related to the common banana (*M. sapientum*). The plantain is a tall plant (3–10 metres [10–33 feet]) with a conical false "trunk" formed by the leaf sheaths of its spirally arranged leaves, which are 1.5 to 3 m long and about 0.5 m wide. The fruit, which is green, is typically larger than the common banana. The botanical classification of plantains and bananas is so complicated that plantain is variously viewed as a subspecies of the banana, and the banana as a subspecies of plantain.

The edible fruit of the plantain has more starch than the banana and is not eaten raw. Because plantain has a maximum of starch before it ripens, it is usually cooked green, either boiled or fried, often with coconut juice or sugar as a flavouring. It may also be dried for later use in cooking or ground for use as a meal. The plantain meal can be further refined to a flour. In some parts of East Africa

Plantain (*Musa paradisiaca*)
Phil Clark

the plantain is a staple food and beer-making crop, notably in central and eastern Uganda and Tanzania (formerly Tanganyika), and particularly in the area inhabited by the Chagga people.

The plant is believed to have originated in Southeast Asia. Two groups of plantains are thought to have a common origin: the horn plantain and the French plantain. Both types grow in India, Africa, Egypt, and tropical America. The French plantains also occur in Indonesia and the islands of the Pacific. Plantain is also a common name for plants of the genus *Plantago* (*q.v.*) of the order Scrophulariales.

plantain-eater (bird): *see* turaco.

plantain lily, any ornamental plant of the genus *Hosta* of the family Liliaceae, consisting

Plantain lily (*Hosta fortunei*)
A to Z Botanical Collection—EB Inc.

of about 10 species of perennial garden herbs. They are native to eastern Asia.

Each species has ribbed leaves in a cluster at the base of the plant and tubular white, or bluish-purple flowers that are borne in clusters at the tip of stalks that emerge from the leaves. The fruit is a long capsule.

plantation, a usually large estate in a tropical or subtropical region that is cultivated by unskilled or semiskilled labour under central direction. This meaning of the term arose during the period of European colonization in the tropics and subtropics of the New World, essentially, wherever huge tracts of crops cultivated by slave labour became an economic mainstay.

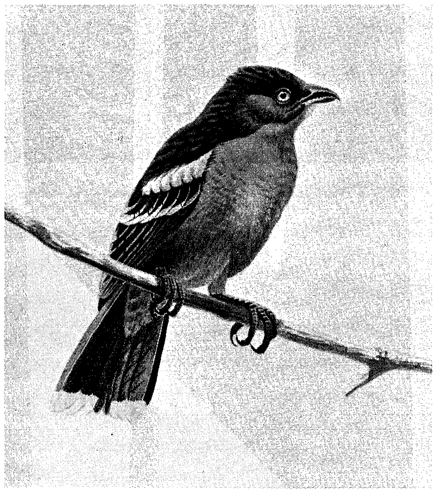
The typical plantation was a self-sustained community, an economic and political institution governed with a monopoly of authority by the planter. Plantation crops were determined by soil and climate, with tobacco, cotton, rice, indigo, and sugarcane, for example, each predominating in a certain zone of the southeastern colonies of North America.

The labour-intensive plantation declined abruptly in the United States with the abolition of slavery. Most plantations were divided into small farms operated by individual owners or tenant farmers; others continued to operate as large plantations that were worked by wage-labourers or sharecroppers, many of whom were held under the tacit bondage of economic insecurity.

In tropical regions worldwide, thousands of square miles of forest land have been cleared since the 18th century for the cultivation of sugarcane, coffee, tea, cacao, rubber trees, oil palms, sisal, and bananas. Such plantations frequently depend on foreign capital and agricultural training and tend to exploit the labour forces of native populations.

plantation walking horse: *see* Tennessee walking horse.

plantcutter, any of three species of South American birds of the family Phytotomidae (order Passeriformes), with finely serrated, stout bills used for snipping off tender shoots, buds, and fruit. In some areas plantcutters do much harm to gardens and orchards. With their broad, squared tails, they resemble streak-backed finches. Males are strongly tinged with reddish brown—especially in the red-breasted, or white-tipped, plantcutter (*Phytotoma rutila*), common from the Patagonian prairies to the uplands of Bolivia. Other species



Peruvian plantcutter (*Phytotoma raimondii*)
Painting by John P. O'Neill

of plantcutter are found in Peru, Argentina, and Chile.

Planté, Francis (b. March 2, 1839, Orthez, Fr.—d. Dec. 19, 1934, St. Avit, Fr.), French pianist active in Paris in the late 19th century.

Planté made his Paris debut as a nine-year-old prodigy. He became a pupil of A.-F. Marmontel at the Conservatoire in 1849 and won the first prize for piano in 1850 after only seven months of tuition. He then became a protégé of Liszt and Rossini, playing in many of the Parisian salons. From 1851 to 1861 he studied piano privately, not appearing in public for about 10 years; on his return to the stage, he was acclaimed as a virtuoso with a finished technique. He gave concerts regularly until 1900, when he abruptly stopped public appearances except for rare concerts for charity. In 1908 he made several recordings.

Planté, Gaston (b. April 22, 1834, Orthez, Fr.—d. May 21, 1889, Paris), French physicist who produced the first electric storage battery, or accumulator, in 1859; in improved form, his invention is widely used in automobiles.

Planté followed an academic career, beginning in Paris as a lecture assistant in physics at the Conservatoire des Arts et Métiers (Conservatory of Arts and Crafts) in 1854 and, six years later, rising to the post of professor of physics at the Association Polytechnique pour le Développement de l'Instruction Populaire.

In 1859 Planté began experiments that resulted in construction of a battery for the storage of electrical energy; his first model contained two sheets of lead, separated by rubber strips, rolled into a spiral, and immersed in a solution containing about 10 percent sulfuric acid. A year later he presented a battery to the Académie des Sciences consisting of nine of the elements described above, housed in a protective box with the terminals connected in parallel. His battery could deliver remarkably large currents.

Plantin, Christophe (b. *c.* 1520, Saint-Avertin, Fr.—d. July 1, 1589, Antwerp), French printer, founder of an important printing house and publisher of the Antwerp Polyglot Bible.

Plantin learned bookbinding and bookselling at Caen, Normandy, and settled in 1549 as a bookbinder in Antwerp. A bad arm wound seems to have led him (about 1555) to turn to typography. His many publications were distinguished by their excellent typography, and he was original in using copper, instead of wood, engravings for book illustrations. His greatest venture, the *Biblia polyglotta,* which would fix the original text of Old and New Testaments, was supported by Philip II of Spain in spite of clerical opposition and appeared in eight volumes during 1569–72. When Antwerp was plundered by the Spaniards in 1576 and Plantin had to pay a ransom, he established a branch office in Paris and then, in 1583, settled in Leiden as the typographer of the new university of the states of Holland, leaving his much-reduced business in Antwerp to his sons-in-law, John Moerentorf (Moretus) and Francis van Ravelinghen (Raphelengius). But in 1585 Plantin returned to Antwerp. After his death, business was carried on by Moretus but declined in the second half of the 17th century. All was religiously preserved, however, and in 1876 the city of Antwerp acquired the buildings and their contents and created the Musée Plantin-Moretus.

Planudes, Maximus, original name MANUEL PLANUDES (b. 1260, Nicomedia, Tur.—d. *c.* 1310, Constantinople), Greek Orthodox humanities scholar, anthologist, and theological polemicist in the controversy between Byzantium and Rome. His Greek translations of works in classical Latin philosophy and literature and in Arabic mathematics publicized these areas of learning throughout the Greek Byzantine cultural world.

After entering political life in Constantinople, Planudes retired to a monastery in 1283 because of factional strife. He later returned to Constantinople and, despite the opposition of the patriarch Athanasius I, established a monastery for laymen and opened a school by the imperial library. Drawing students from the royal family and nobility, the school gained an academic reputation for its thorough humanities curriculum. Planudes' eminence derived in large part from his competence in the Latin language acquired in the wake of the Western occupation of Constantinople (1204–61). This linguistic ability prompted his appointment as the emperor Andronicus II Palaeologus' emissary to Venice in 1295–96.

Notable among his theological writings is a treatise, *De processione Spiritus Sancti* (*c.* 1281; "On the Procession of the Holy Spirit"). Supportive of the Latin Church's teaching on the Holy Spirit, Planudes' first tract was in marked contrast with his second, *Tractatus de Spiritu Sancto adversus Latinos* ("A Treatise on the Holy Spirit Against the Latins"), composed after the accession of the emperor Andronicus II (1282), who reversed his predecessor's policy toward the West. Thus reflecting the variable political atmosphere, Planudes evolved from a Latin Trinitarian (one God in three persons) view that related the Holy Spirit to both the Father and the Son, to the traditional Byzantine dogma that the Spirit proceeds from the Father. In effect, these two works supplied arguments to supporters and opponents of Patriarch John's pro-Latin attitude and, 150 years later, to such Byzantine theological adversaries as Cardinal John Bessarion and George Gemistus Plethon. Related Latin writings that Planudes translated into Greek were *De Trinitate* ("On the Trinity") by the 5th-century Church Father Augustine of Hippo, and logical and theological tracts by the 6th-century philosopher-statesman Boethius. Equally significant were Planudes' translations of the essays and rhetoric of Cicero and the poetry of Ovid.

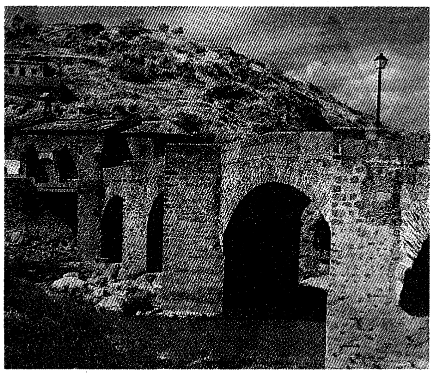
A distinctive contribution to the history of Greek literature was Planudes' revision of the *Anthologia Hellēnikē* ("Greek Anthology"), a renowned collection of Greek prose and poetry comprising authors from *c.* 700 BC to AD 1000, and edited variously from the 1st to the 11th centuries. Although parts of the reconstituted texts show Planudes' personal interpretations, the *Anthologia,* illustrating the continuity of Greek letters for almost 2,000 years, helped the development of modern Italian and French by its influence on 15th-century writers. Similarly, his revision of the *Life and Fables of Aesop* and his commentary on Theocritus, the 3rd-century-BC creator of

Greek pastoral verse, assisted in popularizing this literature throughout Europe.

The evolution of mathematics in Byzantium, and subsequently in Europe, was stimulated by Planudes' *Psephophoria kat' Indous* ("Arithmetic According to the Indians" [*i.e.,* Arabs]). Influenced by the Baghdad school, he encouraged the use of Arabic numerical notation, including the sign for zero, and introduced other mathematical operations (*e.g.,* the extraction of square roots).

planula, plural PLANULAE, free-swimming or crawling larval type common in many species of the phylum Cnidaria (*e.g.,* jellyfish, corals, sea anemones). The planula body is more or less cylindrical or egg-shaped and bears numerous cilia (tiny hairlike projections), which are used for locomotion. Planulae are produced by both of the basic body forms found in cnidarians—polyps, the stalklike, attached adult forms, and medusae, bell- or umbrella-shaped, free-swimming adult forms. *See also* polyp (zoology); medusa.

Plasencia, city, Cáceres *provincia,* in the Extremadura *comunidad autónoma* ("autonomous community"), western Spain. It lies on the Jerte River in the Plasencia Valley northeast of Cáceres city. Although there are Roman ruins at Capera nearby, as well as evidence of Stone Age and Iberian occupations, Plasencia was first known as the Moorish town of Ambroz. When Alfonso VIII of Castile retook it from the Moors in the 12th century, he renamed it Plasencia "that it may be pleasing to God and Man" (*ut Deo placeat et hominibus*) and built a city wall with 68



Bridge of San Lazaro over the Jerte River at Plasencia, Spain
A.G.E. FotoStock

towers. An episcopal see, the city has two cathedrals, the older of which displays 16th-century Plateresque architecture with elaborately carved choir stalls by Rodrigo Alemán. The churches of San Nicolás and San Ildefonso contain interesting tombs. Principal industries are tobacco curing, cotton processing, and meat canning. Olive and soybean oil, peppers, figs, and cattle feed are also produced. Pop. (1981) 32,178.

Plaskett, John Stanley (b. Nov. 17, 1865, Woodstock, Ont., Can.—d. Oct. 17, 1941, Victoria, B.C.), Canadian astronomer remembered for his mastery of the design of instruments and his extensive spectroscopic observations.

Plaskett, a skilled mechanic and photographer, graduated from the University of Toronto in 1899. In 1903 he joined the staff of the Dominion Observatory at Ottawa, where he initiated astrophysical research and devised a new spectrograph that made the telescope at Ottawa equivalent to much larger instruments elsewhere.

In 1913 he persuaded the Canadian government to finance the construction of a 72-inch (183-centimetre) reflector. That instrument, largely designed by Plaskett, was placed in operation near Victoria, B.C., in 1918. Plaskett was appointed director of the observatory at Victoria in 1917. He used the new telescope to study binary stars and the distribution of calcium in interstellar space. In 1922 he resolved a very massive binary star (Plaskett's star), and in 1930 he deduced the distance and direction of the centre of gravity of the Galaxy and the pattern of rotation about it. After his retirement in 1935 he supervised the grinding and polishing of the 82-inch mirror for the telescope of the McDonald Observatory, Fort Davis, Texas.

plasma, in biochemistry, the straw-coloured liquid (including its solutes but excluding the formed elements, such as blood cells and platelets) that constitutes the circulating fluid in animals. Plasma consists of more than 90 percent water, about 7 percent protein, and small percentages of other substances, such as inorganic salts, glucose, and urea and other waste products of metabolism. Plasma serves as a transport system and medium for nutrients, waste products, and blood cells; helps to maintain blood pressure; distributes heat equally throughout the body; and keeps a steady acid–base balance in the bloodstream and body.

Important plasma proteins include fibrinogen, an essential protein necessary for the clotting of blood; albumin, which helps maintain the pressure in blood vessels by its osmotic effect; and a variety of globulins, among which are a hormone that stimulates red blood cell formation and gamma globulin, which is rich in antibodies. *See also* blood.

plasma, in mineralogy, opaque, microgranular or microfibrous, semiprecious variety of the silica mineral chalcedony. Its colour, various shades of green, is due to disseminated silicate particles of different kinds, *e.g.,* amphibole minerals. Other properties are those of quartz (*see* Table 2 under silica mineral). Plasma often has nodules throughout its mass of gray quartz or red jasper (bloodstone). It has long been used for carvings and mosaics. Localities are eastern India, China, Madagascar, Germany, and Egypt.

plasma, in physics, collection of electrically charged particles about equal in number or density that is produced when the atoms in a gas become ionized. It is sometimes referred to as the fourth state of matter, distinct from the solid, liquid, and gaseous states.

A brief treatment of plasma follows. For full treatment, *see* MACROPAEDIA: Matter: Its Properties, States, Varieties, and Behaviour.

When energy (*e.g.,* heat) is continuously applied to a solid, it first melts, then it vaporizes, and finally electrons are removed from some of the neutral gas atoms and molecules to yield a mixture of positively charged ions and negatively charged electrons, while overall neutral charge density is maintained. When a significant portion of the gas has been ionized, its properties will be altered so substantially that little resemblance to solids, liquids, and gases remains. Plasma is unique in the way in which it interacts with itself, with electric and magnetic fields, and with its environment. A plasma can be thought of as a "soup" of ions, electrons, neutral atoms and molecules, and photons, in which some atoms are being ionized simultaneously with other electrons recombining with ions to form neutral particles, while photons are continuously being produced and absorbed.

Scientists have estimated that more than 99 percent of the matter in the universe exists in the plasma state. All of the observed stars, including the Sun, consist of plasma, as do interstellar and interplanetary media and the outer atmospheres of the planets. Although most terrestrial matter exists in a solid, liquid, or gaseous state, plasma is found in lightning bolts, flames, auroras, and in gaseous discharge lamps (neon lights).

plasma cell myeloma: *see* multiple myeloma.

plasma oscillation, the organized motion of electrons or ions in a plasma. Each particle in a plasma assumes positions such that the total force resulting from all the particles is zero, thus producing a uniform neutral-charge state. If an electron is moved from its equilibrium position, the equilibrium position itself takes on a positive charge and exerts an electrostatic attraction on the electron, causing the electron to oscillate about its equilibrium position. Because the interaction between electrons is strong, they will oscillate collectively at a characteristic frequency depending upon the nature of the particular plasma.

plasmapause, portion of the magnetosphere that rotates with the Earth at about four Earth radii (about 26,000 km, or 16,000 miles); beyond this region there is a rapid decrease in electron concentrations, and their circulation pattern is quite different. Under very quiet solar conditions, the plasmapause may extend to six Earth radii, and with very disturbed conditions it contracts to three Earth radii.

plasmid, in microbiology, an extrachromosomal genetic element occurring in many bacterial strains. Plasmids are circular deoxyribonucleic acid (DNA) molecules that are not essential for the bacterium but may confer a selective advantage. One class of plasmids, colicinogenic (or *Col*) factors, determines the production of proteins called colicins, which have antibiotic activity and can kill other bacteria. Another class of plasmids, R factors, confers upon bacteria resistance to antibiotics. Some *Col* factors and R factors can transfer themselves from one cell to another and thus are capable of spreading rapidly through a bacterial population. A plasmid that is attached to the cell membrane or integrated into the bacterial chromosome is called an episome (*q.v.*).

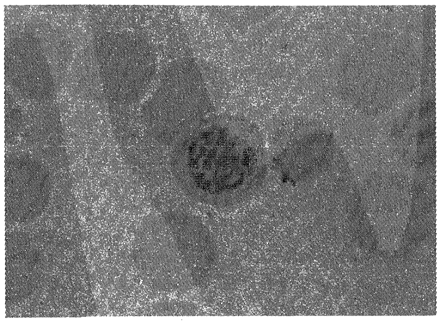
plasmodesma, plural PLASMODESMATA, microscopic cytoplasmic canals that pass through plant-cell walls and allow direct communication of molecules between adjacent plant cells. Plasmodesmata are formed during cell division, when traces of the endoplasmic reticulum (an organelle that synthesizes constituents of the outer cell membrane) become caught in the new wall that divides the parent cell. The two progeny cells may be connected by thousands of plasmodesmata, which contain rings of membrane at each end that are thought to regulate the passage of molecules. By overcoming the barrier posed by the cell wall, plasmodesmata unite plant cells into functioning tissues.

Plasmodiophoromycetes, class of plant parasites in the division Myxomycophyta and referred to as endoparasitic slime molds. Some authors assign them to the fungi (division Mycota). The class contains a single order, Plamodiophorales, a single family, Plasmodiophoraceae, and nine genera, the most important of which are *Plasmodiophora* and *Spongospora.*

All members are obligate parasites of algae, fungi, or higher plants, causing cell enlargement, especially of the roots. They are distinguished by the production of motile cells (zoospores) with two unequal anterior whiplike threads (flagella).

Plasmodiophora brassicae causes clubroot (*q.v.*) of cabbage and related plants. *Spongospora subterranea* causes powdery scab of potato (*see* scab).

Plasmodium, the causative organism of malaria (*q.v.*), a genus of parasitic protozoan of the sporozoan subclass Coccidia. *Plasmodium,* which infects red blood cells in mammals (including humans), birds, and reptiles, occurs throughout the world, especially in tropical and temperate zones. The organism is transmitted by the bite of the female *Anopheles* mosquito. Other insects and some mites may also transmit forms of malaria to animals.



Plasmodium vivax in red blood cell
A.L. Leu

Four species cause human malaria: *P. vivax* (producing the most widespread form), *P. ovale* (relatively uncommon), *P. falciparum* (producing the most severe symptoms), and *P. malariae.* They pass from mosquito to humans as sporozoites in the saliva of the mosquito. The parasites enter liver parenchyma cells first, then red blood cells; there they divide, forming 12 to 24 daughter parasites, and almost simultaneously destroy the red blood cells. They then enter the plasma and infect new red blood cells. The destroyed red cells liberate toxins that cause the periodic chill and fever cycles that are the typical symptoms of malaria. Certain species of *Plasmodium, P. vivax, P. ovale,* and *P. falciparum* repeat the cycle every 48 hours (tertian malaria), and *P. malariae* repeats it every 72 hours (quartan malaria).

Plassey, also called PALĀSHI, historic village, east-central West Bengal state, northeastern India, just east of the Bhāgīrathi River. Plassey was the scene of the decisive victory of British forces under Robert Clive over those of the nawab of Bengal, Sirāj-ud-Dawlah, in 1757. Dispatched from Madras with reinforcements to reestablish British factories (trading stations) in Bengal, Clive was aided in his mission by the treachery of the nawab's generals. The Battle of Plassey helped pave the way for the British acquisition of Bengal. A monument marks the scene of the battlefield, partially washed away by a shift of the Bhāgīrathi.

Plassey battle monument, West Bengal, India
Kaypix—Shostal/EB Inc.

plaster, a pasty composition (as of lime or gypsum, water, and sand) that hardens on drying and is used for coating walls, ceilings, and partitions.

Plastering is one of the most ancient building techniques. Evidence indicates that primitive peoples plastered their reed or sapling shelters with mud, thus developing more durable structures and more effective screens against vermin and inclement weather. More lasting and sightly materials in time replaced mud. Some of the earliest plastering extant is of a quality comparable to that used in modern times. The Pyramids of Egypt contain plasterwork executed at least 4,000 years ago that is still hard and durable. The principal tools of the plasterer of that time were in design and purpose like those used today. For their finest work the Egyptians used a plaster made from calcined gypsum that is identical with plaster of paris. In other respects also the materials and the procedures used by the Egyptians 4,000 years ago were identical with those of today.

Very early in the history of Greek architecture (*e.g.,* at Mycenae), plaster of a fine white lime stucco was used. Greek artisans had achieved high quality earlier than the 5th century BC. Plaster was frequently used to cover the exteriors of temples, a technique commonly known as stucco, in addition to covering the interiors, in some cases even when the building was made of marble. Plaster used in this way provided an excellent ground for decorative painting. The temple of Apollo at Bassae, built of yellow limestone about 450–420 BC, is an excellent example of Grecian use of decoration on stucco and plaster. The ornamental plaster ceilings of England during the reigns of Henry VIII, Elizabeth I, and James I still are admired. Earlier extant specimens of the plasterers' skill in England are the pargeted and ornamented fronts of half-timber houses. Plaster as a medium of artistic expression waned by the 19th century, when imitation and mechanical reproduction usually displaced this creative art. As a surface material for interior walls and ceilings and to a lesser degree for exterior walls, plaster has become common. It facilitates cleanliness and sanitation in building and is a retardant to the spread of fire.

Interior plasterwork is designed according to the type of lathing to which it is applied and the number of applications that are necessary. Ornamental plaster for ceilings and cornices is usually applied with a metal molding tool that has the reverse of the desired profile. Some elements may be formed by hand, while others are precast and stuck in place with plaster of paris. Stucco may be applied directly to concrete, brick, tile, or a supporting metal lath base. Various types of finish, including colours and textures, may be incorporated in the finish coat. Splatter dash and pebble dash are textured surfaces resulting from throwing mortar or pebble with some force on the finish coat while it is still soft.

plaster of paris: *see* paris, plaster of.

plastic, any of numerous synthetic materials that consist of giant molecules called polymers, with extremely long chains of repeating units derived from short molecules. Plastics can be formed into products by molding or otherwise shaping.

A brief treatment of plastics follows. For full treatment, *see* MACROPAEDIA: Industries, Chemical Process.

A significant property of most plastics is that they soften when heated, so that they can be formed into shapes, then become rigid on cooling. This property derives from their physical structure, which consists of a network of polymers, the constituent units of which separate under heat sufficiently to slide apart, but on cooling become firmly entangled again. The first plastic developed was celluloid, consisting of nitrocellulose softened by vegetable oils and camphor, patented in 1870 by an American printer, John W. Hyatt. The first completely synthetic plastic was Bakelite, produced from phenol and formaldehyde by Leo Baekeland in 1909. Advances in basic understanding of molecular physics facilitated the subsequent development of nylon, polyethylene, and other plastics.

All plastics are manufactured by some method of polymerization, the process of forming the long chains and networks of molecules. The two major divisions of plastics are the thermosetting resins and thermoplastic resins. Thermosetting resins become insoluble and infusible on heating. Among thermosetting resins are the phenolic resins, furan resins, aminoplastics, alkyds and polyesters of unsaturated acids, epoxy resins, polyurethanes, and silicones. Thermoplastic resins, which can be melted and solidified repeatedly, unlike thermosetting resins, include cellulose derivatives, addition polymers (polyethylene, polypropylene, vinyls, acrylics, fluorocarbon resins, and polystyrenes), and condensation polymers (nylons, polyethylene terephthalate, polycarbonates, and polyamides). Other types of resins include oil-soluble or modified resins, plastics such as casein and lignin extracted from natural products, and special-application synthetics such as resins used as adhesives and as additives to paper and textiles.

Raw materials for plastics include coal and cellulose, but by far the chief source is petroleum. Plastics are shaped by a variety of means, including extrusion, blow-molding, calendering between rollers, thermosetting in hydraulic presses, injection molding, rotational molding using centrifugal action, thermoforming, vacuum molding, laminating by press, and casting. Foamed plastics are produced by forming gas bubbles in the molten material. Plastic products are further shaped and finished by means ranging from mechanical through laser machining, ultrasonic welding, and radiation processing.

Because of their easy manipulation, economical manufacture, low specific gravity, and resistance to corrosion, plastics have replaced metal, wood, glass, and other materials in many applications. An immense array of plastic industrial and consumer goods is available. *See also* resin.

plastic surgery, surgical specialty concerned with the correction of disfigurement, restoration of impaired function, and improvement of physical appearance. Although surgical reconstruction of the nose was performed by Hindu physicians before the time of Christ, modern techniques of plastic surgery were originated in the post-World War I years by surgeons repairing the wounds and disfigurements of combat veterans.

The term plastic refers to the reshaping of body tissues—bone, fat, muscle, cartilage, and skin. Tissue may be moved to fill a depression; to cover a wound, as in skin grafting; or to improve appearance, as in hair transplantation. Synthetic compounds such as silicone are also used as a substitute for absent or deficient natural tissue. Tissue may be completely removed to alter the contours of a feature, as in rhinoplasty (reconstruction of the nose), otoplasty (ear reduction), and blepharoplasty (the removal of skin and fatty tissue from the eyelids) or to restore youthful appearance, as in rhytidectomy (face-lift, in which excess skin is removed from the face and neck). Among the techniques used in plastic surgery are incision, excision, chemosurgery, electrosurgery, lasar surgery, and dermabrasion. In the late 1970s European doctors developed a technique—known variously as suction lipectomy, lipoplasty, lipodissection, liposuction, or lipolysis—for the removal of diet-resistant fat cells; the procedure involves the use of a blunt, hollow, probelike tool or cannula attached to a mechanical suction machine and inserted through a small incision.

Reconstructive plastic surgery is performed to correct severe functional impairments caused by burns and other traumatic injuries, to correct congenital abnormalities, and to compensate for tissue removed in cancer surgery. The development of microsurgery in the 1960s and '70s greatly expanded the scope of reconstructive surgery, allowing surgeons to reattach severed fingers and limbs. Exceedingly fine needles and sutures make it possible for the surgeon to rejoin small blood vessels and other minute structures under an operating microscope.

The other major impetus to plastic surgery is cosmetic, that is, to improve appearance in otherwise healthy persons. Into this classification fall the majority of the cases of rhinoplasty, rhytidectomy, breast augmentation, hair transplantation, and other procedures.

plasticity, ability of certain solids to flow or to change shape permanently when subjected to stresses of intermediate magnitude between those producing temporary deformation, or elastic behaviour, and those causing failure of the material, or rupture; or the science that describes and explains this behaviour. Plasticity enables a solid under the action of external forces to undergo permanent deformation without rupture, called plastic deformation. Elasticity, in comparison, enables a solid to return to its original shape after the load is removed. Plastic deformation occurs, for example, in many metal-forming processes (rolling, pressing, forging) and in geological processes (rock folding and rock flow within the earth under extremely high pressures and at elevated temperatures).

Plastic deformation is a property of ductile and malleable solids. Brittle materials, such as cast iron, cannot be plastically deformed, though at elevated temperatures some, such as glass, which is not a crystallized solid, do undergo plastic flow.

Plasticity, as a science, refers either to mathematical descriptions of what happens in plastic deformation in terms of stresses, strains, and loads or to physical explanations of plastic flow in terms of atoms, crystals, grains, and motions of structural defects (dislocations) within crystals.

Plaszow, Polish PŁASZOW, German Nazi concentration camp near Kraków, used chiefly as a forced-labour centre.

The camp, opened in June 1942, was the gathering centre for Jews rounded up from the general region of Kraków and, later, for Jews from Hungary; at its peak, it held some 20,000 or more inmates. Brutal labour in local industries and stone quarries, together with poor food and sanitation, caused a heavy death toll. In the final months of 1944 the Nazis attempted to erase evidence of the camp, deporting many prisoners to Auschwitz and other concentration camps, burning some 9,000 exhumed bodies, and destroying many of the installations. When the Soviet army arrived in January 1945, only 600 prisoners remained alive. The commandant of Plaszow, SS officer Amon Goeth, was tried and executed in 1946.

Plata, Río de la (Spanish: "River of Silver"), English RIVER PLATE, estuary on the southeast coast of South America, formed by the Paraná and Uruguay rivers and covering about 13,500 square miles (35,000 square km).

A brief treatment of the Río de la Plata follows. For full treatment, *see* MACROPAEDIA: South America.

Roughly triangular in shape, the Río de la Plata is bounded on the north by Uruguay and on the south by Argentina; it drains eastward into the Atlantic Ocean. Its major tributaries, the Paraná and Uruguay rivers, drain about 1,600,000 square miles (4,144,000 square km), which includes northwestern Argentina, southern Brazil, southeastern Bolivia, Paraguay in its entirety, and most of Uruguay. The combined annual average rate of discharge of the two rivers is nearly 800,000 cubic feet per sec (23,000 cubic m per sec), bringing with it about 2,000,000,000 cubic feet (56,600,000 cubic m) of silt each year. Because the estuary is shallow, constant dredging is required to keep the sand and silt from obstructing the channel to the Argentine port of Buenos Aires. The shoals formed by these deposits are dominant features of the Río de la Plata. The ocean tides, weak though they may be, flow 120 miles (193 km) up the Paraná and the Uruguay rivers from their mouths on the estuary. The average tidal range is 6 inches (15 cm) at Montevideo (in Uruguay) and 2.5 feet (76 cm) at Buenos Aires. The Argentine coast of the estuary is low-lying; its banks are of marine debris and coarse sand. The Uruguayan coast, on the other hand, stands quite high and consists largely of rocks and dunes.

Plataea, ancient city of Boeotia, Greece. Plataea was situated on a triangular ledge 1,000 feet (300 m) above sea level, on the northern side of Mount Cithaeron below the modern village of Plataiaí. It was well-positioned in time of war to threaten the main road from Thebes to the Isthmus of Corinth, which passed east of Plataea over Mount Cithaeron. Plataea was settled by Boeotians who expelled the earlier Bronze Age inhabitants. When Thebes pressed Plataea to join a league of Boeotian cities formed in the 6th century BC, the Plataeans refused and engaged Athens (519) to protect them. Then, when the Persians landed in Attica in 490, the full Plataean levy, numbering about 1,000 men, came to the aid of Athens and fought at Marathon. In 479, Greek forces under Pausanias defeated the invading Persian army of Mardonius on the slopes of Cithaeron below Plataea, decisively crushing Persian ambitions on the Greek mainland. Thereafter the Plataeans offered sacrifice annually to Zeus the Liberator in honour of the Greek dead, and Plataea was declared inviolable by Pausanias. Nonetheless, the city was attacked by Thebans (431), then by Spartans (429), who finally razed it in 427. Thebes occupied the site until 387, then destroyed it again in 373. Athens harboured the survivors until the Macedonian kings Philip II and Alexander the Great rebuilt Plataea after 338 as a symbol of Greek courage in resisting Persia.

Plate, River: *see* Plata, Río de la.

plate glass, form of glass originally made by casting and rolling and characterized by its excellent surface produced by grinding and polishing. Plate glass was first made in the 17th century in France, after which several improvements in the original batch technique culminated in the Bicheroux process (1918), in which the glass was received by power-driven rollers that then delivered it in thinner sheets of greater length to be sheared into sections and annealed (heated, then cooled, to make it less brittle). A continuous process was then developed in which the glass passed through the annealing stage before being cut into lengths, ground, and polished.

A technique developed in Great Britain in the 1950s, called the float-glass method, results in an important economy of space. The molten glass is conveyed onto a bath of a molten metal, such as tin. The high temperature of the molten metal smooths out any irregularities on the surface, making a flat, even sheet. As the glass floats on top of the bath, the temperature of the molten metal is gradually reduced until the glass solidifies.

plate tectonics, theory that present and past earthquakes and volcanism, along with mountain-building processes, can be explained by the relative movement and jostling of enormous, rigid blocks (plates) comprising the Earth's surface.

A brief treatment of plate tectonics follows. For full treatment, *see* MACROPAEDIA: Plate Tectonics.

The surface of the Earth is composed of about a dozen large plates and several small ones. Within each plate the rocks of the terrestrial crust move as a rigid body, with only minor flexuring and few manifestations of seismicity and volcanism. The margins of the plates are defined by narrow bands in which 80 percent of the world's earthquakes and volcanoes occur. There are three types of boundaries. The first of these is a very narrow band of shallow earthquakes caused by tensile stresses that follow exactly the crest of the 48,000-mile- (80,000-kilometre-) long, active midocean ridges. The second boundary type occurs in areas where these ridges are offset. Earthquakes are much more violent along faults at such sites and result from the plates on either side of the faults grinding laterally past one another in opposite directions. Earthquakes forming the third boundary are distributed more diffusely but include all of the world's deep earthquakes (*i.e.,* those originating at depths greater than 90 miles [145 km]) and are associated with extremely narrow zones in which the ocean floor descends below its normal depth to as much as 6.6 miles (10.5 km) below sea level—the oceanic trenches. Across this margin, the maximum earthquake depths systematically increase along a dipping plane, with shallower earthquakes associated principally with the volcanic activity that borders each trench.

The ridge-crest earthquakes originate because of the tension created when the plates on either side move in opposite directions. This movement also releases the pressure on the underlying hot rocks, causing them to begin melting. The resulting magmas rise to form volcanoes (such as those in Iceland), which then solidify and later fracture as the tensional forces reassert themselves. Such new volcanic rocks thus become added to the edge of each plate, which grows at these "constructive" margins. The evidence for plate motion is not only the nature of the earthquakes but also the age of the volcanic oceanic rocks. Dating can be achieved by using both the fossil content of the sediments overlying the volcanic rocks and the time record represented by the anomalies in the magnetism of the rocks, which can be detected by ships sailing on the ocean surface. These show that the youngest volcanic rocks are at the crests of the midocean ridges and the oldest are in the deepest areas, *i.e.,* the oceanic trenches. Nowhere, however, are such rocks older than 190,000,000 years, indicating that all older oceanic rocks must have been destroyed.

The trench margin is termed "destructive" because this is the region where the oceanic rocks are subducted (carried down) into the mantle along the dipping plane. Where subduction occurs along a continental edge, volcanism distorts the continental rocks, forming such mountain chains as the Andes. Elsewhere, volcanism creates island arcs, as in the southwestern Pacific. The composition of the volcanoes and their mineralization changes systematically with depth to the dipping plane, but their overall composition is that of continental crustal rocks. The destructive margins are thus regions where continental crustal rocks are created but oceanic rocks are recycled back to the mantle. The density of continental rocks is too low for them to be subducted, so if they are carried to a trench they will eventually collide, giving rise to mountain chains such as the Alps and Himalayas, which formed when Africa and India, respectively, collided with Europe and Asia.

Although the lateral extent of the plates is well defined, their thickness is less certain. At the crest of the oceanic ridge they are very thin, but heat-flow and seismic evidence suggest that their base increases rapidly with depth, reaching 30–36 mi (48–57 km) within about 6–12 mi (9–19 km) of the crest. By about 600 mi (960 km) distance from the crest the base has increased to 72 mi (115 km). A plate may be subducted at any thickness but rarely exceeds 90 mi (145 km). Each plate is composed of rigid mantle rocks with oceanic crustal rocks, but not necessarily those of the continental variety (*e.g.,* the Pacific plate is devoid of continental rocks). The zone of rigid crustal and mantle rocks is termed the lithosphere to distinguish it from the deeper asthenosphere, where mantle rocks are at a higher temperature and so deform plastically when subjected to tectonic stresses. The continental lithosphere is not consistently underlain by an asthenosphere. Moreover, the presence of volcanic rocks such as diamond-bearing kimberlites indicates that here the Earth's lithosphere is at least 120 mi (190 km) thick, so that mantle flow, which causes plate motions, must occur at even greater depths.

The movements of the mantle result from the need to transfer to the Earth's surface the heat generated within it by radioactive decay, and hence convective patterns vary with time. This is shown by changes in the location of past plate margins. The subduction that formed the Western Cordillera of North America largely ceased 10,000,000 years ago, although some activity continues to produce volcanoes (*e.g.,* the continuing eruptions of Mt. Saint Helens in Washington) and earthquakes in Alaska.

Over time scales of hundreds of millions of years, changes in mantle convection initiated the formation of the Atlantic and Indian Oceans by splitting preexisting continents that were grouped as two major blocks, Laurasia and Gondwanaland (*qq.v.*), some 160,000,000 to 180,000,000 years ago. Similarly, past continental collisions are recorded by largely eroded mountain chains, such as the Appalachian Mountains of eastern North America and the Caledonian-Hercynian Mountains of Europe and Africa, which were formed when these continents collided on successive occasions. The rate of mantle convection depends essentially on the square root of heat production within the mantle. This means that convection rates must have been at least twice as fast about 3,000,000,000 years ago, when the radiogenic heat being produced was about five times greater than today. The surface expressions of such motions, however, may have been different. There are no continental rocks more than 4,000,000,000 years old, possibly because the lithosphere was thin and was recycled without generating continental rocks. The nature of plate tectonic activity during most of the Earth's history is still uncertain, and models of the way in which it would be reflected in the continental rocks are highly speculative.

platea, in medieval theatre, the neutral acting area of a stage. In medieval staging, a number of mansions, or booths, representing specific locations, were placed around the acting area. The actors would move from mansion to mansion as the play demanded. The *platea* would assume the scenic identity of the mansion that was being used. The *platea* was also used as the acting area for places not specified by individual mansions, such as streets and open country.

Plateau, state, east central Nigeria, created in 1976 out of the northern half of former Benue-Plateau state. It occupies an area of 22,405 sq mi (58,030 sq km) and is bounded by the states of Bauchi and Kaduna on the north, Benue on the south, Gongola on the east, and Kwara and the Abuja Federal Capital Territory on the west. The Jos Plateau rises to about 5,250 ft (1,600 m) above sea level in the north central part, and the Benue River Valley stretches along the southwestern border. Although there are wooded valleys in the southeast, the vegetation is mostly open grassland (formerly wooded but now with only occasional hedges of cacti and scattered trees), which is used for grazing and farming. Although the state is best known for its mining production, agriculture is the major occupation of the people. Acha (a grain known as "hungry rice") and millet are the chief cash crops; yams, sorghum, corn (maize), potatoes, cowpeas, rice, fruits, and vegetables are the staple crops. Fulani herdsmen graze their cattle on the tsetse-free plateau and supply milk to the dairy at Vom. Among the major exports of the state are hides and skins.

Plateau state is the most important mining area in Nigeria and is a major exporter of tin and columbite. Previously shipped to Britain for treatment, the tin (also mined in neighbouring Bauchi, Kaduna, Benue, and Kano states) has been smelted since 1962 just outside Jos, the state capital and its largest town. The metals are shipped by rail to Port Harcourt for export. Other minerals, notably tantalite, kaolin, tungsten (wolfram), zircon, and thorium compounds, are also exploited on the plateau. Lead, zinc, and silver are mined on a small scale in the eastern part of the state around Wase, Zurak, and Kigom.

Known for its heterogeneity, the state has about 40 ethnic groups, including the Vergam, Ankwei, Angas, Jawara (Jarauci), Birom, Mango, Fulani, Hausa, and Eggen. The mining industry has attracted European, Ibo, and Yoruba immigrants into the state. Jos is connected by road with Wamba, Akwanga, Keffi, and Lafia and has an airport. Lafia, Pankshin, Wamba, Shendam, and Akwanga are also sizeable market and mining centres. Places of interest include a museum, with Nok terra-cotta sculptures, and a zoo, both located at Jos. There is a federal university at Jos and a college of technology at Bukuru. Major research institutes are located at Vom (veterinary sciences) and at Bukuru (strategic studies). Pop. (1983 est.) 3,313,600.

plateau, extensive area of flat upland usually bounded by an escarpment on all sides but sometimes enclosed by mountains. The essential criteria for plateaus are low relative relief and altitude. Plateaus are extensive, and together with enclosed basins they cover about 45 percent of the Earth's land surface.

A brief treatment of plateaus follows. For full treatment, *see* MACROPAEDIA: Continental Landforms.

Classifications of different plateaus reflect their origins and subsequent erosional history. Tectonic plateaus are the most common. Most of Africa is such an uplifted continental block. The Arabian Peninsula and the Deccan Plateau of the Indian subcontinent are similar landforms. On a rather smaller scale, fault blocks and horsts are plateaus uplifted along marginal fault systems or left standing high when neighbouring blocks have sunk. Horsts are usually more distinctive than the larger fault block. A variation is the tilted block in which the plateau has one steeper edge and a gently tilted surface.

Plateaus enclosed within mountain systems are termed intermontane plateaus. In the United States the term basin and range is often used for this type of landscape, which extends between the Sierra Nevada and the Rockies. Basin-and-range topography, however, has a worldwide distribution. It includes much of Central Asia, Tibet, part of Szechwan, and Mongolia. Anatolia, Armenia, and Iran consist of intermontane plateaus, and some writers have gone so far as to class the Mediterranean, Aegean, and Black seas as intermontane basins. Intermontane plateaus are also common in the Andes; Lake Titicaca, the highest navigable water in the world at 12,500 ft (3,810 m), lies on such a plateau. Intermontane plateaus, horsts, and fault blocks are usually associated with young fold mountains.

Other plateau types consist of resistant rocks. Volcanoes pouring out extensive areas of basaltic lava have created a number of plateaus. Examples include the Antrim basaltic plateau in northern Ireland, the Cumberland–Snake basin in the northwestern United States, Ethiopia, and the northwestern part of the Deccan in India.

Low relief distinguishes plateaus from mountains, although modes of origin may be the same. Plateau areas, however, are subject to erosion and dissection by streams and glaciers. Ancient fold systems, once eroded, have been uplifted as plateaus and begin to undergo erosion once again. The Ardennes of Belgium, the Fjeld-plateaus of Scandinavia, and the Allegheny-Cumberland plateaus in the Appalachians are examples of this. In other places dissection has been more thorough and little remains of the original plateau surface. Such surfaces are inferred from accordant summits and have aroused debate among geomorphologists as to the existence of such erosional surfaces. The Highlands of Scotland are one area where surfaces have been postulated but where the existence of particular levels is often disputed. Apart from presenting problems in sampling surfaces, uplifted areas may have undergone substantial warping, and one cannot be sure that a former low-lying plain has been uplifted.

In arid and semiarid areas dissection often leads to the formation of tabular masses, especially if there is a resistant cap-rock. This is the typical frontier scenery of the southwestern United States where surfaces have been eroded into mesas (tablelands) and buttes (smaller flat-topped hills).

Plateaus, being high, often create their own local climates. In basin-and-range topography, height together with the rain-shadow effect created by surrounding mountains work to produce arid and semiarid conditions.

plateau, oceanic: *see* oceanic plateau.

Plateau Indian, member of any of a group of North American tribes who inhabited the high plateau between the Rocky Mountains on the east and the Cascade Range on the west. Linguistically they belonged to four main families: the Salish, Kutenai, Sahaptin and Klamath-Modoc (Lutuami), although the majority languages were Salish and Sahaptin. Their tribes included the Shuswap, Lillooet, and Thompson of the Northern Plateau group and the Okanagon, Lake, Wenatchee, Sanpoil, Nespelim, Spokan, Kalispel (with the Pend d'Oreille), Coeur d'Alene, and Flathead of the Interior group. There were also the Nez-Percé, the Cayuse-Molala, and other subdivisions of the Central Sahaptin.

A brief treatment of the Plateau Indians follows. For full treatment, *see* MACROPAEDIA: American Indians.

The Plateau Indians in the main were seasonal people, spending their winters in permanent villages along the waterways of the area and their summers in camps on the upland hunting grounds. Winters were harsh (as cold as −30° F [−34° C]) and summers hot (as high as 100° F [38° C]), but the area had plentiful opportunities for fishing (mostly salmon), hunting, and gathering. The Plateau Indians lived in earth lodges in the winter and in mat-covered conical lodges on the summer camping grounds. The basic unit was the village, but, beyond that, customs varied. The Thompson Indians based their decisions on informal village meetings, deferring to the consent of all the villagers. The Sanpoils had a more formal structure based on a chief, a subchief, and a general assembly including all adults except unmarried young men. The Nez Percé had a similar structure with a hereditary chief; the Flathead had a powerful head chief with subordinate band chiefs.

There were annual firstling rites on the occasion of the first salmon catch and the first root or berry harvest. Trickster, or transformer, figures such as the Coyote and the Bluejay were central elements of the mythology. Plateau Indian art is undistinguished, consisting largely of pictographic representations of supernatural beings and cosmic phenomena.

The demise of the old culture and traditions began with the penetration of the Northwest by fur traders and trappers from the east. Among these were Iroquois Christians who spread Christian culture through the area. The fur traders brought modern tools and weapons as well as diseases to which the Indians had no resistance. The horse was introduced at the beginning of the 18th century by the neighbouring Plains Indians and became more widely used than among the Plains Indians themselves.

The great invasion by the white man began with the first wagon train led into the Northwest area by Marcus Whitman, an eastern missionary-doctor, early in the mid-19th century. In the 1850s and '60s there were great waves of settlers and gold seekers, with the result that a series of wars broke out with the Indian tribes. The most famous of these was the Nez Percé War of 1877. By the end of the century the tribes were reduced to living on small reservations, and most of the old culture and the traditional economic ways of life have now been lost.

Plateau Indian cultures in the 20th century represent a mixture of aboriginal and white elements. The members of some tribes have become ranchers or ranch hands while continuing to engage in seasonal fishing; others have become farmers. The Indians have partly retained their religion and group identification but adopted modern technology and material culture.

Plateau Shoshonean languages: *see* Numic languages.

platelet, also called THROMBOCYTE, small, colourless, nonnucleated, usually round body that is important in blood-clot formation and is found only in the blood of mammals. Platelets are formed when cytoplasmic fragments of megakaryocytes, which are very large cells in the bone marrow, pinch off into the circulation as they age. The platelet is metabolically more active than the red blood cell and has a variety of functions. Platelets play an important and not fully understood role in the formation of the blood clot by coagulating to occlude a cut blood vessel and provide a surface on which strands of fibrin (*q.v.*) form an organized clot, by contracting to pull the fibrin strands together to make the clot firm and permanent, and, perhaps most important, by providing or mediating a series of coagulation factors necessary to the formation of the clot. Platelets also store and transport several chemicals, including serotonin, epinephrine, and histamine (the importance of which in this capacity is unknown), and they phagocytose (absorb) foreign bodies, including viruses, as well.

At birth the number of platelets is low, but by three months of age the adult level is reached. The number of platelets rises following trauma or asphyxiation, at high altitudes, after exercise, and in cold weather; the number may be temporarily lowered by menstruation in women. Certain chemicals may prolong the life of platelets; smoking is believed to shorten their life spans.

Platelets are produced in the bone marrow and stored in the spleen. Some evidence suggests they may also be produced or stored in the lungs, where megakaryocytes are frequently found. Individuals may develop antibodies to platelets following repeated platelet or whole-blood transfusion.

Platen(-Hallermünde), August, Graf von (count of), Hallermünde also spelled HALLERMUND (b. Oct. 24, 1796, Ansbach, principality of Ansbach [Germany]—d. Dec. 5, 1835, Syracuse, Sicily), German poet and dramatist

Platen, engraving by C. Barth, second quarter of the 19th century

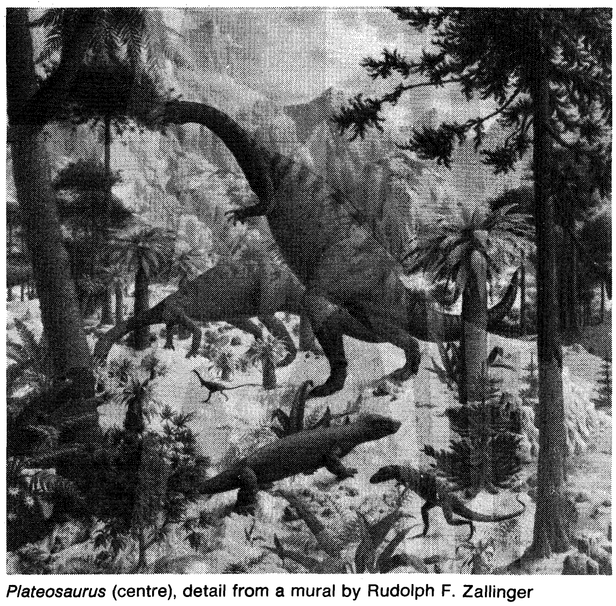
By courtesy of the Germanisches Nationalmuseum, Nurnberg

who was almost unique among his contemporaries in aiming at classical purity of style; although he was schooled in the Romantic tradition, he opposed its undisciplined flamboyance.

Platen entered the Bavarian life guards in 1814 and attended the University of Würzburg in 1818. In 1819 he moved to Erlangen, where he studied under the philosopher of Romanticism, Friedrich Schelling, and made the acquaintance of many of the leading writers of the time, including Johann Wolfgang von Goethe. He became a first-rate scholar and published a little book of poems, *Ghaselen* (1821; "Ghazels"), in which he imitated the style of his friend Friedrich Rückert. This was soon followed by other volumes.

Though Platen was at first influenced as a dramatist by the Romantics and particularly by Spanish models, the plays that he wrote while he was at Erlangen show a clearness of plot and expression that is foreign to the Romantic style. His antagonism to Romanticism became more pronounced, and he attacked its extravagances, particularly the *Schicksaldrama,* or fate drama, in his witty comedies in the manner of Aristophanes: *Die verhängnisvolle Gabel* (1826; "The Fateful Prong") and *Der romantische Oedipus* (1829; "The Romantic Oedipus"). *Der romantische Oedipus* earned him the enmity of two other eminent German writers—Karl Immermann, whose work was ridiculed in it, and Immermann's close friend Heinrich Heine. Platen, however, possessed many admirers who delighted in the classical purity of his plays and their polished form and diction. After 1826 he lived in Italy, and his last play, *Die Liga von Cambrai* (1833; "The League of Cambrai"), and the epic fairy tale *Die Abbassiden* (1834; "The Abbasids") were written at Naples. Platen's odes and sonnets and his *Polenlieder* (1831; "Songs of the Poles"), which expressed sympathy for the Poles in their rising against the tsar's rule, are counted among the best classical poems of their time.

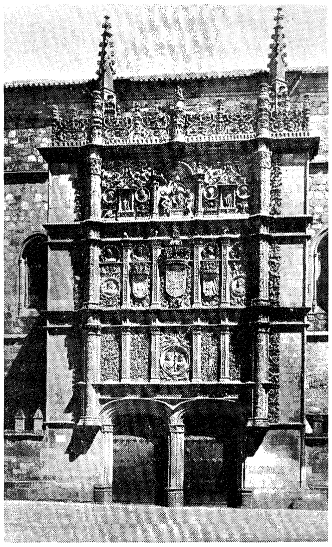
Plateosaurus, genus of early dinosaurs known from extensive Late Triassic fossil material found in Europe (the Triassic period began 245,000,000 years ago and lasted 37,-000,000 years). *Plateosaurus,* a representative of the prosauropods, an early group that might be ancestral to the giant sauropod dinosaurs of later time periods, was among the earliest dinosaurs to attain a relatively large size. It grew to be about 7 m (23 feet) long and was more massive than earlier dinosaurs. The bones were no longer hollow since hollow bones could not support the increasing bulk of the animal. Although *Plateosaurus* walked on its two very strong hind legs, its forelimbs also were relatively well-developed and strong, and thus it would have been able to walk on all four legs as well. The small skull was perched atop a long and flexible neck and contained compressed and spatulate teeth serrated on the front and back edges. Although it has been suggested that *Plateosaurus* was carnivorous, the teeth and jaw musculature seem much better suited to a plant diet. It also has been suggested that *Plateosaurus* was at least partially aquatic, but this, too, is uncertain. Specimens that resemble *Plateosaurus* have been found in South Africa and China, and



Plateosaurus (centre), detail from a mural by Rudolph F. Zallinger

By courtesy of the Peabody Museum of Natural History, Yale University it is possible that the genus had a very wide distribution.

Plateresque, Spanish PLATERESCO ("Silversmith-like"), main architectural style in Spain during the late 15th and the 16th centuries, also used in Spain's American colonies. Cristóbal de Villalón first used the term in 1539 while comparing the richly ornamented facade of the Cathedral of Leon to a silversmith's intricate work. Later the name came to be generally applied to late Gothic and early Renaissance Spanish architecture, since it was characterized by an intricate and minutely detailed relief ornament that is generally applied to the surface of buildings for extravagant decorative effect and without regard for structural articulation. Favourite motifs of this florid ornament include twisted columns, heraldic escutcheons, and sinuous scrolls. Clusters of this jewelry-like ornament contrast with broad expanses of flat wall surface.



Plateresque facade of the University of Salamanca, Spain, early 16th century
Archivo Mas, Barcelona

The Plateresque style went through two distinguishable phases. The first phase, termed the Isabelline style because it flourished during the reign of Isabella I, lasted from about 1480 to about 1540. In this phase (also known as the Gothic-Plateresque style), the forms of late Flamboyant Gothic still predominate, and Renaissance elements are used with only imperfect understanding. The first phase, like its successor, utilized Mudejar ornament—*i.e.,* the intricate and elegant decorative patterns used by Moorish artists working in Christian-ruled Spain. The Isabelline style is well represented in the buildings of Enrique de Egas and Diego de Riaño and is typified by the facade of the College of San Gregorio in Valladolid (1488), in which architectural ornamentation seems free from all external dictates and pursues its own life without regard to scale, composition, placement, or appropriateness.

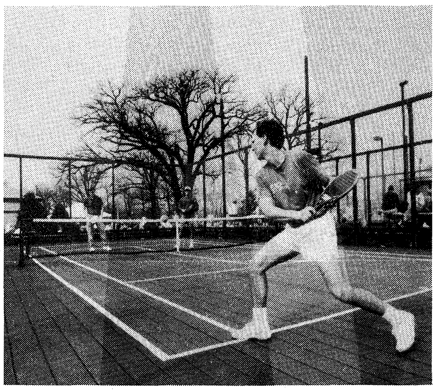
The second phase, the Renaissance-Plateresque, or simply the Plateresque, lasted from about 1525 to 1560. The architect and sculptor Diego de Siloé (d. 1563) helped inaugurate this phase, in which High Renaissance structural and decorative elements clearly predominated over late Gothic ones. In the Granada Cathedral (1528–43) and other buildings, Diego evolved a purer, more severe, harmonious, and unified style using massive geometric forms; correct classical orders became frequent, and nonstructural Gothic ribbing tended to disappear in favour of Italianate round arches and domical vaults. The buildings of Alonso de Covarrubias and of Rodrigo Gil de Hontañón, particularly the latter's facade of the University of Alcalá de Henares (1541–53), are the masterworks of the second style, which lasted only a few decades. Even the balance and correctness of the style seemed excessively rich to the sombre young man who became King Philip II in 1556 and supervised construction of the severe El Escorial.

platform, wave-cut, also called ABRASION PLATFORM (coastal feature): *see* wave-cut platform.

platform rocker, also called SWING ROCKING CHAIR, rocking chair with rockers fixed to move on a stationary base instead of on the floor. Introduced in the United States about 1870, it achieved quick popularity, partly because the movable section of the chair could be kept at a comfortable angle without oscillating. The base of the platform rocker was often of considerable structural complexity, but this meant that the seating portion could be made of lighter material, such as bamboo. The backs were invariably rectangular, never curved, and the general decorative pattern was usually based on 17th-century prototypes.

platform stage: *see* open stage.

platform tennis, also called PLATFORM PADDLE TENNIS, or PADDLE TENNIS, sport that is a combination of tennis and squash, devised in 1928 by American sports enthusiasts Fessenden Blanchard and James Cogswell at Scarsdale, N.Y. It is played on specially constructed platforms, 60 by 30 feet (18 by 9 m), surrounded by back and side walls of tightly strung wire netting 12 feet (3.7 m) high. The actual court measures 44 by 20 feet (13.4 by 6 m), and the net is 2 feet 10 inches (86 cm) high at its centre. The paddles, or bats, used instead of rackets, are made of oval plywood, metal-bound and perforated, and have short handles. Balls are made of sponge rubber. The rules are the same as for tennis, except that balls may be taken off the back or side walls after first striking inside the court proper, and only one serve is allowed.



Men's National Championships in platform tennis
Cathy Melloan

The sport has gained some popularity in the United States. The American Platform Tennis Association, founded in 1934, regulates the game.

Plath, Sylvia (b. Oct. 27, 1932, Boston, Mass., U.S.—d. Feb. 11, 1963, London, Eng.), American poet and novelist whose best-known works are noted for their preoccupation with alienation and with death and self-destruction. Little-known at the time of her death by suicide, her reputation and popularity grew rapidly afterward, and by the mid-1970s she was considered a major contemporary poet.

Plath's early life was dominated by a drive to excel at writing, and she published her first poem at age eight. She entered and won many literary contests and received a scholarship to Smith College. From 1955 to 1957 she attended the University of Cambridge on a Fulbright grant; there she met and in 1956 married the English poet Ted Hughes.

Her first major publication was *The Colossus* (1960), a collection of poems written from 1956 to 1960. This was followed by her only novel, *The Bell Jar* (1963), which first appeared under the pseudonym Victoria Lucas. Drawn from Plath's own experiences, the book describes the mental breakdown, attempted suicide, and eventual recovery of a young college girl. Works published posthumously include *Ariel* (1965) and *Crossing the Water* (1971), both poetry collections, and *Johnny Panic and the Bible of Dreams* (1977), a book of short stories and prose. *The Collected Poems,* which includes many previously unpublished poems, appeared in 1981.

plating, coating a metal or other material such as plastic or china with a hard, nonporous metallic surface to improve durability and beauty. Such surfaces as gold, silver, stainless steel, palladium, copper, and nickel are formed by dipping an object into a solution containing the desired surface material, which is deposited by chemical or electrochemical action. While much plating is done for decorative purposes, still more is done to increase the durability and corrosion-resistance of softer materials. Most automotive parts, appliances, housewares and flatware, hardware, plumbing and electronic equipment, wire goods, aircraft and aerospace products, and machine tools are plated for durability.

Several processes are used for plating: electroplating, electroless plating, and anodizing are the major processes used today, but other methods also have been developed.

In electroplating, the article to be plated serves as the cathode in an electrolytic bath composed of a solution of the salt of the metal to be deposited. The other terminal, the anode, may be of the same metal or another chemically unaffected conductor. A low-voltage current is passed through the solution and causes the metal in solution to plate the article. Electroless plating (*q.v.*) relies on reactions in a chemical bath that may or may not be aqueous and may or may not be heated. Anodizing (*q.v.*) is similar to electroplating, but the article to be plated serves as the anode in the electrical circuit.

platinum (Pt), chemical element, the best known and most widely used of the six platinum metals of Group VIII of the periodic table. A very heavy, precious, silver-white metal, platinum is soft and ductile, has a high melting point and good resistance to corrosion and chemical attack. For example, its surface remains bright after being brought to white heat in air and, though it readily dissolves in aqua regia, it is scarcely attacked by simple acids. Small amounts of iridium are commonly added to give a harder, stronger alloy that retains the advantages of pure platinum.

Platinum and its alloys are indispensable in the chemical laboratory for electrodes and for crucibles and dishes in which materials can be heated to high temperatures. Platinum is used for electrical contacts and sparking points because it resists both the high temperatures and chemical attack of electric arcs. Jewelry and dental alloys account for much of its use; platinum–iridium is used for surgical pins. The prototype international standard kilogram of mass was made from an alloy of 90 percent platinum and 10 percent iridium. The electrical resistivity of platinum is relatively high and depends markedly upon the temperature; the international temperature scale from −183° C to 630° C (−297° to 1,166° F) is defined in terms of a resistance thermometer made with platinum wire. As a catalyst, platinum has many applications.

The Italian-French physician Julius Caesar Scaliger alluded (1557) to a refractory metal, probably platinum, found between Darién and

Mexico. The Spanish mathematician Antonio de Ulloa (1735) and the British metallurgist and assayer Charles Wood (*c.* 1741) found platinum in South America, whence it was taken to Europe. The first certain discovery was in the alluvial deposits of the Río Pinto, Colombia. The Spaniards called the new metal *platina del Pinto* for its resemblance to silver. The world's most important deposits were found (1822) in the Ural Mountains of Russia. It occurs in Finland, Ireland, Borneo, New South Wales, New Zealand, Brazil, Peru, Madagascar, and in the Transvaal of South Africa. Native platinum also is found in Alaska, California, and Oregon, in British Columbia, and in Alberta. Platinum-bearing igneous rocks give rise to the associated placer deposits, the most productive sources of the native element. The ordinary variety of native platinum is called polyxene; it is 80 percent to 90 percent platinum, with 3 percent to 11 percent iron, plus the other platinum metals, and gold, copper, and nickel. For mineralogical properties, *see* native element (table). Platinum is also found in the very rare native alloy platiniridium. Platinum occurs combined with arsenic as sperrylite ($PtAs_2$) in the copper–nickel-mining district near Sudbury, Ont., and with sulfur as cooperite (PtS) in the Transvaal.

For information about the mining, recovery, and production of platinum, *see* MACROPAEDIA: Industries, Extraction and Processing. Additional details on the application of pure platinum and its alloys are also provided in the same article.

Platinum forms an important series of compounds with the oxidation states of +2 and +4 (and some compounds of 0, +5, and +6 states). Many of these compounds contain coordination complexes in which chloride ion (Cl^-), ammonia (NH_3), or other groups are bonded to a central platinum atom. Among the transition metals, platinum has one of the greatest tendencies to form bonds directly with carbon. Natural platinum is a mixture of six isotopes: platinum-190 (0.0127 percent), platinum-192 (0.78 percent), platinum-194 (32.9 percent), platinum-195 (33.8 percent), platinum-196 (25.3 percent), and platinum-198 (7.21 percent). All are stable except platinum-190 and platinum-192, which have been reported as long-lived alpha emitters.

atomic number	78
atomic weight	195.09
melting point	1,769° C (3,216° F)
boiling point	3,827° C (6,920° F)
specific gravity	21.45 (20° C)
valence	2, 4
electronic config.	2-8-18-32-17-1 or (Xe)$4f^{14}5d^{9}6s^{1}$

Plato (b. 428/427 BC, Athens, or Aegina, Greece—d. 348/347, Athens), ancient Greek philosopher, the second of the great trio of ancient Greeks—Socrates, Plato, and Aristotle. He developed a wide-ranging system of philosophy that was strongly ethical, resting on a foundation of eternal Ideas or Forms that represented universals or absolutes. Platonism influenced currents of philosophy up to the 20th century.

A brief account of the life and works of Plato follows; for a full biography, *see* MACROPAEDIA: Platonism.

Born of a distinguished Athenian family, Plato had political ambitions until he became convinced that there was no place for men of conscience in active politics. After the execution of Socrates (399 BC), he and other Socratic men took temporary refuge at Megara and then spent the next few years traveling in Greece, Egypt, Italy, and Sicily, where he found a kindred spirit in Dion, brother-in-law of Dionysius I, the tyrant of Syracuse. About 387 he founded the Academy in Athens as an institute for the systematic pursuit of philosophical and scientific research. He presided over it for the rest of his life, making it the recognized authority also in mathematics and jurisprudence. On the death of Dionysius I in 367, Plato went to Syracuse at the request of Dion to be the tutor for Dionysius II, but the plan to educate a constitutional king failed, and Plato returned to the Academy.

Although Plato considered the foundation and organization of the Academy his chief work, his importance to later generations has been as one of the greatest of philosophical writers. His dialogues are divided into two groups—the earlier and the later—on the basis of a real difference in thought, perhaps indicating the distinction between the more Socratic thought and the more distinctively Platonic thought.

Platonic Academy, Italian ACCADEMIA PLATONICA, a group of scholars in mid-15th-century Florence who met under the leadership of the outstanding translator and promulgator of Platonic philosophy Marsilio Ficino (*q.v.*), to study and discuss philosophy and the classics. The influence of their modernized and Christianized Platonism on Italian Renaissance thought was profound and still survives in the popular concept of "Platonic love." Although the group was never formally organized, its members considered themselves a re-creation of the Academy that had been formed by Plato in Athens. The most important members of the group, most of them connected with the courts of Cosimo and Lorenzo de' Medici, were Politian (or Poliziano), the outstanding poet and classical scholar of the Renaissance; the professor of poetry and oratory at the University of Florence, Cristofero Landino; and the scholars and philosophers Pico della Mirandola and Gentile de' Becchi.

Platonism, family of philosophic movements that derive their ultimate inspiration from the *Dialogues* of Plato and embrace his belief in absolute values rooted in a realm of unchanging and eternal realities independent of the world perceived by the senses. As here construed, Platonism does not include the work of Plato himself. *See also* Plato.

A brief treatment of Platonism and Neoplatonism follows. For full treatment, *see* MACROPAEDIA: Platonism.

After Plato's death, his greatest scholar, Aristotle, went his own way and eventually organized a school of his own in the Lyceum, claiming that he was preserving the essential spirit of Platonism while rejecting the difficult doctrine of the forms. It was under Arcesilaus (*c.* 276–241 BC) that the Academy began its polemic against the sensationalist dogmatism of the Stoics, which was to culminate a century later under the leadership of Philo of Larissa.

The history of the Academy after Philo is obscure, but in the late 1st century AD there arose a popular literary, somewhat corrupted, Platonism of which the writings of Plutarch of Athens are the best example. Genuine Platonism was revived in the 3rd century AD, in Rome, and independently of the Academy, by Plotinus. His Neoplatonism represents a real effort to do justice to the whole thought of Plato. Two aspects of Plato's thought, however, inevitably fell into the background: the mathematical physics and the politics. The 3rd century AD had no understanding for the former, and the Roman Empire under a succession of military chiefs had no place for the latter.

Plotinus lived in an atmosphere too pure for sectarian polemic, but in the hands of his successors, Neoplatonism was developed in conscious opposition to Christianity. Porphyry, his disciple and biographer, was the most formidable of the anti-Christian controversialists; in the next century, "Platonists" were among the allies and counselors of the emperor Julian in his attempts to invent a Hellenic counterpart to Christianity.

Early in the 5th century, Neoplatonism flourished for a short time in Alexandria and captured the Athenian Academy itself, where its last great representative was the acute Proclus (AD 410–485). Traces of Plato are probably to be detected in the Alexandrian *Wisdom of Solomon;* the thought of the Alexandrian Jewish philosopher and theologian Philo, in the 1st century AD, is at least as much Platonic as Stoic. There are, perhaps, no certain marks of Platonic influence in the New Testament, but the earliest apologists (Justin, Athenagoras) appealed to the witness of Plato against the puerilities and indecencies of mythology.

In the 3rd century, Clement of Alexandria and, after him, Origen made Platonism the metaphysical foundation of what was intended to be a definitely Christian philosophy. Although the church could not, in the end, conciliate Platonist eschatology with the dogmas of the resurrection of the flesh and the final judgment, the platonizing tendency was continued through the Middle Ages under the influence of St. Augustine and Boethius. A further powerful influence was exerted by the writings of the so-called Dionysius the Areopagite, which laid down the main lines of medieval mystical theology and angelology.

Apart from this theological current, Plato dominated the thought of the earlier Renaissance by virtue of numerous translations and commentaries. For a time, the work of Aristotle was comparatively unknown in the West. The 13th century saw a change, however, with the recovery of Aristotle's physics and metaphysics from the Moors, Persians, and Jews. Aristotle came to displace Plato in philosophy, partly in consequence of the immediately perceived value of his scientific works as a storehouse of well-digested natural facts, and partly from the brilliant success of the enterprise carried through by St. Thomas Aquinas, the reconstruction of philosophical theology on an Aristotelian basis. Plato is, however, by no means supplanted in the Thomist system; the impress of Augustine on Western thought has been far too deep for that.

Two Platonist revivals in particular are famous. The first is that of the 16th century, marked most notably by the foundation of Lorenzo de' Medici's Florentine Academy. In the 17th century, Plato, seen chiefly through the medium of Plotinus, supplied the inspiration of the so-called Cambridge Platonists (*q.v.*). In the 20th century, on the one hand A.N. Whitehead tried to work out a philosophy of the sciences that confessedly connected itself with the ideas of the *Timaeus;* and on the other the rise of totalitarian governments produced a number of publications confronting Plato with the theories inherent in their policies. Neo-Kantianism, Existentialism, and Analytic philosophy produced their own interpretations of Plato.

Platonov, Sergey Fyodorovich (b. June 28 [June 16, old style], 1860, Chernigov, Russia—d. Jan. 10, 1933, Samara), leading Russian historian of the early 20th century.

Having graduated from the University of St. Petersburg in 1882, Platonov held various academic posts at that institution and elsewhere. After 1920 he was a member of the U.S.S.R.'s Academy of Sciences. Most of Platonov's scholarly work dealt with the Time of Troubles, the chaotic interregnum (1598–1613) between the demise of the Rurik dynasty and the election of the first Romanov tsar. His major work on this subject was the monumental *Studies in the History of the Time of Troubles in the Muscovite State During the 16th and 17th Centuries* (1899). Platonov founded a new school of historiography in Russia based on careful and exhaustive archival research and analysis. His *History of Russia* (1909) and *Lectures on Russian His-*

tory (1899) remained, respectively, the standard high school and university textbooks on the subject for more than 20 years. Platonov's enormous prestige ensured his toleration by the Bolsheviks in the years immediately after the Revolution of 1917, and he continued to teach at Leningrad University (formerly the University of St. Petersburg) as he had since becoming a professor there in 1899. However, the apolitical Platonov came increasingly under attack from Marxist critics in the late 1920s, and in 1930 he was arrested, tried, and convicted on trumped-up charges of participating in a plot to restore the monarchy. He was exiled to Samara (now Kuybyshev), where he died.

platoon, principal subdivision of a military company, battery, or troop. Usually commanded by a lieutenant, it consists of from 25 to 50 men organized into two or more sections, or squads, led by noncommissioned officers.

In the 17th century the term referred to a small body of musketeers who fired together in a volley alternately with another platoon, and it has always retained some sense of systematic alternate employment. Hence "platoon fire" meant a regulated fire of alternating platoon volleys, and "platoon" sometimes referred to the volley itself. In the 18th century, battalions were often organized for tactical purposes into 16 platoons of about 24 men each, plus 2 or 4 platoons of grenadiers or light infantry.

The term platoon has been used in U.S. military manuals since 1779 and throughout the 19th century meant half a company. The platoon was reintroduced into the British Army in 1913.

The "platoon system" in municipal police and U.S. baseball and football organizations signifies the use of two or more shifts or teams of comparable strength that alternate on duty.

Platt, Orville Hitchcock (b. July 19, 1827, Washington, Conn., U.S.—d. April 21, 1905, Washington), U.S. senator from Connecticut (1879–1905) who introduced the Platt Amendment (*q.v.*), which became the basis for the withdrawal of U.S. troops from Cuba following the Spanish–American War of 1898.

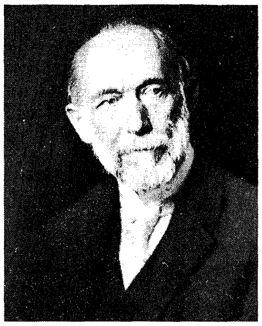
Platt began the practice of law in Meriden, Conn., in 1850 and was active in Connecticut politics, serving as secretary of state (1857), state senator (1861–62), and member of the state House of Representatives (1864, 1869). In 1879 he was elected as a Republican to the U.S. Senate. Although principally remembered in connection with the Platt Amendment, he also sponsored important legislation relating to patents and copyrights, including the international copyright act of 1891, and was chairman of the committee on territories (1887–93), which recommended the admission to the Union of six new Western states. He was also instrumental in the passage of the Sherman Silver Purchase Act of 1890. One of the "Big Four" leaders of the Senate—with Nelson W. Aldrich, William B. Allison, and James C. Spooner—Platt was regarded as a "stand-pat" conservative and was admired for his integrity and independence.

Platt, Thomas Collier (b. July 15, 1833, Owego, N.Y., U.S.—d. March 6, 1910, New York City), U.S. representative and senator from New York, who unwillingly furthered the rise to the U.S. presidency of Theodore Roosevelt (whom he called "a perfect bull in a china shop").

Educated at Owego Academy and at Yale (1849–50), Platt entered banking and lumbering, served in the U.S. House of Representatives (1873–77), and became president (1880) of the United States Express Company.

He first entered the Senate in March 1881. Two months later, both he and Roscoe Conkling, Republican Party boss of New York state, resigned from the Senate to protest the refusal of Pres. James A. Garfield to accept their recommendations for appointments to federal positions in New York State. Platt had to wait more than 15 years to regain his seat. (He then served two full terms, 1897–1909.) Meanwhile, Conkling retired from politics, and Platt assumed control of the Republican machinery in New York.

In 1898 Platt reluctantly accepted the candidacy for governor of the popular young reformer Theodore Roosevelt. Finding that he could not control Roosevelt, he contrived to eliminate him from state politics by persuading the Republican national convention in 1900 to nominate him for vice president. This maneuver backfired when the assassination of



Thomas Collier Platt, *c.* 1903
By courtesy of the Library of Congress, Washington, D.C.

Pres. William McKinley elevated Roosevelt to the presidency in 1901. By the time of the next presidential election, Platt's power had begun a decline that he was unable to reverse.

Platt Amendment, rider appended to the U.S. Army appropriations bill of March 1901, stipulating the conditions for withdrawal of U.S. troops remaining in Cuba since the Spanish–American War, and molding fundamental Cuban–U.S. relations until 1934. Formulated by the secretary of war, Elihu Root, the amendment was presented to the Senate by Sen. Orville H. Platt of Connecticut. By its terms, Cuba would not transfer Cuban land to any power other than the United States, Cuba's right to negotiate treaties was limited, rights to a naval base in Cuba (Guantánamo Bay) were ceded to the United States, U.S. intervention in Cuba "for the preservation of Cuban independence" was permitted, and a formal treaty detailing all the foregoing provisions was provided for. To end the U.S. occupation, Cuba incorporated the articles in its constitution. Although the United States intervened militarily in Cuba only twice, in 1906 and 1912, Cubans generally considered the amendment an infringement of their sovereignty. In 1934, as part of his Good Neighbor policy, Pres. Franklin D. Roosevelt supported abrogation of the amendment's provisions except for U.S. rights to the naval base.

Platte River, river formed at the city of North Platte, Neb., U.S., by the confluence of the North Platte and South Platte rivers (*qq.v.*). The 310-mi (500-km) Platte flows southeast into a big bend at Kearney, Neb., turns northeast, and empties into the Missouri River at Plattsmouth, 15 mi south of Omaha. During the spring runoff, the Platte is a mile wide in many places, but it is almost dry the remainder of the year. The extreme shallowness of the river (named from the French *plat*, "shallow") prevents navigation. It drains an area of 90,000 sq mi (233,000 sq km). The vast quantities of water diverted for irrigation agriculture and for municipal use are the most significant aspects of the Platte River system. The Loup River is the largest tributary to the Platte.

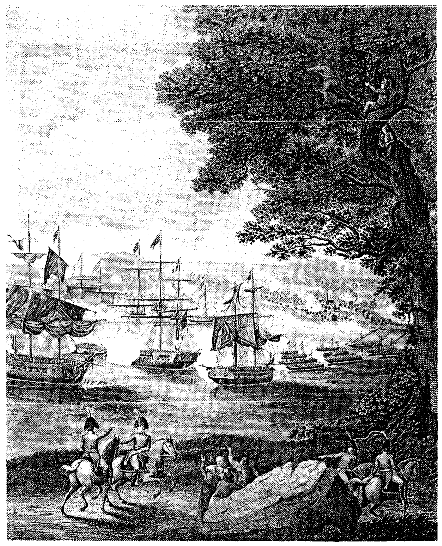
Platter, Thomas (b. Feb. 10, 1499, Grächen, Switz.—d. Jan. 26, 1582, Basel), Swiss writer and humanist known for his autobiography.

After years of hardship, spent as a goatherd

Platter, detail of an engraving by P. Aubrey
By courtesy of the Bibliotheque Nationale Suisse, Bern

in the Alps and as a scholar's assistant in Germany, Platter was initiated at Zürich into Huldrych Zwingli's teachings and the newly discovered world of Greek, Latin, and Hebrew culture. Moving to Basel, Platter first made his living as a ropemaker but contributed to the renown of this great centre of humanistic learning by teaching Hebrew, working as partner to the printer Andrew Cratander, and, after 1541, reforming Basel grammar school. His autobiography, completed in 1576, an important document of the period, tells the story of his lifelong struggle against heavy odds in self-education.

Plattsburgh, historically PLATTSBURG, city, seat (1788) of Clinton County, northeastern New York, U.S., on the west shore of Lake Champlain, at the mouth of the Saranac



"Macdonough's Victory on Lake Champlain in the War of 1812"; detail of an engraving by B. Tanner after a painting by H. Reinagle
By courtesy of the Library of Congress, Washington, D.C.

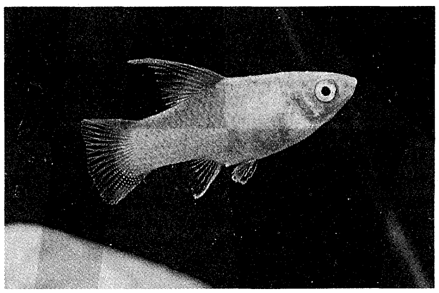
River, 60 mi (97 km) south of Montreal. Founded by Zephaniah Platt in 1784, it was the scene of an important U.S. victory during the War of 1812 on Lake Champlain that saved New York from possible British invasion via the Hudson Valley. A British army of 14,000 troops under Sir George Prevost reached Plattsburg in a joint land and sea operation. U.S. defenders included 1,500 regulars and 2,500 militia commanded by Gen. Alexander Macomb, supported by a 14-ship U.S. naval squadron under Comdr. Thomas Macdonough. The outcome of the battle was determined on water when the British fleet was decisively defeated on Sept. 11, 1814. Deprived of naval support, the invading army was forced to retreat. The victory at Plattsburg influenced the terms of peace drawn at the Treaty of Ghent the following December. The Macdonough Memorial commemorating the battle is in front of the city hall. The Kent-Delord House (1797) served successively as British and American headquarters and is maintained as a museum.

Abundant waterpower influenced the development of lumber and paper mills, and the city is a base for the Champlain resort area. The State University of New York College at Plattsburgh (established as a normal school, 1899), Clinton Community College (1966), and Plattsburgh Air Force Base (activated 1955) are additional economic factors. Recognized as a village in 1785, it was incorporated as a city in 1902. Pop. (1988 est.) 21,013.

Plattsmouth, city, seat (1855) of Cass county, eastern Nebraska, U.S., near the confluence of the Platte and Missouri rivers. Founded in 1854, it developed as a trading post, stagecoach stop, and terminus and shipping point for farmers. With the arrival of the Burlington and Missouri River Railroad in 1869, river traffic declined.

After 1940 Plattsmouth evolved into a commuter suburb of Omaha but retained some industries, the largest being the manufacture of freight cars. The King Korn Karnival, a harvest fair, is held each September. Inc. 1855. Pop. (1986 est.) 6,860.

platy (species *Xiphophorus maculatus*), popular tropical aquarium fish of the live-bearer family, Poeciliidae (order Atheriniformes). The platy is a compact fish, about 5 cm (2 inches)



Platy (*Xiphophorus maculatus*)
Jane Burton—Bruce Coleman Ltd.

long and extremely variable in colour. It has been bred in many attractive colour varieties, and, like the related swordtail (*Xiphophorus helleri*) with which it has been crossed, has been used in a variety of genetic and medical studies.

Platyceras, genus of extinct gastropods (snails) that occurs as fossils in rocks of Silurian to Permian age (438 to 245 million years ago). Its distinctive shape is easily recognized. The caplike shell is high and broad anteriorly. The posterior portion of the shell, at the apex, is slightly coiled in an asymmetrical fashion. Frequently, the front portions of the shells are broken, though the posterior sections are relatively well preserved. *Platyceras* is particularly abundant in Devonian deposits (360 to 408 million years old).

Platycrinites, genus of extinct crinoids, or sea lilies, especially characteristic as fossils of Early Carboniferous marine deposits (360 to 320 million years ago). *Platycrinites,* of moderate size, had a columnar stem with a twisted pattern, an unusual feature.

platyhelminth: *see* flatworm.

platypus, also called DUCKBILL (species *Ornithorhynchus anatinus*), a small, semiaquatic, oviparous mammal, the sole member of the family Ornithorhynchidae, order Monotremata. It lives in lakes and streams of eastern Australia and Tasmania. The platypus is notable in having a broad, flat, rubbery

Platypus (*Ornithorhynchus anatinus*)
By courtesy of the Australian Information Service

snout and in laying eggs. It has a squat body, short splayed legs, webbed feet, and a flat beaverlike tail. Its total length is about 60 cm (24 inches). The dense soft fur varies from yellowish to dark brown. The male of the species has a poison spur on each hindfoot for sexual combat; the poison is intensely painful to humans.

The platypus' sensitive snout has been shown by researchers to contain electroreceptors, which enable it to detect the electrical field produced by the moving muscles of its prey. The platypus finds its food chiefly in underwater mud, and it consumes daily nearly its own weight in crustaceans, fishes, frogs, mollusks, tadpoles, and earthworms. It burrows above the waterline; the long twisting passage dug by the female contains a nest in which she lays one, two, or three sticky soft-skinned eggs. Incubation takes about 10 to 12 days. The young platypus has elongated lips (the incipient bill) for sucking milk, exuded from the nippleless mammae. Weaning occurs four months after hatching.

Because of their enormous appetites, platypuses are difficult to maintain in captivity; one is known to have survived in a zoo, however, for 17 years. Their natural enemies are large fishes and, perhaps, snakes. Platypuses formerly were trapped for their pelts but are now protected by law.

platyrrhine: *see* New World monkey.

Platystrophia, genus of extinct brachiopods (lamp shells) occurring as fossils in marine rocks of the Middle Ordovician epoch to about the middle of the Silurian period (*i.e.,* from about 478 to 421 million years ago). Each valve of the shell is convex in profile, and the hinge line between the valves is wide. Surface markings on the shell include prominent angular ridges and intervening linear depressions. *Platystrophia* is a common Late Ordovician fossil that is useful for stratigraphic correlations.

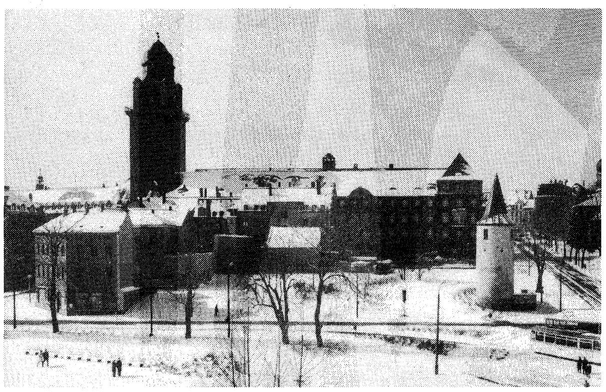
Plauen, city, Saxony *Land* (state), east-central Germany, on the slopes of the Weisse Elster River valley, in the Vogtland. Chartered in 1220, it is the centre of the Vogtland region, which in the Middle Ages was directly administered by the *Vögte* (imperial advocates) of Weida. Plauen became the centre of a flourishing textile industry as early as the 15th century. It was severely damaged by air raids in World War II. Notable landmarks include the old town hall (rebuilt 1548) with the adjoining new town hall, the 12th-century Johanneskirche (John's Church, restored), the Luther Church (1693–1708), and the former castle of the *Vögte* (1250), now a lawcourt.

The contemporary city has a textile craft school. A rail junction, Plauen is known for lace making, but a variety of other textile products are manufactured, and there are also a variety of heavy and light industries in the city. Pop. (1989 est.) 77,593.

Plautus (b. *c.* 254 BC, Sarsina, Umbria? [Italy]—d. 184), great Roman comic dramatist, whose works, loosely adapted from Greek plays, established a truly Roman drama in the Latin language.

Life. Little is known for certain about the life and personality of Plautus, who ranks with Terence as one of the two great Roman comic dramatists. His work, moreover, presents scholars with a variety of textual problems, since the manuscripts by which his plays survive are corrupt and sometimes incomplete. Nevertheless, his literary and dramatic skills make his plays enjoyable in their own right, while the achievement of his comic genius has had lasting significance in the history of Western literature and drama.

According to the grammarian Festus (2nd or 3rd century AD), Plautus was born in northeastern central Italy. His customarily assigned birth and death dates are largely based on statements made by later Latin writers, notably Cicero in the 1st century BC. Even the three names usually given to him—Titus Maccius Plautus—are of questionable historical authenticity. Internal evidence in some of the plays does, it is true, suggest that these were the names of their author, but it is possible that they are stage names, even theatrical jokes or allusions. ("Maccus," for example, was the traditional name of the clown in the "Atellan farces," a long-established popular burlesque, native to the Neapolitan region of southern Italy; "Plautus," according to Festus, derives from *planis pedibus, planipes* [flat-footed] being a pantomime dancer.) There are further difficulties: the poet Lucius Accius (170–*c.* 86 BC), who made a study of his fellow Umbrian, seems to have distinguished between one Plautus and one Titus Maccius. Tradition has it that Plautus was associated with the theatre from a young age. An early story says that he lost the profits made from his early success as a playwright in an unsuccessful business



Clock tower of the old town hall and (right) the Nonnenturm ("Nun's Tower"), Plauen, Ger.
W. Krammisch—Bruce Coleman Inc./EB Inc.

venture, and that for a while afterward he was obliged to earn a living by working in a grain mill.

Approach to drama. The Roman predecessors of Plautus in both tragedy and comedy borrowed most of their plots and all of their dramatic techniques from Greece. Even when handling themes taken from Roman life or legend, they presented these in Greek forms, setting, and dress. Plautus, like them, took the bulk of his plots, if not all of them, from plays written by Greek authors of the late 4th and early 3rd centuries BC (who represented the "New Comedy," as it was called), notably by Menander and Philemon. Plautus did not, however, borrow slavishly; although the life represented in his plays is superficially Greek, the flavour is Roman, and Plautus incorporated into his adaptations Roman concepts, terms, and usages. He referred to towns in Italy; to the gates, streets, and markets of Rome; to Roman laws and the business of the Roman law courts; to Roman magistrates and their duties; and to such Roman institutions as the Senate.

Not all references, however, were Romanized: Plautus apparently set little store by consistency, despite the fact that some of the Greek allusions that were left may have been unintelligible to his audiences. Terence, the more studied and polished playwright, mentions Plautus' carelessness as a translator and upbraids him for omitting an entire scene from one of his adaptations from the Greek (though there is no criticism of him for borrowing material, such plagiarism being then regarded as wholly commendable). Plautus allowed himself many other liberties in adapting his material, even combining scenes from two Greek originals into one Latin play (a procedure known as *contaminatio*).

Even more important was Platus' approach to the language in which he wrote. His action was lively and slapstick, and he was able to marry the action to the word. In his hands, Latin became racy and colloquial, verse varied and choral.

Whether these new characteristics derived from now lost Greek originals—more vigorous than those of Menand—or whether they stemmed from the established forms and tastes of burlesque traditions native to Italy, cannot be determined with any certainty. The latter is the more likely. The result, at any rate, is that Plautus' plays read like originals rather than adaptations, such is his witty command of the Latin tongue—a gift admired by Cicero himself. It has often been said that Plautus' Latin is crude and "vulgar," but it is in fact a literary idiom based upon the language of the Romans in his day.

The plots of Plautus' plays are sometimes well organized and interestingly developed, but more often they simply provide a frame for scenes of pure farce, relying heavily on intrigue, mistaken identity, and similar devices. Plautus is a truly popular dramatist, whose comic effect springs from exaggeration, burlesque and often coarse humour, rapid action, and a deliberately upside-down portrayal of life, in which slaves give orders to their masters, parents are hoodwinked to the advantage of sons who need money for girls, and the procurer or braggart soldier is outwitted and fails to secure the seduction or possession of the desired girls. Plautus, however, did also recognize the virtue of honesty (as in *Bacchides*), of loyalty (as in *Captivi*), and of nobility of character (as in the heroine of *Amphitruo*).

Plautus' plays, almost the earliest literary works in Latin that have survived, are written in verse, as were the Greek originals. The metres he used included the iambic six foot line (*senarius*) and the trochaic seven foot line (*septenarius*), which Menander had also employed. But Plautus varied these with longer iambic and trochaic lines and more elaborate rhythms. The metres are skillfully chosen and handled to emphasize the mood of the speaker or the action. Again, it is possible that now lost Greek plays inspired this metrical variety and inventiveness, but it is much more likely that Plautus was responding to features already existing in popular Italian dramatic traditions. The *Senarii* (conversational lines) were spoken, but the rest was sung or chanted to the accompaniment of double and fingered reed pipes. It could indeed be said that, in their metrical and musical liveliness, performances of Plautus' plays somewhat resembled musicals of the mid-20th century.

Plautus' original texts did not survive. Even by the time that Roman scholars such as Varro, a contemporary of Cicero, became interested in the playwright, only acting editions of his plays remained. These had been adapted, modified, cut, expanded, and generally brought up-to-date for production purposes. Critics and scholars have ever since attempted to establish a "Plautine" text, but 20th-century editors have admitted the impossibility of successfully accomplishing such a task. The plays had an active stage life at least until the time of Cicero and were occasionally performed afterward. Whereas Cicero had praised their language, the poet Horace was a more severe critic and considered the plays to lack polish. There was renewed scholarly and literary interest in Plautus during the 2nd century AD, but it is unlikely that this was accompanied by a stage revival, though a performance of *Casina* is reported to have been given in the early 4th century. St. Jerome, toward the end of that century, says that after a night of excessive penance he would read Plautus as a relaxation; in the mid-5th century, Sidonius Apollinaris, a Gallic bishop who was also a poet, found time to read the plays and praise the playwright amid the alarms of the barbarian invasions.

During the Middle Ages, Plautus was little read—if at all—in contrast to the popular Terence. By the mid-14th century, however, the Humanist scholar and poet Petrarch knew eight of the comedies. As the remainder came to light, Plautus began to influence European domestic comedy after the Renaissance poet Ariosto had made the first imitations of Plautine comedy in the Italian vernacular. His influence was perhaps to be seen at its most sophisticated in the comedies of Molière (whose play *L'Avare,* for instance, was based on *Aulularia*), and it can be traced up to the present day in such adaptations as Jean Giraudoux's *Amphitryon 38* (1929), Cole Porter's musical *Out of This World* (1950), and the musical and motion picture *A Funny Thing Happened on the Way to the Forum* (1963). Plautus' stock character "types" have similarly had a long line of successors: the braggart soldier of *Miles Gloriosus,* for example, became the "Capitano" of the Italian commedia dell'arte, is recognizable in Nicholas Udall's *Ralph Roister Doister* (16th century), in Shakespeare's Pistol, and even in his Falstaff, in Rostand's *Cyrano de Bergerac* (1897), and in Bernard Shaw's Sergius in *Arms and the Man* (1894), while a trace of the character perhaps remains in Bertolt Brecht's Eilif in *Mother Courage and Her Children* (1941). Thus, Plautus, in adapting Greek "New Comedy" to Roman conditions and taste, also significantly affected the course of the European theatre.

MAJOR WORKS. Twenty-one comedies (most dates uncertain) have survived: *Amphitruo* (*Amphitryon*); *Asinaria* (*The Comedy of Asses*); *Aulularia* (*The Pot of Gold*); *Bacchides* (*The Two Bacchuses*); *Captivi* (*The Captives*); *Casina; Cistellaria* (*The Casket Comedy*); *Curculio; Epidicus; Menaechmi* (*The Two Menaechmuses*); *Mercator* (*The Merchant*); *Miles Gloriosus* (*The Braggart Warrior*); *Mostellaria* (*The Haunted House*); *Persa* (*The Persian*); *Poenulus* (*The Little Carthaginian*); *Pseudolus* (first produced 191 BC); *Rudens* (*The Rope*); *Stichus* (first produced 200 BC); *Trinummus* (*Three Bob Day*); *Truculentus; Vidularia* (fragmentary; *The Tale of a Travelling Bag*).

There is an English translation of all the extant plays in the "Loeb Series" (1916–38) and a French translation in the "Budé Series" (1932–40). Several of the plays have been translated in the "Penguin Classics Series." Many other translations of specific plays are available.

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play, in zoology, behaviour performed in the absence of normal stimuli or behaviour elicited by normal stimuli but not followed to the completion of the ritualized behaviour pattern. Play has been documented only among mammals and birds. Play is common among immature animals, apparently part of the process of learning adult behaviour. Much of the play of kittens and other young predators serves to develop hunting skills. The movements of a kitten following a ball or string prepare the animal for stalking prey; likewise leaping and jumping in play are preparation for springing after a bird in flight.

Adult animals also engage in play. Horses, cattle, and other hooved mammals sometimes run, chase each other, and kick up their heels for no obvious reason. Dogs have postural signals of mock aggression used to entice others into play fighting. In play all the elements of ritualized behaviour may be present, but they do not follow the pattern or sequence necessary to communicate serious intent.

Play and Pay (card game): *see* Fan-Tan.

playa, also called PAN, FLAT, or DRY LAKE, flat-bottom depression found in interior desert basins and adjacent to coasts within arid and semiarid regions, periodically covered by water which slowly filtrates into the ground water system or evaporates into the atmosphere, causing the deposition of salt, sand, and mud along the bottom and around the edges of the depression.

A brief treatment of playas follows. For full treatment, *see* MACROPAEDIA: Continental Landforms.

Playa (Spanish: shore or beach) is applied in the English-speaking world to a wide range of topographic depressions and desiccated lakes, but its nomenclature will vary according to individual depressions and regions of the world. Playas are called *shotts* or *sabkhas* in North Africa and Arabia, *kavirs* in Iran, *takyrs* in the Soviet Union, *solonchaks* in the Caspian Sea region, and pans in South Africa and Australia. In North America the terms salt flat, salt marsh, salt plain, and salina are used in reference to playas containing saline deposits, while a salt-free playa is sometimes called a clay pan, hardpan, or dry lake, and the term alkali flat is used for both saline and non-saline playas.

Playas found within interior drainage basins vary in size from tens of metres to tens of kilometres across. Coastal playas or saline flats are usually only a few hundred feet wide, but sometimes they may extend several hundred miles along a coastal plain with widths exceeding 18 mi (30 km). The majority of the approximately 50,000 playas in the world are small. Fewer that 1,000 exceed 25 sq mi (65 sq km) and fewer that 100 exceed 200 sq mi. Most small playas are almost circular in shape and the typical playa will have a length–width ratio of 2:1 or 3:1. Coastal playas will usually be elongated parallel to the shoreline, but the configuration of all playas will vary according to the local topography and climate. Playas can be distinguished from intermittent lakes by the amount of time water is contained in the depression. A depression in which water is present for less than one-fourth of the year should be called a playa. Perhaps the most famous playas are those of Lake Bonneville in Utah, where the almost horizontal surface is ideal, when dry, for automobile speed trials.

Playboy, U.S. monthly magazine for men, the first to feature female nudity and sexually oriented material in a sophisticated format. Famous for its photo features, the magazine combines nude photography with topical general articles and fiction that both are frequently of high quality. Its interviews with celebrities and other newsworthy persons have won wide attention. Founded by Hugh Hefner in 1953, the periodical emphasizes progressive sexual views. The "Playboy philosophy" it enunciates supports the view that man should maintain complete freedom in all things, including sex. It has had a significant influence on the sexual mores of the young U.S. middle-class male, and in format and approach has been widely imitated.

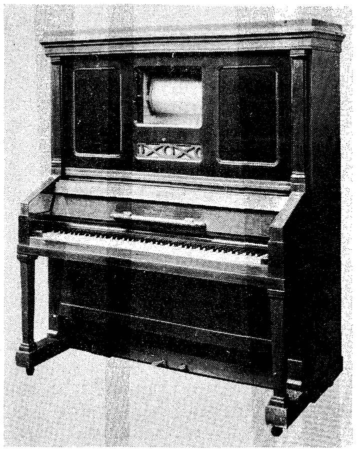
A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

Player, Gary (Jim) (b. Nov. 1, 1935, Johannesburg), South African who was one of the world's best professional golfers in the post-World War II era. He was the third man (after Gene Sarazen and Ben Hogan, both of the U.S.) to win the four tournaments composing the modern golf Grand Slam.

In 1955 Player entered competition on the U.S. Professional Golfers' Association (PGA) circuit of tournaments, and in 1961 he was the leading winner of prize money on the circuit. His international record, unsurpassed by any golfer, was a tribute to his remarkable fitness and love of competition. He won the British Open (1959, 1968, 1974), the Masters (1961, 1974, 1978), the U.S. PGA (1962, 1972), and the U.S. Open (1965). He also won the South African Open 13 times, the Australian Open 7 times, and the World Series of Golf 3 times (1965, 1968, 1972). When he won the Masters in 1978 the span of his major championship victories covered three decades, longer than any previous golfer.

player piano, musical instrument equipped with a device for playing music automatically by pedals and hand levers. The original mechanism—the Pianola, patented in 1897 by a U.S. engineer, Edwin S. Votey—was placed in front of the keyboard. Music was notated in perforations on a paper roll that passed over a tracker bar. Pedals and levers controlled pneumatic devices that released air, moving hammers that struck the piano keys. Later the mechanism was built into the piano body. The pedals and levers made available a considerable range of dynamics and tempo.

In the early 20th century, some companies manufactured player-piano rolls that reproduced with considerable accuracy performances by distinguished figures, such as Alfred Cortot and Claude Debussy. The player piano also attracted composers, who could write pieces without concern for the limitations of the human hand. Such works include Stra-



Steinway-Welte player piano, 1910; in the British Piano and Musical Museum, Brentford, Middlesex, Eng.

By courtesy of The British Piano and Musical Museum, Brentford, Middlesex, Eng.

vinsky's *Étude* for Pianola (1917) and Hindemith's *Toccata* for mechanical piano (1926).

Playfair, John (b. March 10, 1748, Benvie, Forfarshire, Scot.—d. July 20, 1819, Edinburgh), Scottish geologist and mathematician known for his explanation and expansion of ideas on uniformitarianism—the theory that the Earth's features generally represent a response to former processes similar in kind to processes that are operative today.

A professor of natural philosophy at the University of Edinburgh, Playfair was the first to propose that a river cuts its own valley and was also the first to recognize the transport role of glaciers. He wrote *Elements of Geometry* (1795), *Illustrations of the Huttonian Theory of the Earth* (1802), and *Outlines of Natural Philosophy* (1812–16).

Playford, John (b. 1623, Norwich, Norfolk, Eng.—d. November 1686?, London), English music publisher and bookseller whose popular and frequently expanded collection of music and dance steps remains the principal source of knowledge of English country dance steps and melodies. His book, *The English Dancing-Master* (1650, but dated 1651; critical ed., M. Dean-Smith, 1958), originally contained 104 dances and accompanying tunes set to the fiddle; its 18th and last edition (1728, published by John Young) held about 700. Many of the Playford dances were revived in the 20th century. Playford had established his business in London by 1648. He often included his own song and psalm music in his collections of music. His *Brief Introduction to the Skill of Musick*, a handbook on music theory and practice, went into many editions between 1654 and 1730 and was revised in 1694 by Henry Purcell. An elegy on Playford's death, "Gentle shepherds, you that know," by Nahum Tate, was set to music by Purcell.

Playford, engraving by F.H. von Houe, 1680

By courtesy of the trustees of the British Museum; photograph, J.F. Freeman & Co. Ltd.

Playford's son Henry Playford (1657–1709) continued the family business. His publications include two posthumous collections of music by Purcell.

playground, area especially designed for games. The incorporation of play areas in public and private pleasure grounds dates from early antiquity; a training ground for athletes was part of a complex in ancient Athens that included a public promenade and an open-air, informal assembly place. The most ambitious Roman gardens contained tracks for horse racing. Except for bowling greens and occasional accommodations for archery and pall-mall (a game played with a wooden ball and mallet), there was little provision for games in the average 17th- and 18th-century gardens. Formal open-air games took place on common ground, such as the village green or, if walls were needed, in churchyards and city streets. Not until the 19th century was it common to provide for games and to incorporate all open-air pastimes in one central area. In the 20th century there are public playgrounds for team games, such as baseball and cricket, and for children's play; and the private homeowner often arranges facilities in his own garden for tennis, bowls, croquet, and golf.

playing card, one of a set of cards that are numbered or illustrated (or both) and are used for playing games, for education, for divination, and for conjuring. Modern cards are

(Top) The *avatāra* and ten of Paraśurāma, round, painted ivory Indian cards, probably from Deccan, 18th century

By courtesy of the Deutsches Spielkarten Museum, Bielefeld, W.Ger.

divided into four suits—spades, hearts, diamonds, and clubs—with 13 cards in each suit. The set of 52 cards together is known variously as the pack or the deck, the term used in Shakespeare's day. Two jokers, bearing the image of a medieval court jester, are usually included with the standard 52-card deck, although they are not always used in play.

Though where and when cards originated is uncertain, China seems the most likely place, and the 7th to the 10th century the earliest probable time. An Indian origin has been suggested by the resemblance of symbols on some early European decks to the ring, sword, cup, and baton classically depicted in the four hands of Hindu statues. Yet another theory

Deuce of bells from a German deck, Dresden, 1848; bells are equivalent to diamonds

By courtesy of the Deutsches Spielkarten-Museum, Leinfelden-Echterdingen, Zweigmuseum des Wurttembergischen Landesmuseums Stuttgart, Federal Republic of Germany

is that both cards and chess are derived from ancient divinatory procedures used by primitive peoples.

Nor is it known how cards were introduced to Europe. Some early decks had symbols resembling the Chinese markings and may have been taken back by a Venetian, possibly Niccolò Polo or his more famous son, Marco, during travels to and from China in the latter half of the 13th century. Another speculation is that cards may have been brought from Arabia by the Gypsies, but the Gypsies did not reach western Europe in appreciable numbers until after cards had become firmly established. If an Arab origin is to be sought, the Saracen invasion of Sicily or the Moorish conquest of Spain could provide a link. The Spanish word for cards, which is *naipes,* and an earlier Italian word, which is *naibi,* are probably of Arab origin.

There are references to cards in Italy from 1299; in Spain, from as early as 1371; in the Low Countries, from 1379; and in Germany, from 1380. A French manuscript of the early 14th century contains a reference to cards, and in 1392 the registers of the Chambre des Comptes of Charles VI recorded the purchase of three games of cards "in gold and diverse colours." In England by 1465 the use of cards was well enough established for manufacturers to petition for protection against imports.

Cards may have first reached the Americas with Columbus, and they became firmly established there with the arrival of the English, French, and Dutch colonists. Cards are now played throughout the world.

The 52-card French deck, now standard throughout the world, evolved from the numbered cards of the Tarot (*q.v.*) deck. The deck, in usual descending order of rank, consists of an ace, king, queen, jack (formerly knave), and nine numerals (10 to 2) in each of four suits. A German deck of 32 cards and a Spanish deck of 40 also evolved, but modern games requiring a short deck are usually played by removing cards from a standard deck.

The suits had different names and often different symbols in the various countries. The English adopted the French symbols: the French *pique* ("pike") looked like a spade to the English; the *carreau* ("square") became the English diamond, the *trèfle* ("trefoil") became the English club, and the *coeur* ("heart") remained heart. Other traditional suit designations are shown in the Table. The spread of games such as Whist and Piquet, and later Contract Bridge, made the 52-card deck current among card players throughout the world.

The making of cards has been closely linked with the development of printing. The earliest cards were hand-painted, but it would appear that German production in the 15th century almost certainly was so large as to mean that wood-block printing must have been employed. German cardmakers may, in fact, have been the first wood-block engravers in Europe.

The great diversity of early decks gradually lessened, influenced by 15th-century French exporters, whose simple designs became widely popular. Modern variations of those designs may be found primarily in the design of the court cards (kings, queens, and jacks); those in English decks, for instance, show figures dressed in the style of Henry VII. The traditional superstition of gamblers and the more modern tendency to preserve fragments of the past have tended to prevent change, including official attempts in some countries to provide proletarian substitutes for the court cards.

The standard modern card measures about $2\frac{1}{2} \times 3\frac{1}{2}$ inches (6×9 cm) and is double-headed to aid recognition, with indices at two opposite corners. The backs are printed with identical designs, patterns, or pictures. A full deck, including two jokers, is printed on pasteboard consisting of two sheets gummed together with black paste to ensure opaqueness. The spades and clubs normally are printed in black, the hearts and diamonds in red. Each card is stamped out with a die and simultaneously given a knife edge; sometimes the edges are lacquered. Almost invariably the manufacturer's seal is affixed to the wrapped deck.

Governments have often found cards to be a useful source of revenue. In 1615 James I of England granted letters patent for a duty on imports, and in 1628 Charles I taxed manufacturers at a rate gradually increased to the considerable sum of half-a-crown per pack. After 1765 the tax paid was shown in the design of the ace of spades, printed officially by the commissioner of stamps. The heavy impost caused a boom in second-hand sales and a traffic in forged aces of spades, but since 1862 the tax has been moderate. In some countries, however, manufacture is a state monopoly. The high taxes imposed in Austria led to the printing of oversized cards, which were trimmed and cleaned when their edges became soiled. High taxes also encouraged the invention in the 1930s of playing cards printed on plastic, which far outlasted those printed on pasteboard.

Traditional suit designations

English	French	German	Spanish	Italian
spade	pique	Grün ("leaf")	espada	spada ("sword")
heart	coeur	Herz	copa ("cup")	coppa ("cup")
diamond	carreau	Schelle ("bell")	oro ("gold")	denaro ("money")
club	trèfle	Eichel ("acorn")	basto	bastone ("rod")

Playing Cards, Master of the (fl. *c.* 1430–50), anonymous German artist who is one of the most important of the early engravers in the Rhineland. He is known for a set of playing cards (60 remain) that are distinguished for the manner in which the technique of soft-ground engraving has been handled, as well as for an exquisite use of line and the realistic observation evident in the human figures, plants, and animals that have been depicted. Some of the decorative devices employed have been stylistically related to those used by the printer Johannes Gutenberg.

pleached alley, garden path, on each side of which living branches have been intertwined in such a way that a wall of self-supporting living foliage has grown up. To treat each side of a garden walk, or alley, with pleaching and thus make a secluded walk was a favourite device of the 16th and 17th centuries. Although

Pleached alley, Schönbrunn Palace, Vienna

Mary Bacon

most pleaching is done by gardeners, it can also occur naturally. Maples, sycamores, and lindens are commonly pleached.

pleading, in law, presentation by a litigant in a lawsuit setting forth the facts upon which he claims legal relief or challenges the claims of his opponent. A pleading includes both written and oral claims and counterclaims but not the evidence by which the litigant intends to prove his case.

After both the plaintiff and the defendant have made their initial statements, there may be further proceedings, such as a reply, a rejoinder, and even a surrejoinder. It is open to either party to apply to strike out his opponent's pleading, or part thereof, on the grounds that it discloses no cause of action or of defense or on certain other grounds. It is likewise open to either party to apply for further particulars of his opponent's pleading, and the court may order that these be furnished.

The rules make provision for the joinder of other parties whose participation is considered necessary by the court (*see* joinder and impleader). Thus, a defendant under English law may issue a notice—called a third-party notice—containing a statement of the nature of the claim made by him against a third party, relevant to the original subject matter of the action or of issues to be determined. A third party has the same rights against the defendant as the latter has against the plaintiff; he may bring in a fourth party, who may bring in a fifth, and so on.

Whereas pleadings in common-law countries tend to be formal, those in civil-law countries are very informal. In England, for example, the parties, following stated forms, alternately present written statements until all issues of law and fact in question have been brought out. The aim is to separate the legal issues from the factual ones so that the latter, clearly delineated, can be given to a jury.

In civil-law countries, where juries do not exist except in certain criminal cases, it is not necessary to make an early delineation of factual and legal issues. Oral pleadings are stressed; written pleadings are only preparatory to the main hearing in open court, where allegations are clarified and proofs offered.

pleasing fungus beetle, any member of any of the more than 1,400 species of the insect family Erotylidae (order Coleoptera). Some bore into the stems of plants or wood rather than feed on fungi.

Most species in this widely distributed family are tropical. They range in size from 3 to 20 millimetres (up to 4/5 inch) and are often brightly coloured with orange, red, and black patterns.

plebeian, also spelled PLEBIAN, Latin PLEBS, plural PLEBES, member of the general citizenry in ancient Rome as opposed to the privileged patrician class. The distinction was probably originally based on the wealth and influence of certain families who organized themselves into patrician clans under the early republic, during the 5th and 4th centuries BC. Plebeians were originally excluded from the Senate and from all public offices except that of military tribune. Before the passage of the law known as the Lex Canuleia (445 BC), they were also forbidden to marry patricians. Until 287 BC the plebeians waged a campaign (Conflict of the Orders) to have their civil disabilities abolished. They organized themselves into a separate corporation and withdrew from the state on perhaps as many as five or more critical occasions to compel patrician concessions; such a withdrawal was termed a *secessio.* The plebeian corporation held its own assemblies (*concilia plebis*), elected its own officials (tribunes and plebeian aediles), who were usually more well-to-do plebeians, and kept its own records. An important step in the plebeian campaign was the achievement of inviolability of their tribunes.

The Conflict of the Orders was finally resolved in the final secession of 287 BC when a plebeian dictator, Quintus Hortensius, was appointed. He instituted a law (Lex Hortensia) making *plebiscita* (measures passed in the plebeian assembly) binding not only on plebeians but also on the rest of the community. In the later republic and under the empire (after 27 BC), the name plebeian continued to be used in the sense of commoner.

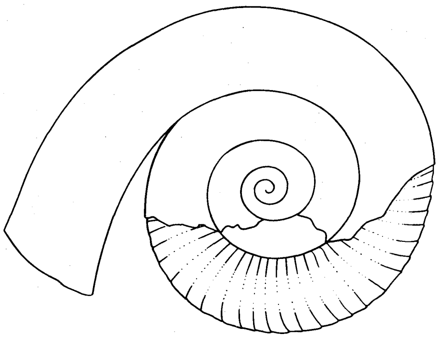
plebiscite, a vote by the people of an entire country or district to decide on some issue, such as choice of a ruler or government, option for independence or annexation by another power, or a question of national policy.

In a plebiscite, voters are asked not to choose between alternate regimes or proposals but to confirm or reject the legitimacy of a certain form of government or course of action. Plebiscites are seen as a way for a government to go directly to the people, bypassing intermediaries such as political parties. After the Revolution of 1789, the plebiscite was popular in France because it was seen as an expression of popular sovereignty. In 1804, a plebiscite made Napoleon emperor.

Plebiscites have been used to establish political boundaries when it is a question of nationality. For example, in 1935, the Saar chose to remain part of Germany rather than become part of France.

Because a plebiscite offers a way of claiming a popular mandate without officially sanctioning an opposition party, totalitarian regimes also use them to legitimize their power.

Plectoceras, extinct genus of small marine nautiloid cephalopods, forms related to the modern pearly nautilus, that had a coiled shell composed of a series of chambers; *Plectoceras* is an Ordovician form (between 430,000,000 and 500,000,000 years old). The junctures between successive chambers of *Plectoceras* were simple in character.



Plectoceras occidentale

From C. Dunbar and K. Waage, *Historical Geology* (copyright 1969); by permission of John Wiley & Sons, Inc.

Plectomycetes, name often given fungi constituting a series of the class Ascomycetes (sac fungi) within the division Mycota. Its more than 2,500 species produce saclike structures (asci) containing ascospores in either a closed fruiting body (ascocarp) or spore balls. Economically important genera include *Ceratocystis,* which includes the agents of Dutch elm disease and oak wilt, and *Trichophyton,* species of which cause skin disease in animals including man.

Pledge of Allegiance to the Flag of the United States of America, pledge to the flag of the United States. It was first published in the juvenile periodical *The Youth's Companion* on Sept. 8, 1892, in the following form: "I pledge allegiance to my Flag and the Republic for which it stands; one nation indivisible, with liberty and Justice for all." The words "the flag of the United States of America" were substituted for "my Flag" in 1924, and the pledge was officially recognized by the U.S. government in 1942. In 1954, at Pres. Dwight D. Eisenhower's urging, the Congress legislated that "under God" be added, making the pledge read:

> I pledge allegiance to the flag of the United States of America and to the Republic for which it stands, one nation under God, indivisible, with liberty and justice for all.

A controversy arose concerning the authorship of the pledge of 1892. Claims were made on behalf of both James B. Upham, one of the editors of *The Youth's Companion,* and Francis Bellamy, an assistant editor. In 1939 a committee of the U.S. Flag Association ruled in favour of Bellamy, and a detailed report issued by the U.S. Library of Congress in 1957 supported the committee's ruling.

According to the legislation of 1954, one is supposed to stand upright, remove any headdress, and place the right hand over the heart while reciting the pledge.

Plehve, Vyacheslav Konstantinovich, Plehve also spelled PLEVE (b. April 20 [April 8, old style], 1846, Kaluga province, Russia—d. July 28 [July 15, O.S.], 1904, St. Petersburg), Russian imperial statesman whose efforts to uphold autocratic principle, a police-bureaucratic government, and class privilege resulted in the suppression of revolutionary and liberal movements as well as minority nationality groups within the Russian Empire.

Appointed director of the police department in the Ministry of the Interior after the assassination of Emperor Alexander II (1881), Plehve became head of the Imperial Chancellery (1894) and acting minister and state secretary for the Grand Duchy of Finland (1899). In 1902 he became minister of interior. From these positions he obstructed liberal local governmental (*zemstvo*) activity, harshly pursued Russification policies, particularly against the Armenians and the Finns, and encouraged anti-Semitic propaganda that led to a violent pogrom (April 1903) at Kishinev, now in the Moldavian S.S.R. To assuage labour discontent, he backed police-controlled patriotic labour unions. He supported the Russian policy in Korea that provoked conflict with Japan. Plehve was assassinated by a member of the Socialist Revolutionary Party.

Pléiade, La, group of seven French writers of the 16th century, led by Pierre de Ronsard, whose aim was to elevate the French language to the level of the classical tongues as a medium for literary expression. La Pléiade, whose name was taken from that given by the ancient Alexandrian critics to seven tragic poets of the reign of Ptolemy II Philadelphus (285–246 BC), also included Joachim du Bellay, Jean Dorat, Jean-Antoine de Baïf, Rémy Belleau, Pontus de Tyard, and Étienne Jodelle.

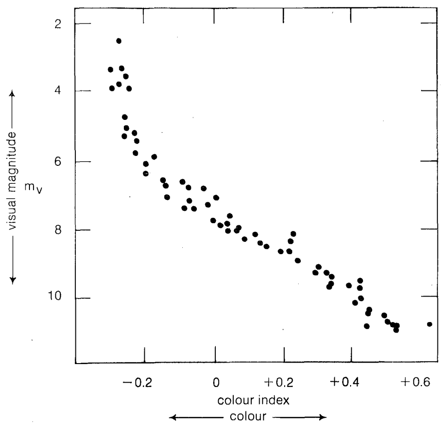
The principles of La Pléiade were authoritatively set forth by du Bellay in *Défense et illustration de la langue françoise* (1549), a document that advocated the enrichment of the French language by discreet imitation and borrowing from the language and literary forms of the classics and the works of the Italian Renaissance—including such forms as the Pindaric and Horatian ode, the Virgilian epic, and the Petrarchan sonnet. Du Bellay also encouraged the revival of archaic French words, the incorporation of words and expressions from provincial dialects, the use of technical terms in literary contexts, the coining of new words, and the development of verse forms new to French literature.

The writers of La Pléiade are considered the first representatives of French Renaissance poetry, one reason being that they revived the alexandrine verse form (composed of 12-syllable lines, rhyming in alternate masculine and feminine couplets), the dominant poetic form of the French Renaissance. The members of La Pléiade are sometimes charged with attempting to Latinize the French language and are criticized for inspiring the slavish imitation of the classics that occasionally occurred among their followers.

Pleiades, in Greek mythology, the seven daughters of the Titan Atlas and the Oceanid Pleione: Maia, Electra, Taygete, Celaeno, Alcyone, Sterope, and Merope. They all fell in love with gods (except Merope, who loved a mortal) and were the mothers of gods.

The Pleiades eventually formed a constellation. One myth recounts that they all killed themselves out of grief over the death of their sisters, the Hyades. Another explains that after seven years of being pursued by Orion, a Boeotian giant, they were turned into stars by Zeus. Orion became a constellation, too, and continued to pursue the sisters across the sky. The faintest star of the Pleiades was thought to be either Merope, who was ashamed of loving a mortal, or Electra, grieving for Troy, her son's city.

Pleiades (catalog number M 45), open cluster of stars in the zodiacal constellation Taurus, about 400 light-years from the solar system. It contains a large amount of bright nebulous material and several hundred stars, of which six or seven can be seen by the unaided eye and have figured prominently in the myths and literature of many cultures. In Greek mythology the Seven Sisters (Alcyone, Maia, Electra, Merope, Taygete, Celaeno, and Sterope, names now assigned to individual stars), daughters of Atlas and Pleione, were changed into the stars. The heliacal (near dawn) rising of the Pleiades in spring of the Northern Hemisphere has marked from ancient times the opening of seafaring and farming seasons, as the morning setting of the group in autumn signified the seasons' ends. Some South American Indians use the same word for "Pleiades" and "year."



Colour-luminosity array of the Pleiades

From Otto Struve, *Elementary Astronomy;* copyright © 1959 by Oxford University Press, Inc.; reprinted by permission

The cluster was first examined telescopically by Galileo, who found more than 40 members; it was first photographed by Paul and Prosper Henry in 1885.

Pleiku, town, central Vietnam, located in the central highlands. The town has a hospital, a commercial airfield, and several airbases that are a legacy of its strategic importance during the later stages of the Vietnam War (1965–75). It lies in a mountainous region inhabited mainly by Bahnar and Jarai peoples, sometimes referred to as Montagnards (French: "Mountain Dwellers"). Tea, coffee, handicrafts, timber, and upland rice are the main products of the region. The town is at the crossroads of several upland highways, including the road north to Cong Tum and the road west to Stœng Trêng, Kampuchea (Cambodia). Pop. (latest est.) 34,867.

plein air painting, in its strictest sense, the practice of painting landscape pictures out-of-doors; more loosely, the achievement of an intense impression of the open air (French: *plein air*) in a landscape painting.

Until the time of the painters of the Barbizon school in mid-19th-century France, it was normal practice to execute rough sketches of landscape subjects in the open air and produce finished paintings in the studio. Some of the Barbizon painters continued this practice, and not until the late 1860s, with the work of Claude Monet, Pierre-Auguste Renoir, and Camille Pissarro, the leaders of Impressionism, did painting out-of-doors become more popular. From 1881 Monet, in his efforts to capture the true effects of light on the colour of landscape at any given moment, began to carry several canvases at once into the out-of-doors. On each he began a painting of the same subject at a different time of day; on subsequent days, he continued to work on each canvas in succession as the appropriate light appeared.

Pleione, star in the Pleiades, thought to be typical of the shell stars, so called because in their rapid rotation they throw off shells of gas. In 1938 sudden changes in the spectrum of Pleione were attributed to the ejection of a gaseous shell, which by 1952 had apparently dissipated. Pleione is a blue-white star of about the fifth magnitude. Some astronomers conjecture that it may have been brighter in the past; it would then have made a seventh bright star in the Pleiades cluster, which is named for seven mythological sisters.

Pleistocene Epoch, the earlier and major of the two epochs that constitute the Quaternary Period of Earth history, and the time period during which a succession of glacial and interglacial climatic cycles occurred. The Pleistocene began about 1.6 million years ago and ended roughly 10,000 years ago. It is preceded by the Pliocene Epoch of the Tertiary Period and is followed by the Holocene Epoch.

A brief treatment of the Pleistocene Epoch follows. For full treatment, *see* MACROPAEDIA: Geochronology.

Originally, the Pleistocene Epoch was envisaged as covering the period of the Great (or Quaternary) Ice Age. The onset of this ice age, however, was marked by a sharp climatic cooling dated about 2,500,000 years ago, and it is now placed within the Pliocene Epoch. Additionally, the Holocene Epoch is now regarded as the latest interglacial stage of the ice age. Some authorities would like to extend the Pleistocene up to the present time, but others feel that the present subdivision of the Quaternary Period into Pleistocene and Holocene epochs is justified by the much-intensified role of man during the latter epoch.

At the height of the Pleistocene glacial ages, more than 30 percent of the land area of the world was covered by glacial ice. At present only about 10 percent is so covered, and much of the ice is in the higher latitudes. The same was probably true for the interglacial stages. Some differences between the present-day conditions and the conditions of at least one of the interglacials are apparent, however, from comparison of fossil faunal forms with the animals of today.

Glacial cirques (theatre-like valley heads fashioned by the action of snowfields at the heads of individual glaciers in mountainous terrain) bear a rough general relation to the snow line (lower limit of perennial snow). Through measurements of the altitudes of cirques in many parts of the world, the approximate position of the snow line at the height of the latest glaciation has been determined. Wherever measured, this former snow line is lower than the snow line of today—at the equator as well as in polar latitudes. The subpolar climate belts were shifted toward the equator during the glacial episodes. This shift may have amounted to as much as 15° of latitude for the boreal, or northern, belt but somewhat less for the warmer belts.

The pluvial conditions of the dry regions of middle and low latitudes support this conclusion in that they appear to show equatorward shifting of the middle-latitude belts of rain-bearing cyclonic storms. Fossil flora and fauna likewise indicate southward shifting of the cold northern climatic zone through many degrees of latitude.

The areas within the Northern Hemisphere that were formerly glaciated include the mountainous western part of North America. This region was occupied by a vast complex of glaciers that, throughout most of the Canadian sector, formed a nearly continuous covering of ice. The vast area from the Atlantic to the Rocky Mountains, Canada and the northern part of the United States (as far south as New York City; Cincinnati, Ohio; Carbondale, Ill.; St. Louis, Mo.; Kansas City, Mo.; and Pierre, S.D.) were buried beneath the Laurentide Ice Sheet that had its source in Canada. This enormous continental glacier is thought to have originated on the Labrador-Ungava plateau and on the Arctic islands of Canada. Greenland and Iceland were almost entirely ice-covered. Nearly half of Europe—from the North Cape off the north coast of Norway south to Kiev on the banks of the Dnepr—was covered by the Scandinavian Ice Sheet. Much of Siberia was overspread by mountain glaciers and by the Siberian Ice Sheet on its northwestern plain. The Alps, the Caucasus, and the Pyrenees in Europe and most of the high mountains on other continents carried glaciers of varying dimensions. The Antarctic continent was even more nearly completely ice-covered than now, and the glaciers of the southern Andes spread westward to tidewater in Chile and eastward onto the pampas of Argentina. The highest mountains of Hawaii, Japan, and New Guinea supported valley glaciers.

The effects of the glacial climate and continental ice sheets included the fall and rise of the sea level throughout the world. The moisture that formed glaciers came from the sea, resulting in the lowering of the sea level. Under warming climates the existing glaciers melted and large volumes of meltwater were returned to the sea, thereby raising its level. The alternation of glacial and interglacial episodes, therefore, resulted in fluctuation of the sea level through a range of more than a hundred metres, including levels both somewhat higher and much lower than today. Glaciation also caused extensive warping of the Earth's crust. The crust yields to excessive loading such as that induced by great ice sheets. In the substratum below the rocky crust, plastic flow transfers rock material outward away from the weighted area, causing basinlike subsidence. When the ice sheet melts, the load is removed,

"Monet Painting in His Garden," oil painting by Pierre-Auguste Renoir, 1873; in the Wadsworth Atheneum, Hartford, Conn.

By courtesy of the Wadsworth Atheneum, Hartford, Conn., bequest of Anne Parrish Titzell causing the crust to rebound. Such uplift is initially rapid, but it decreases with time. The eastern area of Hudson Bay is known to have been uplifted by over 300 m (985 feet) since the last major glaciation.

In the dry regions in low and middle latitudes on all the continents, there is impressive evidence both of former lakes where none now exist and of the formerly much larger size of existing lakes. A good example of the latter is Lake Bonneville, the predecessor of the present-day Great Salt Lake in Utah in the western United States. At its highest stage some 15,000 years ago during the last glaciation, Lake Bonneville covered an area of approximately 51,000 square km (19,700 square miles) and was about 370 m (1,215 feet) deep.

A conspicuous effect of the glacial climates in areas that lay a short distance beyond the ice sheets is the effect of frost heaving and solifluction. Solifluction is the slow creeping of soil, even on gentle slopes, as a result of freezing and thawing. It takes place today in Arctic and Antarctic regions and on high mountain summits in lower latitudes. The effects of solifluction in producing contortion of stratification and the patterned arrangements of stones resulting from frost-heaving of the soil are distinctive.

The flora and fauna of the Pleistocene began to resemble those of today. Angiosperms (flowering plants), particularly the deciduous forms, proliferated in the temperate and colder regions. New groups of land mammals appeared in Europe during the early Pleistocene; these included true elephants, zebrine horses, and cattle. Later in the epoch, there emerged various "Arctic" mammalian forms, such as reindeer, musk-oxen, and lemmings, followed by woolly mammoths, woolly rhinoceroses, and moose. North American fauna of the early and middle Pleistocene was quite similar. It included a large number of immigrants from Asia, notably mammoths, caballine horses, antelopes, and many rodents. By the late Pleistocene, bison, skunks, and bats appeared on the scene.

Among the significant mammals that evolved during the Pleistocene were humans. *Homo erectus,* usually considered to be the direct ancestor of modern humans, had appeared in Africa at the outset of the Pleistocene and became extinct late in the epoch. By the mid-Pleistocene, *Homo sapiens,* the species of modern humans, evolved in Africa and Europe. *H. sapiens* spread to Asia and the Americas before the end of the epoch.

The striking difference between the present-day fauna of large terrestrial mammals and the far richer fauna that existed at the height of the last glaciation is the direct result of mass extinctions. In North America more than 30 genera of large mammals became extinct within a span of roughly 2,000 years during the late Pleistocene. The number in Eurasia was considerably smaller, as was the case in Africa and South America. The extinctions involved not only large mammalian forms but also large flightless birds (*e.g.,* in New Zealand). Of the many causes that have been proposed by scientists for these faunal extinctions, the two most likely are changing environment with changing climate, and the disruption of the ecological pattern by early humans.

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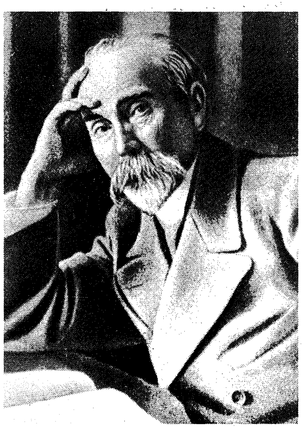
Plekhanov, Georgy Valentinovich (b. Dec. 11 [Nov. 29, Old Style], 1856, Gudalovka, Russia—d. May 30 [May 17], 1918, Terioki, Fin.), Marxist theorist, the founder and for many years the leading exponent of the Marxist movement in Russia. A Menshevik, he opposed the Bolshevik seizure of power in Russia in 1917 and died in exile.

Early life. Plekhanov was born into a family of the minor gentry. In 1873, after completing his studies at the Voronezh Military Academy, he enrolled in St. Petersburg's Konstantinovskoe Military School, with the intention of becoming an army officer.

He soon transferred to the Mining Institute and then, during his second year there, abandoned his studies to devote himself entirely to a populist revolutionary movement. Although this movement aimed to foment a peasant upheaval and to establish an agrarian socialist society, Plekhanov's activity involved him particularly with urban factory workers. After becoming a leader of the populist organization Land and Freedom in 1877, he engaged in underground political agitation. His writings appeared in Land and Freedom's publication of the same name; some of them showed Marxist influence. When Land and Freedom turned increasingly to terrorist methods, Plekhanov formed an antiterrorist splinter group to continue mass agitation. This faction was, however, short-lived, and in 1880 Plekhanov went abroad to avoid arrest. He did not return to Russia until 1917.

Formulation of Russian Marxism. For the greater part of his exile, Plekhanov resided in Geneva. In 1883, with several friends, he established the first Russian Marxian revolutionary organization, Liberation of Labour. In two major works, *Socialism and Political Struggle* (1883) and *Our Differences* (1885),



Plekhanov
Sovfoto

he launched a destructive critique of populism and laid the ideological basis of Russian Marxism. Russia, he argued, had been caught up in a capitalistic development that was altering its social structure and creating the conditions for the overthrow of Russian autocracy and the establishment of a bourgeois-democratic regime. The Marxists, according to Plekhanov, were obliged to organize the emerging industrial proletariat for the struggle against autocracy. After its overthrow further capitalistic development would multiply the numbers of the proletariat; and, under the leadership of a social-democratic labour party, the working class would ultimately liberate itself through a socialist revolution. This two-phase revolutionary scheme lay at the centre of Russian Marxian thought through several decades.

During the 10 years or so after the publication of *Socialism and Political Struggle,* Plekhanov's group produced a mass of socialist literature, but the Marxists remained isolated from the Russian working class. Toward the mid-1890s, however, after a renewal of antigovernment activity, the group won some notable followers, including Vladimir Lenin. Revolutionaries from the intelligentsia established relationships with workingmen to promote labour struggles against management. Plekhanov and his friends joined with these groups, whose activities culminated in 1898 in the formation of the Russian Social Democratic Workers' Party.

In the 1890s Plekhanov continued his polemics against the populists, most importantly with his book *On the Development of the Monistic Conception of History.* In 1898 he began publishing a series of tracts defending Marxian orthodoxy from those who proposed modifications or deviations. His principal targets were the reformist revisionism propounded by the German Social Democrat Eduard Bernstein, and a Russian tendency called "economism," which purportedly deprecated the importance of the direct political struggle and, rather, encouraged efforts to improve the position of the working class through labour pressure on the factory owners.

Break with Lenin. These campaigns were waged in concert with Lenin and some others, who, in 1900, had joined hands to publish the militant journal *Iskra* ("The Spark"). By 1903 their foes in the Russian movement had apparently been routed, and the second congress of the Russian Social Democratic Workers' Party was held. Unexpectedly, a controversy over the character of the party split the congress into what became known as the Bolshevik and Menshevik factions. Plekhanov initially sided with Lenin, the Bolshevik leader, but soon drew away and joined the Mensheviks in attacks upon him. For the remainder of his political life, and especially between 1906 and 1914, Plekhanov strove in vain to reunite the party.

In the last two decades of his life, Plekhanov was deeply absorbed in philosophical, artistic, literary, and historical studies. In all these fields he made significant contributions. But he did not completely retire from political life. A prominent member of the Second International, he assumed a "defeatist" stance toward his country in the Russo-Japanese War of 1904–05. By contrast, he supported the Entente during World War I, as he believed that the victory of German militarism would unquestionably spell disaster for the progressive workers' movement in Russia and elsewhere.

The Revolution of 1905 tested the revolutionary scheme Plekhanov had devised in the 1880s and found it wanting. The bourgeoisie did not act as he had anticipated they would. The peasantry, whose role he had underestimated, proved to be a potent revolutionary force. Yet he did not modify his theory in any fundamental respect. His influence declined noticeably between the two revolutions.

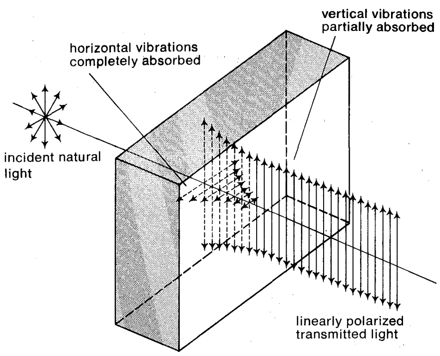
In 1917 Plekhanov greeted the February upheaval as the long-awaited "bourgeois" revolution. Returning to Russia in 1917, he urged continuation of the war to victory. The soldiers heeded him no more than did the peasants and workers whom he urged to subordinate their political demands to the more pressing need for national survival. Though critical of the Provisional Government, he supported many of its key policies. He was impotent to stop the Bolsheviks' march to power, and as a consequence of his attacks on them he was harassed by overzealous Red Guards as "an enemy of the people." (S.H.B.)

BIBLIOGRAPHY. For biographical information, see Samuel H. Baron, *Plekhanov: The Father of Russian Marxism* (1963).

Plenty, Bay of, bay of the South Pacific Ocean, eastern North Island, New Zealand. About 100 miles (160 km) wide, it extends along a narrow lowland strip from Waihi Beach eastward to Opotiki. The Rangitaiki and Whakatane rivers empty into the bay, the largest islands of which are White and Motiti. Matakana Island shelters Tauranga Harbour to the west.

The Bay of Plenty was named in 1769 by Captain James Cook, in recognition of the generous provisions and water received from Maoris living along its shore. Principal settlements are Mount Maunganui, Maketu, Matata, Whakatane, and Opotiki. The region supports dairy and sheep farming.

pleochroism (from Greek *pleiōn,* "more," and *chrōs,* "colour"), in optics, the selective absorption in crystals of light vibrating in different planes. Pleochroism is the general term for both dichroism, which is found in uniaxial crystals (crystals with a single optic axis), and trichroism, found in biaxial crystals



Plane-polarized light transmitted by a dichroic crystal
From F.W. Sears, *Optics*

(two optic axes). It can be observed only in coloured, doubly refracting crystals. When ordinary light is incident on a crystal exhibiting double refraction, the light is split into two polarized components, an ordinary ray and an extraordinary ray, vibrating in mutually perpendicular planes. A dichroic substance such as tourmaline transmits only the extraordinary ray, having absorbed the ordinary ray (*see* illustration).

When a ray of unpolarized (ordinary) light falls on a dichroic uniaxial crystal, any given wavelength will be absorbed differently according to which plane it is vibrating in, except along the optic axis for which there is no distinction between an ordinary ray and an extraordinary ray. Thus, the dichroic crystal will appear to have one colour in the direction of the optic axis and a different one at other angles. A biaxial crystal, one having two optic axes, will exhibit trichroism, in which three colours, sometimes called face colours, may be observed. As an example, in the crystal cordierite, when white light travels through the crystal parallel to one of the three crystal axes, either violet, blue, or yellow light will be absorbed. If a cube is cut having the crystal axis for edges, the three residual colours will be mixtures of blue plus yellow, violet plus yellow, and violet plus blue.

A pleochroic halo is a spherical shell of colour produced around a radioactive impurity included in a mineral. Such a shell—observed as a ring, or halo, if the specimen is cleaved along a plane passing through the sphere—is believed to represent a region in which the crystal structure has been modified by the absorption of the energy of alpha particles emitted by the radioactive elements. Because most of the energy of an alpha particle is absorbed at the end of its path length in a mineral, these colour centres are produced most intensely around the inclusion. Pleochroic halos are commonly found in rock-forming minerals—for example, biotites, fluorites, and amphiboles. The most common inclusions are the minerals zircon, xenotime, apatite, and monazite.

The distance of the rings from the central radioactive inclusion depends upon the range of the alpha particles. Consequently each ring may be identified with alpha emission by a specific element.

pleomorphism, the existence of irregular and variant forms in the same species or strain of microorganisms, a condition analogous to polymorphism in higher organisms. Pleomorphism is particularly prevalent in certain groups of bacteria and in yeasts, rickettsias, and mycoplasmas and greatly complicates the task of identifying and studying them.

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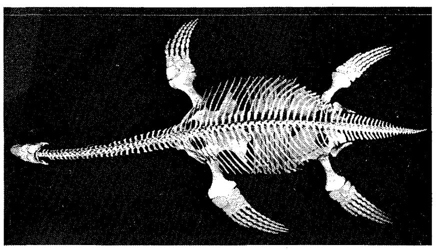
plesiosaur, also called PLESIOSAURUS, plural PLESIOSAURI (genus *Plesiosaurus*), any of a group of extinct long-necked, marine reptiles that are found as fossils in rocks of the Late Triassic through the Late Jurassic epochs (230 to 144 million years old). The plesiosaur had a wide distribution throughout the Eastern Hemisphere and also may be represented in South American deposits. Related forms known from North America and elsewhere persisted until the end of the Cretaceous Period (66.4 million years ago).

The plesiosaur was about 4.5 m (15 feet) long, with a broad and flat body and relatively short tail. The neck was long and flexible. The nostrils were far back near the eyes, and the palate was almost solid. Long, sharp teeth were present in the jaws; the plesiosaur probably fed by swinging its head from side to side through a school of fish. The plesiosaur apparently was able to employ its large, paddle-like limbs to swim backward or forward or even to rotate itself about the body axis.

Early in their evolutionary history, the plesiosaurs split into two main groups: pliosaurs, the short-necked forms, in which the neck was short and the head elongated; and elasmosaurs, in which the head remained relatively small and the neck assumed snakelike proportions and became very flexible. The late evolution of plesiosaurs was marked by a great increase in size. *Kronosaurus,* an Early Cretaceous pliosaur from Australia, was about 12 m (40 feet) long; the skull alone was about



Cryptocleidus, showing dorsal aspect of a plesiosaur skeleton
By courtesy of the American Museum of Natural History, New York

3.7 m (12 feet) long. *Elasmosaurus* had as many as 76 vertebrae in its neck and reached a length of about 13 m (43 feet), fully half of which consisted of the head and neck.

Plessis-Marly, Philippe de Mornay, seigneur du (lord of): *see* Mornay, Philippe de.

Plessner, Helmuth (b. Sept. 4, 1892, Wiesbaden, Ger.—d. June 12, 1985, Göttingen, W.Ger.), German philosopher credited with establishing European philosophical anthropology, the study of the nature of individuals through their experiences. In his theory of existence based on a balance between an "inner" and an "outer" self, he differentiated humans from animals. When individuals transcend their outer self and realize their inner life, he believed, they are open to perceptions, experiences, and expressions that have a greater sociological and historical significance.

Educated in medicine, zoology, and philosophy at the universities of Freiburg, Heidelberg, and Berlin, he acquired a doctorate in philosophy from Erlangen (1916). He was a professor at Cologne from 1926 to 1934, when the Nazi political climate compelled his move to Groningen, Neth., where he became professor of sociology (1934–42). Ousted by the Nazis during the occupation, he taught again at Groningen (1946–51), as professor of philosophy, before returning to the University of Göttingen (1951), where he became professor emeritus in 1962. His principal works include *Die wissenschaftliche Idee* (1913; "The Scholarly Idea"), *Die Einheit der Sinne* (1923; "The Unity of Senses"), *Macht und menschliche Natur* (1931; "Might and Human Nature"), *Das Schicksal deutschen Geistes im Ausgang seiner bürgerlichen Epoche* (1935; "The Destiny of the German Spirit at the End of Its Bourgeois Epoch"), *Lachen und Wienen* (1941; *Laughing and Crying*), *Zwischen Philosophie und Gesellschaft* (1953; "Between Philosophy and Society"), and *Grenzen der Gemeinschaft: Eine Kritik des sozialen Radikalismus* (1972; "Limits of Society: A Critique of Social Radicalism").

Plethon, George Gemistus: *see* Gemistus Plethon, George.

pleura, plural PLEURAE, or PLEURAS, membrane lining the thoracic cavity (parietal pleura) and covering the lungs (visceral pleura). The parietal pleura folds back on itself at the root of the lung to become the visceral pleura. In health the two pleurae are in contact. When the lung collapses, however, or when air or liquid collects between the two membranes, the pleural cavity or sac becomes apparent (*see* pleurisy). There are actually two pleural cavities, the right and the left; each constitutes a closed unit not connected to the other. The glistening surface of the pleura is made up of a sheet of flat cells, the mesothelium, which covers an underlying layer of loose elastic tissue. The pleura exudes a thin fluid that keeps it moist and lubricated.

Major disorders of the pleura include pleurisy, the inflammation of the pleura; pleural effusion, the accumulation of excess fluid between the visceral and parietal pleurae; empyema, the collection of pus in the pleural space; tumours of the pleura; chylothorax, the rupture of the thoratic duct; hemothorax, the accumulation of blood in the pleural space; and fibrothorax, resulting from the presence of large amounts of fibrin in the pleural fluid.

pleurisy, inflammation of the pleura, the membrane that lines the thoracic cavity and folds in to cover the lungs. The inflamed membrane exudes varying quantities of fluid into the pleural cavity, between these two surfaces of the folded membrane. Depending on the amount of exudate, the pleurisy is described as simple or dry or fibrinous (in which case the amount of fluid is normal) or as pleurisy with effusion (in which case the amount of fluid accumulating in the pleural cavity is often extremely large). Because the pleura is well supplied with nerves, pleurisy can be very painful. The disease is commonly caused by infection in the underlying lung and, more rarely, by diffuse inflammatory conditions such as rheumatoid arthritis. Treatment of the disease includes pain relief and fluid evacuation; its main objective is correction of the underlying cause.

pleurisy root: *see* butterfly weed.

Pleurococcus, also called PROTOCOCCUS, or MOSS, genus of green algae. Several other algae and a number of lichens are also popularly called "mosses" (*e.g.* Irish moss, oak moss), as are all members of the plant class Bryopsida (*see* moss).

Pleurococcus is found as a thin, green covering on the moist, shaded side of trees, rocks, and soil. Because it grows on the north (or shaded) side of trees, stone walls, and fences, *Pleurococcus* is an important compass direction indicator. The spherical cells, either solitary or clumped together forming short false filaments, have heavy cell walls that protect the cells against excessive water loss. Each cell contains a large dense chloroplast, either lobed or plate-shaped. Reproduction is by cell division only. The taxonomic position of *Pleurococcus* is uncertain.

pleurodynia, also called BORNHOLM DISEASE, viral (coxsackie B) epidemic disease with an incubation period of two to four days, marked by a fever of brief duration, severe chest and lower back pain aggravated by deep breathing and movement, and a tendency to recur at intervals of a few days. The disease is usually self-limiting, terminating in complete recovery. Pain and fever can usually be relieved by aspirin.

Pleuromeia, a genus of extinct club mosses, order Pleuromeiales (class Lycopsida). It represents a curious line of small, treelike Late Triassic epoch (starting 230 million years ago) lycopsids, perhaps related to members of the present-day quillwort genus (*Isoetes*). *Pleuromeia*'s unbranched trunk reached to more than 1 m (40 inches) in height and about 10 cm (4 inches) in diameter; it bore a zone of elongated leaves near its tip, at which one large terminal cone was produced. Its rootlets were spirally arranged on four or more lobes that flared out at the base of the trunk, inviting comparisons with several other treelike lycopsids (*e.g., Lepidodendron, Sigillaria*).

Pleuronectiformes (fish order): *see* flatfish.

pleuropneumonia, lung disease of cattle and sheep, characterized by inflammation of the lungs and caused by the bacterium *Mycoplasma mycoides*. Fever, thirst, loss of appetite, and difficult breathing are signs of the disease. The United States and Europe eradicated the disease near the end of the 19th century. Vaccines offer protection in places where the disease still exists—Asia, Australia, and parts of Africa.

Pleurothallis, genus of more than 1,000 species of tropical American orchids, family Orchidaceae, that grow on other plants and range greatly in size. The flowers may be solitary or borne on a short spike.

The flowers are primarily in tints and shades of yellow combined with white, red, green, or brown. The widow orchid (*P. macrophylla*) is a dark, deep purple.

Pleve, Vyacheslav Konstantinovich: *see* Plehve, Vyacheslav Konstantinovich.

Pleven, town, northern Bulgaria. It lies a few miles east of the Vit River, which is a tributary of the Danube. At one time a Thracian settlement called Storgosia, the town was destroyed by Huns and was restored by the emperor Justinian I in the 6th century. Renamed Kajluka by Slavs, it became Hungarian in 1266, and the name Pleven was used from 1270 onward. As a key fortress of the Ottoman Empire, it became an important trade centre in the 15th–19th century.

Pleven is now a service town for an agricultural hinterland and also has food-processing, textile, engineering, cement, woodworking, rubber, and tobacco industries. Pleven has good road and rail connections. Innumerable monuments and eight museums in the area are devoted to the Siege of Pleven (*see* Pleven, Siege of), a lengthy and important engagement of the Russo-Turkish War of 1877–78. There is also the important Liberation Museum, which was established in 1905–07. The fertile agricultural area in which Pleven is located is well-irrigated by the Danube and several tributaries. Grains, grapes, fruits, and cattle are the area's major products. Pop. (1987 est.) town, 132,206.

Pleven, René (b. April 13, 1901, Rennes, Fr.), politician, twice premier of the French Fourth Republic (1950–1951, 1951–52), who is best-known for his sponsorship of the Pleven Plan for a unified European army. His efforts spurred the creation of the North Atlantic Treaty Organization (NATO).

After receiving a law degree from the University of Paris, Pleven became an industrial executive. During World War II, he joined General Charles de Gaulle's Free French government, serving successively as commissioner of finance, colonies, and foreign affairs and becoming colonial minister in 1944. After the liberation of France he became minister of finance in de Gaulle's Cabinet and in 1945 was elected deputy to the National Assembly. From 1946 to 1953 he was president of the left-centre Democratic and Socialist Union of the Resistance (Union Dêmocratique et Socialiste de la Résistance; UDSR); he was twice minister of defense (1949–50, 1952–54) and twice premier (July 1950–February 1951 and August 1951–January 1952).

Pro-American in outlook, Pleven convened a conference in Paris in July 1950 to draw up a plan for a European army, the European Defense Community, to unify North Atlantic and western European defense under a single high command. Although the plan was opposed by the French Communists, Socialists, and Gaullists, and none of the governments to which Pleven belonged was willing to ratify the necessary treaty, he had helped lay the foundations of NATO. In Indochina he carried on the war against the nationalist Viet Minh with American aid.

Pleven quit the UDSR in 1958 to support de Gaulle's new constitution and the Fifth Republic. He formed a new party, the Union for a Modern Democracy, in 1959. In 1966 he criticized de Gaulle for withdrawing France from NATO but he supported the Gaullist government after de Gaulle's resignation in April 1969. He was minister of justice (1969–73) and president of the council of Bretagne (1974–76).

Pleven, Siege of, also called SIEGE OF PLEVNA (July 20–Dec. 10, 1877), in the Russo-Turkish War of 1877–78, the Russian siege of the Turkish-held Bulgarian town of Pleven (Russian: Plevna). Four battles were fought, three being repulses of Russian attacks and the fourth being a defeat of the Turks in their attempt to escape.

In the opening weeks of the war of 1877–78 the Russians achieved some successes. On the Bulgarian front they crossed the Danube in June 1877, and a flying column seized the Shipka Pass through the Balkan Mountains on July 19. At this point the Russian plans received a setback. On July 20 a Turkish force under Osman Nuri Paşa repulsed the Russians at newly fortified Pleven and stemmed their advance (First Battle of Pleven). Attempts to break the resistance of Osman Nuri Paşa failed. The Russian assaults of July 30 (Second Battle) and September 11–12 (Third Battle) were repulsed with severe losses. The Russian commander then called up Colonel Count E.I. von Todleben, the engineer officer who had organized the defense of Sevastopol during the Crimean War, and Todleben pronounced in favour of a siege of Pleven. The other Turkish commanders did little to relieve the pressure on Osman Nuri Paşa, who at last perceived that his position was hopeless and attempted to break through the Russian cordon but was defeated and compelled to surrender (Dec. 10, 1877).

The Russians then tried to execute their original plan of penetration deep into European Turkey, but the Great Powers, especially Britain, forced a truce and the signing of the Treaty of San Stefano.

Plexiglas (acrylic plastic): *see* Lucite.

Pleyel, Ignace Joseph, also spelled IGNAZ JOSEF PLEYEL (b. June 18, 1757, Ruppersthal, Austria—d. Nov. 14, 1831, Paris), Austro-French composer, music publisher, and piano builder.

Trained in music while still a very young child, he was sent in 1772 to Eisenstadt to become a pupil and lodger of Joseph Haydn's. Pleyel later claimed a close, warm relationship

Ignace Joseph Pleyel, watercolour by an unknown artist
J.P. Ziolo

had existed between them, and there is evidence of the master's esteem for his student's compositional talents in the overture (or at least the first two movements) of Haydn's puppet opera *Das abgebrannte Haus* (1776?), now generally accepted as being Pleyel's work. His first position was probably as Kapellmeister to Count Erdödy at Pressburg, to whom he gratefully dedicated his string quartets, Opus 1 (1782–83). By 1784 Pleyel had become an assistant Kapellmeister at Strasbourg Cathedral, succeeding as principal Kapellmeister when his predecessor died in 1789. In 1786 he also organized and conducted a series of public concerts, which provided him with additional opportunities to popularize his compositions. The Strasbourg period was his most musically productive, and most of his compositions date from the years 1787–95. Many of his works were widely known in Europe and North America. Because of the interruptions to religious and musical life caused by the French Revolution, Pleyel left Strasbourg in 1791 for London, where his concerts were also well-attended and his compositions—especially the *symphonies concertantes* and quartets—received high praise from the critics. Early in 1795 Pleyel settled in Paris, where he opened a music shop and founded a publishing house; it issued about 4,000 works during the 39 years it existed, including many by Luigi Boccherini, Beethoven, Muzio Clementi, Jan Ladislav Dussek, and Haydn. Pleyel published the first miniature scores, beginning with Haydn's string quarters and symphonies. Though Pleyel attempted to divest himself of the entire business in 1813, the Maison Pleyel continued until 1834, when it ceased publishing completely, selling its stocks of plates and printed works to various Paris music publishers.

The piano-manufacturing company Pleyel had founded in Paris in 1807 continued to prosper. In 1815 Pleyel's eldest son, Camille (1788–1855), became a legal partner of the firm, which then adopted the name "Ignace Pleyel et fils aîné." Recognized as a fine and sensitive pianist as well as an able administrator, Camille was a close friend of Frédéric Chopin, who made his Paris debut and also gave his final Paris concert in the Salle Pleyel. (Chopin later owned a Pleyel grand piano constructed in 1839.)

In 1855 Camille died and was succeeded by his son-in-law, Auguste Wolff (1821–87), the firm becoming Pleyel, Wolff & Cie. After Wolff's death, his son-in-law Gustave Lyon (1857–1936) assumed control of the company, which he renamed Pleyel, Lyon et Cie, best-known for the development of a chromatic harp at the end of the 19th century.

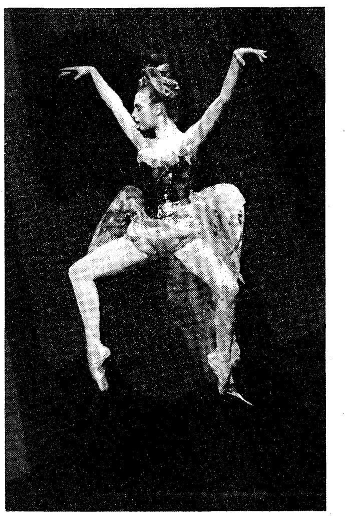
Pleyel, Marie-Félicité-Denise, also called CAMILLE MOKE (b. Sept. 4, 1811, Paris—d. March 30, 1875, St.-Josse-ten-Noode, near Brussels), French pianist and teacher, one of the most celebrated virtuosos of the 19th century.

She studied with Henri Herz, Frédéric Kalkbrenner, and Ignaz Moscheles, and by the age of 15 she was known in Belgium, Austria, Germany, and Russia as an accomplished virtuoso. She was engaged to Berlioz in 1830, but after three months, while Berlioz was in Italy, she broke the engagement to marry Camille Pleyel (1788–1855), scion of the piano-manufacturing family. After their separation in 1835 (her many love affairs were notorious), her concert career flourished. She received praise from Mendelssohn, Liszt, Chopin, and François-Joseph Fétis. From 1848 to 1872 she was professor of piano at the Brussels Conservatory, where she established a true school of piano playing in Belgium. Her few compositions for piano are of minor importance.

plica circularis, plural PLICAE CIRCULARES, also called VALVE OF KERCKRING, any of the crescent or circular folds in the surface of the small-shaped intestine that triple its absorption area, slow down the passage of food, and give it a characteristically pleated appearance. The folds usually run one-half to two-thirds of the way around the inside of the intestinal wall; occasionally, a single fold may spiral the wall for three or four complete turns. The folds are largest and most prevalent in the beginning of the intestinal tract; toward the middle they are more widely spaced and shortened, and near the end they totally disappear.

The tissue that forms these structures is the surface mucous-membrane lining and the deeper submucosa. The mucous membrane further divides into small projections called villi (*q.v.*) and is the predominant site of nutritional absorption, while the submucosa is composed of supportive tissue and blood vessels. Unlike the transient folds in the stomach, these intestinal folds are permanent structures not obliterated by distention.

plié (French: "bent"), knee bend in ballet. It is used in jumps and turns to provide spring, absorb shock, and as an exercise to loosen muscles and to develop balance. Performed in all of the five basic foot positions, pliés may be shallow, so that the dancer's heels remain on the floor (*demi-plié*), or deep, so that in all foot positions except the second the heels rise (*grand plié*).



Plié in second position *en pointe* executed by Gelsey Kirkland in *The Firebird*
Martha Swope

Pliekšāns, Jānis: *see* Rainis.

Pliensbachian Stage, standard, worldwide division of Jurassic rocks and time. (The Jurassic Period began about 190,000,000 years ago and lasted about 54,000,000 years.) The Pliensbachian is characterized by the marly limestones near the village of Pliensbach, in the Swabian Alps. Several ammonite zones (shorter periods of time characterized by kinds of fossil mollusks) have been recognized. Rocks of the Pliensbachian Stage overlie those of the Sinemurian Stage and underlie those of the Toarcian Stage.

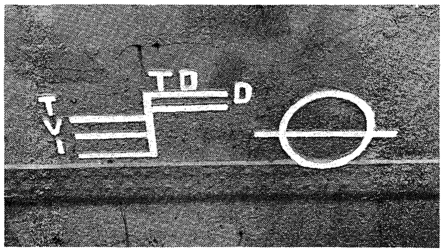
pliers, hand-operated tool for holding and gripping small articles or for bending and cutting wire. Slip-joint pliers have grooved jaws, and the pivot hole in one member is elongated so that the member can pivot in either of two positions in order to grasp objects of different size in the most effective way. On some pliers the jaws have a portion that can cut soft wire and nails.

For bending wire and thin metal, round-nose pliers with tapering, conical jaws are used. Diagonal cutting pliers are used for cutting wire and small pins in areas that cannot be reached by larger cutting tools. Because the cutting edges are diagonally offset about 15 degrees, these can cut objects flush with a surface.

Plievier, Theodor, pseudonym (until 1933) THEODOR PLIVIER (b. Feb. 12, 1892, Berlin—d. March 12, 1955, Avegno, near Locarno, Switz.), German war novelist who was one of the first native writers to begin examining Germany's role in World War II and assessing the national guilt.

Plievier, the son of a labourer, left home at 17. He led a vagrant life until serving in the German Navy in World War I, during which time he participated in the 1918 naval mutiny. An ardent Communist, Plievier worked as a left-wing publicist during the 1920s. He described his war experiences in *Des Kaisers Kulis* (1930; *The Kaiser's Coolies,* 1931), *Zwölf Mann und ein Kapitän* (1930; "Twelve Men and a Captain"), *Der Kaiser ging, die Generäle blieben* (1932; *The Kaiser Goes, the Generals Remain,* 1933), *Der 10. November 1918* (1935; "The 10th of November 1918"), and *Das grosse Abenteuer* (1936; "The Great Adventure"). These novels received little recognition, as did a 1935 play. The only notice his war novels attracted came from the Nazi Party, which banned his books in 1933 and revoked his citizenship in 1934. Plievier fled to Moscow in 1933, to the Soviet Zone in 1945, and returned to the West in 1947. His famous and most important work is a World War II trilogy that deals with the war on the eastern front. The first volume, *Stalingrad* (1945; Eng. trans. 1948), which describes the crushing defeat of the German Sixth Army, became an international bestseller. The trilogy was completed by *Moskau* (1952; *Moscow,* 1953) and *Berlin* (1954; Eng. trans. 1956). The novels are shocking in their graphic naturalistic detail, yet hold out some hope for a reborn humanity.

Plimsoll line, also called PLIMSOLL MARK, official name INTERNATIONAL LOAD LINE, internationally agreed-upon reference line marking the loading limit for cargo ships. At the instigation of one of its members, Samuel Plimsoll, a merchant and shipping reformer, the British Parliament, in the Merchant Shipping Act of 1875, provided for the marking of a load line on the hull of every cargo ship, indicating the maximum depth to which the ship could be safely loaded. Application of the law to foreign ships leaving British ports led to general adoption of load-line rules by maritime countries. An International Load Line was adopted by 54 nations in 1930, and in 1968 a new line, permitting a smaller freeboard (hull above waterline) for the new, larger ships, went into effect.



Plimsoll line, port side
By courtesy of the Alabama Dry Dock and Shipbuilding Corp.

Pliny THE ELDER, Latin in full GAIUS PLINIUS SECUNDUS (b. AD 23, Novum Comum, Transpadane Gaul—d. Aug. 24, 79, Stabiae, near Mt. Vesuvius), Roman savant and author of the celebrated *Natural History,* an encyclopaedic work of uneven accuracy that was an authority on scientific matters up to the Middle Ages.

Life. Pliny was descended from a prosperous family, and he was enabled to complete his studies in Rome. At the age of 23, he began a military career by serving in Germany, rising to the rank of cavalry commander. He returned to Rome, where he possibly studied law. Until near the end of Nero's reign, when he became procurator in Spain, Pliny lived in semi-retirement, studying and writing. His devotion to his studies and his research technique were described by his nephew, Pliny the Younger. Upon the accession in AD 69 of Vespasian, with whom Pliny had served in Germany, he returned to Rome and assumed various official positions.

Pliny's last assignment was that of commander of the fleet in the Bay of Naples, where he was charged with the suppression of piracy. Learning of an unusual cloud formation—later found to have resulted from an eruption of Mt. Vesuvius—Pliny went ashore to ascertain the cause and to reassure the terrified citizens. He was overcome by the fumes resulting from the volcanic activity and died on Aug. 24, 79, according to his nephew's report. Pliny was unmarried and was survived by his only sister.

The Natural History. Seven writings are ascribed to him, of which only the *Natural History* is extant. There survive, however, a few fragments of his earlier writings on grammar, a biography of Pomponius Secundus, a history of Rome, a study of the Roman campaigns in Germany, and a book on hurling the lance. These writings probably were lost in antiquity and have played no role in perpetuating Pliny's fame, which rests solely on the *Natural History.*

The *Natural History,* divided into 37 *libri,* or "books," was completed, except for finishing touches, in AD 77. In the preface, dedicated to Titus (who became emperor shortly before Pliny's death), Pliny justified the title and explained his purpose on utilitarian grounds as the study of "the nature of things, that is, life" ("Preface," 13). Heretofore, he continued, no one had attempted to bring together the older, scattered material that belonged to "encyclic culture" (*enkyklios paideia,* the origin of the word encyclopaedia). Disdaining high literary style and political mythology, Pliny adopted a plain style—but one with an unusually rich vocabulary—as best suited to his purpose. A novel feature of the *Natural History* is the care taken by Pliny in naming his sources, more than 100 of which are mentioned. Book I, in fact, is a summary of the remaining 36 books, listing the authors and sometimes the titles of the books (many of which are now lost) from which Pliny derived his material.

The *Natural History* properly begins with

Book II, which is devoted to cosmology and astronomy. Here, as elsewhere, Pliny demonstrated the extent of his reading, especially of Greek texts. By the same token, however, he was sometimes careless in translating details, with the result that he distorted the meaning of many technical and mathematical passages. In Books III through VI, on the physical and historical geography of the ancient world, he gave much attention to major cities, some of which no longer exist.

Books VII through XI treat zoology, beginning with man (VII), then mammals and reptiles (VIII), fishes and other marine animals (IX), birds (X), and insects (XI). Pliny derived most of the biological data from Aristotle, while his own contributions were concerned with legendary animals and unsupported folklore.

In Books XII through XIX, on botany, Pliny came closest to making a genuine contribution to science. Although he drew heavily upon Theophrastus, he reported some independent observations, particularly those made during his travels in Germany. Pliny is one of the chief sources of modern knowledge of Roman gardens, early botanical writings, and the introduction into Italy of new horticultural and agricultural species. Book XVIII, on agriculture, is especially important for agricultural techniques such as crop rotation, farm management, and the names of legumes and other crop plants. His description of an ox-driven grain harvester in Gaul, long regarded by scholars as imaginary, was confirmed by the discovery in southern Belgium in 1958 of a 2nd-century stone relief depicting such an implement. Moreover, by recording the Latin synonyms of Greek plant names, he made most of the plants mentioned in earlier Greek writings identifiable.

Books XX through XXXII are concerned with medicine and drugs. Like many Romans, Pliny criticized luxury on moral and medical grounds. His random comments on diet and on the commercial sources and prices of the ingredients of costly drugs provide valuable historical evidence relevant to contemporary Roman life. The subjects of Books XXXIII through XXXVII include minerals, precious stones, and metals, especially those used by Roman craftsmen. In describing their uses, he referred to famous artists and their creations and to Roman architectural styles and technology.

Assessment. In retrospect, Pliny's influence is based on his ability to assemble in a methodical fashion a number of previously unrelated facts, his perceptiveness in recognizing details ignored by others, and his readable stories, with which he linked together both factual and fictional data. Along with unsupported claims, fables, and exaggerations, Pliny's belief in magic and superstition helped to shape scientific and medical theory in subsequent centuries. Perhaps the most important of the pseudoscientific methods advocated by him was the doctrine of signatures: a resemblance between the external appearance of a plant, animal, or mineral and the outward symptoms of a disease was thought to indicate the therapeutic usefulness of the plant. With the decline of the ancient world and the loss of the Greek texts on which Pliny had so heavily depended, the *Natural History* became a substitute for a general education. In the European Middle Ages many of the larger monastic libraries possessed copies of the work; these and many abridged versions ensured Pliny's place in European literature. His authority was unchallenged, partly because of a lack of more reliable information and partly because his assertions were not and, in many cases, could not be tested.

The first attack on Pliny's work—Niccolò Leoniceno's tract on the errors of Pliny—was published in Ferrara in 1492. Thereafter, Pliny's influence diminished, as more writers questioned his statements. By the end of the 17th century, the *Natural History* had been rejected by the leading scientists. Up to that time, however, Pliny's influence, especially on nonscientific writers, was undiminished; he was, for example, almost certainly known to William Shakespeare and John Milton. Although Pliny's work was never again accepted as an authority in science, 19th-century Latin scholars conclusively demonstrated the historical importance of the *Natural History* as one of the greatest literary monuments of classical antiquity. It is still of value to those who wish an honest résumé of 1st-century Rome.

(Je.St.)

BIBLIOGRAPHY. The role of Pliny in the preservation and interpretation of the early views of the natural world is assessed in Roger French and Frank Greenaway (eds.), *Science in the Early Roman Empire: Pliny the Elder, His Sources and Influence* (1986), a collection of informative, authoritative essays.

Pliny THE YOUNGER, Latin in full GAIUS PLINIUS CAECILIUS SECUNDUS (b. AD 61 or 62, Comum, Italy—d. *c.* 113, Bithynia), Roman author and administrator who left a collection of private letters of great literary charm, intimately illustrating public and private life in the heyday of the Roman Empire.

Born into a wealthy family and the adopted son of his uncle, Pliny the Elder, Pliny began to practice law at 18. His reputation in the civil-law courts placed him in demand in the political court that tried provincial officials for extortion. His most notable success (100) was securing condemnation of a governor in Africa and a group of officials from Spain. Meanwhile he had attained the highest administrative posts, becoming praetor (93) and consul (100).

Pliny had financial ability and successively headed the military treasury and the senatorial treasury (94–100). After administering the drainage board of the city of Rome (104–106), he was sent (*c.* 110) by Emperor Trajan to investigate corruption in the municipal administration of Bithynia, where apparently he died two years later.

Like his contemporary, the historian Tacitus, Pliny was conventional, accepting the Roman Empire, serving under "good" and "bad" emperors, and making the conventional complaints against the latter in his writings. Between 100 and 109 he published nine books of selected, private letters, beginning with those covering events from the death of Emperor Domitian (October 97) to the early part of 100. The 10th book contains addresses to Emperor Trajan on sundry official problems and the emperor's replies.

The private letters are carefully written, occasional letters on diverse topics. Each holds an item of recent social, literary, political, or domestic news, or sometimes an account of an earlier but contemporary historical event, or else initiates moral discussion of a problem. Each has a single subject and is written in a style that mixes, in Pliny's terminology, the historical, the poetical, and the oratorical manner, to fit the theme. The composition of these *litterae curiosius scriptae* ("letters written with special care") was a fashion among the wealthy, and Pliny developed it into a miniature art form.

There are letters of advice to young men, notes of greeting and inquiry, and descriptions of scenes of natural beauty or of natural curiosities. Pliny also left a detailed picture of the amateur literary world with its custom of reciting works to seek critical revision from friends. Estate business is a frequent theme, and letters concerned with such matters reveal the abilities for which Trajan chose him to reorganize the municipal finances and local government of Bithynia.

Pliny's letters introduce many of the leading figures of Roman society in the 12 years after the death of Domitian—men of letters, politicians, administrators, generals, and rising young men of rank. They make possible the social reconstruction of an age for which there is otherwise no serious historical record. He was an adept at brief character sketches, his works being less satirical, more kindly, and possibly more complete than those of Tacitus. He was also a devotee of literature. He has left a detailed picture of the amateur literary world of his time and of the salons in which it was the custom to recite one's work and to seek critical revision from one's friends.

Pliny published his forensic and literary speeches with care, and late in life he took to the contemporary fashion for light verse in the style of Martial. Though fulsome in the praise of contemporary writers, his judgment of the dead Statius was fair: "He was ever writing poems with greater pains than ability." His letters addressed to his fellow advocate Tacitus, then occupied with his first major work, tell the little that is known about the date and circumstances of the composition of the *Historiae,* to which Pliny contributed his famous account of the eruption of Vesuvius. The biographer Suetonius was among his protégés.

One of the best modern editions of the letters and his panegyric to Trajan is by M. Schuster in the Teubner series (2nd ed., 1952). W. Melmoth's English translation, *The Letters of Pliny the Consul* (1746), was revised by W.M. Hutchinson for the Loeb Classical Library (2 vol., 1915).

BIBLIOGRAPHY. An important scholarly commentary on the political, social, literary, and legal background of Pliny's writings is given in A.N. Sherwin-White, *The Letters of Pliny* (1966, reissued 1985). Federico Gamberini, *Stylistic Theory and Practice in the Younger Pliny* (1983), offers an analysis of the language of the writer.

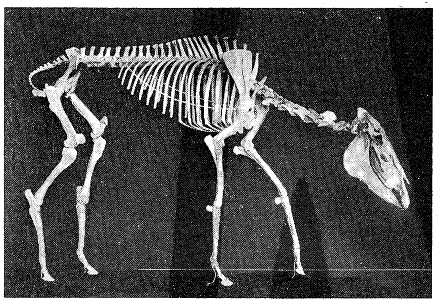
Consult the INDEX *first*

Pliocene Epoch, major worldwide division of the Tertiary Period extending from about 5.3 to 1.6 million years ago. It is often divided into the Early Pliocene Epoch (5.3 to 3.4 million years ago) and the Late Pliocene Epoch (3.4 to 1.6 million years ago). The Pliocene Epoch is the last and shortest epoch of the Tertiary Period. It follows the Miocene Epoch of the Tertiary Period and precedes the Pleistocene Epoch of the Quaternary Period. The Pliocene is also subdivided into two ages and their corresponding rock stages—namely, the Zanclean and the Piacenzian.

Pliocene deposits are known throughout the world. Early Pliocene deposits are well known from the Mediterranean region, the Siwālik Hills of India (*see* Siwalik Series), and the Honan and Shansi provinces of China. Pliocene environments were generally cooler and drier than those of preceding Tertiary epochs, as revealed by the remains of plants and trees.

A very modern aspect is seen in the vertebrate faunas of the Northern Hemisphere. Older groups of animals became extinct throughout the preceding Miocene Epoch. Although similarities are evident between the faunas of Eurasia and North America, little faunal interchange appears to have occurred between the two regions. The similarities are probably due to the continuation of forms that migrated between the two areas late in the Miocene Epoch. It is likely that during the early Pliocene a remarkably homogeneous fauna existed from Spain and Africa to China. Mastodons (elephant-like animals) underwent a great evolutionary diversification during the Pliocene, and many variant forms developed, adapted to varying ecological environments. In North America rhinoceroses became extinct. Camels, some of large size, were abundant and diverse, as were horses. In general, Pliocene mammals grew larger than those of earlier epochs. The more advanced primates continued to evolve in the Pliocene, and it is possible that the australopithecines, the first creatures that can be termed men, developed late in the Pliocene. The land connection between North and South America probably became reestablished in the Pliocene. Species of sloths and glyptodonts, large, armadillo-like, armoured animals, appear in the Pliocene fossil record of North America (previously, they had been isolated on the South American continent).

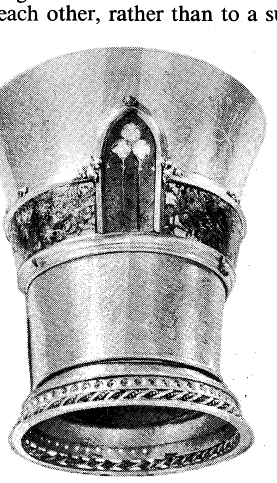
Pliohippus, extinct genus of primitive horses that inhabited North America during the Pliocene Epoch, between 2,500,000 and 7,000,000 years ago. *Pliohippus,* the first of the one-toed horses, evolved from *Merychippus,* an ancestor that lived in the preceding Miocene Epoch. The teeth in *Pliohippus* are



Pliohippus leidyanus
By courtesy of the American Museum of Natural History, New York

more advanced than in earlier forms and tend toward the dentition of modern horses: tall, complexly folded teeth. *Pliohippus* was a grazing and running animal from which modern horses evolved.

plique-à-jour (French: "open to light"), in the decorative arts, technique producing translucent enamels held in an open framework made by soldering individual wires or delicate metal strips to each other, rather than to a support-



The "Merode cup" (shown without cover), silver gilt with plique-à-jour enamelling, Flemish or Burgundian in origin, *c.* 1430–40; in the Victoria and Albert Museum, London
By courtesy of the Victoria and Albert Museum, London; photograph, A.C. Cooper Ltd.

ing surface as in cloisonné. The unattached support, usually a sheet of metal or mica, can be easily removed after the enamels have been annealed and cooled, producing an effect not unlike a stained-glass window in miniature. Developed in France and Italy in the 14th century, this technique has been used largely for making vessels, jewelry, and, in Russia, demitasse spoons.

Plisetskaya, Maya (Mikhaylovna) (b. Nov. 20, 1925, Moscow), prima ballerina of the Bolshoi Ballet of Moscow, admired particularly for her technical virtuosity, expressive use of her arms, and ability to integrate acting with dancing.

A niece of the dancers Asaf and Sulamith

Maya Plisetskaya in *Swan Lake*, 1961
Paris Match—Pictorial Parade/EB Inc.

Messerer, she studied with Paul Gerdt's daughter Yelizaveta and with Agrippina Yakovlevna Vaganova and graduated from the Bolshoi school in 1943. Plisetskaya is noted for her unique, individualistic portrayals in both Soviet and classic ballets; her repertory includes Zarema in *The Fountain of Bakhchisaray, Laurencia,* the Mistress of the Copper Mountain in *The Stone Flower,* Kitri in *Don Quixote, Giselle,* Aurora in *The Sleeping Beauty,* and the dual character Odette-Odile in *Swan Lake,* often considered her greatest role. She has performed in many countries, including the U.S., India, and China, and was a guest artist with the Paris Opéra in 1961 and 1964. Her performances have been recorded in the films *Stars of the Russian Ballet* (1953), *Swan Lake* (1957), and *Plisetskaya Dances* (1966). In 1964 she received a Lenin Prize for outstanding work in the arts. She has appeared in ballets by such non-Soviet choreographers as Roland Petit, Maurice Béjart, and Alberto Alonso. Since 1975 she has also performed with the Ballet de XXe Siècle of Brussels. Her first choreography was *Anna Karenina* (1972).

Plitvice Lakes, Serbo-Croatian PLITVIČKA JEZERA, continuous chain of 16 lakes and many waterfalls in western Croatia, Yugoslavia. The chain, 5 mi (8 km) in length, begins two mountain streams that join near Plitvički Ljeskovac to form the Matica River. The river feeds Lake Prošće, the highest in elevation; it then flows by a number of waterfalls and smaller lakes into Lake Kozjak, the largest. Of the many cascades and falls, Plitvice and the Sastavci falls are the most spectacular, particularly during the spring snow melt. The lakes are the focal point of Plitvice National Park, which is also a nature reserve.

Plivier, Theodor: *see* Plievier, Theodor.

PLO: *see* Palestine Liberation Organization.

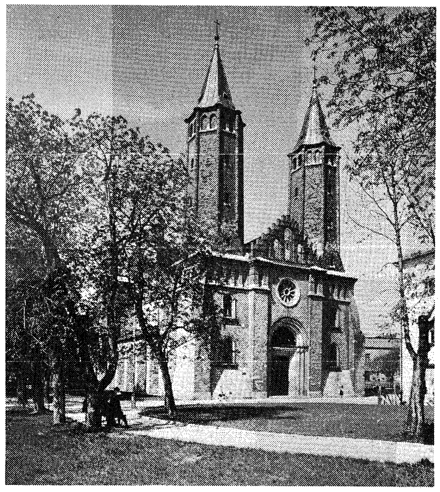
Ploceidae, songbird family, order Passeriformes, including the bishop, weaver, and whydah groups and Old World sparrows. The 135 to 155 species are native chiefly to Africa—but several have been introduced elsewhere. Ploceids are small, compact birds with short, stout bills. In many species the males are brightly coloured; some acquire, in nonbreeding season, dull plumage resembling that of females.

Ploceids are commonest in dry, hot country, where they forage on the ground for seeds and insects. Most are highly gregarious, and many are polygamous. They chirp and chatter incessantly. Except for the parasitic whydahs and certain sparrows, all weave covered nests, typically in colonies. The usually five or six eggs are tinted and speckled in most species.

The relationships of these and other seedeaters are very uncertain, and authorities disagree widely on the classification of the groups.

Płock, *województwo* (province), central Poland, established 1975, comprising an area of 1,976 sq mi (5,117 sq km). It is bordered by the provinces of Ciechanów on the northeast; Warsaw and Skierniewice on the southeast; Łódź and Sieradz on the south; and Konin and Włocławek on the west. The province is crossed from east to west by the Vistula River. Płock (*q.v.*) city, the provincial capital, is located on both banks of the Vistula. The mostly level terrain is broken by 548-ft- (167-m-) high morainal hills in the south. The Łąck Forest (Lasy Łąckie) in the western part of the province is the site of numerous health spas; otherwise, the province is not heavily forested. The soil is arable and supports large crops of wheat, rye, potatoes, and sugar beets. Provincial industry includes food processing, iron mining, oil refining, lumber milling, agricultural-machinery manufacturing, and chemical and petrochemical production. Pop. (1982 est.) 497,100.

Płock, city, capital of Płock *województwo* (province), central Poland, on the Vistula River. First chronicled in the 10th century, Płock is the oldest community in Mazowsze (Mazovia), having served as the seat of Polish



The cathedral at Płock, Poland
Z. Siemaszko

rulers from 1079 to 1138. It received town privileges in 1237 and prospered as a trading centre through the 17th century. In 1793 Płock passed to Prussia; it was returned to Poland in 1918. The town was badly damaged during World War II, at which time it was known as Schröttersburg. The economy is based on oil refining and modern petrochemical and plastics works, supplied by the Druzhba (Friendship) pipeline from the U.S.S.R. There is also production of agricultural machinery and foodstuffs. It is located on a rail line and has riverboat service and good road links with the rest of Poland. It contains the state and diocesan museums. Pop. (1982 est.) 103,800.

ploidy, in genetics, the number of chromosomes occurring in the nucleus of a cell. In normal somatic (body) cells, the chromosomes exist in pairs. The condition is called diploidy. During meiosis the cell produces gametes, or germ cells, each containing half the normal or somatic number of chromosomes. This condition is called haploidy. When two germ cells (*e.g.,* egg and sperm) unite, the diploid condition is restored.

Polyploidy refers to cells the nuclei of which have three or more times the number of chromosomes found in haploid cells. This condition frequently occurs in plants and may result from chromosome duplication without division of the cytoplasm or from the union of two diploid gametes. Polyploid animals, because they have more than the normal number of sex chromosomes, are usually sterile.

Some cells have an abnormal number of chromosomes that is not a whole multiple of the haploid number. This condition, called aneuploidy, is most often caused by some error resulting in an unequal distribution of chromosomes to the daughter cells. Organisms in which aneuploidy occurs may deviate noticeably from the norm in appearance and behaviour.

Ploieşti, also spelled PLOEŞTI, city, capital of Prahova *judeţ* (district), southeastern Romania. It is situated between the valleys of the Prahova and Teleajen rivers, north of Bucharest. According to legend the city was named after its founder, Father Ploaie, an escapee from Transylvania. The city is first documented in the 16th century as a military camp for the army of Michael the Brave (Mihai Viteazul), but not until the mid-19th century did Ploieşti begin to develop rapidly. In 1856 one of the first oil refineries in the world was opened near Ploieşti, and the city's growth since that time has been directly related to that of the expanding Romanian petroleum industry. Ploieşti is the country's primary petroleum centre, having refineries, storage tanks, oil-field equipment works, and a distillery. While under German occupation during World War II, it was the target of repeated massive bombing raids. At Brazi, south of the city, is a giant petrochemical complex. Also in Ploieşti are textile and food-processing factories. Also a cultural centre, the city has six museums, including the Oil Museum, which traces the development of the Romanian petroleum industry. Pop. (1982 est.) 211,657.

Plomer, William (Charles Franklyn) (b. Dec. 10, 1903, Transvaal, S.Af.—d. Sept. 21, 1973, Lewes, East Sussex, Eng.), South African-born British man of letters, whose writing covered many genres: poetry, novels,

Plomer
Camera Press—Pictorial Parade/EB Inc.

short stories, memoirs, and even opera librettos.

Plomer was educated in England but returned with his family to South Africa after World War I. His experience as an apprentice on a remote farm in the eastern Cape when he was 17 alerted him to the literary possibilities of the South African landscape and established the sensibility of his early works. His first novel, *Turbott Wolfe* (1925), caused a scandal because it touched upon miscegenation and dared to criticize the supposed benevolence of whites toward blacks, even casting some white characters in the role of villains. *I Speak of Africa* (1927), a collection of short stories, exacerbated his reputation. In collaboration with Laurens Van Der Post and the iconoclastic poet Roy Campbell, he founded a magazine called *Voorslag* ("Whiplash") with which he intended to excoriate South African racist society. Public outrage silenced the journal, and Plomer and Campbell left the country.

Plomer travelled in Japan and Europe before returning to England, where to all intents he became a British man of letters, though some of his work continued to draw upon his travels. In England he wrote two dramatic novels about London, *The Case Is Altered* (1932) and *The Invaders* (1934). Additional publications included a semifictional memoir, *Museum Pieces* (1952), and three volumes of family and personal memoirs, *Double Lives* (1943), *At Home* (1958), and *Autobiography of William Plomer* (1975). Between 1938 and 1940 he edited three volumes of the diaries of the Victorian clergyman Francis Kilvert. His association with the British composer Benjamin Britten began with the opera *Gloriana* (1953) and continued with librettos for the cantatas *Curlew River* (1964), *The Burning Fiery Furnace* (1966), and *Prodigal Son* (1968). One of his major achievements was *Collected Poems* (1960).

His assimilation into English society is indicated by his service in Naval Intelligence during World War II and his years as senior editor with the publishing house Jonathan Cape. In 1968 he was made Commander of the Order of the British Empire.

plosive (phonetics): *see* stop.

plot, in fiction, the structure of interrelated actions, consciously selected and arranged by the author. Plot involves a considerably higher level of narrative organization than normally occurs in a story or fable. According to E.M. Forster in *Aspects of the Novel* (1927), a story is a "narrative of events arranged in their time-sequence," whereas a plot organizes the events according to a "sense of causality."

In the history of literary criticism, plot has undergone a variety of interpretations. In the *Poetics,* Aristotle assigned primary importance to plot (*mythos*) and considered it the very "soul" of a tragedy. Later critics tended to reduce plot to a more mechanical function, until, in the Romantic era, the term was theoretically degraded to an outline on which the content of fiction was hung. Such outlines were popularly thought to exist apart from any particular work and to be reusable and interchangeable. They might be endowed with life by a particular author through his development of character, dialogue, or some other element. The publication of books of "basic plots" brought plot to its lowest esteem.

In the 20th century there have been many attempts to redefine plot as movement, and some critics have even reverted to the position of Aristotle in giving it primary importance in fiction. These neo-Aristotelians (or Chicago school of critics), following the leadership of the critic Ronald S. Crane, have described plot as the author's control of the reader's emotional responses—his arousal of the reader's interest and anxiety and the careful control of that anxiety over a duration of time. This approach is only one of many attempts to restore plot to its former place of priority in fiction.

Plotina, Pompeia (d. *c.* AD 122), wife of the Roman emperor Trajan. She earned great respect in her lifetime by her virtue and her advocation of the people's interests. During the ceremony of Trajan's accession, she is supposed to have turned around as she climbed the palace steps and addressed the crowd, saying that she desired always to be the same as she was then. One of her accomplishments was to curb the excesses of the procurators, the state's revenue agents.

Plotina was childless. She induced Trajan to adopt Hadrian, with whom she was on close terms. Plotina survived Trajan, and, upon her death, the emperor Hadrian had temples erected in her honour at Rome and at Nemausus (Nîmes) in Gaul.

Plotinus (b. AD 205, Lyco, or Lycopolis, Egypt?—d. 270, Campania), ancient philosopher, the centre of an influential circle of intellectuals and men of letters in 3rd-century Rome, who is regarded by modern scholars as the founder of the Neoplatonic school of philosophy.

Origins and education. The only important source for the life of Plotinus is the biography that his disciple and editor Porphyry wrote as a preface to his edition of the writings of his master, the *Enneads.* Other ancient sources add almost no reliable information to what Porphyry relates. This must be mentioned because, though Porphyry's "Life of Plotinus" is the best source available for the life of any ancient philosopher, it has some important deficiencies that must necessarily be reflected in any modern account of the life of Plotinus that does not use a great deal of creative imagination to fill in the gaps. The "Life" is the work of an honest, accurate, hero-worshipping, and serious-minded friend and admirer. Apart from a few fascinating scraps of information about the earlier parts of the life of Plotinus, Porphyry concentrates on the last six years, when he was with his master in Rome. Thus, a fairly complete picture is available only of the last six years of a man who died at the age of 65. It is the elderly Plotinus, as it is the elderly Socrates, who alone is known. Plotinus' own writings contain no autobiographical information, and they can give no unintentional glimpses of his mind or character when he was young; they were all written in the last 15 years of his life. Nothing is known about his intellectual and spiritual development.

Plotinus was born in AD 205. Porphyry states that he never spoke about his parents, his race, or his country. Eunapius, a late 4th-century writer, and later authors wrote that his birthplace was Lyco, or Lycopolis, in Egypt, either the modern Asyūt in Upper Egypt or a small town in the Nile Delta. Though this may be true, there is no real evidence in the "Life" or in his own writings to suggest that Plotinus had any special knowledge of or affinity with Egypt; the fact that he later studied philosophy in the great cosmopolitan city of Alexandria is not necessarily evidence that he was an Egyptian. His name is Latin in form, but, in the 3rd century AD, this gives no clue to his ethnic origins. All that can be said with reasonable certainty is that Greek was his normal language and that he had a Greek education. For all his originality, he remains Hellenic in his way of thinking and in his intellectual and religious loyalties.

In his 28th year—he seems to have been rather a late developer—Plotinus felt an impulse to study philosophy and thus went to Alexandria. He attended the lectures of the most eminent professors in Alexandria at the time, which reduced him to a state of complete depression. In the end, a friend who understood what he wanted took him to hear the self-taught philosopher Ammonius "Saccas." When he had heard Ammonius speak, Plotinus said, "This is the man I was looking for," and stayed with him for 11 years.

Ammonius is the most mysterious figure in the history of ancient philosophy. He was, it seems, a lapsed Christian (yet even this is not quite certain), and the one or two extant remarks about his thought suggest a fairly commonplace sort of traditional Platonism. A man who could attract such devotion from Plotinus and who may also have been the philosophical master of the great Christian theologian Origen, must have had something more to offer his pupils, but what it was is not known. That Plotinus stayed with him for 11 years is in no way surprising. One did not enter an ancient philosophical school to take courses and obtain a degree, but rather to join in what might well be a lifelong cooperative following of the way to truth, goodness, and the ultimate liberation of the spirit.

Expedition to the East. At the end of his time with Ammonius, Plotinus joined the expedition of the Roman emperor Gordian III against Persia (242–243), with the intention of trying to learn something at first hand about the philosophies of the Persians and Indians. The expedition came to a disastrous end in Mesopotamia, however, when Gordian was murdered by the soldiers and Philip the Arabian was proclaimed emperor. Plotinus escaped with difficulty and made his way back to Antioch. From there he went to Rome, where he settled at the age of 40. That a Greek philosopher, especially at this period, should be interested in Oriental thought is not extraordinary. Plotinus' own thought shows some striking similarities to Indian religious philosophy, but he never actually made contact with Eastern sages because of the failure of the expedition. Though direct or indirect contact with Indians educated in their own religious-philosophical traditions may not have been impossible in 3rd-century Alexandria, the resemblances of the philosophy of Plotinus to Indian thought were more likely a natural development of the Greek tradition that he inherited. That Plotinus was able to join the expedition of the senatorial emperor Gordian, that he went to Rome (an unusual place for a philosopher to settle), and that Porphyry found him, 19 years later, at the centre of a circle of friends and disciples—many of whom were members of the senatorial aristocracy—has been interpreted (probably erroneously) as meaning that he or his family had strong personal connections with Roman senators.

Life in Rome. Whatever may have been the circumstances of Plotinus when he first came to Rome, by the time Porphyry made his acquaintance in AD 263 he was living in dignified and comfortable conditions, though maintaining a considerable degree of personal austerity. His reputation in society was excellent and earned by practical activity as well as by teaching. He acted as an arbitrator in disputes, without ever being known to make an enemy, and many of his aristocratic friends, when they were approaching death, appointed him guardian of their children. "His house," Porphyry says, "was full of young lads and maidens," and he most conscientiously fulfilled his obligations under Roman law as their guardian, taking care of their education and their property. Like other great contemplatives, he had plenty of time for other people and could attend to their worries (sometimes quite trivial) without losing his inward concentration. He heard a boy's lessons, found who had stolen a lady friend's necklace, or noticed that Porphyry was in a state of depression and contemplating suicide and so sent him away for a change of scenery and companionship. "Present at once to himself and others" and "gentle and at the disposal of all who had any sort of acquaintance with him" are ways in which Porphyry described him. He was, it seems, a man who gave the impression of being in touch with the eternal without losing awareness of the earthly needs of his many friends.

His circle of friends was cosmopolitan, including men from the eastern half of the empire as well as Roman senators, their wives, and widows. Among those who venerated Plotinus, according to Porphyry, were the emperor Gallienus (reigned 253–268) and his wife Salonina, and this led Plotinus on one occasion to attempt practical activity on a larger scale. He asked the emperor to restore a ruined city in Campania and endow it with the surrounding land; the restored city was to be called Platonopolis, and its citizens were to live according to the laws and customs of Plato's ideal states. Plotinus promised that he would go and live there himself with his friends. That a philosopher who shows in his writings such a total lack of interest in the political side of Plato's thought and who preached withdrawal from public life should have made such a proposal is interesting. He may well have thought it his duty as a Platonic philosopher to attempt the foundation of a Platonic city, if opportunity offered—however personally disinclined he might have been to such activity. The emperor refused his request, and in the political circumstances of the time there was no chance of its being granted. Gallienus and the Senate were not on good terms. He had excluded members of the senatorial order from all military commands, and they took their revenge by successfully blackening his memory after his death. However much he might have respected Plotinus personally, the emperor would inevitably have regarded Platonopolis as a most undesirable senatorial strongpoint and a centre of intrigue against his authority.

Plotinus' teachings and writings. The main activity of Plotinus, to which he devoted most of his time and energy, was his teaching and, after his first 10 years in Rome, his writing. There was nothing academic or highly organized about his "school," though his method of teaching was rather scholastic. He would have passages read from commentaries on Plato or Aristotle by earlier philosophers and then expound his own views. The meetings, however, were friendly and informal, and Plotinus encouraged unlimited discussion. Difficulties, once raised, had to be discussed until they were solved. The school was a loose circle of friends and admirers with no corporate organization. It was for these friends that he wrote the treatises that Porphyry collected and arranged as the *Enneads.* Some, it seems from their complexity, were destined for an inner circle of his closest friends and philosophical collaborators, such as Porphyry, Amelius Gentilianus from Tuscany (the senior member of the school), and Eustochius, who was Plotinus' physician and who may have produced another edition of his works, now lost.

Some stories in the "Life," and some passages in the *Enneads,* give an idea of Plotinus' attitude to the religions and superstitions of his intensely religious and superstitious age, an attitude that seems to have been unusually detached. Like all men of his time, he believed in magic and in the possibility of foretelling the future by the stars, though he attacked the more bizarre and immoral beliefs of the astrologers. His interest in the occult was philosophical rather than practical, and there is no definite evidence that he practiced magic. A person called Olympius is reported to have once tried to use magic against Plotinus, but he supposedly found that the malignant forces he had evoked were bouncing back from Plotinus to himself. Plotinus was once taken to the Temple of Isis for a conjuration of his guardian spirit; a god, Porphyry stated, appeared instead of an ordinary guardian angel but could not be questioned because of a mishandling of the conjuring process which broke the spell. What Plotinus himself thought of the proceedings is not known, but apparently he was not deeply interested.

His attitude toward the traditional pagan cults was one of respectful indifference. Amelius, his closest friend and coworker in philosophy, was a pious man, addicted to attendance at sacrifices. Plotinus refused to join him in his devotions but seems to have thought none the worse of him. Despite his rather aggressive piety, Amelius remained Plotinus' friend and collaborator. Some members of his circle of friends were Gnostics (heretical Christian dualists who emphasized esoteric salvatory knowledge), and they provoked him not only to write a vigorous attack on their beliefs but to organize a polemic campaign against them through the activities of Porphyry and Amelius. Plotinus' reasons for detesting Gnosticism also would have applied, to some extent, to orthodox Christianity—though there is no evidence that he knew anything about it or that he had any contact with the church in Rome. Gnosticism appeared to him to be a barbarous, melodramatic, irrational, immoral, un-Greek, and insanely arrogant superstition. Plotinus' own religion, which he practiced and taught with calm intensity, was the quest for mystical union with the Good through the exercise of pure intelligence.

Last years. In his last years Plotinus, whose health had never been very good, suffered from a painful and repulsive sickness that Porphyry describes so imprecisely that one modern scholar has identified it as tuberculosis and another as a form of leprosy. This made his friends, as he noticed, avoid his company, and he retired to a country estate belonging to one of them in Campania and within a year died there (270). The circle of friends had already broken up. Plotinus himself had sent Porphyry away to Sicily to recover from his depression. Amelius was in Syria. Only his physician Eustochius arrived in time to be with Plotinus at the end. His last words were either "Try to bring back the god in you to the divine in the All" or "I am trying to bring back the divine in us to the divine in the All." In either case, they express very simply the faith that he shared with all religious philosophers of late antiquity. (A.H.A.)

BIBLIOGRAPHY. The text of Porphyry's *Life of Plotinus* may be found prefixed to most of the editions of the *Enneads* of Plotinus. *Plotins Schriften,* vol. 5c, ed. and trans. by R. Harder (1958), is a critical edition of the Greek text with German translation and notes. A Greek text with English translation and short notes is in *Plotinus,* vol. 1, trans. by A.H. Armstrong (1966). An English translation is in *The Enneads,* trans. by Stephen MacKenna, 4th ed. rev. by B.S. Page, pp. 1–20 (1969). The best character study of Plotinus, and also an excellent introduction to his thought, is Pierre Hadot, *Plotin, ou la simplicité du regard* (1963). See also A.H. Armstrong in the *Cambridge History of Later Greek and Early Mediaeval Philosophy,* part 3, "Plotinus," ch. 12, "Life," and 13, "Teaching and Writing" (1967), with bibliography.

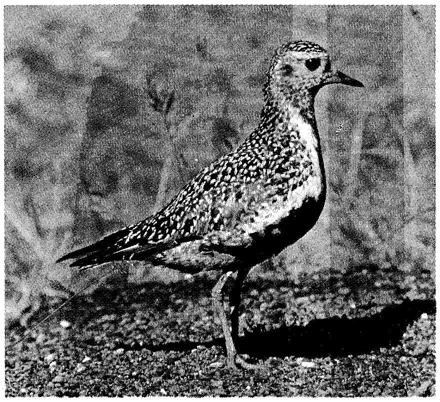
A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

Plovdiv, second largest city of Bulgaria, situated in the south-central part of the country. It lies along the Maritsa River and is situated amid six hills that rise from the Thracian Plain to a height of 400 feet (120 m). Called Pulpudeva in Thracian times, it was renamed Philippopolis in 341 BC after its conquest by Philip II of Macedonia. From AD 46 it was called Trimontium and was the capital of the Roman province of Thrace. Plovdiv repeatedly changed hands during the Middle Ages until 1364, when it was taken by the Turks, who called it Philibé. After the Russo-Turkish War (1877–78), it became capital of Turkish Eastern Rumelia, which united with Bulgaria in 1885. It officially assumed its present name after World War I.

In the old Trimontium quarter of the city, parts of the Roman walls remain. The medieval ruins of Tsar Ivan Asen II's fortress and Bachkovo monastery are nearby. Cultural institutions include a museum housing a collection of Thracian gold vessels.

The city, a junction on the Belgrade–Sofia–Istanbul rail line, is a food-processing centre with diversified industries, including the manufacture of nonferrous metals, machinery parts, textiles, carpets, and fertilizers. The city is the chief market of a fertile region that produces tobacco, rice, vegetables, and fruit. An international trade fair is held biennially. Pop. (1987 est.) city, 349,148.

plover, any of numerous species of plump-breasted birds of the shorebird family Charadriidae (order Charadriiformes). There are about three dozen species of plovers, 15 to 30 centimetres (6 to 12 inches) long, with



Golden plover (*Pluvialis apricaria*)
Kenneth W. Fink—Root Resources

long wings, moderately long legs, short necks, and straight bills that are shorter than their heads. Many species are plain brown, gray, or sandy above and whitish below. The group of so-called ringed plovers (certain *Charadrius* species) have white foreheads and one or two black bands ("rings") across the breast. Some plovers, like the golden (*Pluvialis* species) and black-bellied (*Squatarola squatarola*), are finely patterned dark and light above and black below in breeding dress. These two genera are sometimes included in *Charadrius.*

Many plovers feed by running along beaches and shorelines, snapping up small, aquatic, invertebrate animals for food. Others, like the killdeer (*q.v.*), of upland meadows and grasslands, are chiefly insectivorous. Plovers and their relatives are quick to give alarm. When flushed, they take swift and direct flight. Many utter melodious whistled calls, which can be used to distinguish the species. The nest is in a slight hollow in the ground where two to five (usually four) spotted eggs are laid. Both parents incubate and care for the downy young, which run about and accompany their parents soon after hatching.

Plovers are found in most parts of the world. Those nesting in the north are strongly migratory, and they travel and feed in flocks. Most notable as long-distance migrants are the golden plover of Eurasia (*Pluvialis apricaria*) and the American golden plover (*P. dominica*), which breed in the Arctic and winter in the Southern Hemisphere. The American golden plovers of the eastern range fly over the Atlantic and South America as far south as Patagonia, and most return via the Mississippi Valley; those in the western range travel, presumably nonstop, to groups of islands in the South Pacific. *See also* crab plover.

plow, also spelled PLOUGH, most important agricultural implement since the beginning of history, used to turn and break up soil, to bury crop residues, and to help control weeds.

The antecedent of the plow is the prehistoric digging stick. The earliest plows were doubtless digging sticks fashioned with handles for pulling or pushing. By Roman times, light, wheelless plows with iron shares (blades) were drawn by oxen; these implements could break up the topsoil of the Mediterranean regions but could not handle the heavier soils of northwestern Europe. The wheeled plow, at first drawn by oxen but later by horses, made possible the northward spread of European agriculture. The 18th-century addition of the moldboard, which turned the furrow slice cut by the plowshare, was an important advance. In the mid-19th century the black prairie soils of the American Midwest challenged the strength of the existing plow, and American mechanic John Deere invented the all-steel one-piece share and moldboard. The three-wheel sulky plow followed and, with the introduction of the gasoline engine, the tractor-drawn plow.

In its simplest form the moldboard plow consists of the share, the broad blade that cuts through the soil; the moldboard, for turning the furrow slice; and the landside, a plate on the opposite side from the moldboard that absorbs the side thrust of the turning action. Horse-drawn moldboard plows, still widely used, have a single bottom (share and moldboard), while tractor-drawn plows have from one to five hydraulically lifted and controlled bottoms staggered in tandem. Listers and middlebusters are double-moldboard plows that leave a furrow by throwing the dirt both ways.

Disk plows usually have three or more individually mounted concave disks that are inclined backward to achieve maximum depth. They are particularly adapted for use in hard, dry soils, shrubby or bushy land, or on rocky land. Disk tillers, also called harrow plows or one-way disk plows, usually consist of a gang of many disks mounted on one axle (*see* harrow). Used after grain harvest, they usually

A three-bottom, tractor-mounted moldboard plow
By courtesy of Overums Bruk

leave some stubble to help reduce wind erosion and often have seeding equipment. Two-way (reversible) plows have disks or moldboards that can be either opposed, so that one fills the trench made by the other, or set to throw the soil entirely to the right or left.

Rotary plows or tillers (sometimes called rototillers) have curved cutting knives mounted on a horizontal power-driven shaft. The pronged rotary hoe, a plow used chiefly for seedbed and weed control, works well at high speed. Garden sizes cut swaths from 1 to $2\frac{1}{2}$ feet (about $\frac{1}{3}$ to $\frac{4}{5}$ metre) wide; tractor types, up to 4 feet.

Deep tillage implements, used chiefly to break up hardpan and packed soils, include the subsoiler and the chisel plow. The subsoiler must be pulled by a heavy tractor, for its steel-pointed shank is capable of penetrating the subsoil to a depth of three feet. The chisel plow, or ripper, has several rigid or spring-toothed shanks with double pointed shovels mounted on a transverse bar at intervals of one to three feet. Plowing depths vary from a few inches to $1\frac{1}{2}$ feet.

Plowright, Joan (Anne) (b. Oct. 28, 1929, Scunthorpe, Lincolnshire, Eng.), English dramatic actress.

Plowright received her dramatic training at the Laban Art of Movement Studio in Manchester and at the Old Vic Theatre School in London. She made her first appearances on stage in 1951, played with an Old Vic touring company in South Africa in 1952, and made her debut in London in *The Duenna* in 1954. She continued to perform on the London stage until 1958, when she made her first appearance in New York City. Her dual performances in two plays by Eugene Ionesco as both an old woman and a 17-year-old girl demonstrated her range and versatility as an actress and brought her wide critical acclaim.

Plowright's most notable stage performances included those in *A Taste of Honey* (1960), *Saint Joan* (1963), and *Saturday, Sunday, Monday* (1973). She also performed in such motion pictures as *Moby Dick* (1956), *The Entertainer* (1960), *Three Sisters* (1974; the latter two with her husband, Sir Laurence Olivier), and *Equus* (1977), and on television.

Plücker, Julius (b. June 16, 1801, Elberfeld, Duchy of Berg—d. May 22, 1868, Bonn), German mathematician and physicist whose work suggested the far-reaching principle of duality, which states the equivalence of certain related types of theorems. He also discovered that cathode rays (electron rays produced in a vacuum) are diverted from their path by a magnetic field. This effect is a principle vital to the development of modern electronic devices, such as television.

Plücker attended the universities of Heidelberg, Berlin, and Paris. In 1829, after four years as an unsalaried lecturer, he became extraordinary professor at the University of Bonn. From his lectures came his first great work, *Analytisch-geometrische Entwicklungen,* 2 vol. (1828–31; "The Development of Analytic Geometry"), in which he introduced the abridged notation in analytic geometry.

In 1829 Plücker proposed a revolutionary idea in analytic geometry: that the fundamental geometric element need not be the point but could be the straight line. Through this idea he developed the principle of duality. In 1834 Plücker became professor of mathematics at the University of Halle and two years later professor of mathematics at the University of Bonn. *Theorie der algebraischen Curven* (1839; "Theory of Algebraic Curves"), his greatest work, contains equations detailing the number of singularities (points at which there is no unique tangent line) on algebraic curves, and his *System der analytischen Geometrie* (1835; "System of Analytic Geometry") introduced the use of linear functions in place of the usual coordinate points. Plücker's *System der Geometrie des Raumes in neuer analytischer Behandlungsweise* (1846; "System of the Geometry of Space in a New Analytical Treatment") contains a more systematic and polished rendering of his earlier results.

After his appointment as professor of physics at Bonn in 1847, Plücker began research on the behaviour of crystals in a magnetic field and then studied the properties of magnetic bodies, establishing results integral to knowledge of magnetism. He discovered and investigated the magnetic deflection of cathode rays and thus stimulated research in electronics and atomic physics.

At first alone and later with the German physicist Johann W. Hittorf, Plücker made many important discoveries in spectroscopy. He anticipated Robert Bunsen and Gustav R. Kirchhoff, both of Germany, in announcing that spectral lines were characteristic for each chemical substance and in indicating the value of this discovery to chemical analysis. According to Hittorf, Plücker was the first who saw the three lines of the hydrogen spectrum that a few months after his death were recognized in the spectrum of the solar prominences, thus solving a mystery of modern astronomy. In 1862 he pointed out that the same element may exhibit different spectra at different temperatures.

In 1865 he returned to the study of mathematics and later published his work on modern pure geometry of space, *Neue Geometrie* *des Raumes gegründet auf die Betrachtung der geraden Linie als Raumelement* (1868–69; "New Geometry of Space Founded on the Treatment of the Straight Line as Space Element").

plum, fruit of the genus *Prunus* of the rose family (Rosaceae). Like the peach and cherry, it is a stone, or drupe, fruit. Trees of some plum species reach a height from 6 to 10

Plum (*Prunus*)
Grant Heilman—EB Inc.

metres (20 to 33 feet), while others are much smaller; some species are small shrubs with drooping branches. The flower buds on most varieties are borne on short spurs or along the terminal shoots of the main branches. Each bud may contain from one to five flowers, two or three being most common; where the buds are close together, they give an appearance of densely packed, showy flower clusters when the trees are in full bloom. The individual flower is made up of a receptacle forming a hollow cup bearing sepals, petals, and stamens on the outer rim, surrounding a single pistil attached at the bottom of the cup. After fertilization the receptacle and attachments fall off, and the style withers and drops off, leaving the enlarged basal portion of the pistil, the ovary, which develops into the fruit.

As the fruit grows, the outer part of the ovary ripens into a fleshy, juicy exterior, making up the edible part of the fruit, and a hard interior, called the stone, or pit. The seed is enclosed within the stone. The fruits show a wide range of size, flavour, colour, and texture.

The common European plum (*Prunus domestica*) probably originated in the region around the Caucasus and the Caspian Sea. According to the earliest writings in which the plum is mentioned, the species is at least 2,000 years old. Another Old World plum species, probably of European or Asiatic origin, is the Damson plum (*Prunus institia*). Ancient writings connect early cultivation of these plums with the region around Damascus. It is not known when European plums were introduced into North America, but pits were probably brought over by the first colonists.

In the United States and Europe the plum has long been recognized as one of the most delicious fruits. It is widely eaten fresh as a dessert fruit, cooked as compote or jam, or baked in a variety of pastries. Among the stone fruits, the plum ranks next to the peach in commercial production. Many varieties cultivated in the United States have been introduced from elsewhere; when these are added to the native varieties, they give plums the largest number of kinds and species among the stone fruits. Different varieties are adapted to a wide range of soils and climatic conditions. Plums respond to good soil-management practices. As trees come into bearing, they do not require much pruning and in the home fruit garden can be grown satisfactorily if diseases and pests are controlled.

Plums are the most widely distributed of the stone fruits. The fruit is grown over a wide region in Europe, from Italy on the south to Norway and Sweden on the north. The Soviet Union is the leading European producer of plums, followed by Yugoslavia and Romania. A popular distilled liquor called *šljivovica* made from plums is an important article of commerce in Yugoslavia. Germany is the next-largest producer of plums in Europe, with a tree potential that in some years has equalled that of the United States in production. Turkey and China are leading countries in plum production in Asia.

Plum varieties that can be or have been dried without resulting in fermentation are called prunes. Such plums have firm flesh and contain a sufficiently high level of sugar, qualities that favour their being preserved by drying, which is done in dehydrators or in the sun. Dried prunes keep far longer than do fresh plums.

plum curculio, also called AMERICAN PLUM WEEVIL (*Conotrachelus nenuphar*), North American insect pest of the family Curculionidae (order Coleoptera); it does serious damage to a variety of fruit trees. The adult has a dark brown body, about six millimetres (¼ inch) long, with gray and white patches and conspicuous humps on each wing case. It has the typical weevil's snout, strongly down-curved for puncturing the skin of young fruit (apple, plum, peach, or cherry) so that an egg can be deposited in each wound. An average of less than 100 eggs are produced by each female. After hatching, the legless larva burrows into the centre of the fruit, spoiling it. The larva then leaves the fruit and enters the soil, where it pupates and eventually emerges as an adult. Up to two generations occur annually. Both sexes of the adult plum curculio pass the winter in hibernation.

plum-yew (*Cephalotaxus* species), any of about seven species of small coniferous trees and shrubs in the genus *Cephalotaxus,*

Plum-yew (*Cephalotaxus drupacea*)
Joan E. Rahn—EB Inc.

comprising the plum-yew family (Cephalotaxaceae). Native to central and eastern Asia, these plants are used in many temperate-zone areas as ornamentals. The small, fleshy, plumlike fruit contains a single, hard seed. The Japanese plum-yew, or cow's tail pine (*C. harringtonia*), grows only in cultivation; it may reach 3 metres (about 10 feet). The Chinese plum-yew (*C. fortuni*) grows to 12 m (40 ft) in the wild and up to 6 m (20 ft) under cultivation.

plumage, collective feathered covering of a bird. It provides protection, insulation, and adornment and also helps streamline and soften body contours, reducing friction in air and water. Plumage of the newborn chick is downy, called neossoptile; that which follows is termed teleoptile. Juvenal plumage, frequently distinct from that of the adult bird, is often drab, streaked, or spotted and thus camouflages the young.

Sexual differences are common, the plumage of the male usually showing more brilliance and pattern than that of the female. Feathers are normally lost and replaced at least once a year through molt and regrowth. Eclipse plumage, typical of ducks but found in other birds as well, is dull, female-like plumage worn by the male for a month or more in summer after breeding. It "eclipses" his usual bright plumage. He soon molts and is flightless until he grows new wing feathers. *Compare* pelage.

Plumbaginales, the plumbago, or leadwort, order of dicotyledonous flowering plants comprising the family Plumbaginaceae, with 10 genera of herbs and shrubs, found throughout the world but especially in semi-arid salt steppes and seacoasts of Europe, Asia, Africa, and Australia. The plants are characterized by alternating, simple leaves that often bear glands on the surface and by radially symmetrical, bisexual flowers, the petals of which are fused into a tube, and the sepals of which remain attached to the fruit until maturity.

Thrift (*Armeria*)
Kenneth W. Fink from Root Resources—EB Inc.

The male flower parts (stamens) number five and arise from the inner surface of the corolla (fused petal tube) opposite the petal lobes. The female structure (pistil) is superior, *i.e.,* positioned above the other flower parts, and is composed of five carpels (structural segments), which enclose one chamber containing a single ovule. The upper part of the pistil consists of five more or less united styles topped by their stigmas, the pollen-receptive surfaces. The largest genera include *Limonium* (300 species), *Acantholimon* (150 species), *Armeria* (80 species), *Plumbago* (12 species), *Limoniastrum* (10 species), and *Ceratostigma* (8

Plumbago capensis
L.J. Uttal

species). The remaining four genera (*Dyerophytum, Aegialitis, Plumbagella,* and *Limoniopsis*) contain only one or two species each.

Economically the group is important mainly for the many garden ornamentals it contains. Among these are a number of species of *Armeria* that go by the common name thrift, especially *A. maritima,* also called sea pink, a plant with small red flowers that is common on sea cliffs and in high mountains in western Europe. Sea lavender (*Limonium vulgare*), with small flowers in dense spikes, grows in large tracts that sometimes turn acres of ground lilac-coloured during the late summer blooming season. The flower spikes of *L. vulgare* and other *Limonium* species, also known as sea lavender, are often used in dry-flower arrangements for their lasting qualities and permanent colours. Prickly thrifts (species of *Acantholimon*, especially *A. glumaceum*) are favourite rock-garden plants. The sap of leadwort (*Plumbago europea*) is irritating and caustic, as are the juices of other *Plumbago* species, for example, *P. indica* (or *P. rosea*) and *P. scandens,* which are grown in the cool greenhouse for their rose and white or blue flowers, respectively. The leaves and roots of *P. zeylanica* have been used as a remedy for skin disease, especially in the tropical Far East. The active principle extracted from *Plumbago* roots, used in several medicinal drugs, is a yellow pigment called plumbagin.

plumbago (mineral): *see* graphite.

plumbing, system of pipes and fixtures installed in a building for the distribution and use of potable (drinkable) water and the removal of waterborne wastes. It is usually distinguished from water and sewage systems that serve a group of buildings or a city.

One of the problems of every civilization in which the population has been centralized in cities and towns has been the development of adequate plumbing systems. In certain parts of Europe the complex aqueducts built by the Romans to supply their cities with potable water can still be seen. However, the early systems built for the disposal of human wastes were less elaborate. Human wastes were often transported from the cities in carts or buckets or else discharged into an open, water-filled system of ditches that led from the city to a lake or stream.

Improvement in plumbing systems was very slow. Virtually no progress was made from the time of the Romans until the 19th century. The relatively primitive sanitation facilities were inadequate for the large, crowded population centres that sprang up during the Industrial Revolution, and outbreaks of typhoid fever and dysentery were often spread by the consumption of water contaminated with human wastes. Eventually these epidemics were curbed by the development of separate, underground water and sewage systems, which eliminated open sewage ditches. In addition, plumbing fixtures were designed to handle potable water and water-borne wastes within buildings.

The term plumbing fixture embraces not only showers, bathtubs, lavatory basins, and toilets but also such devices as washing machines, garbage-disposal units, hot-water heaters, dishwashers, and drinking fountains.

The water-carrying pipes and other materials used in a plumbing system must be strong, noncorrosive, and durable enough to equal or exceed the expected life of the building in which they are installed. Toilets, urinals, and lavatories usually are made of stable porcelain or vitreous china, although they sometimes are made of glazed cast iron, steel, or stainless steel. Ordinary water pipes usually are made of steel, copper, brass, plastic, or other nontoxic material; and the most common materials for sewage pipes are cast iron, steel, copper, and asbestos cement.

Methods of water distribution vary. For towns and cities, municipally or privately owned water companies treat and purify water collected from wells, lakes, rivers, and ponds and distribute it to individual buildings. In rural areas water is commonly obtained directly from individual wells.

In most cities, water is forced through the distribution system by pumps, although, in rare instances, when the source of water is located in mountains or hills above a city, the pressure generated by gravity is sufficient to distribute water throughout the system. In other cases, water is pumped from the collection and purification facilities into elevated storage tanks and then allowed to flow throughout the system by gravity. But in most municipalities water is pumped directly through the system; elevated storage tanks may also be provided to serve as pressure-stabilization devices and as an auxiliary source in the event of pump failure or of a catastrophe, such as fire, that might require more water than the pumps or the water source are able to supply.

The pressure developed in the water-supply system and the friction generated by the water moving through the pipes are the two factors that limit both the height to which water can be distributed and the maximum flow rate available at any point in the system.

A building's system for waste disposal has two parts: the drainage system and the venting system. The drainage portion comprises pipes leading from various fixture drains to the central main, which is connected to the municipal or private sewage system. The venting system consists of pipes leading from an air inlet (usually on the building's roof) to various points within the drainage system; it protects the sanitary traps from siphoning or blowing by equalizing the pressure inside and outside the drainage system.

Sanitary fixture traps provide a water seal between the sewer pipes and the rooms in which plumbing fixtures are installed. The most commonly used sanitary trap is a U bend, or dip, installed in the drainpipe adjacent to the outlet of each fixture. A portion of the waste water discharged by the fixture is retained in the U, forming a seal that separates the fixture from the open drainpipes.

plumbism: *see* lead poisoning.

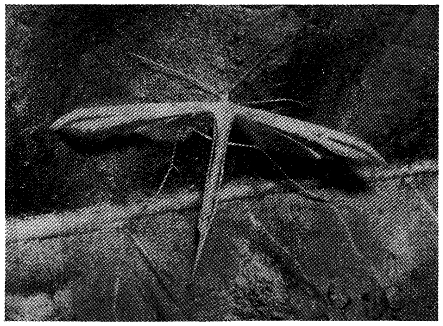
plumbojarosite, a widespread iron and lead sulfate mineral, $PbFe_6(SO_4)_4(OH)_{12}$, that has been found in the oxidized zone of lead deposits, particularly in arid regions. It is an important ore mineral of lead in Bolkar Daği, Tur., and in Clark County, Nev. It also occurs in many places in the western United States. For detailed physical properties, *see* sulfate mineral (table).

Consult the INDEX *first*

plume grass, any of about 20 species of grasses constituting the genus *Erianthus* (family Poaceae), native to warm regions of the Northern and Southern hemispheres. Plume grasses are tall, reedlike perennials with dense, cylindrical, plumelike panicles. Most species are 1 to 3 m (3 to 10 feet) tall, but Ravenna grass (*E. ravennae*), native to southern Europe, grows to 4 m (13 feet). It is cultivated as an ornamental for its long (0.6 m [2 feet]) panicle.

plume moss: *see* feather moss.

plume moth, any of the approximately 600 species of the cosmopolitan insect family Pterophoridae (order Lepidoptera), named for the deep wing divisions that resemble plumes or lobes. It differs from the many-plumed moth, an Orneodidae-family member, in that its forewings and hindwings are not split down to their base into six plumes but are divided only to their middle, the forewings usually into two plumes, the hindwings into three. Plume moths have slender bodies with long, fragile legs. The moths vary in wingspan from 6 to 50 mm (0.25 to 2 inches) and are weak fliers. Active at night, they usually rest in plants during the day, stretching their wings



Plume moth (*Platyptilia ochrodactyla*)
G.E. Hyde—EB Inc.

out and rolling them into the shape of a rod, rather than folding them back. Larval habits range from rolling leaves to boring in stems.

plumebird, any of several bird-of-paradise species. *See* bird-of-paradise.

Plummer, Christopher, byname of ARTHUR CHRISTOPHER ORME PLUMMER (b. Dec. 13, 1929, Toronto), Canadian actor known for his interpretations of classical roles on the stage as well as his starring and supporting roles in motion pictures.

Plummer made his first professional appearance in 1950 in Ottawa and spent several years performing with Canadian repertory theatre groups. In 1954 he made his New York City debut and soon attracted wide critical praise. He joined the American Shakespeare Festival Company in Stratford, Conn., in 1955—quickly establishing a reputation as a leading Shakespearean actor and performing in repertory in Canada and England as well as the United States. His nonclassical roles included those in such plays as *The Dark is Light Enough* (1955), *The Lark* (1955), *Arturo Ui* (1963), *The Royal Hunt of the Sun* (1965), and *The Good Doctor* (1973). In 1981 he returned to Shakespeare to play Iago, opposite the Othello of James Earl Jones.

Plummer's first motion picture was *Stage Struck* (1956), and later notable film performances were in *The Sound of Music* (1965), *The Battle of Britain* (1968), *The Man Who Would Be King* (1975), *The Silent Partner* (1978), *Murder by Decree* (1980), and *Eyewitness* (1981).

Plummer's disease, also called TOXIC MULTINODULAR GOITRE, thyroid condition characterized by marked enlargement of the thyroid gland (goitre), firm thyroid nodules, and mild overproduction of thyroid hormone (hyperthyroidism). Plummer's disease, which usually occurs in older people, is of unknown etiology. Its symptoms resemble those of Graves' disease (*q.v.*), a condition believed to be an autoimmune disorder caused by antibodies to the thyroid.

Typically, persons affected by Plummer's disease develop a goitre many years before the onset of symptoms of hyperthyroidism; most patients are over age 50 before the characteristic accelerated heart rate and other cardiac conditions appear. Unlike other forms of hyperthyroidism, the disease seldom causes bulging of the eyes (exophthalmos). Swelling of the thyroid gland may obstruct breathing or swallowing, requiring surgery to remove the excess tissue; the cardiac symptoms, resulting in congestive heart failure in some cases, can also be fatal. In the absence of obstruction or cosmetic reasons for removing the gland, the goitre may be treated with drugs that block thyroid activity or with radioactive iodine therapy; however, the multiple thyroid nodules characteristic of the disease may raise suspicion of cancer, necessitating surgical excision of the gland.

Plumtree, town, Matabeleland North Province, southwestern Zimbabwe. At the Botswana border, it is the last major Zimbabwean station on the Bulawayo–Cape Town railway and has customs, immigration, and quarantine facilities. Founded in 1897, it serves the Bulalima-Mangwe district as administrative centre. Local industries include grain milling and brickmaking. Pop. (latest census) 2,040.

Plunket, Saint Oliver, Plunket also spelled PLUNKETT (b. 1629, Loughcrew, County Meath, Ire.—d. July 1, 1681, London; canonized 1975; feast day July 11), Roman Catholic primate of all Ireland and the last man to

St. Oliver Plunket, engraving by R. Collin, 1681

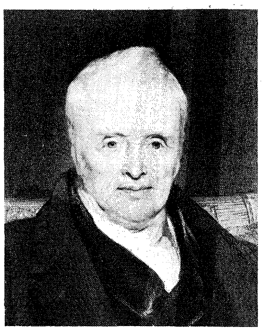
By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

suffer martyrdom for the Catholic faith in England.

Plunket was educated and ordained in Rome, serving there as professor of theology at the College of Propaganda Fide and as the representative of the Irish bishops at the Holy See. Appointed archbishop of Armagh and primate of all Ireland in 1669, he arrived in the following year at a time when, after prolonged repression, the Catholic Church was greatly disorganized, with only one aged bishop at liberty. Setting himself to restore order and discipline in accordance with the precepts of the Council of Trent, Plunket kept on good terms with the English and the Protestants until in 1673 when, under renewed persecution, he was obliged to go into hiding. For the next five years he laboured under conditions of increasing difficulty, brought to a climax by the terror inspired by the Titus Oates plot of 1678. In the following year he was betrayed, arrested, and imprisoned in Dublin Castle. His trial at Dundalk was made absurd by the ignominious witnesses for the prosecution; he was taken to London, where, after protracted and farcical legal proceedings, he was sentenced to be hanged, disembowelled, and quartered; the sentence was carried out at Tyburn before a large crowd. Plunket was beatified by Benedict XV in 1920 and canonized by Pope Paul VI on Oct 12, 1975. His head is preserved at Drogheda and his body at Downside Abbey, near Bath.

Plunket (of Newton), William Conyngham Plunket, 1st Baron (b. July 1, 1764, Enniskillen, County Fermanagh, Ire.—d. Jan. 4, 1854, near Bray, County Wicklow), Anglo-Irish lawyer, parliamentary orator, successor to Henry Grattan (died 1820) as chief spokesman for Roman Catholic emancipation—*i.e.,* admission of Catholics to the British House of Commons, a goal that was achieved in 1829.

Called to the Irish bar in 1787, Plunket was highly successful as an equity lawyer. Entering the Irish Parliament in 1798, he found that the British prime minister, William Pitt the Younger, was planning an Anglo-Irish



1st Baron Plunket, engraving by David Lucas, 1844, after a painting by Richard Rothwell

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

legislative union that would abolish the Irish Parliament. During Grattan's temporary retirement from politics (1797–1800), Plunket was the most vehement opponent of Pitt's design, speaking often in the Irish legislature and writing articles for the newspaper *Anti-Union* (1798–99). On the passage of the Act of Union (Aug. 1, 1800), he returned to his law practice. In 1803 he acted for the crown in prosecuting the Irish nationalist Robert Emmet for his futile rising in Dublin. Emmet was executed, and later in the year Pitt appointed Plunket solicitor general of Ireland. Charged with disloyalty to the Irish cause by a writer in the *Weekly Register,* Plunket in 1804 recovered damages for libel from that periodical's editor, the English radical William Cobbett.

After serving as Irish attorney general (1805–07), Plunket sat in the British House of Commons (1807, 1812–27). Himself a Presbyterian minister's son, he unsuccessfully introduced bills (1821, 1825) for increased political rights for Catholics. He disliked popular agitation, however, and opposed the Irish leader Daniel O'Connell's Catholic Association. The Emancipation Act of 1829 was passed two years after Plunket had been created baron (1827). From 1830 to 1841 he was lord chancellor of Ireland, his term proving largely uneventful.

Plunkett, Edward John Moreton Drax: *see* Dunsany, Edward John Moreton Drax Plunkett, 18th Baron.

Plunkett, Sir Horace Curzon (b. Oct. 24, 1854, Sherborne, Gloucestershire, Eng.—d. March 26, 1932, Weybridge, Surrey), pioneer of Irish agricultural cooperation who strongly influenced the rise of the agricultural cooperative movement in Great Britain and the Commonwealth.

Educated in England, he went to the United States in 1879 and spent 10 years as a cattle rancher in Wyoming. He returned to Ireland in 1889 and devoted himself to the agricultural cooperative movement, first organizing creameries and then, in 1894, the Irish Agricultural Organization Society, a forerunner of similar societies in England, Wales, and Scotland. A Unionist member of Parliament for South County Dublin from 1892 to 1900, he became president in 1899 of the new Department of Agriculture and Technical Instruction for Ireland, which he had been instrumental in creating.

His later experience convinced him of the need for the independence of an Ireland without partition inside the Commonwealth, and he fought strongly for this goal, although from 1922 to 1923 he was a senator of the Irish Free State. In 1919, in London, he endowed a trust, now the Plunkett Foundation for Cooperative Studies, as a commonwealth agricultural research and information centre. He was made a fellow of the Royal Society in 1902 and Knight Commander of the Royal Victorian Order in 1903. His writings include *Ireland in the New Century* (1904) and *The Rural Life Problem of the United States* (1910).

pluralism, in social and political thought, the autonomy enjoyed by disparate groups within a society—such groups as religious groups, trade unions, professional organizations, or ethnic minorities.

The term also refers to the doctrine that the existence of such groups is beneficial, a major element in the ideologies of both the liberal Western nations and the Communist nations. Pluralism was stressed most vigorously in England during the early 20th century by a group of writers (including F. Maitland, S.G. Hobson, Harold Laski, R.H. Tawney, and G.D.H. Cole) reacting against what they alleged to be the alienation of the individual under conditions of unrestrained capitalism. It was necessary, they argued, to integrate the individual in a social context that would give him a sense of community; a historical example of such a society was held to be the medieval structure of guilds, chartered cities, villages, monasteries, and universities. Some of the negative aspects of modern industrial society might be overcome, the pluralists argued, by economic and administrative decentralization.

pluralism and monism, philosophical theories that answer "many" and "one," respectively, to the distinct questions: how many kinds of things are there? and how many things are there? Different answers to each question are compatible, and the possible combination of views provide a popular way of viewing the history of philosophy.

All philosophy as well as science may be regarded as a search for unity in the attempt to comprehend the diversity of things under general principles or laws. But some thinkers have been so attracted to unity that they have denied the multiplicity of things and asserted some form of monism. Thus, Parmenides in the ancient world held that all is being, since whatever is is; Spinoza at the beginning of modern philosophy asserted that there is but one infinite divine substance in which everything else has its finite being as a mode or affect; whereas for Hegel all that is is the Absolute Idea developing through time.

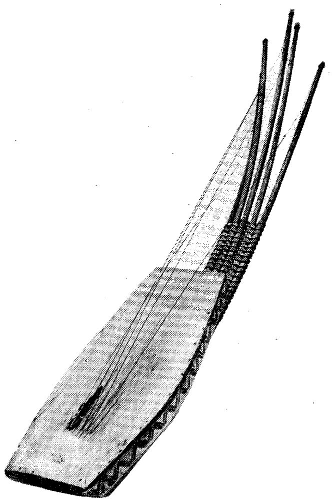
Opposed to such monistic theories are those philosophers for whom the multiplicity and diversity of things rather than their unity is the more striking and important fact. Thus William James, who titled one of his books *A Pluralistic Universe,* held that it is characteristic of empirically minded thinkers to note and take into account the changeability of things, their multiplicity in being as well as in their relations with one another, and the unfinished character of the world as in process. James asserted that the problem of the one and the many is "the most central of all philosophical problems" in that the answer given to it influences so greatly the approach to other problems and the answers given to them.

plurality system, electoral process in which the candidate who polls more votes than any other candidate is elected. It is distinguished from the majority system, in which, to win, a candidate must receive more votes than all other candidates combined. Election by a plurality is the most common method of selecting candidates for public office.

Advantages of the plurality system are that it is easily understood by voters, provides a quick decision, and is more convenient and less costly to operate than other methods. The main argument against it is that in an election with more than two candidates, it may result in the election of a candidate who has received only a minority of the votes cast: for example, in a closely contested election with four candidates, the total required to win by a plurality could be as little as 25 percent of the total vote plus one. To overcome this disadvantage, alternative devices, such as election by an absolute majority and proportional representation (*q.v.*), are used. The plurality method operates best under a two-party system.

Election by a plurality is not limited to government; it is commonly used in the selection of officers in such large organizations as trade unions and professional associations and also in arriving at decisions at meetings of boards of directors and trustees.

pluriarc, also called BOW LUTE, west African stringed musical instrument having a deep boxlike body from which project between two and eight slender, curved arms; one string runs from the end of each arm to a string holder on



West African *pluriarc;* in the Pitt-Rivers Museum, Oxford
By courtesy of the Pitt-Rivers Museum, Oxford

the belly. The strings are plucked, usually by the fingers, occasionally by plectra attached to the fingers. They are generally played open, as on a harp; in some regions they are stopped, as on a lute. The *pluriarc,* possibly derived from the musical bow, is known by various names among many peoples of the Congo and Gabon and a few of southern Africa; as the *kissanga* it was taken to Cuba by African slaves. As early as the 16th century it was described by the German composer Michael Praetorius.

Plutarch, Greek PLUTARCHOS, Latin PLUTARCHUS (b. *c.* AD 46, Chaeronea, Boeotia [Greece]—d. after 119), biographer and author whose works strongly influenced the evolution of the essay, the biography, and historical writing in Europe from the 16th to the 19th century. Among his approximately 227 works, the most important are the *Bioi parallēloi* (*Parallel Lives*), in which he recounts the noble deeds and characters of Greek and Roman soldiers, legislators, orators, and statesmen, and the *Moralia,* or *Ethica,* a series of more than 60 essays on ethical, religious, physical, political, and literary topics.

Life. Plutarch was the son of Aristobulus, himself a biographer and philosopher. In 66–67, Plutarch studied mathematics and philosophy at Athens under the philosopher Ammonius. Public duties later took him several times to Rome, where he lectured on philosophy, made many friends, and perhaps enjoyed the acquaintance of the emperors Trajan and Hadrian. According to the Suda lexicon (a Greek dictionary dating *c.* AD 1000), Trajan bestowed the high rank of an ex-consul upon him. Although this may be true, a report of a 4th-century church historian, Eusebius, that Hadrian made Plutarch governor of Greece is probably apocryphal. A Delphic inscription reveals that he possessed Roman citizenship; his *nomen,* or family name, Mestrius, was no doubt adopted from his friend Lucius Mestrius Florus, a Roman consul.

Plutarch traveled widely, visiting central Greece, Sparta, Corinth, Patrae (Patras), Sardis, and Alexandria, but he made his normal residence at Chaeronea, where he held the chief magistracy and other municipal posts and directed a school with a wide curriculum in which philosophy, especially ethics, occupied the central place. He maintained close links with the Academy at Athens (he possessed Athenian citizenship) and with Delphi, where, from about 95, he held a priesthood for life; he may have won Trajan's interest and support for the then-renewed vogue of the oracle. The size of Plutarch's family is uncertain. In the *Consolatio* to his wife, Timoxena, on the death of their infant daughter, he mentions four sons; of these at least two survived childhood, and he may have had other children.

Plutarch's literary output was immense. The 227 titles in the so-called catalog of Lamprias, a list of Plutarch's works supposedly made by his son, are not all authentic, but neither do they include all he wrote. The order of composition cannot be determined.

The Lives. Plutarch's popularity rests primarily on his *Parallel Lives.* These, dedicated to Trajan's friend Sosius Senecio, who is mentioned in the lives "Demosthenes," "Theseus," and "Dion," were designed to encourage mutual respect between Greeks and Romans. By exhibiting noble deeds and characters, they were also to provide model patterns of behaviour.

The first pair, "Epaminondas and Scipio," and perhaps an introduction and formal dedication, are lost. But Plutarch's plan was clearly to publish in successive books biographies of Greek and Roman heroes in pairs, chosen as far as possible for their similarity of character or career, and each followed by a formal comparison. Internal evidence suggests that the *Lives* were composed in Plutarch's later years, but the order of composition can be only partially determined; the present order is a later rearrangement based largely on the chronology of the Greek subjects, who are placed first in each pair. In all, 22 pairs survive (one pair being a double group of "Agis and Cleomenes" and the "Gracchi") and four single biographies, of Artaxerxes, Aratus, Galba, and Otho.

The *Lives* display impressive learning and research. Many sources are quoted, and, though Plutarch probably had not consulted all these at first hand, his investigations were clearly extensive, and compilation must have occupied many years. For the Roman *Lives* he was handicapped by an imperfect knowledge of Latin, which he had learned late in life, for, as he explains in "Demosthenes," political tasks and the teaching of philosophy fully engaged him during his stay in Rome and Italy. The form of the *Lives* represented a new achievement, not closely linked with either previous biography or Hellenistic history. The general scheme was to give the birth, youth and character, achievements, and circumstances of death, interspersed with frequent ethical reflections, but the details varied with both the subject and the available sources, which include anecdote mongers and writers of memoirs as well as historians. Plutarch never claimed to be writing history, which he distinguished from biography. His aim was to delight and edify the reader, and he did not conceal his own sympathies, which were especially evident in his warm admiration for the words and deeds of Spartan kings and generals; his virulent and unfair attack on Herodotus, the Greek historian of the 5th century BC, probably sprang from his feeling that he had done Athens more and Boeotia less than justice.

The Moralia. Plutarch's surviving writings on ethical, religious, physical, political, and literary topics are collectively known as the *Moralia,* or *Ethica,* and amount to more than 60 essays cast mainly in the form of dialogues or diatribes. The former vary from a collection of set speeches to informal conversation pieces set among members of Plutarch's family circle; the date and dramatic occasion are rarely indicated. The diatribes, which often show the influence of seriocomic writings of the 3rd-century-BC satirist Menippus, are simple and vigorous. The literary value of both is enhanced by the frequent quotation of Greek poems, especially verses of Euripides and other dramatists.

The treatises dealing with political issues are of especial interest. "Political Precepts" is an enlightening account of political life in contemporary Greece; in "Whether a Man Should Engage in Politics When Old," Plutarch urged his friend Euphanes to continue in public life at Athens; Stoic ideas appear in the short work "To the Unlearned Ruler" and the fragmentary argument that "The Philosopher Should Converse Especially with Princes."

Plutarch's interest in religious history and antiquarian problems can be seen in a group of striking essays, the early "Daemon of Socrates," and three later works concerning Delphi, "On the Failure of the Oracles," in which the decline of the oracle is linked with the decline in the population, "On the E at Delphi," interpreting the word EI at the temple entrance, and "On the Pythian Responses," seeking to reestablish belief in the oracle. Contemporary with these is "On Isis and Osiris," with its mystical tones. "Convivial Questions" (nine books) and "Greek and Roman Questions" assembled a vast collection of antiquarian lore.

Among the more important works no longer accepted as authentic are the *Consolatio* to Apollonius for his son, the "Lives of the Ten Orators," "On Fate," the "Short Sayings of Kings and Commanders," the "Short Sayings of Spartans," and "Proverbs of the Alexandrines."

Assessment. Plutarch's perennial charm and popularity arise in part from his treatment of specific human problems in which he avoids raising disquieting solutions. He wrote easily and superficially, with a wealth of anecdote. His style is predominantly Attic, though influenced by the contemporary Greek that he spoke; he followed rhetorical theory in avoiding hiatus between words and was careful in his use of prose rhythms. He is clear, but rather diffuse. Plutarch's philosophy was eclectic, with borrowings from the Stoics, Pythagoreans, and Peripatetics (but not the Epicureans) grouped around a core of Platonism. His main interest was in ethics, though he developed a mystical side, especially in his later years; he reveals that he had been initiated into the mysteries of the cult of Dionysus, and both as a Platonist and as an initiate he believed in the immortality of the soul. He believed too in the superiority of Greek culture and in the meritoriousness and providential character of the Roman Empire. Personally, he preferred a quiet and humane civic life as a citizen of a small Boeotian town, where his writing and teaching did much to illuminate the darkness of provincial life in 1st-century Greece.

Reputation and influence. Plutarch's later influence has been profound. He was loved and respected in his own time and in later antiquity; his *Lives* inspired a rhetorician, Aristides, and a historian, Arrian, to similar comparisons, and a copy accompanied the emperor Marcus Aurelius when he took the field against the Marcomanni. Gradually, Plutarch's reputation faded in the Latin West, but he continued to influence philosophers and scholars in the Greek East, where his works came to constitute a schoolbook. Proclus, Porphyry, and the emperor Julian all quote him, and the Greek Church Fathers Clement of Alexandria and Basil the Great imitate him without acknowledgment. His works were familiar to all cultivated Byzantines, who set no barrier between the pagan past and the Christian present. It was mainly the *Moralia* which appealed to them; but in the 9th century the Byzantine scholar and patriarch Photius read the *Lives* with his friends.

Plutarch's works were introduced to Italy by Byzantine scholars along with the revival of classical learning in the 15th century, and Italian humanists had already translated them into Latin and Italian before 1509, when the *Moralia,* the first of his works to be printed in the original Greek, appeared at Venice published by the celebrated Aldine Press. The first original Greek text of the *Lives* was printed at Florence in 1517 and by the Aldine Press in 1519. The *Lives* were translated into French in 1559 by Jacques Amyot, a French bishop and classical scholar, who also translated the *Moralia* (1572). The first complete edition of the Greek texts by a French humanist in 1572 marked a great improvement in the text.

That Rabelais knew Plutarch well is proved by the frequency with which he quotes from both the *Lives* and the *Moralia.* It was Montaigne, however, who read Plutarch in Amyot's version, who first made his influence widely felt. The style of Montaigne's *Essays* (1580–88) owed much to the *Moralia,* and from the *Lives* he adopted Plutarch's method of revealing character by illustrative anecdote and comment, which he applied to self-revelation. Moreover, the *Essays* made known the ideal, derived from Plutarch's presentation of character and openly expressed opinion, of "high antique virtue and the heroically moral man" which became the humanist ideal of the Renaissance period.

The *Lives* were translated into English, from Amyot's version, by Sir Thomas North in 1579. His vigorous idiomatic style made his *Lives of the Noble Grecians and Romans* an English classic, and it remained the standard translation for more than a century. Even when superseded by more accurate translations, it continued to be read as an example of Elizabethan prose style. North's Plutarch was Shakespeare's source for his Roman plays and influenced the development of his conception of the tragic hero. The literary quality of North's version may be judged from the fact that Shakespeare lifted whole passages from it with only minor changes.

In 1603 the complete *Moralia* was first translated into English directly from the Greek. Its influence can be seen in the 1612 edition of Bacon's *Essays,* which contain counsels of public morality and private virtue recognizably derived from Plutarch. Francis Bacon was more attracted by Plutarch the moralist than by Plutarch the teller of stories or painter of character, but to the Renaissance mind it was the blend of these elements that gave him his particular appeal. His liking for historical gossip, for the anecdote and the moral tale, his portrayal of characters as patterns of virtue or vice (in the manner of the morality play and the character), and his emphasis on the turn of fortune's wheel in causing the downfall of the great, all suited the mood of the age, and from him was derived the Renaissance conception of the heroic and of the "rational" moral philosophy of the ancients.

Historians and biographers in the 16th and 17th centuries followed Plutarch in treating character on ethical principles. The 17th-century English biographer Izaak Walton knew Plutarch well, and his own *Lives* (collected 1670, 1675) imitated Plutarch by dwelling on the strength, rather than the weakness, of his subjects' characters.

Plutarch was read throughout the 17th and 18th centuries. The English poet and dramatist John Dryden edited a new translation of the *Lives* first published in 1683–86, and abridged editions appeared in 1710, 1713, and 1718. The *Moralia* was retranslated in 1683–90 and also frequently reprinted. In France, Amyot's translations were still being reprinted in the early 19th century, and their influence on the development of French classical tragedy equaled that of North's version on Shakespeare. Admiration for those heroes of Plutarch who overthrew tyrants, and respect for his moral values, inspired the leaders of the French Revolution; Charlotte Corday, who assassinated the revolutionary leader Jean-Paul Marat, spent the day before that event in reading Plutarch. The German classical poets—Johann Wolfgang von Goethe, Friedrich von Schiller, and Jean Paul (Johann Paul Richter) especially—were influenced by his works, and he was read also by Beethoven and Nietzsche.

In the 19th century, Plutarch's direct influence began to decline, in part as a result of the reaction against the French Revolution, in part because the rise of the Romantic movement introduced new values and emphasized the free play of passions rather than their control, and in part because the more critical attitude of scholars to historical accuracy drew attention to the bias of his presentation of fact. He was still admired, however, notably by the American poet, philosopher, and essayist Ralph Waldo Emerson, and, although in the 20th century his direct influence was small, the popular ideas of Greek and Roman history continued to be those derived from his pages. (F.W.W./Ed.)

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Pluto (Greek god): *see* Hades.

Pluto, in astronomy, ninth major planet of the solar system. It is named after the Greek and Roman god of the lower world.

A brief treatment of Pluto follows. For full treatment, *see* MACROPAEDIA: Solar System, The.

Pluto is normally the outermost of the known planets and the most distant from the Sun; its mean distance from the latter is calculated at about 5,913,000,000 km (3,666,060,000 miles). Pluto's orbit, however, is so eccentric (0.246) that the planet comes closer to the Sun than Neptune does at times around perihelion (about every 248 years), as for example between 1979 and 1999. During this 20-year interval Pluto will remain inside Neptune's orbit.

Pluto has an inclination of 17°8′ to the mean plane of the solar system, the highest of any of the major planets. Because of its great distance from the Earth, Pluto always appears relatively faint even when viewed with a telescope—no more than 14th magnitude. Pluto's brightness level varies regularly by about 12 percent in a period of 6.39 days, which indicates that the surface reflection properties of the planet are not uniform and that the planet rotates on its axis every 6.39 days.

Having a diameter of slightly more than 2,200 km (1,370 miles), Pluto is roughly two-thirds the size of the Moon. Its mean density ranges from 0.5 to 0.9 gram per cubic centimetre. Because of this low density value, many astronomers theorize that the planet consists largely of solid methane rather than of the denser rocky matter found in the inner (or terrestrial) planets. Infrared observations suggest strongly that Pluto has polar caps composed of methane ice. These ice caps sometimes appear to extend halfway to Pluto's equator. That the surface materials are frozen is supported by evidence of extremely low temperatures on the planet. It is estimated that the average surface temperature on the sunlit side of Pluto is less than 60 K when the planet is at perihelion and only about 47 K at aphelion. The far side of the planet may have a temperature as low as 20 K. The planet appears to have a thin atmosphere, also composed of methane.

Pluto's origin and evolution are obscure. Pluto differs significantly from the outer planets in such physical properties as size, mass, axial rotation, orbital eccentricity, and inclination. Thus, it most likely formed and evolved in a different manner. Some investigators have proposed that Pluto may be a runaway satellite that was originally part of Neptune's system. Not only do Pluto's properties resemble those of Triton but its orbit almost intersects Neptune's periodically. (Pluto's orbit clears that of its neighbour by only about 385,000,000 km [240,000,000 miles]). Moreover, recent computer simulations show that if a planet three times as massive as the Earth had plunged into a hypothetical proto-Neptunian satellite system of four members, one of the moons would have been perturbed away from the planet into a Pluto-like orbit.

Pluto was discovered in 1930 by the American astronomer Clyde W. Tombaugh during a systematic search for a trans-Neptunian planet predicted by Percival Lowell and William H. Pickering. In a series of photographs he had taken at the Lowell Observatory in Flagstaff, Ariz., Tombaugh recognized the new planet by its motion, which was much slower than that of numerous asteroids also recorded on the same photographs.

Pluto has one satellite, an object of less than half its size and one-tenth its mass. The satellite was discovered in 1978 by two American astronomers, James W. Christy and Robert S. Harrington, and was named Charon (*q.v.*) after the mythological boatman who ferried souls across the river Styx to Pluto for judgment.

pluton, body of intrusive igneous rock the size, composition, shape, or exact type of which is in doubt; when such characteristics are known, more limiting terms can be used. Thus, plutons include dikes, laccoliths, batholiths, sills, and other forms of intrusions. Most plutons are thought to be the result of igneous activity in which a magma is involved; the controversial origin of some large granitic bodies, however, requires that metasomatic processes or granitization be included when discussing many plutons.

Articles are alphabetized word by word, not letter by letter

plutonium (Pu), radioactive chemical element of the actinide series in Group IIIb of the periodic table, atomic number 94. It is the most important transuranium element because of its use as fuel in certain types of nuclear reactors and as an ingredient in nuclear weapons. Plutonium, warm because of energy released in alpha decay, is a silvery metal that takes on a yellow tarnish in air. The element was first detected (1940) as the isotope plutonium-238 by Glenn T. Seaborg, Joseph W. Kennedy, and Arthur C. Wahl, who produced it by deuteron bombardment of uranium-238 in the 60-inch cyclotron at Berkeley, Calif. Traces of plutonium have subsequently been found in uranium ores, where it is not primeval but naturally produced by neutron irradiation.

All plutonium isotopes are radioactive. The most important is plutonium-239 because it is fissionable, has a relatively long half-life (24,360 years), and can be readily produced in large quantities in breeder reactors by neutron irradiation of plentiful but nonfissile uranium-238. Critical mass (the amount that will spontaneously explode when brought together) must be considered when handling quantities in excess of 300 grams (2/3 lb). The critical mass of plutonium-239 is only about one-third that of uranium-235.

Plutonium and all elements of higher atomic number are radiological poisons because of their high rate of alpha emission and their specific absorption in bone marrow. The maximum amount of plutonium-239 that can be indefinitely maintained in an adult without significant injury is 0.008 microcuries (equal to 0.13 micrograms). Longer lived isotopes plutonium-242 and plutonium-244 are valuable in chemical and metallurgical research. Plutonium-238 can be manufactured to harness its heat of radioactive decay to operate thermoelectric and thermionic devices that are small and lightweight but long-lived (the half-life of plutonium-238 is 86 years).

Plutonium exhibits six forms differing in crystal structure and density (allotropes); the alpha form exists at room temperatures. It has the highest electrical resistivity of any metallic element (145 microhm-centimetres). Chemically reactive, it dissolves in acids and can exist in four oxidation states as ions of characteristic colour in aqueous solution: Pu^{3+}, blue-lavender; Pu^{4+}, yellow-brown; PuO_2^+, pink (?); PuO_2^{2+}, pink-orange. Very many compounds of plutonium have been prepared, often starting from the dioxide (PuO_2), the first compound of any synthetic element to be separated in pure form and in weighable amounts (1942).

atomic number	94
stablest isotope	244
melting point	639.5° C (1,183.1° F)
boiling point	3,235° C (5,855° F)
specific gravity (alpha)	19.84 (25° C)
valence	3,4,5,6
electronic config.	2-8-18-32-24-8-2 or (Rn)$5f^67s^2$

Plutus, in Greek religion, god of abundance or wealth, a personification of *ploutos* (Greek: "riches"). According to Hesiod, Plutus was born in Crete, the son of the goddess of fruitfulness, Demeter, and the Cretan Iasion. In art he appears chiefly as a child with a cornucopia. He was sometimes confused with Pluto (Hades), god of the underworld.

pluvial regime, a regular seasonal and annual pattern of rainfall and other precipitation in a specified region or locality.

Averaged zonally, regions of excessive precipitation, in which annual precipitation exceeds annual evaporation, exist in the tropics and at latitudes poleward of 40° in both hemispheres. In the subtropics, dominated by high atmospheric pressure, annual evaporation exceeds annual precipitation, at least over the oceans. At high-latitude coastal locations, precipitation tends to peak in winter; in the continental interior and in regions affected by monsoon winds, the maximum usually occurs in summer. Many points near the Equator have two rainy seasons, in response to the northward and southward movement of the equatorial trough with the Sun. The trough separates the trade winds of the two hemispheres and is a zone of strong convergence, rising motion, and heavy precipitation.

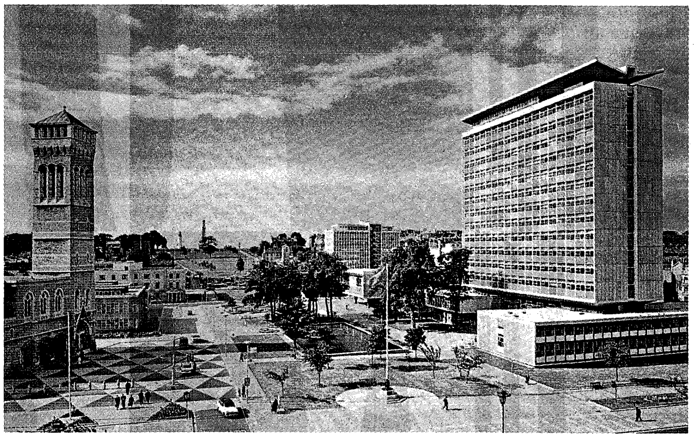
In paleoclimatology, pluvial regimes are usually associated with periods of unusually heavy precipitation as deduced from geologic evidence, especially in tropical and subtropical latitudes. The best evidence for pluvial phases in the ancient past comes from splendidly preserved lake terraces in present desert areas. Lake Bonneville in western Utah is an excellent example. The level of this lake has fluctuated greatly and rapidly during at least the last 500,000 years, with the latest pluvial stage occurring about 10,000 years ago, when the lake level was 180 metres (600 feet) above the present elevation of the lake bed. Lake Chad, in the southern Sahara, is another notable example of this widespread phenomenon.

Most authorities equate pluvial regimes in the subtropics with periods of glacial advance at higher latitudes, though, during these cold periods, global precipitation and evaporation may decrease. Because of the advancing ice sheets, the middle-latitude storm track is shifted Equatorward, thus bringing heavy precipitation to the subtropics, especially in winter. In contrast, recent evidence indicates a correspondence between glacial and interpluvial periods in the tropics. Tropical lowlands were apparently dry during the last glaciation and wet during the postglacial period.

Plymouth, district (city), county of Devon, England. It lies between the Rivers Plym and Tamar, which flow into Plymouth Sound, covering 4,500 ac (1,821 ha) and providing an extensive anchorage used principally by the Royal Navy.

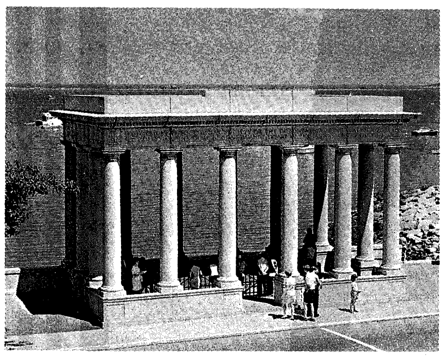
Named Sudtone in Domesday Book (1086), Plymouth's original harbour is still called Sutton Harbour. A developing trade and the shipment of armies to France led to its early growth. In the 16th century the attempts of Sir Walter Raleigh to colonize Virginia were made from Plymouth; it was the home port of other famous Elizabethan adventurers, and the British fleet sailed from there to attack the Spanish Armada (1588). The Hoe (the southern waterfront) is dominated by the Citadel, built by Charles II (reigned 1660–85) to replace a Tudor castle. In 1690 the Royal Dockyard was begun on the eastern bank of the Tamar, and the town of Plymouth Dock (renamed Devonport in 1824) was founded. A third town, Stonehouse, developed between Devonport and Plymouth, and all were amalgamated in 1914.

During World War II, Plymouth suffered severe bomb damage from air raids. The new Plymouth has some of the finest commercial, shopping, and civic centres in Britain. New approach roads link the city with new bridges over the Plym and Tamar. The reconstruction included the building of several satellite communities in which light industries were introduced. Others include the manufacture of machine tools, precision instruments, lubrication equipment, chemicals, and engineering products. The district has an area of 30 sq mi (79 sq km). Pop. (1983 est.) 255,200.


The Guildhall (left) and the Civic Centre (right), Plymouth, Devon
Kenneth Scowen

Plymouth, city, seat (1836) of Marshall County, northern Indiana, U.S., 23 mi (37 km) south of South Bend. Founded in 1834 and apparently named for Plymouth, Mass., it is near the site of the area's last Potawatomi Indian village from where, in 1838, more than 800 Indians were dispossessed and moved to a reservation on the Osage River in Kansas. Many of them died of malaria before reaching their destination. Plymouth is now the trade centre for an extensive agricultural area (livestock, dairy products, soybeans, and grain) and has acquired some industry. Manufactures include light machinery, batteries, and chemical fertilizers. Marshall County Historical Museum exhibits Indian artifacts. Culver Military Academy is 11 mi southwest, and Ancilla College (1937) is in nearby Donaldson. Inc. 1872. Pop. (1980) 7,693.

Plymouth, town (township), seat (1685) of Plymouth County, southeastern Massachusetts, U.S., on Plymouth Bay, 37 mi (60 km) southeast of Boston. Site of the first permanent settlement by Europeans in New England Plymouth Colony (formally, the colony of New Plymouth), it was founded by Pilgrims (separatists from the Church of England) who, in their search for religious toleration, had emigrated first to the Netherlands and then to North America. Sailing in the "Mayflower" (*q.v.*) from Plymouth, Eng., the settlers reached the shores of Cape Cod in November 1620, and an exploring party arrived in the Plymouth area on December 21 (now celebrated as Forefathers' Day). The Pilgrims landed (according to tradition) on Plymouth


Granite portico protecting Plymouth Rock, Mass.
R.E. Dietrich—Shostal/EB Inc.

Rock on December 26 and built their first fort and watchtower on Burial Hill (so called because it contains the graves of Gov. William Bradford and others of the original group). Half their number died that first winter and were buried on Cole's Hill, which was later levelled and planted to grain so that the Indians could not judge the extent of the colony's depletion. Although never officially incorporated, the town was recognized in 1633 as the seat of Plymouth Colony (absorbed into Massachusetts Bay Colony in 1691).

Its seaside location and historic associations make Plymouth an outstanding summer resort. A tourist-based economy is supplemented by light manufacturing (cordage), fishing, and cranberry growing. Seafaring was the heart of the early economy of the community, and active wharves and boatyards remain. Numerous historic attractions include Plimoth Plantation (a re-creation of the original Pilgrim village), Pilgrim Hall Museum (built in 1824), Harlow Old Fort House (a building depicting 17th-century household occupations of Plymouth women), and "Mayflower II," a goodwill ship built at Brixham, in England, that sailed across the Atlantic in 53 days in 1957. Many early colonial houses in the town have been restored, including the Edward Winslow House (now the headquarters of the Mayflower Society). Plymouth Rock, first identified in 1741, became a symbol of freedom in 1774 when it was split by being dragged to Liberty Pole Square in pre-Revolutionary agitation. It now rests on its original waterfront site under a portico of granite. On a hill behind the town is the 81-ft (25-m) National Monument to the Forefathers (Pilgrim Monument), dedicated in 1889. Plymouth includes most of Myles Standish State Forest (10,910 ac [4,415 ha]). Pop. (1980) 35,913.

Plymouth, town (township), Grafton County, central New Hampshire, U.S., on the Pemigewasset River, north-northwest of Laconia, west of Squam Lake and overlooked (southwest) by Plymouth Mountain (2,187 ft [667 m]). Chartered in 1763, it annexed parts of Hebron and Campton in 1845 and 1860. Agriculture, lumbering, and the manufacture of pig-iron, gloves, mattresses, and sporting goods are local economic activities, and since the mid-19th century the town has been a popular resort centre. The Plymouth State Fair is an annual (August) event. Plymouth State College originated in 1871 as a state normal school. Nathaniel Hawthorne died (1864) in Pemigewasset House (burned down; site near the railroad station) while on a trip to improve his health. The Tenney Mountain Ski Area and Polar Caves are nearby. Pop. (1980) 5,094.

Plymouth, town (includes Plymouth Notch, Plymouth Union, and Tyson), in Windsor County, south central Vermont, U.S. It was chartered in 1761 as Saltash and renamed in 1797. Calvin Coolidge, 30th president of the United States, was born (July 4, 1872) in Plymouth in a small house behind the crossroads village store. The homestead in Plymouth Notch where he took the presidential oath of office, on Aug. 3, 1923, and six other buildings, are preserved. Coolidge's grave is in a local church cemetery. The Calvin Coolidge State Forest is nearby. Pop. (1980) 405.

Plymouth Brethren, community of Christians whose first congregation was established in Plymouth, Devon, Eng., in 1831. The movement originated in Ireland and England a few years earlier with groups of Christians who met for prayer and fellowship. Biblical prophecy and the Second Coming of Christ were emphasized. John Nelson Darby, a former clergyman in the Church of Ireland (Anglican), soon became the dominant personality in the movement. He founded groups of Brethren in many parts of the British Isles and in continental Europe, especially in French Switzerland, where he spent the greater part of the period 1838–45.

After Darby returned to England in 1845, disputes over doctrine and church government split the Brethren. Darby's followers formed a closely knit federation of churches and were known as Exclusive Brethren; the others, called Open Brethren, maintained a congregational form of church government and less rigorous standards for membership. Exclusive Brethren have suffered further divisions.

Brethren of all parties recognize no order of clergy or ministers as distinct from the laity. A communion service is celebrated every Sunday. Practically all groups practice believer's Baptism, although some Exclusives, following Darby's practice, baptize children of members.

The Plymouth Brethren have been active in foreign missionary work, principally in Central Africa, India, and Latin America. Brethren are found throughout the English-speaking world and in most European countries. In the U.S., which they reached in the early 1860s, there are eight groups, distinguished for statistical purposes by roman numerals I through VIII.

Plymouth Company, also called VIRGINIA COLONY OF PLYMOUTH, commercial trading company chartered by England's King James I in April 1606 for the purpose of colonizing the eastern American coast between parallels 38° and 45° N. Its shareholders were men of Plymouth, Bristol, and Exeter.

The Plymouth Company was less successful than its twin, the London Company (*q.v.*). In 1606 it established two colonies, and in 1607 settlers landed at the mouth of the Kennebec River (Maine), only to abandon the enterprise the next spring. The failure of the Plymouth Company led in 1620 to its reorganization as a new company under a new charter the Council for New England, (*q.v.*).

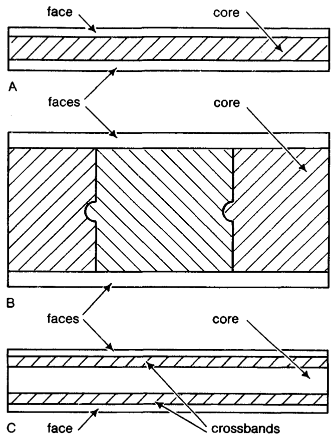
Plymouth porcelain, first hard-paste, or true, porcelain made in England, produced at a factory in Plymouth, Devon, from 1768 to 1770. Formulated by a chemist, William Cookworthy, it is distinguishable from the Bristol porcelain that he produced later by its imperfections.

Cookworthy found deposits of kaolin (a soft, white clay, also called china clay) and china stone (or petuntse, a partly decomposed granite) near St. Austell in Cornwall and began experimenting. His first porcelain was coarse, with many faults, and it was liable to smoke staining during firing. Later, both body and decoration were improved. Chinese motifs were copied from Worcester porcelain, and the shapes of the wares generally were inspired by silver work or shells, mainly from early Bow wares. Plymouth porcelain is marked in underglaze blue, blue enamel, red, or gold, with the alchemical sign for tin.

Plynlimon, Welsh PUMLUMON, ridge on the gritstone plateau of central Wales, rising to 2,468 ft (752 m) at Plynlimon Fawr. The ridge marks the watershed between drainage westward to Cardigan Bay and east to the Rivers Severn and Wye, flowing toward England and ultimately the Bristol Channel. It forms part of the administrative boundary between the counties of Dyfed and Powys. It is known for its mists and general wetness. Much of the surface is boggy and of little agricultural value except for sheep grazing. Extensive planting of conifers has been carried out by the British Forestry Commission, and the heavy rainfall sustains reservoirs supplying water to the industrial cities of England. Mining for lead was active in the 19th century and led to an extension of settlement; abandoned lead mines dot the slopes of the ridge. The area now suffers from severe rural depopulation.

plywood, composite wood panel made of three or more layers glued together with the grain of adjoining plies at right angles to each other. Thin panels are built up of veneer (thin sheet wood) exclusively. For thicker panels, sawed lumber often is used as the centre ply, or core, the product being called lumber-core plywood.

Two types of plywood are made: interior plywood, for use only in dry locations, and exterior plywood, for which water-resistant glues are used. Wherever a material is required to cover large areas with a light but strong and rigid sheeting, plywood may be used; for example, in cabinetmaking, for chests, dressers, wardrobes, and tables; in housebuilding, for walls, ceilings, floors, doors, cupboards, and cement forms; in coachbuilding, for trucks, vans, and trailers; in shipbuilding, for small boat hulls, decks, and cabins; and in boxmaking, for shipping and storage chests and cases.



Three types of plywood construction
(A) Three-ply, all veneer; (B) three-ply, lumber core; (C) five-ply, all veneer (edge views)

From "Wood Handbook," Forest Products Laboratory, U.S. Department of Agriculture

Plywood has a number of advantages over solid wood: it can be manufactured into large sheets with few defects; it is stronger than boards of the same thickness; shrinking and swelling are almost eliminated because the plies cross each other; splitting in handling and nailing is greatly reduced; and wood of lower grades can be used for the interior plies. Since veneer can be dried in a few minutes, dry plywood can be produced from green logs in a day. Plywood is almost always composed of an odd number of plies so that the grain of corresponding plies, counting from the outside in, runs in the same direction, balancing and stabilizing the construction.

Veneer used for plywood usually varies in thickness from $^1/_{28}$ to $^1/_8$ inch (0.09 to 0.32 centimetres), but both thinner and thicker veneers often are used. Thin veneers have an advantage, especially for the outer, or face, plies, in that they set up less severe transverse stresses with changes in moisture content, thereby reducing warping and surface checking (superficial cracking) of panels. The use of thin veneer also makes valuable wood go farther. Since successively cut layers of thin veneers are similar in appearance, identical areas from adjacent sheets can be matched to make highly symmetrical ornamental patterns. In lumber-core panels, the plies next to the faces or the crossbands usually are thicker than the face plies and largely control the stability of the panel.

In sandwich construction, thin facings are bonded on a thick core. The facings are made of strong material, such as thin, dense plywood, and the core of a lightweight material, such as balsa wood, cellular cellulose acetate, or paper honeycomb. The core serves primarily to separate and stabilize the thin faces, which are the principal load-carrying portions. The complete assembly is exceedingly strong and stiff for its weight.

Plzeň, German PILSEN, city, capital of Západočeský *kraj* (Western Bohemia region), Czechoslovakia; it lies in the fertile Plzeň basin, where several tributaries gather to form the Berounka River. Situated on a busy trade route between Prague and Bavaria, it was first recorded in the 10th century, chartered in 1292, and fortified in 1295 by King Wenceslas II. Plzeň was a Roman Catholic stronghold in the 15th century during the Hussite Wars and withstood long sieges.

The medieval town square forms the centre of Plzeň and is dominated by St. Bartholomew's church, with its slender steeple (335 ft [102 m]), the highest in Bohemia; the Franciscan church of the Virgin Mary; and the Renaissance town hall (1556) and burgher houses.

The coalfields at nearby Nýřany and local iron-ore deposits gave rise in the 19th century to Plzeň's engineering industry, symbolized by the Škoda (now officially the V.I. Lenin) Works, which occupy most of the city's western sector. Severely damaged in World War II, the factories were rebuilt and restored to production. Best known for munitions, the Škoda Works also manufacture heavy machinery, military aircraft, railway locomotives, and cars. Škoda pioneered the development of electric-railway locomotives, with plastic body panels to reduce axle loadings. Since the Middle Ages, Plzeň has been famous for its Pilsner beer; its Měšťanský pivovar (Citizen's Brewery) was built in 1842. Other manufactures include chemicals, pottery, hardware, and paper. The city is the transportation hub and the economic and cultural centre of western Bohemia. It is the site of the College of Mechanical and Electrical Engineering (1949; reconstituted 1953–60) and the West Bohemian Gallery and Museum. Pop. (1984 est.) 174,094.

pneumatic device, any of various tools and instruments that generate and utilize compressed air. Examples include rock drills, pavement breakers, rivetters, forging presses, paint sprayers, blast cleaners, and atomizers.

Compressed-air power is flexible, economic, and safe. An air device creates no spark hazard in an explosive atmosphere and can be used under wet conditions without electric shock hazard. A relatively small compressor suffices to fill a storage tank for intermittent use, and no return lines are needed. Other characteristics of a compressed-air system are important in meeting special service requirements. It is relatively easy to connect one device (such as a valve or a cylinder and piston) to another by pipe, tubing, or flexible hose. Many actions can be controlled by a simple manipulation of valves. The motion of an actuating piston in a cylinder can be changed quickly and in small steps with practically no shock. An air system can provide great flexibility in speed and motion control. Relief valves are easily arranged to protect a system and avoid damage. Control of operations is simple, efficient, and centralized. In general, air systems have relatively few moving parts, contributing to high reliability and low maintenance costs.

Development of pneumatic devices. The ordinary hand bellows, used by early smelters and blacksmiths for working iron and other metals, was a simple type of air compressor. The air intake consisted of several holes in a piece of wood, covered with flaps that served as valves. A simple check valve in the discharge prevented air from being drawn back into the bellows during the suction stroke. In the time of Hero (probably 1st century AD) a simple jet-type compressor was used to provide air for smelting and forging.

In the 17th century, Otto von Guericke, of Magdeburg, Ger., carried out notable experiments and made significant improvements in compressors. In 1829 a stage, or compound, compressor which involved compressing air in successive cylinders was patented. Cooling by jets of water sprayed into the cylinder during compression was introduced about 1872; later, a better system of cooling by the use of water-jacketed cylinders was developed. In the United States the first compressor used in large-scale work was a four-cylinder unit for the Hoosac Tunnel, at North Adams, Mass., in 1866.

The 20th century witnessed a large increase in the use of compressed air and of compressed-air devices. The introduction of jet engines for military and passenger aircraft stimulated the use and improvement of centrifugal and axial-flow compressors. The further development of automatic machinery, labour-saving devices, and automatic-control systems led to an increase in the use of pneumatics. In the late 1960s there began a significant development of a new class of compressed-air devices: digital-logic pneumatic-control components, which can be used in various power and control systems.

Major types of pneumatic devices. Air compressors and pneumatic tools constitute the principal classes of pneumatic devices. Other kinds of apparatus that make use of compressed air are paint-spray equipment, pneumatic tubes for conveying materials, and train brake systems.

An air compressor is a power-driven machine for compressing air from some initial intake pressure (usually atmospheric) to a higher pressure. Compressors (as well as other fluid machines) can be classified into two main types, depending on the air or fluid action: (1) the positive-displacement type and (2) the velocity, or dynamic, type.

In the positive-displacement, or static-pressure, type, the characteristic action is a volumetric change or displacement action. Successive volumes of air are confined within a closed space, and the pressure is increased by reducing the volume of the space. In the simple hand tire pump, pressure is developed by moving a piston in a cylinder. The positive-displacement type may be subdivided into reciprocating (back-and-forth straight-line motion) and rotary (motion in a circular path) compressors. In a positive-displacement machine, neglecting leakage, the volume rate of flow (cubic feet per second) through the compressor is essentially constant over a wide range of discharge pressures.

The dynamic type of compressor may be subdivided into the centrifugal type (with flow through a rotating runner or rotor primarily in a radial direction), the axial-flow type (with flow through a runner primarily in a direction parallel to the axis of rotation), and the fluid-jet type.

Pneumatic tools can be separated into two broad categories on the basis of the driving method: rotor and reciprocating piston. Both kinds are known as air motors. A rotating type of compressor, operating in reverse, serves as one type of motor. Compressed air enters the housing, pushes on the vanes, and rotates a central shaft or spindle. A drill, grinding wheel, or other device is fastened to the spindle. A reciprocating compressor, operating in reverse, also functions as a motor. Compressed air enters the cylinder, expands, and forces the piston to move. The return stroke may be actuated by compressed air on the other side of the piston or by spring action. A tool, such as a rivetting hammer, may be connected to the reciprocating piston. Pneumatic tools are normally supplied with compressed air at about 90 psig (pounds per square inch gauge).

With compressed air as the power source, tools have been designed that are relatively lightweight, compact, portable, easy to operate, and free from electrical shock and spark hazards. In underwater operations, compressed air prevents water from entering the air motor.

Pneumatic tools can also be divided into two groups according to the type of tools: portable tools and rock drills. Portable pneumatic tools include abrasive devices (*e.g.*, grinders, buffers, and sanders), drills, reamers, tappers, stud setters, screwdrivers, nutsetters, shears, wrenches, and impact tools. They are normally powered by a rotary-vane type of air motor. Operating speeds can be varied by throttling the air to the motor. Air motors do not become hot when overloaded; they will stand repeated stalling and rapid reversals without damage. Figure 1 illustrates a grinder; the air motor is typical for this class of device.

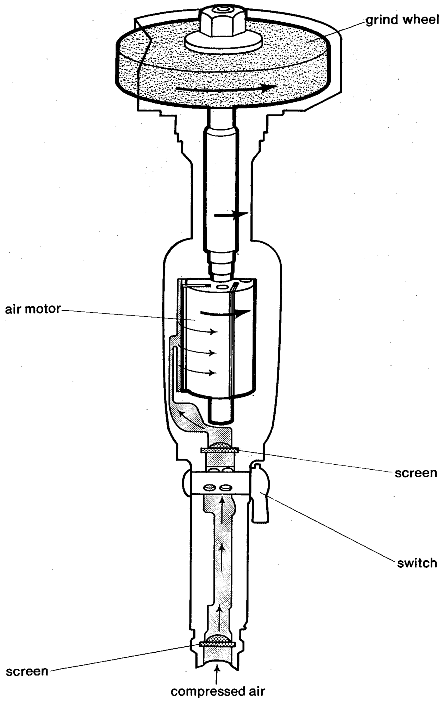


Figure 1: Pneumatic grinder

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Portable tools also include chipping hammers and air hoists. Pneumatic chipping hammers contain an air-operated piston that delivers successive blows to a chisel or forming tool at the end of the hammer. The valve type of tool has a separate mechanism to control the airflow to the piston, thus allowing the operator to control the speed and force of the blows. In a compression rivetter the compression, or squeezing action, on the rivet is obtained from an air piston connected to a cam, wedge, or toggle. A yoke rivetter has an air-operated clamp or vise that holds the work in place; the yoke absorbs the hammering action and thus reduces operator fatigue. Hoists operated by compressed air are employed in operations requiring accurate control of lifting or lowering speeds. In most cases, they are used outdoors and under conditions in which corrosive fumes, explosive gases, or inflammable fluids are present.

There are also various portable specialty tools, such as concrete vibrators, countersinking tools, spikedrivers, paint mixers, air cranking motors, railway roadbed tampers, valve grinders, reciprocating filing machines, and shank grinders.

Rock drills are used for mining and rock excavation. An example of such a pneumatic tool is the hammer drill, or percussion hammer, which is composed of a piston and a drill made of high-carbon steel. The drill is held loosely in a chuck at the end of the cylinder and is struck by rapid blows from the freely moving piston. For downward-sloping holes, some means must be provided for removing drill cuttings, dust, and sludge. A hollow drill is usually used, and water or air is passed through it to remove the cuttings and cool the drill bit. Another kind of rock drill, called the drifter drill, is used for horizontal holes in mining operations and tunnel driving. It is mounted on some type of rig or frame and is mechanically fed into the work. Stoper drills are used primarily on up-hole or overhead drilling because of the automatic-feed characteristics. The usual stoper is a hammer drill with a self-rotating drill bit and an automatic feed by means of an air piston. Large air-operated earth drills, mounted on motor trucks on trailers, are utilized for digging water wells and blast holes for quarry operations. A high-capacity compressor provides air not only to power the drill tool but also to raise the tools in the hole and to remove drill cuttings from the hole. Such machines are used to advantage in areas where surface water supplies are insufficient to provide the drilling fluid needed for standard rotary and cable-tool well-drilling machines.

Hand-operated pneumatic paving breakers usually use solid steel drills and are not equipped for automatic rotation. Figure 2 shows a portable paving breaker. One type of tool is valve actuated, another is valveless. Heavy machines of about 80 pounds (36 kilograms) are used to break concrete pavement, foundations, and boulders. Medium breakers, weighing about 50 to 70 lbs (23 to 32 kg), are employed when breaking light concrete floors, macadam, and frozen ground. Light tools, weighing less than 50 lbs, are used to break floors, paving, and masonry walls. Heavy and medium-weight breakers can be adapted for driving spikes.

Compressed air is a good vehicle for conveying a paint spray. In a spray gun, the paint (*e.g.*, lacquer, enamel, or plastic coating) is atomized and mixed with compressed air. The principle of operation is similar to that of the jet compressor, with the compressed air serving as the motive fluid to draw the paint into the mixing area. *Spray painting* usually implies covering relatively large surfaces, such as a building. The term *airbrush*, by contrast, implies a device for developing a fine, small diameter spray of paint, protective coating, or liquid colour. The airbrush can be a pencil-shaped atomizer used for a variety of much more detailed activities such as shading drawings and retouching photographs.

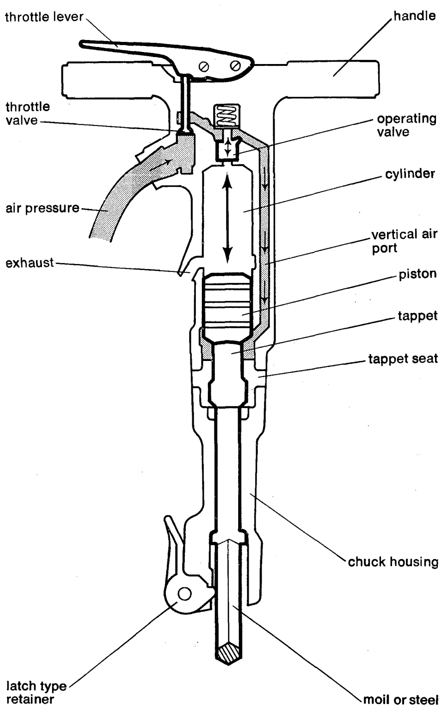

Figure 2: Pneumatic paving breaker

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Pneumatic conveyers are used in various applications for handling materials. In a pressure system the outlet of the compressor leads into the inlet of the conveyer system. In a vacuum system the compressor inlet is at the end of the system. The air-pressure difference across the system depends on the material to be handled. In many places, mail is transferred from one site to another by pneumatic transport capsules in tubes. All sorts of materials may be conveyed by pneumatic systems, from ashes and cement to frozen foods, minerals, nuts, and seeds. Pneumatic handling is safe, fast, clean, automatic, and flexible.

Certain recently developed vehicles are supported by a cushion of air. The most successful of these air-cushion vehicles (ACVs) is the British-made Hovercraft. It is used commercially as a passenger- and car-carrying ferry; a number of them ply the English Channel. Experimental "tracked skimmers" (air-cushion trains) are under development in a number of countries, but they are not yet used commercially to any great extent. In the planning of many city transit systems, consideration is being given to air-cushion vehicles capable of speeds up to 300 miles (480 kilometres) per hour. Other specialized forms of air-cushion vehicles have been designed for use over rough terrain—such as that in Arctic regions—and for other uncommon applications.

Brakes on trains and most buses and large trucks are operated by air pressure. A piston rod from an air cylinder exerts force on the braking device. On railroad cars the air-brake system includes a compressor, pneumatic valves, regulators, piping, reservoir, and other accessories. There are levers, cylinders, and other rigging to apply forces to the brake shoe, which bear directly on the rim of the wheel. Various automatic-control safety arrangements assure a definite braking action should some malfunction develop.

pneumatism, in medicine, Alexandrian medical school, or sect, based on the theory that life is associated with a subtle vapour called the pneuma; it was, in essence, an attempt to explain respiration.

Pneumatism was expounded by the Greek anatomist and physiologist Erasistratus in about 300 BC, though the concept had been suggested earlier by other commentators. Unlike his contemporary, the Alexandrian anatomist Herophilus, who accepted the old theory of humoral pathology (*i.e.*, that human temperament and features were determined by certain combinations of body fluids), Erasistratus held that health and disease and, in fact, the nature of life were intimately connected with the pneuma, which had affinities with the air man breathes. Erasistratus drew a distinction between two kinds of pneuma: one was a "vital spirit" formed in the heart from air; the second type was formed in the brain from the first kind. The former was transported by arteries to the parts of the body and the latter, the "animal spirit," by the nerves, being the prime cause of movement. Although Erasistratus held that hindrance of the action of the pneuma, or an excess of blood, was the essential cause of certain diseases, he did not follow the contemporary practice of bloodletting, preferring to attempt to control the blood supply by diet and other less drastic measures.

Pneumatomachian, also called PNEUMATOMACHIST, Greek PNEUMATOMACHOS, plural PNEUMATOMACHOI ("Opponents of the Spirit"), any of the Christian heretics of the 4th century AD who denied the consubstantiality of the Holy Spirit with the Father in the divine Trinity. *See* Macedonianism.

pneumococcus (*Streptococcus pneumoniae*), spheroidal bacterium in the family Streptococcaceae that causes human diseases such as pneumonia, sinusitis, otitis media, and meningitis. It is microbiologically characterized as a gram-positive coccus, 0.5 to 1.25 μm (micrometre; 1 $\mu m = 10^{-6}$ metre) in diameter, often found in a chain configuration and surrounded by a capsule consisting of complex carbohydrate (polysaccharide). Many serological types have been differentiated. Pneumococci normally occur in the upper respiratory tract.

Pneumococci have proved useful in elucidating microbial genetics. The phenomenon of transformation—an alteration of one cell by another—was first observed in these microorganisms in 1928. For the most part, colonies formed by pneumococci are small, round, and smooth. Occasional mutant rough colonies are produced by organisms incapable of synthesizing the capsular material. When a rough colony is grown in the presence of genetic material (deoxyribonucleic acid) from a smooth colony, the rough colony is transformed into a smooth one.

Pneumococci are separated into types depending on the specific capsular polysaccharide formed. The disease-causing ability of pneumococci resides in the capsule, which delays or prevents their destruction by phagocytes, cells in the bloodstream that normally engulf foreign material.

pneumoconiosis, any of many lung diseases caused by the inhalation of a variety of organic or inorganic dusts or chemical irritants, usually over a prolonged period of time. The type and severity of disease depends on the composition of the dust; small quantities of some substances, notably silica and asbestos, produce grave reactions, while milder irritants produce symptoms of lung disease only with massive exposure. Much evidence indicates that the smoking of cigarettes in particular aggravates the symptoms of many of the pneumoconiosis diseases.

Typically, the early symptoms of mild pneumoconioses include chest tightness and shortness of breath, progressing to more serious breathing impairment, chronic bronchitis, and emphysema in the most severe cases. Inhaled dust collects in the alveoli, or air sacs, of the lung, causing an inflammatory reaction that converts normal lung tissue to fibrous scar tissue and thus reduces the elasticity of the lung. If enough scar tissue forms, lung function is seriously impaired, and the clinical symptoms of pneumoconiosis are manifested. The total dust load in the lung, the toxic effects of certain types of dust, and infections of the already damaged lung can accelerate the disease process.

Among inorganic dusts, silica, encountered in numerous occupations including mining, quarrying, sand blasting, and pottery making, is the most common cause of severe pneumoconiosis. As little as 5 or 6 grams (about 0.2 ounce) in the lung can produce disease (*see* silicosis).

Graphite, tin, barium, chromate, clay, iron, and coal dusts (*see* anthracosis) are other inorganic substances known to produce pneumoconiosis, although silica exposure is also involved in many cases. Pneumoconioses associated with these substances usually result only from continued exposure over long periods. Asbestos (*see* asbestosis), beryllium (*see* berylliosis), and aluminum dusts can cause a more severe pneumoconiosis, often after relatively brief exposure to massive amounts of dust. Asbestosis has also been associated with cancers of the lung and other organs.

Prolonged exposure to organic dusts such as spores of molds from hay, malt, sugarcane, mushrooms, and barley can produce lung disease through a severe allergic response within a few hours of exposure, even in previously nonallergic persons. Brown lung disease (*see* byssinosis) in textile workers is also a form of pneumoconiosis, caused by fibres of cotton, flax, or hemp, which, when inhaled, stimulate histamine release. Histamines cause the air passages to constrict, impeding exhalation.

Chemical irritants that have been implicated in lung disease include sulfur dioxide, ammonia, acid, and chloride, which are quickly absorbed by the lining of the lungs. The chemicals themselves may scar the delicate lung tissues, and their irritant effect may cause large amounts of fluid to accumulate in the lungs. Once exposure to the chemical ceases, the patient may recover completely or may suffer from chronic bronchitis.

pneumonia, inflammation and consolidation of the lung tissue as a result of infection, inhalation of foreign particles, or irradiation. Many organisms, including viruses and fungi, can cause pneumonia, but the most common causes are bacteria, in particular species of *Streptococcus* and *Mycoplasma.* Although viral pneumonia does occur, viruses more commonly play a part in weakening the lung, thus inviting secondary pneumonia caused by bacteria. Fungal pneumonia can develop very rapidly and may be fatal, but it usually occurs in hospitalized persons who, because of impaired immunity, have reduced resistance to infection. Contaminated dusts, when inhaled by previously healthy individuals, can sometimes cause fungal lung diseases such as histoplasmosis.

Mycoplasmal pneumonia, caused by *Mycoplasma pneumoniae,* an extremely small organism, usually affects children and young adults; few cases beyond the age of 50 are seen. Most outbreaks of this disease are confined to families, small neighbourhoods, or institutions, although epidemics can occur. *M. pneumoniae* grows on the mucous membrane that lines the surfaces of internal lung structures; it does not invade the deeper tissues—muscle fibres, elastic fibres, or nerves. The bacteria can produce an oxidizing agent that might be responsible for some cell damage. Usually the organism does not invade the membrane that surrounds the lungs, but it does sometimes inflame the bronchi and alveoli.

Symptoms do not appear until about three weeks after the initial infection. Headaches and a run-down feeling increase to feverishness, muscle pain, and sore throat. As the disease progresses, coughing becomes the major symptom. Sputum discharge may contain flecks of blood. Any chest pains result from the tenderness of the trachea (windpipe) and muscles from severe coughing. The illness may be severe but there are few fatalities. Recovery generally occurs in a few weeks with the help of antibiotic drugs.

Streptococcal pneumonia, caused by *Streptococcus pneumoniae,* is the single most common form of pneumonia, especially in hospitalized patients. The bacteria may live in the bodies of healthy persons and cause disease only after resistance has been lowered by other illness or infection. Viral infections such as the common cold promote streptococcal pneumonia by causing excessive secretion of fluids in the respiratory tract. These fluids provide an environment in which the bacteria flourish. This is generally a more severe illness than mycoplasmal pneumonia, although most patients recover with antibiotic treatment.

Another bacterium, *Klebsiella pneumoniae,* although it has little ability to infect the lungs of healthy persons, produces a highly lethal pneumonia that occurs almost exclusively in hospitalized patients with impaired immunity. Other bacterial pneumonias include Legionnaires' disease (*q.v.*), caused by *Legionella;* pneumonia secondary to other illnesses caused by *Staphylococcus aureus* and *Hemophilus influenzae;* and psittacosis (*q.v.*), an atypical infectious form.

Pneumonia can also result from inhalation of oil droplets, which scar the lung surfaces. This type of disease occurs most frequently in workers exposed to large quantities of oily mist and in the elderly. Oil that is being swallowed may be breathed into the respiratory tract, or, less often, it may come from the body itself when the lung is physically injured. Scar tissue forms as a result of the presence of the oil. Ordinarily no treatment is necessary. Inflammation of lung tissues may result from X-ray treatment of structures within the chest. The disease makes its appearance from one to 16 weeks after exposure to the X-rays has ceased. Recovery is usual unless too great an area of lung tissue is involved.

pneumothorax, condition in which air accumulates in the pleural sac, causing it to expand and thus compress the underlying lung, which may then collapse. (The pleural sac is a cavity formed by the two pleural membranes that line the thoracic cavity and cover the lungs.) Traumatic pneumothorax is the accumulation of air caused by penetrating wounds (knife stabbing, gunshot) or other injuries to the chest wall, after which air is sucked through the opening and into the pleural sac. Spontaneous pneumothorax is the passage of air into the pleural sac from an abnormal connection created between the pleura and the bronchial system as a result of tuberculosis or some other lung disease. The symptoms of spontaneous pneumothorax are a sharp pain in one side of the chest and shortness of breath. Artificial pneumothorax, which now is of strictly historical interest, was achieved by injecting air into the sac by means of a needle inserted into the chest wall. This procedure was used in the treatment of tuberculosis; the injected air served to compress the underlying lung and thus stop its movement, giving it time to heal free of the stress of breathing.

Pnom Penh (Kampuchea): *see* Phnom Penh.

Po (people): *see* Pai.

p'o, Pinyin PO, in Chinese Taoism, the earthly (inferior, material) human soul as distinguished from the heavenly *hun* (superior, spiritual) soul; the distinction is based on the Chinese concept of yin–yang, the inescapable principle of duality in all things. When the two souls of man are joined in harmonious union, health and life flourish; separation causes sickness and death. The Chinese assigned organic functions to *p'o.*

Although right order demands that the *p'o* (yin) soul be subservient to the *hun* (yang), in many cases the passions of *p'o* dominate men's lives. Because the *p'o* soul can turn into a *kuei* (malevolent spirit) if the deceased is not properly interred or sacrificed to, fitting burial rites not only ensure peaceful rest for the dead but further guarantee that the *hun* soul will impart special blessings to surviving family members.

Po Chü-i, Pinyin BO JUYI (b. 772, Hsin-cheng, Shensi Province, China—d. 846, Lo-yang, now Honan, Honan Province), Chinese poet of the T'ang dynasty (618–907) in China, who used his elegantly simple verse to protest the social evils of his day.

Po Chü-i began composing poetry at the age of five. Because of his father's death in 794 and straitened family circumstances, Po did not take the official examinations for the bureaucracy until the late age of 28. He did extremely well and was given a minor post at the palace library, as was another successful examination candidate and poet, Yüan Chen. Their friendship became perhaps the most famous in Chinese history. Po became a member of the prestigious Han-lin Academy in Ch'ang-an, the capital, in 807 and rose steadily in official life except for his banishment in 814 to a minor post at Chiu-chiang, the cause

Po Chü-i, portrait by an unknown artist; in the National Palace Museum, Taipei

By courtesy of the Collection of the National Palace Museum, Taipei, Taiwan, Republic of China

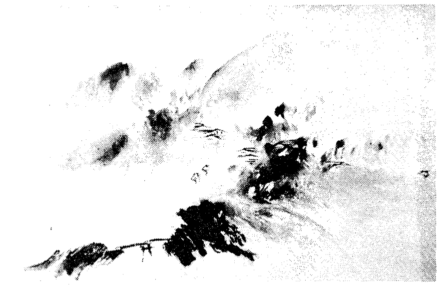
for which remains unclear. He assumed the important posts of governor of Chung-chou (818), Hangchow (822), and, later, Soochow. In 829 he became mayor of Lo-yang, the eastern capital, but retired from that post in 833 because of illness.

Po Chü-i was the informal leader of a group of poets who rejected the courtly style of the time and emphasized the didactic function of literature, believing that every literary work should contain a fitting moral and a well-defined social purpose. Po considered his most important contributions to be his satirical ballads and social-protest poems, which usually took the form of free verse based on old folk ballads, or "new *yüeh-fu,*" as he entitled a series of 50 of these poems. The most prolific of the T'ang poets, Po aimed for simplicity in his writing and, like Tu Fu, a great T'ang poet of the preceding generation, whom Po greatly admired, was deeply concerned with the social problems of the times. His poetry is marked by humour, compression, and clarity.

P'o-hai (ancient Chinese state): *see* Parhae.

Po Hai, Pinyin BO HAI, also called GULF OF CHIHLI, shallow northwestern arm of the Yellow Sea, off the North China coast. It is enclosed by the Liaotung Peninsula (northeast) and the Shantung Peninsula (south). The broad Gulf of Liaotung on the northeast is generally considered part of the Po Hai. Within these limits, the gulf's maximum dimensions are 300 miles (480 km) from northeast to southwest and 190 miles (306 km) east–west. The strait leading to the gulf is about 65 miles (105 km) in width. The Huang Ho (Yellow River), China's second longest river, discharges into the gulf. The gulf has long been used as a source of prawns and salt. There are both onshore and offshore petroleum deposits, and several oil refineries are located there.

p'o-mo, Pinyin BOMO, either of two different phrases (two different Chinese characters are pronounced *p'o*) that describe two kinds of textured surface given to Chinese paintings (*see* ts'un). The more common interpretation of *p'o-mo* is "broken ink," which, though it is now difficult to identify, was supposedly an innovation of the 8th-century painter Wang Wei. The brush was used to render and build up a series of dense ink washes (diluted ink applied in broad sweeps) to give a sense of the solid surface of landforms first defined by line. The other interpretation of *p'o-mo,* "splashed ink," was probably similar in effect but with forms unconfined by an outline and rendered by more freely and actively maneuvering the ink over the surface. "Splashed ink" is associated with the art of the eccentrics of the later T'ang dynasty and with some Ch'an artists of the 13th century.

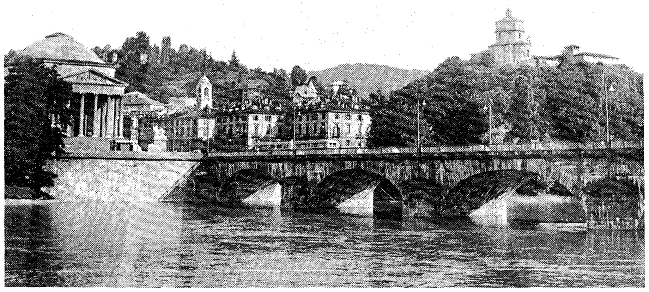


"Village in Clearing Mist," ink painting in the *p'o-mo* technique by Ying Yü-chien, early 13th century, Sung dynasty, in the Yoshikawa Eiji Collection, Tokyo
By courtesy of the International Society for Educational Information, Tokyo

Po River, Latin PADUS, longest river in Italy, rising in the Monte Viso group of the Cottian Alps on Italy's western frontier and emptying into the Adriatic Sea in the east after a course of 405 miles (652 km). Its drainage basin covers 27,062 square miles (70,091 square km), forming Italy's widest and most fertile plain.

Flowing eastward in its upper course, the Po is rapid and precipitous, descending about 5,500 feet (1,700 m) in its first 22 miles (35 km). Just west of Saluzzo the Po turns sharply northward, flows through Turin and skirts the Monferrato upland, then turns east at Chivasso and continues in a generally easterly course to its delta on the Adriatic.

The Po forms the boundary between the regions of Lombardy and Veneto (north) and Emilia-Romagna (south). The Po receives the waters of the Dora Riparia and the Dora Baltea below Turin, and its other principal tributaries are the Sesia, Ticino, Adda, Oglio, and Mincio from the north. Among the numerous streams that drain into the Po from the south, the Tanaro (from the Maritime Alps) and the Scrivia and Trebbia (from the Apennines) are important; but many of the others are rain fed and torrential and carry little water through much of the year. Throughout its middle and lower courses the Po describes many meanders, which have left numerous oxbows (circular lakes).



The Po River flowing through Turin, Italy
Authenticated News International

Its delta is among the most complex of any European river, with at least 14 mouths, usually arranged in five groups (from north to south): the Po di Levante, Po di Maestra, Po della Pila, Po delle Tolle, and Po di Goro e di Gnocca. Of these mouths, the Po della Pila carries the greatest volume of water and is the only navigable one.

The river is navigable from its mouth to Pavia. At Pontelagoscuro, 60 miles (96 km) from the sea, the Po's average discharge is 48,400 cubic feet (1,370 cubic m) per second, with variations from 910 to 340,000 cubic feet (26 to 9,630 cubic m), although in the great flood of 1951 the discharge was estimated at 424,000 cubic feet (12,000 cubic m) per second. The most devastating floods have been those of 589, 1150, 1438, 1882, 1917, 1926, 1951, 1957, and 1966, all in the autumn.

The sediment load carried by the river is considerable, and the extension of the delta is estimated at 200 acres (80 hectares) per year. Certain ancient ports south of the delta, such as Ravenna, now find themselves as much as 6 miles (10 km) from the sea as a result of silt from the Po carried down by currents in the Adriatic. The floods of the river and the silt load carried by it have long challenged hydraulic engineers. The Venetian Republic built dikes to control floods and canals to divert silt, and in the area between Ferrara and the Adriatic numerous undertakings have reclaimed thousands of acres during the past three centuries. The latest of these projects, undertaken in 1953 by the Italian Land Reform, was devoted to soil improvements, reclamation of marshy areas such as the Valli di Comacchio, and the creation of small peasant farms in the delta area, or *polesine,* which, nevertheless, suffered enormously in the great floods of 1951 and 1966.

The lower valley of the Po was, during prehistoric times, occupied by people of the Paleolithic and Neolithic stages of civilization, who built houses on piles along the swampy banks. The river regulation works originated in pre-Roman times. The reclamation and protection of the riparian lands went on rapidly under the Romans, and in several places their rectangular divisions of the ground are still visible. During the barbarian invasions much of the protective system decayed, but the later Middle Ages saw the works resumed so that the present arrangement existed in the main by the close of the 15th century.

The Ligurian name of the Po was Bodincus, or Bodencus, meaning "bottomless." The name Padus was taken from the Celts or the Veneti of Brittany. Thus, Bodincomagus is found as a town name on the upper course and Padua as a name of one of the mouths of the river.

Po-se (China): *see* Pai-se.

P'o-yang Lake, Wade–Giles romanization P'O-YANG HU, Pinyin POYANG HU, large lake in northern Kiangsi Province, China. It lies in a depression south of the Yangtze River and is fed by various rivers from Kiangsi, the most important being the Kan River, which drains almost the whole of Kiangsi. P'o-yang Lake itself drains into the Yangtze at Hu-k'ou. The lake's size is ill defined, a whole system of lakes and marshes being subject to very great seasonal variation. At its greatest extent it is about 95 miles (150 km) in length from north to south and has a breadth of 19 miles (31 km) from east to west. In winter the whole area becomes a huge marsh, intersected by waterways and dotted with hills surmounted by villages. In summer the whole area is flooded, and the hills become islands. The water level depends on complex factors, including the level of the Yangtze River as well as the level of its tributaries. The P'o-yang has always been an important retention lake that receives some of the excess of the Yangtze in flood time; consequently, the surrounding farmland is often extensively flooded.

The lake has been silting up in recent centuries. Even in summer there is a wide margin of reedbeds and swamp around the lake itself, and over the centuries large areas of farmland have been reclaimed from the lacustrine deposits. Nan-ch'ang, capital of Kiangsi, was once on the shore of the lake but is now some 15 miles (24 km) from it. The lake is divided into two sections by a narrow neck of land known as Ying-tzu-k'ou. The northern section is sometimes known as the Lo-hsing Lake. The much larger southern section is sometimes known as the Tzu-t'ing Lake or Kung-t'ing Lake.

The total area of the lake is about 1,383 square miles (3,583 square km), but precise measurement is impossible because the difference between flood level and low-water level is sometimes as much as 25 feet (8 m). Unlike Tung-t'ing Lake in Hunan Province, P'o-yang Lake has no artificial retention basin to increase its capacity to receive the Yangtze's floodwaters.

Poaceae, also called GRAMINEAE, the grass family comprising the flowering plant order Poales, containing about 600 genera with an estimated 5,000 to 10,000 species. It is economically the most important of all plant families.

A brief treatment of grasses follows. For full treatment, *see* MACROPAEDIA: Angiosperms.

Grasses thrive in all climates and are found throughout the world. Their long, narrow leaves form sheaths around the stem; the sheaths are usually split and have overlapping edges. The round or flattened stems are often hollow between the joints. The stems may grow upright or be bent at their bases; they may lie on the ground, producing new plants at each joint, or grow just below the surface. Cell division above each joint causes stem elongation. The small flowers lack petals and sepals, are located between two bracts, and are arranged into units called spikelets. The seeds store oil, starch, and protein. The fibrous roots are often greatly branched; when combined with underground or extensive surface stems in perennial species, they prevent erosion.

Cereal grasses such as rice, millet, corn (maize), and wheat (*qq.v.*) are cultivated for the nutritional value of their seeds. Many grass species provide forage for wild and domestic animals; others are used by man for shelter construction, industrial purposes, erosion control, and ornamentation.

Traditionally, botanists divide the Poaceae into two subfamilies, Festucoideae and Panicoideae, on the basis of spikelet arrangement. More recent workers prefer a system of six subfamilies (Pooideae, Panicoideae, Bambusoideae, Chloridoideae, Arundinoideae, and Oryzoideae), separated by both anatomic and microscopic characteristics. Each classification system is further subdivided into a number of tribes.

poacher, also called POGGE, or ALLIGATOR FISH, any of the marine fish of the family Agonidae (order Scorpaeniformes). Poachers live in cold water, on the bottom, and are found mainly in the northern Pacific. They are small fish, about 30 cm (12 inches) or less in length, and are distinguished by the bony, often saw-edged armour plates covering their bodies.

Notable species include the sturgeon poacher (*Agonus acipenserinus*), a large, common, northern Pacific poacher, and the hook-nose, pogge, or armed bullhead (*A. cataphractus*), a small fish, common in northern Europe and one of the few poachers found outside the Pacific. Little is known about the natural history of the poachers. The various species are of little commercial value to man.

poaching, in law, the shooting, trapping, or taking of game or fish from private property or from a place where such practices are specially reserved or forbidden.

Until the 20th century most poaching was subsistence poaching—*i.e.,* the taking of game or fish by impoverished peasants to augment a scanty diet. In medieval Europe feudal landowners from the king downward stringently enforced their exclusive rights to hunt and fish on the lands they owned, and poaching was a serious crime punishable by imprisonment. Large stretches of forested countryside were subject to special laws to preserve in them the deer, wild boars, and other beasts of the chase who provided the nobles and royalty with sport. With the cumulative destruction of forests over the centuries and the taking of communal or royally owned lands into private use, laws were passed in the 17th and 18th centuries restricting hunting and shooting rights on private property to the landowner and his sons, and the practice of hiring gamekeepers to protect the wildlife on one's own land became common. Given these obstacles, subsistence poaching necessarily became a more specialized activity; during the 18th and 19th centuries gangs of organized poachers frequently engaged in fierce battles against gamekeepers, and mantraps and spring guns were hidden in the underbrush to catch intruders.

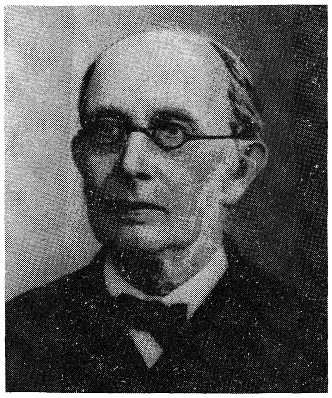
Present-day poaching is usually done for sport or commercial profit, but it can be a serious threat to many species of wild animals, particularly those protected in wildlife preserves or national parks. Many animal species have been limited in range or severely depleted in numbers, sometimes to the point of extinction, by the depredations of market hunters and unregulated sportsmen. In Africa the difficulty of enforcing game codes has led to the critical depletion of the rhinoceros, which is hunted for its horn. The Bengal tiger of India and the gorilla of central Africa have similarly been threatened with extinction by hunters operating illegally. River poaching has also been a problem in some countries, causing the depletion of stocks of fish in many areas.

Game management and other conservation programs throughout the world have been instituted to counteract the effects of poaching and other threats to wildlife, reinforced by the patrolling of game wardens to restrain poaching for commercial profit.

Poales, grass order of flowering plants, containing the family Poaceae (or Gramineae), economically the most important order of plants, with a worldwide distribution in all climates. *See* grass; Poaceae.

Pobedonostsev, Konstantin Petrovich (b. May 21, 1827, Moscow—d. March 23, 1907, St. Petersburg, Russia), Russian civil servant and conservative political philosopher, who served as tutor and adviser to the Russian emperors Alexander III and his son Nicholas II. Nicknamed the "Grand Inquisitor," he came to be the symbol of Russian monarchal absolutism.

The youngest son of a Russian Orthodox priest who was also professor of Russian literature at Moscow University, Pobedonostsev was educated at home and at the Oldenburg School of Law in St. Petersburg (now Leningrad), from 1841 to 1846. His adult life was devoted to service at the centre of the Russian state bureaucracy, beginning in the Moscow office of the senate. The publications he produced in his spare time there on the history of Russian civil law and institutions led to his being invited in 1859 also to lec-



Pobedonostsev
H: Roger-Viollet

ture on civil law in Moscow University. His courses were so distinguished in organization, learning, and clarity that in 1861 Alexander II asked him to serve also as a tutor to his sons during the time they spent in Moscow each year. At the same time, he was an important contributor to the 1864 reform of the Russian judicial system. In 1865 he accepted the tsar's invitation to leave Moscow University and the senate to serve as a tutor to the tsar's sons and their families in St. Petersburg. Gradually he turned against all the reforms of Alexander II, particularly that of the courts. His service as one of the tutors and closest advisers of Alexander III helped make the latter a most reactionary ruler. Pobedonostsev was appointed to the senate in 1868, to the council of state (a high advisory body) in 1872, and in 1880 to the director generalship, or chief administrative position, of the Most Holy Synod of the Russian Orthodox Church, a position he held until the fall of 1905. This post gave him immense power over domestic policy, particularly in matters affecting religion, education, and censorship.

Pobedonostsev considered man to be by nature "weak, vicious, worthless, and rebellious." He denounced the 18th-century Enlightenment view of the perfectibility of man and of society, and therefore strongly supported paternalistic and authoritarian government. He looked upon each nation as being based on the land, the family, and the national church, and he regarded the maintenance of stability as the principal purpose of government. He sought, therefore, to defend Russia and the Russian Orthodox Church against all rival religious groups, such as the Old Believers, Baptists, Catholics, and Jews. He also defended Russian rule over the various minority groups and supported their Russification. As lay head of the church, he promoted the rapid expansion of primary education in parish schools because he saw it, with its emphasis upon religion, as a strong bulwark of the autocracy. He sought to keep each person in that station in life into which he had been born and to restrict higher education to the upper classes and exceptionally talented. He tried also to prohibit and to banish all foreign influences, especially western European ideas concerning constitutional and democratic government. He was thus largely responsible for the government's repressive policies toward religious and ethnic minorities and toward Western-oriented liberal intellectuals.

Pobedonostsev had great influence in 1881, immediately after the assassination of Alexander II, when he persuaded Alexander III to reject the so-called Loris-Melikov constitution that was designed to bridge the gap between the government and the leading elements of society. He influenced the government's reactionary domestic policies throughout the rest of the 1880s but exercised little authority during the last 15 years of his life. His role, however, was exaggerated during his lifetime by critics of the regime and since then by historians, largely because his personality, appearance, and known views superbly qualified him as the symbol of a system of government deeply unpopular among many educated Russians and among all liberals and radicals.

Pobedonostsev was a childless, dry, reserved, and deeply pessimistic ascetic with almost no close friends, except for the novelist Dostoyevsky, who died in 1881. At the same time, he was a man of immense learning and scholarship who was widely respected among foreign diplomats. He read and spoke most European languages and was deeply familiar with the great body of European and American literature and philosophy—although he strongly supported censorship and tight controls for other Russians. Especially after 1890 he was convinced the regime would be overthrown by revolution. His deep hatred and fear of constitutional and democratic government, freedom of the press, religious freedom, trial by jury, and free secular education was best expressed in a collection of essays, *Moskovskyy sbornik,* published in 1896.

(R.F.B./Ed.)

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Pocahontas, personal name MATOAKA, Christian name REBECCA (b. *c.* 1595 [near future Jamestown, Va., U.S.]—d. March 1617, Gravesend, Kent, Eng.), Powhatan Indian woman who helped maintain peace between English colonists and native Americans by be-

Pocahontas, detail of a portrait by an unknown artist, 1616
By courtesy of the Library of Congress, Washington, D.C.

friending the settlers at Jamestown, Va., and eventually marrying one of them; dramatic accounts of her unusual role have immortalized her name in American folk history.

Daughter of the powerful intertribal leader Powhatan, Pocahontas was a young girl when she first became acquainted with the colonists who settled in the Chesapeake Bay area in 1607. The following year, according to a later account written by Capt. John Smith, founder and leader of the colony, she saved Smith's life after he had been captured by the tribe. Just as he laid his head on the sacrificial stone to await death, Pocahontas supposedly flung herself down and, embracing the captain's head, successfully implored her father to spare him.

After Smith returned to England in 1609, relations between the Virginians and Powhatan deteriorated. Capt. Samuel Argall therefore seized the opportunity to kidnap Pocahontas, hoping to use her to negotiate permanent peace. Treated with great respect and courtesy during her captivity, Pocahontas was converted to Christianity and was baptized Lady Rebecca. She was ransomed by her father but had in the meantime fallen in love with John Rolfe, a distinguished settler; both the Virginia governor, Sir Thomas Dale, and Chief Powhatan agreed to a marriage, and peace prevailed as long as Powhatan lived.

In 1616 Governor Dale, seeing in the adaptable and charming Indian princess a pleasing advertisement for the London Company of Virginia, took Pocahontas and her husband to England, where she was received at court and lionized by English society. About to embark for home, she contracted smallpox and died. Her only son, Thomas Rolfe, was educated in England and later migrated to Virginia, where he became a leading citizen.

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Pocatello, city, seat (1893) of Bannock County, southeastern Idaho, U.S., in the Portneuf Valley. Originally an intermontane stopover point on the Oregon Trail, it was settled in 1882 and named for a Bannock Indian chief who granted rights-of-way to the railroads. It grew slowly at first because of its location on the Fort Hall Indian Reservation. The opening of the reservation to settlement in 1902 provided impetus for development, and Pocatello became a prominent railway depot on the Union Pacific line between Omaha, Neb., and Portland, Ore. It progressed as a processing and distribution centre for an irrigated agricultural area, with trucking augmenting rail freight transportation. An Army air base reverted to a municipal airport after World War II, and the community expanded industrially with the acquisition in the 1940s of a large naval ordnance plant and a phosphate reduction works. In 1962 it annexed Alameda. The city is the seat of Idaho State University (established as the Academy of Idaho, 1901). It is the headquarters for the Caribou National Forest. Inc. village, 1889; city, 1893. Pop. (1985 est.) 47,937.

pochard, any of the 14 to 16 species of diving ducks of the tribe Aythyini (family Anatidae, order Anseriformes), often called bay ducks.

Pochards are round-bodied, big-headed, rather silent birds of deep water; they dive well, with closed wings, to feed chiefly on aquatic plants. All lack a metallic wing mark, but most species show some white in the wings. Drakes commonly are black or gray with red heads, hens are plain brown. The nest is either a scraped hollow or a mound of reeds, and the hen lays 7–17 buff or dark-greenish eggs. Along seacoasts and on the bigger lakes, where most species spend the winter, "rafts" of pochards are a familiar sight.

The common, or European, pochard (*Aythya ferina*) breeds along northern reedy lakes; some winter in Egypt, India, and southern China. The drake of the red-crested pochard (*Netta rufina*) has a puffy yellowish-red head with fuzzy erectile crown feathers, black throat and breast, and white sides. This is a more southerly species of inland waters. Mahogany-coloured relatives are the pochards of South America and Africa (*N. erythrophthalma*).

The canvasback (*Aythya valisineria*) is a mallard-sized North American pochard, red-headed and black-breasted with its back and sides white, finely penciled with gray (like canvas). The redhead (*A. americana*) of North America resembles the common pochard of Europe but is larger and darker. Its round-headed, short-billed profile distinguishes it from the similarly coloured canvasback. Hunters call redheads "fool ducks" because they can be lured with decoys so easily. Scaups, or bluebills, are smaller than mallards. In the greater scaup (*A. marila*), a white stripe extends nearly to the wing tip; in the lesser scaup (*A. affinis*), the wing stripe is about half as long. Scaups gather in huge flocks offshore in winter and dive for shellfish (hence "scaup," from "scallop").

Poch'ŏngyo (Korean: "Universal Religion"), indigenous Korean religion, also popularly called Humch'igyo from the distinctive practice of chanting *humch'i,* a word said to have mystical significance.

Poch'ŏngyo was founded by Kang Il-sun (1871–1909), who initially gained a following by offering to cure illnesses through incantations and by medicine. The Japanese rulers of Korea, fearful that Poch'ŏngyo was an underground political movement, so restricted Kang's activities that only a weak organization was established before his death. Leadership of the religion was subsequently assumed by Cha' Kyŏng-sŏk, an early associate of Kang. During the March 1 independence movement of 1919, Cha' and 30,000 of the religion's adherents were imprisoned by the Japanese. Cha' escaped two years later and established Pohwagyo ("Religion of Universal Enlightenment"), which was registered with the government the following year as Poch'ŏngyo.

The religion's belief centres on Okhwang-sangje, or "Great Lord of Okhwang (Heaven)." Poch'ŏngyo professes the four principles of one mind, coexistence, forgiveness, and conquest of disease. By practicing one mind, adherents are led to God through the unity of mind and body and thus conquer disease. By dissolving divine and human anger, coexistence and forgiveness prevail. Confucianism later influenced Cha's espousal of benevolence and righteousness and his four principles: respect for heaven, bright virtue, proper conduct, and love of mankind.

The religion's incantations are said to induce trembling and to produce a trancelike sense of selflessness. More recently, meditation on the Tao ("Way") has been emphasized as the path to self-enlightenment and as an effective means of inducing a state of selfless trance, which is the highest of all goals. To this end, group sessions are held once a year. Adherents pay reverence to a tablet of Okhwang every morning and evening by offering fresh water, burning incense, lighting a candle, and bowing four times. Temple services have more elaborate rituals.

pocket billiards, also called POOL, a billiards game, most popular in the United States and Canada, played with a white cue ball and 15 consecutively numbered coloured balls on a rectangular table with six pockets (one at each corner and one at the midpoints of both longer sides). The dimensions of the table are usually 4 by 8 feet (122 by 244 cm) or 4½ by 9 feet (137 by 274 cm).

To begin play, the 15 object balls are arranged (racked) in a pyramid formation with its apex on a spot near the foot of the table. The first player then stands at the head of the table and drives the cue ball into the formation to break it apart. To continue play, he is usually required either to pocket a ball or to drive two object balls in addition to the cue ball against the cushions. When a player fails to pocket a ball, his opponent begins play. The first player or side to pocket eight balls wins the round.

After the break (first) shot, a player must designate (call) the ball that he intends to pocket, although in this form of the game he need not indicate the pocket into which the ball will go. If the ball called is pocketed, any other balls pocketed on that stroke are also credited to the player. If the ball called is not pocketed, any other balls pocketed on that shot are replaced on the table on the spot where the rack is made or, if more than one ball is replaced, in a line from that spot; the player then loses his turn.

Penalties of one ball replaced on the table in addition to those pocketed on the foul stroke are assessed for such infractions as failure to comply with rules for the break shot; touching the cue ball twice with the cue on the same stroke; pocketing the cue ball ("scratching") or knocking it off the table; and failing either to pocket a ball, to drive an object ball to a cushion, or to drive the cue ball to a cushion after contacting an object ball. For a double foul on a single stroke, only one penalty is assessed. *See* Sporting Record: *Billiards.*

pocket borough, election district that is controlled by, or "in the pocket" of, one person or family. The term was used by 19th-century English parliamentary reformers to describe the many boroughs in which a relatively small population was either bribed or coerced by the leading family or landowners to elect their representatives to Parliament. As a result, Parliament was controlled by the landed gentry and seats were filled by representatives who wanted to please their patrons rather than their constituents. Reforms passed in 1832 and 1867 ended this practice by widening the franchise and redistributing parliamentary seats to reflect the population shift from rural areas to the industrial towns.

pocket gopher: *see* gopher.

pocket mouse (*Perognathus*), any of about 30 species of small North American rodents, belonging to the family Heteromyidae (order Rodentia), characterized by fur-lined, external cheek pouches that open alongside the mouth. Pocket mice are pale yellowish brown to dark gray in colour, and they measure 6 to 13 cm (about 2½ to 5 inches) long, excluding a tail of about the same length. They are nocturnal and usually solitary and are found in dry and desert regions. They carry food (mainly seeds) in their cheek pouches and store it in their burrows. They breed in spring and summer, the female bearing one or more litters of about four young.

Spiny pocket mice (*Liomys* and *Heteromys*), also of the family Heteromyidae, are harsh-furred, gray, brown, or black rodents found from Mexico through Central America. They are nocturnal burrowers and are inhabitants of wet, forested regions as well as of dry or desert country.

pocketbook flower: *see* slipper flower.

Pocock, Lena Margaret (English actress): *see* Ashwell, Lena (Margaret).

Pocomam, also spelled POKOMAM, Mayan Indians of the highlands of eastern Guatemala. The Pocomam are primarily agriculturists; they cultivate corn (maize) and beans and manufacture pottery and charcoal. Houses are built of poles or adobe, with thatch, tile, or tin roofs. The houses are scattered over the countryside, with little congregation even around a church or town hall; territory is divided into cantons, which act as administrative districts and social barriers.

The Pocomam practice ritual kinship involving the choosing of godparents for children at baptism, marriage, or other major occasions. Young unmarried men also enter into ritual friendships called *camaradería.* There is a rigid class system, status being based on age and wealth. The Pocomam adhere to an admixture of Roman Catholicism, pagan mythology, and belief in sacred places and sacred objects.

Poços de Caldas, city, southern Minas Gerais state, Brazil. It lies along a stream called Poços de Caldas, near the Pardo River. Known principally for its thermal baths, the city has resort hotels and casinos. The local soils are rich in minerals and yield thorium, zirconium, and bauxite, which is converted into aluminum there. The city has Brazil's first uranium-ore concentration plant, for use in the Angra I nuclear power facility in Angra dos Reis. Poços de Caldas is accessible by air from São Paulo, Belo Horizonte, and other cities. Pop. (1980 prelim.) 81,448.

pod (botany): *see* legume.

podesta, Italian PODESTÀ, or POTESTÀ ("power"), in medieval Italian communes, the highest judicial and military magistrate. The office was instituted by the emperor Frederick I Barbarossa in an attempt to govern rebellious Lombard cities. From the end of the 12th century the communes became somewhat more independent of the emperor, and they began to elect their own podesta, who gradually superseded the collegiate government of consuls. The podesta was usually a nobleman with legal training. He was selected from another city to ensure his neutrality in local disputes. Though the office was subject to strict statutory limitations, it sometimes served as a starting point for the establishment of a despotic government, or signoria. After the 13th century the office declined in importance; in 15th-century Florence its principal functions were judicial.

Podesta was the title of mayors in the Austrian territories of Italy from 1815 to 1918 and of mayors appointed by the Italian government during the Fascist regime.

Podgorica (Yugoslavia): *see* Titograd.

Podgorny, Nikolay Viktorovich (b. Feb. 18 [Feb. 5, Old Style], 1903, Karlovka, Ukraine, Russian Empire—d. Jan. 12, 1983, Moscow), Soviet statesman and Communist Party official.

As a youth, Podgorny served as secretary in his district's Komsomol committee. He attended Kiev Technological Institute for the Food Industry, graduating in 1931 and subsequently working in engineering jobs in the sugar industry. Podgorny's first government appointment came in 1939, as deputy people's commissar of the food-processing industry in the Ukraine; he was promoted in 1940 to deputy commissar of the Soviet food-processing industry. His first important Communist Party appointment was as first secretary of the Kharkov regional party committee (1950–53), and he soon rose to first secretary of the Ukraine party committee (1957–63). He became a full member of the Politburo in 1960, and he was later promoted to secretary of the Central Committee of the Communist Party of the Soviet Union (1963–65).

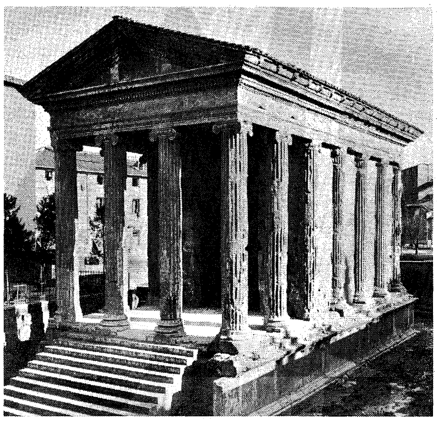
Podgorny became involved in a power struggle with Leonid Brezhnev, who had become party first secretary in 1964. The apparent loser, Podgorny relinquished his secretaryship in 1965 and was given the less-influential post of chairman of the Presidium of the Supreme Soviet from 1965 to 1977. Podgorny enhanced his position of ceremonial head of state and traveled widely, but real power was in the hands of Brezhnev, general secretary of the Communist Party. On May 24, 1977, as a result of his resistance to Brezhnev's wish to hold both the party secretaryship and the Presidium chairmanship, Podgorny was ousted from the Politburo and "relieved" of his duties as chairman of the Presidium, with Brezhnev assuming the latter title. Thereafter Podgorny lived in retirement in Moscow.

podiatry, also called CHIROPODY, medical specialty dealing with the diagnosis and treatment of diseases and disorders of the human foot. The ancient Egyptian Ebers medical papyrus (*c.* 1500 BC) records some of the earliest remedies for foot problems, and other references to foot treatment are found in the medical literature of most succeeding centuries. The word *chiropody* derives from the first modern work that was primarily devoted to the medical care of the foot, a 1774 treatise by D. Low of London entitled *Chiropodologia.* Doctors specializing in foot care appeared in England in the late 18th century, and itinerant "corn cutters" became a fixture of North American rural life during the 19th century. The National Association of Chiropodists was founded in the United States in 1912 and was renamed the American Podiatry Association in 1958. The term *podiatry* was coined by M.J. Lewi of New York in 1917.

Podiatrists diagnose and treat the diseases, disabilities, and deformities of the foot by physical therapy, special shoes and other mechanical devices, pharmaceuticals, and minor surgery. After a prerequisite of at least two years of college education, the podiatry student must usually complete a four-year educational curriculum that embraces the fundamental medical sciences with an emphasis on their application to the human foot.

podicipediform: *see* grebe.

podium, in architecture, term referring to various structural elements, namely a raised pedestal or base; a low wall supporting columns; or the structurally or decoratively emphasized lowest portion of a wall. Sometimes the basement story of a building may be treated as a podium. The podium is usually designed with a modeled base and plinth at the bottom; a central surface known as a die, or dado; and a projecting cornice, or cap. Major Roman examples can be seen in the Maison Carrée (*c.* 12 BC) in Nîmes, Fr., and the Temple of Fortuna Virilis (*c.* 40 BC) in the Forum Boarium at Rome.



Podium upon which the Temple of Fortuna Virilis stands, in the Forum Boarium, Rome, *c.* 40 BC
Anderson—Alinari from Art Resource/EB Inc.

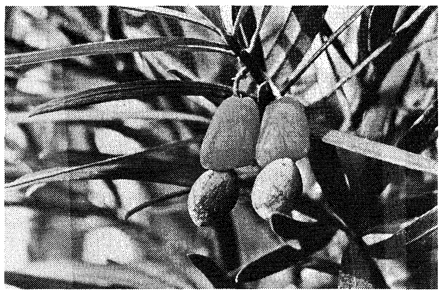
The term podium is also applied to raised platforms in general, especially those used by orchestra conductors and lecturers.

Podkamennaya Tunguska River, also spelled PODKAMENNAJA TUNGUSKA, English STONY TUNGUSKA, also called SREDNYAYA TUNGUSKA, tributary of the Yenisey River in Western Siberia, Irkutsk *oblast* (administrative region), Russian S.F.S.R. It has a total length of 1,159 miles (1,865 km) and a drainage basin of 96,100 square miles (249,000 square km). Known in its upper section as the Katanga, it rises on the Central Siberian Plateau near the watershed with the Lena–Angara system and flows generally northwestward to join the Yenisey at Podkamennaya Tunguska village. Its upper part has a wide, swampy valley; its lower section has numerous falls and rapids. The river is navigable for 710 miles (1,140 km) to the village of Vanavara.

Podluží, agricultural and cultural area of southeastern Jihomoravský *kraj* (region), Czech Socialist Republic. It is situated along the borders of Austria and the Slovak Socialist Republic, in south-central Czechoslovakia. Located in the lower Morava River Valley, Podluží's rich soils and warm climate support wheat, barley, corn (maize), sugar beets, and vegetable cultivation, and the area is noted for its vineyards. Small oil and natural-gas fields were found in the 1960s; and brown-coal (lignite) extraction began in the early 1980s at Mikulčice. Industry, centred in the main cities of Břeclav and Hodonín, consists of oil refining and the production of synthetic rubber, petrochemicals, machinery, textiles, and brick. There is woodworking, and food processing includes sugar refining, dairy products, and wine, slivovice (a plum brandy), and beer production. Mikulov and Valtice are wine centres. In Mikulov, the Dietrichstein Castle has a noted wine cellar with one of Europe's largest wine tuns, made in 1643 and holding 26,400 gallons (99,932 l).

Podluží's population is mixed Czech (Moravian) and Slovak but speaks a dialect closest to Slovak. Podluží has two noted archaeological sites: Mikulčice, where a 9th-century Slavic settlement was excavated in 1957, and Dolní Věstonice, where a prehistoric site has been excavated, yielding the renowned Věstonice Venus, a clay and ash female figurine dated *c.* 20,000 BC. The Moravian Slovak Museum in Uherské Hradiště has exhibits with artifacts from the two sites, as well as costumes and folk art of the Podluží area.

Podocarpaceae, family of seven genera in the conifer order (Coniferales), containing over 125 species of ornamental and timber evergreen trees and shrubs, distributed mainly in the Southern Hemisphere. The largest genus, *Podocarpus,* contains more than 100 species, commonly called yellowwood, found throughout Australasia, Africa, and South America. *Dacrydium* has about 20 species of Australasian trees and shrubs, including the Huon pine, or Macquarie pine (*D. franklinii*), and the rimu, or New Zealand red pine. The celery-top pine is the best-known of the six species of Australasian trees and shrubs in the genus *Phyllocladus.* The Prince Albert yew, a timber tree native to South America, is the only species in the genus *Saxegothaea.*



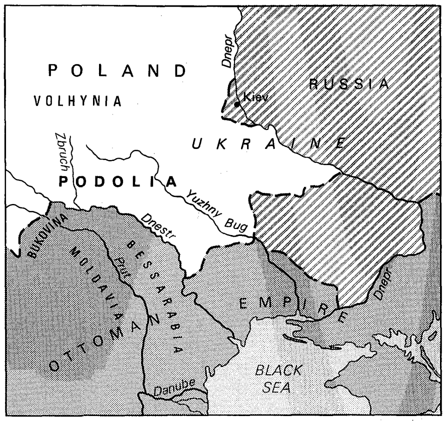
Podocarpus
W.H. Hodge

Podokesaurus, very small carnivorous dinosaur found as fossils in Late Triassic rocks of North America (the Triassic Period began 225,000,000 years ago and lasted 35,000,000 years). *Podokesaurus,* representative of the coelurosaurs, was about 1.5 m (5 feet) long and was very light. *Coelophysis,* a very slender relative, was about 2.5 m (8 feet) long and weighed 18 to 23 kg (40 to 50 pounds).

The skull of the coelurosaur was small, the eyes large, and the neck long and slender. In general, the coelurosaurs were primitive bipeds probably capable of rapid movement. *Podokesaurus* and the other coelurosaurs were active predators; it is possible that they fed on other small reptiles and the very early mammals. This group is well-representative of the basal stock from which the sauropod dinosaurs evolved; clear relationships are evident in the structure of the pelvis.

Podolia, western Ukrainian region, south of Volhynia and extending between the rivers

Dnestr and southern Bug. The name Podolia appeared in the 14th century when the Poles began to colonize the area. Except for a period



Podolia in the 18th century

in the late 17th century when it was held by the Ottoman Turks, it was under Polish rule until 1772. Then the part west of the Zbruch River became Austrian; the rest became the Podolian *guberniya* (province) in Russia in 1793. After World War I the region continued to be divided at the Zbruch, between Poland and the U.S.S.R. After World War II it was entirely incorporated into the U.S.S.R. and divided among the *oblasti* (provinces) of Ternopol (Tarnopol), Khmelnitski, and Vinnitsa.

Podolsk, city, Moscow *oblast* (province), western Russian Soviet Federated Socialist Republic, south of Moscow on the Pakhra River, a tributary of the Moskva. The village of Podol, created a town in 1781, owed its development to its position on a main highway and, after the 1860s, on a railway running south from Moscow. It has engineering, nonferrous-metallurgical, cement, and food-processing industries. Pop. (1989 prelim.) 210,000.

Podostemales, riverweed order of dicotyledonous flowering plants comprising the family Podostemaceae, with 45 genera of aquatic plants that look like mosses, liverworts, algae, and even lichens and live on rocks in rushing rivers and waterfalls. Many species lack both stems and leaves; photosynthesis takes place instead in a highly modified, ribbonlike thallus (vegetative plant body) upon which flowering and leaf-bearing secondary shoots sometimes develop. The juice of many species is milky. Few species are found outside the tropics and subtropics. One representative, the riverweed (*Podostemum ceratophyllum*), grows in shallow streams from western Quebec southward to Georgia and Arkansas.

Flowers are produced only after the plants are exposed to the air for a specific period as a result of a drop in water level. After the seeds mature they are shed on the rocks during the dry season, and they germinate when the wet season returns. The seeds of many are sticky and adhere to the rocks and to the feet of birds, by which means they are distributed to new habitats. The petalless flowers, which are bisexual, are solitary or occur in clusters, are very tiny, and stand on a relatively long stalk inside a cuplike sheath. The stamens (male pollen-producing parts) are usually one to four in number and are all on one side of the flower. The ovary is two- or three-chambered with a like number of styles (prolonged pollen-receptive upper parts of the ovary), and there are many ovules in each chamber. The fruits are many-seeded capsules.

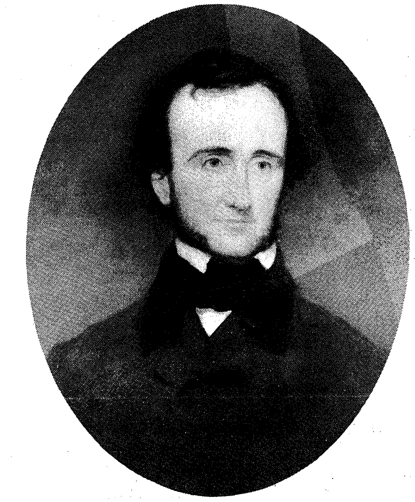
The principal genera are *Apinagia* (50 species, tropical South America), *Inversodicraea* (35 species, tropical Africa and Madagascar), *Rhyncholacis* (25 species, northern tropical South America), *Marathrum* (25 species, Central America and northwestern tropical South America), *Podostemum* (17 species, worldwide tropics and subtropics), *Dicraea* (12 species, tropics of Asia and Africa), *Castelnavia* (9 species, Brazil), *Mourera* (6 species, northern tropical South America), *Oserya* (6 species, Mexico to northern tropical South America), and *Hydrobryum* (3 species, eastern Nepal, Assam, and southern Japan). Most of the remaining 35 genera have only one or 2 species each. The order is considered to have evolved from an ancestor in the stonecrop family (Crassulaceae) of the order Saxifragales.

podzol, also spelled PODSOL, also called PODZOL SOIL, or PODSOL SOIL, soil that typically forms in very cold climates under coniferous forests, heaths, or tundra. The humus formed is very rich in slightly polymerized substances (*e.g.,* fulvic acid), which descend through the soil, form complexes with the clay minerals and iron, and leach out all the weathering products—*i.e.,* bases, iron, alumina (aluminum oxide), and silica (silicon dioxide). Podzols are characterized by one or more of the following horizons (layers): a bleached horizon that resembles ash; a spodic horizon, one formed by the accumulation (illuviation) of clay or organic matter, or both, which is transported by water and which, because it is rich in amorphous clay (allophane), iron, and organic matter, has a high cation-exchange capacity (ability of a charged metal atom in the structure to exchange places with another in aqueous solution); a horizon in which the soil grains are coated with organic matter and bound together; and hard horizons (pans) cemented together by organic matter or iron and resistant to breakdown in water. *See also* podzolic soil.

podzolic soil, podzolic also spelled PODSOLIC, also called LESSIVÉ SOIL, soil usually forming in a broadleaf forest and characterized by moderate leaching, which produces an accumulation of clay and, to some degree, iron that have been transported (eluviated) from another area by water. The humus formed produces a textural horizon (layer) that is less than 50 cm (20 inches) from the surface. Podzolic soils may have laterite (a soil layer cemented together by iron) in place of the humic horizon or along with it. A podzolic soil may be distinguished from a podzol (*q.v.*) because the main effect of the humic acid in podzolic soils is clay eluviation, whereas in podzols it is iron eluviation or the leaching of all weathering products, or both, which leaves a bleached, ashy horizon.

Poe, Edgar Allan (b. Jan. 19, 1809, Boston, Mass., U.S.—d. Oct. 7, 1849, Baltimore, Md.), American poet, critic, and short-story writer famous for his cultivation of mystery and the macabre in fiction, illustrated in such pieces as "The Murders in the Rue Morgue" (1841) and "The Raven" (1845).

Life. Poe was the son of the English-born actress Elizabeth Arnold Poe and David Poe, Jr., an actor from Baltimore. After his mother died in Richmond, Va., in 1811, he was taken into the home of John Allan, a Richmond merchant (presumably his godfather) and of his childless wife. He was taken to Scotland and England (1815–20), where he was given a classical education that was continued in Richmond. For 11 months in 1826 he attended the University of Virginia, where he studied Greek, Latin, French, Spanish, and Italian; but his gambling losses at the university so incensed his guardian that he refused to let him continue, and Poe returned to Richmond to find his sweetheart, (Sarah) Elmira Royster, engaged. He went to Boston, where in 1827 he published a pamphlet of youthful Byronic poems, *Tamerlane, and Other Poems,* some of which allude to Elmira. Poverty forced him to join the army under the name of Edgar A. Perry, but on the death of Poe's foster mother, John Allan purchased his release from the army and helped in getting him an appointment to the U.S. Military Academy at West Point. Before going, Poe published a new volume at Baltimore, *Al Aaraaf, Tamerlane, and Minor Poems* (1829), showing the influence of the English poet John Milton and the Irish poet Thomas Moore, as well as of a local Maryland poet, Edward Coote Pinkney. He successfully sought expulsion from the academy, where he was absent from all drills and classes for a week. He proceeded to New York City and brought out a volume of *Poems,* containing several masterpieces, some showing the influence of John Keats, Percy Bysshe Shelley, and Samuel Taylor Coleridge. He then returned to Baltimore, where he began to write stories. In 1833 his "MS. Found in a Bottle" won $50 from a Baltimore weekly, and by 1835 he was in Richmond as editor of the *Southern Literary Messenger.* There he


Poe, oil portrait by S.S. Osgood, 1845
By courtesy of The New-York Historical Society

made a name as a critical reviewer and married his young cousin Virginia Clemm, who was only 13. Poe seems to have been an affectionate husband and son-in-law. He wrote a tribute "To My Mother" to his aunt, Mrs. Clemm, in 1849.

Poe was dismissed from his job in Richmond, apparently for drinking, and went to New York City. Drinking was in fact to be the bane of his life. To talk well in a large company he needed a slight stimulant, but a glass of sherry might start him on a spree; and, although he rarely succumbed to intoxication, he was often seen in public when he did. This gave rise to the conjecture that Poe was a drug addict, but according to medical testimony he had a brain lesion. While in New York City in 1838 he published a long prose narrative, *The Narrative of Arthur Gordon Pym,* combining (as so often in his tales) much factual material with the wildest fancies. It is considered one inspiration of Herman Melville's *Moby Dick.* In 1839 he became coeditor of *Burton's Gentleman's Magazine* in Philadelphia. There a contract for a monthly feature stimulated him to write "William Wilson" and "The Fall of the House of Usher," stories of supernatural horror. The latter contains a study of a neurotic now known to have been an acquaintance of Poe, not Poe himself.

Later in 1839 his *Tales of the Grotesque and Arabesque* appeared (dated 1840). He resigned from *Burton's* about June 1840 but returned in 1841 to edit its successor, *Graham's Lady's and Gentleman's Magazine,* in which he printed the first detective story, "The Murders in the Rue Morgue." In 1843 his "The Gold

Bug" won a prize of $100 from the Philadelphia *Dollar Newspaper,* which gave him great publicity. In 1844 he returned to New York, wrote the "Balloon Hoax" for the *Sun,* and became subeditor of the *New York Mirror* under N.P. Willis, thereafter a lifelong friend. In the *New York Mirror* of Jan. 29, 1845, appeared, from advance sheets of the *American Review,* his most famous poem, "The Raven," which gave him national fame at once. Poe then became editor of the *Broadway Journal,* a short-lived weekly, in which he republished most of his short stories, in 1845. During this last year the now forgotten poet Frances Sargent Locke Osgood pursued Poe. Virginia did not object, but "Fanny's" indiscreet writings about her literary love caused great scandal. His *The Raven and Other Poems* and a selection of his *Tales* came out in 1845, and in 1846 Poe moved to a cottage at Fordham (now part of New York City), where he wrote for *Godey's Lady's Book* (May–October 1846) "Literati of New York"—gossipy sketches on personalities of the day, which led to a libel suit.

His wife, Virginia, died in January 1847. The following year Poe went to Providence, R.I., to woo Sarah Helen Whitman, a poet. There was a brief engagement. Poe had close but platonic entanglements with Annie Richmond and with Sarah Anna Lewis, who helped him financially. He composed poetic tributes to all of them. In 1848 he also published the lecture "Eureka," a transcendental "explanation" of the universe, which has been hailed as a masterpiece by some critics and as nonsense by others. In 1849 he went south, had a wild spree in Philadelphia, but got safely to Richmond, where he finally became engaged to Elmira Royster, by then the widowed Mrs. Shelton, and spent a happy summer with only one or two relapses. He enjoyed the companionship of childhood friends and an unromantic friendship with a young poet, Susan Archer Talley.

Poe had some forebodings of death when he left Richmond for Baltimore late in September. There, after toasting a lady at her birthday party, he began to drink heavily. The indulgence proved fatal, for Poe had a weak heart. He was buried in Westminister Presbyterian churchyard in Baltimore.

Appraisal. Poe's work owes much to the concern of Romanticism with the occult and the satanic. It owes much also to his own feverish dreams, to which he applied a rare faculty of shaping plausible fabrics out of impalpable materials. With an air of objectivity and spontaneity, his productions are closely dependent on his own powers of imagination and an elaborate technique. His keen and sound judgment as appraiser of contemporary literature, his idealism and musical gift as a poet, his dramatic art as a storyteller, considerably appreciated in his lifetime, secured him a prominent place among universally known men of letters.

The outstanding fact in Poe's character is a strange duality. The wide divergence of contemporary judgments on the man seems almost to point to the coexistence of two persons in him. With those he loved he was gentle and devoted. Others, who were the butt of his sharp criticism, found him irritable and self-centred and went so far as to accuse him of lack of principle. Was it, it has been asked, a double of the man rising from harrowing nightmares or from the haggard inner vision of dark crimes or from appalling graveyard fantasies that loomed in Poe's unstable being?

Much of Poe's best work is concerned with terror and sadness, but in ordinary circumstances the poet was a pleasant companion. He talked brilliantly, chiefly of literature, and read his own poetry and that of others in a voice of surpassing beauty. He admired Shakespeare and Alexander Pope. He had a sense of humour, apologizing to a visitor for not keeping a pet raven. If the mind of Poe is considered, the duality is still more striking. On one side, he was an idealist and a visionary. His yearning for the ideal was both of the heart and of the imagination. His sensitiveness to the beauty and sweetness of women inspired his most touching lyrics ("To Helen," "Annabel Lee," "Eulalie," "To One in Paradise") and the full-toned prose hymns to beauty and love in "Ligeia" and "Eleonora." In "Israfel" his imagination carried him away from the material world into a dreamland. This Pythian mood was especially characteristic of the later years of his life.

More generally, in such verses as "The Valley of Unrest," "Lenore," "The Raven," "For Annie," and "Ulalume" and in his prose tales his familiar mode of evasion from the universe of common experience was through eerie thoughts, impulses, or fears. From these materials he drew the startling effects of his tales of death ("The Fall of the House of Usher," "The Masque of the Red Death," "The Facts in the Case of M. Valdemar," "The Premature Burial," "The Oval Portrait," "Shadow"), his tales of wickedness and crime ("Berenice," "The Black Cat," "William Wilson," "Imp of the Perverse," "The Cask of Amontillado," "The Tell-Tale Heart"), his tales of survival after dissolution ("Ligeia," "Morella," "Metzengerstein"), and his tales of fatality ("The Assignation," "The Man of the Crowd"). Even when he does not hurl his characters into the clutch of mysterious forces or onto the untrodden paths of the beyond, he uses the anguish of imminent death as the means of causing the nerves to quiver ("The Pit and the Pendulum"), and his grotesque invention deals with corpses and decay in an uncanny play with the aftermath of death.

On the other side, Poe is conspicuous for a close observation of minute details, as in the long narratives and in many of the descriptions that introduce the tales or constitute their settings. Closely connected with this is his power of ratiocination. He prided himself on his logic and carefully handled this real accomplishment so as to impress the public with his possessing still more of it than he had; hence the would-be feats of thought reading, problem unravelling, and cryptography that he attributed to his Legrand and Dupin. This suggested to him the analytical tales, which created the detective story, and his science fiction tales.

The same duality is evinced in his art. He was capable of writing angelic or weird poetry, with a supreme sense of rhythm and word appeal, or prose of sumptuous beauty and suggestiveness, with the apparent abandon of compelling inspiration; yet he would write down a problem of morbid psychology or the outlines of an unrelenting plot in a hard and dry style. In Poe's masterpieces the double contents of his temper, of his mind, and of his art are fused into a oneness of tone, structure, and movement, the more effective, perhaps, as it is compounded of various elements.

As a critic, Poe laid great stress upon correctness of language, metre, and structure. He formulated rules for the short story, in which he sought for the ancient unities: *i.e.,* the short story should relate a complete action and take place within one day in one place. To these unities he added that of mood or effect. He was not extreme in these views, however. He praised longer works and sometimes thought allegories and morals admirable if not crudely presented. Poe admired originality, often in work very different from his own, and was sometimes an unexpectedly generous critic of decidedly minor writers.

Poe's genius was early recognized abroad. No one did more to persuade the world and, in the long run, the United States, of Poe's greatness than the French poets Charles Baudelaire and Stéphane Mallarmé. Indeed his role in French literature was that of a poetic master model and guide to criticism. French Symbolism relied on his "Philosophy of Composition," borrowed from his imagery, and used his examples to generate the modern theory of "pure poetry." (C.Ce./T.O.M./J.Ba.)

MAJOR WORKS. *Poems. Tamerlane and Other Poems* (1827); *Al Aaraaf, Tamerlane, and Minor Poems* (1829); *Poems by Edgar Allan Poe* (1831); *The Raven and Other Poems* (1845); "Ulalume" (1847); "Annabel Lee" (1849); "The Bells" (1849).

Short stories. Tales of the Grotesque and Arabesque (1840); *The Prose Romances of Edgar A. Poe* (1843), includes "The Murders in the Rue Morgue" and "The Man That Was Used Up"; *Tales* (1845), includes "The Fall of the House of Usher," "The Mystery of Marie Roget," "The Gold Bug," "The Black Cat," and "The Purloined Letter"; "The Masque of the Red Death" (1842); "The Pit and the Pendulum" (1843); "The Tell-Tale Heart" (1843); "The Premature Burial" (1844); "The Cask of Amontillado" (1846).

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Psychoanalytic. Joseph Wood Krutch, *Edgar Allan Poe: A Study in Genius* (1926); John W. Robertson, *Edgar Allan Poe: A Psychopathic Study* (1922); David M. Rein, *Edgar Allan Poe: The Inner Pattern* (1960); Marie Bonaparte, *Edgar Poe, étude psychoanalytique,* 2 vol. (1933; *The Life and Works of Edgar Allan Poe,* with an introduction by Sigmund Freud, 1949), often farfetched in its interpretations.

Poel, William, original name WILLIAM POLE (b. July 22, 1852, London—d. Dec. 13, 1934, London), English actor, theatre manager, and producer who revolutionized modern Shakespearean production by returning to Elizabethan staging.

As a child, Poel was reared among the Pre-Raphaelite artists and early decided to go on the stage. After working as an actor, stage manager, and theatre manager, he founded the Elizabethan Stage Society (1894–1905), which demonstrated the importance of the theatrical conditions under which Shakespeare wrote. Using largely amateur casts, no scenery, and an Elizabethan open-platform stage, Poel's productions were distinguished by swift and musical speech, continuity of action in nonlocalized scenes, fidelity to Shakespeare's words, and a more intimate relationship between the actors and the audience. Poel's staging methods were perhaps the single most important influence on what became the accepted approach to Shakespearean production in the 20th century. At the Elizabethan State Society, Poel revived works by Christopher Marlowe, Ben Jonson, and Beaumont and Fletcher, in addition to presenting Shakespeare's plays.

Poelzig, Hans (b. April 30, 1869, Berlin—d. June 14, 1936, Berlin), German architect who is remembered for his Grosses Schauspielhaus

Poelzig, 1932
Bavaria-Verlag

(1919), an auditorium in Berlin that is one of the finest architectural examples of German Expressionism.

Poelzig taught at the Breslau Art Academy (1900–16) and the Technical Academy in Berlin (1920–35). His Luban Chemical Factory, situated near Posen, and office building at Breslau (both 1911–12) contained novel elements, but nothing suggesting the imagination evident in his Grosses Schauspielhaus. This structure, a rebuilding of the Schumann Circus, has as its most notable feature an interior lined with stalactite shapes that, particularly under changing lighting conditions, create a grottolike atmosphere. Poelzig's later works, such as the administrative building of I.G. Farben in Frankfurt am Main (1930), although monumental in design, are held to be conventional.

Poema de Mio Cid (Spanish epic): *see* Cantar de Mio Cid.

Poerio, Carlo (b. Oct. 13, 1803, Naples—d. April 28, 1867, Florence), Italian revolutionary, distinguished for his services to liberalism during the Risorgimento.

The son of the Neapolitan lawyer and liberal Baron Giuseppe Poerio and the brother of the poet and soldier Alessandro Poerio, Carlo shared in the exiles of his family from Naples by the Bourbons; and, when he returned to Naples in 1833, he was an object of constant suspicion, though he was careful to play no part in politics. He was arrested in 1837, 1844, and 1847. In the Revolution of 1848 he helped to formulate the demands of the constitutionalists and then became at first director of police and afterward minister of education in the Liberal government. After his resignation in May 1848 he led the constitutional opposition. He was again arrested in July 1849 but was not tried until February 1851, when he was sentenced with his fellow Liberals to 24 years in irons. The illegality of the trials, the atrocious sentences, and the sufferings of the prisoners horrified the visiting English politician William Ewart Gladstone, who denounced the conditions of the Neapolitan prisons in his two *Letters to Lord Aberdeen* (July 1851) and so made Poerio's case notorious throughout Europe. Poerio was not released until January 1859 and then made his way to London.

After the outbreak of war between Sardinia–Piedmont and Austria, he went to Turin. He served as a deputy in the Parliament of the new Kingdom of Italy (1861) but later refused a governmental portfolio.

poet laureate, title first granted in England for poetic excellence. Its holder is a salaried member of the British royal household, but the post has come to be free of specific poetic duties.

The office is remarkable for its continuity. It began with a pension granted to Ben Jonson by James I in 1616, confirmed and increased by Charles I in 1630 (when an annual "butt of canary wine" was added, to be discontinued at the request of Henry James Pye—made laureate in 1790—who preferred the equivalent in money). Jonson's pension specifically recognized his services to the crown as a poet and envisaged their continuance, but not until 16 months after Jonson's death in 1637 was a similar pension for similar services granted to Sir William Davenant. It was with John Dryden's appointment in 1668, within a week of Davenant's death, that the laureateship was recognized as an established royal office to be filled automatically when vacant.

At the Revolution of 1688, Dryden was dismissed for refusing the oath of allegiance, and this gave the appointment a political flavour, which it retained for more than 200 years. Dryden's successor, Thomas Shadwell, inaugurated the custom of producing New Year and birthday odes; this hardened into a tradition between 1690 and about 1820, becoming the principal mark of the office. The odes were set to music and performed in the sovereign's presence. On his appointment in 1813, Robert Southey sought unsuccessfully to end this custom, but, although it was allowed tacitly to lapse, it was only finally abolished by Queen Victoria. Her appointment of William Wordsworth in 1843 signified that the laureateship had become the reward for eminence in poetry, and the office since then has carried no specific duties. The laureates from Alfred Tennyson onward have written poems for royal and national occasions as the spirit has moved them.

The list of poets laureate (with dates of tenure) follows: John Dryden (1668–89), Thomas Shadwell (1689–92), Nahum Tate (1692–1715), Nicholas Rowe (1715–18), Laurence Eusden (1718–30), Colley Cibber (1730–57), William Whitehead (1757–85), Thomas Warton (1785–90), Henry James Pye (1790–1813), Robert Southey (1813–43), William Wordsworth (1843–50), Alfred Tennyson (1850–92), Alfred Austin (1896–1913), Robert Bridges (1913–30), John Masefield (1930–67), C. Day-Lewis (1968–72), Sir John Betjeman (1972–84), and Ted Hughes (1984–).

In 1985 the U.S. government created a title of poet laureate, to be held by the same person who holds the post of consultant in poetry for the Library of Congress. Both appointments are annual ones. The American poet laureate receives a modest stipend and is expected to present one major poetic work and to appear at certain national ceremonies.

The title of the office stems from traditions concerning the laurel dating to the earliest Greek and Roman times.

poète maudit (French: "accursed poet"), in literary criticism, the poet as an outcast of modern society, despised by its rulers who fear his penetrating insights into their spiritual emptiness. The phrase was first applied by Paul Verlaine in *Les Poètes maudits* (1884), a collection of critical and biographical studies that focused on the tragedy of the lives of the then little-known Symbolist poets Tristan Corbière, Marceline Desbordes-Valmore, Villiers de l'Isle-Adam, Stéphane Mallarmé, and Arthur Rimbaud. Verlaine may have taken *les poètes maudits* from Baudelaire's "Bénédiction," in which a poet is described as untouched by the suffering and contempt he experiences. The term carries the implication of the low estate into which the poet has fallen from his ancient position as seer and prophet.

poetry, literature that evokes a concentrated imaginative awareness of experience or a specific emotional response through language chosen and arranged for its meaning, sound, and rhythm.

A brief treatment of the art of poetry follows. For full treatment, *see* MACROPAEDIA: Literature, The Art of.

For a description of the place of poetry in the circle of learning, and for a list of both MACROPAEDIA and MICROPAEDIA articles on the subject, including those on the poetry of specific languages and cultures, *see* PROPAEDIA: Part Six, Division II.

Poetry may be distinguished from prose literature in terms of form by its compression, by its frequent (though not prescribed) employment of the conventions of metre and rhyme, by its reliance upon the line as a formal unit, by its heightened vocabulary, and by its freedom of syntax. The characteristic emotional content of poetry finds expression through a variety of techniques, from direct description to highly personalized symbolism. One of the most ancient and universal of these techniques is the use of metaphor and simile to alter and expand the reader's imaginative apprehension through implicit or explicit comparison. This may involve an appeal to sense experience, especially visual sensation, or to emotional experience or cultural and historical awareness. Thus, by conjuring up pictures or images and by invoking different kinds of imaginative associations, the poet elicits in others something of his own feeling and consciousness.

Poetry encompasses many modes: narrative, dramatic, aphoristic, celebratory, satiric, descriptive, didactic, erotic, and personal. Within a single work the poet may move from one mode to another, preserving overall unity through the consistency of the formal pattern. The formal patterns available to the poet vary considerably: in English poetry the formal unit may be the single unrhymed line (as in blank verse), the rhymed couplet, the rhymed stanza of four lines or more, or more complex rhyming patterns such as the fourteen-line sonnet.

Poetry is an ancient mode of expression; even before the development of writing, primitive societies seem to have achieved poetic renderings of their religious, historical, and cultural awareness and to have transmitted them to the next generation in hymns, incantations, and narrative poems. Something of this early association with the cultural traditions of the tribe has persisted in later theories of poetic inspiration and poetic privilege, though from the time of the Romantics the autonomous creative imagination has been regarded as the source of poetic energy and the guarantee of poetic authenticity. Some modern poets, such as the Surrealists, would claim that the poetic faculty is a mode of access to individual and collective unconscious experience.

In the 19th and 20th centuries Western poetry has responded more to the expressive possibilities of poetic idiom and convention in different traditions. Some poets have experimented with reviving or adapting the subject matter and the verse forms of other times and places. For other poets it has been important to break with tradition and convention and attempt a studied informality of manner, an approximation of the relaxed rhythms and colloquial vocabulary of ordinary speech, and a self-consciously "prosaic" imagery.

pogge (fish): *see* poacher.

Poggio Bracciolini, Gian Francesco (b. Feb. 11, 1380, Terranuova, Tuscany—d. Oct. 30, 1459, Florence), Italian humanist and calligrapher, foremost among scholars of the early Renaissance as a rediscoverer of lost, forgotten, or neglected classical Latin manuscripts in the monastic libraries of Europe.

While working in Florence as a copyist of manuscripts, Poggio invented the humanist script (based on the Caroline minuscule), a round, formal writing that, after a generation of polishing by scribes, served the new art of printing as prototype of "Roman" fonts. In 1403 he moved to Rome, where he became a secretary to Pope Boniface IX. In 1415, at Cluny, he brought to light two unknown orations of Cicero. At St. Gall in 1416 he found the first complete text of Quintilian's *Institutio oratoria,* three books and part of a fourth of Valerius Flaccus' *Argonautica,* and the commentaries of Asconius Pedianus on Cicero's orations. Various expeditions in 1417 to Fulda, St. Gall, and other monasteries produced P. Festus' *De significatu verborum;* Lucretius' *De rerum natura;* Manilius' *Astronomica;* Silius Italicus' *Punica;* Ammianus Marcellinus' *Res gestae;* Apicius' work on cooking; and other lesser works. He also found at Langres in 1417 Cicero's oration *Pro Caecina* and perhaps at Cologne seven other orations of Cicero. It is not known where and when he discovered the *Silvae* of Statius. Poggio made copies of the newfound works in his elegant script, several of which still survive.

He spent four years (1418–23) in England, where his hopes of continuing his discoveries were disappointed by the inadequacy of English libraries. In 1423 he was reappointed curial secretary in Rome and made further discoveries, including Frontinus' *De aquaeductibus* and Firmicus Maternus' *Matheseos libri,* the latter found at Montecassino in 1429. He translated into Latin Xenophon's *Cyropaedia,* the histories of Diodorus Siculus, and Lucian's *Onos.* His classical interests extended to the study of ancient buildings and the collecting of inscriptions and of sculpture, with which he adorned the garden of his villa near Florence. He succeeded Carlo Aretino as chancellor of Florence (1453). His last years were spent in exercising this office and in writing his history of Florence.

In his own writings, Poggio was gifted with a lively eloquence and a capacity for artistic representation of character and conversation that distinguish his moral dialogues from numerous similar contemporary works. The most important of these are *De avaritia* (1428–29), *De varietate fortunae* (1431–48), *De nobilitate* (1440), and *Historia tripartita disceptativa convivalis* (1450). A vein of sad-

Poggio, miniature from an illuminated manuscript, *c.* 1475; in the Vatican Library (Ms. Urb. lat. 224, f.2r)
By courtesy of the Biblioteca Apostolica Vaticana

ness and pessimism runs through some and appears strongly in his *De miseria humanae conditionis* (1455). His *Facetiae* (1438–52), a collection of humorous, often indecent tales, contains vigorous satires on monks, clerics, and rival scholars such as Francesco Filelfo, Guarino, and Lorenzo Valla, with whom Poggio engaged in some of the most notorious and vituperative polemics of a polemical age. This same spirit animates his dialogue *Contra hypocritas* (1447–48). Poggio's ability to handle Latin as a live idiom is best shown in his copious correspondence, which for its form as much as for its content stands out among the *epistolari* of the humanists.

Pogonia, genus of at least 10 species of orchids, family Orchidaceae, native to central and eastern Asia and North and South America. Some of them are variously known as ettercaps, beardflowers, and rose crest-lips.

Snakemouth (*P. ophioglossoides*), also known as rose pogonia and adder's mouth, is common in bogs and swamps of eastern North America. The plant is about 8 to 70 cm (3 to 28 inches) tall. It bears one leaf about halfway up the stem and several at the base. The pinkish flowers have an odour similar to red raspberries and usually are solitary. The lip of each flower is toothed and bearded.

pogonophoran (marine invertebrate): *see* beardworm.

pogrom (Russian: "devastation," or "riot"), a mob attack, either approved or condoned by authorities, against the persons and property of a religious, racial, or national minority. The term is usually applied to attacks on Jews in Russia in the late 19th and early 20th centuries.

The first extensive pogroms followed the assassination of Tsar Alexander II in 1881. Although the assassin was not a Jew, and only one Jew was associated with him, false rumours aroused Russian mobs in more than 200 cities and towns to attack Jews and destroy their property. In the two decades following, pogroms gradually became less prevalent; but from 1903 to 1906 they were common throughout the country. Thereafter, to the end of the Russian monarchy, mob action against the Jews was intermittent and less widespread.

The pogrom in Kishinev, in April 1903, although more severe than most, was typical in many respects. For two days mobs, inspired by local leaders acting with official support, killed, looted, and destroyed without hindrance from police or soldiers. When troops were finally called out and the mob dispersed, 45 Jews had been killed, nearly 600 had been wounded, and 1,500 Jewish homes had been pillaged. Those responsible for inciting the outrages were not punished.

The Russian central government did not organize pogroms, as was widely believed; but the anti-Semitic policy that it carried out from 1881 to 1917 made them possible. Official persecution and harassment of Jews led the numerous anti-Semites to believe that their violence was legitimate, and their belief was strengthened by the active participation of a few high and many minor officials in fomenting attacks and by the reluctance of the government either to stop pogroms or to punish those responsible for them.

Pogroms have also occurred in other countries, notably in Poland and in Germany during the Hitler regime. *See also* anti-Semitism; Kristallnacht.

pogy (fish): *see* menhaden.

P'ohang, city, Kyŏngsang-pukto (North Kyŏngsang Province), eastern South Korea. A fishing port, it lies on the eastern side of the Yŏngil Gulf, 51 miles (82 km) east-northeast of Taegu, the provincial capital. Formerly a small village, it began to develop after 1930 with the construction of a modern harbour by reclamation of the shoreline and diversion of the Hyŏngsan River to the south of the city. The surrounding plains produce various agricultural products, and the sea provides good fishing grounds. The city is at the intersection of rail and shipping lines. Traditional industries include wine and brandy making, but during the 1970s heavy industry, including iron and steel production, and shipbuilding were developed. Pop. (1980 prelim.) 201,355.

Pohjanmaa, Swedish ÖSTERBOTTEN, lowland plain covering about 70 percent of Vaasan *lääni* (Vaasa province), southwestern Finland, along the Gulf of Bothnia. Also known as the Ostrobothnian plain, Pohjanmaa is about 60 miles (100 km) wide and 160 miles (257 km) long. It consists of flat plains of sand and clay soil that are broken by rivers and bog areas. It is drained mainly by the Lapuan, Kyrön, and Iso rivers, which flow to the Gulf of Bothnia. The lowlands are divided between agricultural developments and forested areas. The Swedish-speaking farmers produce turnips, winter wheat, and hay and raise dairy cattle. Since the 1950s the raising of mink and fox and the exporting of furs have grown in importance. The pine forests, which cover approximately 65 percent of the region, have not been exploited to any great extent. The city of Vaasa is the primary port and economic centre for the area.

Pohjois-Karjala, in full POHJOIS-KARJALAN LÄÄNI, Swedish NORRA KARELENS LÄN, English NORTH KARELIA, *lääni* (province), east central Finland, bordering the Soviet Union to the east and southeast. Its land area is 6,866 square miles (17,782 square km). The province includes Lake Pielinen, which is the northeastern part of the Saimaa lake system. Lumbering of the province's softwood forests is the principal source of income, and there is some small-scale mixed farming. Joensuu, the administrative capital at the mouth of the Pielis River, is a lumber shipment centre with rail and lake port facilities. Other towns are Lieksa and Nurmes, both smaller market centres. Pop. (1986 est.) 177,565.

Pohnpei, also spelled PONAPE, also called ASCENSION, high coral-capped volcanic island, eastern Caroline Islands; it and nearby atolls constitute a state in the Federated States of Micronesia, in the western Pacific. Pohnpei island is roughly square in shape with a land area of 129 square miles (334 square km). It is well watered, hilly (rising to Mount Totolom, 2,595 feet [791 m]), and is surrounded by a barrier reef with many small islets. Its fertile soil and heavy rainfall have resulted in luxuriant tropical foliage, and it has been called the "garden of Micronesia." It has mangrove swamps along its coasts and rain forest in the central hilly area. Situated near Pohnpei are the low-lying coral atolls of Oroluk, Pakin, and Ant to the west; Ngatik, Nukuoro, and Kapingamarangi atolls to the southwest; and Mokil and Pingelap atolls to the east. Most of the coral atolls are wooded and support coconut palms. The native people, with the exception of the Polynesian inhabitants of Nukuoro and Kapingamarangi, are Micronesians.

In the lagoon on the eastern coast of Pohnpei is Nan Madol, a group of 92 prehistoric, artificial platform islands built in the lagoon and surrounded by man-made canals. Ruins of a town and ceremonial centre of the early 2nd millennium AD include tombs of former kings, belonging, according to tradition, to the Sau Deleur dynasty that once ruled the whole island.

Though Pohnpei was much visited by whalers and traders, it was not until the mid-19th century that missionaries established schools there. Spanish administration was followed by German possession after 1898. The Germans promoted the production of copra. After World War I, Japan was given mandate of Micronesia under the League of Nations, and Pohnpei was made one of the administrative centres. During World War II Pohnpei's Japanese garrison was bypassed by the Allies and isolated prior to its surrender. The island was part of the United Nations Trust Territory of the Pacific Islands from 1947 until the dissolution of the Trust Territory in 1986.

Pohnpei yields a wide variety of tropical products, including copra, breadfruit, taro, cacao, trochus, and tilapia. Rice is grown, pigs and poultry are raised, and fish are caught. Main coastal villages are Kolonia (capital of the Federated States of Micronesia and headquarters of Pohnpei State), Metalanim, and Ronkiti. Pohnpei has an international airport. The Community College of Micronesia is in Kolonia. Pop. (1985 est.) island (including Ant Atoll), 24,788.

poi, starchy Polynesian food paste made from the taro root. In Samoa and other Pacific islands, poi is a thick paste of pounded bananas or pineapples mixed with coconut cream; the word originally denoted the action of pounding the food to a pulp. In Hawaii, where poi is a staple of local cuisine, taro root is used almost exclusively for its preparation. The peeled roots are cooked, pounded, mixed with water to the desired consistency, and strained to remove fibres. The resultant bland, bluish-gray paste is eaten fresh or allowed to ferment for up to a week to develop a tangy taste. Hawaiians traditionally did not use eating utensils, and poi is still characterized as one-, two-, or three-finger, according to the technique necessary to scoop up a mouthful. The luau (*q.v.*), a Hawaiian banquet, is sometimes called a poi supper.

poikilothermy: *see* cold-bloodedness.

Poincaré, (Jules-)Henri (b. April 29, 1854, Nancy, Fr.—d. July 17, 1912, Paris), French mathematician, theoretical astronomer, and philosopher of science who influenced cosmogony, relativity, and topology and was a gifted interpreter of science to a wide public.

Poincaré was from a family distinguished by its contributions to government and administration. His first cousin was Raymond Poincaré, president of the French Republic during World War I. Poincaré was ambidextrous and was nearsighted; during his childhood he had poor muscular coordination and was seriously ill for a time with diphtheria. He received special instruction from his gifted mother and excelled in written composition in elementary school. He learned German during the Franco-German War—at which time he also witnessed the suffering of the soldiers and populace with his father, who was a physician. Becoming deeply interested in mathematics during adolescence, he attended in 1872–75 the École Polytechnique in Paris, where he easily won top honours in mathematics, but was undistinguished in physical exercise and

Henri Poincaré, 1909
H. Roger-Viollet

in art. He had an unusually retentive memory for everything he read; moreover, he could visualize what he heard, a useful faculty because he could not clearly see at a distance the mathematical symbols that were on the blackboard. Throughout his life he was able to perform complex mathematical calculations in his head and could quickly write a paper without extensive revisions. He received, in 1879, a doctorate from the École Nationale Supérieure des Mines with a thesis on differential equations.

Following a brief appointment in mathematical analysis at the Université de Caen, in 1881 Poincaré joined the Université de Paris, where, during the rest of his life, he lectured and wrote prolifically—almost 500 papers—on mechanics and experimental physics, in all branches of pure and applied mathematics, and in theoretical astronomy. Changing his lectures every year, he would review optics, electricity, the equilibrium of fluid masses, the mathematics of electricity, astronomy, thermodynamics, light, and probability. Many of these lectures appeared in print shortly after they were delivered at the university. In his extensive writings on probability, Poincaré anticipated the concept of ergodicity that is basic to statistical mechanics.

Applying his mastery of analysis to the question of the solvability of algebraic equations, Poincaré developed before age 30 the idea of the automorphic function—one that is invariant under a group of transformations that are characterized algebraically by ratios of linear terms. He showed how these functions can be used to integrate linear differential equations with rational algebraic coefficients and how to express the coordinates of any point on an algebraic curve as uniform functions of a single algebraic variable (or parameter). Some of these automorphic functions he called Fuchsian, after the German mathematician Immanuel Lazarus Fuchs, who was one of the founders of the theory of differential equations; he found that they were associated with transformations arising in non-Euclidean geometry. In recognition of his fundamental contributions to mathematics, he was elected, in 1887, to membership in the Académie des Sciences in Paris.

In celestial mechanics, Poincaré made substantial contributions to the theory of orbits, particularly the classical three-body problem (for example, the system involving the Sun, Moon, and Earth). This was part of the "problem of *n* bodies" (planets, stars, etc.), set for a prize by King Oscar II of Sweden: given the present masses, velocities, motions, and mutual distances of "*n* bodies," how long will they remain stable in their present spatial relationships, or will their orbits change at some future date? In his solution, Poincaré developed powerful new mathematical techniques, including the theories of asymptotic expansions and integral invariants, and made fundamental discoveries on the behaviour of the integral curves of differential equations near singularities. He was awarded the prize in 1889, even though his solution to the problem was only partially correct; in the same year he was also made a knight of the French Legion of Honour.

Poincaré summarized his new mathematical methods in astronomy in *Les Méthodes nouvelles de la mécanique céleste,* 3 vol. (1892, 1893, 1899; "The New Methods of Celestial Mechanics"). Another result of this work, his *Analysis situs* ("Positional Analysis") in 1895, was an early systematic treatment of topology, which deals with properties of a system that endure when metric distortion occurs—that is, topology deals with the qualitative characteristics of spatial configurations that do not vary during cumulative transformations. He also contributed to the theory of numbers by demonstrating how the conception of binary quadratic forms, which was developed by the German mathematician Carl Friedrich Gauss, could be cast in geometric form. In 1904 he lectured at the St. Louis Exposition.

In mathematical analysis, Poincaré made important contributions to the theory of equilibrium of rotating fluid masses. In particular, he described the conditions of stability of the pear-shaped figures that played so prominent a part in the researches of later cosmogony, with reference to the evolution of celestial bodies. He attempted an application of these ideas to the stability of Saturn's rings and to the origin of binary stars. In 1906, in a paper on the dynamics of the electron, he obtained, independently of Einstein, many of the results of the special theory of relativity. The principal difference was that Einstein developed the theory from elementary considerations concerning light signaling, whereas Poincaré's treatment was based on the full theory of electromagnetism and was restricted to phenomena associated with the concept of a universal ether that functioned as the means of transmitting light.

After Poincaré achieved prominence as a mathematician, he turned his superb literary gifts to the challenge of describing for the general public the meaning and importance of science and mathematics. Always deeply interested in the philosophy of science, he wrote *La Science et l'hypothèse* (1903; *Science and Hypothesis*), *La Valeur de la science* (1905; *The Value of Science*), and *Science et méthode* (1908; *Science and Method*), all of which reached a wide public of nonprofessionals. His works were translated into English, German, Hungarian, Japanese, Spanish, and Swedish. He emphasized the subconscious, while probing the psychology of mathematical discovery and invention. He was a forerunner of the modern intuitionist school in that he believed that some mathematical induction is a priori and independent of logic. In his view, sudden illumination, following long subconscious work, is a prelude to mathematical creation. But his greatest contribution to philosophy was to emphasize the role played in scientific method by convention—*i.e.,* by the arbitrary choice of concepts.

Poincaré's prestige and influence increased in French science, and in 1906 he was elected president of the Académie des Sciences and in 1908 to membership in the Académie Française, the highest honour accorded a French writer. (G.J.W.)

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Poincaré, Raymond (b. Aug. 20, 1860, Bar-le-Duc, Fr.—d. Oct. 15, 1934, Paris), French statesman who as prime minister in 1912 largely determined the policy that led to France's involvement in World War I, during which he served as president of the Third Republic.

Raymond Poincaré, 1913
H. Roger-Viollet

The son of an engineer, he was educated at the École Polytechnique. After studying law at the University of Paris, he was in 1882 admitted to the bar. Elected a deputy in 1887, he became six years later the youngest minister in the history of the Third Republic, holding the portfolio of education. In 1894 he served as minister of finance and in 1895 again as minister of education. In the Dreyfus affair (*q.v.*) he declared that new evidence necessitated a retrial.

Despite the promise of a brilliant political career, Poincaré left the Chamber of Deputies in 1903, serving until 1912 in the Senate, which was considered comparatively unimportant politically. He devoted most of his time to his private law practice, serving in the Cabinet only once, in March 1906, as minister of finance. In January 1912, however, he became prime minister, serving simultaneously as foreign minister until January 1913. In the face of new threats from Germany, he conducted diplomacy with new decisiveness and determination. In August 1912 he assured the Russian government that his government would stand by the Franco-Russian alliance, and in November he concluded an agreement with Britain committing both countries to consult in the event of an international crisis as well as on joint military plans. Although his support of Russian activities in the Balkans and his uncompromising attitude toward Germany have been cited as evidence of his being a warmongering revanchist, Poincaré believed that in the existing state of contemporary Europe war was inevitable and that only a strong alliance guaranteed security. His greatest fear was that France might be isolated as it had been in 1870, easy prey for a militarily superior Germany.

Poincaré ran for the office of president; despite the opposition of the left, under Georges Clemenceau, a lifelong enemy, he was elected on Jan. 17, 1913. Although the presidency was a position with little real power, he hoped to infuse new vitality into it and make it the base of a *union sacrée* of right, left, and centre. Throughout World War I (1914–18) he strove to preserve national unity, even confiding the government to Clemenceau, the man best qualified to lead the country to victory.

After his term as president ran out in 1920, Poincaré returned to the Senate and was for a time chairman of the reparations commission. He supported the thesis of Germany's war guilt implicit in the Versailles Treaty; and when he served again as prime minister and minister for foreign affairs (1922–24), he refused a delay in German reparation payments and in January 1923 ordered French troops into the Ruhr in reaction to the default. Unseated by a leftist bloc, he was returned as prime minister in July 1926 and is largely credited with having solved France's acute financial crisis by stabilizing the value of the franc and basing it on the gold standard. Under his highly successful economic policies the country enjoyed a period of new prosperity.

Illness forced Poincaré to resign from office in July 1929. He spent the remainder of his life writing his memoirs, *Au service de la France*, 10 vol. (1926–33).

Poinsat, Juan: *see* John of Saint Thomas.

Poinsett, Joel R(oberts) (b. March 2, 1779, Charleston, S.C., U.S.—d. Dec. 12, 1851, near Statesburg), U.S. statesman noted primarily for his diplomacy in Latin America. A fervent liberal, he frequently meddled in the affairs of Latin American nations, incurring their animosity by his misdirected good intentions.

The son of a prominent physician, Poinsett was educated in the U.S. and England and then travelled for seven years in Europe and western Asia. Returning home to serve in the approaching war with England, he was instead appointed the special agent for the U.S. in Buenos Aires and Chile in 1810. Although he initiated diplomatic and commercial relations with these Spanish territories, he also supported the nascent revolutionary forces there.

After serving in the South Carolina legislature (1816–20), Poinsett was elected to the U.S. House of Representatives in 1820. Interrupting his legislative career, he went on a special mission to Mexico in 1822 and 1823, publishing his *Notes on Mexico* in 1824. In 1825 he became the first U.S. minister to Mexico, a post he held until 1829. Deeply involved in Mexican politics, he finally became *persona non grata* to the government. The Mexicans even coined the word *poinsettismo* to characterize his officious and intrusive behaviour.

Poinsett, detail of a portrait by Thomas Sully; in the collection of the American Philosophical Society, Philadelphia
By courtesy of the American Philosophical Society, Philadelphia

In 1830 Poinsett became a leader of the Unionist Party in South Carolina, a group that opposed the doctrine of nullification, which held that the individual states have the right to set aside any federal law that violates their compact in the U.S. Constitution. As a reward for these services, Pres. Martin Van Buren appointed him secretary of war in 1837. He served until 1841 and then retired to South Carolina.

An accomplished amateur botanist, Poinsett brought a flower from Mexico that was renamed the poinsettia in his honour. He was instrumental in founding the National Institute for the Promotion of Science and the Useful Arts, a precursor of the Smithsonian Institution.

poinsettia (*Euphorbia pulcherrima*), best known member of the diverse spurge family, Euphorbiaceae. The poinsettia is native to Mexico and Central America, where it grows in moist, wet, wooded ravines and on rocky hillsides. It was named for Joel R. Poinsett, who popularized the plant and introduced it to floriculture while he was U.S. minister to Mexico in the late 1820s.

Poinsettia (*Euphorbia pulcherrima*)
Grant Heilman—EB Inc.

In warm climates the poinsettia grows outdoors as a winter-flowering leggy shrub about 5 metres (16 feet) high; as a potted plant in northern areas it rarely grows beyond 1 metre. What appear to be petals are actually coloured leaflike bracts that surround a central cluster of tiny yellow flowers. A milky latex in the stems and leaves can be irritating to persons or animals sensitive to it, but the claim that poinsettias are deadly poisonous is greatly exaggerated.

Cultivated varieties are available with white, pink, mottled, and striped bracts, but the solid red varieties, in several shades, remain in greatest demand during the Christmas season.

point appliqué: *see* application lace.

Point Barrow, northernmost point of Alaska, U.S., on the Arctic Ocean. It is connected with Anchorage and Fairbanks by regular air service. The headland was discovered in 1826 by Frederick W. Beechey and named for Sir John Barrow, promoter of Arctic exploration. Once important in Arctic aviation, it was the departure point of Sir George Hubert Wilkins' flight (1928) over the North Pole and was the site of the air crash (1935) that killed Will Rogers and Wiley Post. An Arctic research station was constructed by the U.S. Navy in the 1940s. The area has vast oil and gas deposits. The city of Barrow was incorporated in 1959. In June 1977 it was the site of the first international Inuit (Eskimo People's) Circumpolar Conference. Pop. (1980) Barrow city, 2,207.

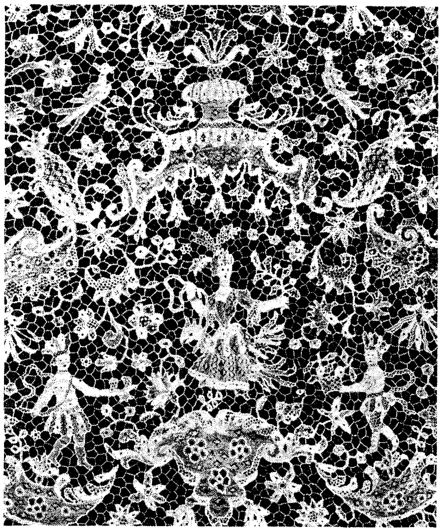
point Colbert (French: "Colbert lace"), needle-made lace developed at Bayeux in France in 1855, inspired by 17th-century Alençon lace (*q.v.*) and named after Louis XIV's minister Jean-Baptiste Colbert, who started Alençon's industry. Like Alençon, it had conventionalized flowers, stems, and the like on a background of bars, or brides, but new designs were also made.

point d'Alençon (lace): *see* Alençon lace.

point d'Angleterre (lace): *see* Angleterre.

point d'Argentan: *see* Argentan lace.

point de France (French: "French lace"), specifically, the 17th-century school of French lace set up by Louis XIV's minister Jean-Baptiste Colbert to curb the national extravagance in buying foreign lace. Colbert imported lace-



Point de France lace, end of the 17th century; in the Victoria and Albert Museum, London

By courtesy of the Victoria and Albert Museum, London

workers from Venice and Flanders and settled them in and around centres where lace was already being made, such as Sedan and Alençon; in 1665 they were granted a monopoly for 10 years to produce lace that was artistically and financially competitive with imported varieties.

Point de Galle (Sri Lanka): *see* Galle.

point de gaze (French: "gauze lace"), needle lace produced in Brussels, principally from 1851 to around 1900, though in the 1980s it was still being produced for the tourist trade. It was the last of the great laces to be devel-

Point de gaze lace from Brussels, 1870–90; in the Rijksmuseum, Amsterdam

By courtesy of the Rijksmuseum, Amsterdam

oped. Its gauzy appearance is the result of a delicate, needle-made mesh, created with one continuous thread forming a network of semicircular loops. In the solid parts of the design, shading is achieved by a combination of close and open stitches. The characteristic flowers sometimes have detached petals.

point de Paris (French: "Paris lace"), product of a lace industry known to have existed around 1634 in the Île de France. No authenticated examples of this lace have been found, however. In modern usage, *point de Paris* has come to mean any bobbin-made lace with a six-pointed star mesh that is twisted, as opposed to that of Chantilly, which is plaited.

point estimation, in statistics, the process of finding an approximate value of some parameter (mean, standard deviation, proportion) of a population from corresponding functions of random samples of the population. The accuracy of the approximation is not known, though probabilistic statements concerning such numbers as found over many experiments can be constructed.

It is desirable for an estimate to be: (1) Consistent. The larger the sample size, the more accurate the estimate. (2) Unbiassed. The expectation (*q.v.*) of the observed values of a function of many samples is the corresponding population parameter. (3) Most efficient or best unbiassed—of all consistent, unbiassed estimates, the one possessing the smallest variance.

Several methods are used to calculate the estimator. The most often used, the maximum likelihood method, uses differential calculus to determine the maximum of the probability function of a number of sample parameters. The moments method equates values of sample moments (functions describing the parameter) to population moments. The solution of the equation gives the desired estimate. The Bayesian method, named for the 18th-century English mathematician Thomas Bayes, differs from the traditional methods by introducing a frequency function for the parameter being estimated. The drawback to the Bayesian method is that sufficient information on the distribution of the parameter is usually not available. One advantage is that the estimation can be easily adjusted as additional information becomes available.

Point Four Program, U.S. policy of technical assistance and economic aid to underdeveloped countries, so named because it was the fourth point of Pres. Harry S. Truman's 1949 inaugural address. The first appropriations were made in 1950. The program was originally administered by a special agency of the Department of State, but in 1953 it was merged with other foreign-aid programs. The program was designed to promote U.S. influence by making modern technological and scientific knowledge available to underdeveloped areas, primarily in Asia, Africa, and Latin America.

point group, also called CRYSTAL CLASS, in crystallography, listing of the ways in which the orientation of a crystal can be changed without seeming to change the positions of its atoms. These changes of orientation must involve just the point operations of rotation about an axis, reflection in a plane, inversion about a centre, or sequential rotation and inversion. Only 32 distinct combinations of these point operations are possible, as demonstrated by a German mineralogist, Johann F.C. Hessel, in 1830. Each of the possible combinations is called a point group or crystal class. A crystal can be assigned to one of these point groups on the basis of its external shape, or morphology. The addition of translational changes will yield a total of 230 possible combinations; these are called space groups.

Point Pelee National Park, park in southeastern Ontario, Canada, lying southeast of Leamington, at the western end of Lake Erie. Established in 1918, it occupies an area of 6 sq mi (16 sq km) and comprises a wedge-shaped sandspit jutting into the lake. It lies astride a major flyway of wild ducks, Canada geese, swans, and other migratory birds, which find sanctuary in its marshland. The park has a variety of forest trees, shrubs, and fruit-bearing bushes and includes a large cattail marsh.

Point Pleasant, city, seat (1804) of Mason County, western West Virginia, U.S., on the Ohio River at the mouth of the Kanawha River, adjacent to Henderson (southwest). The settlement developed around Ft. Blair, built in 1774, and was chartered in 1794. On Oct. 10, 1774, at the confluence of the two rivers, Gen. Andrew Lewis and a band of Virginia frontiersmen defeated the allied Indian nations under Chief Cornstalk. That victory, which broke the strength of the warring Indians, is recognized by some historians as the first battle of the Revolution because the Indians were supposedly incited by the British; it is commemorated by Point Pleasant Battle Monument, an 84-ft (26-m) granite shaft in Tu-Endie-Wei Park. (In 1908 the U.S. Senate recognized the claim of the Battle of Point Pleasant as the first battle of the Revolution over the claim of Lexington, Mass.) Also in the park is the log Mansion House (1796), oldest building in the Kanawha Valley, now restored as a museum, and the graves of Chief Cornstalk and Ann Bailey, celebrated frontierswoman. Point Pleasant developed rapidly after a shipyard was built in 1849. Manufactures now include iron products and textiles.

On Dec. 15, 1967, Silver Bridge, spanning the Ohio River between Point Pleasant and Kanauga, Ohio, collapsed, dumping more than 50 cars into the river; the death toll exceeded 50. Inc. town, 1833; city, 1915. Pop. (1980) 5,682.

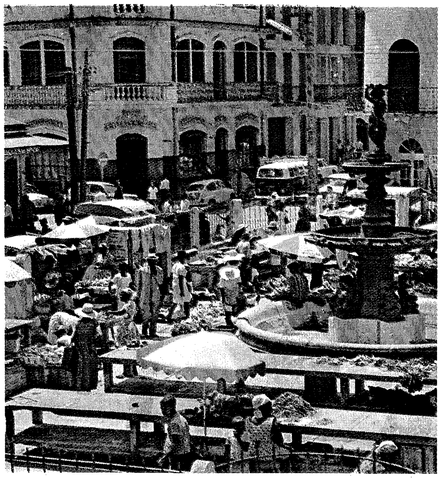
point-to-point, race run during the non-hunting season (February–May) by horses regularly hunted at fox hunts.

The races originated in England in the second half of the 19th century as a way to keep hunters fit and were first called hunt races. Each hunt had one such race. All riders are amateurs. The races are related to steeplechasing in that jumping is involved. At the turn of the 20th century, there were about 50 such races. In the second half of the 20th century there were nearly 200 throughout the British Isles. They came to be run on oval tracks set up on open ground rather than from one point to another crosscountry. The shortest distance is 3 miles (4.8 km) and the longest 4½ miles (7.2 km). There are races for novices and ladies. The major point-to-point is the Player's Gold Leaf Championship, for which the final is run at Newbury. The governing body is the National Hunt Committee.

Point-to-point raicng also began in the 19th century in the United States, mainly in fox hunting country along the Atlantic coast. There the governing body is the National Steeplechase and Hunt Association.

Pointe-à-Pitre, principal town and *arrondissement* of the French overseas *département* of Guadeloupe in the Caribbean Sea. The town lies on the southwestern coast of Grande-Terre island, on the eastern shore of the Mouillage (anchorage) de la Rivière Salée, a channel that connects two large bays to the north and south and separates Grande-Terre from Guadeloupe (Basse-Terre), the mountainous western island of Guadeloupe. Several islets in the southern bay guard the approach to the town's harbour, and there are extensive mangrove swamps in the vicinity of the town.

Pointe-à-Pitre was founded in the mid-17th century, soon after the French settlement of Guadeloupe, but it was eclipsed in importance until the late 18th century by Basse-Terre, which still remains the administrative capital. In 1906 a road bridge across the Rivière Salée replaced the existing ferry, and, favoured by its central position and harbour facilities, Pointe-à-Pitre became the chief commercial town. It

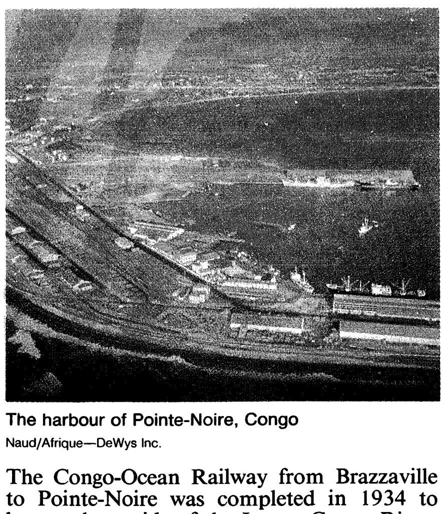


Pointe-à-Pitre market, Guadeloupe
Kurt Scholz—Shostal/EB Inc.

handles some 95 percent of Guadeloupe's imports. Near the town centre are many old houses with stone lower and wooden upper stories; in the mid-20th century there was extensive suburban development, particularly north toward Raizet Airport and the nearby town of Les Abymes. Pop. (1982) 25,151.

Pointe-Claire, city, Montréal region, southern Quebeç province, Canada, on the southern shore of Île-de-Montréal (Montreal Island), overlooking Lake Saint-Louis, a widening of the St. Lawrence River. Founded in 1713, it was a quiet agricultural settlement until after World War II, when the spread of metropolitan Montreal brought about its transformation into a modern residential and industrial suburb. Both national railways and the Trans-Canada Highway serve the city. Inc. town, 1911; city, 1958. Pop. (1986) 26,026.

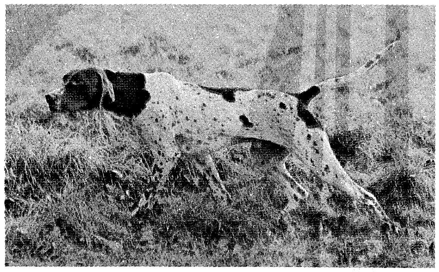
Pointe-Noire, commune (town), principal port of the Congo. It lies at the Atlantic coastal terminus of the Congo-Ocean Railway 95 miles (150 km) north of the Congo River and 245 miles (394 km) west of Brazzaville, the capital. Between 1950 and 1958 Pointe-Noire was the capital of the Moyen-Congo region of French Equatorial Africa. With independence in 1958, it was replaced by Brazzaville as the national capital, but Pointe-Noire remained the primary entrepôt and second largest city.



The harbour of Pointe-Noire, Congo
Naud/Afrique—DeWys Inc.

The Congo-Ocean Railway from Brazzaville to Pointe-Noire was completed in 1934 to bypass the rapids of the Lower Congo River. Although the city is situated on a calm bay, its port facilities were not completed until 1939; they were expanded during World War II. An international airport was built south of the town. Later, light industries and mineral-processing plants were established, but the city's chief importance remained its transit trade. In the 1970s, petroleum drilled offshore near Pointe-Noire and processed at a refinery in the town became a major national export. Pop. (1985 est.) 298,014.

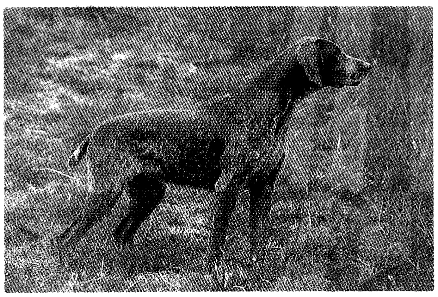
pointer, highly regarded breed of sporting dog of hound, spaniel, and setter ancestry. First recorded about 1650, in England, the pointer was originally used to point out hares for



English Pointer
Sally Anne Thompson—EB Inc.

greyhounds to track down. It was trained as a bird dog in the 18th century. Clean-cut, lithe, and powerful, it stands 58 to 64 cm (23 to 25 inches) and weighs 23 to 27 kg (50 to 60 pounds). It has a long muzzle, hanging ears, tapered tail, and a short, smooth coat, usually white with black, liver-coloured, yellowish brown, or reddish brown markings.

The German short-haired pointer is another sporting breed. Developed in Germany, it is



German short-haired pointer
Sally Anne Thompson

an all-purpose dog that can track game as well as point and retrieve game in water. It is about the size of a pointer and has a short coat of solid liver colour or liver and gray-white.

pointillism, in painting, the practice of applying small strokes or dots of colour to a surface so that from a distance they blend together. The technique is associated with the painting style known as Neo-Impressionism (*q.v.*).

pointing, in building maintenance, the technique of repairing mortar joints between bricks or other masonry elements. When aging mortar joints crack and disintegrate, the defective mortar is removed by hand or power tool and replaced with fresh mortar, preferably of the same composition as the original. Often an entire wall, or even a whole structure, is pointed because defective points cannot easily be detected, and adjacent joints may also be in need of repair. The mortar is packed tightly in thin layers and tooled to a smooth, concave, finished surface. Tuckpointing is a refinement of pointing, by which sharply defined points are formed for decorative purposes.

Poiré, Emmanuel: *see* Caran d'Ache.

Poiret, Paul (b. April 20, 1879, Paris, Fr.—d. April 30, 1944, Paris), French couturier, the most fashionable dress designer of pre-World War I Paris, who was particularly noted for his introduction of the hobble skirt, a vertical, tight-bottomed style that confined women to mincing steps.

After serving as a designer in the house of Parisian fashion designer Charles Frederick Worth, Poiret opened a small shop in Paris in 1903.

By placing a belt on the straight silhouette high under the bosom (1908), he revived the Empire style, popular in France during the reign of Napoleon I. Inspired by a widespread interest in Far Eastern art and Russian ballet, he added draped and belted knee-length tunics to his popular hobble skirt. Fringed and tasseled capes, multicoloured feathers, coils of pearls, and white-fox stoles imparted a flamboyant, theatrical look to Poiret's designs. His evening gowns appeared in brilliant shades of purple, red, orange, green, and blue. Poiret's simple, flowing Greek costumes were popular in the pre-World War I period, but his popularity waned in the 1920s.

Poiseuille, Jean-Louis-Marie (b. April 22, 1799, Paris, Fr.—d. Dec. 26, 1869, Paris), French physician and physiologist who formulated a mathematical expression for the flow rate for the laminar (nonturbulent) flow of fluids in circular tubes. Discovered independently by Gotthilf Hagen, a German hydraulic engineer, this relation is also known as the Hagen-Poiseuille equation.

Poiseuille received his medical degree in 1828 and established his practice in Paris. His interest in the circulation of the blood led him to conduct a series of experiments on the flow of liquids in narrow tubes, from which he determined the law that bears his name. This equation states that the flow rate is determined by the viscosity of the fluid, the drop in pressure along the tube, and the tube diameter. He also is believed to be the first to have used the mercury manometer to measure blood pressure.

poison, in biochemistry, a substance, natural or synthetic, that causes damage to living tissues and has an injurious or fatal effect on the body, whether ingested, inhaled, or absorbed or injected through the skin. Stated another way, a poison is a substance that, when consumed by an organism through an appropriate route of exposure at the correct dose, is capable of causing toxic effects or even death by its action on the tissues with which it comes into contact.

A brief treatment of poisons and poisoning follows. For full treatment, *see* MACROPAEDIA: Poisons and Poisoning.

A poison does not necessarily have an all-or-none effect. Degrees of poisoning are recognized, and some substances are more toxic than others. Potassium cyanide, of which as little as 0.25 gram may be lethal, is rated as highly toxic. Common salt, on the other hand, usually regarded as benign and as an item of the diet, can kill if a large enough single dose is taken. It has a relatively low toxicity.

Poisoning may be acute or chronic, defined mainly in reference to time. When a single dose is followed immediately by symptoms that imperil the victim, the poisoning is said to be acute. When the doses or exposures are repetitive or continuous, with either immediate or delayed toxic effects, the poisoning is called chronic. For example, in a delayed reaction, a person may consume extremely low doses of arsenic for weeks or months without symptoms; indigestion, skin rashes, and changes in the nerves of the arms and legs, all symptoms of arsenic poisoning, will appear only gradually and only as the rate of accumulation of the poison in the tissues exceeds the rate of excretion. Thus, although a normal person may harbour a small quantity of a chemical throughout life without any distress, and a somewhat higher level may even confer increased benefit, only when a still higher critical, toxic level is exceeded do adverse complications ensue. Consequently, it is sometimes difficult to classify a substance as a poison without information about such factors as the amount consumed and the duration and pattern of consumption.

Chronic poisoning can occur without the causal substance actually becoming stored in the body. The pain-relieving drug phenacetin, taken daily, even in large doses, is completely metabolized and eliminated. Yet a person who indulges in such self-medication excessively over months or years can sustain severe and irreversible kidney damage.

A peculiar variant of chronic toxicity is chemical carcinogenicity. Prolonged exposure to certain oils, to benzidine, to beta-naphthylamine, to asbestos, and to cigarette smoke can lead, after an interval, to the development of distinctive and characteristic cancers. No dose-response relationship has been worked out for this process; repeated contact seems to be the essential feature, together, possibly, with a particular chemical configuration.

Local effects of poisons include wheals, blisters, and violent inflammation, often followed by necrosis, muscle spasm, and disturbances in sensation. Systemic effects include local or widespread hemorrhages, destruction of blood cells, and abnormal clotting. Irritative effects on the various systems of the body may include excitement, convulsions, vomiting, diarrhea, or tetany; depressive symptoms include clouding of senses, paralysis, and weakening or arrest of respiration and heartbeat.

Agricultural and industrial chemicals. Most agricultural chemicals are pesticides, which include insecticides, fungicides, rodenticides, and fumigants. One well-known insecticide is chlorophenothane (DDT), which has been banned in many countries because it is thought to cause cancer and to have adverse environmental effects. Herbicides are chemicals used to kill plants. Milder symptoms of human toxicity from agricultural chemicals include skin and respiratory irritation. More severe effects include neurological symptoms, respiratory depression, clotting inhibition, birth defects, cancer, and even death.

Industrial chemicals include such agents as gasoline, paint strippers, spot removers, and chemicals used in industry. Human poisoning by such chemicals occurs most often either through the skin or through inhalation; irritation of the respiratory tract is common.

Drugs and health-care products. Drugs and health-care products include (1) pain killers, or analgesics, such as aspirin, acetaminophen, and morphine, (2) tranquilizers, such as benzodiazepines, (3) antiseptics, such as hydrogen peroxide, (4) vitamins and iron pills, such as vitamins A and C, (5) antidepressants, such as amitriptyline and imipramine, (6) drugs of abuse, such as amphetamines, cocaine, and heroin, and (7) cardiovascular drugs, such as digitalis and beta blockers. Most drug poisoning involves oral routes of exposure, resulting primarily in such gastrointestinal symptoms as anorexia, nausea, and vomiting. Many drugs also affect the nervous system, generally either depressing or stimulating the central nervous system.

Poisons of biological origin. Poisonous plants may cause various adverse physical effects, perhaps death, when eaten or touched by human beings or animals. Most plant species are harmless; a few are poisonous under ordinary conditions; others are poisonous under special conditions. Toxic materials are often very strictly localized in the plant.

Poisonous plants can be classified according to their effects on (1) the respiratory system, such as the ragweeds (*Ambrosia*) and cottonwood (*Populus trichocarpa*); (2) the nervous system, such as Jimson weed (*Datura stramonium*) and nightshade (*Solanum nigrum*); (3) the skeletal muscles, such as poison hemlock (*Conium maculatum*) and chinaberry (*Melia azedarach*); (4) the heart, such as foxglove (*Digitalis purpurea*) and mistletoe (*Phoradendron flavescens*); and (5) the skin, such as poison ivy (*Toxicodendron radicans*).

The poisons, or venoms, of animal origin are produced by specialized glands often associated with spines, teeth, or other piercing devices; some are skin, or cuticular, secretions. The poisonous apparatus may be primarily for killing or paralyzing prey or may be a purely defensive adaptation. Venoms of snakes, centipedes, and some marine invertebrates are also digestive fluids.

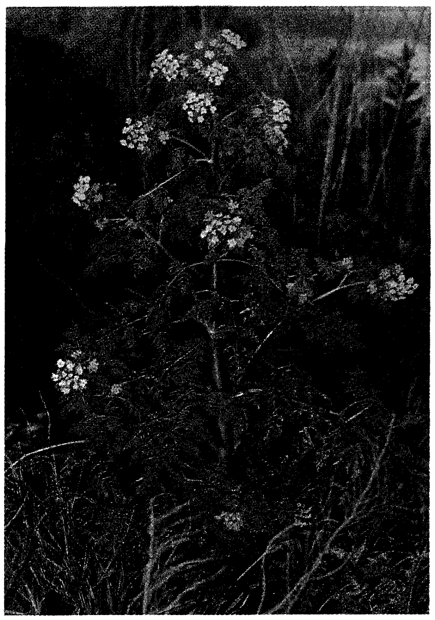
All major animal phyla except birds contain poisonous species, but relatively few are dangerous to humans. Among these are certain snakes (cobra, coral snake, rattlesnake, etc.), some scorpions, some spiders (black widow, brown recluse, etc.), some social insects (bee, wasp, ant, etc.), and a few jellyfish. Dangerous but causing few accidents because of habitat or habits are sea snakes (Hydrophidae), scorpion fish (*Synanceja*), and some cone shells. Poisonous animals that rarely or never cause human fatalities include sea anemones, fire corals, most jellyfish, some sea urchins, centipedes, most spiders and scorpions, certain ticks and mites, many insects, fishes with poisonous spines (sting rays, weever fish, certain catfish), and mildly venomous snakes.

Radiation. Most forms of radiation can be toxic. With ionizing radiation, human tissue is "poisoned" when it comes in contact with certain particulates (alpha particles, beta particles, neutrons, or positrons) or electromagnetic radiation (gamma rays or X rays). Ionizing radiation may produce nausea, vomiting, diarrhea, low production of blood cells, hair loss, and, more seriously, genetic mutations and cancer. Nonionizing radiation (*e.g.,* ultraviolet light, infrared radiation, and microwaves) can also be harmful, especially if exposure is prolonged or to large amounts. The areas chiefly affected are the eyes and skin.

poison, in nuclear physics, any material that can easily capture neutrons without subsequently undergoing nuclear fission. Examples of poisons are the naturally occurring elements boron and cadmium and the fission products xenon-135 and samarium-149. In nuclear reactors, poisons act as parasitic neutron absorbers and lower the rate of fission.

poison guava (plant): *see* manchineel.

poison hemlock, any of several poisonous herbaceous plants but especially *Conium maculatum,* which, according to tradition, was the plant used to kill Socrates. The water hemlocks (*Cicuta* species) are similar and also dangerous. They are members of the parsley family (Apiaceae). *Conium maculatum* is a tall biennial (living for two years) with green stems spotted with red or purple, large compound leaves, and white flowers. Coniine, the poison, is concentrated in the seeds, though the entire plant is dangerous to livestock when fresh. Of the water hemlocks, the European *Cicuta virosa* is perhaps the best known; it is a tall perennial herb that grows in marshy areas and is a deadly poison. The American *Cicuta maculata,* known as musquash root, or beaver poison, has potato-like tubers with a pleasant odour; the tubers as well as the leaves are poisonous. It grows to about 2.5 m (8 feet) and has divided leaves and clusters of white flowers resembling those of some nonpoisonous plants in the family.



Poison hemlock (*Conium maculatum*)
Ken W. Davis

Where the same name may denote a person, place, or thing, the articles will be found in that order

poison ivy, either of two species of white-fruited woody vines or shrubs of the cashew family (Anacardiaceae), native to North America. The species found in eastern North America (*Rhus toxicondendron*) is abundant; the western species (*R. radicans*) is less common.

Poison ivy (*Rhus toxicodendron*)
Walter Chandoha

(Some experts prefer to designate both as the genus *Toxicodendron.*) The plants are highly variable in growth habit. The leaves have three leaflets, which may be hairless and glossy or hairy, entire, toothed, or lobed.

The plant is poisonous to touch, producing in many persons a severe inflammation of the skin, or dermatitis. The toxic principle, urushiol, is produced in the resinous juice of the resin ducts of the leaves, flowers, fruits, and bark of stems and roots but not in the pollen grains. Being almost nonvolatile, the urushiol may be carried from the plant on clothing, shoes, tools, or soil or by animals or by smoke from burning plants to persons who never go near the poison ivy plants. Poisoning may occur if clothing is worn a year after contact with poison ivy.

poison wind: *see* samūm.

Poisons, Affair of the, one of the most sensational criminal cases of 17th-century France. In 1679 an inquiry revealed that nobles, prosperous bourgeois, and the common people alike had been resorting secretly to female fortune-tellers—at that time numerous in Paris—for drugs and poisons, for black masses, and for other criminal purposes.

Nicolas de La Reynie, whose diligent investigation took three years, headed the inquiry. A special tribunal for the trial of the accused, known as the *chambre ardente,* was created in April 1679. It held 210 sessions at the Arsenal in Paris, issued 319 writs of arrest, and sentenced 36 persons to death, including the poisoner La Voisin (Catherine Deshayes, Madame Monvoisin), who was burned on Feb. 22, 1680.

Among the many members of French society who were implicated was Madame de Montespan, the mistress of King Louis XIV. She was accused by Voisin's daughter and her accomplices of being a customer of La Voisin from 1667; of resorting to magic and philtres to win the King's love; of participating in black masses; and of attempting to poison her young rival, Mlle de Fontanges, and the King.

Louis suspended the public proceedings after the accusations against Madame de Montespan but ordered the continuation of the inquiry. Thus, most of the chief offenders, who had managed by their accusations to transform a criminal trial into an affair of state, escaped execution and ended their lives in various provincial prisons. The charges concerning black masses and attempted poisonings were never proved against Madame de Montespan.

Poisson, Jeanne-Antoinette: *see* Pompadour, Jeanne-Antoinette Poisson, marquise de.

Poisson, Siméon-Denis (b. June 21, 1781, Pithiviers, Fr.—d. April 25, 1840, Sceaux), French mathematician known for his work on definite integrals, electromagnetic theory, and probability.

His family coerced him into studying medicine, which he abandoned in 1798 in

Poisson, detail of a lithograph by François-Séraphin Delpech after a portrait by N. Maurin

By courtesy of the Archives de l'Academie des Sciences de Paris; photograph, J. Colomb-Gerard, Paris

favour of mathematics, studying at the École Polytechnique, Paris, under the mathematicians Pierre-Simon Laplace and Joseph-Louis Lagrange, who became his lifelong friends. His life was almost entirely engaged in mathematical research and in teaching. He became a deputy professor at the École Polytechnique in 1802 and a full professor in 1806. In 1808 he was made astronomer at the Bureau des Longitudes, and, when the Faculté des Sciences was instituted in 1809, he was appointed professor of pure mathematics.

Poisson's most important work concerned the application of mathematics to electricity and magnetism, mechanics, and other parts of physics. His *Traité de mécanique* (1811 and 1833; "Treatise on Mechanics") was the standard work in mechanics for many years. One of his publications (1812) contained many of the most useful laws of electrostatics and his theory that electricity is made up of two fluids, in which like elements repel and unlike attract.

Poisson contributed to celestial mechanics by extending the work of Lagrange and Laplace on the stability of planetary orbits and by calculating the gravitational attraction exerted by spheroidal and ellipsoidal bodies. His expression for the force of gravity in terms of the distribution of mass within a planet has been used in the late 20th century for deducing details of the shape of the Earth from accurate measurements of the paths of orbiting satellites.

Poisson's other works include *Théorie nouvelle de l'action capillaire* (1831; "A New Theory of Capillary Action") and *Théorie mathématique de la chaleur* (1835; "Mathematical Theory of Heat"). In *Recherches sur la probabilité des jugements . . .* (1837; "Researches on the Probability of Opinions . . ."), an important work on probability, the Poisson distribution, or Poisson law of large numbers, first appeared. Although originally derived as merely an approximation to Bernoulli's binomial law, it is now fundamental in the analysis of problems concerning radioactivity, traffic, and general distribution.

In pure mathematics his most important works were a series of papers on definite integrals and his advances in Fourier's series, which paved the way for the researches of Peter Dirichlet and Bernhard Riemann on the same subject.

Poissy, town, Yvelines *département,* Paris region, north central France, on the Seine River. It contains the 12th-century collegiate church of Notre-Dame, restored by the architect E.-E. Viollet-le-Duc, and the Savoye House (1929–30), a major work of the architect Le Corbusier. The town is the birthplace (1214) of Louis IX (St. Louis). Its former abbey was the scene of the Colloquy of Poissy (September 1561), at which French Catholics and Huguenots tried unsuccessfully to reconcile their differences. Manufactures include a variety of metal products (automobiles, kitchen equipment, cables, and razor blades). Pop. (1982) 35,938.

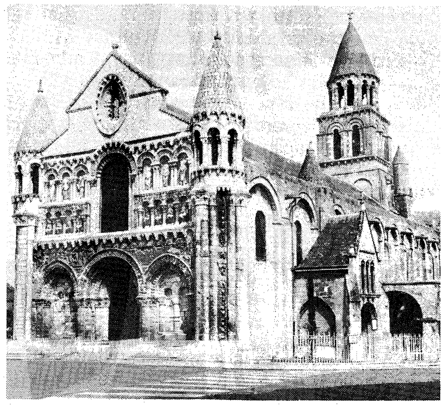
Poitier, Sidney (b. Feb. 20, 1924, Miami), Bahamian-American actor and motion-picture director. He was also a founder of First Artists Production Company in 1969.

Poitier grew up in the British West Indies. During World War II he served in a U.S. Army medical unit. After the war he decided to become an actor and applied at the American Negro Theatre (ANT) in New York City. He was refused because of his accent, spent six months listening to the radio and practicing enunciation, and applied again. He was accepted, studied acting, appeared in a series of ANT productions, and then in 1959 he won acclaim starring in Lorraine Hansberry's *A Raisin in the Sun* on Broadway.

Among Poitier's many film performances, the most notable include those in *No Way Out* (1950); *Blackboard Jungle* (1955); *The Defiant Ones* (1958); *Lilies of the Field* (1963), for which he won an Academy Award as best actor; *In the Heat of the Night* (1967); and *Guess Who's Coming to Dinner* (1967). Poitier is recognized as the actor who broke the colour barrier in the U.S. motion-picture industry and made the careers of other black actors possible. He directed such films as *Buck and the Preacher* (1972), *A Warm December* (1973), *Stir Crazy* (1980), and *Hanky Panky* (1982).

Poitiers, town, capital of Vienne *département,* Poitou-Charentes region, west central France, southwest of Paris. Situated on high ground at the confluence of the Clain and Boivre rivers, the town commands the so-called gate of Poitou, a gap 44 mi (71 km) wide between the mountains south of the Loire River and the Massif Central that serves as the connecting link between northern and southern France.

Poitiers derives its name from the Pictones, or Pictavi, a Gallic tribe that first settled there. It became a Christian centre in the 4th century in the time of Bishop St. Hilary of Poitiers. The Visigoths settled there in the 5th century but were driven out in 507 by the Frankish king Clovis. The city became a landmark in 732, when the Frankish ruler Charles Martel defeated the Saracens near the city, thus halting their invasion of France. The town and neighbouring provinces passed under English rule as the dowry of Eleanor of Aquitaine for her marriage (1152) to Henry Plantagenet (later Henry II of England). Poitiers was joined to the French crown during the 12th century,



Notre-Dame-la-Grande church, Poitiers, Fr.

Shostal—EB Inc.

but the English won it back at the Battle of Poitiers in 1356. The French reconquered the province and its capital between 1369 and 1374. The French national heroine St. Joan of Arc was interrogated there in 1429. The town suffered from the fighting during the 16th-century Wars of Religion. After a period of prosperity in the 16th century, it declined until the 19th century. Parts were destroyed during World War II.

The oldest part of the city has a maze of narrow, hilly streets encircled by boulevards that follow the line of the ancient fortifications. The great artistic wealth of Poitiers is not immediately noticeable, for its many old monuments are dispersed throughout the town. Notre-Dame-la-Grande church is a good example of Romanesque architecture, with a remarkable 12th-century facade containing a profusion of fine sculptures. The Saint-Pierre cathedral (12th–16th century), built largely in the local Gothic style known as Angevin (after the counts of Anjou and their descendants), has a great crucifixion window (12th century) that is said to be a gift of Henry II of England. The carved wooden pews in the choir are among the oldest in France. Nearby stands the 4th-century rectangular Baptistère Saint-Jean, probably the oldest Christian edifice in France; it now houses an archaeological museum containing a collection of tombs dating to the era of the Merovingians (5th–8th century). The Romanesque Saint-Hilaire-le-Grand church was built over the tomb of St. Hilary of Poitiers, the first known bishop of Poitiers, and was restored in the 19th century. The 12th-century former ducal palace has been incorporated into the 19th-century Hôtel de Ville, which houses the Musée des Beaux-Arts that contains a collection of Roman and medieval sculptures.

Poitiers has good road and rail communications and is a commercial and administrative centre. Recent industrial growth has been strong (printing and rubber) and electrical machinery and chemical industries have developed in the suburbs. Pop. (1982) 76,793.

Poitiers, Battle of, also called BATTLE OF TOURS (732), victory won by Charles Martel, Carolingian mayor of the palace and de facto ruler of the Frankish kingdoms, over Muslim invaders from Spain. The battlefield cannot be exactly located, and the battle may possibly have consisted of a series of running engagements. ʿAbd-ar-Raḥmān, governor of Córdoba, had invaded Aquitaine (present southwestern France) and defeated its duke, Eudes. Eudes appealed for help to Charles, who had already stationed his cavalry to defend the city of Tours. According to tradition, the Muslim attack was broken by Charles's cavalry near Poitiers. ʿAbd-ar-Raḥmān was killed, and the Arabs retired. There were no further Muslim invasions of Frankish territory, and Charles's victory has sometimes been regarded as decisive for world history. The Muslim advance, however, was really ended by internal dissensions and the revolt of the Berbers in North Africa. Charles derived profit as well as glory from the engagement; he was able to assert his authority in Aquitaine, where Eudes swore allegiance to him.

Poitiers, Battle of (Sept. 19, 1356), the catastrophic defeat sustained by the French king John II at the end of the first phase of the Hundred Years' War between France and England.

Edward, the Black Prince, son and heir to Edward III of England, with English troops under Sir John Chandos and with Gascon troops under the Captal de Buch (Jean III de Grailly), together rather less than 7,000 men, was conducting a raid from Bordeaux into central France but was turning westward and southward from the lower Loire River valley under pursuit from John II's probably superior forces. Contact between the enemy armies was made east of Poitiers on Sept. 17, 1356; but a truce for September 18, a Sunday, enabled the English to secure themselves on the Maupertuis (Le Passage), near Nouaillé south of Poitiers, where thickets and marshes surrounded the confluence of the Miosson and Clain rivers. Forgetful of the lessons of Crécy (1346), the French launched a series of assaults in which their knights, bogged down, became easy targets for the Black Prince's archers. John II himself led the last French charge and was taken prisoner. For his freedom he had to consent to the disadvantageous but inconclusive treaties of Brétigny and Calais (1360).

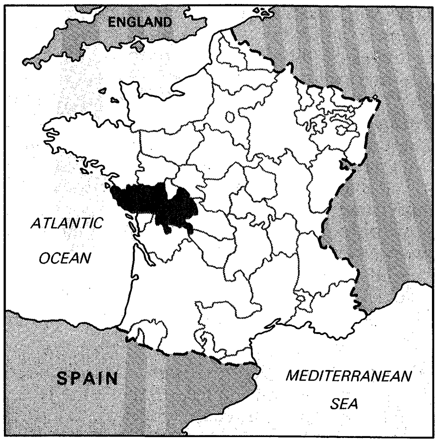
Where the same name may denote a person, place, or thing, the articles will be found in that order

Poitiers, University of, French UNIVERSITÉ DE POITIERS, coeducational, autonomous state institution of higher learning in Poitiers, Fr. Founded in 1970 under a law of 1968 reforming higher education, it replaced a university founded in 1431 by a Papal Bull of Eugene IV and confirmed by Charles VII in 1432. The university was suppressed by the French Revolution and was eventually replaced by separate faculties of law, letters, and science and by a school of medicine which was part of the University of France. In 1896 these faculties reconstituted as the University of Poitiers.

The modern university is organized into independent teaching and research units that include law and social sciences, exact and natural sciences, medicine and pharmacy, and languages and literature. Several institutes of technology offer two-year courses.

Poitou, historic and cultural region encompassing the western French *départements* of Vendée, Deux-Sèvres, and Vienne and coextensive with the former province of Poitou.

Poitou derives its name from the Gallic tribe of Pictones, or Pictavi, whose *civitas,* or community, formed part of Roman Aquitania. For centuries the northern part of Aquitaine, Poitou was a border country and a battlefield (Battle of Vouillé in 507, Charles Martel's victory over the Muslims in 732, the Anglo-French Battle of Poitiers in 1356, and the Battle of Moncontour in 1569) as well as the meeting place of northern and southern cultures. Its golden age (11th–12th century) is represented by a great school of Romanesque architecture, sculpture, and painting. The great counts of Poitiers (who also held the title duke of Aquitaine from the mid-10th century) were succeeded by the Angevin kings of England in the 12th century, but Philip II Augustus and



The *gouvernement* of Poitou in 1789

Louis VIII of France conquered the country early in the 13th century. Poitou was ceded to the English monarchy by the treaties of Brétigny and Calais (1360), but by 1375 the French had won it back. Poitou suffered in the Wars of Religion; its later history was quieter, apart from the Wars of the Vendée in the Revolutionary period.

Physiographically, Poitou consists of two smaller regions, Haut (High) Poitou at the southern end of the Massif Armoricain and Bas (Low) Poitou about the periphery. The Vendée is a northern section of the region. Small farms predominate in the north; the population tends to be dispersed. The rural population in the south tends to cluster in small villages surrounded by open fields. The *bourrine* is the traditional farmstead of Vendée and consists of one story roofed with thatch; the exterior is lime-washed.

Superstitions in the region include the *garou,* who is a person condemned by Satan to take the shape of an animal. The *cheval mallet* is a black stallion that wanders the roads at night and brings death to his rider. La Tranche-sur-Mer in Vendée hosts a festival of tulips over Easter; Les Sables-d'Olonne in Vendée features a festival of flowers the fourth week in June.

There are large Protestant enclaves in Vienne around Loudun and Châtellerault and in villages around Niort. Vendée is predominantly Roman Catholic, though there are sizable Protestant communities in Chantonnay and Pouzauges. The Petite Église ("Little Church") outside Courlay in Deux-Sèvres rejected the Concordat of 1801 and functions without a priest.

Regional cuisine features mussels cooked in cream or marinated in white wine, escargots prepared in wine, and a soup of fish and white wine.

Poitou-Charentes, *région de programme* ("planning region") encompassing the western French *départements* of Vienne, Charente, Charente-Maritime, and Deux-Sèvres. The capital is Poitiers. The region has an area of 9,965 square miles (25,809 square km) and is bounded by the *départements* of Vendée to the northwest, Maine-et-Loire and Indre-et-Loire to the north, Indre, Haute-Vienne, and Dordogne to the east, and Gironde to the south. The Bay of Biscay lies to the west. The Massif Armoricain extends into northwestern Deux-Sèvres; the Massif Central rises to the southeast. The centre of the region is low-lying and punctuated by the shallow valleys of Vienne, Clain, Charente, and Sèvre Niortaise. An oceanic climate prevails.

The region is sparsely populated. The population declined by more than 9 percent between 1901 and 1946, in common with most of rural France during that period, and has subsequently increased at a rate well below the national average. Vienne has benefited from its proximity to Paris.

Wheat, barley, and corn (maize) are widely cultivated. Cognac is produced in Charente and Charente-Maritime. Beef cattle are raised in the Massif Central and the Massif Armoricain; milk cows are raised in southern Deux-Sèvres and around Poitiers. Montmorillon in Vienne produces goat cheese. The mouth of the Seudre River in Charente-Maritime is a centre for oyster culture.

Industries must import raw materials and energy and are underdeveloped. Manufacturing is concentrated in Poitiers, Châtellerault, La Rochelle, Angoulême, and Niort, which produce electrical machinery, automobiles, and aeronautical equipment. Pop. (1988 est.) 1,599,600.

Poivre, Pierre (b. Aug. 23, 1719, Lyon, Fr.—d. June 6, 1786, near Lyon), French missionary-turned-entrepreneur whose enthusiasm for trade with Indochina stimulated French colonial expansion and whose many commercial schemes, had they been realized, might have established France securely in Indochina in the 18th instead of the 19th century.

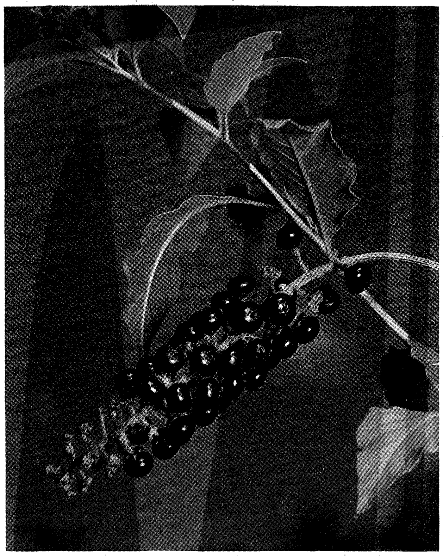
The son of a wealthy silk merchant, Poivre early developed an interest in the Far East and joined the Society of Foreign Missions as a seminary student, arriving in the Orient in 1740. His visits to India, China, and Indochina aroused his mercantile interests, and he became involved in trading ventures in China. After returning to Europe in 1747, he abandoned missionary work and persuaded the French East India Company to set up a bank in Cochinchina (southern Vietnam), to which he returned two years later as the company's representative. He obtained permission from the Vietnamese king Vo Vuong to set up temporary trading posts and a permanent one at Tourane but then alienated the king by kidnapping a young Vietnamese to serve as his interpreter. As a result, all European missionaries were expelled from the country and were not reinstated until the interpreter was returned two years later.

Poivre then made his way to the Moluccas, in the Dutch East Indies, despite the deceptive maps that the Dutch had drafted to delude other navigators. Landing at the island of Timor, he smuggled more than 3,000 nutmeg plants and other fruit trees and spices out to the French islands of Mauritius and Réunion, off the coast of eastern Africa. He returned to France in 1750 with samples of his goods and again tried to interest businessmen there in his ventures. In a brief respite from his continuing commercial pursuits, Poivre was appointed administrator of the French colony of Mauritius (1765), where he governed capably.

Poix, Charles I de Blanchefort, prince de (prince of): *see* Créquy, Charles I de Blanchefort, marquis de.

poke, also called POKEBERRY, or POKEWEED (species *Phytolacca americana*), strong-smelling shrublike plant with a poisonous root resembling that of a horseradish. It has white flowers and reddish black berries and leaves that often are red-veined or borne on red leafstalks. The berries contain a red dye used to colour wine, candies, cloth, and paper. Poke is native to wet or sandy areas of eastern North America.

Like the roots, mature stalks, which are red



Poke (*Phytolacca americana*)
Grant Heilman—EB Inc.

or purplish in colour, are poisonous. Very young shoots—up to about 15 centimetres (6 inches)—are edible, however. The tender green stalks, stripped of leaves and peeled, may be simmered and eaten like asparagus. The leaves may be cooked with other greens.

poke bonnet, hood-shaped hat tied under the chin, with a small crown at the back and a wide projecting front brim that shaded the face. It became fashionable at the beginning of the 19th century and was worn by women and children of all ages. The size of the poke bonnet increased until, in 1830, a woman's face could not be seen except from directly in front.

After Queen Victoria's accession, in 1837, romantic dress designs were abandoned for more subdued and modest effects. The poke bonnet adorned with flowers and ribbons and fitting closely around the face came to mark the height of prudery. The fashion for small hats, which began in the 1860s, brought the era of the poke bonnet to an end.

Woman wearing a poke bonnet, detail of a coloured lithograph from *Ackerman's Repository*, English, 1820; in the Victoria and Albert Museum, London
By courtesy of the Victoria and Albert Museum, London

Poker, a family of card games, almost invariably played as gambling games. Although played internationally, Poker is most popular in North America.

A Poker hand usually consists of five cards. Players try for combinations of two or more cards of a kind, five-card sequences, or five cards of the same suit. (*See below* Rank of Hands.)

Poker is played with a standard 52-card deck in which all suits are of equal value, the cards ranking from the ace high, downward through king, queen, jack, and the numbered cards 10 to the deuce. The ace may also be considered low to form a straight (sequence) ace through five as well as high with king–queen–jack–10.

Each deal is a separate game in which there is a pot, the aggregate of a preliminary ante and all bets made. There are one or more rounds of betting, and the pot is taken by the player with the best hand, or in some forms of the game it may be divided between two or more players.

History. The forerunner of Poker was a 16th-century European three-card game called *primera* (Spain) or *primero* (England). There was betting and valued hands were three of a kind, pairs, and three of the same suit: a flux (later flush). By the 18th century the betting and bluffing aspects of the game had been incorporated in such five-card games as Brag (England), Pochen (Germany), and Poque (France). The importance of bluffing (betting with a poor hand) is shown by the fact that pochen means "to bluff."

The game was carried to North America in the 18th century by French colonists to the Louisiana territory, the American term being a corruption of Poque. The game spread north up the Mississippi River and West as the country developed. By 1834 it was adapted to the 52-card deck and from the mid-19th century on it was described in books on card games. At first it was a game for men only, but by the mid-20th century it was played by women as well. It is the classic game in all Western films.

Poker was taken back to Europe when Robert C. Schenck, U.S. minister to Great Britain, introduced it to members of the court of Queen Victoria in the early 1870s. A set of rules written by Schenck was the first book on the game.

The rank of hands in the original European games was supplanted (in descending order) by four of a kind; full house (three of a kind and a pair); three of a kind; two pairs; one pair; and no pair (high card winning). Later the straight (five cards in sequence regardless of suit) and the flush were introduced, ranking, respectively, above three of a kind. Additional rounds of betting were also introduced.

Two principal forms of the game developed: (1) Closed (Straight or Draw Poker), in which all five cards are dealt face down; and (2) Open (Stud) Poker, in which one or two cards are dealt face down (five-card or seven-card) and the rest face up one at a time in five-card or the last card down, in seven-card. In Draw Poker, after the first round of betting, each player may draw from one to three cards to improve his hand. Six or seven players make the best game.

Rank of hands. The traditional ranking is (1) straight flush (five cards of the same suit in sequence, the highest ace–king–queen–jack–ten being called a royal flush; (2) four of a kind, plus any fifth card; (3) full house; (4) flush; (5) straight; (6) three of a kind; (7) two pair; (8) one pair; (9) no pair, highest card determining the winner.

To determine the winner in hands in which there are hands of the same rank, the one containing the highest card wins. If the high cards are identical, the second highest wins, and so on. With full houses, the higher three of a kind wins; with two pairs, the highest pair wins, or if the pairs are identical, the odd high card wins, as in the case of identical pairs. For the occasion when none of the above applies, *e.g.,* two flushes with identical cards in different suits, house rules may apply (the winning hand being the one in the higher bridge suit, or the two hands may split the pot). There is no universally accepted code of Poker rules. A code prepared by Oswald Jacoby in 1940 and a set of rules in the United States Playing Card Company's *Official Rules of Card Games*, published from 1945, are the ones usually adopted subject to house rules in the United States.

Wild cards. Most serious poker players decry the use of wild cards, but among the less serious, a wild card can be declared by the dealer (the deuce is most popular, but any rank can be used, or a distinguishable face card: the one-eyed jack). When there are wild cards in the game, the highest hand becomes five of a kind, though some house rules preserve the sanctity of the royal flush.

Betting. In each deal there are one or more betting rounds. In Draw Poker, the usual prerequisite to bet is holding a pair of jacks or better, though this requirement may be waived by the dealer, such a game being called "guts," *i.e.,* all that is required to open. In Stud Poker games, the highest card showing (or the first dealt if there are more than one) is the first to bet. Betting begins from the player to the left of the dealer. After a bet, a succeeding player may match the bet, "call," or raise. A player who declines to match a bet or a bet and raise drops out. Again, house rules may limit the size of bets and raises, and the number of raises. When all bets and raises have been matched by players still in the game, each player calls his hand, the player whose last bet has been matched, going first. The highest hand wins. Again, in serious games, a player who miscalls his hand (claiming a flush, say, when in fact he has a straight flush) is held to that call; in less serious games, the actual high hand may be allowed to win.

Playing the hand. A knowledge of probability ties is important. Chances are about 1 in 2 of receiving a hand of one pair or better, 1 in 5 for a pair of jacks or better, rising to 1 in 590 for a full house or better. Odds against improving the original hand in Draw Poker range from $2\frac{1}{2}$ to 1 (to improve a pair by drawing three cards) to 1,080 to 1 (to make a pair and an ace into four by drawing two cards). In Five-Card Stud, after 12 cards have been dealt face up, the odds against pairing an ace are 6 to 1 if none of the 12 was an ace and 10 to 1 if one was.

Betting decisions are based on the ratio of expected profit to the amount bet and on chances of winning. If a one chip bet can win ten chips (10 to 1 odds) and chances of winning appear to be 1 in 6, this is a good bet. It is important to know the mathematics of the game, but it is even more important to know the characteristic playing habits of other players. Such knowledge is best acquired through experience. (O.J.)

BIBLIOGRAPHY. See *Oswald Jacoby on Poker* (1947) for the game as played in the U.S.; M. Ellinger, *Poker* (1950), for the game as played in England. Other works include: A. Dowling, *Great American Pastime: Notes on Poker, the Game and the Players* (1970); Nesmith Askeny, *Poker Strategy: Winning with Game Theory* (1981).

Poker Dice, game involving five dice specially marked to simulate a playing-card deck's top six cards (ace, king, queen, jack, 10, 9); the dice may also be standard ones, one equalling an ace and the rest designated in descending order from 6. The object is to throw a winning Poker hand, with hands ranking as in Poker, (*see* Poker), except that five of a kind is high and there are no flushes. A player throws up to two times; after each throw, he elects either to stand pat or to draw, as in Draw Poker; in the latter case he separates out his best-showing dice and throws up to three of the dice again. In a version called Horses, a hand of five aces loses.

A variant, Liar Dice, as the name suggests, permits bluffing. Each player shields his throws and announces his hand, either truthfully or not. The second player, named the caller, or doubter, may either attempt a better hand or call the bluff. If the caller is correct in his call, he wins; if not, he loses.

The Puerto Rican game General is similar, with three throws instead of two. The English game Yacht is similar but with point values for various combinations and a game involving 12 throws. Trademarked variants called Yahtzee and Kismet, featuring other score categories and 13 rounds, are popular.

Pokomam (people): *see* Pocomam.

Pokorny, Julius (b. June 12, 1887, Prague, Austria-Hungary [now in Czechoslovakia]—d. April 8, 1970, Zürich, Switz.), European linguist known primarily for his work in Celtic studies and Indo-European etymological research.

Pokorny was a professor at the University of Berlin from 1920 until 1935 or 1936 and taught subsequently in Switzerland, holding lectureships at the University of Bern from 1944 to 1948 and at the University of Zürich from 1944 to 1958. He was named an honorary professor at the University of Munich in 1955. His major works include *Altirische Grammatik* (1925; "Old Irish Grammar"), *Altkeltische Dichtungen* (1944; "Old Celtic Poems"), and the monumental *Indogermanisches etymologisches Wörterbuch,* 2 vol. (1948–69; "Indo-European Etymological Dictionary").

Pokrovsky, Mikhail Nikolayevich (b. Aug. 29 [Aug. 17, Old Style], 1868, Moscow, Russia—d. April 10, 1932, Moscow), Soviet historian and government official, one of the most representative Russian Marxist historians.

Pokrovsky joined the revolutionary movement as a young man, becoming a member of the Bolshevik Party in 1905. Forced to leave Russia following the revolutionary disturbances of 1905–07, he lived abroad from 1908 until 1917, when he returned to take part in the Bolshevik seizure of power in the October Revolution.

Pokrovsky was active in the campaign against Leon Trotsky in the early 1920s and subsequently held several positions in the government, the Communist Party, and various academic institutions, becoming a member of the Academy of Sciences in 1929. He was instrumental in setting up new Marxist scholarly institutes and in subordinating historical writing to the political needs of the new state. Despite his rigid Marxism, his ideas were denounced by Joseph Stalin as anti-Marxist, pseudoscientific, and injurious. He was posthumously rehabilitated at the 22nd congress of the Communist Party of the Soviet Union in 1961.

In developing an orthodox Marxist interpretation of Russian history, Pokrovsky emphasized the socialist revolution and the dictatorship of the proletariat as the inevitable political consequences of class struggle and stressed the dialectical method in history. In the 1930s Stalinists attacked his "internationalist" insistence that the Russian Revolution was not necessarily the leading event in world revolution. His works include *Russkaya istoriya s drevneyshikh vremyon* (1911–12; "Russian History from the Earliest Times") and *Ocherk istorii russkoy kultury* (1915–18; "An Outline History of Russian Culture").

Pokrovsky Cathedral: *see* Saint Basil the Blessed.

Pol Pot, also called POL PORTH, TOL SAUT, SALOTH SAR, or SALOT SAR (b. May 19, 1925/28, Kompong Thom province, Cambodia), Khmer political leader whose totalitarian regime (1975–79) imposed severe hardships on the people of Kampuchea (Cambodia). His radical communist government forced the mass evacuations of cities, killed or displaced millions of people, and left a legacy of disease and starvation.

Pol Pot was born into a peasant family and stayed in a Buddhist monastery, according to his own account, for six years, two of which he spent as a monk. He studied carpentry for a year in Phnom Penh at a technical school. In the 1940s he joined the anti-French resistance under Ho Chi Minh, and from 1946 he was a member of the Cambodian Communist Party.

He went to Paris in August 1949 to study radio electronics but spent more time on revolutionary activities than on his studies. His scholarship was cut short after he failed examinations, and he returned to Phnom Penh in January 1953.

Pol Pot taught at a private school in Phnom Penh from 1954 to 1963 but left the capital because his communist ties were suspected by the police. He spent the next 12 years building up the Communist Party that had been organized in Cambodia in 1960, and he served as the party's secretary. An opponent of the Norodom Sihanouk government and of the military government of General Lon Nol, he led the Khmer Rouge guerrilla forces in their overthrow of Lon Nol's regime in 1975. Pol Pot was prime minister of the new Khmer Rouge government from 1976 until he was overthrown in January 1979 by invading Vietnamese. Under the leadership of Pol Pot, it is estimated that from 1975 to 1979 his government caused the deaths of about 2 million people from forced labour, starvation, disease, torture, or execution.

Following the Vietnamese invasion of his country, Pol Pot withdrew to the mountains of the southwest to lead the Khmer Rouge forces against the new Hanoi-supported government in Phnom Penh, which refused to consider peace negotiations as long as he remained at the head of the party. Although officially removed from the military and political leadership of the Khmer Rouge in 1985, he apparently remained the guiding force of the organization.

Pola (Yugoslavia): *see* Pula.

Polab, member of the westernmost Slavs of Europe who dwelt in medieval times in the territory surrounded by the lower Elbe River in the west, the Baltic Sea in the north, the lower Oder River in the east, and Lusatia in the south. (This territory lay in what later became Germany.) Their name, derived from *po* and *Laba,* means "along the Elbe."

By the early 9th century the Polabs were organized into two confederations, or principalities, the Obodrites and the Lutycy, or Wilcy. The many Lutycy tribes, of which the Ratarowie and Stodoranie (Hawolanie) were the most important, were subdued by Lothar of Saxony and Albert the Bear of Brandenburg in the 12th century. The other Polab groups were also subjugated by the Germans in the 12th–13th century. Nevertheless, the Polab language, related to Kaszub and Polish, survived in what is now Lower Saxony until the beginning of the 19th century.

Poland, officially REPUBLIC OF POLAND, Polish POLSKA, or POLSKA RZECZPOSPOLITA, seventh largest country of Europe (excepting the European portion of the U.S.S.R.), covering an area of 120,727 square miles (312,683 square km). The capital is Warsaw. The country extends about 405 miles (650 km) from south to north and about 430 miles (690 km) at its widest from west to east. It is bordered on the east and northeast by the Soviet Union, on the south by Czechoslovakia, and on the west by Germany; it fronts the Baltic Sea on the northwest. The population in 1990 was estimated at 38,064,000.

A brief treatment of Poland follows. For full treatment, *see* MACROPAEDIA: Poland.

For current history and for statistics on society and economy, *see* BRITANNICA WORLD DATA ANNUAL.

Poland

The land. Except for its southern mountainous regions, Poland consists almost entirely of lowlands belonging to the North European Plain. More than 75 percent of its area lies below 650 feet (200 m) in elevation. The country can be divided into six physiographic zones from north to south: the swamps and sand dunes of the Baltic coast; the glacial outwash plain with thousands of lakes that marks the southern limit of the last ice sheet; the central lowlands—the heartland of Poland, where Warsaw, Wrocław, and Poznań cities are located; the Little Poland Uplands, including rounded, low-lying hills; the Sudeten, which includes the Giant Mountains (Karkonosze), in the southwest; and the Carpathian Mountains and their foothills in the extreme south, respectively. The highest point of the country, the peak of Rysy, at an elevation of 8,199 feet (2,499 m), is located in the Tatra Mountains of the Carpathians on the Czechoslovakian border. The Vistula (Wisła) and Oder (Odra) are the country's principal river systems and drain into the Baltic Sea.

Poland's climate is transitional between maritime and continental types, with cold, snowy winters and warm summers. Mean annual temperatures range from 46° F (8° C) in the southwestern lowlands to 43° F (6° C) in the colder northeast. The average annual precipitation is about 24 inches (600 mm).

Forests occupy more than one-fourth of the total land area; common tree species include pine, larch, beech, oak, and birch and, at higher elevations, spruce. Subalpine and alpine vegetation are found at higher elevations in the Carpathians. Large mammals include deer, wild pig, elk, brown bear, and wildcat.

Poland has relatively extensive natural mineral resources. It has among the world's largest reserves of bituminous coal (in Upper and Lower Silesia in the southwest), sulfur (near Tarnobrzeg in the southeast), and zinc and lead (near Katowice in the south) and other substantial reserves of lignite (brown coal), rock salt, natural gas, and copper.

The people. Poland's population is ethnically and linguistically very homogeneous, although minority groups include Germans, Ukrainians, and Belorussians. Polish is the predominant language, and about 95 percent of the population is Roman Catholic. During World War II a fifth of Poland's people, some 6 million in all, including almost the entire Jewish population of more than 3 million, were exterminated under the Nazi occupation.

Poland's population had one of the highest postwar rates of natural increase compared with other European countries. Between 1950 and 1990 the incidence of urban dwellers increased from 37 percent to 61 percent.

The economy. Poland's economy in the early 1990s was making the transition from a state-owned, centrally planned one to a more mixed economy relying on market pricing mechanisms and permitting private ownership and free enterprise in most spheres. In 1990 the government adopted a plan under which it lifted price controls and subsidies on many basic consumer items, allowed the exchange rate of the złoty, its currency, to be set freely on the international currency market, began converting many state-owned companies to private ownership, and permitted inefficient state-owned enterprises to go bankrupt. Under communist rule Poland's economic growth had been undermined by inefficient allocation of fuels and raw materials, low productivity, shortages of capital and consumer goods, and disaffection among workers and farmers. Consequently the country's gross national product (GNP) per capita is relatively low for an industrialized European country.

Agriculture accounts for more than one-seventh of the net material product (NMP) and employs more than one-fourth of the work force. About half of the land is arable. Poland traditionally exports food products and agricultural produce, but since the late 1970s it has often had to import fodder and grain to offset poor harvest years. Most farmland is privately owned, though the private agricultural sector suffers from a shortage of investment and a faulty distribution system. Major crops include potatoes, sugar beets, rye, wheat, and barley. Pigs are the leading livestock.

Sawn softwood taken mostly from state-owned forests is an important export. The fishing industry operates primarily in the Atlantic Ocean.

Coal (both bituminous and lignite), sulfur, copper, lead, and zinc are mined. Coal regularly accounts for about one-tenth or more of Poland's exports and is the country's chief source of electrical energy. Some natural gas is also produced, but about half of the natural gas consumed and most petroleum are imported from the Soviet Union, which has been Poland's chief postwar trading partner.

Manufacturing accounts for approximately one-third of the NMP and employs more than one-fourth of the work force. Major manufactures include steel, chemicals, household glass, cotton fabrics, paper, washing machines, refrigerators, television receivers, and motor vehicles. Poland's large shipbuilding industry is a major source of export earnings.

The private sector employs most of the country's farmers and a rapidly growing proportion of workers in industry and services. Many Polish workers belong to Solidarity (Solidarność), which was established as a labour union independent of the state in 1980, forcibly abolished by the government in 1981, and legalized again in 1989.

Poland owed a large public external debt to Western lenders by the early 1990s and, given the difficulties besetting the nation's economy, had little prospect of repaying it.

Government and social conditions. Poland's political system was in a state of transition in the early 1990s. From 1947 to 1989 the country had been ruled by the Polish United Workers' (communist) Party (PUWP). Poland was essentially a one-party state whose governmental structure and administration were patterned on the Soviet model. Ultimate political authority in the country was exercised by the Politburo of the PUWP's Central Committee and by the PUWP's first secretary.

In 1989 Poland's political system underwent a basic restructuring that converted the nation into the first multiparty parliamentary democracy among the Soviet-bloc nations of eastern Europe. The restructuring allowed the anticommunist opposition (*i.e.*, the Solidarity movement) to participate in free elections and, subsequently, to form a coalition government with the PUWP as its junior partner.

Under a historic agreement negotiated between the PUWP and Solidarity in April 1989, Poland's formerly unicameral Parliament was made into a bicameral National Assembly composed of a 460-member Sejm (lower house) and a 100-member Senate (upper house). The PUWP (now split into socialist or social democratic parties) and its former allies, the United Peasants' Party and the Democratic Party, henceforth competed with Solidarity factions in local and national elections. The April agreement also replaced the Council of State, which functioned as a collective presidency, with a strong executive president elected by the National Assembly. The president nominates as prime minister a member of that party that can command a voting majority in the Sejm. The prime minister then forms a cabinet, called the Council of Ministers, which must be approved by the Sejm.

Poland's social-welfare system provides health care for all workers, as well as pensioners, invalids, students, and the rural farm population.

Poland's high literacy rate reflects its comprehensive educational system. Education is compulsory between ages 7 and 14 and is free at all levels. Most print and electronic media were state-controlled until 1990, by which time an independent press had asserted itself.

Cultural life. Poland has produced many prominent artists and intellectuals. In literature the first half of the 19th century produced the Polish poet Adam Mickiewicz, and in the 20th century the Polish-born prose writers Henryk Sienkiewicz, Władysław Reymont, and Czesław Miłosz each won a Nobel Prize for Literature. Frédéric Chopin is the most famous Polish composer of music, while the pianists Ignacy Jan Paderewski and Artur Rubinstein headed a procession of famed musical performers in the late 19th and early 20th centuries. The 20th-century film director Andrzej Wajda has an international following.

History. Archaeological evidence supports the theory that Slavic tribes inhabited the Vistula River basin as early as the 2nd millennium BC. The tribes migrated in many directions from the Vistula basin and eventually formed differentiated groups referred to as East, South, and West Slavs. Several West Slavic tribes united to form small states between the years 800 and 960. One of these came to be ruled by the Piast dynasty (*q.v.*), which united the region around what is now modern Poznań, commonly called Great Poland. The year 966 is accepted as the founding date of Poland, when the Piast ruler Mieszko I (*c.* 963–992) adopted Christianity. A few decades later, the tribes of southern Poland united into Little Poland. In 1047 both Great Poland and Little Poland recognized the Piast ruler Casimir I the Restorer as their duke. The Piast dynasty continued to rule Poland until 1386, at which time Jogaila (Jagiełło), grand duke of Lithuania, married Jadwiga, the crown princess of the Piasts, and thus founded the ruling Jagiellon dynasty (*q.v.*) of Poland and Lithuania. Jagiellon heirs ruled over Poland and Lithuania until 1572. Poland's union with Lithuania enabled it to become the dominant power in east-central Europe during the 15th and early 16th centuries. The Jagiellon monarchs ruled Hungary and Bohemia for much of that time and repelled such powerful enemies as the (Germanic) Knights of the Teutonic Order, the Ottoman Turks, and the Grand Principality of Moscow. Poland's kings had to make growing concessions to the kingdom's landed gentry, however, who in turn used their powers to enserf the peasantry.

Following the end of the Jagiellon dynasty in 1572, the Polish nobility elected their kings from various royal houses of Europe, as well as from native Polish aristocratic families. The resulting succession of weak or inattentive rulers let power fall increasingly into the hands of the contentious and self-seeking Polish landed gentry, and thus the strength of the Polish-Lithuanian state was sapped just as powerful neighbours were once again reviving on the nation's borders.

Poland managed to suppress a great rebellion of Tatars and Cossacks on its southeastern frontier (the Ukraine) in the 1650s, but Sweden invaded Poland in 1655 and forced the cession of considerable territory in 1660. Poland then became embroiled in continuing conflicts with Russia and Sweden, while internally the Polish state succumbed to economic backwardness and social conflicts between Roman Catholic and Orthodox Poles.

In 1772 the first of three partitions of Poland occurred, and more than one-quarter of Poland's territory was seized by Russia (part of northeastern Poland), Austria (Galicia in the south), and Prussia (Polish Pomerania and Ermeland in the northwest). The second partition occurred in 1793 as Poland lost additional lands to Russia and Prussia. The third partition of Poland took place in 1795, and Poland was eradicated from the political geography of Europe and replaced by Austrian, Prussian, and Russian sectors.

In 1815 the Kingdom of Poland was established (with its own governmental system and army) within the Russian empire. The Polish people unsuccessfully revolted against tsarist oppression in 1830, 1846, and 1863. These revolts led to a policy of Russification in the educational system. Following the Russian example, the German chancellor Otto von Bismarck instituted a strict policy of Germanized education in the Prussian sector; only in the Austrian sector was Polish autonomy somewhat recognized.

Following World War I (1914–18) and the Russian Revolution (1917), an independent Poland was reestablished by the Allies in 1918 out of territories taken from Germany, Austria, and the Soviet Union. Between the world wars Poland's political life was dominated by Marshal Józef Piłsudski, who ruled Poland dictatorially from 1926 to 1935. Poland's uneasy coexistence with the Soviet Union to the east and Nazi Germany to the west ended in 1939 when Germany invaded and occupied the western two-thirds of Poland, while the Soviet Union occupied the remainder. When Germany invaded the Soviet Union in 1941, all of Poland came under Nazi rule. Germany's occupation policy in Poland was designed to eradicate Polish culture through mass executions and to exterminate the country's large Jewish minority.

In the winter of 1944–45, the Soviet Red Army drove the Germans from Polish soil. Under Red Army protection, a provisional Polish government headed by communists was established. (The Polish government-in-exile in London was ignored.) In 1945 Poland's boundaries were redrawn; the revived nation lost large territories in the east to the Soviet Union but gained significant territories in the west from defeated Germany. Meanwhile, the Soviet leader Joseph Stalin wanted to place Poland firmly into the Soviet orbit. To this end, the Polish communists under their leader, Bolesław Bierut, curtailed free elections, launched mass arrests of anticommunists, collectivized Polish farms, and nationalized the nation's industries. The communist Polish United Workers' Party was officially formed in 1948 to rule the country, and in 1952 a Soviet-style constitution was adopted. Poland was firmly in the grip of Stalinist totalitarianism.

In 1956, three years after the death of Stalin, Polish workers went on a general strike that was suppressed by force. In the ensuing crisis, Władysław Gomułka became the leader of the PUWP, and, under his rule (1956–70), Poland's farms were decollectivized and there was a mild relaxation of the regime's totalitarian controls. In 1970 Gomułka's failing economic policies provoked a new round of strikes by workers, and he was replaced as party leader by Edward Gierek. But Gierek similarly failed to make Poland's economy function effectively along Soviet lines, and by the late 1970s the Polish people again faced high prices and shortages of food and housing.

In 1979 Pope John Paul II, the former Karol Cardinal Wojtyła, archbishop of Kraków, made his first papal visit to his native country. He was received with great enthusiasm by the Roman Catholic faithful, for whom displaying loyalty to the church was an indirect means of protesting the Soviet political system.

In August 1980 strikes led by Lech Wałęsa, an electrician, erupted at the Gdańsk shipyards and quickly spread to other cities. The striking workers coalesced under Wałęsa's leadership into an illegal union, Solidarity, which won concessions from the government, notably legal status. Gierek was replaced as general secretary of the PUWP first by Stanisław Kania and then by the defense minister, General Wojciech Jaruzelski. Solidarity pressed for more concessions amid continuing strikes, and in response Jaruzelski declared martial law in December 1981. Solidarity's legal status was terminated, and its leadership was arrested. Martial law was lifted 18 months later, but the government continued to exercise tight control over its domestic opposition.

In the following years Poland's economy did not improve, and renewed labour unrest in 1988 prompted Jaruzelski to undertake a radical change of course and approve negotiations with the outlawed Solidarity movement. In April 1989 these negotiations resulted in far-reaching reforms of Poland's political system that allowed a newly legalized Solidarity to participate in free elections to a bicameral National Assembly. After Solidarity's overwhelming victory in these elections in June 1989, Solidarity formed a coalition government with the communists (who later converted to social democracy). The Cabinet was dominated by Solidarity members or supporters and was headed by the first noncommunist prime minister of Poland since the late 1940s. In subsequent months the new government enacted radical plans to transform Poland's centrally planned economy into a free-enterprise economy.

Poland, Congress Kingdom of: *see* Congress Kingdom of Poland.

Poland, Partitions of (1772, 1793, 1795), three territorial divisions of Poland, perpetrated by Russia, Prussia, and Austria, by which Poland's size was progressively reduced until, after the final partition, the state of Poland ceased to exist.

The First Partition occurred after Russia became involved in a war against the Ottoman Turks (1768) and won such impressive victories, particularly in the Danubian principalities, that Austria became alarmed and threatened to enter the war against Russia. Frederick II the Great of Prussia, however, in order to avoid an escalation of the Russo-Turkish War, determined to calm Austro-Russian relations by shifting the direction of Russia's expansion from the Turkish provinces to Poland, which not only had a structurally weak government but also, since 1768, had been devastated by a civil war and by Russian intervention and was, therefore, incapable of resisting territorial seizures.

On Aug. 5, 1772, Russia, Prussia, and Austria signed a treaty that partitioned Poland. Ratified by the Polish Sejm (legislature) on Sept. 30, 1773, the agreement deprived Poland of approximately half of its population and almost one-third of its land area. Russia received all the Polish territory east of the line formed roughly by the Dvina, Drut, and Dnepr rivers. Prussia gained the economically valuable province of Royal Prussia, excluding the cities of Gdańsk (Danzig) and Toruń, and also gained the northern portion of the region of Great Poland (Wielkopolska). Austria acquired the regions of Little Poland (Małopolska) south of the Vistula River, western Podolia, and the area that subsequently became known as Galicia.

Almost 20 years later Poland, which had made efforts to strengthen itself through internal reforms, adopted a new, liberal constitution (May 3, 1791). This action, however, resulted in the formation of the conservative Confederation of Targowica (May 14, 1792), which asked Russia to intervene to restore the former Polish constitution. Not only did Russia accept the confederates' invitation but Prussia also sent troops into Poland, and on Jan. 23, 1793, the two powers agreed upon the Second Partition of Poland. Confirmed in August and September 1793 by the Polish Sejm surrounded by Russian troops, the Second Partition transferred to Russia the major remnant of Lithuanian Belorussia and the western Ukraine, including Podolia and part of Volhynia, and allowed Prussia to absorb the cities of Gdańsk and Toruń as well as Great Poland and part of Mazovia.

In response to the Second Partition, the Polish officer Tadeusz Kościuszko led a national uprising (March–November 1794). Russia and Prussia intervened to suppress the insurgents, and on Oct. 24, 1795, they concluded an agreement with Austria that divided the remnants of Poland among themselves. By the Third Partition of Poland, which was not finally settled until Jan. 26, 1797, Russia incorporated Courland, all Lithuanian territory east of the Neman (Nieman) River, and the rest of the Volhynian Ukraine; Prussia acquired the remainder of Mazovia, including Warsaw, and a section of Lithuania west of the Neman; and Austria took the remaining section of Little Poland, from Kraków northeastward to the arc of the Northern Bug.

These territorial divisions were altered in 1807, when the emperor Napoleon of France created the duchy of Warsaw out of the central provinces of Prussian Poland, and in 1815, when the Congress of Vienna created the Congress Kingdom of Poland, but the main result of the partitions—*i.e.,* the elimination of the sovereign state of Poland—was in effect until after World War I, when the Polish Republic was finally restored (Nov. 11, 1918).

Polano, Pietro Soave (Italian theologian): *see* Sarpi, Paolo.

Polanski, Roman (b. Aug. 18, 1933, Paris, Fr.), motion-picture director, scriptwriter, and actor who was one of the more innovative filmmakers of the 1960s and '70s.

Shortly after the young Polanski's family resettled in Kraków, Pol., after having lived in France, his parents were interned in a Nazi concentration camp, where his mother subsequently died. At the age of 14, Polanski appeared on the stage, later acting in films directed by Andrzej Wajda, a leader in the Polish film revival of the 1950s. Polanski studied directing at the State School of Cinema in Łódź. By the time he graduated in 1959, he had already directed several award-winning short films. He made the French film *Le Gros et le maigre* (1961; *The Fat and the Lean*) and then returned to Poland to direct his first full-length feature, *Nóż w wodzie* (1962; *Knife in the Water*), a tense psychological study of sexual rivalry that brought him international fame.

After he left Poland in 1962, Polanski made several major films in Great Britain and the United States. *Repulsion* (1965) traces the psychotic breakdown of a young woman whose fear and loathing of sex drive her to commit several murders. *Rosemary's Baby* (1968) is a thriller about a young New York City matron who unwittingly bears a child by the devil. *Macbeth* (1971) is a gory but artistically effective adaptation of the play by William Shakespeare. *Chinatown* (1974) was one of the finest detective films made in the 1970s. These films were notable for their careful buildup of mood and suspense, their subtle handling of human psychology, and their fascination with evil in its various forms.

Polanski's second wife, the Hollywood actress Sharon Tate, was one of the victims of a horrible group murder in 1969. In 1977 Polanski was arrested and eventually pleaded guilty to a charge of unlawful intercourse with a minor. He subsequently jumped bail and fled to France, where he remained active in both the theatre and motion pictures. His subsequent films included *Tess* (1979), based on Thomas Hardy's novel *Tess of the D'Urbervilles,* and *Frantic* (1988), a suspense film.

Polanyi, John C(harles) (b. Jan. 23, 1929, Berlin, Ger.), chemist and educator who, with Dudley R. Herschbach and Yuan T. Lee, received the Nobel Prize for Chemistry in 1986 for his contribution to the field of chemical-reaction dynamics.

Born to an expatriate Hungarian family, Polanyi, whose father was also a noted chemist, was reared in England and attended Manchester University (Ph.D., 1952; D.Sc., 1964). He accepted a research position with the National Research Council of Canada in 1952 and began teaching at the University of Toronto in 1956, accepting the title of university professor in 1974.

Polanyi developed a technique that is known as infrared chemiluminescence based on the observation that molecules, when excited, emit infrared light. By means of spectroscopic analysis of the changes in emitted light that take place during a chemical reaction, he was able to trace the exchange of chemical bonds, thus helping to detail the disposal of excess energy that occurs during the process of chemical reaction.

Polanyi, Karl (Paul) (b. Oct. 25, 1886, Vienna, Austria—d. April 23, 1964, Pickering, Ont., Can.), economic anthropologist and former Hungarian political leader.

Polanyi qualified as a lawyer in Budapest in 1912. In college he had founded the radical Club Galilei, which would have far-reaching effects on Hungarian intellectual life. He served as a cavalry officer during World War I. Once back home he founded the Radical Citizens Party of Hungary. He then had to leave Hungary for political reasons. After working in Vienna as an economic journalist (1924–33), he moved to England and then, in 1940, to the United States. He was professor of economics at Columbia University (1947–53).

Polanyi was not a conventional economist but was instead concerned with the development of an overall view of the functioning of economic relationships within different social frameworks. This led him to detailed historical and anthropological studies. He produced three works based on the theme of the market economy as a special form of social organization. *The Great Transformation* (1944) concentrated on the development of the market economy in the 19th century, with Polanyi presenting his belief that this form of economy was so socially divisive that it had no long-term future. The second volume, *Trade and Markets in the Early Empires* (1957, written with others), concentrated on nonmarket forms of society. Polanyi had to develop a conceptual framework for what he regarded as nonmarket economies. His final work, published posthumously, was *Dahomey and the Slave Trade* (1966), which analyzed the economic structure of a slave-exporting state.

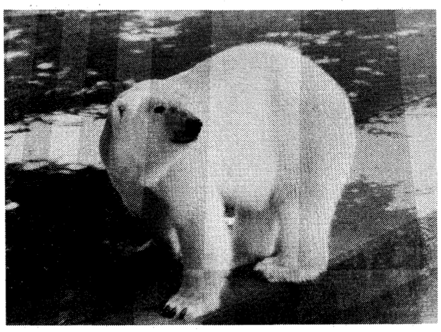
polar air mass, vast body of air that forms over land or water near either the North or the South Pole. *See* air mass; front.

polar anticyclone, wind system associated with a region in which high atmospheric pressure develops over the northern areas of continental landmasses during the colder half of the year. The Siberian anticyclone is an example of a polar anticyclone, as is the weaker high-pressure area that forms over Canada and Alaska during the winter.

Polar anticyclones are created by the cooling of surface layers of air over continental landmasses during the colder season. This cooling causes the air near the surface to become denser and, at the same time, causes an inflow of air at high levels to replace the denser, sinking air. These processes increase the mass of air above the surface, thus creating the anticyclone. The weather within the central regions of these anticyclones is typically clear and quite cold.

Polar anticyclones frequently migrate to the south and east in the winter season, bringing cold waves to more southerly latitudes. The boundary separating the cold polar air from the warmer air to the south is called the polar front, and along this frontal surface many of the mid-latitude extratropical cyclones, or wave cyclones, form. *See also* front.

polar bear, also called WHITE BEAR, WATER BEAR, SEA BEAR, or ICE BEAR (genus *Ursus maritimus,* formerly *Thalarctos maritimus*),



Polar bear (*Ursus maritimus*)
Roger Evans/Robert Harding Picture Library

semiaquatic northern bear, family Ursidae, found throughout Arctic regions, generally on drifting oceanic ice floes. The polar bear is sought for its trophy value and (especially by Eskimos) for its hide, tendons, fat, and flesh; the liver, however, is inedible and often poisonous because of its high vitamin A content. Since 1973 the polar bear has been protected by an international agreement that allows hunting of polar bears only by local populations using traditional weapons.

Camouflaged against ice and snow by its whitish fur, the polar bear is a swift and wide-ranging traveler. It swims very well and is often found many miles from land or ice packs. The polar bear stalks and captures its primary prey, the seal, whose southward migrations it may follow as far south as the Gulf of St. Lawrence in Canada and the mouth of the Amur River in the Soviet Union. It supplements its diet with fish, seaweed, grass, birds, caribou, and the occasional stranded whale.

The male polar bear, which is usually larger than the female, ranges in weight from about 410 to 720 kg (about 900 to 1,600 pounds). It grows to about 1.6 m (5.3 feet) at the shoulder and 2.2–2.5 m (about 7 feet) in length (also having a tail of 7–12 cm [3–4 inches]). The hairy soles of the polar bear's broad feet protect and insulate it from the cold and also facilitate movement across the ice. An elongated neck supports its relatively small head. The polar bear is usually shy but is dangerous when confronted or attacked.

One to four (usually two) cubs are born in winter, in a den of ice or snow, after a gestation period of 240–270 days. Cubs weigh about 1 kg (2 pounds) at birth and remain with their mother for 10 months to 2 years.

Polar Bear Provincial Park, wilderness park, northern Ontario, Canada, on Hudson and James bays. A huge undeveloped area of 11,233 square miles (29,093 square km), it is the largest of Ontario's provincial parks; it was established in 1970. Polar Bear Provincial Park is accessible only by plane or boat, and travel within the park is restricted in order to help preserve the abundant wildlife, which includes caribou, bearded seal, walrus, white whale, polar and black bear, red and Arctic fox, and moose. Birds include the Canada and snow goose, Arctic loon, and northern phalarope. The lowest 20 miles (32 km) of the Winisk River flow through the park.

polar biome, plant and animal community of either the Arctic or the Antarctic region, characterized by a cold, arid climate and a perpetual cover of snow or ice.

A brief treatment of the polar biome follows. For full treatment, *see* MACROPAEDIA: Biosphere.

Despite similarities of latitude, temperature, and barrenness, the Arctic and the Antarctic polar regions have markedly different plant and animal communities, or biomes. In both regions, the year is divided about equally between day (summer) and night (winter) owing to the continuous position of the Sun above or below the horizon during these seasons.

The polar ice caps are about 4.5 billion years old. It is probable, based on fossil discoveries, that before the ice froze over the poles both polar regions had temperate climates and were covered with forests. Variations in world climate and the poleward drift of landmasses have, over millions of years, rendered the Arctic and Antarctic largely barren, with only about 10 mm (0.4 inch) of yearly rainfall and permanently frozen subsoils. What flora exists is due to snow-melt water and the sunlight of the long summer day.

At the North Pole is the Arctic Ocean, lying in the midst of islands and landmasses (the

Gentoo penguins on Wiencke Island, Antarctica
Geoff Renner/ Robert Harding Picture Library

northernmost being Greenland) and the Canadian arctic archipelago. In all lowland areas the extreme cold is relieved with above-freezing temperatures for a month or more each year, allowing for a varied plant and animal life.

The South Pole is occupied by the continent of Antarctica, the mountains of which project through the world's greatest ice cap. No more than about 4 percent of the Antarctic's land is capable of sustaining life, while only the coast of Graham Land on the Antarctic Peninsula and several off-lying islands are warmed each year by above-freezing temperatures.

Plant life. In summer the Arctic is sprinkled with mosses and fields of grasses with brightly coloured flowers. There are many individual plants, and the number of species is fairly diverse. Lichens, fungi (850 species), liverworts (300 species), vascular plants, and nearly 2,000 species of algae take advantage of the short daylight period to fill the tundra with life, while nearly 1,000 species of ferns and flowers cover the landscape. Nourished by bird excrement, lichen and mosses spring up on the cliffs where birds dwell.

By contrast, there are only three native flowering plants in Antarctica: two grasses of the genus *Deschampsia* and a flower, *Colobanthus quitensis.* Besides some 70 species of mosses and a few liverworts, a large number (400 species) of lichens, because of their ability to live in extreme cold and dryness, inhabit the bare rock. On the coast the snow algae dapple the otherwise white expanse with a palette of yellow, red, and green. Life abounds in the Antarctic, primarily in the sea. Here, upward of 200 species of algae, mostly diatoms, populate the shallows, sometimes forming miniature underwater "forests."

Animal life. The Arctic is inhabited to its northernmost land reaches by the Arctic hare, wolf, fox, collared lemming, short-tailed weasel, caribou, musk-ox, and polar bear. The red fox, ermine, and brown bear, as well as some small rodents, the wolverine, shrew, and ground squirrel, also live in the south and mid-Arctic. In the sea are found seals, whales, walrus, and narwhals. Most of these species are threatened with extinction by human tampering with the ecosystem. Except for the Arctic ptarmigan and snowy owl, all Arctic birds migrate south for the winter. Ducks, geese, and swans come to nest in the Arctic in the summer. Terns, fulmar, puffins, guillemots, and little auk fill the cliffs and ground in vast numbers. There are also ravens and pipits, as well as falcons and other birds of prey. Waterbirds, such as loons, gulls, and skuas, fill the air with the sound of their calling, while the skies are sometimes clouded with masses of mosquitoes and other insects.

Animal life in Antarctica is limited to partially terrestrial species such as petrels, penguins, and seals. Although the sea contains some of the largest animals known (such as whales), small midges are the largest land creatures. There are also mites, springtales, worms, and a few microscopic fauna. In the seas of Antarctica, the blue, fin, and humpback whales feed on krill, a tiny, abundant crustacean. Zooplankton also provides food for mammals. In Antarctica the seas are rich in nutrients, and shallow marine waters feed much marine life, accounting for an overall biomass often greater than the otherwise more prolific Arctic.

Polar organisms have developed a remarkable ability to withstand their fiercely cold environment. Many green plants are capable of photosynthesis at temperatures slightly below freezing, and the Antarctic lichen can survive, in laboratory tests, at −324.4° F (−198° C). Differentials as great as 45–55° F (25–30°C) between plant and air temperatures have been recorded in both polar regions.

polar coordinates, system of locating points in a plane with reference to a fixed point (origin) and an axis through that point. The coordinates are written (r, θ), in which r is the distance from the origin to any desired point and θ is the angle made by the vector $\boldsymbol{r}$ and the axis. A simple relationship exists between Cartesian coordinates given in terms of two reference axes (x,y) and the polar coordinates (r, θ), namely: $x = r\cos\theta$, and $y = r\sin\theta$.

Polar coordinates, like Cartesian coordinates, may also be used to locate points in three-dimensional space. The system used involves again the radius vector $\boldsymbol{r}$, which gives distance from the origin, the angle θ, measured between r and the z axis, and a second angle φ, measured between the x axis and the projection of r in the x,y plane. This system is essentially identical to that of spherical coordinates; points on Earth, for example, are located in terms of latitude and longitude, which express angles measured with respect to the axis of the Earth's rotation and with respect to an arbitrary reference of longitude (the Greenwich meridian).

polar fox: *see* Arctic fox.

polar motion, a periodic rotation of the Earth's spin axis about a mean axis, somewhat like the wobble of a spinning top. Slight variations in latitude and longitude result from this wobble because the poles are displaced from their mean positions. The north pole of rotation rotates counterclockwise around its mean position.

Polar motion is primarily made up of two discrete periodic oscillations: one, called the Chandler Wobble, has about a 14-month period, and the other has a 12-month period. The combination of these two wobbles causes the poles to trace spiral paths out of, around, and eventually back into their mean positions over a period of about 6.5 years. The separation between the actual and mean poles was exceptionally large in about 1952, when they were separated by 12 m (37 feet), or 0.37 arc second (0.37″). Their maximum separation during the 6.5-year period averages about 0.25″.

Polar motion was first predicted by the Swiss physicist Leonhard Euler in 1765 using dynamical theory and a rigid model of the Earth; he predicted a 10-month oscillation period for the phenomenon. Observational proof for the postulated latitude variations was obtained in the mid-1880s, and about that time the American astronomer S.C. Chandler analyzed these data and obtained both the 14-month and the 12-month periods. The four-month difference between Euler's predicted period and the actual duration of the Chandler Wobble is due to the elasticity of the Earth's mantle and the mobility of the oceans, which together subtly affect the Earth's response to rotation and for which Euler had not provided in his calculations.

Astronomical observations of the Earth's rotational position in space, which are used in determining Universal Time, must be corrected for slight variations in longitude caused by polar motion.

polar wandering, the migration over the surface of the Earth of the magnetic poles of the Earth through geological time. It was long recognized that the directions of magnetization of many rocks do not correspond to the present direction of the geomagnetic field at their sites; but not until the 1950s was there sufficient paleomagnetic data to suggest that the poles had moved in a systematic way over the surface of the Earth. On the time scale of polar wandering, polarity reversals of the geomagnetic field are relatively frequent, and the field direction may be neglected. If this is done, the evidence clearly indicates that the magnetic poles have slowly wandered across the globe with respect to sections of the crust on which datable rock samples are found. Pole locations calculated from measurements on rocks younger than about 20 million years do not depart from the present pole locations by distances greater than the experimental uncertainties. Going back more than 30 million years, however, successively greater "virtual pole" distances are revealed, indicating that substantial deviations occurred.

If the continents had had fixed positions, it could be assumed that the path of a magnetic pole over the Earth would be a global phenomenon, independent of the location of the observer. That polar-wandering curves for different continents do not agree was one of the first important evidences for continental drift. Because the pole-location curves converge to the present pole location, it becomes possible to infer the relative movement of different continental blocks over different intervals of geologic time.

polarimetry, in analytic chemistry, measurement of the angle of rotation of the plane of polarized light (that is, a beam of light in which the vibrations of the electromagnetic waves are confined to one plane) that results upon its passage through certain transparent materials. Polarimetry is of interest to the chemist because the ability of a substance to affect polarized light in this way is closely related to its chemical structure. A compound that displays this ability is called optically active (*see* optical activity).

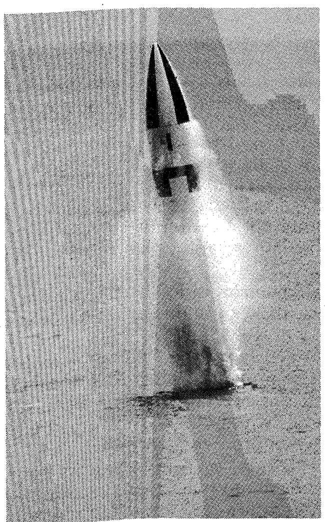
Polarimetric analysis is commonly used in the sugar industry, because the angle of rotation is related to the concentration of sucrose in a solution and can be used, in conjunction with other properties (such as density), in rapid and simple measurements of such concentrations. Many organic and some inorganic compounds are optically active; this property, easily determined by polarimetry, frequently is used as an indication of purity.

Polaris, also called ALPHA URSAE MINORIS, Earth's present northern polestar, or North Star, at the end of the "handle" of the so-called Little Dipper in the constellation Ursa Minor. Polaris is actually a triple star, the brighter of two visual components being a spectroscopic binary with a period of about 30 years and a Cepheid variable with a period of about 4 days. Its changes in brightness are too slight to be detected with the unaided eye. Apparent visual magnitude of the Polaris system is 2.04. *See also* polestar.

Polaris missile, first U.S. submarine-launched ballistic missile (SLBM) and the mainstay of the British nuclear deterrent force during the 1970s and '80s.

After four years of research and development, the U.S. Navy in 1960 began to deploy nuclear-powered submarines armed with 16 Polaris missiles each. Each missile was 31 feet (9.4 m) long and 4.5 feet (1.4 m) in diameter and was powered by two solid-fueled stages. Three models were developed: the A-1, with a range of 1,400 miles (2,200 km) and a one-megaton nuclear warhead; the A-2, with a 1,700-mile (2,700-kilometre) range and a one-megaton warhead; and the A-3, capable of delivering three 200-kiloton warheads a distance of 2,800 miles (4,500 km).

Between 1971 and 1978 the Polaris was replaced by the Poseidon missile in the U.S. SLBM force. The United Kingdom, after adopting the A-3 in 1969, refined it into the A-3TK, or Chevaline, system, which was fitted with such devices as decoy warheads and electronic jammers for penetrating Soviet ballistic-missile defenses around Moscow. In 1980 the United Kingdom announced plans to replace its Polaris force with the Trident SLBM in the 1990s.



Underwater firing of Polaris A-3 missile
By courtesy of the U.S. Navy

polarization, property of certain electromagnetic radiations in which the direction and magnitude of the vibrating electric field are related in a specified way.

Light waves are transverse: that is, the vibrating electric vector associated with each wave is perpendicular to the direction of propagation. A beam of unpolarized light consists of waves moving in the same direction with their electric vectors pointed in random orientations about the axis of propagation. Plane polarized light consists of waves in which the direction of vibration is the same for all waves. In circular polarization the electric vector rotates about the direction of propagation as the wave progresses. Light may be polarized by reflection or by passing it through filters, such as certain crystals, that transmit vibration in one plane but not in others.

polarization, electric: *see* electric polarization.

polarography, also called POLAROGRAPHIC ANALYSIS, or VOLTAMMETRY, in analytic chemistry, an electrochemical method of analyzing solutions of reducible or oxidizable substances, invented by a Czech chemist, Jaroslav Heyrovský, in 1922.

The majority of the chemical elements can be identified by polarographic analysis, and the method is applicable to the analysis of alloys and to various inorganic compounds. Polarography is also used to identify numerous types of organic compounds and to study chemical equilibria and rates of reactions in solutions.

The solution to be analyzed is placed in a glass cell containing two electrodes. One electrode consists of a glass capillary tube from which mercury slowly flows in drops, and the other is commonly a pool of mercury. The cell is connected in series with a galvanometer (for measuring the flow of current) in an electrical circuit that contains a battery or other source of direct current and a device for varying the voltage applied to the electrodes from zero up to about two volts. With the dropping mercury electrode connected (usually) to the negative side of the polarizing voltage, the voltage is increased by small increments, and the corresponding current is observed on the galvanometer. The current is very small until the applied voltage is increased to a value large enough to cause the substance being determined to be reduced at the dropping mercury electrode. The current increases rapidly at first as the applied voltage is increased above this critical value but gradually attains a limiting value and remains more or less constant as the voltage is increased further. The critical voltage required to cause the rapid increase in current is characteristic of, and also serves to identify, the substance that is being reduced (qualitative analysis). Under proper conditions the constant limiting current is governed by the rates of diffusion of the reducible substance up to the surface of the mercury drops, and its magnitude constitutes a measure of the concentration of the reducible substance (quantitative analysis). Limiting currents also result from the oxidation of certain oxidizable substances when the dropping electrode is the anode.

When the solution contains several substances that are reduced or oxidized at different voltages, the current-voltage curve shows a separate current increase (polarographic wave) and limiting current for each. The method is thus useful in detecting and determining several substances simultaneously and is applicable to relatively small concentrations—*e.g.,* 10^{-6} up to about 0.01 mole per litre, or approximately 1 to 1,000 parts per 1,000,000.

Polaroid Corporation, major U.S. manufacturer of photographic equipment and supplies. Edwin Herbert Land, the founder, was the inventor of the instant camera. Headquarters are in Cambridge, Mass.

The company was founded in 1932 as the Land-Wheelwright Laboratories by Land and George Wheelwright to produce Land's first invention, an inexpensive plastics sheet light polarizer. By 1936 Land began to use polarized material in sunglasses and other optical devices, and in 1937 the company was incorporated under the Polaroid name.

During the 1930s and 1940s the corporation introduced a three-dimensional motion-picture process and polarized optical devices for military use. After World War II Land began to research an instantaneous developing film, and in 1947 the company brought out the Polaroid Land camera, which delivered a finished sepia-toned print 60 seconds after exposure. In the 1950s the cameras were refined to produce black-and-white prints in 15 seconds; in the 1960s a colour-developing process and film cartridges were introduced. The company introduced the compact Polaroid SX-70 in 1972. In addition to further technical refinements, the SX-70 combined the negative and positive prints in a single sheet. Instant motion pictures were introduced in 1977.

Polaroid's cameras and films are sold both to amateur photographers and professionals. The company also manufactures both specialty films used for scientific purposes and polarizing filters used in sunglasses and for a wide variety of technical applications.

polaron, electron moving through the constituent atoms of a solid material, causing the neighbouring positive charges to shift toward it and the neighbouring negative charges to shift away. This distortion of the regular position of electrical charges constitutes a region of polarization that travels along with the moving electron. After the electron passes, the region returns to normal. An electron accompanied by this kind of electrical displacement of neighbouring charges constitutes a polaron.

A polaron behaves as a negatively charged particle with a mass greater than that of an isolated electron because of its interaction with the surrounding atoms of the solid. The effect is most pronounced in ionic solids, composed of positively and negatively charged atoms called ions, because the forces between the electron and ions are strong. The strength of these forces is reflected in the mass of the polaron. In common table salt, or sodium chloride, the mass of a polaron is more than twice the mass of a free electron.

polder, tract of lowland reclaimed from a body of water, often the sea, by the construction of dikes roughly parallel to the shoreline, followed by drainage of the area between the dikes and the natural coastline. Where the land surface is above low-tide level, the water may be drained off through tide gates, which discharge water into the sea at low tide and automatically close to prevent re-entry of seawater at high tide. To reclaim lands that are below low-tide level, the water must be pumped over the dikes. If a sediment-laden stream can be diverted into the polder area, the sediment may serve to build up the polder bottom to a higher level, thus facilitating drainage.

Soil in areas newly reclaimed from the sea contains so much salt that most plants will not grow. Procedures for ridding the soil of salt, therefore, must be used along with diking and draining to develop agriculturally productive land.

The most notable example of polder construction is the system developed adjacent to the IJsselmeer (Zuiderzee) in The Netherlands.

Poldi Pezzoli, Museo (Italian: Poldi Pezzoli Museum), in Milan, museum in the former private house of G.G. Poldi-Pezzoli, housing fine examples of arms and armour from the 14th to the 17th centuries. There are also antique tapestries. The staircase is decorated with landscapes by Alessandro Magnasco. One room is devoted to works by Bernardino Luini and the Lombard school of painters. Other notable works include portraits of Martin Luther and his wife by Lucas Cranach, a madonna by Andrea Mantegna, a madonna by Botticelli, "St. Nicholas of Tolentino" by Piero della Francesca, and "Lady of the Bardi Family" by Antonio Pollaiuolo. The Dante hall is decorated in Art Nouveau style. The museum was founded in 1879; destroyed by bombs in World War II, it was subsequently rebuilt.

Polding, John Bede (b. Nov. 18, 1794, Liverpool—d. March 16, 1877, Sydney), first Roman Catholic bishop in Australia (from 1835), where eight years later he became the first archbishop of Sydney.

Polding joined the Benedictine Order in 1811 and was ordained priest in 1819. Consecrated bishop, he arrived at Sydney in 1835. There he divided his territory into missionary districts and swiftly provided them with priests, churches, and schools. He procured help for his bishopric through visits to Europe. Appointed archbishop in 1843, he became primate of the Catholic Church in Australia. In 1844 and 1859 he convoked synods in Melbourne and in Sydney, where he founded St. John's College.

Pole, Reginald (b. March 3, 1500, Stourton Castle, Staffordshire, Eng.—d. Nov. 17, 1558, London), English prelate who broke with King Henry VIII over Henry's anti-papal policies and later became a cardinal and a powerful figure in the government of the Roman Catholic queen Mary Tudor.

Reginald Pole, detail of a portrait attributed to Fra Sebastiano del Piombo; in a private collection
By courtesy of R.J.R. Arundell

His father, Sir Richard Pole, was a cousin of King Henry VII, and his mother, Margaret, countess of Salisbury, was a niece of Edward IV. In recognition of Pole's royal descent, his cousin, Henry VIII, paid for Pole's education at Oxford University and at Padua, Italy, and gave him minor offices in the church. Nevertheless, when Henry's attempts to obtain an annulment of his marriage to Catherine of Aragon encountered resistance from Pope Clement VII, Pole found himself unable to support the King's cause. He therefore withdrew to Padua in 1532 and immersed himself in theological studies. In 1536 Pole completed and sent to Henry a long treatise attacking his claim of royal supremacy over the English Church and strongly defending the Pope's spiritual authority. The document was later published, without Pole's consent, as *Pro ecclesiasticae unitatis defensione* ("In Defense of Ecclesiastical Unity").

Pole could no longer return to England. Remaining in Italy, he was made cardinal by Pope Paul III in December 1536, and he served on the commission that produced the important document *Consilium de emendanda ecclesia* (1537; "Plan for Church Reform"), a report on abuses in the church with recommendations for reforms. Between 1537 and 1539 the Pope sent Pole on two diplomatic missions to persuade Europe's Catholic monarchs to ally against Henry. Both endeavours were totally unsuccessful, and Henry, in revenge for Pole's treasonous activities, executed Pole's brother, Lord Montague, in 1538 and his mother in 1541. In August 1541 Pole was appointed papal governor of the Patrimony of St. Peter (the area around Rome). He took up residence at Viterbo and gathered around him a group of Humanists. Later, he was the presiding legate at the Council of Trent; and, upon the death of Paul III in November 1549, Pole, with backing from the Holy Roman emperor Charles V, was nearly elected pope. The office fell to Julius III only after the French and Italian prelates refused to endorse Pole's candidacy.

On the accession of Mary Tudor to the English throne in July 1553, the Pope at once appointed Pole legate for England. He landed at Dover on Nov. 20, 1554, and 10 days later formally received the country back into the Catholic fold. He then began to refound the monasteries, and in November 1555 he assembled at Westminster a synod that instituted a number of church reforms. Soon Pole was virtually running the government. Although he was not directly responsible for the burnings of Protestants that marked Mary's reign, he did not oppose them. Pole was made archbishop of Canterbury in March 1556, but as a result of a conflict between the papacy and England's ally Spain, Pope Paul IV cancelled his legatine authority in April 1557. Denounced by the Pope as a heretic, the demoralized Pole died 12 hours after the death of Queen Mary. Two biographies are K.B. McFarlane's *Cardinal Pole* (1924) and W. Schenk's *Reginald Pole, Cardinal of England* (1950).

Pole, Richard de la (d. Feb. 24, 1525, Pavia, Duchy of Milan), last Yorkist claimant to the English throne.

Pole was the youngest son of John de la Pole, 2nd duke of Suffolk (died 1491/92), and Elizabeth, sister to the Yorkist king Edward IV (ruled 1461–70, 1471–83). Since Edward IV's brother and successor, Richard III, died childless and since Edward's own sons disappeared in the Tower of London, the de la Poles inherited the Yorkist claim to the throne, a claim strengthened when Richard III named Suffolk's eldest son John, earl of Lincoln (d. 1487), as his successor. After the accession in 1485 of the first Tudor, Henry VII, the family therefore lived under suspicion; nor did it help that Lincoln joined Lambert Simnel's rebellion (1487), which cost him his life. The claim thus devolved upon the second brother, Edmund de la Pole, earl of Suffolk (1472?–1513). After years of waiting, Suffolk fled abroad in 1499; and though he returned briefly he fled again in 1501, this time accompanied by his brother Richard. The brothers tried to interest the emperor Maximilian in their cause, but in 1502 Maximilian agreed with Henry VII on terms that included dropping the Yorkist claimants. Suffolk, accused as a traitor in 1504, was imprisoned in Burgundy in that year and surrendered to Prince Henry (later Henry VIII) in 1506, on condition that his life be spared. He lived a prisoner in the Tower of London until Henry VIII carried out the old sentence against him in 1513.

Meanwhile, Richard had led an adventurous life, escaping (1504) the pressing attentions of his brother's creditors at Aachen, taking service with King Vladislas (Ulászló) II of Hungary, and establishing something of a reputation as a condottiere. After Edmund's death he took over the claim to the crown, calling himself duke of Suffolk. Although treated equivocally by Louis XII of France, he did find service with Louis's successor, Francis I, who saw fit to use him as a weapon in his complex diplomacy. In 1523 he encouraged an intrigue that was meant to restore the Yorkist claimant to England with the help of an exiled claimant to the Scottish throne. Though nothing came of this, Richard de la Pole remained in Francis' service, accompanied him to the war in Italy, and was killed in the Battle of Pavia (1525). His death terminated the claims of the main Yorkist line and ended a threat to the Tudor throne.

Pole, William: *see* Poel, William.

Pole, William de La: *see* Suffolk, William de La Pole, 1st duke of.

Pole of Inaccessibility, point on the Antarctic continent that is farthest, in all directions, from the surrounding seas, lying on the Polar Plateau in a vast territory claimed by Australia. The site, at an elevation of 12,198 feet (3,718 m) above sea level, is occupied by a meteorological research station set up by the Soviet Union during the International Geophysical Year (1957–58).

The term is also used occasionally in the Northern Hemisphere in conjunction with a point in the Arctic Ocean that is equidistant from the encircling landmasses; it lies 400 miles (640 km) from the North Pole in the direction of Alaska.

pole star: *see* polestar.

pole vault, track-and-field sport of jumping over an obstacle with the aid of a pole. Originally a practical means of clearing objects, such as ditches, brooks, and fences, pole-vaulting for height became a competitive sport in the mid-19th century. The sport is generally for men only.

In competition, each vaulter is given three chances to clear a specified height. A bar rests on two uprights so that it will fall easily if touched. It is raised progressively until a winner emerges by process of elimination. Ties are broken by a "count back" based on fewest failures at the final height, fewest failures in the whole contest, or fewest attempts throughout the contest. The pole may be of any material (glass fibre became the most effective and popular by the early 1960s) and of any length or diameter.

A slideway, or box, is sunk into the ground with its back placed directly below the crossbar. The vaulter thrusts his pole into this box as he leaves the ground. A pit at least 5 m (16.4 feet) square and filled with soft, cushioning material is provided behind the crossbar for his landing.

Requirements of the athlete include a high degree of coordination, timing, speed, and gymnastic ability. The modern vaulter makes a run of 30 to 45 m (100 to 150 feet) while carrying the pole and approaches the take-off with great speed. As the stride before the spring is completed, he performs the shift, which consists in advancing the pole toward the slideway and at the same time allowing the lower hand to slip up the pole until it reaches the upper hand, then raising both hands as high above his head as possible before leaving the ground. He is thus able to exert the full pulling power of both arms to raise his body and help swing up his legs.

As the vaulter plants his pole firmly in the box, he runs off the ground (he does not jump), leaving his body hanging by the hands as long as possible and not pulling too soon; the quick, catapulting action of the glass-fibre pole makes timing especially important. He lets his legs swing upward and to the side of the pole, then shoots his legs high above the crossbar and twists his body face downward. His body travels across the crossbar by "carry"—the forward speed acquired from the run. For winners in the pole-vault competition of the World Cup and world championships, *see* Sporting Record: *Athletics.* For Olympic champions, *see* Olympic Games.

polecat, any of several weasel-like carnivores of the family Mustelidae (which includes the weasel, mink, otter, and others). The pelt, especially of the European polecat, is called fitch in the fur trade.

The European, or common, polecat, also called foul marten for its odour (*Mustela,* sometimes *Putorius, putorius*), occurs in wood-

European polecat (*Mustela putorius*)
Russ Kinne—Photo Researchers

lands of Eurasia and North Africa. It weighs 0.5–1.4 kg (1–3 pounds) and is 35–53 cm (14–21 inches) long exclusive of the bushy tail, which is 13–20 cm (5–8 inches) long. Its long, coarse fur is brown above, black below, and marked with yellowish patches on the face. Much lighter fur distinguishes the masked, or steppe, polecat (*M. p. eversmanni*) of Asia.

Principally terrestrial, the polecat hunts at night, feeding on small mammals and any birds it can catch. It also eats snakes, lizards, frogs, fishes, and eggs. The polecat is more powerful than the marten but less active, and it rarely climbs trees. Its litters of three to eight young are born in the spring after about two months' gestation. The domestic, albino variety of the European polecat is known as the ferret (*q.v.*).

The marbled polecat (*Vormela peregusna*) of Eurasian foothills and steppes is similar to the European species in habits, appearance, and size. It is mottled reddish brown and yellowish above, blackish below.

The zorille (*q.v.*), a related African carnivore, is also called striped, cape, or African polecat. In the United States the name polecat is often applied to skunks (*see* skunk), particularly the spotted and striped species.

Polemoniaceae, phlox, or Jacob's ladder, family of plants; there are about 18 genera and at least 300 species, mostly in North America but found in temperate parts of western South America and Eurasia. The family includes many popular garden ornamentals. A few species are woody, but most are herbaceous annuals or perennials.

The tubular, five-lobed, funnel-shaped or flaring flowers are gathered into clusters or heads. They usually have three-chambered ovaries with styles topped by three narrow stigmas.

Polemoniales, order of flowering plants that includes some of the most handsome and favoured garden flowers and wildflowers. Most of the order's 8 families, 208 genera, and more than 4,000 species are annual, biennial, or perennial herbs. There are also, however, woody trees, shrubs, and vines and two families of nonphotosynthetic parasites.

A brief treatment of Polemoniales follows. For full treatment, *see* MACROPAEDIA: Angiosperms.

The only member of Polemoniales that is of economic importance is the sweet potato (*Ipomoea batatas*) of the Convolvulaceae family; its tuberous roots are used as a food. Other members of *Ipomoea,* such as the heavenly blue morning glory (*I. violacea*), are of interest for their seeds, which contain hallucinogenic alkaloids similar to the drug LSD. Known to the Aztecs, the seeds are traditionally used by the Zapotec Indians of Mexico for ceremonial and curative purposes. The common morning glory (*I. purpurea*), cypress vine (*I. quamoclit*), bush morning glory (*I. leptophylla*), and morning glory tree (*I. arborescens*) are ornamentals prized for their flowers.

The bindweed (*Convolvus* and *Calystegia*) of the Convolvulaceae are low, twining plants that produce small white, pink, or blue funnel-shaped flowers. Bellbine (*Calystegia sepium*) creeps along hedges and roads in North America and Eurasia, while sea bindweed (*C. soldanella*) is found along the beaches of Europe. Field bindweed (*Convolvus arvensis*) is a flowering weed. Other species of *Convolvus* are the sources of rosewood oil and scammony, a purgative.

The Convolvulaceae family also includes several species of lawn-leaf (*Dichondra*), used in tropical and subtropical regions as a ground cover. The low plants, with round green leaves, spread along the ground by runners and make an excellent substitute for grass.

The largest family of the Polemoniales is the Boraginaceae, or borage family, containing about 2,000 species. Most of its members are tropical or temperate herbs, although some are shrubs or trees. The flowers of this family are known for their bright blue colours and some, such as the forget-me-not (*Myosotis* species), the borage (*Borago officinalis*), the Virginia bluebell (Virginia cowslip; *Mertensia virginica*), the heliotropes (*Heliotropium*), and the lungworts (*Pulmonaria*), are grown as ornamentals.

Of the family Polemoniaceae, the 65 *Phlox* species are much admired as garden flowers and wildflowers. The group includes the perennials summer phlox (*P. paniculata*), blue phlox (*P. divaricata*), and perennial phlox (*P. pilosa*). The 50 species of *Polemonium,* especially Jacob's ladder (Greek valerian; *Polemonium caeruleum*) are also prized for their flowers.

The waterleaf family (Hydrophyllaceae) of about 250 species is best known for its garden annuals. These include *Hydrolea spinosa, Wigandia caracasana,* the Virginia waterleaf (*Hydrophyllum virginianum*), the California bluebell (wild Canterbury bell; *Phacelia whitlavia*), and baby blue-eyes (*Nemophila menziesii*).

Many members of the family Loasaceae (Particularly *Loasa, Caiophora,* and *Mentzelia*) have nettle-like stinging hairs, in addition to beautiful, unusual flowers of red, orange, yellow, or white.

The dodder (Cuscutaceae) and sand food (Lennoaceae) families within the Polemoniales order are composed of totally parasitic plants. The dodders (*Cuscuta*) are nearly leafless and without chlorophyll; they twine about the host plant, withdrawing both water and nutritive substances. The sand foods send out roots that attach to the roots of a host plant, thereby establishing parasitism.

Polenta FAMILY, Italian noble family, named for its castle of Polenta (located in the Romagna, southwest of Cesena), which dominated the city-state of Ravenna from the end of the 13th century to the middle of the 15th. The family's ascendancy began with Guido da Polenta (d. 1310), known as Guido Minore, or Guido the Old, who led the Guelf, or propapal, faction in Ravenna against the Ghibelline, or pro-emperor, faction. Ravenna, traditionally Ghibelline, had fallen to the Guelfs in 1239. When the emperor Frederick II reconquered the city in the following year, Guido's father, Lamberto, was imprisoned and executed. In 1275 Guido, with the aid of the Malatesta family of nearby Rimini, seized the town, driving out rival factions.

After the Romagna (the territory of Ravenna) fell under direct papal administration in 1278, Guido consolidated his power and after 1285 began to resist papal encroachment. In 1290, when Guido was in Florence serving as chief magistrate, the papal official Stefano Colonna arrived in Ravenna to demand that the town surrender to his authority. Guido's sons Lamberto and Bernardino imprisoned him, kindling a revolt against papal power in the Romagna. Elected chief magistrate of Ravenna from 1286 to 1290 and again in 1292 and 1293, Guido was a strong ruler, repelling outside enemies and suppressing factions within the town.

Guido's grandson Guido Novello da Polenta, a patron of the arts known as the host of Dante during his final years of exile (*c.* 1318–21), was himself a scholar and poet. In 1322 Guido Novello was chosen captain of the people in Bologna and left his brother Rinaldo, the archbishop, to govern Ravenna in his place; but his cousin Ostasio da Polenta assassinated Rinaldo and made himself lord of the city. With Bolognese aid, Guido Novello tried to recover Ravenna the following year but was defeated and ended his life in exile.

Ostasio was also a patron of letters, befriending Boccaccio in 1345–46, but his politics were violent. In 1326 he had seized Cervia, south of Ravenna, killing his uncle and cousin. The tradition was continued by his descendants. His son Bernardino punished a conspiracy of his brothers by starving them to death (1347). In 1390 Bernardino's son Guido was deposed by his own sons and starved to death; one of the sons, Obizzo, then killed the others. During Obizzo's rule, Ravenna began to fall under the power of Venice, and he was forced in 1410 to accept a Venetian chief magistrate. In 1441 the da Polenta family yielded the city to Venice, Obizzo's son and grandson taking refuge in Crete, where they died not long after, the last of their line.

polestar, also spelled POLE STAR, also called (Northern Hemisphere) NORTH STAR, the brightest star that appears nearest to either celestial pole at any particular time. Owing to the precession of the equinoxes, the position of each pole describes a small circle in the sky over a period of 25,800 years. Each of a succession of stars has thus passed near enough to the north celestial pole to serve as the polestar. At present the polestar is Polaris; Thuban (α Draconis) was closest to the North Pole *c.* 2700 BC, and the bright star Vega (α Lyrae) will be the star closest to the pole in AD 14000. The location of the northern polestar has made it a convenient object for navigators to use in determining latitude and north–south direction in the Northern Hemisphere. There is no bright star near the south celestial pole; the present southern polestar, σ Octantis, is only of the 5th magnitude.

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

Polesye (Soviet Union): *see* Pripet Marshes.

Polevskoy, city, Sverdlovsk *oblast* (administrative region), western Russian Soviet Federated Socialist Republic, located near the Chusovaya River in the mid-Urals. Founded in 1724 in connection with copper mining, it was called Polevskoy Zavod until 1928; it became a city in 1942. Copper is still mined and refined there; ferrous metallurgy, hoisting and transport equipment production, and a chemical industry based on Siberian fluorspar are located in the city. Pop. (1985 est.) 69,000.

police, body of civil officers charged with maintaining public order and safety and enforcing the law, including preventing and detecting crime. In addition, it is usually entrusted with various inspectional, licensing, and regulatory activities.

A brief treatment of police follows. For full treatment, *see* MACROPAEDIA: Police.

Police administration in most countries has six major aspects: uniformed patrol, criminal investigation (detection of criminals), traffic regulation, special measures for controlling commercial "vice" (narcotics, prostitution, and gambling), regulation of the sale and consumption of intoxicating liquor, and procedures and facilities for dealing with juvenile delinquents.

The internal organization of police departments varies from country to country, but a general pattern can be detected. A uniformed patrol is distributed over cities on beats or territories as a first line of defense and protection against crime and disorder. The detective bureau is organized as a separate unit having to do with detection of the more serious crimes and apprehension of offenders. Special units of plain-clothes operatives devote their attention chiefly to suppression of gambling, prostitution, illegal sale of narcotics, and liquor law violations. Traffic regulation is a pressing problem in cities, and requirements in this direction have called for the employment of a large number of officers. Most large cities have training schools for instruction of new recruits, and in some cases advanced instruction is given to older members of the force. Considerable progress has been made in the keeping of records, installation of systems of telecommunication, and the use of land, sea, and air equipment in patrol and emergency service. Laboratories for scientific criminal investigation and identification have become common.

Many governments permit much local autonomy in police administration, whereas others tend to centralize police control. England, Wales, and Scotland have scores of local police forces, whereas the Republic of Ireland and the government of Northern Ireland each maintains a single police establishment. Belgium has dual police systems for the national and local levels, with municipal forces that are almost completely autonomous, whereas in Denmark all police activities are administered by functionaries of the crown. For the most part, western European countries follow the French pattern of a national police charged with the maintenance of public order, the investigation of all major crimes, and the full policing of the larger cities, together with locally recruited forces, which are concerned with routine law enforcement duties such as local traffic control in the smaller places. In some countries, such as France and Italy, a branch of the national police force also performs routine police duties in rural districts. Japan, under a law of 1954, centralized all police forces under the National Defense Force; even so, a certain degree of autonomy in matters of authority, administration, and finance is left to the prefectural and larger municipal departments. In the United States and Canada, national and state (or provincial) police parallel the local police systems.

A special use of the word police is involved when authoritarian states set up secret political police organizations that operate independently of the regular civil police establishments. Political police are always highly centralized agencies. The Nazi Gestapo and *Schutzstaffel*, the tsarist Okhrana, and the Soviet KGB all shared characteristics sharply distinguishing them from other civil police. Their governments may be called police states. Under democratic governments, police authority is carefully limited and numerical strength is held within modest bounds. Under some systems the police officer bears a heavy responsibility for the manner in which he or she performs law-enforcement functions and is personally answerable in the criminal and civil courts for abuses of authority.

Police Gazette, The, daily publication of the London Metropolitan Police that carries details of stolen property and of persons wanted for crime. It is distributed without charge to British and certain European police forces.

The original *Gazette,* the *Quarterly Pursuit,* was founded in 1772 by John Fielding, chief magistrate of the Bow Street Police Court, then seat of London's police forces. The name was changed to *The Police Gazette* in 1828, and responsibility for the publication was transferred to Scotland Yard in 1883. Wood engravings of stolen valuables, photographs of criminals, and a classified system of descriptions all became features of the publication under Sir Howard Vincent, first director of the Criminal Investigation Division. The *Gazette* became a daily publication in 1927.

police power, in U.S. constitutional law, the permissible scope of federal or state legislation so far as it may affect the rights of an individual when those rights conflict with the promotion and maintenance of the health, safety, morals, and general welfare of the public. When the U.S. Supreme Court has considered such cases, it has tended to use a doctrine called "balance of interests," to determine whether a state has the right to exercise its implied police powers although that exercise may be in conflict with a federal law, either statutory or constitutional. The court has held, in these instances, that if a state does enact legislation for the protection and maintenance of the health, safety, or welfare of its citizens, such laws "fall within the most traditional concept of the state's police power." Therefore, even in matters where federal laws take precedence over those of the state, the court has decided in favour of the state. For example, a state's police power may be employed to ban the export of immature citrus fruits on the grounds that such shipments would adversely affect the reputation of the grower state in the marketplace. Although it would seem to be a clear impediment to the free exercise of interstate commerce, the court, in *Sligh* v. *Kirkwood* (1915), upheld the measure as legitimate police power exercise on behalf of its citizenry. However, if the statute were intended to discriminate against another state's market or resource, rather than (as in *Sligh*) to protect its own resource, then it is not a legitimate exercise of police power.

Even where the balance of interests may well lie in favour of the state's apparent right to enact legislation under its police powers privilege, the burden on other factors, *e.g.,* interstate commerce, may be too great to permit such enactment. In *Bibb* v. *Navajo Freight Lines Inc.* (1959), an Illinois law requiring special mudguards on trucks using its highways was found to be too cumbersome a requirement although it had been enacted in behalf of the safety of its citizens.

State courts also render decisions on the validity of contested legislation that enables a state to exercise its police powers.

Periodically, state courts have had to deal with matters involving private concepts of health in contention with the public's health. One example is the insistence on immunizing school children against certain communicable diseases, or prohibiting children from entering school without such immunization. The private concerns of the parent who may feel that only he or she has a right to decide what medical treatment the child should have—

or the convictions of a person who feels that medication is an infringement on his or her religious practice—are matters that do come to state courts from time to time. Again, the court usually finds that the public's right to health tends to outweigh private or individual concerns.

In general, the courts tend to uphold laws exercising what it considers bona fide concerns for the public's well-being, on the ground that the legislature has the discretion to discern public need and to enact legislation in protection of the public interest.

Police Zone, southern two-thirds of South West Africa (now Namibia) in which the German and later South African colonial administrations were able to establish effective European-style police control beginning in the early 20th century. The name of the area and its original boundary were adopted in 1919 by the South Africans from a 1911 German map of the territory on which the area was marked *Polizei-Zone.*

Spanning the north-central sector of what became the mandated territory of South West Africa, the Police Zone's boundary (often called the Red Line because it was printed on maps in red ink) extended from the Atlantic Ocean to Botswana in a generalized northward-arcing semicircle. The boundary separated indigenous African groups to the north, including the numerically significant Owambo (Ovambo) as well as other Bantu-speaking peoples, from white settlement areas to the south. Not all indigenous groups of South West Africa, however, lived north of the Police Zone. The numerically less significant Herero, together with groups of Khoikhoin (Hottentots) and other groups of mixed origin, lived mostly within the Police Zone.

The Police Zone boundary was long inviolate. Whites were prohibited from entering the north, and the indigenous groups of the north were generally prohibited from entering the Police Zone except when hired as a "labour unit" contracted for a prescribed period. Many successive demarcation changes of the boundary between the 1920s and '60s usually reflected the increasing white control of better farming areas. The name Police Zone was used less after the South African Odendaal Commission defined the geographic, economic and political aspects of apartheid in South West Africa. The commission's directive in 1964 led to the establishment of 10 reserves (homelands) in the 1970s for South West Africa's African peoples and groups of mixed origin; the eastern, southern, or western boundaries of the 6 reserves for the indigenous African groups to the north of the Police Zone followed the Police Zone boundary with slight alterations.

The 1977 South African agreement to create an interim government in Namibia until independence was achieved led to the Rural Areas Proclamation (1977), which revoked the regulations previously used to control the movement of black Africans and permitted all ethnic groups to take employment and residence wherever they chose. By the time of independence in 1990, even the effects of a Police Zone had ceased.

policy, form of lottery in which pellets usually numbered 1 to 78 are deposited in a drum-shaped wheel and players wager that certain numbers will appear among the pellets—usually 12 pellets—that are selected at the drawing.

Policy, a true lottery initiated in the United States by Italian-Americans, derives its name from the Italian *polizza* ("receipt," or "ticket") and retains only occasional and local popularity. It has been substantially replaced by the numbers game (*q.v.*).

Polidoúri, Maria, Polidoúri also spelled POLYDOÚRE (b. 1905, Kalámai, Greece—d. 1930, Athens), Greek poet known for her impassioned, eloquent farewell to life.

Polidoúri was orphaned as a small child, and in 1921 she went to Athens to study law. There she began a friendship with another poet, Kóstas Kariotákis. In 1926 she went to Paris, returning two years later, fatally ill. In 1930 she entered a sanatorium near Athens, where she died.

Her two books of poems reflect her awareness of impending death. The tone alternates between bitter questioning and a cold resignation in which she seems to contemplate her own pain from outside herself.

Polignac FAMILY, French noble house important in European history.

From the 1050s and perhaps even from 860, the first viscounts of Polignac (in the modern *département* of Haute-Loire) were practically independent rulers of Velay, where the Loire River rises. Their ultimate heiress, Valpurge, was married in 1349 to Guillaume III de Chalençon, whose descendants assumed the Polignac name in 1421. The actual power of the house declined as feudalism broke down, but it maintained its exalted rank in the nobility; and in the ninth generation after Guillaume of Chalençon it emerged into political prominence with Melchior (b. Oct. 11, 1661, Puy, Fr.—d. April 3, 1742, Paris), known first as the abbé, then as the cardinal de Polignac. Early experienced in diplomatic affairs between France and Rome, the Abbé was sent as King Louis XIV's ambassador to Poland in 1693. There he procured the abortive election of François Louis de Bourbon, Prince de Conti, as king of Poland in 1697. After a temporary disgrace, Melchior was elected to the French Academy in 1704. During the War of the Spanish Succession he played a major part in the negotiations at Gertruydenberg (1710) and at Utrecht (1712) before becoming a cardinal (creation *in petto* 1712, published 1713). He was exiled for participation in the Cellamare plot of 1718 but was French chargé d'affaires in Rome from 1724 to 1732 and was made archbishop of Auch in 1726. His long Latin poem, *Anti-Lucretius,* first printed in 1747, largely against Pierre Bayle's philosophy, went through many editions and translations.

The cardinal's grandnephew, Armand-Jules-François, Count de Polignac (b. 1743, Claye, Fr.—d. 1817, St. Petersburg [now Leningrad], Russia), was married in 1767 to Yolande Martine Gabrielle de Polastron (1749–93). She became a great favourite of Queen Marie-Antoinette, and he was created Duke de Polignac (1780). Their influence was savagely denounced in pamphlets during the Revolution.

Auguste-Jules-Armand-Marie de Polignac (b. May 14, 1780, Versailles, Fr.—d. March 2, 1847, Paris), the first duke's second son, went from England back to France, with his elder brother Armand-Jules-Marie-Héraclitus (b. Jan. 17, 1771, Paris, Fr.—d. March 30, 1847, Saint-Germain-en-Laye), to conspire against Napoleon in 1804, but they were arrested. Released in 1813, Auguste-Jules was made a peer at the Bourbon Restoration (1815) but refused at first to take the constitutional oath because he thought it derogatory to the Holy See's rights. For this the Holy See granted him the Roman title of prince (1820; recognized in France 1822). His ultramontanism and extreme royalism appealed to King Charles X, who appointed him minister of foreign affairs on Aug. 8, 1829, and prime minister on November 17. Responsible for the ordinances that provoked the July Revolution of 1830, he was arrested and, in December 1830, sentenced to life imprisonment. Released but banished in November 1836, he finally returned to France in 1845. The Bavarian monarchy in 1838 extended the title of prince to all his descendants; and, because his elder brother died childless, he inherited the ducal title as well just before his own death the same month. The counts de Polignac descend from the first duke's third son, Camille-Melchior-Henri (1781–1855). One of them, Count Pierre (1895–1964), was the father of Prince Rainier III of Monaco.

Prince Edmond-Melchior (1834–1901), fifth son of Jules, was a composer. In 1893 he married Winnaretta Singer (1865–1943), who, as Princess Edmond de Polignac, was the outstanding Parisian patroness of avant-garde music in the first half of the 20th century.

polio vaccine, preparation of poliomyelitis virus given to prevent infection with the disease. The virus is grown in kidney tissue from rhesus monkeys. There are two types of vaccine: one with killed virus, which is injected, and the other with live, attenuated (weakened) virus, which is given orally. Vaccines, whether killed or live, must contain strains of all of the three poliovirus types, and three doses are required, as the body develops immunity to only one type at a time.

poliomyelitis, also called INFANTILE PARALYSIS, acute infectious viral disease characterized by symptoms that range from a mild nonparalytic infection to an extensive flaccid paralysis of voluntary muscles.

Severe epidemics of poliomyelitis have been reported in many parts of the world. In the United States the greatest recorded sustained incidence was in 1942–53; in 1950 there were 33,344 cases. In 1952 severe epidemics occurred in Denmark, Germany, and Belgium. In Asia outbreaks were reported in Bombay, Singapore, Japan, Korea, and the Philippines.

Since the 1960s, however, poliomyelitis has been more or less under control in the developed world. Control is based on community- or area-wide use of the attenuated live polio vaccine, given orally (Sabin), and the inactivated (killed) injectable vaccine (Salk).

The poliovirus is believed to enter the body through the throat. From the alimentary tract it is absorbed into the blood and lymphatics, whence it is widely disseminated throughout the body and ultimately reaches the central nervous system.

The most common early symptoms of poliomyelitis are mild headache, fever, sore throat, nausea, vomiting, diarrhea, restlessness, and drowsiness. Temperature rises slowly, and fever peaks in two to three days and then rapidly subsides. More than 80 percent of all patients who develop poliomyelitis recover within three to four days without the development of paralysis. When the disease is severe, the patient becomes irritable and develops pain in the back and limbs, muscle tenderness, and stiff neck.

Paralytic poliomyelitis results from the destruction of the anterior horn (motor nerve) cells of the spinal cord. Cells that are destroyed are not replaced because nerve cells cannot regenerate. Cells that are not severely injured recover their normal function in time; to the extent that they do recover, a corresponding restoration of muscle function may be expected. The paralysis may range in severity from transient weakness that soon disappears to complete permanent paralysis, with associated progressive atrophy of the unused muscles.

In respiratory poliomyelitis the virus injures the upper part of the spinal cord, with resulting difficulties in breathing.

In bulbar poliomyelitis the virus attacks the bulb, or brainstem, situated just above the spinal cord, and the nerve centres that control swallowing and talking are injured. Secretions collect in the throat and may lead to suffocation by blocking the airway.

Treatment during the preparalytic stages includes complete bed rest, isolation, and careful observation. If paralysis occurs, passive movement of the limbs can be used to avoid deformities. As muscle strength returns, exercises are increased. Breathing requires mechanical aids such as the iron lung or the positive pressure ventilator, which pumps air into the patient's lungs through a tracheotomy tube inserted in the windpipe. Accumulated secretions in the throat may be removed by a mechanical suction machine.

There seem to be individual differences in the degree of natural susceptibility to the disease. Many persons have acquired antibodies to the polio virus in their blood without having had any symptoms of infection. It is generally held that a lasting immunity follows recovery from the disease; but second attacks are known to occur, caused, at least in some cases, by viral strains differing immunologically from those responsible for the first attack. Among the predisposing factors, age is the most important, children and young adults being most often affected. Other predisposing factors include strenuous exercise, sudden chilling, and pregnancy.

Polioptilidae (bird family): *see* gnatcatcher.

polis, plural POLEIS, ancient Greek city-state. The small state in Greece originated probably from the natural divisions of the country by mountains and the sea and from the original local tribal (ethnic) and cult divisions. There were several hundred poleis, the history and constitutions of most of which are known only sketchily if at all. Thus, most ancient Greek history is recounted in terms of the histories of Athens, Sparta, and a few others.

The polis centred on one town, usually walled, but included the surrounding countryside. The town contained a citadel on raised ground (acropolis) and a marketplace (agora). Government was centred in the town, but citizens of the polis lived throughout its territory. The citizens governed in varying degrees, depending upon the form of government; usually there was an assembly of citizens, a council, and magistrates. Each polis also contained substantial numbers of noncitizens (women, minors, resident aliens, and slaves).

In the Hellenistic Age the political freedom of most poleis was curtailed, since they came under the ascendancy of the large territorial monarchies of Macedonian origin. But they continued to manage local affairs, and some, such as Athens, were flourishing intellectual centres. The Hellenistic kings founded numerous new cities, bringing in Greek and Macedonian settlers who Hellenized part of the local population; in this way the institutions characteristic of the polis spread through much of the Middle East.

Consult the INDEX *first*

Polisario, abbreviation of POPULAR FRONT FOR THE LIBERATION OF SAGUIA EL HAMRA AND RÍO DE ORO, Spanish FRENTE POPULAR PARA LA LIBERACIÓN DE SAGUIA EL HAMRA Y RÍO DE ORO, politico-military organization striving to end Moroccan control of the former Spanish territory of Western Sahara (*q.v.*), in northwestern Africa, and win independence for that region. Polisario is composed largely of the indigenous nomadic inhabitants of the Western Sahara region, the Saharawis. Polisario began as an insurgency (based in neighbouring Mauritania) against Spanish control of the Western Sahara. After Spain withdrew and Morocco and Mauritania partitioned Western Sahara between them in 1976, Polisario relocated to Algeria, which henceforth provided the organization with bases and the military hardware with which to try to wrest control of the region. Mauritania made peace with Polisario in 1979, but Morocco then unilaterally annexed Mauritania's portion of the Western Sahara. During the 1980s the Polisario guerrillas, numbering some 20,000 motorized and well-armed troops, harassed and raided Moroccan outposts and defenses in the Western Sahara. Polisario also mounted a diplomatic campaign, and by the late 1980s more than 60 countries had recognized the government-in-exile that Polisario had formed for what it called the Saharan Arab Democratic Republic.

Polish Corridor, strip of land, 20 to 70 miles (32 to 112 km) wide, that gave the newly reconstituted state of Poland access to the Baltic Sea after World War I. The corridor lay along the lower course of the Vistula River and consisted of West Prussia and most of the province of Posen (Poznań), which the Treaty of Versailles (1919) transferred from defeated Germany to Poland. Perhaps no provision of the treaty caused so much animosity and resentment among Germans than this arrangement, for the corridor ran between Pomerania and East Prussia and separated the latter province from the main body of the German Reich to the west. On the other hand, it should be noted that (1) the territory was historically Polish (that is, before the partitions of Poland in the late 18th century) and was inhabited by a Polish majority; (2) the provision accorded with the 13th of U.S. President Woodrow Wilson's Fourteen Points, for giving Poland "a free and secure access to the sea" and indeed its only access; and (3) the territory ceded did not include Danzig (Gdańsk), then a purely German town, which was established as a free city under the sovereignty of the League of Nations. Poland developed the corridor port of Gdynia as an alternative to Danzig. Free German transit was permitted across the corridor.

The Polish Corridor was the issue, or at least the apparent pretext, over which World War II began. In March 1939 the Nazi dictator of Germany, Adolf Hitler, demanded the cession of Danzig and the creation of extraterritorial German highways across the corridor connecting to East Prussia. Poland refused these demands and secured French and British guarantees against German aggression. In September Germany invaded Poland, thus beginning the war. Hitler annexed the Polish Corridor, Danzig, Posen, and districts along the Silesian frontier and placed the rest of the conquered Polish territory under a German governor. But after World War II the whole area was remapped, with great shifts of German and Polish populations, and the issue disappeared as the Polish Corridor, along with Gdansk and East Prussia, became part of postwar Poland.

Polish language, Polish JĘZYK POLSKI, West Slavic language belonging to the Lekhitic subgroup and closely related to Czech, Slovak, and the Sorbian language of eastern Germany; it is spoken by the majority of the present population of Poland.

The modern literary language, written in the Roman (Latin) alphabet, dates from the 16th century and was originally based on the dialects of the area around Poznań, in western Poland. The first written Polish consists of a list of names in the Papal Bull issued in 1136 by Pope Innocent II to the Archbishop of Gniezno; the oldest recorded sentence is a gloss translating a quotation in a document from 1270. Extant manuscripts containing any appreciable amount of connected Polish text date back no earlier than the 14th century.

Polish contains a great number of words borrowed from Latin, Czech, German, Belorussian, and Ukrainian and also some words from Italian, French, and English. Along with the other West Slavic languages, it has a fixed stress accent. In contrast to the others, however, the language has nasalized vowels (spelled *ę* and *ą*), indirectly continuing the nasalized vowels of Church Slavonic. Among the major dialects are Great Polish and Pomeranian, Silesian, Little Polish, and Mazovian. Kashubian (Cassubian), often classified as a Polish dialect, is, historically, a separate language.

Polish literature, body of writing in Polish, one of the Slavic languages. The Polish national literature holds an exceptional position in the life of the country. Over the centuries it has mirrored the turbulent events of Polish history and at times sustained Poland's cultural and political identity.

A brief account of Polish literature follows. For full treatment, *see* MACROPAEDIA: Polish Literature.

Poland's early literature was slow to emerge. The oldest documents, written in Latin, date from the 12th century, but the development of vernacular writing in the 14th and 15th centuries, hampered by internal disorders and destructive invasions, was late, and extant records are few. Although probably written in the 13th century, the earliest copy of a poetic text to have survived dates from 1407.

The Golden Age of Polish literature occurred during the 16th century. The spread of Italian Renaissance influences, closer contacts with other countries, and a period of relative peace and stability encouraged a varied and confident expression. The first original Polish writer is Mikołaj Rej. The date of his verse debate (1543), belonging in content and style to the earlier period, conveniently marks the beginning of the new age. His contemporary, the poet Jan Kochanowski, a man truly of the Renaissance, is the outstanding early Polish writer. The richness of the literature of the period is represented by prose (Lukasz Górnicki), sermons (Piotr Skarga), political writings (Andrzej Modrzewski), idylls (Simonides), and sonnets (Mikołaj Sęp Szarzyński).

The stylistic tensions of 17th-century Baroque writing, with its exotic colour and textures, its vigorous, sharp contrasts, and unexpected twists, mirror those of a century plagued by religious discord and war. Courtly lyrics (Jan Andrzej Morsztyn), religious poetry (Zbigniew Morsztyn), historical epics (Samuel Twardowski), and the memoirs of the boisterous Jan Chryzostom Pasek exemplify the literature of this troubled age.

Following a period of debility in the first part of the 18th century, the Age of Enlightenment during the reign of the last Polish king, Stanisław II August Poniatowski, brought a vigorous revival in all areas of Poland's cultural, political, and intellectual life. Literature, journalism, publishing, political and educational reform, and the opening of a national theatre (1765) attest to the progressive attitudes of the age. Its best representative is Ignacy Krasicki. The poetry of Franciszek Karpiński and Franciszek Dionizy Kniaźnin, the plays of Wojciech Bogusławski and Franciszek Bohomolec, and the writings of Julian Ursyn Niemcewicz are among the best examples of 18th-century Polish literature.

The enthusiasm and passions that stirred the 19th-century Romantics were common everywhere, but in Poland they were soon charged by the drama of events. After the failure of the 1830 insurrection, Polish Romanticism assumed the guilt and the tragic sorrows of an oppressed and martyred nation. Written in exile, the bardic tones of Adam Mickiewicz's work (with its Promethean anguish and Messianic visions) and that of Juliusz Słowacki and Zygmunt Krasiński became an expression of the national spirit. These writers' major works—with their quest for self-identification, individual liberty, and questioning of history—are an enduring part of the Polish consciousness.

The unsuccessful uprising of 1863 marked the end of earlier Romantic dreams. In the aftermath of a bitter defeat, the old idealism gave way to a new positivism with an emphasis on practical endeavour and social and political realism. The novels of Henryk Sienkiewicz, Bolesław Prus, and Eliza Orzeszkowa (ranging from historical themes to social and contemporary problems) dominated the literature of the second part of the 19th century.

Reacting against the constrictions of positivism, the Young Poland movement (1890–1918) vibrated with new names and new ideas. European and provokingly modernistic in its early, enthusiastic manifestos, it contained a wide variety of currents and styles. Its best examples embrace poetry (Kazimierz Tetmajer), symbolist drama (Stanisław Wyspiański), and the novel (Stefan Żeromski).

The short period of restored independence during the interwar years (1918–39) produced a literature of freshness and diversity. Apart from the work of the older writers such as Bolesław Leśmian and Leopold Staff, the period witnessed the noisy inventions of the Futurists, the avant-garde poetry of Tadeusz Peiper and Julian Przyboś, and the confident optimism of the Skamander poets. In prose there were the works of some of the major modern Polish writers: Maria Dąbrowska, Witold Gombrowicz, Jerzy Andrzejewski, and Bruno Schulz; in the theatre were the plays of Jerzy Szaniawski and the innovative surrealism of Stanisław Ignacy Witkiewicz.

After 1945 the experiences of war and occupation produced new topics for Polish writers, particularly since the lifting of Soviet-inspired Stalinist cultural controls in 1956. Whether distilling the tragedies of war or depicting the traumas of contemporary Polish life in the Soviet bloc, the works of Zbigniew Herbert, Tadeusz Konwicki, Tadeusz Różewicz, Sławomir Mrożek, and Stanisław Lem, and of the older Czesław Milosz, mirror the modern Polish condition.

Polish National Catholic Church of America, Old Catholic church that arose in the late 19th and early 20th centuries among Polish immigrants in the United States who left the Roman Catholic church. Polish immigrants were unhappy with the Roman Catholic church in the United States for several reasons, including various internal disputes and dissatisfaction with pastors, the absence of a bishop of Polish birth or descent in the American hierarchy, and the 1884 ruling that gave bishops the title to all diocesan properties.

In 1896–97 members of the Sacred Hearts of Jesus and Mary parish in Scranton, Pa., founded an independent parish under the leadership of their former curate, Reverend Francis Hodur. They launched a petition calling for ownership by Polish parishes of property built by their members, parish-wide elections of administrators of such property, and no appointment by bishops of non-Polish pastors to such parishes without the consent of the parishioners. Excommunication followed. Father Hodur's parish became the nucleus of a movement that took in other seceded congregations. In 1904 a synod, in Scranton, of independent parishes voted to form one body and chose its present name. It also adopted a constitution, elected a lay-clerical Supreme Council, and unanimously elected Hodur bishop. On Sept. 29, 1907, he was consecrated in Utrecht, Neth., by bishops of the Old Catholic church.

Liturgically, the Polish National Catholic Church resembles the Roman Catholic church. From 1900 masses were in Polish, but in the 1960s English masses were permitted if the parishes desired them. Doctrinally, the church is based on the Scriptures, tradition, decrees of the first four ecumenical councils, and decrees of its own synods. In 1922 the requirement of clerical celibacy was abolished. General rather than private confession is made by adults. Between synods, executive power in the church rests with the prime bishop and Supreme Council, which consists of all bishops and the seminary rector, and a lay and a clerical representative from each of the church's five dioceses. Synods, consisting of all the clergy as well as lay delegates, are held every four years. Headquarters and a seminary are in Scranton. In the late 20th century the membership was reported to be about 270,000.

Polish People's Republic: *see* Poland.

Polish Succession, War of the (1733–38), general European conflict waged ostensibly to determine the successor of the king of Poland, Augustus II the Strong. The war resulted mainly in a redistribution of Italian territory and an increase in Russian influence over Polish affairs.

After Augustus died (Feb. 1, 1733), Austria and Russia supported the election of his son Frederick Augustus II of Saxony as king of Poland. Most Poles, however, preferred Stanisław I Leszczyński, who had been their king (1704–09) when the Swedes had temporarily forced Augustus II to be deposed and who also had become the father-in-law of Louis XV of France. France and Spain both opposed the Austro-Russian position and supported Leszczyński, who was elected king of Poland by a *sejm* (Diet) of 12,000 delegates in Warsaw on Sept. 12, 1733. But when a Russian army of 30,000 approached Warsaw, Leszczyński fled to Gdańsk, and another *sejm* of 3,000 delegates named Frederick Augustus as Poland's new king, Augustus III (Oct. 5, 1733). France consequently formed anti-Habsburg alliances with Sardinia-Savoy (September 26) and Spain (November 7) and declared war on Austria (October 10).

Don Carlos, the Spanish infante, led a Spanish army of 40,000 across Tuscany and the Papal States to Naples, defeated the Austrians at Bitonto (May 25, 1734), conquered Sicily, and was crowned king of Naples and Sicily as Charles III. The French, however, after overrunning Lorraine, were effectively checked in southern Germany by Austria's prince Eugene of Savoy. Furthermore, the French and Savoyard forces that invaded Lombardy were unable to take Mantua, and the small French contingent sent by sea to relieve the Russian siege of Gdánsk was ineffective. Gdánsk fell in June 1734.

Leszczyński escaped to Prussia, and to support him the Poles organized the Confederation of Dzików (November 1734), which, however, failed to defeat the Russians and Augustus. Furthermore, dissension between the Spaniards and the Savoyards made the Italian campaign of 1735 inconclusive; and, because the French feared that the British and the Dutch would enter the war as Austria's allies, France signed a preliminary peace with Austria (Peace of Vienna; Oct. 3, 1735). It provided for Augustus to remain king of Poland. In addition, Don Carlos was to retain Naples-Sicily but had to give Austria both Parma and Piacenza, which he had inherited in 1731, and to renounce his claims to Tuscany. Sardinia-Savoy also acquired Novara and Tortona from Lombardy, which remained a Habsburg possession. Following the settlement, Leszczyński renounced the crown (Jan. 26, 1736), and the Dzików Confederation recognized Augustus as king (July 1736).

Three years later, on Nov. 18, 1738, France and Austria signed the final Treaty of Vienna, in which the provisions of the preliminary agreement were confirmed and in which France also conditionally guaranteed the Pragmatic Sanction, by which Holy Roman emperor Charles VI named his daughter, the Austrian archduchess Maria Theresa, as the heiress to his Habsburg lands. The other outstanding belligerents acceded to the peace in 1739.

Politburo, the supreme policy-making body of the Communist Party of the Soviet Union. The Politburo until July 1990 exercised supreme control over the Soviet government; in 1990 the Politburo was enlarged and was separated to a certain degree from control over the Soviet government. Central party organs comparable to the Soviet Politburo are found in China and other communist countries.

The first Politburo was created in Russia by the Bolshevik Party Central Committee in late October 1917 to provide continuous and flexible leadership in that year's uprising. The seven Politburo members included Vladimir Lenin, Leon Trotsky, and Joseph Stalin. The Bolshevik coup accomplished, the Politburo was dissolved. The 8th Party Congress in March 1919 instructed the Central Committee to elect a new Politburo of five from its ranks; its formal role would be to decide on questions too urgent to await Central Committee deliberation. The Politburo soon assumed a major position in party and state administration, and it eventually came to overshadow the role of the Central Committee. Because the party secretariat planned the agenda, provided all documentation for debate, and transmitted Politburo decisions to the lower echelons, the general secretary of the Communist Party (Stalin) became the Politburo's most influential member. Following the power struggles after Lenin's death in 1924, Stalin achieved a controlling position on the Politburo, exercising complete dominance over it and the party in general.

In 1952 the Politburo was abolished and was replaced by a larger Presidium of the Central Committee. More stress was laid on "collective leadership" within this body after the tyrannical excesses of Stalin (d. 1953), and the Presidium was actually strong enough to remove Nikita Khrushchev from the party's leadership in 1964. The old name of Politburo was revived for the body in 1966, and so it has remained.

The Politburo's membership is nominally elected by the Central Committee of the Communist Party, but in truth the Politburo has been a self-perpetuating body that itself decides which new members it will admit and which it will expel from its ranks. Until mid-1990 it consisted of about 12–15 members and 5–8 candidate members. With the changes made in 1990, the body grew to include a representative from each of the Soviet republics. Several top government officials were dropped from the Politburo; though they remained party members, they were to concentrate on their responsibilities as members of the presidential council. The chairman of the Politburo is the general secretary of the Communist Party and, traditionally, was in effect the leader of the Soviet Union. (The Politburo formerly included the minister of defense, the head of the KGB [the Soviet secret police], and the heads of the most important republic or urban party organizations.) The Old Bolshevik ideologues who sat in the early Soviet Politburo have been replaced by party members with some technical training and records of long and loyal service in the bureaucracy.

The politburos of the eastern European communist countries were similar in form and function to the Soviet model. The politburo of China is also similar, but it contains a Standing Committee of about 7 members who exercise great power within the party and the politburo itself.

Politian, Italian in full ANGELO POLIZIANO, also called ANGELO AMBROGINI (b. July 14, 1454, Montepulciano, Tuscany [Italy]—d. Sept. 28/29, 1494, Florence), Italian poet and humanist, the friend and protégé of Lorenzo de' Medici, and one of the foremost classical scholars of the Renaissance. He was equally

Politian, detail from "Zaccharias and the Angel" by Ghirlandajo, 1490–94; in Sta. Maria Novella, Florence
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fluent in Greek, Italian, and Latin and was equally talented in poetry, philosophy and philology.

The murder of Politian's father in May 1464 left the family poverty-stricken, and not later than 1469 Politian was sent to Florence. He started to write Latin and Greek epigrams and attracted the attention of Lorenzo de' Medici, to whom Politian dedicated the first two books of his Latin translation of the *Iliad.* In about 1473 he entered the Medici household and was able to study in the Medici library until, in 1475, he was entrusted with the education of Lorenzo's eldest son, Piero, then aged three. In 1477 he was given as a benefice the priory of San Paolo. His translation of the *Iliad,* books ii–v, into Latin hexameters (1470–75) brought him his first renown. Between 1473 and 1478 he produced Latin and Greek verses that are among the best examples of humanist poetry: they include elegies, odes, and epigrams (of particular merit are the elegies *In violas* ["In Violets"] and *In Lalagen* and the ode *In puellam suam* ["In Regard to One's Daughters"]). To the same period belong the strange and poetically experimental *Sylva in scabiem* (1475; "Trees with Mildew"), in which he describes realistically the symptoms of scabies.

His poetic masterpiece of this period is, however, a vernacular poem in ottava rima, *Stanze cominciate per la giostra del Magnifico Giuliano de' Medici* ("Stanzas Begun for the Tournament of the Magnificent Giuliano de' Medici"), composed between 1475 and 1478, which is one of the great works of Italian literature. In it he was able to synthesize the grandeur of classical literature with the spontaneity of Florentine vernacular poetry. The poem describes the love of "Julio" (*i.e.,* Giuliano de' Medici), for "Simonetta" (*i.e.,* Simonetta Cattaneo; d. 1476) by means of a poetic transfiguration in which beauty is glorified according to humanist ideals. Stylistically it is influenced by Latin epic and encomiastic poems and reveals the author's taste for refined poetry. It was interrupted at book ii, stanza 46, probably because of Giuliano's death in 1478.

Politian was, with Lorenzo de' Medici, one of those mainly responsible for the revaluation of vernacular literature. It is generally believed that it was he who wrote the dedicatory letter, tracing the history of vernacular poetry and warmly defending it, that accompanied the so-called *Raccolta Aragonese* ("The Aragon Collection"), a collection of Tuscan verse sent by Lorenzo de' Medici to Federico d'Aragona in about 1477.

Politian was with Lorenzo and Giuliano when the latter was killed by the Pazzi on April 26, 1478; on this episode he wrote the dramatic report *Pactianae coniurationis commentarium* (1478). In May 1479, as a result of a quarrel with Lorenzo's wife, Clarice Orsini, he was expelled from the Medici household. In December, instead of accompanying Lorenzo on a difficult diplomatic mission to Naples, he undertook a series of journeys in northern Italy. After visiting Venice and Verona he was attracted to Mantua, where, in the Gonzaga court, he found a new patron in Cardinal Francesco Gonzaga. It was for a court occasion that he wrote in Mantua *Orfeo* (1480; "Orpheus"), a short dramatic composition in the vernacular, based on the myth of Orpheus and Eurydice and inspired by the same humanist ideal of beauty that pervades his *Stanze. Orfeo* is less refined than the *Stanze,* but it nevertheless reveals the author's poetic genius. During his stay in Mantua, Politian repeatedly wrote to Lorenzo asking to be recalled to Florence, and in August 1480 he was at last invited to return and was again entrusted with Piero's education. Thanks to Lorenzo he was appointed to the Florentine chair of Latin and Greek (autumn 1480) but was not readmitted to the Medici household and went to live outside of Florence.

At the Florentine university he gave four inaugural lectures in verse, known collectively as the *Sylvae* ("The Trees"): *Manto* (1482; "The Cloak"), on Virgil's poetry; *Rusticus* (1483; "The Countryside"), on the bucolic poems of Hesiod and Virgil; *Ambra* (1485; "Amber"), on Homer; and *Nutricia* (1486; "The Foster Mother"), on the different genres of Greek and Latin literature.

In 1488 he took part in a diplomatic mission to Pope Innocent VIII; and in 1491 he traveled to Bologna, Ferrara, Padua, and Venice to trace manuscripts for the Medici library. Otherwise he spent the last years of his life in Florence. His writings of this last period include a Latin translation of Epictetus' *Manual* (1479); a collection of *Detti piacevoli* (witty sentences), composed in the vernacular between 1477 and 1479; Greek epigrams; a number of vernacular *canzoni a ballo* ("songs for dancing") and *rispetti* ("regards"), which show his taste for popular poetry; and Latin letters on problems of style and literature.

His most important work on classical philology is the *Miscellanea* (1489), two collections, each consisting of about 100 notes (*centuria*) on classical texts: these and other works laid the foundations for subsequent scholarly studies in classical philology.

political action committee (PAC), in U.S. politics, an organization whose purpose is to raise and distribute campaign funds to candidates seeking political office. PACs are formed by corporations, labour unions, trade associations, or other organizations to solicit voluntary campaign contributions from individuals and channel the resulting funds to candidates for elective offices in the federal government, primarily in the House of Representatives and the Senate. PACs rose to prominence after the Federal Election Campaign Act of 1971 set strict limits on the amount of money a particular corporation, union, or private individual could give to a candidate. By soliciting smaller contributions from a much larger number of individuals, PACs circumvent these limitations and manage to provide substantial funds for candidates. By the late 20th century, the vast amounts of money raised by PACs had greatly escalated the cost of running for federal office in the United States.

political convention, in U.S. politics, a meeting of party delegates at the local, state, or national level to select candidates for office and to decide on party policy. The conventions, as representative organs of the parties, may also elect executive committees of the parties and adopt rules governing party organization. In practice they also act as rallies for the election campaigns that follow.

Before the institution of conventions in the 1830s, parties decided on candidates and policies in informal caucuses. Conventions were introduced to eliminate the abuses of the caucus system; they were expected, by their open and public conduct of business, to be more democratic and less amenable to control by party bosses and machines. However, most of the real business of conventions has been conducted in informal meetings of various delegates and leaders; activity on the floor of the convention has usually been merely a reflection of behind-the-scenes decisions and compromises. In order to lessen this control by party oligarchies, candidates for most elective offices at the state and local levels are now nominated by direct primaries rather than conventions, although conventions still play an important role in endorsing party candidates.

National party conventions are held every four years to nominate candidates for president and vice president and to adopt a national platform. At first, voting strength in both conventions was apportioned among the states according to their electoral-college vote, usually two convention votes for each of the state's electors. For its 1916 convention, the Republican Party adopted rules curtailing the representation of congressional districts in which the Republican vote was light. Both parties later began giving "bonus" votes to the states carried by the party in a previous election.

Each convention begins by electing a convention chairman and a rules committee, adopting convention rules, and checking delegate credentials through a credentials committee. Thereafter, party platforms, prepared by a special committee, are debated and voted upon by the delegates.

Although nominations of candidates are the work of the convention as a whole, the growth of presidential primaries increasingly limits conventions to ratifying the candidate already selected by the voters. Candidates are nominated in eulogistic speeches; noisy demonstrations are then staged, with bands and marchers hired for the occasion parading up and down the aisles; and eventually the convention votes. The roll of states is called alphabetically, and the vote of each state delegation is reported by its chairman; if necessary, the delegation is polled, each delegate being asked to openly declare his vote. Although many contests have been settled on the first ballot, the taking of several ballots is common.

In the late 20th century the great majority of Republican and Democratic delegates have been selected through primaries. Most of the delegates elected in primaries are bound to vote in a way that reflects the voters' choice, at least on the first ballot. A candidate who has won enough delegate votes in the primaries can be certain of nomination on the first ballot. This reduces the power of party leaders and favourite-son candidates to broker delegate votes to candidates in exchange for political favours. Their bargaining strength has also been lessened by the public-opinion polls that measure the strength of the candidates and show their support by regions and demographic groups. The convention seeks to run a candidate who can win, and the polls are persuasive assessments of a candidate's viability. If primaries and polls do not make the nomination a foregone conclusion, they at least eliminate all but the serious contenders before the convention.

The nomination of a vice-presidential candidate, frequently one chosen by the presidential nominee in consultation with party leaders, follows the selection of the presidential standard bearer. At the final convention session the nominees make acceptance speeches that usually spell out the major campaign platforms.

The national conventions are nationally televised and receive a great deal of attention. Local and state conventions perform similar functions, but the rules governing their composition and proceedings vary from state to state. The tendency has been toward greater uniformity in such procedures.

The national conventions have been criticized throughout their history as undemocratic spectacles. Critics have proposed replacing them with some form of national presidential primary. Defenders argue that, besides promoting party unity and enthusiasm, conventions allow compromise, and they tend to nominate candidates and take positions that represent the political mean rather than the extremes. Because a president must be able to win-over party leaders as well as the public to function in office, supporters of the system claim that it is a better test of how a candidate will perform.

political economy, branch of social science, which later developed into economics, concerned with the raising of revenue by the state and the increase of the state's general resources. The term was introduced about the beginning of the 17th century to describe the study of the problems of the princely states, which at the close of the Middle Ages in Europe replaced the feudal-ecclesiastical political order. Adam Smith, the first to present a comprehensive systematized study, seemed to equate political economy with the treatment of "the nature and causes of the wealth of nations."

After the nationalistic epoch gave way to individualism or liberalism in the late 18th century, the older state-oriented literature came to be called mercantilism. Works in this period, including David Ricardo's *Principles of Political Economy and Taxation* (1817) and John Stuart Mill's *Principles of Political Economy* (1848), gave increased attention to problems of value and distribution.

The term economics replaced political economy in general usage during the 20th century; the change of name accompanied the expansion of the discipline itself, which had become subdivided into a number of specialties.

political machine, in U.S. politics, a party organization, headed by a single boss or small autocratic group, that commands enough votes to maintain political and administrative control of a city, county, or state.

The rapid growth of American cities in the 19th century, owing to both immigration and migration from rural areas, created huge problems for city governments, which were often poorly structured and unable to provide services. In these conditions, political machines, such as Tammany Hall, run by boss William Marcy Tweed (1823–73) in New York City, were able to build a loyal voter following, especially among immigrant groups, by performing such favours as providing jobs or housing.

Political machines are characterized by a disciplined and hierarchical organization, reaching down to neighbourhood and block organizers, that enables the machine to respond to the problems of individual neighbourhoods, or even families, in exchange for loyalty at the polls. The term refers to their ability to elect candidates or enact measures with mechanical efficiency and predictability.

Although the primary goal of a political machine is keeping itself in power rather than providing good government, machines have been responsible for restructuring city governments to centralize authority, improving facilities and services, helping to assimilate immigrant groups, and encouraging the growth of business and industry. Supporters of political machines say that they "work" and that consolidating power in the hands of a boss, like Mayor Richard J. Daley (1902–76) of Chicago, guarantees city governments the power and authority that they need to cope with urban problems effectively. However, because political machines in such cities as Boston, Philadelphia, New York, Pittsburgh, Chicago, and Kansas City have also been responsible for many abuses of power, the term carries a pejorative sense.

Organizers who "deliver" the votes are often rewarded with patronage jobs. However, patronage can result in poorer service to the citizens because appointees may be neither qualified for their jobs nor interested in performing them. Control of both elective and appointed posts also gives a machine control of government salaries and revenues, which can be used to enrich the party at the public's expense. For example, the machine may accept donations or kickbacks from businesses in return for such favours as tax or zoning concessions or the award of lucrative public-works contracts. In some cities, machine business dealings have included accepting money from organized-crime syndicates in exchange for protection from legal interference.

In cities whose neighbourhoods are divided along ethnic or racial lines, machine patronage may aggravate hostilities by awarding most jobs and services to those people of the same background as the city's power elite. In practice, this made machine politics the last defense of white neighbourhoods against growing black populations, while black politicians who anticipated power viewed their constituents as merely the latest in a series of ethnic or racial groups that had benefited from the machine.

Since the 19th-century heyday of machine politics, civil-service reforms limiting the number of patronage jobs, the institution of direct primaries rather than party nomination of candidates, the municipal operation of public utilities, and judicial review by state and federal courts have all reduced the power of political machines. The steady exodus of city residents to the suburbs since World War II and a more mobile population with fewer ties to particular neighbourhoods have also weakened the social base that once made political machines synonymous with city government.

political party, a group of persons organized to acquire and exercise political power through election or revolution. Political parties are a product of the 19th century, when they developed in Europe and the United States alongside modern electoral political systems.

A brief treatment of political parties follows. For full treatment, *see* MACROPAEDIA: Political Parties and Interest Groups.

Structurally, political parties fall into one of two categories: the cadre party, with a membership confined to an active elite, and the mass-based party. In practice most parties combine features of each type. Cadre parties promoting the interests of the landed classes and the established church (conservative) or of the commercial and industrial bourgeoisie (liberal) developed in 19th-century England from earlier cliques and factions. American parties were from their beginning less ideological and less centralized than those in Europe, and, because of a high degree of economic mobility and the early adoption of broad-based suffrage in the United States, they were not so distinctly based on class.

By the late 19th century complaints that existing parties did not truly represent their constituencies led in the United States to the adoption of various reforms, notably the primary system of nominating candidates, which promoted the democratization of parties in the direction of the mass-based model. Truly mass-based parties arose in Europe with the organization of socialist parties in several countries. These differed from cadre parties in their efforts to enroll as many individual members as possible, in their financing by numerous small contributions, and in the election of party leaders by the membership. Parties may seek political power by electoral or revolutionary means, or sometimes by both. There is a strong tendency for a party that has gained power by revolution to decree a one-party state, a special case considered below. The two- or multiparty state with an electoral system is more common.

After an election all parties exercise some degree of power, either as the governing majority party, as one party in a governing coalition, or as an opposition. In parliamentary systems the continuance of the government depends on its ability to obtain a majority vote of the legislature on important measures, and all parties therefore exercise strong discipline over their members. In the American presidential system, party discipline is less necessary and is rarely applied because both president and Congress serve definite terms. Whether a country has a two-party or a multiparty system depends partly on tradition and partly on the structure of the electoral system. Systems of proportional representation encourage the proliferation of parties, while the winner-take-all systems of English-speaking countries make it difficult for new parties to succeed.

The single-party system prevails in countries where revolutionary parties have come to power or where leaders believe that political conflict and criticism of the government serve only to divide a society. The most notable examples are the communist regimes, in which the party bureaucracy, chosen from a small elite, has in effect become the state, and facist regimes, where the party is even more of a closed corporation but is usually subordinated to a charismatic leader or to the army. Variations of the single-party system are also found in many developing countries.

political philosophy, branch of philosophy that is concerned, at the most abstract level, with the concepts and arguments involved in political opinion. The meaning of "political" is itself one of the major problems of political philosophy. Broadly, however, one may characterize as political all those practices and institutions that are concerned with government.

A brief treatment of Western political philosophy follows. For full treatment, *see* MACROPAEDIA: Political Philosophy, The History of Western.

Of first importance in political philosophy is the analysis of the state and related institutions. The question of the state leads to those of sovereignty (the power and authority assumed by the ruler) and political obligation (the duty and submission assumed by the ruled). Under what conditions, if any, can political obligation arise, and what is its extent? Political obligation tends to be upheld on grounds either of utility or of justice. But what is justice? This question was regarded by Plato and Aristotle as the fundamental question of political theory, and it remains high on the agenda of modern liberal philosophers. No political philosophy is complete without an account of law and constitution. What is a law, how are laws justified, and how far should they extend? Are there forms of reasoning that are special to law? Finally, the concept of a constitution is one of the major inventions of Western thought and describes the condition of "limited government"—government that is circumscribed by its own procedures.

The first major work of political philosophy in the Western tradition was Plato's *Republic,* defending a well-ordered, authoritarian state presided over by a "philosopher king." Aristotle's *Politics* rejected Plato's approach in favour of a detailed consideration and step-by-step justification of existing political institutions, including both the family and private property. Both philosophers influenced the Roman tradition of civil thought, which is best exemplified by Cicero and Polybius. They also profoundly influenced St. Augustine, whose *City of God* began the long tradition of Christian political thinking, in which a concept of natural law is used to describe and to circumscribe the rights and duties of the sovereign. Medieval thinkers such as St. Thomas Aquinas further developed that idea, while philosophers of the Italian Renaissance—of whom Francesco Guicciardini and Niccolò Machiavelli were the most prominent—concerned themselves with the problem posed by the need for both the existence of power and its limitation.

The seminal work of modern political philosophy—the *Leviathan* (1651) of Thomas Hobbes—raised the problem of political obligation in its modern form and tried to give a theory of sovereignty that would incorporate the conclusions of Machiavelli. Hobbes was followed by Baruch de Spinoza, John Locke, and Jean-Jacques Rousseau in the exposition of a social-contract theory of political obligation. This theory was rejected by David Hume and also by Friedrich Hegel, whose *Philosophy of Right* (1821) set the stage for 19th-century political thought by making the questions of private property and individual freedom central to the analysis of political order. Hegel's defense of private property stimulated Karl Marx's critique of it; J.S. Mill meanwhile developed Jeremy Bentham's utilitarian theory of law and political institutions, so as to reconcile them with a demand for individual liberty.

By the beginning of the 20th century, political philosophy had become so diversified that few philosophers recognized a single set of problems that they shared with their competitors. Recent work has been characterized by a division between Marxists (concerned with sociological analysis and the "class struggle") and more traditional liberal thinkers, who remain attached to the problems posed by the concepts of liberty and right. Such a division is by no means exhaustive—there are also pragmatic conservatives in the tradition of Edmund Burke, and latter-day Hegelians—yet, it accounts for one of the major existing barriers of comprehension.

political science, academic discipline concerned with the study of government and politics.

A brief treatment of the discipline of political science follows. For full treatment, *see* MACROPAEDIA: Social Sciences, The.

For a description of the place of political science in the circle of learning and for lists of both MACROPAEDIA and MICROPAEDIA articles on the subject, *see* PROPAEDIA: Part Five, Division IV.

Political science studies the functions performed by governments—*e.g.*, legislation and administration of the law—as well as the behaviour of voters, the operation of political parties, the influence of political organizations, and other factors in the functioning of the state. The discipline, which is concerned with observing patterns in political behaviour and deriving principles from the data, is generally distinguished from political philosophy, a normative field that is concerned with such concepts as "right," "justice," and "obligation."

Speculation on political subjects is found in the thought of many ancient cultures, but it is generally agreed that the roots of political science are found in the works of Plato and Aristotle. The scientific character of the discipline was developed by the Christian Socialist Henri de Saint-Simon and by Auguste Comte and other 19th-century Positivists. During this period political science became allied with other disciplines that were beginning to study human behaviour by using scientific techniques, and scholars began to examine actual human behaviour as reflected in political life. A pioneer in this development was Ludwig Gumplowicz, who drew upon ideas from anthropology and from Charles Darwin's theory of evolution and who focused attention on the interactions that take place between groups within the state.

During the last three decades of the 19th century, institutions dedicated specifically to the study of political science were established. The first such institution was the Free School of Political Sciences (now the Institute for Political Studies, of the University of Paris), founded in 1871. Although a chair in history and political science had been created in 1857 at Columbia University, it was not until 1880 that John W. Burgess, who had studied at the Free School of Political Sciences, established a separate school of political science at Columbia. The London School of Economics and Political Science was founded in 1895, and the University of Oxford established a separate chair in politics in 1912.

One of the most influential books in American political science was Arthur F. Bentley's *The Process of Government* (1908). Following Gumplowicz, Bentley made the concept of the group central to his thought, and he considered how governmental actions could be understood in terms of human activities. In the 1920s and '30s, the so-called Chicago school, which later influenced the development of behavioralism, assumed preeminence in political science. Charles E. Merriam and Harold D. Laswell, leading members of the school, emphasized the role of psychological factors in political life, though Merriam was also interested in the use of mathematical techniques such as statistics in the analysis of politics.

Since World War II the techniques of systems analysis have become increasingly important in political science. This approach, particularly as developed by David Easton in *The Political System* (1953), studies politics as that part of the overall social system whose activities involve the making of social policy and the distribution of social goods. Systems analysis also provides a broad framework for other topics of study, such as the interactions of interest groups, elite classes, and political parties.

Politis, Nikolaos Sokrates (b. Feb. 7, 1872, Corfu, Greece—d. March 4, 1942, Cannes, Fr.), Greek jurist and diplomat, a champion of disarmament and the peaceful settlement of disputes. He was president of the Institute of International Law (1937–42) and was largely responsible for the founding of the Academy of International Law at The Hague.

After holding law professorships at Aix-en-Provence, Poitiers, and Paris, Politis was summoned in 1914 to reorganize the Greek Ministry of Foreign Affairs, of which he became director general. After becoming Greece's minister of foreign affairs in 1916, he attended the Paris Peace Conference in 1919 as the Greek delegate. Later, as the representative of Greece in the League of Nations, he wrote the report on the Geneva Protocol (1924), and, as vice president of the Disarmament Conference, he framed the official League definition of aggression. Among Politis' published works on jurisprudence are *La Justice internationale* (1924) and *Les Nouvelles Tendances du droit international* (1927; *New Aspects of International Law*).

Politis
H. Roger-Viollet

Polivanov, Aleksey Andreyevich (b. March 16 [March 4, Old Style], 1855—d. Sept. 25, 1920, Riga, Latvia), general in the imperial Russian army who, during World War I, was appointed minister of war in 1915 to revitalize the sagging Russian war effort. A capable administrator of liberal sympathies, he was dismissed after less than a year.

Having fought in the Russo-Turkish War of 1877–78, Polivanov served on the army's general staff (1899–1904), during which time he edited several journals. He was chief of the general staff from 1905 to 1906 and was assistant minister of war from 1906 to 1912, but he was dismissed from the latter post for being too cooperative with liberal elements in the Duma. From 1912 to 1915 he served on the State Council. As minister of war from June 1915 to March 1916, Polivanov reorganized the army's training program as well as the military production and supply system. He also unsuccessfully tried to dissuade Tsar Nicholas II from personally assuming supreme command of Russia's armed forces in September 1915. Nicholas eventually dismissed Polivanov from his ministry at the instigation of the empress, Alexandra.

Polivanov offered his services to the Red Army in February 1920 and was a military expert at the Soviet–Polish peace talks in 1920 at Riga, where he died of typhus.

Poliziano, Angelo (Renaissance scholar): *see* Politian.

polje (Serbo-Croatian: "field"), elongated basin having a flat floor and steep walls; it is formed by the coalescence of several sinkholes. The basins often cover 250 square km (about 100 square miles) and may expose "disappearing streams." Most such basins have steep enclosing walls that range from 50 to 100 m (165 to 330 feet) in height, giving rise to the name "blind valley." The flat floor of a polje is characteristically covered with a soil composed of the residues of limestone solution. These areas may constitute the only arable part of the rock wasteland in a karst region. *See also* karst.

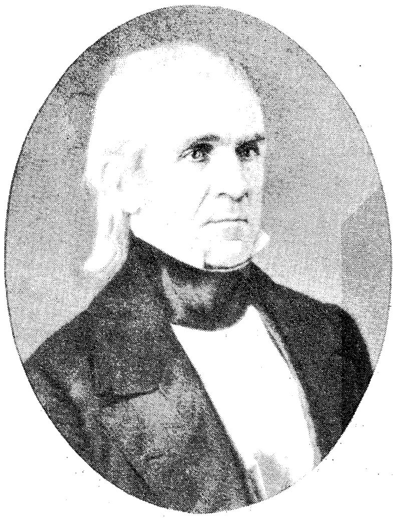
Polk, James K(nox) (b. Nov. 2, 1795, Mecklenburg County, N.C., U.S.—d. June 15, 1849, Nashville, Tenn.), 11th president of the United States (1845–49). Under his leadership the United States fought the Mexican War (1846–47) and acquired vast territories along the Pacific coast and in the Southwest.

Early life and career. At the age of 11 Polk accompanied his family to Tennessee, where his father operated a prosperous farm in Maury County. Though ill health made formal schooling impossible during his childhood, at the age of 20 he successfully passed the entrance requirements for the second-year class of the University of North Carolina. He was "correct, punctual, and industrious," and as a graduating senior in 1818 he was the Latin salutatorian of his class—the preeminent scholar in both the classics and mathematics.

After graduation he returned to Tennessee and began to practice law in Nashville. His interest in politics, which had fascinated him even as a young boy, was encouraged by his association with leading public figures in the state. In 1820 he was admitted to the bar. Because he was a confirmed Democrat and an unfailing supporter of Andrew Jackson and because his style of political oratory became so popular that he was characterized as the "Napoleon of the stump," his political career was assured.

His rapid rise to political power was furthered by his wife, Sara Childress Polk (1803–91), whom he married Jan. 1, 1824, while serving in the state house of representatives (1823–25). The social prominence of her family and her personal charm were distinct assets for a politically ambitious lawyer. As an official hostess she won the admiration and esteem of the leading figures of the day, and for 25 years she was her husband's close companion in state and national politics.

James K. Polk was by nature a student of government, by experience a legislator, and by force of circumstance an administrator. He was not an easy man to know or to like. Even



James K. Polk, daguerreotype by Mathew Brady, 1849

By courtesy of the Library of Congress, Washington, D.C.

close companions did not relish his austerity, and associates tolerated but did not approve his inflexible living standards. Among his few close friends was Andrew Jackson, who encouraged and advanced Polk and whose influence carried him from the Tennessee House of Representatives to the United States House of Representatives, where he served from 1825 to 1839.

As speaker of the House during that time, Polk acquired a reputation as an undeviating supporter of Jacksonian principles. In 1839 he left the House to become governor of Tennessee. Two defeats for a second term (1841, 1843) by small majorities convinced him that to strengthen his party he should return to Washington in some capacity.

Polk's nomination as the Democratic candidate for president in 1844 was unsought by him, for the party had more prominent sons in Martin Van Buren, Lewis Cass, and James Buchanan. But the Democrats could not reconcile their differences, and a compromise candidate had to be found because the campaign was to be run on issues and not on personalities; it was decided that Polk would do. He is regarded as the first "dark horse" nominee in the history of the presidency.

It was thought that Polk, as a party man from what was then the West, and a former member of the House of Representatives, would bring about legislative and executive cooperation and understanding in the functioning of the national government. While speaker of the House he had decided many procedural questions and had usually been sustained by majorities composed of the leaders of both parties. His party feeling was intense, but his integrity was unquestioned; he knew the rights and privileges of the House, and he also knew its responsibilities.

During his campaign Polk surprised the country by taking a positive stand on two burning issues of the day. Whereas other candidates hedged on the question of whether to annex Texas, which had been independent of Mexico since 1836, he demanded annexation. Whereas other candidates evaded the problem of joint occupancy of Oregon with England, he openly laid claim to the whole territory that extended as far north as 54°40′ with the campaign slogan "Fifty-four Forty or Fight." His election was close, but it was decisive—a popular plurality of about 38,000 and 170 electoral votes against 105 for Henry Clay.

Presidency. Not yet 50 years of age, Polk was the youngest successful presidential candidate up to that time. He entered the presidency full of vigour and with an expressed zeal to serve his country to the best of his ability. He left it four years later exhausted and enfeebled by his efforts. In office he demonstrated remarkable skill in the selection and control of his official advisors, and in his formal relations with Congress his legislative experience served him well. When his party was firmly united behind a policy he himself opposed, he yielded to the wishes of Congress. When he disagreed strongly with congressional policy and decided to make an issue of it, he fortified his position with recognized executive precedent and practice. His formal disapprovals (in the form of two message vetoes and one pocket veto, by which legislation is killed by the failure of the president to sign a bill before the adjournment of Congress) were questioned, but the two returned measures failed to command the necessary two-thirds majority in order to override his vetoes.

The Polk administration was marked by large territorial gains. The annexation of Texas as a state was concluded and resulted in a two-year war with Mexico. As a consequence of that war the Southwest and far West (California), partly by conquest and partly by purchase, became part of the U.S. domain. During this period the northwestern boundary became fixed by treaty, and the continental United States emerged a recognized reality.

Additional achievements included a treaty with New Granada (Colombia) resolving the problem of right-of-way for U.S. citizens across the Isthmus of Panama; establishment of a warehouse system that provided for the temporary retention of undistributed imports; and the passage of the Walker Tariff Act of 1846, which lowered import duties and did much to pacify British public opinion that had been inflamed over the Oregon compromise of 1846 that established the international frontier at the 49th parallel. As these measures helped foreign trade, so the reenactment of the independent treasury system in 1846 helped in the solution of domestic financial problems.

The expansion of the country westward led to the creation of a new agency, the Department of the Interior. The Polk administration should also be credited with the establishment of the United States Naval Academy at Annapolis and the authorization of the Smithsonian Institution, a national foundation for all areas of science.

Assessment. Polk's influence over his Congresses may be gauged from the results of the recommendations of 4 annual messages and 10 significant special messages to one or both houses. His control of legislative policy in bitterly partisan Congresses must be judged in terms of results, not oratory or parliamentary delay. He recommended with a high degree of success settlement of a trade dispute with Great Britain, an increase in U.S. armed forces, war with Mexico, peace with Great Britain over Oregon, making available finances to expedite peace conclusions, organization of the Oregon Territory, peace with Mexico providing for limited conquest, and a revised treasury system. He refused information desired by Congress (on the ground that it was incompatible with the public interest), recognized a new French revolutionary government, and proclaimed the validity of the Monroe Doctrine. Succeeding presidents recognized these pronouncements.

A diary kept by Polk during his term of office stressed the presidential burden. Day after day, week after week, he recounted in his diary his experiences with the hosts of office seekers who infested Washington and who occupied so much of his public time. Again and again there is evident in his writings a note of despair. He knew from experience what an evil an unlimited executive patronage can become, but he felt powerless to change its obligations and too conscientious to avoid its duties. At the close of his term, March 4, 1849, Polk retired to his Nashville home, where he died three months later.

The office of chief executive under Polk was well filled—maintained with dignity, integrity, and an extraordinary sense of duty. His great influence over Congress was due to the justness of his policies and his persistence in having the members see questions not as interests of district or section but as matters of national welfare. His sturdy character and unblemished reputation gave weight to his counsels and strengthened his pleas. History may not rate him as one of the greatest U.S. presidents, but his successes in office made his influence considerable. (G.C.R.)

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Polk, Leonidas (b. April 10, 1806, Raleigh, N.C., U.S.—d. June 14, 1864, Pine Mountain, Ga.), U.S. bishop of the Protestant Episcopal Church, founder of the University of the South, and lieutenant general in the Confederate Army during the U.S. Civil War.

After two years at the University of North Carolina (1821–23), Polk entered the U.S. Military Academy at West Point, from which he was graduated in 1827. But during his final year there, Polk underwent a profound religious experience and resigned his commission at the end of 1827 to enter the Virginia Theological Seminary.

In 1830 Polk was ordained a deacon in the Protestant Episcopal Church, and in May 1831 he was advanced to the priesthood. He was appointed missionary bishop of the Southwest in 1838 and was made bishop of Louisiana in 1841. Polk attempted to combine his religious duties with life as a benevolent and paternalistic planter, since by marriage he acquired a large number of slaves. Polk also turned his energies toward creating an Episcopal university in the South, dedicated to training Southern aristocrats in their responsibilities toward blacks, who Polk anticipated would be gradually emancipated. In 1856 he began to raise funds and acquire land for the school, and on Oct. 9, 1860, he laid the cornerstone for the University of the South at Sewanee, Tenn.

With the coming of the Civil War, Polk, after some hesitation, accepted a commission as major general in the Confederate Army. Put in charge of defending the Mississippi River, Polk performed well despite his lack of practical military experience. On Nov. 7, 1861, he defeated Ulysses S. Grant's smaller force at Belmont, Mo., and he personally led four charges at Shiloh while in command of the Confederate right flank. In October 1862 he was promoted to lieutenant general. Polk sustained fatal wounds in fighting at Pine Mountain, Ga., in June 1864—four years before classes opened at the University of the South.

polka, lively courtship dance of Bohemian folk origin. It is characterized by three quick steps and a hop and is danced to music in $\frac{2}{4}$ time. The couples cover much space as they circle about the dance floor. Introduced in Paris in about 1843, it became extraordinarily

"The Original Polka," coloured lithograph by J. Brandard, 1844; Jules Perrot and Carlotta Grisi are the dancers
By courtesy of the Victoria and Albert Museum, London

popular in ballrooms and on the stage, sweeping across Europe and the Americas from Scandinavia to Latin America and developing many varieties. Still popular in the 20th century both as a folk dance and as a ballroom dance, polkas also appear in stage works—*e.g.*, in Jaromir Weinberger's opera *Schwanda the Bagpiper* and in Bedřich Smetana's opera *The Bartered Bride.*

poll tax, tax of a uniform amount levied on each individual, or "head."

Of the poll taxes in English history, the most famous was the one levied in 1380, a main cause of the peasant's revolt of 1381 led by Wat Tyler. In the United States, most discussion of the poll tax centred on its use as a voting prerequisite in the Southern states. The origin of the tax is associated with the agrarian unrest of the 1880s and 1890s, which culminated in the rise of the Populist Party in the West and the South. The Populists, a low-income farmers' party, gave the Democrats in these areas the only serious competition that they had experienced since the end of Reconstruction. The intensity of competition led both parties to bring blacks back into politics and to compete for their vote. Once the Populists had been defeated, the Democrats amended their state constitutions or drafted new ones to include various disfranchising devices. When payment of the poll tax was made a prerequisite to voting, impoverished blacks and often poor whites, unable to afford the tax, were denied the right to vote.

Poll taxes of varying stipulations lingered in Southern states into the 20th century. Some states abolished the tax in the years after World War I, while others retained it. Its use was declared unconstitutional in federal elections by the Twenty-fourth Amendment to the U.S. Constitution, effective in 1964. In 1966 the Supreme Court, going beyond the Twenty-fourth Amendment, ruled that under the "equal protection" clause of the Fourteenth Amendment, states could not levy a poll tax as a prerequisite for voting in state and local elections.

Pollaiuolo, Antonio del and Piero del, Pollaiuolo also spelled POLLAJUOLO, original names ANTONIO E PIERO DI JACOPO D'ANTONIO BENCI (respectively b. Jan. 17, 1432/33, Florence—d. Feb. 4, 1498, Rome; b. 1443, Florence—d. 1496, Rome), Italian brothers who, as sculptors, painters, engravers, and goldsmiths, produced myriad works together under a combined signature. The Pollaiuolo brothers had significant influence on the development of Florentine art, and their workshop is regarded as one of the most important in Florence during the late 15th century.

The brothers received the name of Pollaiuolo because their father was alleged to have been a poulterer (from *pollaio,* "hen coop"), though he was probably a goldsmith. Antonio learned goldsmithing and metalworking from either his father or Andrea del Castagno. Piero probably learned painting from Andrea del Castagno and became his brother's associate in goldsmithing, painting, sculpture, and engraving.

After 1460 the two collaborated consistently, and the individual contributions of each are frequently difficult to determine. Their Florentine commissions included the altarpiece in the Chapel of the Cardinal of Portugal in S. Miniato al Monte and the "Martyrdom of St. Sebastian" (1475) for the Pucci Chapel in the church of SS. Annunziata. In 1484 they went to Rome, where their works included the tomb of Pope Sixtus IV (1484–93) in the Vatican Grottoes of St. Peter's and, in the final years of their lives, the tomb of Pope Innocent VIII (1493–97), also in St. Peter's.

Antonio Pollaiuolo is recognized individually as a superb draftsman whose mastery of line is best exemplified in his renderings of the human figure in motion; he was among the first artists to practice anatomical dissection in the study of the human form. His contri-

"Hercules and Antaeus," bronze statuette by Antonio Pollaiuolo; in the Bargello, Florence
Alinari—Art Resource/EB Inc.

butions to landscape representation were also significant. Notable works include his engraving "Battle of the Nudes" (*c.* 1470) and the bronze statuette "Hercules and Antaeus" (*c.* 1475).

The individual works of Piero are regarded as less artistically significant than those of his brother. His principal works were his "Coronation of the Virgin," an altarpiece painted in 1483 (in the choir of the cathedral at San Gimignano); his "Three Saints," an altarpiece; and "Prudence" (both at the Uffizi Gallery).

Pollaiuolo, Simone del: *see* Cronaca, Il.

Pollard, A(lbert) F(rederick) (b. Dec. 16, 1869, Ryde, Isle of Wight, Hampshire, Eng.—d. Aug. 3, 1948, Milford-on-Sea, Hampshire), English historian who was the leading Tudor scholar of the early 20th century.

He was educated at Felsted School and at Jesus College, Oxford. In 1893 he was appointed to the editorial staff of the *Dictionary of National Biography,* to which he contributed about 500 entries, mainly on figures in the Tudor period. During that period, before the *Dictionary* was completed (through the first supplement), he completed two biographical volumes, *England Under Protector Somerset* (1900) and *Henry VIII* (1902).

Quitting the *Dictionary of National Biography* in 1901, he was elected to the chair of constitutional history at University College, London, in 1903; he held that position until his retirement in 1931. At the University of London he firmly established the history degree course and strove to promote postgraduate research. In 1906 he founded the Historical Association, which served teachers of history and which, from 1916, published the periodical *History.* The Institute of Historical Research, of which he was chairman (1921–31) and honorary director (1931–39), was largely his achievement.

Pollard's works on English history under the Tudor dynasty—including his volume *The History of England from the Accession of Edward VI to the Death of Elizabeth (1547–1603)* (1910) in "The Political History of England" series and his books on *Thomas Cranmer and the English Reformation* (1904), *The Elizabethans and the Empire* (1921), and *Wolsey* (1929)—were models of careful and enduring work. On more modern subjects he wrote *The Commonwealth at War* (1917), *A Short History of the Great War* (1920), and *Factors in American History* (1925). He also wrote *The Evolution of Parliament* (1920; 2nd ed. 1926).

Pollard, Marjorie (b. 1899, Peterborough, Northamptonshire, Eng.—d. March 21, 1982), field hockey player who became one of England's greatest players. She was also editor of *Hockey Field* magazine from 1946 to 1970.

Pollard competed in her first hockey match at school as a goalkeeper, but when her team was beaten 17–0, she opted to become a forward. She won her first cup for England in 1921 and, except for two short periods, played regularly for the national team until 1933.

Her goal-scoring feats were extraordinary, including eight goals that she scored against Germany in 1926 and 13 in the 20–0 defeat of Wales in 1928. Pollard spent most of her career with the Peterborough club before founding North Northants, for whom she played her last match in 1949. After her retirement Pollard became acting president of the All England Women's Hockey Association and a sports journalist.

pollarding, cutting of top tree branches back to the trunk, leaving club-headed stems that grow a thick head of new branches. The purpose in some areas is to limit the area of top growth or to create an annual harvest of boughs for basket weaving, securing thatch, and the like. In cities such as London it is done to prevent branches from tangling with overhead wires and from overhanging streets and to promote growth of a denser foliage.

pollen, a mass of microspores in a seed plant appearing usually as a fine dust. Each pollen grain is a minute body, of varying shape and structure, formed in the anther, or male apparatus, in seed-bearing plants and transported by various means (wind, water, insects, etc.) to the pistil, or female structure, where fertilization occurs. The pollen grain of flowering plants (angiosperms) consists of three distinct parts. The central cytoplasmic part is the source of nuclei responsible for fertilization. The other parts constituting the wall of the grain are an inner layer, the intine, and an outer layer, the exine. The intine consists, at least in part, of cellulose. The outer and most durable layer, the exine, is very resistant to disintegration; treatment with intense heat, strong acids, or strong bases has little effect upon it. The composition of the exine is uncertain; its constituents have been termed sporopollenins. The internal parts of the pollen grain are easily broken down, whereas the exine layer, and thus the general form of the pollen grain, is easily preserved in various kinds of sediments; the quality of preservation may vary with different environments.

Because of their remarkably symmetrical structure and surface patterns, pollen grains are readily recognizable under the microscope. The structure of the wall of a pollen grain is oftentimes so characteristic that in some cases species may be identified by pollen grains alone. On the other hand, there are cases in which pollen grains of very like structure occur in quite unrelated plant families.

Because of their high resistance to decay, their widespread dispersal by wind and water, and their abundant production by plants, pollen grains are very common constituents of geologic sediments, both recent and ancient. Because of these features pollen grains have provided much information on the origin and geologic history of terrestrial plant life.

Pollen is produced in such quantities that it is a significant component of the airborne constituents of the Earth's atmosphere, especially in areas over continents. The proteinaceous substance in many pollen grains (namely, ragweed and many grasses) induces an allergic reaction commonly known as hay fever (*q.v.*). Frequently local governmental authorities publish pollen counts, estimates of the concentration of pollen grains in the air, for the purpose of indicating the relative discomfort that may be experienced by sufferers from hay fever and similar allergies.

The study of pollen and spores is known as palynology (*q.v.*). *See also* pollination.

Consult the INDEX *first*

Pollen, Daniel (b. June 2, 1813, Dublin—d. May 18, 1896, New Zealand), Irish-born physician, prime minister of New Zealand (1875–76), and a public figure who combined business and politics with his profession and worked for such liberal causes as the enfranchisement of women and the rights of the Maori.

Pollen settled in New Zealand in the 1840s, purchased land, practiced medicine, and contributed articles to the *New Zealander* in support of such issues as temperance, libraries, and responsible government. Appointed to the Auckland superintendent's office (1852, 1854) and elected to the Provincial Council (1856, 1857–61), he accepted appointment as commissioner of crown lands for Auckland (1858–62) and began his life-long support of the Maori cause. Pollen served on the Legislative Council (1861–62, 1868–70), and in 1870, after attempting to resign in protest at the government's censure of his approval of a truce offer to a Maori guerrilla leader, he not only was agent for Auckland but also became receiver of land revenue, commissioner of confiscated lands, commissioner under the native land Act of 1870, and immigration officer.

Recalled by the government of Sir Julius Vogel to the Legislative Council, Pollen joined this ministry as colonial secretary until he formed his own ministry for a few months (1875–76). He remained a member of the "continuous ministry" of Vogel and Sir Harry Atkinson as colonial secretary and native minister (1876–77), and he served on the Legislative Council until his death.

Pollentia, modern POLLENZA, ancient town in the territory of the Statielli in Liguria, northern Italy, located 10 miles north of Augusta Bagiennorum (Vagienna) on the Tenarus (Tanaro) River. Its position on the road from Augusta Taurinorum (Turin) to Hasta (Asti) gave it military importance in ancient Roman times.

Decimus Brutus checked Mark Antony's retreat at Pollentia in 43 BC. The Roman general Stilicho on Easter Sunday, April 6, AD 402, fought a battle there with the Goths. Though it was indecisive, the leader of the Goths, Alaric, afterward withdrew them from Italy. Pollentia was noted for its pottery and its dark-coloured wool. Remains survive at the village of Pollenza.

pollex: *see* thumb.

pollination, the transfer of pollen grains in seed plants from the stamens, where they are formed, to the ovules or ovule-bearing organs. Pollination is a prerequisite for fertilization and the production of seeds.

A brief treatment of pollination follows. For full treatment, *see* MACROPAEDIA: Reproduction and Reproductive Systems.

In flowering plants the ovules are contained at the base of a hollow pistil, and the pollen is deposited on the pistil's surface, the stigma. There the pollen grains germinate and form pollen tubes that grow downward toward the ovules. Fertilization takes place as a sperm cell in a pollen tube fuses with the egg cell of an ovule, giving rise to the plant embryo. The ovule then grows and becomes a seed.

Since the pollen-bearing parts of the stamens are rarely in contact with the stigma, plants commonly rely on external agents for pollen transport. Insects and wind are the most important pollinators; other agents include birds and a few mammals. Water transport of pollen is rare. Very ancient flowering plants apparently developed odours and mechanical traps to attract and hold beetles, which would scatter stray grains after they fed on the pollen. More advanced species began to produce nectar, a concentrated sugar solution found in modern flowers, and developed patterns of colour as guides for insects to the presence of nectar. Insects acquired sucking mouthparts capable of feeding on the nectar.

Fertilization of an egg cell may take place by self-pollination, when the sperm cell derives from pollen produced by the same flower or by another flower on the same plant; or by cross-pollination, when the sperm comes from the pollen of a different plant. Cross-pollination, producing seeds that contain the hereditary traits of two parent plants, tends to result in a species that is sturdier and more adaptable to environmental changes.

Many plants have developed mechanisms that prevent self-pollination. Some species produce only male (staminate) flowers on some plants and only female (pistillate) flowers on other plants. Species with staminate and pistillate flowers on the same plant and those with flowers having both stamens and pistils often avoid self-pollination by shedding their pollen either before or after the stigmas on the same plant are receptive to it. Another preventive device is chemical self-incompatibility; the pollen either fails to grow on a stigma of the same plant or fails to produce pollen tubes that reach the ovules. Self-pollination is sometimes advantageous, however, and may take place when external pollinators are scarce, when plants are widely scattered, or when cross-pollination has not occurred at the end of a flower's life span. It is common among annual plants, which often produce an abundance of seed to ensure species survival.

The most important insect pollinators are the bees, which live on nectar and feed their larvae on pollen and honey, a modified nectar. Bees have long tongues that can reach the nectar; hairy bodies that pick up sticky pollen grains, facilitating their transport to another flower; and a sensitivity to colours and aromas that helps guide them to nectar-producing flowers. Bee flowers are brightly coloured, fragrant, and open in the daytime. Many have a broad lower lip on which the bee can land before pushing its way inside the flower.

Pollination by wind, although prevalent in the conifers and cycads, is less common in flowering plants. Plants that depend on wind pollination produce copious quantities of light, powdery pollen that can be blown a considerable distance; but even so, an individual stigma is likely to be hit by only one or two grains. To facilitate exposure to the wind, the flowers often bloom before the leaves come out in the spring, or they may grow high up on the tree or plant. Stigmas tend to be long and lobed to provide a large area for catching pollen grains, and plants of one species frequently grow in dense populations. Wind flowers are usually inconspicuous and devoid of the fragrance, colours, and nectar that attract insects.

Birds are important as pollinators, especially in tropical regions. Many species have adapted to feeding on nectar, pollen, or flower-inhabiting insects or spiders by developing slender beaks and brushlike or tubelike tongues. Birds rely on their powerful vision and colour sense in their quest for food, and bird-pollinated flowers often display vivid colours. They generally lack the fragrance of most insect flowers, are bigger and more sturdily built, and produce greater quantities of nectar. The stamens are usually numerous and protruding so that they touch the bird as it feeds. Some bird flowers provide a landing platform or a perch of twigs near the flower. A few species of small mammals, notably certain bats, also help to pollinate plants as they feed on the flowers.

Pollio, Gaius Asinius (b. 76 BC, Italy—d. AD 4, Tusculum, near Rome), Roman orator, poet, and historian who wrote a contemporary history that, although lost, provided much of the material for Appian and Plutarch.

Pollio moved in the literary circle of Catullus and entered public life in 56. In 54 he impeached unsuccessfully the tribune C. Cato, incurring Pompey's displeasure. In the Civil War he joined Caesar at the Rubicon and campaigned in Africa with Curio and (49–45) in Greece, Africa, and Spain with Caesar, for whom he held a praetorian command in Spain against Sextus Pompey (44). On Caesar's death he followed Antony, for whom he governed Cisalpine Gaul. There he was friendly with Virgil and in distributing land to veterans saved the poet's property from confiscation. He stood aloof in the Perusine War but held his army firmly in Antony's interests, and he shared in the negotiations leading to the pact of Brundisium between Antony and Octavian in 40. In that year he was consul, and Virgil addressed his Fourth Eclogue to him. In 39 Pollio subdued the Parthini, an Illyrian people. From the booty he built the first public library in Rome, in the Atrium Libertatis, which he restored. With full honours he then retired from public life. Unwilling to join Antony in the east, hoping for nothing from Octavian, he took no part in the Actium campaign (31) and subsequently maintained a position of republican dignity and independence. He gave hospitality to the rhetorician Timagenes, when the latter was in disgrace with Augustus. This was the main period of his activity as an advocate, and he devoted himself to the support of literature, organizing public recitations.

Pollio was a distinguished orator, combining, according to Tacitus and Seneca, careful composition and dry Atticist elegance in strict presentation of his argument. His style displeased Ciceronian critics, and his speeches are lost. As a poet he was accepted by Catullus, Helvius Cinna, and Virgil. He also wrote tragedies, which Virgil and Horace praised, but he ceased to write serious verse when he turned to history shortly after 35. His *Historiae* (*History of the Civil Wars*) covered the period from 60 probably to 42; that is, from the First Triumvirate to Philippi—the period in which the Roman republic fell. A stern critic of men and style, he corrected Caesar, attacked Cicero, and praised Brutus; he reprimanded Sallust for archaism and Livy for a quality of provincialism that Pollio termed *Patavinitas*. Above all, he defended Roman *libertas* under the *principatus* of Augustus.

Pollio, Marcus Vitruvius: *see* Vitruvius.

Pollitt, Harry (b. Nov. 22, 1890, Droylsden, Lancashire, Eng.—d. June 27, 1960, at sea en route from Australia to England), British Communist, general secretary (1929–39, 1941–56) and chairman (1956–60) of the Communist Party of Great Britain (CPGB).

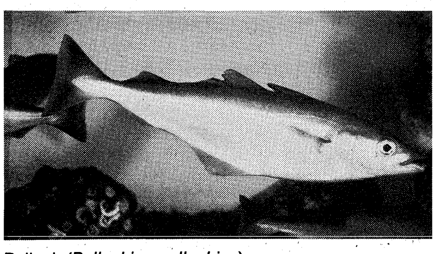
Pollitt's father was a factory worker and trade unionist and his mother a weaver in a textile manufacturing village. At age 13 (1903) he left school to work in the local textile mill and eventually became a boilermaker and a leader in the boilermakers union. He helped found the CPGB in 1920 and went to Moscow in 1921 to attend a congress of the Third International, where he met Lenin. In 1925 he was sentenced to a year's imprisonment for seditious libel and incitement to mutiny. (In 1934 he was acquitted in another sedition trial.) In 1929 he became head of his party as general secretary.

Pollitt enthusiastically supported Britain's declaration of war against Germany on Sept. 3, 1939; but when Russia invaded Poland two weeks later, the official Moscow line changed, and Pollitt was caught in an embarrassing contradiction. He was removed from the secretaryship. Following the outbreak of war between Germany and the Soviet Union in June 1941, however, Pollitt was returned to leadership of the party.

He was caught again in a contretemps in 1956, when, while he was praising Stalin, the secret 20th Party Congress in Moscow was condemning the former Soviet leader. Pollitt was again set aside, this time given the nominal post of chairman of the British Communist Party. His autobiography, *Serving My Time*, appeared in 1940.

polliwog: *see* tadpole.

pollock (*Pollachius*, or *Gadus, virens*), North Atlantic fish of the cod family, Gadidae, known as saithe, or coalfish, in Europe. The pollock is an elongated fish, deep green with a



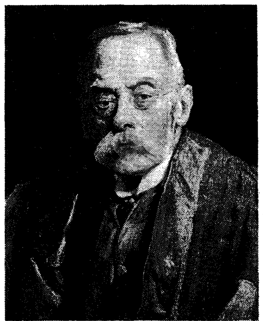
Pollock (*Pollachius pollachius*)
Ingmar Holmasen

pale lateral line and a pale belly. It has a small chin barbel and, like the cod, has three dorsal and two anal fins. A carnivorous, lively, usually schooling fish, it grows to about 1.1 metres (3½ feet) in length and 16 kilograms (35 pounds) in weight. It is caught commercially for food and also affords sport for anglers.

The pollock classified as either *Gadus* or *Pollachius pollachius* is a related species of no commercial value found inshore in European waters.

Pollock, Sir Frederick, 3RD BARONET (b. Dec. 10, 1845, London—d. Jan. 18, 1937, London), English legal scholar, noted for his *History of English Law Before the Time of Edward I* (with F.W. Maitland, 2 vol., 1895) and for his correspondence over 60 years with U.S. Supreme Court Justice Oliver Wendell Holmes.

Pollock was called to the bar in 1871, taught jurisprudence at Oxford (1883–1903), succeeded his father in the baronetcy in 1888,



Sir Frederick Pollock, portrait by R.G. Eves; in the National Portrait Gallery, London
By courtesy of the National Portrait Gallery, London

and was made a king's counsel in 1920. He was a founder and the first editor (1885–1919) of the *Law Quarterly Review* and also edited the *Law Reports* (1895–1935). Three of Pollock's textbooks remained in use for many years: *Principles of Contract* (1876), *Digest of the Law of Partnership* (1877), and *The Law of Torts* (1887). The *Holmes-Pollock Letters*, edited by Mark De Wolfe Howe, were published in 1941.

Pollock's son, Frederick John Pollock (1878–1963), a noted historian, succeeded to the baronetcy.

Pollock, (Paul) Jackson (b. Jan. 28, 1912, Cody, Wyo., U.S.—d. Aug. 11, 1956, East Hampton, N.Y.), American painter, one of the leading exponents of a loose movement called Abstract Expressionism, particularly the form known in the United States as Action Painting (or *tachisme* in France). After considerable stylistic experimentation, he developed about 1947 the radical "drip painting" technique that became his hallmark.

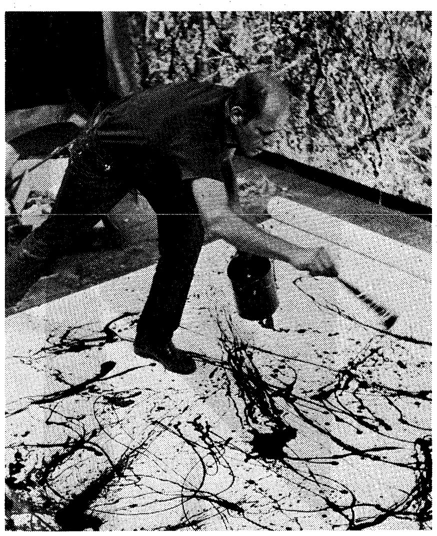
Pollock's family left Cody, Wyo., 11 months after his birth, and he grew up in California and Arizona. In Los Angeles in the late 1920s he was taught and influenced by Frederick John de St. Vrain Schwankovsky, a painter and illustrator who was also a member of the Theosophical Society, a mystical religious sect. Pollock was also drawn to an exploration of unconscious imagery espoused by adherents of Surrealism.

In the fall of 1930 Pollock followed a brother to New York City, where he enrolled at the Art Students League under his brother's teacher, the regionalist painter Thomas Hart Benton. In the fall of 1935 he came to be employed on the WPA Federal Art Project as an easel painter. This provided economic security during the years of the Great Depression and the opportunity to develop his art through early 1943. In 1937 he began psychiatric treatment for alcoholism, and he briefly suffered a nervous breakdown in 1938. In 1943, after the liquidation of the Federal Art Project, he was given a contract by Peggy Guggenheim at her Art of This Century Gallery in New York City, and his first one-man show was held there in November. Thereafter he had one-man shows of new work nearly every year. In 1945 he married the painter Lee Krasner and moved to East Hampton, Long Island, N.Y., where he lived until his death in an automobile accident.

Pollock's artistic development went through a number of evolutions. From his years with Benton to 1938, his work was strongly influenced by the methods and subject matter of his teacher and consisted mostly of small landscapes and figurative scenes such as "Going West." After his breakdown and hospitalization in 1938 until the time of his first one-man show in 1943, his work was semi-abstract and shows the assimilation of motifs from the modern Spanish artists Pablo Picasso and Joan Miró as well as the Mexican muralist José Clemente Orozco. Jungian symbolism and Surrealist theory also influenced the works of this period. Paintings such as "Bird," "Male and Female," and "Guardians of the Secret" reflect these influences in their powerful and seething imagery.

Late in 1943 or early in 1944, Pollock painted his first wall-size work, called "Mural." This painting is his breakthrough into a totally personal style in which Benton's compositional methods and energetic linear invention are fused with Surrealist free-association of motifs or unconscious imagery. His evolution from this point through the 1940s shows a struggle to find a process by which he could translate his entire personality into painting. In 1947 he first used the process of pouring or dripping enamel or aluminum paint onto a flat canvas in stages, often taking weeks of alternating periods of painting and contemplating to finish a canvas. The results were huge areas covered with complex and dynamic linear patterns. A whole series of paintings—beginning with "Full Fathom Five" and proceeding through "Summertime" and "Number Ten, 1949" to the mural-size canvases of 1950 such as "One," "Autumn Rhythm," "Lavender Mist," and the black and white "Number Thirty-two, 1950"—display the infinite variety of effect and expression that this method—poured painting—permitted him. In 1951 and 1952 he painted almost exclusively in black and white. In 1952 he returned to colour and mural-scale in "Convergence" and "Blue Poles." In 1953 he created his last series of major works. "Portrait and a Dream," "Easter and the Totem," "Ocean Greyness," and "The Deep," among other works, recapitulate many aspects of his former styles and images. Though his production waned and his health deteriorated after 1953, Pollock did produce important paintings such as "White Light" and "Scent" in his last years.

From the early 1940s on, Pollock created numerous works on paper, ranging from drawings to mixed-media paintings that parallel the development of his work on canvas. He created few prints, however, and only experimental sculpture.



Pollock painting in his studio on Long Island, New York, 1950
Hans Namuth

His critical reception ranged from the favourable art criticism of Clement Greenberg in *The Nation* during the 1940s to *Time* magazine's reference to him as "Jack the Dripper" a few months before his death in 1956. Despite occasional attempts in the art press to treat his work seriously, his name became synonymous with extreme artistic caprice, since the novelty of his "drip" technique overshadowed his obsession with the personal expression which that technique may have permitted. Ironically, he did not profit financially from his fame. He never sold a painting for more than $10,000 in his life and often was hard-pressed for cash.

BIBLIOGRAPHY. The definitive biography to date, along with all known statements by the artist, a detailed history of his exhibitions and their critical reception, and a comprehensive bibliography, is Francis V. O'Connor, *Jackson Pollock* (1967). Interpretative monographs have been written by Frank O'Hara, *Jackson Pollock* (1959); Bryan Robertson, *Jackson Pollock* (1960); Italo Tomassoni, *Pollock* (1968; Eng. trans. 1969); and Alberto Busignani, *Pollock* (1979).

Pollock v. Farmers' Loan and Trust Company (1895), U.S. Supreme Court case in which the court voided portions of the Wilson–Gorman Tariff Act of 1894 that imposed a direct tax on the incomes of U.S. citizens and corporations, thus declaring the federal income tax unconstitutional. The decision was mooted (unsettled) in 1913 by ratification of the Sixteenth Amendment to the federal Constitution, giving Congress the power "to lay and collect taxes on incomes."

The 1894 act provided (for a five-year term) that "gains, profits and incomes" in excess of $4,000 would be taxed at 2 percent. In compliance with the Tariff Act, the Farmers' Loan and Trust Company, a New York financial institution with vast holdings, announced to its shareholders that it intended to pay the tax and also to provide the U.S. collector of internal revenue a list of all persons for whom the company was acting in a fiduciary capacity who were liable for tax under the act.

Charles Pollock, a citizen of Massachusetts who owned 10 shares of the company's stock, filed a lawsuit seeking to enjoin the company from carrying out its stated intention to comply with the act. He lost in the lower courts, but the Supreme Court ruled in his favour. It declared that a direct income tax was a breach of the constitutional provision requiring that direct taxes be apportioned among the states according to population.

A highly unpopular decision, *Pollock* v. *Farmers' Loan and Trust Company* spurred the Democratic Party to include an income tax plank in its 1896 platform and to charge the court with "judicial usurpation." Farmers and workers saw the decision as one designed to protect wealthy individuals and corporations from paying their fair share of the cost of government. Sen. Norris Brown of Nebraska declared that the Supreme Court was wrong in its interpretation of the Constitution and proposed the explicit language permitting an income tax that was incorporated into the Sixteenth Amendment. He said it was imperative that Congress "give the court a Constitution that cannot be interpreted in two ways." The Senate and House of Representatives approved the amendment in 1909, and it was ratified in 1913.

pollution, the addition to the environment of any substance or energy form (*e.g.,* heat, sound) at a rate that results in higher than natural concentrations of that substance or energy form.

A brief treatment of pollution follows. For full treatment, *see* MACROPAEDIA: Conservation of Natural Resources.

Pollutants commonly are classified according to the part of the environment primarily affected by them; either the air, water, or land. Subgroupings depend on characteristics of the pollutants themselves: chemical, physical, thermal, and others. Many pollutants affect more than one resource.

Some pollutants, such as noise, produce only local and short-lived effects. Others, such as smelter slag, affect limited areas but may persist for many years. Some substances, such as radioactive dusts and certain pesticides (*e.g.,* DDT), can be relatively long lasting and can disperse readily to the point that they become virtually worldwide in distribution. Such pollutants, which include many chlorinated hydrocarbon insecticides and several toxic mercury compounds, may enter biological food chains by becoming concentrated in the bodies of microorganisms (algae and protozoans) and move upward as successively larger organisms prey upon smaller ones. The concentration of the pollutant may increase 100-fold at each stage of the chain, so that the predator at the top of the chain is the organism most seriously affected.

The control of pollution has provided many of the most difficult economic, legislative, and administrative questions of the 20th century. Many serious pollutants are closely and fundamentally bound to vital agricultural or industrial systems or products. Abatement of a given pollutant may involve the total redesign of an industry or its product.

pollution and purification, in Hinduism, twin concepts central to the ritual and social order. The notions of pollution and purification are based on Hindu beliefs that each caste group can maintain its status by regulating its contact with lower caste groups (that is, by avoiding their "polluting" effects) and by regulating its contact with objects thought to be inherently impure.

Important delimiters of caste pollution include: (1) occupational association with the destruction of cows (considered sacred), typified by some leatherworkers and shoemakers; (2) occupational destruction of living things, typified by slaughterers; (3) occupational association with death and decay, typified by funeral officiators and scavengers; (4) occupational association with human emissions, typified by barbers, washermen, midwives, and lavatory attendants. The participants in such occupations are deemed polluted in varying degrees, and physical contact with either their persons or their bodily emissions—*i.e.,* external pollution—is thought to be contaminating.

The notion of pollution by physical contact also includes the conception that a person is vulnerable to internal pollution (as by ingesting impure foodstuffs). While external pollution can be washed off with water, internal pollution requires another means of purification, normally imposed by tradition but on occasion by decision of the caste assembly (sabha).

Because castes are normally endogamous and commensal (*i.e.,* members intermarry and dine together), a polluted individual could, by association, pollute other caste members. Purification rites could include a fine or penalty paid by giving a feast for caste members or Brahmans. A common purification rite is the consumption of a cleansing agent the constituents of which include cow's milk, butter, curds, dung, and urine.

A woman's sexual alliance with a lower ranking male (*anuloma,* or hypergamous, marriage) would normally mean excommunication from the caste. *Pratiloma,* or hypogamous, marriage (an alliance between a male and a lower ranking female) also carries with it a lowering of social rank, but not to the same degree as *anuloma* marriage.

Pollution is therefore a relative term describing the degree to which a caste allows practices that a ritually and socially superior caste group does not permit its members. There is a code of prescriptions, ultimately based on the texts of the traditional Hindu code (dharmashastra), which lays down, in theory at least, the proper standards of conduct for a pure group.

In fact, there are many regional and sectarian differences. Each caste maintains its own standards, infractions of which are adjudicated and punished by the caste itself. An upwardly mobile caste may aim for a higher degree of purity and eventually higher social rank by abstaining from earlier polluting practices, typically by restricting the groups with which it allows intermarriage and commensality or by increasing its observance of vegetarianism.

In all, the concepts of pollution and purity have reinforced the hierarchical nature of the Hindu caste system. At the top are the Vedic Brahmans (those families continuing the practice of Vedic study and ritual); at the bottom are the "untouchables," whose very shadows were once thought to pollute a superior group. This extremism is receding, and untouchability is in fact officially outlawed (*see* untouchable). Other factors in lessening the abuses of caste discrimination are movement from the villages to the cities, increased literacy and education, and new occupational opportunities. Nonetheless, caste, as the basic means of distinguishing between social groups, persists.

Pollux (Roman deity): *see* Dioscuri.

Pollux, also called BETA GEMINORUM, brightest star in the zodiacal constellation Gemini (*q.v.*). A reddish giant star, it has an apparent visual magnitude of 1.15. The stars Castor and Pollux are named for the mythological twins. Pollux is about 40 light-years from the Earth.

Pollux, Julius (fl. last half of the 2nd century AD), Greek scholar and rhetorician from Naukratis, Egypt. The emperor Commodus appointed him to a chair of rhetoric in Athens. He is author of an *Onomasticon,* a Greek thesaurus of terms. The 10-volume work, which has survived incomplete, contains rhetorical material and technical terms relating to a wide variety of subjects, as well as citations from literature. It is especially interesting in discussion of music and the theatre.

polo, game played on horseback between two teams of four players each who use mallets with long flexible handles to drive a wooden ball down a grass field and between two goal posts. It is the oldest of equestrian sports.

History. A game of Central Asian origin, polo was first played in Persia (Iran) at dates given from the 6th century BC to the 1st century AD. Polo was at first a training game for cavalry units, usually the king's guard or other elite troops. To the warlike tribesmen, who played it with as many as 100 to a side, it was a miniature battle.

In time polo became a Persian national sport played extensively by the nobility. Women as well as men played the game, as indicated by references to the Queen and her ladies engaging King Khosrow II Parvīz and his courtiers in the 6th century AD.

From Persia the game spread to Arabia, then to Tibet (the English word polo is the Balti word meaning "ball"), to China, and to Japan. In China (910) the death of a favoured relative in a game prompted Emperor A-pao-chi to order the beheading of all surviving players.

Polo was introduced into India by the Muslim conquerors in the 13th century; but, although the game had been described in Sir Anthony Sherley's *Travels to Persia* (1613), the first Europeans to play the game were British tea planters in Assam, who formed the first European polo club in 1859 at Silchar. The Calcutta Polo Club was formed in the early 1860s. Polo spread rapidly after a captain in the 10th Hussars stationed in India saw a match early in 1866 and immediately formed a team from among his fellow offi-

Persian princes playing polo, miniature from an illuminated manuscript, 1472; in the British Library
Reproduced by permission of the British Library

cers. Before the year ended, informal matches were held between British cavalry units stationed in India. In 1870 a challenge round was held between the 10th Hussars and the 9th Lancers in England. At this time there were eight men to a side and almost no rules. Polo grew rapidly in England, with matches at Richmond Park and Hurlingham attracting more than 10,000 spectators by 1875. After it had been introduced by the military, the sport of polo remained popular with them but also spread to the universities and was popular with the nobility and royalty.

In 1876, the sportsman and newspaper publisher James Gordon Bennett saw his first polo game and introduced it in the United States. Later that year informal games were being played in New York City and by 1877 at Jerome Park racetrack in Westchester County, N.Y., where the Westchester Polo Club was founded the same year. In 1881 the Meadow Brook Club was formed in Long Island, N.Y., by such early outstanding players as Thomas Hitchcock, Sr., August Belmont, and Benjamin Nicoll. The size of the team was reduced to five and then, in 1881 in the United States and in 1883 in England, to four, the present number. Though the rules devised by the Hurlingham Club of England (founded 1886) were at first used in the United States, in 1888 a system of handicapping players (see below) was devised to equalize tournament play. The Polo Association (later the United States Polo Association) was founded in 1890 and standardized the rules. Polo spread throughout the country, though the game long remained one for the rich because of the expense of acquiring and maintaining a stable of polo ponies. Outside the United States, the governing body is the Hurlingham Polo Association, which maintains relations with many national bodies.

International competition. The first international competition took place in 1886 when the United States unsuccessfully challenged the English, then the undisputed world leaders in polo, for the Westchester Cup. England defended the Cup successfully in 1902, but the United States won in 1909. The Cup was contested nine additional times (the last in 1939), with the Americans winning each time except in 1914. The next international meeting was in 1971, when the United States defeated England for the first Coronation Cup, a single-game rather than a three-game match, thereafter held annually.

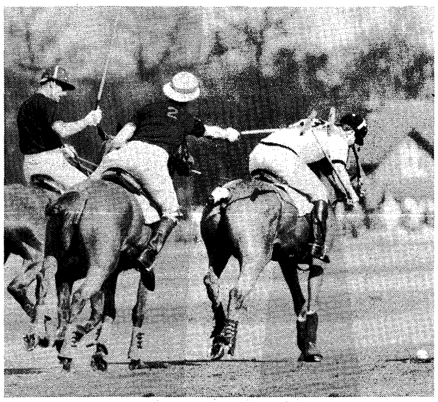
After 1909 the style of the game changed from the relatively slow English form of play characterized by short, controlled hitting. American polo players used a long-hitting, fast-moving, wide-open style that revolutionized the sport. The rules of the two countries were eventually assimilated, the United States adopting the English rule permitting a player to hook an opponent's stick with his mallet, while the English abandoned their offside rule that forbade players preceding the ball.

From 1909 to 1950 the United States was supreme in polo. Through the 1920s and 1930s polo became increasingly popular in Argentina, and in 1928 the first Copa de las Americas (Cup of the Americas) was contested between the United States and Argentina. Since then Argentina has become the uncontested master of international polo. Polo became the Argentine national game, and crowds exceeded 60,000. International matches commercially sponsored (mainly at Boca Raton, Fla.) were held in the 1970s, and European championships were inaugurated in 1980.

Although in the 20th century it is far from common, British and American women also play polo. In the United States, women compete against women on the collegiate level, and there is a women's National Handicap competition. Occasionally a woman also acts as the fourth member of an otherwise all-male team.

The game. Polo is played on an outdoor grass field 300 yards (274.3 metres) long by 160 yd wide. Centred at each end are lightweight goal posts 8 yd apart. A score is made by hitting the ball between the goal posts. Play begins with the two teams of four lined up facing each other in the centre of the field. One of the umpires (there are two mounted umpires on the field and a referee on the sidelines) bowls the ball between the teams. Then, with passes to teammates, speed, and maneuvering, each team tries to score as the opponents try to prevent a score. A game consists of six periods of 7½ minutes each, called chukkers, chukkars, or chukkas. Eight chukkers are played in Argentina, and four is a common number in England and on the Continent.

The players. Each player is assigned a position with certain responsibilities, but the positions are numbered, not named. The basic duties of the players are as follows: Number One is usually the novice or weakest player



Centre player trying to prevent a shot by hooking his stick under the stick of the player at right
UPI/EB Inc.

on the team, though the position is one of the most difficult to play. Number One needs anticipation, determination, and self-control, being theoretically responsible for scoring goals and neutralizing the opposing Number Four (defensive player). Number Two is the "hustler" or "scrambler," always scrapping for the ball. He needs extremely maneuverable, fast ponies, a keen eye, and an optimistic, aggressive nature. Number Three, who plays quarterback, is a kind of pivot man. He must be a long, powerful hitter and is the tactical leader. He must feed balls up to Number One and Number Two, but he must also help maintain a solid defense. Number Three is usually the best player on the team. Number Four is primarily a defensive player, who, though he may move anywhere on the field, mainly functions to prevent scoring.

Polo ponies. Restrictions on size having been removed after World War I, the term pony is purely traditional. The mount is a full-sized horse and should have docility, speed, endurance, and intelligence. The pony is judged to be 60 to 75 percent of a player's ability. At first only Thoroughbreds were used, but horses of mixed breeding are now common. Most of the best ponies are bred in Argentina or in Southwestern or Rocky Mountain ranches in the United States, where they are broken early and are worked as cow ponies. A training period beginning at about age five lasts from six months to two years. Ponies reach their peak at about age 9 or 10 but, barring accidents, may play until age 18 or 20.

Handicaps. Each player is rated from 0 to 10 according to his ability in competition. Minus ratings such as −1 and −2 are also used. Rating is based on horsemanship, hitting ability, knowledge of the game, quality of horses, and sportsmanship. The number of 10-goal players has not increased, though the total number of players has. Argentine dominance is reflected in a virtual monopoly of active 10-goal players.

Equipment. Each player wears a protective helmet, riding boots to just below the knees, and a coloured shirt bearing the number of his position. He may also wear knee pads and spurs (not sharp) and carry a whip. The ball for outdoor polo is made of bamboo or willow root about 3¼ inches (8.3 centimetres) in diameter and weighing about 4 ounces (113.4 grams). The mallet has a rubber-wrapped grip with a webbed thong for wrapping around the hand and a flexible bamboo-cane shaft with a bamboo head 9½ in. in length, the whole weighing about 7 oz and varying from 48 to 53 in., depending on pony size and length of a player's arm. The ball is struck with the side of the mallet, not the end.

Saddles are English-style with deep seats like jumping saddles. The pony's front legs are bandaged from just below the knee to the ankle to prevent injury, and the pony's mane is clipped and its tail braided to prevent interference with the mallet swing.

Indoor, or arena, polo. The indoor game was introduced in the United States and is played predominantly there, thus allowing polo in winter. The field is 100 yd long and 50 yd wide, with wooden boards 4–4½ ft (1.2–1.4 m) high to keep the ball in play. The ball is inflatable leather, 4½ in. in diameter and weighing at least 6 oz. A team has three players instead of four as in the outdoor game. Except for some minor rule changes, the indoor game is basically the same as the outdoor. (R.C.L./Ed.)

Polo, Marco (b. *c.* 1254, Venice, or Curzola, Venetian Dalmatia—d. Jan. 8, 1324, Venice), Venetian merchant, adventurer, and outstanding traveler, who journeyed from Europe to Asia in 1271–95, remaining in China for 17 of those years, and whose *Il milione* ("The Million"), known in English as the *Travels of Marco Polo,* became a geographical classic.

Travels of the Polo family. Marco found his way paved by the pioneering efforts of his ancestors and especially of his father, Niccolò, and his uncle Maffeo. The family had traded with the Middle East for a long time, apparently reaching a position of considerable wealth and prestige. Although it is not quite clear if the family was actually of the nobility, the point lost much of its typically medieval relevance in a city of republican and mercantile traditions such as Venice.

The Polos appear to have been shrewd, alert, and courageous; in about 1260 they foresaw a political change in Constantinople, liquidated their property there, invested it in jewels, and set off for the Volga River, where Berke Khan, sovereign of the western territories in the Mongol Empire, held court at Sarai or Bulgar, according to the season. The Polos seem to have managed their affairs well at this provincial Mongol court, doubling their assets. When political events prevented their return to Venice, they travelled eastward to Bokhara, eventually ending their journey four years later (1265) at the capital of the Mongol Empire, probably the summer residence of the Grand Khan—called Shang-tu (the Xanadu of the English poet Samuel Taylor Coleridge).

Marco Polo, title page of the first printed edition of *The Travels of Marco Polo,* 1477
By courtesy of the Columbia University Libraries, New York

Establishing friendly relations with the great Kublai Khan himself, they were eventually sent back to Europe as Kublai's ambassadors to the Pope, carrying letters asking the Pope to send Kublai one hundred intelligent men "acquainted with the Seven Arts"; they also bore gifts and were asked to bring back some oil from the lamp burning at the Holy Sepulchre in Jerusalem.

Marco himself had meanwhile been born in or around 1254. (This date, like nearly all the others concerning major events in his life, is conjectural.) Nothing is known of his early years in Venice, although it seems fairly certain that he learned little or no Latin. He was a lad of 15 or 16 when he first met his father, on the latter's return from the East in 1269.

Marco's journey to Asia. When Niccolò and Maffeo returned, they found that the Pope (Clement IV) had recently died. They waited patiently in Venice for a new pontiff to be elected, but after two years a successor had not yet been chosen. Becoming restive, the Polos started off on their journey, taking the young Marco with them (1271). In Palestine the papal legate, Teobaldo of Piacenza, gave them letters for the Mongol emperor; the Polos had been only a few days on the road when they heard that their friend Teobaldo had been elected pope (Gregory X). They went back to Acre, where they were given proper credentials and the company of two friars. The small expedition departed once more; the two friars, however, soon lost heart, and the Polos continued alone.

From Acre the travellers proceeded to Ayas ("Laiazzo" in Marco's writings, now Yumurtalik, on the Gulf of İskenderun, also called Gulf of Alexandretta, in southeastern Turkey). During the early part of 1272 they probably passed through Erzurum, in what is now eastern Turkey, and Tabriz, in what is now northern Iran, later crossing inhospitable deserts infested with brigands, before reaching Hormuz on the Persian Gulf. There the Polos decided not to risk a sea passage to India and beyond but to proceed overland to the Mongol capital.

Soon they were on the road again, travelling through deserts of "surpassing aridity" toward the Khorasan region in what is now eastern Iran. Turning gradually to the northeast they reached more hospitable lands; Badakhshān ("Balascian"), in Afghanistan, in particular, pleased the travellers. Marco seems to suggest that they remained here for a year; long illness (possibly malaria) was cured by the benign climate of the district. It has also been supposed that Marco, during this period, visited territories to the south (other parts of Afghanistan, Kafiristan in the Hindu Kush, Chitral in what is now Pakistan, and perhaps Kashmir); it is, however, difficult to establish which districts he traversed and which he may be describing from information gathered en route.

Leaving Badakhshān, the Polos proceeded up the Vākhān ("Vocan") valleys toward the Pamirs, which were eventually crossed by an itinerary that has long been a subject of discussion and conjecture. Descending on the northeastern side of the chain, they reached Kashgar ("Cascar") in what is now the Sinkiang Uighur Autonomous Region of China. By now the Polos were on the main Silk Road, and their advance can be followed along the oases to the south and east of the Takla Makan Desert—Yarkand ("Yarcan"), Khotan ("Cotan"), Charchan ("Ciarcian"), and Lop Nor (Lop Lake)—stepping-stones on the way to Sha-chou ("Saciu") on the borders of China, a place now called Tun-huang (Kansu province).

Before reaching Sha-chou, the Polos had travelled primarily among Muslim peoples—also encountering sprinklings of Nestorian Christians, Buddhists, Manichaeans, and Zoroastrians; now, however, they entered the vast province of Kansu (called "Tangut" by Marco), where an entirely different civilization, mainly Buddhist in religion but partly Chinese in culture, prevailed. Their itinerary most probably took the travellers to Su-chou ("Sukchu") and Kan-chou ("Campiciu") before entering the Ning-hsia area. It is not clear whether the Venetians reached the Mongol summer capital of Shang-tu ("Ciandu") directly or after a detour; at all events, some time in 1275 (1274, according to recent researches by a Japanese scholar, M. Otagi), the Polos were again at the Mongol court, presenting the sacred oil from Jerusalem and the papal letters to their patron, Kublai Khan.

Marco's sojourn in China. For the next 16 or 17 years the Polos lived in the Emperor's dominions—which included, among other countries, Cathay (now North China) and Mangi, or "Manzi" (now South China). Possibly they moved with the court from the summer residence, Shang-tu, to the winter one, Ta-tu or "Taidu"—modern Peking.

Unfortunately Marco's book *Il milione* is only incidentally a biography and autobiography; it is therefore exceedingly difficult to ascertain where the Polos went and what they did during these years. It is well known that many foreigners were in the employ of the Mongol state, since Chinese were mistrusted; it was therefore natural for the Polos to fit in most honourably and successfully with this motley society.

But precisely how successfully? In what specific capacities did they make themselves useful? These and similar points have been discussed for centuries without definite conclusions being reached. The elder Polos were probably employed in some technical role. Once and very abruptly, a glimpse is obtained of them acting as military advisers during the siege of "Saianfu" (historically and presently Hsiang-yang), a city that was finally taken, says Marco, thanks to some "great mangonels" (missile-throwing engines) built according to their specifications. The whole episode is, however, dubious.

Marco himself reached Cathay very young (at the age of 20 or so). Although he knew little or no Chinese, he spoke some of the many languages then used in East Asia—most probably Turkish (in its Coman dialect) as spoken among the Mongols, Arabized Persian, perhaps Mongol, and Uigur Turkish. Marco was noticed very favourably by Kublai Khan, who took great delight in hearing of strange countries; the Emperor repeatedly sent him on fact-finding missions to distant parts of the empire. One such journey took Marco to southwestern China, to Yunnan, and perhaps as far as Tagaung in Burma; on another occasion he visited southeastern China, later giving an enthusiastic description of the city of "Quinsay" (now Hang-chou) and of the populous regions recently conquered by the Mongols. There is ample evidence that Marco considered himself an adoptive son of his new country.

Marco's reticence concerning personal matters has left a void that has been eagerly filled in by romantic hero-worshippers, who see him as a brilliant young courtier enamouring princesses and governing provinces: indeed, a Marco Polo myth has been current for centuries and has often provided a theme for novelists, filmmakers, or dramatists. On the other hand, more sober critics point out that contemporary Chinese records show no trace of Marco. (But under what name was he known: who would recognize the 16th- and 17th-century Italian missionary Matteo Ricci under Li Matou or the 18th-century painter Giuseppe Castiglione under Lang Shih-ning?) They also observe that his reports sound more like echoes of bazaar gossip than gleanings from inner councils. The truth probably lies somewhere in between. Apart from the missions he undertook for the Emperor, Marco's evident competence in matters pertaining to salt and the administration of its monopoly suggest that he may have held some responsibility in this branch of government. According to some texts of *Il milione,* Marco governed the city of Yang-chou (in Kansu) for three years, sometime between 1282 and 1287; but this seems hardly credible and hinges entirely on the reading of one word.

The return to Venice. Some time around 1292 (1290 according to Otagi), a Mongol princess was to be sent by sea to Persia, there to become the consort of Arghun Khan, and the Polos offered to accompany her. It seems that Kublai Khan was unwilling to let them go but finally granted permission. Kublai Khan was then nearing his 80th year, and his death (and the consequent change in regime) might well have been dangerous for a small group of isolated foreigners. They also, naturally, longed to see once more their native Venice and their families.

The Princess, with some 600 courtiers and sailors, and the Polos boarded a fleet of 14 ships, which left the port of Ch'uan-chou ("Zaiton") and sailed southward. The fleet touched Champa ("Ciamba," modern Vietnam), as well as a number of islands and the Malay Peninsula. On the island of Sumatra ("Lesser Giaua") a stop of five months was made to avoid monsoon storms. There, Marco was much impressed by the fact that the North Star appeared to have dipped below the horizon. The fleet then passed near the Nicobar Islands ("Necuveran"), touching land again in Ceylon ("Seilan"). The Chinese ships subsequently followed the west coast of India and the southern reaches of Persia, finally anchoring at Hormuz. The expedition then proceeded to Khorasan, handing over the Princess not to Arghun, who had died, but to his son Maḥmūd Ghāzān.

The Polos eventually departed for Europe, but their movements at this point are not clear; possibly they stayed for a few months in Tabriz. Unfortunately, as soon as they left the Mongol dominions and set foot in a Christian country, at Trebizond in what is now Turkey, they were robbed of most of their hard-won earnings. After further delays, they reached Constantinople and finally Venice (1295). The story of their dramatic recognition by relatives and neighbours, who had thought them long since dead, is a part of Polo lore that is universally known.

Compilation of Il milione. Soon after his return to Venice, Marco was taken prisoner by the Genoese—great rivals of the Venetians at sea—during a skirmish or battle in the Mediterranean; Marco was then sent to Genoa and locked in one of the local prisons. There a most felicitous encounter occurred. The Venetian traveller met a prisoner from Pisa, who had possibly lost his liberty some 10 years earlier at the Battle of Meloria—one Rustichello (or Rusticiano), a fairly well-known writer of romances and a specialist in chivalry and its lore, then a fashionable subject. Marco may have had it in mind to write a report of his 25 years in Asia but possibly did not feel sufficiently at home in either Venetian or Franco-Italian; but now Rustichello was at hand, and the traveller began dictating his tale. The language employed was Franco-Italian—a strange composite tongue fashionable during the 13th and 14th centuries. Page by page the great book was compiled.

Fortunately Marco was soon freed and returned to Venice. His subsequent life can be reconstructed, in part, through the testimony of some legal documents that have reached us. He seems to have led a somewhat retired life, managing a not too conspicuous fortune, and died at the age of 70. A famous story relates how Marco was asked on his deathbed to retract the "fables" he had invented in his book; his answer was that he barely told half of what he actually saw. It is known that in his will he set free a "Tatar slave," who may possibly have followed him all the way from East Asia.

Nature and content of Il milione. The actual personality of Marco is somewhat elusive. Practically all that is known about him derives from the text of his book; the traditional view is that Marco dictated the text, and certainly many portions sound like transcriptions from a tape recording. But was Rustichello always such a passive intrument? Scholarly research has shown that he often asserted his personality and familiar phraseology, especially in the somewhat standardized description of battles.

The book itself was an instant success. "Tutta Italia in pochi mesi ne fu piena" ("In a few months it spread throughout Italy"), wrote Giovanni Battista Ramusio, the 16th-century Italian geographer. Unfortunately, however, people read the book for the wrong reasons—not as history, geography, or travel but as a fantastic romance in which Kublai Khan was ranked with King Arthur and Cathay became a new province in the dreamy topography of chivalry.

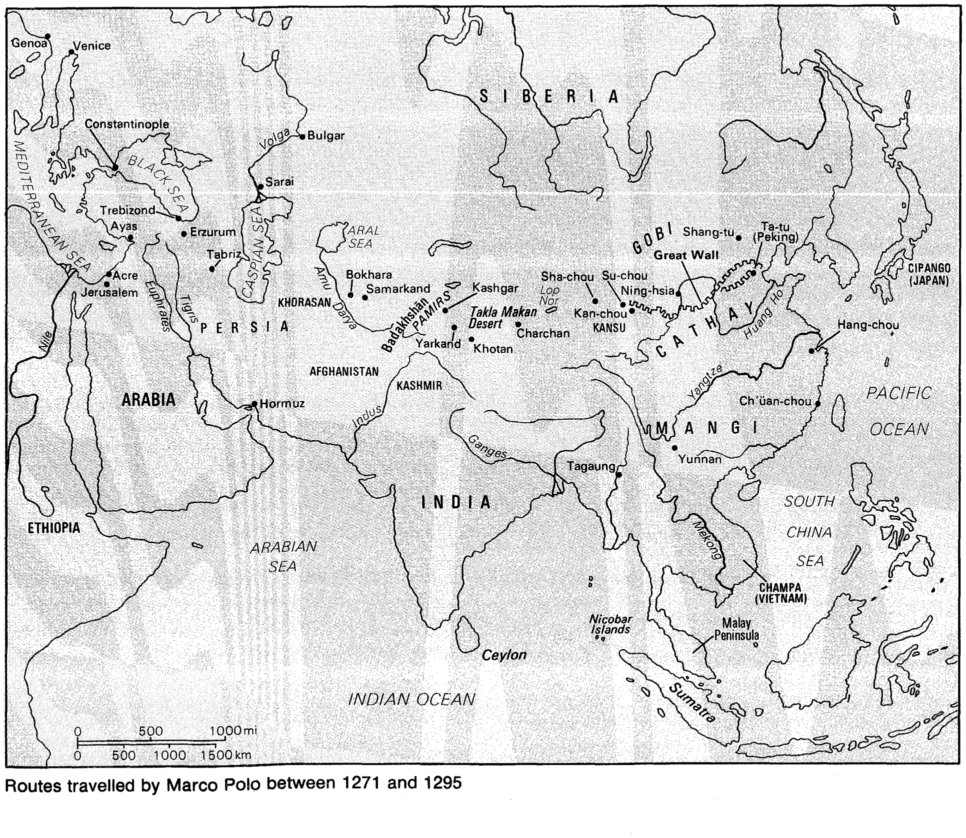
Since all this happened long before the invention of printing, professional scribes or amateurs made dozens of copies of the book, as well as free translations and adaptations—often adding to or subtracting from the text with little or no respect for authenticity. There were also many unfamiliar names that rarely passed unharmed from one copy to another; as a result, modern commentators throw up their hands in despair when confronted with the task of reconstruction. In fact, an authentic and original copy of *Il milione* does not exist; there are some 140 different manuscript versions of the text, in a dozen different languages and dialects—an immensely complex and controversial body of material representing one of the most obdurate philological problems inherited from the Middle Ages.

Marco seems to have made additions and corrections himself, on various copies of the work, during the last 20 years or so of his life. Some editors—for instance, the friar Pipino, who made a good Latin translation of the original—found many of Marco's descriptions or interpretations impious or dangerously near to heresy and therefore heavily bowdlerized the text.

The book seems to have been conceived by Marco as a vast cosmography based on first-hand experience—the book to end all books on Asia. The original title—*Divisament dou Monde* ("Description of the World") is significant; Marco all too often sacrifices personal recollections to doctrinal ambitions. Details concerning travel, stages (*i.e.,* distances covered), and seasons are rarely stated; the panorama is observed from an impersonal distance with a powerful wide-angle lens. In *Il milione* Marco follows a definite itinerary but often branches off into descriptions of places probably visited not by himself but by his relatives or people he knew. Typical digressions are those on Mesopotamia, the Assassins and their castles, Samarkand, Siberia, Japan, India, Ethiopia, and Madagascar. *Il milione* is better understood if considered as forming a part of the vernacular didactic literature, of which the Middle Ages offer many examples.

The origin of the popular title, *Il milione,* is not quite clear; it may have source relation with the idea of a "tall story," but it may also derive from a nickname running in the family, possibly traceable back to a corruption of Aemilione (Big Emil). The complete silence of the poet Dante Alighieri regarding his illustrious contemporary seems to be significant; he evidently considered the book a fable, an invention, and a dangerously heretical one at that. Marco's descriptions of peoples living under the Equator, where according to the orthodox views of the times there should have been nobody, may have appeared particularly alarming.

Marco Polo's subsequent reputation. As a result of such controversies, which have continued for nearly seven centuries, Marco's reputation has suffered dramatic ups and downs. For some he was a genius, a man of prodigious memory, a most conscientious observer,



Routes travelled by Marco Polo between 1271 and 1295 and a successful official at the Khan's court—a man at home in the cosmopolitan Asia of the great Mongol rulers. For others he was a braggart, who made too much of himself; a drifter ready to believe the gossip of ports and bazaars; a man with little culture, scant imagination, and a total lack of humour; a man who failed, among other things, to mention the Great Wall of China, the use of tea, and the ideographic script of the Far East.

A more balanced view must take into account many factors, especially the textual problem and medieval ideas of the world. Modern scholarship and research have, however, given a new depth and scope to his work. It is now generally conceded that he reported faithfully what he saw and heard, even though much of what he heard was fabulous or distorted. In any case, Marco's account opened new vistas to the medieval mind. As Western horizons expanded, Marco's influence became greater and greater. His description of Japan set a definite goal for Columbus in his journey toward the setting sun in 1492, while his detailed localizations of spices encouraged Western merchants to seek out these areas and break the age-old Arab trading monopoly. The wealth of new geographical information recorded by Marco Polo was widely used in the late 15th and the 16th centuries, during the age of the great European ocean voyages. (F.M.)

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Polochic River, Spanish RÍO POLOCHIC, river in eastern Guatemala. Its major headstreams arise in the Sierra de Chamá and in the Sierra de las Minas. Flowing eastward for 150 miles (240 km), it forms a delta south of the town of El Estor. The Polochic is navigable as far upstream as Panzós; its principal traffic consists of coffee and lumber. Except for some nickel mining, the river's valley is undeveloped. The unpaved highway linking El Estor with Huehuetenango follows the Polochic Valley.

Polock (Belorussian S.S.R.): *see* Polotsk.

polonaise, also spelled POLONESE, in clothing, a coatlike dress, originally worn by Polish women, that was extremely popular in the 1770s and 1780s in western Europe and North America. It consisted of a fitted bodice with a full skirt, draped in front from the waist and caught up on either side at the back, so that it fell in three large loops.

The underskirt, or petticoat, which showed prominently, was elaborately decorated, quilted, or embroidered. In the 19th century the polonaise gave its name to a short over-

Woman wearing a polonaise, "Mrs. Graham," oil painting by Thomas Gainsborough, *c.* 1777; in the National Gallery of Scotland, Edinburgh

By courtesy of the National Galleries of Scotland

coat, usually fur-trimmed, worn by men and, somewhat later, by women.

polonaise, Polish POLONEZ, in dance, dignified ceremonial dance that from the 17th to 19th century often opened court balls and other royal functions. Likely once a warrior's triumphal dance, it was adopted by the Polish nobility as a formal march as early as 1573 for the coronation of Henry of Anjou as king of Poland. In its aristocratic form the dancers, in couples according to their social positions, promenaded around the ballroom with gliding steps accented by bending the knees slightly on every third step. Polonaise music is in $\frac{3}{4}$ time. The dance was used as a musical form

Polonaise

Culver Pictures

by such prominent composers as Beethoven, Handel, Mussorgsky, and Chopin.

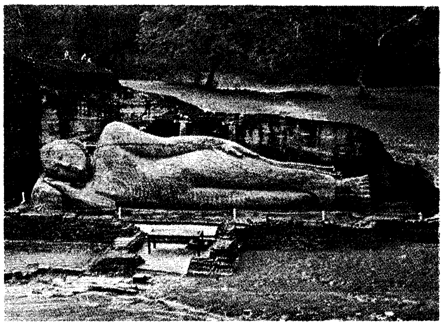
polonium (Po), a radioactive, silvery-gray or black metallic element of the oxygen family (Group VIa in the periodic table). The first element to be discovered by radiochemical analysis, polonium was discovered in 1898 by Pierre and Marie Curie, who were investigating the radioactivity of a certain pitchblende, a uranium ore. Polonium is a very rare element (its abundance in the Earth's crust is about one part in 10^{15}) that occurs in nature as a radioactive decay product of uranium, thorium, and actinium. The half-lives of its isotopes range from a fraction of a second up to 103 years; the most common natural isotope of polonium, polonium-210, has a half-life of 138.4 days.

Polonium usually is isolated from by-products of the extraction of radium from uranium minerals. It can be produced artificially by bombarding bismuth or lead with neutrons or with accelerated charged particles.

Chemically, polonium resembles the elements tellurium and bismuth. Because polonium is highly radioactive—it disintegrates to a stable isotope of lead by emitting alpha rays, which are streams of positively charged particles—it must be handled with extreme care. When contained in such substances as gold foil, which prevent the alpha radiation from escaping, polonium is used industrially to eliminate static electricity generated by such processes as paper rolling, the manufacture of sheet plastics, and the spinning of synthetic fibres. It is also used on brushes for removing dust from photographic film and in nuclear physics as a source of alpha radiation. Mixtures of polonium with beryllium or other light elements are used as sources of neutrons.

atomic number	84
atomic weight	210
melting point	254° C (489° F)
boiling point	962° C (1,764° F)
density	9.4 g/cm^3
oxidation states	−2, +2, +3(?), +4, +6
electron config.	2-8-18-32-18-6 or $1s^22s^22p^63s^23p^63d^{10}4s^24p^6 4d^{10}4f^{14}5s^25p^65d^{10}6s^26p^4$

Polonnaruwa, town, north-central Sri Lanka (Ceylon), near the Mahaweli River. It is an ancient Ceylonese capital that was long deserted but has been revived in modern times. Polonnaruwa (Polonnaruva) became the residence



Reclining Buddha, Polonnaruwa, Sri Lanka

Richard Abeles

of Ceylon's kings in AD 368 and succeeded Anuradhapura as the capital in the 8th century when the latter was captured by Tamils. The modern town arose in the 20th century after the restoration nearby of an ancient irrigation reservoir to serve the needs of the surrounding agricultural region, in which rice and tobacco are grown. There is also a rail station. The town contains numerous temples and other Buddhist structures, most of them dating from the 12th century. The most imposing remaining structure is a building 170 feet (52 m) long with walls about 80 feet (24 m) high and 12 feet (3.5 m) thick. Many other great ruins have been carefully excavated and preserved. Pop. (1981 prelim.) 11,793.

Polotsk, also spelled POLOCK, city, Vitebsk *oblast* (administrative region), Belorussian Soviet Socialist Republic. It is situated on the Western Dvina River at its confluence with the Polota. Polotsk, first mentioned in 862, has always been a major trading centre and an important fortress with a remarkably stormy history. Modern Polotsk and its satellite town, Novopolotsk, are railway junctions and industrial centres, with oil-refining, petrochemical, glass-fibre, wood-working, and food-processing industries, as well as a teacher-training institute. Pop. (1985 est.) 79,000.

Polovtsy (Euro-Asian tribal confederation): *see* Kipchak.

Polska: *see* Poland.

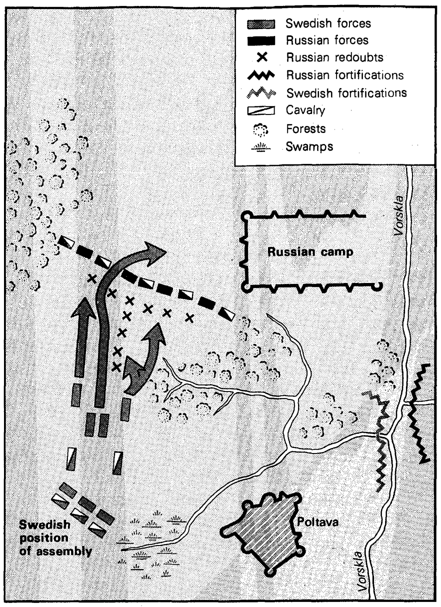
polska (Swedish: Polish), Scandinavian folk dance originating in the 16th century, possibly influenced by Polish courtly dances. Polska in Finland refers nonspecifically to many dances in $\frac{3}{4}$ time, both for individual couples and for sets of several couples. In Sweden the polska is a turning dance in $\frac{3}{4}$ time, usually for couples, who grasp each other firmly and pivot around and around with a smooth, carefully coordinated step. Among its varieties, the *gammal polska,* or old polska, is the simplest and probably the oldest. The lively and very popular *hambo* is a 19th-century offshoot of the *gammal polska.* The Norwegian dance analogous to the Swedish polska is the *pols.*

Poltava, *oblast* (administrative region) in the Ukrainian Soviet Socialist Republic, occupying an area of 11,100 sq mi (28,800 sq km) along the left bank of the middle Dnepr River. It is almost wholly within the forest-steppe zone, only the extreme south lying in true steppe. Except on the meadows of the Dnepr floodplain, soils are fertile. The natural grass and forest vegetation have been very largely removed by plowing, and soil erosion is serious. Surviving groves of oak or pine cover only 6 percent of the surface. Nearly half of the population is rural, reflecting the agricultural importance of the *oblast.* Communities, except Poltava, the administrative centre, and Kremenchug, are small and concerned chiefly with processing farm produce. Agriculture is dominated by wheat, corn (maize), sugar beets, and sunflowers. Natural gas and petroleum are found in several areas, oil is refined at Kremenchug, and iron ore is mined at Komsomolskoye near Kremenchug. Pop. (1983 est.) 1,727,000.

Poltava, city and administrative centre of Poltava *oblast* (region), Ukrainian Soviet Socialist Republic, located on the Vorskla River. Archaeological evidence dates the city from the 8th–9th century, although the first documentary reference is from 1174, when it was variously known as Oltava or Ltava. Destroyed by the Tatars in the early 13th century, it was the centre of a Cossack regiment by the 17th century. In 1709 Peter I the Great inflicted a crushing defeat on Charles XII of Sweden outside Poltava after Charles had laid siege to the town for three months. In 1802 it became a provincial centre.

The modern city of Poltava is largely new, having been reconstructed after it suffered severe damage during World War II. It is the focus of a fertile agricultural region and has a range of industries processing farm produce. Its textile and clothing industries include the largest cotton mill in the Ukraine. There are also important engineering works engaged in diesel-locomotive repair and machine building. Poltava has teacher-training, medical (dealing with mouth diseases), agricultural, and agricultural-engineering institutes and several research establishments. Pop. (1983 est.) 290,000.

Poltava, Battle of (July 8 [June 27, old style], 1709), the decisive victory of Peter the Great of Russia over Charles XII of Sweden in the Great Northern War, ending Sweden's status as a major power and marking the beginning of Russian supremacy in eastern Europe. It was fought north and west of Poltava, west of the Vorskla River, in the Ukraine, between 80,000 Russian troops under Peter the Great and the general Prince Aleksandr Danilovich Menshikov and 17,000 Swedes under Charles XII. The Swedish invasion of Russia had already failed the previous winter, with the loss of their major supply column to the Russians and their failure to receive expected reinforcements. Despite the severe shortages of men, artillery, and powder, Charles continued the war and besieged Poltava in May 1709. The Russians assembled their forces to raise the siege. They set up entrenchments (a countersiege) within a few hundred yards of the Swedish siege lines, thus forcing the Swedes to attack. Charles planned to charge past the Russian line of redoubts, without stopping to subdue them, and directly assault the main Russian defensive position. This called for extreme mobility and daring. But Charles himself lacked mobility because he had been injured a few days before, and his secondary commanders either lacked daring or failed to understand his plan. The Swedish attack faltered; the Russian counterattack, with 40,000 troops, killed or captured the entire Swedish army, except for Charles and 1,500 followers, who escaped south into Turkish territory.



Poltava, the initial Swedish attack

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poltergeist (German *Polter,* "noise" or "racket"; *Geist,* "spirit"), in occultism, a disembodied spirit or supernatural force credited with certain malicious or disturbing phenomena, such as inexplicable noises, sudden wild movements, or breakage of household items. Poltergeists are also blamed for violent actions—throwing stones or setting fire to clothing and furniture. Such events are said to be sporadic, unpredictable, and often repetitive.

A poltergeist's activity appears to concentrate on a particular member of a family, often an adolescent, its object being harassment or, rarely, physical harm. When strangers are present, the unusual phenomena often cease. A large portion of those reported to be victimized suffer from hysteria. In many instances, the activities attributed to poltergeists have been explained as natural phenomena—*e.g.,* the normal creaking of boards in an old house. *See also* kobold.

Poltoratsk (Turkmen S.S.R.): *see* Ashkhabad.

poludnitsa, in Slavic mythology, female field spirit, generally seen either as a tall woman or a girl dressed in white. The *poludnitsa* customarily appears in the field at noon, when the workers are resting from their labours. Any human who dares upset her traditional visit risks his health and his life.

The *poludnitsa* is related to the *polevoy,* the male field spirit, who is seldom seen and then only at noon in the fields. Some describe him as a man black as the earth, with grass instead of hair growing out of his head. Others say he dresses in white. In some areas offerings are made to the *polevoy* at night to insure fertility.

Polwarth, Patrick Hume, Lord: *see* Hume, Sir Patrick.

polyacrylonitrile, any of a class of resinous, fibrous, or rubbery substances belonging to the family of organic polymers based on acrylonitrile. Almost all polyacrylonitrile resins are copolymers (*q.v.*), made from mixtures of monomers, with acrylonitrile (*see* nitrile) usually making up the major portion; other monomers often present include butadiene, styrene, vinylidene chloride, or other vinyl compounds.

Acrylic fibres, such as Orlon, contain at least 85 percent acrylonitrile; modacrylics contain 35–85 percent. The inclusion of other monomers confers desirable properties upon the fibres, such as increased affinity for dyestuffs. Acrylonitrile, butadiene, and styrene polymerize together to form the so-called ABS resins, which are hard, tough, strong, and resistant to impact; they are easily fabricated into pipe, structural panels, housewares, and the like. Mixtures of butadiene and acrylonitrile, containing 15–40 percent of the latter, form elastomers called NBR or Buna N rubber, which are highly resistant to abrasion and to attack by hydrocarbon solvents such as gasoline. Saran N is a resin made from acrylonitrile and vinylidene chloride (*q.v.*).

Polyaenus (fl. 2nd century AD), Macedonian rhetorician and pleader living in Rome, the author of a work entitled *Strategica* (or *Strategemata*), which he dedicated to the emperors Marcus Aurelius and Lucius Verus on the outbreak of the Parthian War (162–165).

Strategica, still extant, is a historical collection of stratagems and maxims of strategy written in Greek and strung together in the form of anecdotes; it also includes examples of wisdom, courage, and cunning from civil and political life. Comprising eight books (parts of the sixth and seventh are lost), it originally contained 900 anecdotes, of which 833 are extant. Despite its many errors of judgment and fact, its contents have some historical value. Evidently highly esteemed by the Roman emperors, it was handed down by them as a sort of heirloom and passed to Constantinople, where it was diligently studied by Leo VI, who himself wrote a work on tactics.

polyandry, marriage of a woman to two or more men at the same time; the term is derived from the Greek *polys,* "many," and *anēr, andros,* "man." When the husbands in a polyandrous marriage are brothers or are said to be brothers, the institution is called adelphic or fraternal polyandry. Sometimes in the latter form of union the children are said to be descended from the eldest brother only, whereas in other instances the role of father is established by special ceremony, or the children are said to belong to all brothers equally.

A related form of marital union, sometimes called secondary marriage, obtains when a woman cohabits with a man other than her first husband but without having terminated the first marriage by annulment or divorce.

Polyandry must be distinguished from the privileged sexual access to a woman by several men, a practice not uncommon and often associated with customs of kinship or hospitality. True polyandry is, in fact, so rare a phenomenon as to be considered a curiosity and a response to peculiar localized conditions, but not a survival of an earlier polyandrous stage of civilization, as was contended by the early cultural evolutionists.

polyarteritis nodosa, also called PERIARTERITIS NODOSA, inflammation of blood vessels and surrounding tissue; it may affect functioning of adjacent organs. The word nodosa ("knotty") forms part of the name because of the fibrous nodules along the medium-sized arteries that are affected.

The course and symptoms of the disease vary. Men are more susceptible to it than women. It often follows other illnesses, particularly bronchial asthma, and hypersensitivity to drugs is a suspected cause. The condition is diagnosed by microscopic examination of inflamed tissue. Treatment involves corticosteroid therapy.

polybasite, heavy, black sulfosalt mineral, a sulfide of the elements silver, copper, and antimony ($[Ag, Cu]_{16}Sb_2S_{11}$), that occurs as monoclinic crystals and masses in silver veins, sometimes in large amounts.

Polybasite is found in Chile, Peru, Czechoslovakia, and many localities in Mexico and in the states of Colorado, Montana, Idaho, and Nevada. For detailed physical properties, *see* sulfosalt (table).

Polybius (b. *c.* 200 BC, Megalopolis, Arcadia—d. *c.* 118), Greek statesman and historian who wrote of the rise of Rome to world prominence.

Early life. He was the son of Lycortas, a distinguished Achaean statesman, and he received the upbringing appropriate for a son of rich landowners. His youthful biography of Philopoemen reflected his admiration for that great Achaean leader, and an interest in military matters found expression in his lost book, *Tactics.* He enjoyed riding and hunting, but his knowledge of literature was rather specialized (apart from the historians) and his acquaintance with philosophy superficial. Before 170/169, when he was hipparch (cavalry commander) in the Achaean Confederation, almost nothing is known of his career. But he then became involved in critical events. Encumbered by their war with Perseus of Macedonia, the Romans were watching for disloyalty in the Greek states. Although Polybius declared for open support of Rome and was sent as an envoy to the consul Quintus Marcius Philippus, Achaean help was rejected. After Perseus' defeat at Pydna in 168, Polybius was one of 1,000 eminent Achaeans who were deported to Rome and detained in Italy without trial.

Residence in Rome. At Rome, Polybius had the good fortune to attract the friendship of the great Roman general Scipio Aemilianus; he became Scipio's mentor and through his family's influence was allowed to remain in Rome. It is probable that Polybius accompanied Scipio to Spain in 151, went with him to Africa (where he saw the Numidian king Masinissa), and crossed the Alps in Hannibal's footsteps on his way back to Italy. Shortly afterward, when his political detention had ended, Polybius joined Scipio at Carthage and was present at its siege and destruction in 146; and it is likely that he then undertook a voyage of exploration in the Atlantic, which is related in Pliny the Elder's *Natural History.* Meanwhile, hostilities had broken out between Achaea and Rome, and Polybius was in Corinth shortly after its destruction, in 146. He devoted himself to securing as favourable a settlement as possible for his countrymen and to reestablishing order; and, as the geographer Pausanias states, Achaean gratitude found expression in the erection of statues in his honour at Tegea, Pallantium, Mantineia, Lycosura—where the inscription declared that "Greece would never have come to grief, had she obeyed Polybius in all things, and having come to grief, she found succour through him alone"—and Megalopolis, where it was recorded that "he had roamed over all the earth and sea, had been the ally of the Romans, and had quenched their wrath against Greece." Of Polybius' life after 146 little is known. At some date he visited Alexandria and Sardis. He is known to have discussed political problems with Scipio and Panaetius of Rhodes. He wrote a history of the Numantine War, evidently after 133 BC, and also a treatise on the habitability of the equatorial region; but when he composed the latter is unknown.

Polybius' history of Rome. The Histories on which his reputation rests consisted of 40 books, the last being indexes. Books I–V are extant. For the rest there are various excerpts, including those contained in the collection of passages from Greek historians assembled in the 10th century and rediscovered and published by various editors from the 16th to the 19th century.

Polybius' original purpose was to narrate the history of the 53 years (220–168 BC)—from Hannibal's Spanish campaign to the Battle of Pydna—during which Rome had made itself master of the world. Books I–II form an introduction covering Roman history from the crossing into Sicily against the Carthaginians in 264 and including events in various other parts of the world (especially Achaea) between 264 and 220. In Book III, Polybius sketches a modified plan, proposing to add an account of how the Romans exercised their supremacy down to the destruction of Carthage, in 146.

The events of 168–146 were related in Books XXX–XXXIX. Polybius probably conceived his revision after 146, having by this date completed his narrative down to the end of the Second Punic War. At least Books I–VI seem to have been published by about 150; there is no information as to when the rest of the work, including the revised plan in Book III, appeared.

Conception of history. "All historians," according to Polybius,

> have insisted that the soundest education and training for political activity is the study of history, and that the surest and indeed the only way to learn how to bear bravely the vicissitudes of fortune is to recall the disasters of others.

Practical experience and fortitude in facing calamity are the rewards of studying history and are stressed repeatedly throughout the work. History is essentially didactic. Pleasure is not to be wholly excluded, but the scale comes down sharply on the side of profit. To be really profitable, history must deal with political and military matters; and this is *pragmatikê historia,* in contrast to other sorts of history (IX, 1–2)—genealogies and mythical stories, appealing to the casual reader, and accounts of colonies, foundations of cities, and ties of kindred, which attract the man with antiquarian interests. Its nature is austere, though it may include contemporary developments in art and science. He stands in contrast to the sensationalism of many of his predecessors, who confuse history with tragedy.

In Book II, in which he attacks the Greek historian Phylarchus for practices that might be called unprofessional today, Polybius states:

> . . . A historian should not try to astonish his readers by sensationalism, nor, like the tragic poets, seek after men's probable utterances and enumerate all the possible consequences of the events under consideration, but simply record what really happened and was said, however commonplace. For the object of history is the very opposite of that of tragedy. The tragic writer seeks by the most plausible language to thrill and charm the audience temporarily; the historian by real facts and real speeches seeks to instruct and convince serious students for all time. There it is the probable that counts, even though it be false, the object being to beguile the spectator; here it is the truth, the object being to benefit the student.

This attack on Phylarchus is not isolated. Similar faults are castigated in other historians judged guilty of sensationalism (*cf.* II, 16, 13–15; III, 48, 8; VII, 7, 1–2; XV, 34, 1–36). Nor are these their only weaknesses. Many historians are prone to exaggeration—and that for a special reason. As writers of monographs whose subjects are simple and monotonous, they are driven "to magnify small matters, to touch up and elaborate brief statements and to transform incidents of no importance into momentous events and actions" (XXIX, 12, 3). In contrast to such practices, Polybius stresses the universal character of his own theme, which is to narrate "how and thanks to what kind of constitution the Romans in under 53 years have subjected nearly the whole inhabited world to their sole government—a thing unique in history" (I, 1, 5).

Polybius believed that he had a particular reason for adopting a comprehensive view of history, apart from his own predilection for such a view. He wrote:

> Hitherto the affairs of the world had been as it were dispersed . . .; since this date [220 BC] history has formed an organic whole, and the affairs of Italy and Africa have been interlinked with those of Greece and Asia, all tending towards one end (I, 3, 3–4).

Indeed, only universal history is capable of adequately treating Rome's rise to world power—the historian's synoptic view matches the organic character of history itself:

> What gives my work its peculiar quality, and is nowadays most remarkable, is this. Tyche [Fortune] having guided almost all the world's affairs in one direction and having inclined them to one and the same goal, so the historian must bring under one conspectus for his readers the operations by which she has accomplished her general purpose. For it was chiefly this consideration, coupled with the fact that none of my contemporaries has attempted a general history, which incited and encouraged me to undertake my task (I, 4, 1–2).

The role here allotted to Fortune is somewhat unusual. For clearly the value of history as a source of practical lessons is diminished if cause and effect are at the mercy of an incalculable and capricious power. Usually, although Polybius uses Fortune to cover a variety of phenomena, ranging from pure chance to something very like a purposeful providence, much of the apparent inconsistency springs from his use of purely verbal elaboration or the careless adoption of current Hellenistic terminology, which habitually made Fortune a goddess. Here, however, Fortune seems to be a real directive power, which raised Rome to world dominion—because Rome deserved it. Normally, Polybius lays great emphasis on causality, and his distinction (III, 6) between the causes of an event (*aitiai*) and its immediate origins (*archai*) is useful up to a point, though it is more mechanical than that of the great Greek historian Thucydides and allows nothing for the dialectical character of real historical situations.

An important place in Polybius' work is occupied by his study of the Roman constitution and army and the early history of the city in Book VI. His analysis of the mixed constitution, which had enabled Rome to avoid the cycle of change and deterioration to which simple constitutional forms were liable, is full of problems, but it has exercised widespread influence, from Cicero's *De republica* down to Machiavelli and Montesquieu.

Sources of information. Polybius defines the historian's task as the study and collation of documents, acquaintance with relevant geographical features, and, finally, political experience (XII, 25e); of these the last two are the most essential. And he practiced what he preached, for he possessed good political and military experience and had travelled widely throughout the Mediterranean and beyond. Nor did he neglect written sources; indeed, for his introductory books, covering the period from 264 to 220, they were essential. For the main part of his history, from 220 onward, he consulted many writers, Greek and Roman, but, following precedent, he rarely names them.

He had access to private sources; for example, Publius Cornelius Scipio's letter to Philip V of Macedonia describing the capture in Spain, in 209 BC, of New Carthage (X, 9, 3), and a letter of Scipio Nasica to some Hellenistic king about the campaigns of the Third Macedonian War (XXIX, 14, 3). He almost certainly consulted the Achaean record office and must have drawn on Roman records for such material as the treaty between Carthage and Philip V (VII, 9). It has not been proved that he had access to the Rhodian records. His detailed figures for Hannibal's troop formations in Italy came from an inscription left by Hannibal, which he found in the Temple of Juno on the Lacinian promontory.

Polybius regarded oral sources as his most important, and the questioning of witnesses as the most vital part of a historian's task; indeed, this is one reason why he chose to begin his main history at the year 220. Anything else would be "hearsay at one remove," a safe foundation for neither judgments nor statements.

Style and qualities as a historian. Writing in the 1st century BC, Dionysius of Halicarnassus reckons Polybius among those who "have left behind them compositions which no one endures to read to the end"; that his successors shared this view of Polybius' style is confirmed by the failure of his works to survive except in an incomplete form. The infelicity of Polybius' Greek (which frequently reproduces the conventional phrases of the Hellenistic chancelleries familiar from contemporary inscriptions) lies in its awkward use of long and cumbersome circumlocutions, vague abstract nouns, and pedantic repetitions. To the scholar his style is, however, no great obstacle; and, though in his anxiety to improve his reader he moralizes and belabours the obvious, the perennial interest and importance of his theme will always ensure him a following among those who can enjoy a historian who is accurate, serious, and sensible, who understands the events of which he writes, and, above all, who asks the right questions.

(F.W.W.)

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Polycarp, SAINT (fl. 2nd century; feast day February 23), Greek bishop of Smyrna who was the leading 2nd-century Christian figure in Roman Asia by virtue of his work during the initial appearance of the fundamental theological literature of Christianity. Historically, he formed a link between the apostolic and patristic ages.

By his major writing, *The Letter to the Philippians,* and by his widespread moral authority, Polycarp combated various heretical sects, including certain Gnostic groups that claimed religious salvation exclusively through their arcane spiritual knowledge. Polycarp's *Letter to the Philippians* contains a classic formulation in which he refutes the Gnostics' argument that God's incarnation in, and the death and Resurrection of, Christ were all imaginary phenomena of purely moral or mythological significance.

More important, however, is the way in which Polycarp referred to the apostle Paul in *The Letter to the Philippians.* Not only does he repeatedly quote from Paul's writings but he also stresses the personal importance of Paul as a primary authority of the Christian church. It must be remembered that at that time Paul had been adopted as a primary authority by the Gnostic heretics. Polycarp, in response, reclaimed Paul as a treasured figure of the orthodox church. It is apparently thus partly due to Polycarp that Paul, the disputed apostle, became a theologically respectable part of the Christian church's tradition. Furthermore, Polycarp's orthodox use of the Pauline texts marked a crucial advance in the Christian theology of biblical interpretation. According to certain scholars, Polycarp may even have composed or directly influenced some of the letters traditionally ascribed to St. Paul, the so-called Pastoral Letters (I and II Timothy, Titus). These letters possess a 2nd-century vocabulary and style that are characteristic of Polycarp.

Polycarp's *Letter to the Philippians* is doubly important for its early testimony to the existence of various other New Testament texts. It probably is the first to quote passages from the Gospels of Matthew and Luke, the Acts of the Apostles, and the first letters of St. Peter and St. John. Other immediate postapostolic writers employed a more oral tradition.

Toward the end of his life Polycarp visited Bishop Anicetus of Rome to discuss with him the date at which the Easter festival was to be celebrated, a controversy that threatened to provoke a schism between Rome and Asia Minor. The two men could not reach agreement on a common date on which to celebrate Easter, so they agreed that Rome and Asia Minor would follow different practices in this regard. On his return to Smyrna, Polycarp was arrested by the Roman proconsul and burned to death when he refused to renounce Christianity. This event has been eulogized in the *Martyrdom of Polycarp,* one of the earliest-known Christian documents of this nature.

Polycarp, Martyrdom of (letter): *see* Martyrdom of Polycarp.

polychaete, any worm of the class Polychaeta (phylum Annelida). About 5,400 living species are known. Polychaetes, which include rag worms, lugworms, bloodworms, sea mice, and others, are marine worms notable for well-defined segmentation of the body. They vary in size from a few millimetres to about 3 m (10 feet) and are divided informally into two groups; the errantia, or free-moving forms, and sedentaria, or tube-dwelling forms.

Most body segments bear a pair of parapodia—flat, lobelike outgrowths—with setae, or tiny bristles. The head has short sensory projections (palps) and tentacles. The body is often brightly coloured. The diet consists of minute aquatic plants and animals.

The sexes are usually separate; sperm and eggs are discharged directly into the water, where fertilization occurs. Larvae are free-swimming. Some species are hermaphroditic; *i.e.,* the functional reproductive organs of both sexes are present in one individual. Other species reproduce by budding, in which a portion of an adult's body breaks away to form a new individual.

Polychaetes play an important role in turning over bottom sediments in the sea. The palolo worm (*q.v.*) is used as human food in areas of the South Pacific where it swarms in great abundance at breeding time.

polychaete hypothesis, theory that conodonts (minute toothlike structures found as fossils in marine rocks) are parts of the jaw apparatus of polychaete worms, a class of the annelid, or segmented, worms. Conodonts resemble the jaws (scolecodonts) of polychaete worms in form, and they are found in left and right pairs, as are scolecodonts. Polychaete teeth are known as early as the Ordovician period (about 505 million to 438 million years ago), but conodonts have their first undisputed occurrence earlier, in the Late Cambrian epoch (about 523 million to 505 million years ago). Arguments against the conodont–polychaete relationship include the fact that scolecodonts change little with time, whereas conodonts exhibit great variation and evolution over time. Scolecodonts are composed of chitin, a resistant, horny material similar to fingernails in composition. Conodonts, however, are composed of calcium phosphate, as in the skeletons of vertebrates. Some unknown group of polychaetes may have been able to secrete structures of calcium phosphate, but the large differences in manner of growth between conodonts and polychaete jaws constitute a convincing argument against the polychaete hypothesis.

polychlorinated biphenyl (PCB), any of a class of highly stable organic compounds that are prepared by the reaction of chlorine with biphenyl. A commercial mixture of such chlorinated isomers of biphenyl provides a colourless, viscous liquid that is relatively insoluble in water, does not degrade under high temperatures, and is a good dielectric. Because of these qualities, PCBs are particularly useful as lubricants, heat-transfer fluids, and fire-resistant dielectric fluids in transformers and capacitors. They also are good plasticizers and have found application in points, paper coatings, and certain packaging materials.

PCBs came into widespread industrial use during the 1930s and '40s, but since the mid-1970s the production and application of these chemicals have been restricted because they have been found to be injurious to living organisms. PCBs were never intended to be released into the environment, but they found their way into the air, water, and soil via industrial and municipal waste disposal and leaks from mechanical equipment. The high resistance of PCBs to decomposition ensures that they remain in soils and bodies of water for many years, enabling them to accumulate and enter the food chain. PCBs are particularly toxic to fishes and invertebrates and are fatal to these animals even in small concentrations. PCBs cause liver dysfunction, dermatitis, and dizziness in humans exposed to them. The chemicals are also suspected of being carcinogenic. PCB concentration levels in the environment have dropped since the manufacture and use of the compounds were curtailed in several countries.

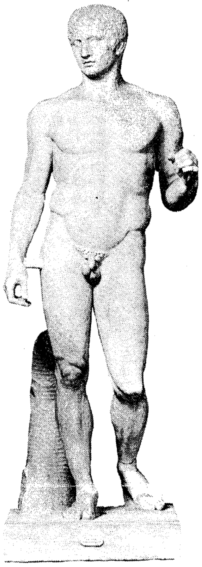
polychlorotrifluoroethylene, synthetic resin belonging to the family of organic polymers, prepared by treatment of an aqueous suspension of chlorotrifluoroethylene with a catalyst composed of a mixture of sodium persulfate and sodium hydrogen sulfite. Polychlorotrifluoroethylene, sometimes abbreviated to CTFE resin, is similar to polytetrafluoroethylene; although it is slightly less resistant to chemical attack, it has the important advantage that it can be shaped by molding or extrusion into solid articles such as gaskets, linings for containers, and parts for valves and pumps. Dispersions of the resin in organic liquids can be used to form protective coatings on surfaces.

polychondritis, disease characterized by inflammation and destruction of cartilages. The disease begins in middle age and most often affects the external ear and the nose; there is painful swelling of the joints when their cartilage is affected. Involvement of the trachea may obstruct breathing or lead to pneumonia. Relapsing polychondritis may affect the inner ear and cause deafness, or it may cause inflammation of the eyes. Corticosteroid drugs are administered to moderate the symptoms of the disease, but the effects on the cartilage cannot be reversed.

Polyclitus, also spelled POLYCLEITUS, or POLYKLEITOS (fl. late 5th century BC), Greek sculptor from the school of Argos, known for his masterly bronze sculptures of young athletes; he was also one of the most significant aestheticians in the history of art.

Polyclitus' two greatest statues were the "Diadumenus" (430 BC; "Man Tying on a Fillet") and the "Doryphorus" (*c.* 450–440 BC;

"Spear Bearer"), the latter work being known as the "Canon" (Greek: Kanon) because it was the illustration of his book by that name. The *Canon* is a theoretical work that discusses ideal mathematical proportions for the parts of the human body and proposes for sculpture of the human figure a dynamic counterbalance—between the relaxed and tensed body parts and between the directions in which the parts move. In Greece this concept was called *symmetria,* and Polyclitus' statues of young athletes, balanced, rhythmical, and finely detailed, were the best demonstration of his principles. His freer use of contrapposto (depiction of the human body with twistings in its vertical axis) helped liberate Greek sculpture from its tradition of rigid frontal poses.



"Doryphorus" ("Spear Bearer"), Roman marble copy of Greek bronze by Polyclitus, about 450–440 BC; in the Museo Archeologico Nazionale, Naples
Hirmer Fotoarchiv, Munchen

Another outstanding work by Polyclitus was his gold and ivory statue of the goddess Hera. As a contemporary of Phidias, Polyclitus was considered by the Greeks of the period to be that sculptor's equal. His "Hera" was ranked with Phidias' gold and ivory statues of "Athena" and "Zeus," and Polyclitus' entry in a competition to make an Amazon for the Temple of Artemis at Ephesos was selected over that of Phidias, among others. None of Polyclitus' original works survive, and the "Doryphorus" and "Diadumenus" are known only through Roman copies.

Polycrates (fl. 6th century BC), tyrant (*c.* 535–522 BC) of the island of Samos, in the Aegean Sea, who established Samian naval supremacy in the eastern Aegean and strove for control of the archipelago and mainland towns of Ionia.

Polycrates seized control of the city of Samos during a celebration of a festival of Hera outside the city walls. After eliminating his two brothers, who had at first shared his power, he established a despotism, and ships from his 100-vessel fleet committed acts of piracy that made him notorious throughout Greece. He made an alliance with Egypt, but, when the Persians advanced against Egypt in 525 BC, he abandoned his ally and sent a squadron of 40 ships to join the Persian fleet. He took the opportunity to send his main political opponents with the squadron; they deserted, however, and, supported by Spartans, attempted unsuccessfully to dislodge the tyrant. He maintained his ascendance until about 522, when Oroetes, Persian governor of Sardis, lured him to the mainland and had him crucified.

In addition to the political and commercial preeminence that his reign brought to Samos, Polycrates was also a patron of letters; the poet Anacreon lived at his court.

polycrystal, any solid object composed of randomly oriented crystalline regions, called crystallites, especially as distinguished from a single crystal (*q.v.*). Polycrystalline materials result when a substance solidifies rapidly; crystallization commences at many sites (*see* nucleation), and the structurally ordered regions growing from each site intersect each other. The random arrangement of the boundaries between individual crystallites in a polycrystal causes them to scatter a beam of light instead of reflecting or refracting it uniformly, so that even colourless polycrystals are opaque. Other mechanical, electrical, or magnetic properties of single crystals are similarly altered by the absence of long-range order in polycrystals.

polycythemia, abnormal increase in red blood cells and hemoglobin in the circulation, a situation that results in thickened blood, retarded flow, and an increased danger of clot formation within the circulatory system. Polycythemia may be relative (*e.g.,* after blood-plasma loss), transient (as when a large number of red blood cells suddenly enter the circulation from storage), or absolute (*i.e.,* reflecting an increase in actual mass of red cells in the body). Relative and transient, or secondary, polycythemia disappear when the condition to which they are secondary is eliminated. Absolute polycythemia, when the cause is known, is called erythrocytosis; this may accompany congenital heart disease, some hemoglobin defects, pulmonary disease (*e.g.,* emphysema, silicosis), the Pickwickian syndrome (a form of obesity), and living at high altitudes.

The situation in which excess red blood cells occur without known cause is called erythremia, primary polycythemia, or polycythemia vera. Symptoms include headache, dizziness, difficulty in breathing, skin changes (*e.g.,* tendency to bruise), an enlarged spleen, and red discoloration of the face and sometimes the extremities. Certain blood-clotting factors are not produced in adequate amounts, and consequently hemorrhages may occur from ulcers or minor wounds. Duodenal ulcer and gout occur with increased frequency in persons with erythremia. The disease is relatively common in Jews, affects men more often than women, and usually appears at middle age or later. Treatment is aimed at reducing the volume of red blood cells.

Polydoûre, Maria: *see* Polidoúri, Maria.

polyembryony, a condition in which two or more embryos develop from a single fertilized egg, forming what in humans is known as identical twins. A common phenomenon in many plant and animal species, polyembryony occurs regularly in the nine-banded armadillo, which usually gives birth to four identical young. Striking examples may be found among parasitic insects of the order Hymenoptera; *Copidosoma truncatellum,* a parasite of certain cutworms, lays a single egg in the body of the host worm from which may develop as many as 2,000 individuals.

polyester, any of a class of organic substances composed of large linear (chainlike) or cross-linked (network) molecules, or polymers, formed from a large number of smaller molecules, or monomers, by establishment of ester linkages between them. Polyesters most commonly are prepared from equivalent amounts of glycols (organic compounds containing two hydroxyl groups) and dibasic acids (containing two carboxyl groups).

The long-chain polyester made from ethylene glycol and terephthalic acid is the basis of the fibre called Dacron, Fortrel, or Terylene and the film Mylar. The polycarbonate resin Lexan is also a long-chain polyester.

The polyester fibres are generally similar in performance and properties. They recover quickly after extension and absorb very little moisture. They melt at about 260° C (500° F). Prolonged exposure to light reduces their strength but does not affect their colour. Polyesters have good resistance to chemicals. They can be washed or dry-cleaned with most common cleaning solvents; they are resistant to attack by insects and microorganisms. Their low moisture content makes them likely to accumulate static charges unless treated with antistatic agents.

Polyesters are made into both woven and knitted fabrics, either alone or blended with other fibres. Industrial applications include ropes, filters, conveyor belts, and tire cords. In surgery, polyester is used to replace or reinforce damaged body tissue.

Liquid linear polyesters made from unsaturated dibasic acids, especially maleic and fumaric acids, can be used to impregnate materials such as glass fabrics, then cured, or converted by cross-linking, into durable, resinous polymers; such composite materials have been widely used for hulls of small boats, patches for automobile bodies, and the like.

Alkyd resins, used in paints, varnishes, and other kinds of coating materials, are cross-linked polyesters of which the principal components are glycerol and phthalic acid.

polyether, any of a class of organic substances prepared by joining together or polymerizing many molecules of simpler compounds (monomers) by establishing ether links between them; polyethers, which may be either chainlike or networklike in molecular structure, comprise an unusually diverse group of polymers.

Polyethylene glycols are water-soluble liquids or waxy solids used in cosmetic and pharmaceutical preparations and in the manufacture of emulsifying or wetting agents and lubricants. Polypropylene glycols are liquids, mostly insoluble in water, used to suppress foaming in industrial processes and for making polyurethane resins, hydraulic fluids, and various other materials.

Epoxy resins, widely used as coatings and adhesives, are prepared by converting liquid polyethers into infusible solids by connecting the long-chain molecules into networks, a process called curing. Phenoxy resins are polyethers similar to those used in epoxies, but the polymers are of higher molecular weight and do not require curing; they are used mostly as metal primers. Polyphenylene oxide resins, such as Noryl, possess great resistance to water and to high temperatures (175°–300° C; 350°–575° F). Penton, a chlorine-containing polyether unaffected by many chemicals, is fabricated into sheets used for lining storage tanks and the like.

Polygalales, the milkwort order of dicotyledonous flowering plants comprising five families, with 26 genera of herbs, shrubs, small trees, and vines. They are characterized by the presence in most species of simple leaves and bilaterally symmetrical, bisexual flowers of distinctive structure that superficially resemble those of the pea family (Fabaceae). Despite this resemblance, the order is related instead to the geranium order (Geraniales), which is considered to be its evolutionary ancestor.

The milkwort family (Polygalaceae), with 12 genera and about 1,000 species, is the largest, most typical, and most important of the order; its members are found throughout the world except in New Zealand, Polynesia, and the far northern parts of North America and Asia. The chief genera are *Polygala* (500 to 600 species, mostly herbs, with the distribution of the family), *Monnina* (150 species, Mexico to

Chile), *Muraltia* (115 species, South Africa), *Securidaca* (80 species, vines and climbers of the tropics excepting Australia), and *Xanthophyllum* (60 species, trees of the Indo-Malayan region that accumulate aluminum in their leaves). The genus *Salomonia* (8 species, Indo-Malayan region and Australia) contains saprophytic (deriving nutrients from decaying matter) plants with scalelike leaves. The seeds of many milkworts (*Polygala* species) have a fleshy appendage (aril) that attracts ants, which carry the seeds about for food and thus distribute them.

The milkwort family is important for the Seneca snakeroot (the root of *Polygala senega*), which is used medicinally. The only genus with any horticultural importance is *Polygala*, with about two dozen species grown as ornamentals—*e.g.*, the bastard box (*P. chamaebuxus*), used in rock gardens; the orange milkwort (*P. lutea*), with showy yellow flowers and used in bog gardens; and the flowering wintergreen or fringed milkwort (*P. paucifolia*), which has purple flowers and is grown in wildflower gardens. All are small herbs less than 30 centimetres (one foot) tall. The common milkwort (*P. vulgaris*) produces showy white, pink, or bluish flowers, usually on separate plants but sometimes on the same plant.

The family Vochysiaceae, mostly consisting of trees and shrubs of Central America and tropical South America, contains six genera and 200 species, of which the most important are *Vochysia* (105 species), *Qualea* (60 species), *Erisma* (20 species), and *Callisthene* (10 species).

The family Trigoniaceae, with four genera and 35 species, consists mostly of shrubs and climbers of Central America and tropical South America. The genera are *Trigonia* (30 species), and *Lightia, Trigoniastrum,* and *Humbertiodendron,* which have only one or two species each.

The family Tremandraceae is a group of small herbs and heather-like shrubs of Australia that have small leaves. Unlike the other families of the order, which have irregular (bilaterally symmetrical) flowers, those of this family are regular (radially symmetrical). The genera are *Tetratheca* (20 species), *Tremandra* (2 species), and *Platytheca* (one species).

The family Krameriaceae (of doubtful inclusion) comprises the genus *Krameria,* 15 species of shrubs that occur in warm regions from the southern United States to Chile. They are little-known parasites on the roots of other plants.

polygamy, marriage to more than one spouse at a time—either polygyny, marriage with more than one woman, or polyandry (*q.v.*), marriage with more than one man. The term polygamy is often used, however, as a synonym for polygyny, which appears once to have been common in most of the world. Nowhere, however, has it been the exclusive form of marriage. Among most peoples who permit or prefer it, the large majority of men live in monogamy either because of a limited number of eligible women or because only the well-to-do can afford to support several wives and households.

From the male viewpoint polygyny may be preferred for several reasons: the economic contributions of the wives to the wealth of the household; the availability of sexual companionship, especially in those cultures where pregnancy and lactation dictate abstinence for the married couple; and the enhanced social status and prestige that accrue to the head of a large household. Polygyny also offers certain advantages to women. Particularly in societies that provide no institutionalized role for the unmarried woman, a surplus of women may make polygyny a preferred way of life. Shared labour is also a factor, as it lightens the woman's economic burdens. Despite certain advantages to both sexes, the polygynous family is commonly fraught with bickering and sexual jealousy. To preserve harmony, one wife, usually the first, is accorded seniority, and each wife and her children have separate living quarters or compounds.

The practice of polygyny in developing countries is becoming increasingly unfeasible, as a result of economic changes, urbanization, and mass education. The general prestige of Western ways and the influence of the Western women's movement have also contributed to the decline of polygyny.

polyglot Bible, any of several editions of the Bible in which the text consists of translations in various languages arranged in parallel columns. This arrangement allows scholars to compare ancient and modern versions, as well as to examine closely the translation from one language to another.

The first and best known polyglot Bible is the Complutensian, begun in 1502 under the sponsorship of the archbishop of Toledo, Cardinal Francisco Jiménez de Cisneros, printed in 1514–17 at the University of Alcalá de Henares near Madrid, and published in 1522. The Old Testament in the Complutensian contained a revised Masoretic Hebrew text and translations in Aramaic (the Targum of Onkelos), Latin (the Vulgate), and Greek (the Lucianic recension of the Septuagint, printed in full for the first time). The Complutensian New Testament presented the original Greek version together with the Latin translation.

The *Biblia Regia,* or Antwerp Polyglot (1569–72), is another important polyglot. The work, paid for by Philip II of Spain, was supervised by the Spanish scholar Benedictus Arias Montanus and printed in Antwerp by a well-known printer, Christophe Plantin.

One of the most comprehensive and generally considered the finest is the London Polyglot, also called the Londoninesis or Waltonian (1657), compiled by Brian Walton, with the aid of many contemporary scholars; the Waltonian was one of the first English books assembled under public subscription. Its six volumes contain a total of nine languages: Hebrew, Samaritan, Aramaic, Greek, Latin, Ethiopic, Syriac, Arabic, and Persian.

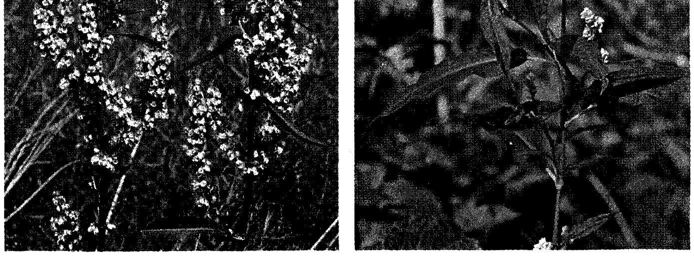
polygnathiform, conodont, or small toothlike fossil of uncertain relationship found widely in ancient marine rocks, that resembles or may be derived from the genus *Polygnathus,* a genus found in rocks of Early Devonian to Early Mississippian age (the Devonian Period ended 345,000,000 years ago, when the Mississippian Period began). *Polygnathus* is clearly a key conodont genus; from this form a wide variety of distinct conodont genera evolved, including many forms that are important index, or guide, fossils.

Polygnotus (b. *c.* 500 BC, Thasos, Thrace—d. *c.* 440 BC, Athens), painter famed for his large monumental wall paintings in a severely classical style, none of which is extant. He lived in Athens and eventually acquired citizenship.

The Greek traveler Pausanias left an account of two paintings in the hall of the Cnidian at Delphi: the "Iliupersis" ("Sack of Troy") and the "Nekyia" ("Ulysses Visiting Hades"). Idealized figures approximately life size were freely distributed within the composition: in Greek painting of the first half of the 5th century BC this method represents an innovation, though precedents existed elsewhere, notably in Assyrian art. It constitutes a break with the ancient Greek principle of arranging figures on a single base line; Polygnotus replaced the horizontal base lines by irregular mounting or descending terrain lines. Comparable representations can be found in contemporary vase paintings, perhaps under his influence. There was no unifying perspective in the modern sense; the individual figure remained the focus of interest even when several figures were grouped together. Stateliness was paired with subtlety of detail: delicate headdresses of women, transparent garments, mouths with parted lips uncovering the teeth. Polygnotus employed sharp foreshortening and four basic colours: black, white, red, and ochre. The "ethos," which later critics, including Aristotle (*Poetics*, ch. 6), valued so highly in his work, indicates a concept of character as an innate disposition, governing the actions and manifest in a person's outward bearing.

Polygonales, the buckwheat order of dicotyledonous flowering plants comprising the family Polygonaceae, with about 40 genera of herbs, shrubs, and trees.

The plants are characterized by the presence in most species of leaves that have an appendage (ochrea) that clasps the stem just above the base of the leafstalk. The flowers are radially symmetrical and bisexual and have a single-chambered ovary with one basally positioned ovule. The flowers are variable in the structure and number of their petallike parts and stamens (the male pollen-producing structures). The perianth (petallike parts) consists of three, four, five, or six members that are not differentiated into sepals and petals.



Polygonales
(Left) Dock (*Rumex*) and (right) knotweed (*Polygonum aviculare*)
(Left) Jeanne White—The National Audubon Society Collection/EB Inc., (right) Peter L. Ames—EB Inc.

The fruits are nearly always small, triangular, one-seeded, nutlike structures with membranous wings formed from the persistent perianth. The seeds are distributed by wind.

The largest genera include *Polygonum* (300 species); *Eriogonum* and *Rumex* (200 species each); *Coccoloba* (150 species); *Calligonum* (80 species); *Chorizanthe* (50 species); *Rheum* (25 species); and *Oxygonum* (30 species). Some botanists classify the Polygonaceae as a family of the order Caryophyllales.

The order is not of great economic importance, though there are some notable species. Buckwheat (*Fagopyrum esculentum*) is cultivated for its edible seeds and as an animal-feed plant and honey plant. The leafstalks of rhubarb (*q.v.*; *Rheum rhaponticum*) are edible, but the leaf blades are poisonous. The sea grape (*Coccoloba uvifera*), growing on beaches, produces edible fruit. Ornamental plants include the sea grape; the sacaline (*Polygonum sachalinense*); the silver-lace vine (*P. aubertii*); the fleeceflower (*P. reynoutria*, or *P. cuspidatum compactum*), an aggressive ground cover; the ribbonbush or tapeworm plant (*Homocladium platycadum*); and the coral vine (*Antigonon leptopus*). A number of common weeds and pasture plants belong to this order, for example, the common sorrel, or dock (*Rumex acetosa*), and sheep's sorrel (*R. acetosella*), both of which are sometimes used in dried flower arrangements.

polygraph: *see* lie detector.

polygyny, marriage of a man to two or more women at the same time. *See* polygamy.

polyhalite, a sulfate mineral in evaporite deposits that often occurs with anhydrite and halite. Its name, from the Greek words meaning "many salts," reflects its composition, hydrated sulfates of potassium, calcium, and magnesium. It makes up 7 percent of the rock in the salt deposits at Stassfurt, Ger., and is also abundant in the salt deposits of the Saratov region of the Soviet Union, where certain beds consist of 85 percent polyhalite. The Texas–New Mexico potash region is another noteworthy locality. For detailed physical properties, *see* sulfate mineral (table).

Polyhistor, Alexander: *see* Alexander Polyhistor.

polyhydramnios (medicine): *see* hydramnios.

Polyhymnia (Greek religion): *see* Polymnia.

polymer, any of a class of natural or synthetic substances composed of very large molecules that are multiples of simpler chemical units called monomers. Polymers make up many of the materials in living organisms, as, for example, proteins, cellulose, and nucleic acids. Moreover, they constitute the basis of such minerals as diamond, quartz, and feldspar and such man-made materials as concrete, glass, paper, plastics, and rubbers.

A brief treatment of polymers follows. For full treatment, *see* MACROPAEDIA: Chemical Compounds.

The word polymer designates an unspecified number of monomer units. When the number of monomers is very large, the compound is sometimes called a high polymer. Polymers are not restricted to monomers of the same chemical composition or molecular weight and structure. Some natural polymers, such as the proteins, are composed of one kind of monomer. Most natural and synthetic polymers, however, are made up of several different monomers.

Organic polymers play a crucial role in living things, providing basic structural materials and participating in vital life processes. For example, the solid parts of all plants are made up of polymers. These include cellulose, lignin, and various resins. Cellulose is a polysaccharide, a polymer composed of sugar molecules. Lignin consists of a complicated three-dimensional network of polymers. Wood resins are polymers of a simple hydrocarbon—a structure of carbon atoms with hydrogen atoms attached—called isoprene. Another familiar isoprene is rubber.

Other important natural polymers include the proteins, which are polymers of amino acids, and the nucleic acids, which are polymers of nucleotides—complex molecules composed of nitrogen-containing bases, sugars, and phosphoric acid. The nucleic acids carry genetic information in the cell. Starches, important sources of food energy derived from plants, are natural polymers composed of glucose.

Many inorganic polymers also are found in nature, including diamonds and graphite. Both are composed of carbon. In diamond, carbon atoms are linked in a three-dimensional network that gives the material its hardness. In graphite, used as a lubricant and in pencil "leads," the carbon atoms link in planes that can slide across one another.

Synthetic polymers are produced in different ways. Many simple hydrocarbons, such as ethylene and propylene, can be transformed into polymers by adding one monomer after another to build the polymer chain. Polyethylene, the polymer of ethylene, is an addition polymer. It may have as many as 10,000 monomers joined to form in long, coiled chains.

Polyethylene is crystalline, transluscent, and thermoplastic—*i.e.,* it softens when heated. It is used for coatings, packaging, molded parts, and for the manufacture of bottles and containers. Polypropylene is also crystalline and thermoplastic. Its molecules may consist of from 50,000 to 200,000 monomers. This compound is used in the textile industry and to make molded objects.

Other addition polymers include polybutadiene, polyisoprene, and polychloroprene, which are all important in the manufacture of synthetic rubbers. Some polymers, such as polystyrene, are glassy and transparent at room temperature, as well as being thermoplastic. Thus, polystyrene, which can be coloured any shade, is used in the manufacture of toys and other plastic objects.

Replacing one hydrogen atom in ethylene by a chlorine atom makes vinyl chloride. This polymerizes to polyvinyl chloride, a colourless, hard, tough, thermoplastic material that can be manufactured in a number of forms films, including foams, films, and fibres. Vinyl acetate, produced by the reaction of ethylene and acetic acid, polymerizes to amorphous, soft resins used as coatings and adhesives. It copolymerizes with vinyl chloride to produce a large family of thermoplastic materials.

Many important polymers have oxygen or nitrogen atoms, along with those of carbon, in the backbone chain. Among such macromolecular materials with oxygen atoms are polyacetals. The simplest polyacetal is polyformaldehyde. It has a high melting point and is crystalline and resistant to abrasion and the action of solvents. Acetal resins are more like metal than are any other plastics and are used in the manufacture of machine parts such as gears and bearings.

A linear polymer characterized by a repetition of ester groups—carbon and oxygen—along the backbone chain is called a polyester. Open-chain polyesters are colourless, crystalline, thermoplastic materials. Those with high molecular weights (10,000 to 15,000 molecules) are employed in the manufacture of films, molded objects, and fibres such as Dacron.

The polyamides include the naturally occurring proteins casein, found in milk, and zein, found in corn (maize), from which plastics, fibres, adhesives, and coatings are made. Among the synthetic polyamides are the urea-formaldehyde resins, which are thermosetting. They are used to produce molded objects and as adhesives and coatings for textiles and paper. They are also utilized in plywood and various other laminated products. Also important are the polyamide resins called nylons. They are strong, resistant to heat and abrasion, noncombustible, nontoxic, and can be coloured. Their best known use is as textile fibres, but they have many other applications.

Another important family of synthetic organic polymers is formed of linear repetitions of the urethane group. Polyurethanes are employed in making elastomeric fibres known as spandex and in the production of coating bases and soft and rigid foams.

A different class of polymers are the mixed organic–inorganic compounds. The most important representatives of this polymer family are the polysiloxanes, also called silicones. Their backbone consists of alternating silicon and oxygen atoms with organic groups attached to each of the silicon atoms. Polysiloxanes with low molecular weight are oils and greases. Higher molecular-weight species are versatile elastic materials that remain soft and rubbery at very low temperatures. They are also relatively stable at high temperatures.

Where the same name may denote a person, place, or thing, the articles will be found in that order

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polymerization, any process in which relatively small molecules, called monomers, combine chemically to produce a very large chainlike or network molecule, called a polymer. The monomer molecules may be all alike, or they may represent two, three, or more different compounds. Usually at least 100 monomer molecules must be combined to make a product that has certain unique physical properties—such as elasticity, high tensile strength, or the ability to form fibres—that differentiate polymers from substances composed of smaller and simpler molecules; often, many thousands of monomer units are incorporated in a single molecule of a polymer. The formation of stable covalent chemical bonds between the monomers sets polymerization apart from other processes, such as crystallization, in which large numbers of molecules aggregate under the influence of weak intermolecular forces.

Two classes of polymerization usually are distinguished. In condensation polymerization, each step of the process is accompanied by formation of a molecule of some simple compound, often water. In addition polymerization, monomers react to form a polymer without formation of by-products. Addition polymerizations usually are carried out in the presence of catalysts, which in certain cases exert control over structural details that have important effects on the properties of the polymer.

Linear polymers, composed of chainlike molecules, may be viscous liquids or solids with varying degrees of crystallinity; many of them can be dissolved in certain liquids, and they soften or melt upon heating. Cross-linked polymers, in which the molecular structure is a network, are thermosetting resins (they form under the influence of heat but, once formed, do not melt or soften upon reheating) that do not dissolve in solvents. Both linear and cross-linked polymers can be made by either addition or condensation polymerization.

Polymnia, also called POLYMNIS, or POLYHYMNIA, in Greek religion, one of the nine Muses, patron of dancing or geometry. She was said in some legends to have been the mother of Triptolemus, the first priest of Demeter and the inventor of agriculture, by Cheimarrhus, son of Ares, god of war, or by Celeus, king of Eleusis. In other versions, she was the mother of Orpheus, the legendary lyre-playing hero, or of Eros, the god of love.

polymorphism, in biology, any of several structural or functional variations among members of a single species. Such variations may be determined by genetic differences or by differences in the circumstances under which individual organisms live and are able to adapt. In a few characters, such as the blood groups, the differences are wholly genetic in origin, and no external influence can change them. Most characters, however, show both genetically and environmentally determined variation simultaneously. Furthermore, variation arising from genetic causes cannot be distinguished by inspection from that determined by environment. Thus an animal may be smaller than others of its species because of the genes it has received or because it is undernourished.

Genetic variation can be classified as discontinuous or continuous. In principle, discontinuous and continuous variation have the same genetic basis. Discontinuous variation is usually controlled by unit genetic determiners (alleles) of one gene or a cluster of genes; continuous variation, on the other hand, is the result of the cumulative effects of many genes, each exerting small but similar effects.

A discontinuous variation divides the individuals of a population into two or more sharply distinct forms. If the frequency of both forms is too high to be explained by mutation, the variation—as well as the population displaying it—is said to be polymorphic. The most obvious example of a discontinuous variation is the separation of most higher organisms into males and females; another is the human blood types.

In continuous, or multifactorial, variation the individuals do not fall into sharp classes but are almost imperceptibly graded between wide extremes. A familiar example is the smooth graduation of height among individuals of human populations. The relationship between polymorphic and multifactorial variation is important. In the latter, numbers of genes having small, similar, and cumulative effects operate, as in the genetic component of human height. This may allow a change to develop more easily than in the case of polymorphism, since most of the genes concerned in multifactorial variation are generally scattered in the normal population.

A specific character may, however, show both discontinuous and continuous variation within a population. Thus a human population, while showing continuous variation in height among its normal members, may simultaneously include sharply distinct dwarf or giant individuals.

Several types of nongenetic variation can be distinguished. One type occurs in adults of animal species that undergo seasonal changes in phenotype (outward, observable characteristics); the plumage of certain birds and the fur of some mammals, for example, change colour with the season. The effects of physical environment are particularly pronounced in plants. Composition of the soil, amount of sunlight, water, and other factors can affect height; size, shape, and colour of leaves; number and appearance of flowers; and other physical traits. The phenotype of some freshwater fishes is dependent upon certain physical and chemical properties of the water they inhabit—*e.g.,* temperature, acidity. The formation of genetically identical but morphologically different castes among social insects such as ants and bees is regulated by the nutrition of the larvae and other environmental conditions. Similarly, among a few butterfly species, temperature or moisture differences may give rise to highly dissimilar spring and summer forms or dry- and wet-season forms.

Because no two individuals are genetically identical in sexually reproducing species, genetic variation is important with regard to variations of the phenotype. Thus, almost any feature, be it morphological, physiological, or cytological, may vary. When the differences among individuals within a population can be divided into several classes based on the presence of certain characters, the variation, called polymorphism, is frequently controlled by one gene; however, the genetic requirements for polymorphism may be met by the segregation of a gene, a super-gene (a section of a chromosome containing more than one gene and acting as a unit), or a specialized pair of chromosomes.

polymorphism, in crystallography, the condition in which a solid chemical compound exists in more than one crystalline form; the forms differ somewhat in physical and, sometimes, chemical properties, although their solutions and vapours are identical. The existence of different crystalline or molecular forms of elements is called allotropy, although it has been suggested that the meaning of allotropy should be restricted to different molecular forms of an element, such as oxygen (O_2) and ozone (O_3), and that polymorphism be applied to different crystalline forms of the same species, whether a compound or an element. Differences in the crystalline forms of many elements and compounds were discovered during the 1820s by Eilhardt Mitscherlich, a German chemist.

Among polymorphs of certain compounds, one is more stable than the others under all conditions; in the cases of other compounds, one polymorph is stable within a particular range of temperature and pressure while another is stable under a different set of conditions. In either circumstance, the rate at which a less stable polymorph becomes more stable often is so low that an intrinsically unstable form may persist indefinitely. As an example of the first class, calcium carbonate has an orthorhombic form (*i.e.,* having three unequal crystalline axes at right angles to each other) called aragonite and a hexagonal form (having three equal axes intersecting at angles of 60 degrees and a fourth axis at right angles to these three) called calcite. Calcite is the stabler form; aragonite changes into calcite rapidly at temperatures around 470° C (about 880° F) but very slowly at room temperatures. The second class is represented by silica, which has three forms—quartz, tridymite, and cristobalite—each of which is stable only in its particular range of temperature and pressure, the others slowly changing into the stable modification.

The conditions under which synthetic crystalline substances are prepared often dictate the formation of one or another polymorph; in the manufacture of pigments, particular care is required because the colour, reflectivity, and opacity frequently vary among the polymorphic modifications of a single substance.

polymyositis, connective-tissue disease characterized by inflammation and degeneration of skeletal muscle, especially the muscles of the shoulder and pelvic girdles. In dermatomyositis, a closely related disorder, polymyositis is accompanied by an inflammation of the skin.

Polymyositis occurs in all age groups (though it is most common in the fifth and sixth decades of life) and is slightly more common in women. Involvement of the muscles of the esophagus and the larynx causes difficulty in swallowing and in uttering sounds. Heart muscle may be affected. The skin changes, which occur in approximately half the persons affected and are highly variable, include a characteristic puffiness around the eyes, with lavender discoloration of the upper eyelids and sharply demarcated reddened patches overlying the small joints of the fingers, which heal with atrophy and whitening of the skin; a rash also may occur over parts of the face, neck, shoulders, chest, and back. Calcium deposits under the skin, around the joints, and in the muscles are a common sequel to the inflammation in skin and muscle; when extensive, the condition is called calcinosis universalis.

The cause of polymyositis is unknown. Corticosteroids are used with some success, but treatment is generally long-term, and the disease may recur or reappear if the drug is discontinued.

polymyxin, any of several polypeptide antibiotics that are active against gram-negative bacteria. Polymyxins act on the cell membranes of bacteria, interrupting their function by causing a loss of intracellular material.

Only polymyxins B and E are used clinically; others damage the kidneys. Polymyxin B is somewhat toxic and therefore mostly used for severe infections. Polymyxin E, also known as colistin, is used frequently for diarrhea in children. The chief therapeutic use of the polymyxins is treating infections of gram-negative bacteria that are resistant to penicillin and aminoglycosides. They work particularly well against *Pseudomonas.*

Polynesia, ethnogeographic grouping of islands scattered across a huge triangular area of the east-central Pacific Ocean; the triangle has its apex at the Hawaiian Islands and its base angles at New Zealand and Easter Island. Polynesia (from Greek *poly,* "many," and *nēsoi,* "islands") comprises the island groups of Samoa (American Samoa and Western Samoa), the Cook Islands, French Polynesia (Tahiti and the other Society Islands, the Marquesas Islands, the Tubuai Islands, and the Tuamotu Archipelago), the island of Niue, the islands of Tokelau, Tuvalu (formerly the Ellice Islands), the islands of Tonga and of Wallis and Futuna, the Hawaiian Islands, and Pitcairn Island. New Zealand's original inhabitants, the Maori, are also Polynesian; Fiji is sometimes included in Polynesia because of the proportion of its population that is Polynesian.

A brief treatment of Polynesia follows. For full treatment, *see* MACROPAEDIA: Pacific Islands.

On the basis of both archaeological evidence and relative linguistic homogeneity, authorities believe that central Polynesia was settled by migration from Melanesia beginning some 3,000 to 4,000 years ago. Secondary migrations then occurred from the central island groups to the more remote areas of Polynesia. Samoan peoples are believed to have settled the Marquesas perhaps as early as AD 300, and Easter Island may have been settled from the Marquesas as early as AD 400. Hawaii also was settled by voyagers from the Marquesas some time in the second half of the 1st millennium AD; centuries later explorers from the Society Islands arrived. The Societies were probably the point of origin for the Polynesians who later settled the Cook Islands. Either the Marquesas or the Societies were the point of origin for the people who settled New Zealand sometime before AD 1000. The closely related Polynesian languages, spread over a vast area of the Pacific Ocean, tend to support the archaeological indication of relatively recent dispersal of Polynesian culture.

Prior to European contact, settlement of the Polynesian islands was of two types, the hamlet and the village. The larger volcanic islands in general were settled in hamlets, because food resources were diversified and spread over many environmental zones. Houses were clustered in groups of four or five, with gardens, taro patches, coconut trees, and breadfruit growing in the immediate vicinity. Village-type settlements of 30 or more houses were found, especially along the coasts, in Samoa and New Zealand. Such settlements were often fortified by walls of stone or wooden palisades. The most elaborate and impressive of fortified villages were built by the Maori of New Zealand.

Both hamlet and village settlement depended upon kinship patterns and family descent for organization. The usual Polynesian kinship pattern is based on an extended patrilineal, patrilocal family. Adoption, however, was common and social custom was flexible. In certain societies (those of Tahiti and Hawaii, for example), kinship could be traced through the female line if it conferred greater advantage; though male descent lines were preferred, in practice descent was bilateral.

The most common type of kinship-based descent group in Polynesian society was the "ramage" type, in which descent passed from firstborn son to firstborn son and was traceable back to the mythological past. The ruling chief of an independent district or island was supposed to be the most direct descendant in the senior line from the head of the family that had established itself on the land by virtue of first occupancy or conquest. Another major type of kinship-based organization, the "descent line," seems to be the result of a breakdown in the lower levels of "ramage" organization. Descent line is unconcerned with ranking based on relative position tc a particular male line of descent and with genealogical relationship of one descent line to another.

In ancient Polynesian societies, the chief, though highest in social status and clearly the repository of sacred power for the group, was regarded as the first among equals. In some Polynesian societies—such as those of Hawaii, Tahiti, and Tonga—this system gave way to a new order in which the families of the chiefs (sometimes determined by prestige or greater force) established themselves as a class apart from commoners and their position became hereditarily fixed. Their genealogies provided connections with creator gods from whom they derived their mana (superior and supernatural power). Rigid taboos, the infringement of which often involved the death penalty, were laid down to protect the chief from being familiarly approached by those not of his blood or rank and to uphold the religious system that supported him. In these societies social stratification was clear-cut, and warfare was frequent. It is also notable that in societies of this type, Christian missionaries succeeded in overthrowing ancient religious practices only after they had converted the chiefs. Because chiefly powers were deeply rooted in religious belief and made effective through religious taboos, the chiefs lost much of their hold on the people through this change. Those who let their land be taken over by foreigners lost even more power and prestige.

Religion and magic played an important role in traditional Polynesian culture. The gods of Polynesia were a complex assortment, including malevolent as well as benevolent beings, and they varied in rank and importance from those of the pantheon (who had a part in the cosmogony) to strictly local gods. Each of these beings had its own ritual requirements, and often schools of priests were required to carry them out. Among the religious practices were sacrifice (sometimes human sacrifice), chanting, great feasting, and fertility rites.

One of the key beliefs of the culture was that all things animate and inanimate possess mana. This mana was dynamic and could be damaged, sapped, or nullified by improper actions. Women especially were considered powerful (though unclean) creatures, capable of defiling the sacredness of certain tracts of land or groves and any number of inanimate objects with which they came into contact. An elaborate system of social rules was established on the principle of mana, both to protect mana and to avoid violations of taboo (tapu). Magic was also prevasive, and countless rituals regarding love, war, revenge, agriculture, and fishing were practiced.

Polynesian culture had a largely marine-based way of life, though horticulture and arboriculture were not disdained in Polynesia as they were among many other marine-based cultures. In addition to fish, mollusks and crustaceans were an important source of food. Fishing was often a group activity, with a line of men driving fish and even porpoises and whales toward shore or spreading and drawing enormous nets. Bays and lagoons were not the only source of fish; Polynesian fishermen explored vast expanses of ocean around their island homes, taking grouper, schools of tuna, and sometimes sharks and rays, which were a delicacy.

Other dietary staples and condiments were generally provided by gardens and groves. Crops of sweet potatoes, taro, breadfruit, bananas, sugarcane, and coconuts were cultivated and, depending on the particular society and growing conditions, achieved dietary importance. Kava, a nonalcoholic, euphoria-producing beverage made from the root of the pepper plant, was a favourite drink of the elders and was used ceremonially.

Food plants also provided raw material for much of Polynesian material culture. Breadfruit wood was used in canoe-making, and its sap served as caulking; the inner bark, or bast, of the breadfruit tree (as well as that of the paper mulberry plant) was soaked and beaten into cloth called tapa. Leaves of some plants were used in weaving mats, clothing, sails, and other household goods. In what they fashioned, Polynesians showed themselves consummate craftsmen and artists. The outrigger canoe, which could negotiate shallow lagoons, land over reefs, and be easily hauled ashore, was essential to island life. When a second canoe was substituted for the outrigger float, the craft became a double canoe. Both the single canoe and the double canoe were often equipped with mat sails. Very large double canoes for interisland communication or for settlement expeditions were vessels 100–150 feet (30–45 m) long, decked over and supporting a thatched house. These were capable of transporting families, domesticated animals, and plants over great stretches of ocean.

Over the course of time, each island group developed distinctive artistic skills. The ruined stone temples of the Society Islands, Easter Island, and the Marquesas indicate a fine grasp of masonry and architecture. Functional goods—canoes, war clubs, dance shields, fish hooks—were elegantly designed and meticulously decorated. In Hawaii single whale teeth were fashioned into pendants to be worn by chiefs. Bark cloth was decorated by means of bamboo stamps. Feather cloaks represented a phenomenal amount of effort in the gathering of thousands of small, rare feathers, arranging them in tufts, and tying them in overlapping rows onto a fabric of extremely fine netting. These and other objects—some of which have survived into the late 20th century—bear eloquent witness to Polynesian craftsmanship and artistry.

The exchange of goods and services among Polynesian societies was characterized by redistribution and reciprocity. This system, evident even in the late 20th century, is exemplified in early land-holding practices. In traditional Polynesian societies, land was corporately held, and sections were apportioned to various family groups. As social organization evolved, however, each island group began to develop its own methods of land distribution, some of which were determined by social class.

Contact with European culture that began in the late 1700s radically altered life in Polynesia. Spanish explorers searching for riches and eager to spread Christianity were the first Europeans to explore Polynesia. Álvaro de Mendaña de Neira landed on the Marquesas in 1595, and in 1606 Pedro Fernández de Quirós sighted the Tuamotu Archipelago and the northern Cook Islands. The Dutch arrived soon thereafter. In 1642 Abel Tasman sighted New Zealand and later Tonga. British and French exploration in Polynesia began in 1766 with the British navigator Samuel Wallis, who explored Tahiti; in the same year, the French navigator Louis-Antoine de Bougainville reached Tahiti and later the Samoan islands. The British naval officer and explorer Captain James Cook circumnavigated and charted the two major islands of New Zealand in 1769 and 1770 and later reached Tahiti. In 1778 Cook landed on the Hawaiian Islands, which he named the Sandwich Islands in honour of the earl of Sandwich. Resistance to European intervention occurred in almost all of the Polynesian islands, but such movements were brief.

Hawaii was annexed by the United States in 1898; France annexed the Marquesas and Society Islands in 1880; Chile claimed Easter Island in 1888; the British annexed New Zealand in 1840 and the Cook Islands in 1901; and Tonga remained an independent kingdom but came under British protection from 1900. By the end of the 19th century, all of Polynesia was under the control of European powers and the United States.

During the 20th century, Western Samoa achieved its independence (1962); American Samoa became a U.S. territory (1929); Hawaii became the 50th state of the United States (1959); New Zealand achieved independence (1947) within the Commonwealth; the Cook Islands became politically dependent on New Zealand; and the Marquesas Islands, Society Islands, and Tuamotu Archipelago were made the French overseas territory of French Polynesia.

Colonizers and, especially, Christian missionaries, in imposing Western belief systems and cultural ways, effectively wiped out Polynesian local traditions and customs. Most of the traditional ways were lost or amalgamated with Western ways. Of the Polynesian islands, Western Samoa and Tonga retain more of traditional culture than the others. Elsewhere, Western influence is evident nearly everywhere, particularly in the conspicuous presence of consumer goods.

The Polynesian way of life had considerable romantic appeal for many Western artists and writers because it represented to them a simple, natural way of life, free of "civilization" and bourgeois attitudes. The French painter Paul Gauguin lived and worked for several years toward the end of his life in Tahiti and the Marquesas, taking Polynesian people and culture as subjects for his paintings. Another example of this phenomenon is Herman Melville, who as a young man worked aboard a number of Pacific-bound whaling ships and wrote about his experiences in the South Seas in *Typee: A Peep at Polynesian Life* (1846) and *Omoo: A Narrative of Adventures in the South Seas* (1847).

Polynesian geographic race, a group of human populations inhabiting islands in the southern Pacific Ocean within the area bounded by Hawaii, New Zealand, and Easter Island. Characteristic of the Polynesian race are light to medium skin pigmentation, medium stature and rather stocky body build, straight to curly hair, little body hair, low incidence of blood type B (ABO system), and rather high incidence of blood type N (MNSs blood-group system). In the past, the Polynesians were thought to be a mixture of at least three racial stocks, European Caucasoid, Asian Mongoloid, and Pacific Melanesian. Though their light skin, wavy hair, and full beards suggest European ties, and their facial features sometimes suggest Mongoloid affinities, they are more or less typically Pacific in blood type, with high N and little B, no Rh-negative blood type or type A_2 in the ABO system (European traits), and not high enough B, M, or Duffy-positive blood types for close Mongoloid ties.

Polynesian languages, group of about 30 languages belonging to the Eastern, or Oceanic, branch of the Austronesian (Malayo-Polynesian) language family and most closely related to the languages of Micronesia and Melanesia. Spoken by fewer than 1,000,000 persons spread across a large section of the Pacific Ocean, the Polynesian languages show a relative homogeneity indicating that they have dispersed only in the last 2,500 years from an original centre in the Tonga-Samoa area.

The best-known Polynesian languages are Samoan, with about 200,000 speakers; Maori, spoken in New Zealand by about 100,000 persons; Tahitian, with an unknown number of native speakers but widely used as a lingua franca in French Polynesia; and Hawaiian, with only a few remaining native speakers but formerly spoken by perhaps 100,000 persons. Samoan is the national language of Western Samoa, and Tongan is the official tongue of the Kingdom of Tonga.

The Polynesian languages are notable for their scarcity of consonants; they make heavy use of vowels, distinguishing long and short forms of all vowels. One of the major features of Polynesian grammar is the reliance on particles, small separate words that function as grammatical markers of various sorts, standing before or after the words they modify, in some ways similar to English prepositions, conjunctions, and articles.

polyneuritis, also called MULTIPLE PERIPHERAL NEURITIS, inflammation of serveral peripheral nerves at the same time. A great variety of toxic and metabolic disorders can cause polyneuritis, including alcoholism, ingestion of toxic substances (such as lead or buckthorn), infectious disease, vitamin deficiency (as in beriberi), thyroid-gland disorders, and cancer. Symptoms may range from mild to severe; in general, with treatment, recovery is complete. *See also* neuritis.

polynya, also spelled POLYNIA, a semipermanent area of open water in sea ice. Polynyas are generally believed to be of two types. Coastal polynyas characteristically lie just beyond landfast ice, *i.e.,* ice that is anchored to the coast and stays in place throughout the winter. They are thought to be caused chiefly by persistent local offshore winds, such as the foehn, or katabatic (downward-driving), winds typically found off Greenland's coast. Open-ocean polynyas, the larger and longer-lasting of the two types, form within the ice cover and are believed to be caused by the upwelling of deep warmer water. This type is best exemplified by the vast Weddell Polynya in the antarctic Weddell Sea.

Polynyas are as yet incompletely understood. Early explorers who ventured into open waters often mistakenly believed they had discovered a new ocean. Since the 1970s, satellites containing microwave sensors have enabled scientists to closely observe changes in polar ice cover. Many hypotheses about the formation of polynyas have been put forward. Among the other factors thought to influence their formation are cyclones (which pile up ice on some portions of the landfast ice while drawing ice away from other boundary areas), eddies and local gyres, and swift surface currents.

Polynyas vary in size, some being as large as inland seas. One of the larger arctic polynyas, known as North Water, is centred on Smith Sound, at the northern end of Baffin Bay on the Greenland coast; it has an area of approximately 85,000 square km (33,000 square miles). Some polynyas, like that found in the Weddell Sea, have been measured at 350 by 1,000 km (215 by 620 miles); some remain open for a number of years at a time. Smaller polynyas, often recurring at the same place and time each year, may slowly get smaller and close, or they may dramatically reopen at any point in the seasonal cycle.

Polynyas support a significant ecosystem as the source of plankton, krill, and cod, and large colonies of arctic birds (including murres, kittiwakes, black guillemots, and Ross's gulls) breed nearby. Many marine mammals (walruses, seals, whales, and polar bears) also depend on the polynyas as feeding grounds and overwintering areas. Scientists also are studying the effects of polynyas on atmosphere and the processes involved in the circulation of the Earth's oceans.

polyolefin, any of a class of organic substances prepared by the addition polymerization of olefins (hydrocarbons containing one double bond per molecule), especially ethylene and propylene.

In textiles, polyolefin denotes synthetic fibre composed of at least 85 percent by weight of polyethylene or polypropylene. Trademarked fibres in this group include DLP, Herculon, Polycrest, and Vectra. Polyolefins were originally used for various plastic items and films; the fibres were not developed until the mid-1950s.

The strength of polyethylene fibres varies with type, ranging from that of nylon-6,6 to somewhat less. Polypropylenes can withstand about the same range of loads, again varying with type. Polyethylenes can be stretched about 10–40 percent beyond their original length and polypropylenes from about 15 to 30 percent, with some types having elongation up to 50 percent. Fibres can return to about 90–98 percent of their original length when stretched by about 5 percent.

The polyolefins absorb very little moisture. Polyethylenes melt at 110°–140° C (230°–280° F) and polypropylenes at about 165°–175° C (330°–350° F). Most polyolefins lose some strength upon prolonged exposure to sunlight.

The fibres are not usually affected by age, provided moderate temperatures are maintained, and they have high resistance to most chemicals. They can be washed in strong alkaline solutions and can be dry-cleaned with most common cleaning solvents. Resistance to attack by insects and microorganisms is high, and the fibres are good electrical insulators.

The polyolefins are used, alone or in blends, in hosiery, sportswear, and undergarments and in pile fabrics. They are also used in such home furnishings as upholstery, outdoor furniture, and rugs and carpeting, particularly indoor-outdoor types for both residential and public area use. Industrial applications include filters, marine cordage, automobile seat covers, electrical insulation, and carpet backing.

polyoma virus, minute infectious agent normally present in extremely small amounts in wild mice and causing no obvious ill effects. There is evidence that the virus may induce malignant tumours if grown in tissue culture and injected in sizable quantities into newborn mice or young hamsters, guinea pigs, and rabbits. The virus is highly antigenic; *i.e.,* all animals bearing its tumours also have virus-neutralizing antibodies in their blood. The virus is also capable of clumping red blood cells and affecting deoxyribonucleic acid (DNA) synthesis.

Polyoma virus is one of the infectious oncogenic (tumour-forming) viruses and belongs to the papova group of viruses. Another oncogenic virus of the same group is simian virus 40 (SV-40). Great care has to be taken to make sure that vaccine viruses grown on monkey (simian) kidney cells are not contaminated with SV-40.

polyp, in medicine, any growth projecting from the wall of a cavity lined with a mucous membrane. A polyp may have a broad base, in which case it is called sessile; or it may be a pedunculated polyp, *i.e.,* one with a long, narrow neck. The surface of a polyp may be smooth, irregular, or multilobular. The most common locations of polyps in the human body are the nose, the urinary bladder, and the gastrointestinal tract, especially the rectum and colon.

Symptoms of polyps depend upon their location and size. There may be no symptoms, or there may be symptoms resulting from pressure or from mechanical obstruction of all or part of a channel, such as that of the nose or a bowel. Polyps occasionally may bleed. Usually polyps are simple, benign growths, but a small percentage may be either precursors to cancers or may actually contain cancers. For that reason, it is advisable, when possible, to have all polyps removed and examined microscopically.

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polyp, in zoology, one of two principal body forms occurring in members of the animal phylum Cnidaria. The polyp may be solitary, as in the sea anemone, or colonial, as in coral, and is sessile (attached to a surface). The upper, or free, end of the body, which is hollow and cylindrical, typically has a mouth surrounded by extensible tentacles that bear stinging structures called nematocysts. The tentacles capture prey, which is then drawn into the mouth. The lower end of the polyp typically is adapted for attachment to a surface. The body wall consists of an ectodermal, or outer, layer and an endodermal, or inner, layer.

Hydroid polyp (*Pennaria*)
William H. Amos—Helen Wohlberg, Inc.

One class of cnidarians, anthozoans, is polypoid; most species of the other three classes (hydrozoans, scyphozoans, and cubozoans) alternate in their life cycles between polypoid and medusoid (free-swimming) body forms. *Compare* medusa.

The term polyp also is sometimes applied to an individual in a colony of invertebrate aquatic animals belonging to the phylum Bryozoa.

Polypemon (in Greek mythology): *see* Procrustes.

Polyphemus, in Greek mythology, the most famous of the Cyclops (one-eyed giants), son of Poseidon, god of the sea, and the nymph Thoösa. According to some accounts, Polyphemus loved Galatea, a Sicilian Nereid. When the Greek hero Odysseus was cast ashore on the coast of Sicily, he fell into the hands of Polyphemus, who shut him up with 12 of his companions in his cave and blocked the entrance with an enormous rock. Odysseus at length succeeded in making Polyphemus drunk, blinded him by plunging a burning stake into his eye while he lay asleep, and, with six of his friends (the others having been devoured by Polyphemus), made his escape by clinging to the bellies of the sheep let out to pasture.

polyphony, in the broadest sense, music comprising two or more relatively autonomous voices or parts (*compare* monophony, music consisting of only a single melodic line), in contrast to homophony (*q.v.*; music emphasizing chordal textures.) In polyphony the different voices are heard as separate entities and are rhythmically more or less independent of each other. Counterpoint, the combination of simultaneous lines of melody, is sometimes equated with polyphony; but the technique of counterpoint can be applied within either polyphony or homophony. Palestrina's textures are typically polyphonic, Mozart's are basically homophonic; yet both use counterpoint. More specifically, therefore, polyphony refers to multipart textures animated by the dynamic interplay of usually closely related, complementary parts. The energies thus generated (for example, in canons and fugues) are not easily brought to a halt; hence the intrusion of homophony and functional harmonic forces, especially toward the end of polyphonic compositions. In the fugues of J.S. Bach, in which polyphony and functional harmony are uniquely matched, the concluding cadence is often presaged by a pedal point, which serves as a kind of ground to which the extended polyphonic flight can return.

Purely vocal polyphony had its heyday in the 16th century, prior to the reign of functional harmony. With the latter's decline, in the first quarter of the 20th century, polyphonic textures regained much of their former prominence, especially in the dodecaphonic compositions of Arnold Schoenberg and his followers.

Consult the INDEX *first*

polyploidy, the condition in which a normally diploid cell or organism acquires one or more additional sets of chromosomes. In other words, the polyploid cell or organism has three or more times the haploid chromosome number. Polyploidy arises as the result of total nondisjunction of chromosomes during mitosis or meiosis.

Polyploidy is common among plants and has been, in fact, a major source of speciation in the angiosperms. Particularly important is allopolyploidy, which involves the doubling of chromosomes in a hybrid plant. Normally a hybrid is sterile because it does not have the required homologous pairs of chromosomes for successful gamete formation during meiosis. If through polyploidy, however, the plant duplicates the chromosome set inherited from each parent, meiosis can occur, because each chromosome will have a homologue derived from its duplicate set. Thus, polyploidy confers fertility on the formerly sterile hybrid, which thereby attains the status of a full species distinct from either of its parents. It has been estimated that up to half of the known angiosperm species arose through polyploidy, including some of the species most prized by man. Plant breeders utilize this process, treating desirable hybrids with chemicals, such as colchicine, that are known to induce polyploidy.

Polyploid animals are far less common, and the process appears to have had little effect on animal speciation.

Polypodiaceae, one of several families in the fern order Polypodiales. The family contains 30 to 50 genera (depending on the authority consulted) and more than 1,000 species of diverse and widely distributed medium-sized and small ferns. Some earlier classification systems have recognized as many as 170 genera and 7,000 species in the family, most of which are now placed in other families. This entire larger group is still often referred to as polypodiaceous ferns, however, because all exhibit certain characteristics considered to be evolutionarily advanced; *i.e.,* long-stalked, spore-producing structures (sporangia) characterized by the presence of an incomplete, vertically arranged band of thick-walled cells (annulus). In addition, members of the presently recognized family are mostly tropical and subtropical epiphytes (plants not rooted in soil but growing upon other plants) with a rootlike creeping stem (rhizome) covered with distinctive scales. The lower surfaces of the leaves bear round or oblong clusters of sporangia (sori) that usually lack the protective membranous covering (indusium) found in many other fern families. The genera are distinguished by numerous characteristics such as presence and type of plant hairs on stems and leaves, arrangement of sori, rhizome type, growth habit, and others. The limits of the family and many of its included genera are still in need of study. Some of the chief genera include *Polypodium* (true polypodies, 75 species), *Platycerium* (staghorn ferns [*q.v.*], 17 species), *Pleopeltis* (40 species), *Loxogramme* (40 species), *Microsorium* (60 species), and *Pyrrosia* (100 species).

Polypody (*Polypodium*)
Leonard Lee Rue III

The dwarf polypodies (*Grammitis,* about 150 species; *Ctenopteris,* about 200 species; and 7 other genera) are sometimes included in the family Polypodiaceae, but recent opinion favours their separation into a closely related family, Grammitidaceae.

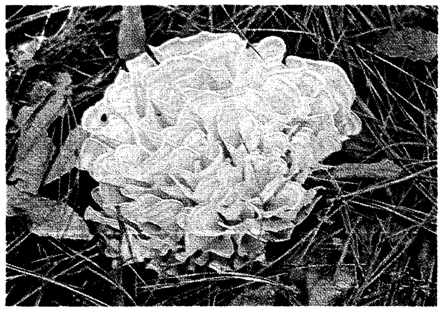
Economically, the family is of little importance except for the few grown as ornamentals, the most popular of which are the staghorn ferns and true polypodies.

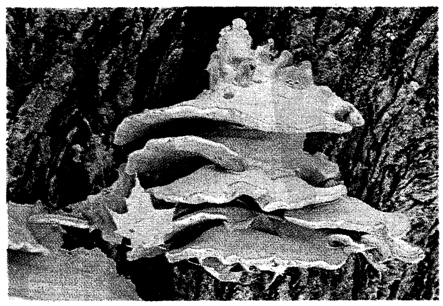
Polyporales, the large pore fungus order of fungi (division Mycota) within the class Basidiomycetes. (It is sometimes relegated to family rank, Polyporaceae, in the order Agaricales.) The 1,000 known species have conspicuous sporophores (fruiting bodies), sometimes mushroomlike, the spore-bearing layer (hymenium) appearing either tube-shaped, gill-like, rough, smooth, or convoluted. Many species are found on the ground or on decaying wood. Some species are edible; others cause diseases of trees.

The order includes the coral (club) fungi (Clavariaceae), shelf, or bracket, fungi (Polyporaceae), and the cantharelles (Cantharellaceae). About 500 widely distributed species of coral fungi are known. They are edible, but not delectable, and have an upright growth habit with branches. Coral fungi are found mostly in late summer and autumn on soil or decaying wood. Representative genera include *Clavaria* (25 species), *Pistillaria* (50 species), *Pterula* (50 species), *Rumaria,* and *Typhula* (40 species).

Shelf, or bracket, fungi produce a shelf-like fruiting structure on many trees. They cause decay of birch and other hardwoods and of structural timbers (certain *Poria* species); conifer rot, heart rot, and root rot of rubber plants (*Fomes*); wood decay and root rot of cacao, coffee, rubber, and other trees (*Ganoderma*); and diseases of birch and conifers (*Polyporus*). The white undersurface of artist's fungus (*Fomes applanatus*), which darkens when cut, has been used for etching.

The inedible birch fungus *Polyporus betulinus* causes decay on birch trees in the northern United States. Dryad's saddle (*P. squamosus*) produces a fan- or saddle-shaped mushroom. It is light coloured with dark scales, has a strong odour, and grows on many deciduous trees. The edible hen of the woods (*P. frondosus*), which grows on old trees and stumps, produces a cluster of grayish mushrooms with two or three caps on a stalk; the undersides of the caps are porous. The sulfur mushroom, *P.* (*Laetiporus*) *sulphureus,* a common, shelf-like fungus that grows on dead wood, derives its name from its sulfur-yellow colour; only the younger portions of the fruiting body are edible.





Polyporales
(Top) sponge fungus (*Sparassis herbstii*) and (bottom) artist's fungus (*Fomes applanatus*)
(Top) L.N. and Anella Dexter, (bottom) Mary W. Ferguson

The hedgehog fungus is the common name for species of the genera *Dentinum* (*Hydnum*) and *Hericium. Hydnum repandum,* an edible, whitish mushroom with toothlike structures hanging from the cap, occurs on decaying organic matter in autumn.

The horn of plenty (*Craterellus cornucopioides*), also called the trumpet of death, is a member of the family Cantharellaceae. Common in the woods in late summer, it is edible when young and turns black with age and when cooked. Another cantharelle, the chanterelle (*Cantharellus cibarius*), an edible mushroom yellow-orange in colour and with a pleasant odour, is found in woods during summer and autumn.

The genus *Schizophyllum* of the family Schizophyllaceae consists of five species. *S. commune* is a very common and widespread whitish mushroom that grows on decaying wood. The cap has split edges. Sponge fungus is the common name for five species of the genus *Sparassis* (family Sparassidaceae). *S.*

crispa and *S. radicata* produce at the base of trees in autumn a large (up to 20 kilograms, or about 44 pounds), edible fruiting body like a gray to buff cluster of lettuce.

Beefsteak fungus (*Fistulina hepatica*) of the family Fistulinaceae is an edible species found on oaks and other trees in the autumn. Its name derives from its colour, which resembles that of raw beef. It causes a stain on oaks called brown oak.

polyrhythm, also called CROSS-RHYTHM, the simultaneous combination of contrasting rhythms in a musical composition. Rhythmic conflicts, or cross-rhythms, may occur within a single metre (*e.g.*, two eighth notes against triplet eighths) or may be reinforced by simultaneous combinations of conflicting metres. The latter effect is characteristic of numerous non-Western musical forms (*e.g.*, Indonesian gamelan) and of certain Western, especially American, compositions.

Polyrhythmic and polymetric textures are in fact among the stylistic earmarks of such American composers as Charles Ives and his disciple Elliott Carter. Polyrhythm is also prevalent in American jazz and related Afro-American phenomena, including rock music.

polysaccharide, also called GLYCAN, the form in which most natural carbohydrates occur. Polysaccharides may have a molecular structure that is either branched or linear. Linear compounds such as cellulose often pack together to form a rigid structure; branched forms (*e.g.*, gum arabic) generally are soluble in water and make pastes.

Polysaccharides composed of many molecules of one sugar or one sugar derivative are called homopolysaccharides (homoglycans). Homopolysaccharides composed of glucose include glycogen and starch, the storage carbohydrates of animals and plants respectively; and cellulose (*q.v.*), the important structural component of most plants. Preparations of dextran, a glucose homopolysaccharide found in slimes secreted by certain bacteria, are used as substitutes for blood plasma in treating shock. Other homopolysaccharides include pentosans (composed of arabinose or xylose) from woods, nuts, and other plant products; and fructans (levans) composed of fructose, such as inulin from such roots and tubers as the Jerusalem artichoke and dahlia. Mannose homopolysaccharides occur in ivory nuts, orchid tubers, pine trees, fungi, and bacteria. Pectins, found in fruits and berries and used commercially as gelling agents, consist of a derivative of galacturonic acid (itself a derivative of the sugar galactose). The repeating unit of chitin, a component of the outer skeleton of arthropods (*e.g.*, insects, crustaceans) is *N*-acetyl-D-glucosamine, a compound derived from glucose; shells of arthropods such as crabs and lobsters contain about 25 percent chitin. It is also found in certain structures of annelid worms, mollusks, and other invertebrate groups (*e.g.*, jellyfishes, bryozoans, nematodes, and acanthocephalans). The cell walls of most fungi also are chitin. Chitin in nature is linked to protein.

Polysaccharides consisting of molecules of more than one sugar or sugar derivative are called heteropolysaccharides (heteroglycans). Most contain only two different units and are associated with proteins (glycoproteins; *e.g.*, gamma globulin from blood plasma, acid mucopolysaccharides) or lipids (glycolipids; *e.g.*, gangliosides in the central nervous system). Acid mucopolysaccharides are widely distributed in animal tissues. The basic unit is a so-called mixed disaccharide consisting of glucuronic acid linked to *N*-acetyl-D-glucosamine. The most abundant mucopolysaccharide, hyaluronic acid from connective tissue, is also the major component of joint fluid (synovia) and occurs in the soft connective tissue (Wharton's jelly) of the umbilical cord of mammals. Glucuronic acid linked to *N*-acetyl-D-galactosamine is the repeating unit of chondroitin sulfate, a heteropolysaccharide found in cartilage. Heparin, a heteropolysaccharide related to the acid mucopolysaccharides, has anticoagulant properties and is present in connective and other tissues.

Complex heteropolysaccharides occur in plant gums such as gum arabic from *Acacia* and gum tragacanth from *Astragalus.* Most contain glucuronic acid and various sugars. Produced after either mechanical damage to bark (a method used in commercial production) or an attack on the bark by certain bacteria, insects, or fungi, plant gums are used in the arts (gum arabic) and as an adhesive agent and emulsifying agent (gum tragacanth). Heteropolysaccharides also occur in bacterial cell walls.

polysiloxane: *see* silicone.

polystyrene, an important member of the class of synthetic organic polymers, composed of long-chain molecules prepared by a chemical reaction in which many (usually 2,000–3,000) molecules of the aromatic hydrocarbon styrene become linked together.

Large-scale manufacture of polystyrene was begun in the late 1930s; usually the styrene is dispersed in water with the aid of soap, and the polymerization reaction is initiated by free-radical catalysts. The product, an inexpensive, strong, thermoplastic (softened by heat) resin that resists attack by acids, alkalies, and many solvents, does not absorb water and is an excellent electrical insulator.

Addition of rubber latex to the suspension in which polystyrene is made greatly increases its resistance to impact. By the mid-1960s, more than half the polystyrene made in the United States was produced by this process. Polystyrene has numerous uses, as in making housings for such large household appliances as refrigerators and air conditioners.

polysulfide, any member of a class of chemical compounds containing one or more groups of atoms of the element sulfur linked together by covalent bonds. In inorganic compounds belonging to this class, these groups are present as ions having the general formula S_n^{2-}, in which *n* is a number from 3 to 10 or more; these compounds usually are prepared by dissolving sulfur in solutions containing the sulfide ion, S^{2-}. Sodium polysulfides are used in the tanning industry to remove hair from hides; lime-sulfur and sulfurated potash, prepared by heating sulfur with lime and potash, respectively, are mixtures containing polysulfides, used as insecticides and pesticides.

Sodium polysulfide, in which *n* has a value around 4, has been used as a starting material in the preparation of rubbery or resinous synthetic organic substances called Thiokols. The molecules of these products consist of long chains in which polysulfide groups alternate with small organic groups capable of forming two covalent bonds. They can be converted by heating with zinc oxide to tough, resilient materials used to make hoses and linings for storage tanks and in other applications requiring resistance to chemical and physical attack; they also have been used as solid fuels for rockets. Thiokols also can be prepared as aqueous dispersions useful for forming protective coatings on surfaces such as wood, metal, or concrete or for preparing caulking compositions.

polysulfone, any of a class of resinous organic chemical compounds belonging to the family of polymers in which the main structural chain most commonly consists of benzene rings linked together by sulfonyl ($-SO_2-$), ether ($-O-$), and isopropylidene ($-C(CH_3)_2-$) groups.

The polysulfone resins, introduced in the 1960s, are tough, strong, stiff, and resistant to decomposition by heat or chemical attack. They retain their mechanical properties over a wide temperature range (−70° to 150° C, or about −95° to 300° F) and are used as wire coatings, for fabricating household and plumbing items, and for automotive parts.

Polytechnical Museum, Russian POLITEKHNICHESKY MUZEY, in Moscow, museum of science and technology that emphasizes the history of Soviet science and technology and contemporary developments and inventions. The museum was founded in 1872 after the first Russian technical exhibition on the bicentennial anniversary of the birth of Peter the Great. The building housing the museum was completed in 1877. It includes some foreign exhibitions.

polytetrafluoroethylene (PTFE), a strong, tough, waxy, nonflammable resin belonging to the family of organic polymers, substances composed of large molecules formed by chemical combination of many small ones (monomers) into chains or networks. Known by the abbreviation PTFE or the trade name Teflon, it is distinguished by its complete indifference to attack by almost all chemicals and by its slippery surface; it retains its physical properties over a wide temperature range (−270° to 250° C, or −450° to 480° F). These qualities suit polytetrafluoroethylene to uses in gaskets, bearings, linings for containers and pipes, and parts for valves and pumps that must operate in corrosive environments and for protective coatings on cooking utensils, saw blades, and other articles.

Polytetrafluoroethylene forms upon treating tetrafluoroethylene with oxygen; the monomer is made by heating chlorodifluoromethane at about 600°–750° C (about 1,100°–1,400° F). The chemical and physical properties of PTFE necessitate a special technique for fabricating it into solid articles: a suspension of the powder in a diluent is molded into the desired shape, the diluent is removed by evaporation, and the object is consolidated by sintering (heating to a temperature sufficient to cause the particles to adhere to each other without actually melting).

Polymerization of mixtures of tetrafluoroethylene and hexafluoropropylene yields rubbery products that have high resistance to heat and chemical attack; these substances, called Viton, are used in gaskets and sealing devices.

polytheism, the belief in many gods, which, as opposed to the monotheism of Judaism, Christianity, and Islām, has characterized nearly all other religions throughout history. The many gods may be subordinate to a supreme god and object of devotion (as in some stages of Hinduism), or subordinate to some higher state, end, or saviour (as in Buddhism), or subordinate to one god that is dominant though not supreme (as in Greek religion). In addition to belief in many gods, polytheistic cultures generally also include belief in many other malevolent or benevolent spiritual forces or powers, which are unlike the gods in that they are usually unnamed and conceptually indefinite.

A brief treatment of polytheism follows. For full treatment, *see* MACROPAEDIA: Religious and Spiritual Belief, Systems of.

The gods and powers of polytheism appear in many different forms. Religions often identify the forces and objects of nature as deities. The common threefold breakdown of these nature-deities as celestial, atmospheric, and earthly is exemplified by the Indo-Aryan triad of Sūrya (sun), Indra (rain and battle), and Agni (fire). In hunting and agrarian cultures, religious fertility rites usually acknowledge the vitality of the sun in the rhythm of growth and decay. Furthermore, the sun is frequently viewed as all-knowing, just as the sky is associated with creation; thus sky gods tend to be very powerful and knowledgeable, and mythic thought often associates creation with light. The divine mother who gives birth to plant life is a primary earthly god. Particular features of a religious group's environment also often take on divine significance; thus, the sacred mountains, such as Mt. Olympus in Greece, and the sacred rivers, such as the Ganges in India.

Plants and animals figure prominently in most polytheistic schemes, either explicitly deified or in association with deities in other forms. Trees have commonly been regarded as having a symbolic relation to earth and heaven. Most important plant gods are associated with cultivated plants, such as corn (maize) in Central America and the vine of the Mediterranean world; in the Dionysian cult of the classical period, for instance, ecstasy and agriculture were symbolically united in the vine. Animals may be represented in the divine scheme on the basis of their importance to the livelihood of the culture or, more commonly, attributes associated with their appearance or behaviour.

In addition to the forces and objects of nature, various social and other functions, such as healing, seafaring, war, learning, or love, may be divinized. Of special importance are the gods concerned with death and judgment after death, such as Osiris in ancient Egypt, Yama in India, Hades in Greece, and Hel in Norse religion.

Anthropomorphism, or the modelling of the gods in the form of human beings, is a widespread phenomenon in polytheism. This is evident especially in the religious tradition of the Greeks, in which the gods are fully human in their thoughts and emotions. In some cases, human beings may take on the attributes of divinity, either through their manifestation of power or through their identification with deities; divine kingship was a characteristic feature of the ancient Middle East, the Roman world, Japan, and China. Cultural heroes have frequently been elevated to a semidivine status, and sages in the Buddhist and Jain traditions have become objects of cults.

polytonality, in music, the simultaneous occurrence of two or more different tonalities or keys (the interrelated sets of notes and chords used in a composition). If only two keys are employed, the term bitonality is sometimes used.

Polytonality first appeared in music of the early 20th century. Stravinsky's *Petrushka* (1911) employs "black keys against white" (in terms of the piano keyboard), combining C major and F♯ major. Sergey Prokofiev's *Sarcasms for piano* juxtaposes the keys of F♯ minor in the right hand and B♭ minor in the left, while Darius Milhaud's *Saudades do Brasil* combines a melody in C with an accompaniment in A♭ major. Such combinations of tonalities may be reviewed as 20th-century extensions of diatonic harmonic practices, following logically from post-Wagnerian chromaticism.

polyurethane, any of a class of synthetic resinous, fibrous, or elastomeric compounds belonging to the family of organic polymers made by the reaction of diisocyanates (organic compounds containing two functional groups of structure −NCO) with other difunctional compounds such as glycols. The best known polyurethanes are flexible foams—used as upholstery material, mattresses, and the like—and rigid foams—used for such lightweight structural elements as cores for airplane wings.

Foamed polyurethanes result from the reaction of diisocyanates with organic compounds, usually polyesters, containing carboxyl groups; these reactions liberate bubbles of carbon dioxide that remain dispersed throughout the product. Use of polyethers or polyesters containing hydroxyl groups in preparing polyurethanes results in the formation of elastomeric fibres or rubbers that have outstanding resistance to attack by ozone but are vulnerable to the action of acids or alkalies.

In textiles the synthetic fibre known generically as spandex is composed of at least 85 percent polyurethane by weight. Such fibres are generally used for their highly elastic properties. Trademarked fibres in this group are Lycra, Numa, Spandelle, and Vyrene. Such fibres have, for many textile purposes, largely replaced natural and synthetic rubber fibres.

Although somewhat weak in the relaxed state, spandex fibres can be stretched about 500–610 percent beyond their original length without breaking and quickly return to their original length. The fibre, usually white with dull lustre, is readily dyed. It absorbs very little moisture. It melts at about 250° C (480° F) and yellows upon prolonged exposure to heat or light. Items made of spandex can be machine washed and dried at moderate temperatures. Use of chlorine bleach can produce yellowing. Spandex fibres are frequently covered with other fibres such as nylon.

Spandex is used in such apparel as foundation garments, support hosiery, and swimsuits. It is light in weight and cool; it is resistant to deterioration from body acids; and it is easily laundered and quick-drying.

polyvinyl acetate, a colourless, water-insoluble resin belonging to the family of organic polymers, prepared by treating its monomer, vinyl acetate, with peroxide catalysts. In its most important application, polyvinyl acetate comprises the film-forming ingredient of water-based (latex) paints; it also is used in adhesives, lacquers, and cements and as the starting material for making polyvinyl alcohol (*q.v.*).

Polyvinyl acetate resins are thermoplastic (they soften upon heating) and flammable; they dissolve in certain organic compounds, including methanol, benzene, butyl acetate, and methyl ethyl ketone.

polyvinyl alcohol, a colourless, water-soluble, flammable resin belonging to the family of organic polymers. The resin is used in sizing agents that confer resistance to oils and greases upon paper and textiles, to make films resistant to attack by solvents or oxygen, as a component of adhesives and emulsifiers, and as a starting material for the preparation of other resins.

Polyvinyl alcohol is made by treating polyvinyl acetate (*q.v.*) with acids or alkalies, which remove the acetate groups without disrupting the long-chain structure of the molecule. If this reaction is allowed to proceed to completion, the product is highly soluble in water and insoluble in practically all organic solvents. Incomplete removal of the acetate groups yields resins less soluble in water and more soluble in certain organic liquids.

The chemical properties of polyvinyl alcohol resemble those of simpler alcohols; the reactions with aldehydes are particularly useful in the preparation of additional resinous substances. Polyvinyl formal, made by the reaction with formaldehyde, and polyvinyl acetal, from acetaldehyde, are employed in making lacquers, coatings, and films; polyvinyl butyral, from butyraldehyde, is produced as a tough, clear, adhesive, and water-resistant film widely used in laminating glass to make it shatterproof (safety glass) and for similar applications.

polyvinyl chloride (PVC), a synthetic resin belonging to the family of polymeric organic compounds, manufactured by treating vinyl chloride (*q.v.*) with a peroxide catalyst, usually in aqueous suspension or emulsion. After mixing with plasticizers, stabilizers, and pigments, the resin may be fabricated by techniques such as calendering, molding, or extrusion into flexible articles such as raincoats, shower curtains, and packaging films. The resin is not plasticized for use in making rigid products such as water pipe, plumbing fittings, and phonograph records.

For use in making piping or structural panels that require high resistance to impact, polyvinyl chloride often is blended with small proportions of rubbery synthetic polymers. Resins more easily plasticized than polyvinyl chloride can be prepared by adding various proportions of vinyl acetate to vinyl chloride before polymerizing the mixture; stiffer resins result from treatment of polyvinyl chloride with chlorine.

polyvinyl fluoride, a synthetic resin belonging to the family of organic polymers. It is a tough material resistant to attack by chemicals or by weathering, produced by treating vinyl fluoride (*q.v.*) under pressure in the presence of oxygen and peroxide catalysts. It is commonly manufactured in the form of films for use in coating such surfaces as siding for buildings or pipes used for transporting corrosive chemicals.

polywater: *see* anomalous water.

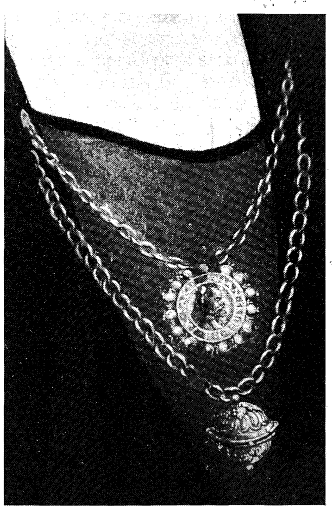
Polyxena, in Greek mythology, a daughter of Priam, king of Troy, and his wife, Hecuba. After the fall of Troy, she was claimed by the ghost of Achilles, the greatest of the Greek warriors, as his share of the spoils and was therefore put to death at his tomb. In post-classical times the story was elaborated to include a love affair between Polyxena and Achilles before his death.

polyzoan (aquatic invertebrate): *see* moss animal.

Polzone, Scipio: *see* Pulzone, Scipione.

pomace fly: *see* vinegar fly.

pomander, small metal (sometimes china) container designed to hold a ball of aromatic spices or herbs. Worn suspended from neck or girdle or attached to the finger by a ring, it was believed to be a protection against infections and noxious smells. As fashionable jew-



Pomander (bottom), detail from "Portrait of a Man," oil painting by Lucas Cranach the Younger, 1543; in the Staatsgalerie Stuttgart, Germany

By courtesy of the Staatsgalerie Stuttgart, Ger.

elry in the late Middle Ages, pomanders were decorative objects often enriched with gems and enamels. Late in the 16th century, the original sphere shape was divided into several segments in order to accommodate a variety of powdered spices, and soon afterward pomanders in the form of dice, skulls, and books appeared.

They were succeeded in the 18th century and 19th century by the vinaigrette. In the 20th century, inexpensive pomanders are made by encrusting an orange with whole dried cloves. *See also* pouncet-box.

Pomare, Sir Maui, in full SIR MAUI WIREMU PITA NAERA POMARE (b. Jan. 13, 1876, Pahou Pa, N.Z.—d. June 27, 1930, Los Angeles), Maori statesman and physician whose public-health work helped revive New Zealand's Maori population, which had declined nearly to extinction by the late 19th century.

Pomare was educated at Te Aute College in Hawkes Bay, where he helped form the Young Maori Party. He became a Maori health officer in 1900 and worked to improve medical care and hygiene in Maori settlements in an effort to overcome resistance to European medical practices. Largely through Pomare's efforts, the Tohunga Suppression Act (1907) was passed, which prohibited unqualified medical treatment in native communities.

As a member of Parliament from 1911 to 1930 and minister for the Maori race (1912–28), Pomare helped form two royal commissions that allowed the Taranaki Maori to buy back their ancestral lands and compensated tribes that had lost land in the Waitara district. His term as minister of health (1923–26) under William F. Massey was noted for the reorganization of New Zealand's mental hospitals. As minister for the Cook Islands (1916–28), Pomare helped to improve the islands' educational and legal systems and fought monopoly trading interests. After his health declined in 1928, he collaborated with James Cowan in writing *The Legends of the Maori.*

He was knighted in 1922.

Pomatorhinidae, scimitar babbler family of noisy birds, based on the genus *Pomatorhinus*—in this encyclopaedia classified as part of the babbler family (Timaliidae, *q.v.*).

Pombal, Sebastião de Carvalho, marquês de (marquess of), in full SEBASTIÃO JOSÉ DE CARVALHO E MELLO, MARQUÊS DE POMBAL, also called (1759–69) CONDE (count) DE OEIRAS (b. May 13, 1699, Lisbon—d. May 8, 1782, Pombal, Port.), Portuguese reformer

Pombal, engraving by João S. Carpinetti, 1759
By courtesy of the Biblioteca Nacional, Madrid

and virtual ruler of his country from 1750 to 1777.

Sebastião was the son of Manuel de Carvalho e Ataíde, a former cavalry captain and former nobleman of the royal house. The elder Carvalho died relatively young, and Sebastião's mother remarried. Sebastião's uncle, Paulo de Carvalho, who was professor at the Universidade de Coimbra, archpriest of the patriarchal see, and a person of political influence, enrolled his nephew in that institution. But Sebastião abandoned his studies to enlist in the army, in which he reached the humble rank of corporal. Disillusioned with the army, he quit and dedicated himself to the study of history and law and was later admitted, at the age of 34, to the Academia Real da História Portuguesa.

In 1733 he married Teresa Maria de Noronha e Almada, a widow, niece of the Conde de Arcos. They moved to the village of Soure, near Coimbra, where he had property. There he dedicated himself to his studies and to agriculture. In 1738 he returned to Lisbon. His uncle now recommended him to João da Mota, prime minister for King John V, who appointed him Portuguese ambassador to England. His wife, in poor health, was unable to accompany him; she died in 1739.

His diplomatic career opened wider political horizons for him. He distinguished himself by the zeal with which he conducted several negotiations. And, for the seven years he stayed in London, Carvalho carefully studied English political, social, and economic practices.

After returning to Lisbon in 1745, Carvalho was immediately appointed ambassador plenipotentiary to Vienna, with the mission of serving as mediator in the solution of a serious quarrel between the Holy Roman empress Maria Teresa and the Vatican. The probabilities of success were very slight, but he overcame all obstacles, winning the sympathy of the Empress and the love of Eleonora von Daun, daughter of the Graf von Daun, whom he married in December 1745. The Austrian climate was bad for his health, however, and he submitted his resignation and returned to Lisbon at the end of 1749.

As King John V did not like him, Carvalho's progress was temporarily halted. But soon after John's death on July 31, 1750, he was called by Queen Maria Ana, the King's widow, of whom he was a favourite, and was appointed to one of the royal councils. The heir to the throne, Prince Joseph, on being crowned king, made him a minister, along with two other favourites. He soon came to dominate Portuguese politics and the new monarch gave him a free hand. Thus began what may be termed the reign of the Marquês de Pombal.

Carvalho instituted domestic administrative reforms and succeeded in elevating Portugal's prestige in external politics. He granted England privileges that entitled it to receive large amounts of gold in exchange for manufactured articles. On the other hand, he stimulated national industry, forbidding the exportation of certain raw materials and developing the manufacture of silk, woollens, ceramics, and glass. Aiming at the development of commerce in the Orient, he founded a company for trade with India, similar to England's but which, however, was unsuccessful. But he was successful in another, similar enterprise—the Companhia do Grão-Pará—aimed at stimulating trade with Brazil.

His reforming activity was interrupted by a catastrophe, the earthquake of Nov. 1, 1755. Two-thirds of Lisbon was reduced to rubble. Carvalho mobilized troops, obtained supplies, and had shelters and hospitals improvised. The day after the catastrophe, he was already outlining ideas for reconstruction. With architect Eugênio dos Santos' plans, old medieval Lisbon was changed into one of the most beautiful European cities.

Carvalho's firm and effective handling of the crisis enhanced his prestige and strengthened even further his position with the King. But his ascendancy had from the beginning created envy and animosity among two very powerful and influential groups: the high nobility and the Society of Jesus. On the night of Sept. 3, 1758, an unsuccessful attempt was made on the King's life. This served as a pretext for Carvalho to rid himself of his enemies among the nobility and Jesuits, whom he accused of conspiracy. The court, influenced by him, attributed the crime to the Duque de Aveiro and to other members of the Távora family. On Jan. 12, 1759, they were tortured to death. Carvalho then began persecuting members of the Society of Jesus. Almost all were deported to Rome, but some were imprisoned, along with many noblemen who were confined without proof of guilt.

Sebastião de Carvalho's power had become absolute. He was created conde de Oeiras in 1759 and continued to enact reforms, including the reform of university education, the initiation of commercial education, the creation of trading companies, and the reorganization of the army. In September 1769 the King conferred on him the title of Marquês de Pombal.

Upon the death of King Joseph on Feb. 24, 1777, however, all the Marquês' power vanished. Under the new queen, Maria I, political prisoners were freed, and Pombal was accused of having abused his powers. He was found guilty by a judicial tribunal that subjected him to severe interrogation from October 1779 to January 1780. Queen Maria then banished him from Lisbon, and he retired to Pombal, where he died in 1782. (M.J.D.)

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pomegranate, fruit of *Punica granatum,* a bush or small tree of Asia, which with a little-known species from the island of Socotra constitutes the family Punicaceae. The plant, which may attain 5 or 7 metres (16 or 23

Pomegranate (*Punica granatum*)
Walter Dawn

feet) in height, has elliptic to lance-shaped, bright-green leaves about 75 millimetres (3 inches) long and handsome axillary orange-red flowers borne toward the ends of the branchlets. The calyx is tubular and persistent and has five to seven lobes; the petals are lance-shaped, inserted between the calyx lobes. The ovary is embedded in the calyx tube and contains several compartments in two series, one above the other.

The fruit is the size of a large orange, obscurely six-sided, with a smooth, leathery skin that ranges from brownish yellow to red; within, it is divided into several chambers containing many thin, transparent vesicles of reddish, juicy pulp, each surrounding an angular, elongated seed. The fruit is eaten fresh, and the juice is the source of grenadine syrup, used in flavourings and liqueurs.

Throughout the Orient, the pomegranate has since earliest times occupied a position of importance alongside the grape and the fig. According to the Bible, King Solomon possessed an orchard of pomegranates, and, when the children of Israel, wandering in the wilderness, sighed for the abandoned comforts of Egypt, the cooling pomegranates were remembered longingly. Centuries later, the prophet Muḥammad remarked, "Eat the pomegranate, for it purges the system of envy and hatred."

While the pomegranate is considered indigenous to Iran and neighbouring countries, its cultivation long ago encircled the Mediterranean and extended through the Arabian Peninsula, Afghanistan, and India. It is commonly cultivated in the Americas from the warmer parts of the United States to Chile.

Though the pomegranate grows in a wide range of climates, good fruit is produced only where high temperatures and dry atmosphere accompany the ripening period. Deep, rather heavy loams appear to be the best soils. Seeds can readily be grown, but choice varieties are reproduced by cutting and layerings. Commercial propagation is performed by taking hardwood cuttings 250–300 mm (10–12 inches) long and rooting them in the open ground.

pomelo: *see* grapefruit.

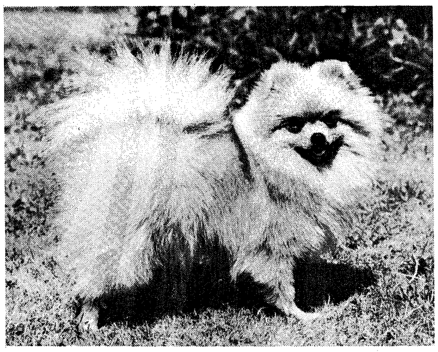
Pomerania, Polish POMORZE, German POMMERN (from Slavic *po,* "along"; *morze,* "sea"), historic region of northeastern Europe lying along the Baltic coastal plain between the Oder and the Vistula rivers. Politically, the name also came to include the area west of the Oder as far as Stralsund, including the island of Rügen (Rugia). Most of Pomerania is now part of Poland, but its westernmost section is in eastern Germany, as reflected in the name of Mecklenburg-West Pomerania *Land* (state). The region is generally flat, and there are numerous small rivers and, along the east coast, many lakes.

Pomerania was inhabited successively by Celts, Germanic tribes, and, by the 5th century AD, the Slavic Pomeranians (Pomorzanie) and Polabs. Mieszko I, prince of Poland (d. 992), mastered it, and in 1000 his successor, Bolesław I the Brave, organized a diocese in Pomerania with its seat at Kołobrzeg. A local dynasty then ruled Pomerania and also the region to the west, later called Mecklenburg. On the death of Duke Swiatobor in 1107, his three sons each inherited a district: Bogusław I received the eastern area, later called Hinterpommern (Pomerania Ulterior, or Eastern Pomerania), including Gdańsk (Danzig); Warcisław I received the western area, Vorpommern (West Pomerania) including Wołogoszcz (Wolgast); and Ratibor obtained the central area including Szczecin (Stettin). German immigration into the western and central regions of Pomerania began in the late 12th century. This resulted in the Germanization of the towns and later of the nobility and the countryside.

Until the 17th century, Polish dukes ruled western and central Pomerania (the duchies of Wolgast and Stettin) under the suzerainty of the Holy Roman Empire. The elector of Brandenburg acquired these duchies in 1637, when the last Polish duke, Bogusław XIV, who had united them, died without issue. Sweden received Western Pomerania by the Peace of Westphalia (1648); part of it was returned to Brandenburg-Prussia in 1720, and the remainder (Stralsund and Rügen) was recovered by Prussia in 1815. Prussia united western and central Pomerania into one province called Pommern.

Eastern Pomerania was held by the Teutonic Knights from 1308 to 1454, when it was reconquered by Poland. In 1772 it was annexed by Prussia and made into the province of West Prussia. Part of it was restored to Poland after World War I; and the remainder, together with central Pomerania, became Polish in 1945. The German population of eastern and central Pomerania was expelled westward and replaced by Poles. Western Pomerania was incorporated into the German Democratic Republic.

Pomeranian, breed of toy dog that can be traced back, like the related Keeshond, Samoyed, and Norwegian elkhound, to early



Pomeranian
Sally Anne Thompson—EB Inc.

sled-dog ancestors. The breed is named for the duchy of Pomerania, where, in the early 19th century, it is said to have been bred down in size from a 30-pound (13.5-kilogram) sheep dog. Characteristically spirited but docile, the Pomeranian is a compactly built dog with a foxlike head and small, erect ears. Its long coat, especially full on the neck and chest, may be any of a variety of colours, including white, black, brown, and reddish brown. The Pomeranian stands about 6 to 7 inches (14 to 18 cm) high and weighs about 3 to 7 pounds (1.5 to 3 kg).

Pomeranian Lakeland, Polish POJEZIERZE POMORSKIE, lake district, northwestern Poland. Located immediately south of the Baltic coastal plain, the 20,000-square-mile (52,000-square-kilometre) lakeland is bounded by the lower Oder River on the west, the ancient river valley occupied by the modern Warta and Noteć rivers on the south, and the lower Vistula River on the east. Owing to the gentle descent of the land to the west as well as northward to the Baltic, the drainage pattern of the district is characterized by rivers that drain alternately from south to north and from east to west. As a result, a trellised, or grid, pattern of valleys dissects the region into rectangular blocks. The region abounds with marshes and streams and has considerably more than 1,000 lakes. Consequently, it is covered with sandy deposits consisting of postglacial outwash, morainal hills, and fluvial material.

The soil of the area is rather acidic and is deficient in humus. In the western part, brown forest soils have developed on the glacial till. In the eastern part, near the Vistula River delta, there are heavier and more fertile soils yielding rye, potatoes, and fodder crops. Important urban centres of the district are Szczecin, Piła, and Bydgoszcz.

pomerium (from Latin *post-moerium,* "behind the wall"), in ancient Rome, a sacred open space located just inside the wall surrounding the four hills—the Esquiline, the Palatine, the Quirinal, and the Capitoline—of the early city. In most Italian walled cities, such spaces, which ran along the complete length of the city walls, were originally left clear to facilitate the maneuvering of defenders in times of attack. This space was later invested with religious significance, being dedicated to the gods in gratitude for their protection, and building and planting upon it remained forbidden. Rome rapidly expanded beyond its pomerium, but the legendary date of its demarcation—April 21—continued to be celebrated as the anniversary of the city's foundation.

pomfret, any of the approximately 35 species of marine fishes constituting the family Bramidae (order Perciformes), with representatives occurring in the Atlantic, Pacific, and Indian oceans. Most are relatively rare. Members of the family are characterized by a single dorsal fin, extending the length of the body in some species. Most species are deep-bodied and have deeply forked tails. Young pomfrets often differ markedly in body and fin form from adults of their species. The blunt-headed Pacific pomfret (*Brama japonica*) ranges abundantly throughout the north Pacific. The bigscale pomfret (*Taractichthys longipinnis*) of the Atlantic Ocean, the largest species in the family, reaches a length of 90 cm (35 inches).

Pomigliano d'Arco, town, in Napoli *provincia,* Campania *regione,* southern Italy, at the northern foot of Vesuvius. It is an agricultural centre with a castle dating from the 15th century. An air-force flight-training establishment is nearby. The town is the site of an automobile factory established in 1970, one of the most important development projects in the Mezzogiorno. Pop. (1987 est.) mun., 41,358.

pommel horse (gymnastics): *see* side horse.

pommer (musical instrument): *see* bombard.

Pommern: *see* Pomerania.

Pomo, Hokan-speaking Californian Indians of the west coast of the United States. Their territory was centred in the Russian River valley some 50 to 100 miles (80 to 160 km) north of what is now San Francisco. The Pomo's territory also included the adjacent coastlands and the interior highlands near Clear Lake. A small, detached group lived in the Sacramento River valley surrounded by Wintun (*q.v.*).

The Pomo were a wealthy people, well-supplied with food and other natural resources. Fish, waterfowl, deer, acorns, bulb plants, and other food were plentiful. Northeastern settlements held a lucrative salt deposit. Southeastern settlements had magnesite, a substance that, along with ground shells, was made into beads used as standard currency in north-central California. Pomo basketry, considered by some to be the finest in California, was exceptionally well twined and intricately ornamented, using various woody materials, beads, and coloured feathers. Their housing depended on locale: coastal people constructed dwellings of heavy timber and bark; inland peoples built various types of dwellings out of such materials as poles, brush, grass, and tule mats.

The Pomo practiced the Kuksu cult, a ceremonial religion involving secret societies, esoteric dances and rituals, and impersonations of spirits. There were also ceremonies for such things as ghosts, coyotes, and thunder.

There were probably about 900 Pomo remaining in the late 20th century, living in some 20 communities in their original territory.

Consult the INDEX *first*

Pomona (island, Scotland): *see* Mainland.

Pomona, city, Los Angeles county, southern California, U.S., in the Pomona Valley at the base of the San Gabriel Mountains. Once part of the Rancho San José, it was promoted

(1875) as an agricultural centre and named for the Roman goddess of fruit. Development was sustained by railroad links and artesian irrigation. By mid-20th century rapid residential and industrial growth paralleled the expansion of the Los Angeles metropolitan area. Pomona is the home of California State Polytechnic University (1938). Inc. city, 1888. Pop. (1980) 92,742.

Pomorze: *see* Pomerania.

pompadour, style of dressing the hair in which the front hair is rolled back and the side hair up to meet it in a roll drawn high over the forehead; also a type of bodice that is cut square and low over the bosom. The styles

Woman with a pompadour, detail of "The Misses Acheson," oil painting by John Singer Sargent, *c.* 1900; in the Devonshire Collection, Chatsworth, Derbyshire, Eng.

By courtesy of the Devonshire Collection, Chatsworth, Eng., by permission of the trustees of the Chatsworth Settlement; photograph, Mattershaw

were introduced by Madame de Pompadour, mistress of Louis XV of France, and imitated by members of his court.

Dressing the hair with a pompadour was favoured in the opening years of the 20th century. Men brushed the front hair back, and women used pads or other devices to create the raised pompadour, thus giving the illusion of a mass of puffy hair.

Pompadour, Jeanne-Antoinette Poisson, marquise de (marchioness of), byname MADAME DE POMPADOUR, also called (1741–45) JEANNE-ANTOINETTE LE NORMANT D'ÉTIOLES (b. Dec. 29, 1721, Paris—d. April 15, 1764, Versailles, Fr.), influential mistress (from 1745) of the French king Louis XV and a notable patron of literature and the arts.

Early years. Her parents were on the fringes of a class gaining in importance, speculators in the world of finance. Some of these people made immense fortunes, but many ended in the gutter if not in prison. Her father, François Poisson, involved in a black-market scandal, had to flee the country in 1725; his beautiful wife and two small children were then looked after by a more fortunate colleague, Le Normant de Tournehem. Both children were clever, and the girl was fascinating; she was educated to be the wife of a rich man. In those days rich men, even if they came from a low class, were interested in art and literature, and they expected their wives to share these interests.

By the time Mademoiselle Poisson was of an age to marry, she could hold her own in any society and had made friends with many distinguished men, including Voltaire. Le Normant de Tournehem arranged a match for her with his own nephew, Charles-Guillaume

Madame de Pompadour, detail of a portrait by François Boucher; in the National Gallery of Scotland, Edinburgh

By courtesy of the National Galleries of Scotland, Edinburgh

Le Normant d'Étioles, a rising young man; they had a little girl, Alexandrine. Madame d'Étioles became a shining star of Parisian society and was admired by the King himself. In 1744 Louis XV's young mistress, the Duchesse de Châteauroux, died suddenly. She was soon replaced by Madame d'Étioles, who obtained a legal separation from her husband and was created marquise de Pompadour.

Nineteenth-century historians thought that Madame de Pompadour had complete ascendancy over Louis XV. These post-Revolution writers were concerned with portraying the Bourbon monarchs as poor creatures; it is now generally admitted that Louis XV was a much more able man than he has been painted. Shy and introspective, he had difficulty in communicating with people whom he did not know well. Madame de Pompadour acted as his private secretary, but, although she gave the orders, the decisions were made by the King.

She began her reign at Versailles modestly. She was lodged in a few rooms under the roof; she set out to make herself agreeable to all those who counted for anything in the palace, beginning with Queen Marie (Maria Leszczyńska). Marie could hardly have been a more unsuitable wife for the handsome, artistic, sensual, and pleasure-loving Louis XV. Eight years older than he, she was preoccupied with the welfare of her father (a deposed king of Poland), with childbearing, and with religion. After giving birth to an heir to the throne (and eight or nine other children between 1727 and 1737), she let the King understand that she had no wish to remain sexually intimate with him.

After five romantic years in her attic, Madame de Pompadour moved downstairs to a regal apartment. Louis XV now began to take other mistresses, but Madame de Pompadour was more firmly established than ever before; favours, promotions, and privileges could be obtained only through her good offices.

Artistic and political collaboration with Louis. Her collaboration with the King was twofold, artistic and political. The artistic side was wholly successful. On her suggestion, her brother was appointed director of the King's buildings and created marquis de Marigny; the brother, the sister, and Louis XV, working in perfect harmony, planned and built the École Militaire and the Place Louis XV (now the Place de la Concorde) in Paris, most of the palace of Compiègne, the Petit Trianon Palace at Versailles, a new wing at the palace of Fontainebleau, and the exquisite Château de Bellevue, as well as many pavilions and summer houses. He and his mistress patronized all forms of decorative art: painters, sculptors, cabinetmakers, and craftsmen worked under the royal eye; the famous porcelain factory was built at Sèvres. Madame de Pompadour's 20 years of power marked the very apogee of taste in France. The protector of most of the authors and the editor of the *Encyclopédie,* she would have liked to do for literature what she did for the arts, but the King had no literary interests and disliked the intellectuals whom he knew.

The political collaboration between the King and his mistress was much less successful than the artistic, mainly because the French politicians and generals of the day were of such poor calibre. The Duc de Choiseul, by far the ablest of the ministers, was Madame de Pompadour's protégé. He was brought in to implement the famous Reversal of Alliances, which allied France with its old enemy Austria against the German Protestant principalities. This was a statesmanlike conception, but it was unpopular and led to the Seven Years' War, disastrous to France. Frederick the Great crushed the huge, incompetently led French and Austrian armies, while the English were driving the French out of Canada. All these defeats were laid at the door of Madame de Pompadour. She fell prey to melancholy, and soon after the end of the war she died, in the spring of 1764, probably of cancer of the lung, in her apartment at Versailles. One of her last actions was to get Louis XV's support for the revision of the Calas case, a gross miscarriage of justice in which Voltaire was interested. Voltaire said of her:

> I mourn her out of gratitude . . . Born sincere, she loved the King for himself; she had righteousness in her soul and justice in her heart; all this is not to be met with every day.

(Na.M.)

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pompano (*Trachinotus*), any of several marine fishes of the family Carangidae (order

Florida pompano (*Trachinotus carolinus*)

Robert Redden—Animals Animals

Perciformes). Pompanos, some of which are highly prized as food, are deep-bodied, toothless fishes with small scales, a narrow tail base, and a forked tail. They are usually silvery and are found along shores in warm waters throughout the world. The Florida, or common, pompano (*T. carolinus*), considered the tastiest, is a valued commercial food fish of the American Atlantic and Gulf coasts and grows to a length of about 45 centimetres (18 inches) and weight of 1 kilogram (2 pounds). The blue and silver great pompano (*T. goodei*), or permit, is found off Florida and the West Indies.

The African pompano, or threadfish, also of the family Carangidae, is *Alectis crinitis* of the Atlantic and eastern Pacific oceans. It is about 90 centimetres (35.5 inches) long and, especially when young, has very long, threadlike rays extending from the dorsal and anal fins.

The Pacific pompano (*Peprilus simillimus*) is a food fish of the butterfish (*q.v.*) family.

Pompeii, ancient city of Campania, Italy, 14 miles (23 kilometres) southwest of Naples, near Mt. Vesuvius, built on a spur formed by a prehistoric lava flow to the north of the mouth of the Sarnus (modern Sarno) River. Pompeii was destroyed, together with Herculaneum and Stabiae (*qq.v.*), by the violent eruption of Mt. Vesuvius in AD 79; the circumstances of their preservation make their remains a unique document of Greco-Roman life. The modern town of Pompei (pop. [1981 prelim.] 22,896) lies to the east; it contains the basilica of Santa Maria del Rosario, a pilgrimage centre.

History. It seems certain that Pompeii, Herculaneum, and Stabiae were first settled by the Oscans, who were descendants of the Neolithic inhabitants of Campania. Archaeological evidence indicates that the Oscan village of Pompeii, strategically located near the mouth of the Sarnus River, soon came under the influence of the cultured Greeks who had settled across the bay in the 8th century BC. Greek influence was challenged, however, when the Etruscans came into Campania in the 7th century. The Etruscans' influence remained strong until their sea power was destroyed by King Hieron I of Syracuse in a naval battle off Cumae, in 474 BC. A second period of Greek hegemony followed.

Then, toward the end of the 5th century, the warlike Samnites, an Italic tribe, conquered Campania, and Pompeii, Herculaneum, and Stabiae became Samnite towns. Coinage suggests that a century later the city of Nuceria was the head of a league to which Pompeii, Herculaneum, and Stabiae may have belonged.

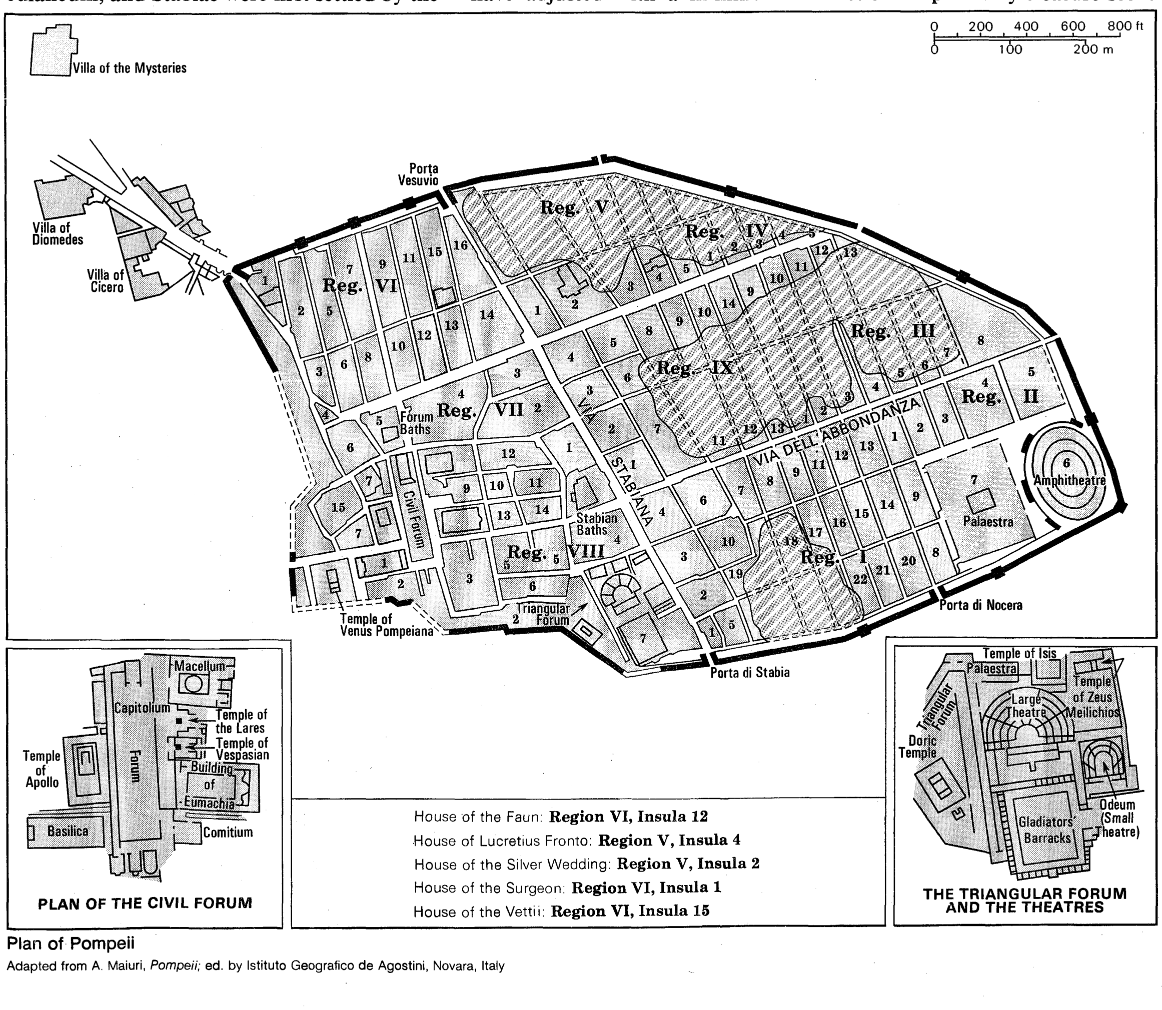
Pompeii is first mentioned in history in 310 BC, when, during the Second Samnite War, a Roman fleet landed at the Sarnus port of Pompeii and from there made an unsuccessful attack on Nuceria. At the end of the Samnite Wars, Campania became a part of the Roman confederation, and the cities became "allies" of Rome. But they were not completely subjugated and Romanized until the time of the Social War (the war of the *socii,* or "allies"). Pompeii joined the Italians in their revolt against Rome in this war and was besieged by the Roman general Lucius Cornelius Sulla in 89 BC. After the war, Pompeii, along with the rest of Italy south of the Po, received Roman citizenship. As a punishment for Pompeii's part in the war, a colony of Roman veterans was established there under Publius Sulla, the nephew of the Roman general. After initial difficulties, Pompeians and colonists seem to have adjusted with a minimum of friction. Latin now replaced Oscan as the official language, and the city soon became Romanized in institutions, architecture, and culture.

A riot in the amphitheatre at Pompeii between the Pompeians and the Nucerians, in AD 59, is reported by the Roman historian Tacitus. An earthquake in AD 62 did great damage in both Pompeii and Herculaneum. The cities had not yet recovered from this catastrophe when final destruction overcame them 17 years later.

Mt. Vesuvius erupted on Aug. 24, AD 79. A vivid eyewitness report is preserved in two letters written by Pliny the Younger to Tacitus, who had inquired about the death of Pliny the Elder, commander of the Roman fleet at Misenum. Pliny the Elder had died at Stabiae while trying to rescue friends. When the eruption ceased on the second day, Pompeii was covered with lapilli (volcanic debris) and ashes to a depth of 19 to 23 feet (6 to 7 metres). The villas at Stabiae, at a greater distance from Vesuvius, did not have as deep a covering. At Herculaneum the avalanche of volcanic materials carried along by torrents of water hardened into a kind of mud-lava that penetrated everywhere and covered the city up to a depth of 65 feet.

History of excavations. The ruins at Pompeii were first discovered late in the 16th century by the architect Domenico Fontana, who tunnelled under the hill known as La Cività to bring water from the Sarno River to the town of Torre Annunziata. Excavation of the buried cities began first at Herculaneum, in 1709, during Austrian occupation. Work did not begin at Pompeii until 1748, and in 1763 an inscription ("*rei publicae Pompeianorum*") was found that identified the site as Pompeii.

Excavations have continued intermittently until the present. Earlier digging was haphazard and often irresponsible; excavators were primarily treasure seekers, hunting for impos-



Plan of Pompeii

Adapted from A. Maiuri, *Pompeii;* ed. by Istituto Geografico de Agostini, Novara, Italy ing buildings or museum objects. Haphazard digging was brought to a stop in 1860, when the Italian archaeologist Giuseppe Fiorelli became director of the excavations. Areas lying between excavated sites were cleared and carefully documented. Pompeii was divided into nine Regions; the insulae (blocks) in each Region were numbered, and each door on the street was given a number so that each house could be conveniently located by three numbers (*see* plan). Fiorelli also developed the technique of making casts of bodies by pouring cement into the hollows formed in the volcanic ash when the bodies disintegrated. This technique is also used to make casts of ancient doors, furniture, and roots.

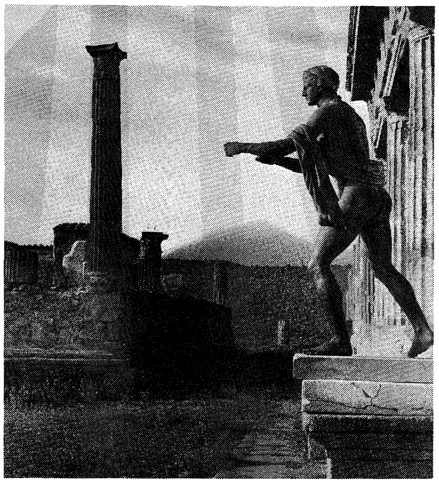
In 1951, after the interruption caused by World War II, intensive excavation was resumed under Amedeo Maiuri, who was in charge of the excavations from 1924 to 1961. Large areas to the south of the Via dell'Abbondanza in Regions I and II were uncovered, and the debris piled outside the city walls was cleared away. This revealed the Porta (Gate) di Nocera and an impressive stretch of cemetery lining each side of the road leading from the gate to Nuceria. By the late 20th century, about three-fourths of the city had been excavated.

In the vicinity of Stabiae and Gragnano, excavations initiated by Charles IV discovered 12 villas between 1749 and 1782. Work was not resumed again until the present century, and it is still in progress. The Villa of San Marco, with its two large peristyle gardens and bath, is the best preserved. Other villas have been found near Gragnano, in the vicinity of Pompeii, and at nearby Scafati, Domicella, Torre Annunziata, and on the lower slopes of Vesuvius near Boscoreale and Boscotrecase. Many of these villas were reburied after excavation, but a few can be seen, notably the Villa of the Mysteries.

Description of the remains. The city of Pompeii was shaped irregularly because of the prehistoric lava flow on which it was built. Excavations indicate that the southwestern part of the town was the oldest, but scholars are not agreed as to the stages by which the walls were expanded, or by whom. The walls are two miles (three kilometres) in circumference, and they enclose an area of about 155 acres (63 hectares). They were probably given their final boundaries after the Samnites took over Pompeii, but there is evidence of Greek influence. Seven city gates have been excavated. The chief street running in a southeast–northwest direction was the Via Stabiana; it connected the Porta Vesuvio (144 feet [44 metres] above sea level), in the highest part of the city, with the Porta di Stabia (26 feet [8 metres]), in the lowest part of town. Through this gate came traffic from the Sarnus River and Stabiae. This street was crossed by two other main streets, the Via dell' Abbondanza and the Via di Nola.

The public buildings are for the most part grouped in three areas: the Forum (elevation 110 feet [34 metres]), located in the large level area on the southwest; the Triangular Forum (82 feet [25 metres]), standing on a height at the edge of the south wall overlooking the bay; and the Amphitheatre and Palaestra, in the east.

The Forum was the centre of the religious, economic, and municipal life; it was a large rectangular area surrounded by a two-storied colonnaded portico. Dominating the Forum on the north was the temple dedicated to the Capitoline triad of deities: Jupiter, Juno, and Minerva. To the east was the Macellum, or large provision market; to the south were the small sanctuary of the city Lares (guardian deities), built after the earthquake in AD 62; the Temple of Vespasian; and the imposing headquarters of the woollen industry, erected by the wealthy patroness Eumachia. Opposite the Capitolium on the southern end of the Forum were the meeting place of the city council and the offices of the magistrates of the city. The large basilica, with its main room surrounded on four sides by a corridor, is the most architecturally significant building in the city and of considerable importance in studying the origin and development of the Christian basilica. It served as a covered exchange and as a place for the administration of justice. To the west was the Temple of Venus Pompeiana, patron deity of Pompeii.



Temple of Apollo, Pompeii, with Mt. Vesuvius in the background
Edwin Smith

Across from the basilica was the Temple of Apollo, one of the oldest in the city. Subsoil excavations here give evidence for Greek and Etruscan influence.

The Triangular Forum is the site of the Doric Temple, the oldest temple in the city. Between the 3rd and the 1st century, a theatre, a palaestra, and a small covered theatre were built to the east of the Triangular Forum. The temples of Zeus Meilichius and of Isis, and the old Samnite palaestra, were nearby. In the east corner of Pompeii was the Amphitheatre; the oldest so far known, it was built after the Roman colony was established at Pompeii. To the west a large palaestra was built to replace the old Samnite palaestra. Baths were scattered throughout the town: the Stabian Baths (which date before the Roman period), the Forum Baths, the Central Baths—still under construction at the time of the eruption—and many baths in luxurious private homes.

But more significant than the public buildings, which have been excavated at other sites, are the hundreds of private homes. These are unique, for only at Pompeii is it possible to trace the history of domestic architecture for at least four centuries. The earliest houses date from the First Samnite period (4th–3rd century BC). The House of the Surgeon is the best known example of the early atrium house built during this period.

The most luxurious houses were built during the Second Samnite period (200–80 BC), when increased trade and cultural contacts resulted in the introduction of Hellenistic refinements. The House of the Faun occupies an entire city block, has two atria (chief rooms), four triclinia (dining rooms), and two large peristyle gardens. Its facade is built of fine-grained gray tufa from Nuceria, the chief building material of this period. The walls are decorated in the Incrustation, or First Pompeian, style of painting, which imitates marble-veneered walls by means of painted stucco. The famous Alexander the Great mosaic found in the House of the Faun is probably a copy of a lost Hellenistic painting. Many of the houses from this period were decorated with elaborate floor mosaics. The House of the Silver Wedding, with its imposing high-columned atrium, was also built during this period, but it underwent later alterations. The handsome banquet hall and the exedra, which served as a schoolroom for children of the family, were decorated in the Second Pompeian, or Architectural, style, which was popular from 80 BC to AD 14.

The large number of houses built during the Samnite period made it necessary to build fewer houses in the Roman period. Those that were built were usually less imposing, with lower atria, but with more elaborate decoration. The House of Lucretius Fronto is a small but elegant house of the Roman Imperial period. The tablinum (master's office) is decorated in especially fine Third Pompeian, or Egyptianizing, style, usually dated from the early empire to the earthquake. The House of the Vettii is typical of the homes of the prosperous merchant class of the Roman period. Some of its rooms are decorated in the Fourth Pompeian, or Ornamental, style.

The atrium-peristyle house, with its handsome paintings, elegant furniture, beautiful gardens with fountains and bronze and marble sculptures, is not as typical as has generally been supposed. There are also numerous small homes throughout the city, many of them shop houses. Excavators now preserve as completely as possible all aspects of ancient life. The homes of the humble are as informative as those of the wealthy. Roofs, second stories, and balconies can now be restored.

Influence on European culture. The discoveries at Pompeii and other sites buried by the Vesuvian eruption had a profound influence on European taste. News of the excavations kindled a wave of enthusiasm for antiquity that spread throughout Europe. The laudatory pronouncements of the eminent German classicist Johann Joachim Winckelmann, who made his first trip to Naples in 1755, and the etchings of Giambattista Piranesi did much to popularize the excavations. Naples, Pompeii, and Herculaneum became important stops on the European Grand Tour made by English visitors, who found an enthusiastic guide and a well-informed amateur archaeologist in Sir William Hamilton, ambassador to the Naples court from 1764 to 1800, and a captivating hostess in his second wife, Lady Emma Hamilton.

Artists, architects, potters, and even furniture makers drew much inspiration from Pompeii. Contemporary painted interiors were inspired by the frescoed walls found in the excavations. The stucco work popularized in England by the 18th-century architects Robert and James Adam used the same motifs. The famed potter Josiah Wedgwood changed the style of his work and named his factory "Etruria," sharing the mistaken belief that Pompeii was Etruscan. In France, the Louis XVI style incorporated Pompeian motifs, and the apartment of Louis's queen, Marie Antoinette, at Fontainebleau was decorated in this style, which became popular throughout Europe. Jacques-Louis David and his student Jean-Auguste-Dominique Ingres drew inspiration for their paintings from the excavations. Indeed, the Neoclassic style stimulated by the discoveries at Pompeii completely replaced the Rococo and became the artistic style of the French Revolution and of the Napoleonic period.

Importance as historical source. The extent of the archaeological sites makes them of the greatest importance, for they provide a unique source of information about so many aspects of social, economic, religious, and political life of the ancient world. The many well-preserved house shrines give a hitherto unexpected picture of the vitality of religion in the family. The bakeries, complete with mills, kneading machines, and ovens, some still containing loaves of bread, show how this staple of everyday life was produced. Numerous fulleries (processing and cleaning plants for wool) make it possible to study this important industry. The shops of the sculptor, toolmaker, and gem cutter, as well as the *garum* (fish sauce) and the lamp factories and the many wine and food shops, document other aspects of ancient life. Pompeii was a busy port town that exported products throughout the Mediterranean. Merchants and tradesmen found food and lodging near the city gates and the Forum. Some restaurants and inns were quite attractive and served food to guests who reclined in the garden; in the cheaper places, the rooms were small and dark and customers sat on stools.

Inscriptions provide further information. They include monumental inscriptions on public buildings, tombs, and statue bases; the business transactions recorded in the famous wax tablets of the banker Lucius Caecilius Jucundus; announcements of gladiatorial combats; and many election notices, echoes of hotly fought contests. Preserved in the graffiti are accounts, lists of market days, the exchanges of lovers, quotations from Virgil, and even the scratched alphabets of children. Epigraphical and archaeological evidence makes it possible to study the stratification of society and learn more of the freedmen, slaves, small businessmen, and aristocrats of the ancient Roman world.

Further, Pompeii offers the best opportunity for the study of city planning and land use in an ancient city. Recent excavations have revealed an unexpected amount of open land. The large insula across from the Amphitheatre was not the Foro Boario (Cattle Market), as had been long supposed, but a vineyard. Many vineyards, fruit trees, and gardens have been found, indicating less intensive land use and a smaller population than had been thought.

Unfortunately, the excavations are constantly endangered by the ravages of weather and destructive vegetation. Of first importance is the preservation, restoration, and study of the valuable evidence already uncovered before it is lost forever.

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Pompeius Magnus, Gnaeus: *see* Pompey the Great.

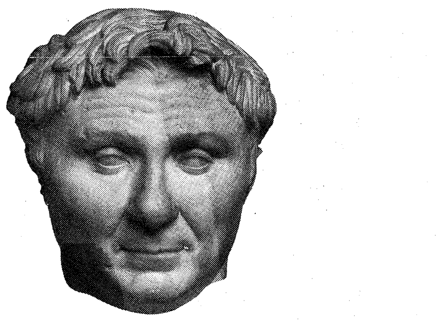
Pompeius Magnus Pius, Sextus (b. *c.* 67 BC—d. 35 BC, Miletus), younger son of the Roman general Pompey the Great, and a vigorous opponent of Pompey's Caesarian rivals.

After his father was killed in the Civil War (49–45 BC) against Julius Caesar, Pompeius fled to Spain, where he continued the struggle against Caesar's forces. Following the assassination of Caesar in 44, Pompeius came to terms with Mark Antony and was given a naval command, but in August 43 he was outlawed. For the next several years he ravaged the coast of Italy with his fleet. Occupying Sicily and blockading Italy, he helped Mark Antony against Octavian and, after they renewed their agreement, forced them to make a formal treaty with him, appointing him governor of Sicily and other islands and of Achaea (39). When these promises were not carried out, Pompeius renewed the war and, after some striking successes against Octavian, was decisively defeated by Octavian's friend Agrippa at Naulochus (near Messina, Sicily, 36). He fled to Asia Minor but was captured and executed by the Roman general Marcus Titius.

Pompe's disease, also called GLYCOGENOSIS TYPE II, hereditary defect in the body's ability to metabolize glycogen, resulting in a muscle disorder that is usually fatal during the first year of life. The defect responsible, absence of the enzyme alpha-1,4-glucosidase, is extremely rare, occurring in fewer than one in every 150,000 births, and is transmitted as an autosomal recessive trait. In Pompe's disease, glycogen accumulates in all body tissues, but especially in the muscles, causing enlargement of the heart, cardiac muscle failure, and breathing difficulties. Accumulation of glycogen in other tissues causes mental retardation and enlargement of the liver and spleen. Death usually results from cardiorespiratory failure. Juvenile and adult forms, with similar but milder symptoms, are also known.

Pompey THE GREAT, Latin in full GNAEUS POMPEIUS MAGNUS (b. Sept. 29, 106 BC, Rome—d. Sept. 28, 48 BC, Pelusium, Egypt), one of the great statesmen and generals of the late Roman Republic, a triumvir (61–54 BC), the associate and later opponent of Julius Caesar. He was initially called Magnus (the Great) by his troops in Africa (82–81 BC).

Early career. Pompey belonged to the senatorial nobility, although his family first achieved the office of consul only in 141.



Pompey, bust *c.* 60–50 BC; in the Ny Carlsberg Glyptotek, Copenhagen
By courtesy of Ny Carlsberg Glyptotek, Copenhagen

Fluent in Greek and a lifelong and intimate friend of Greek literati, he must have had the normal education of a young Roman nobleman; but his early experience on the staff of his father, Pompeius Strabo, did much to form his character, develop his military capabilities, and arouse his political ambition. The family possessed lands in Picenum, in eastern Italy, and a numerous body of clients, which Strabo greatly enlarged in the year of his consulship. In a civil war (88–87) between the rival generals Lucius Sulla and Gaius Marius, Strabo defied Sulla and favoured the Marians and a fellow general.

After his father's death, however, Pompey detached himself from the Marians. A report that he was "missing" in Cinna's army, when it was embarking for the Balkans to deal with Sulla, led to the lynching of Cinna by his troops (84). Pompey's part in this mutiny is unclear; he next appears with three legions recruited in Picenum, joining Sulla as an independent ally in the campaign to recover Rome and Italy from the Marians (83). Sulla made ample use of his youthful ally's military abilities. Pompey married Sulla's stepdaughter. On Sulla's orders the Senate gave Pompey the job of recovering Sicily and Africa from the Marians—a task he completed in two lightning campaigns (82–81). Pompey ruthlessly executed Marian leaders who had surrendered to him. To his enemies he was Sulla's butcher; to the troops he was "Imperator" and "Magnus." From Africa Pompey demanded that a triumph be given him in Rome; he refused to disband his army and appeared at the gates of Rome, obliging Sulla to yield to his demand. After Sulla's abdication, Pompey supported the renegade Sullan Marcus Lepidus for the consulship of 78. Once in office Lepidus attempted revolution, and Pompey promptly joined the forces of law and order against him. The rising crushed, however, Pompey refused to disband his army, which he used to bring pressure on the Senate to send him with proconsular power to join Metellus Pius in Spain against the Marian leader Sertorius.

The reconquest of Spain taxed Pompey's military skill and strained his own and the state's resources to the utmost. In the end it was he, not Metellus, who imposed on Spain a settlement reflecting and promoting his own political aims. His policy was one of reconciliation and rehabilitation. His personal authority and patronage now covered Spain, southern Gaul, and northern Italy. Unlike Metellus, Pompey took his army back to Italy with him, ostensibly to assist in putting down a slave revolt led by Spartacus, but in reality to secure a triumph and election to the consulship for 70. The nobles whom Sulla had restored to power had proved to be more corrupt and incompetent than ever. Pompey promised reforms at home and abroad. A bargain was struck with his rival Marcus Licinius Crassus, the two were jointly elected consuls, and Pompey was given another triumph.

Reorganization of the East. Although the nobles were to continue to dominate the consular elections in most years, the real sources of power henceforth lay outside of Italy. Extraordinary commands would have to be created if Rome was to recover control of the sea from pirates. It was Pompey who benefitted most from the restoration of tribunician initiative. After his consulship, he waited in Rome while rival nobles undermined the position of Lucius Licinius Lucullus, who was campaigning against Mithradates in Anatolia, and made halfhearted attempts to deal with the pirates. Finally, in 67, the tribune Aulus Gabinius forced a bill through the popular assembly empowering Pompey to settle the pirate problem.

Pompey was still in the East, resettling pirates as peaceful farmers, when in Rome another tribune, Gaius Manilius, carried through, against weakened opposition, a bill appointing Pompey to the command against Mithradates, with full powers to make war and peace and to organize the whole Roman East (66). Pompey displaced Lucullus and lost no time defeating Mithradates in Asia Minor. After the death of Mithradates in 63, Pompey was free to plan the consolidation of the eastern provinces and frontier kingdoms. For 6,000 talents he set up King Tigranes in Armenia as a friend and ally of Rome—and as his own protégé. Pompey rejected the Parthian king's request to recognize the Euphrates as the limit of Roman control and extended the Roman chain of protectorates to include Colchis, on the Black Sea, and the states south of the Caucasus. In Anatolia, he created the new provinces of Bithynia-Pontus and Cilicia. He annexed Syria and left Judaea as a dependent, diminished temple state. The organization of the East remains Pompey's greatest achievement. His sound appreciation of the geographical and political factors involved enabled him to impose an overall settlement that was to form the basis of the defensive frontier system and was to last, with few important changes, for more than 500 years.

Pompey's power and prestige were at their height in December 62, when he landed at Brundisium (Brindisi) and dismissed the army. His third triumph (61) trumpeted the grandeur of his achievement. The following decade was the period of his ascendancy in Italy, an ascendancy that was to be eroded through Caesar's growing military power and gradual capture of Pompey's worldwide *clientelae,* from the power base Caesar, in turn, created in northern Italy and Gaul. Pompey's inveterate enemies in Rome were the Optimates, the inner ring of nobles, not Crassus or Caesar, who had merely tried to steal the limelight in Pompey's absence and to manoeuvre into a better position for bargaining with their former political ally. The nobles meanwhile had gradually reasserted their dominance in Rome and hampered attempts to alleviate the condition of Italy and the Roman populace. Once back in Italy, Pompey avoided siding with popular elements against the Optimates. He was no revolutionary. He wanted all classes to recognize him as first citizen, available for further large-scale services to the state. He had divorced his third wife, Mucia, and now proposed to ally himself by marriage to the party of the young senatorial leader Marcus Porcius Cato the Younger. But the nobles were closing their ranks against him, and his offer was rebuffed. Lucullus and others were determined to prevent the en bloc ratification of Pompey's eastern settlement and to reject his demand for land for his veterans.

The First Triumvirate. Help came only when Caesar returned from his governorship in Spain. Pompey, Crassus, and Caesar formed the unofficial and at first secret First Triumvirate. It was to become more than a mere election compact. It would strain all the resources of the triumvirs to wrest one consulship from the Optimates; their continued solidarity was essential if they were to secure what Caesar gained for them in 59. Caesar, for his part, wanted a long-term command. Pompey, who now married Caesar's daughter, Julia, saw Caesar as his necessary instrument. Caesar, once consul, immediately forced through a land bill and, shortly after, another appropriating public lands in Campania. Once he had secured a five-year command in Illyria and Gaul he could be relied on to take off a large proportion of Pompey's discharged troops and give them further opportunities for profitable employment.

Pompey solved the problem of Rome's grain supply with his usual efficiency, but the nobles kept up their opposition. The year 56 was a critical one for the triumvirs. The nobles concocted religious impediments to prevent the dispatch of Pompey on a military mission to Egypt, while Publius Clodius contrived to persuade Pompey that Crassus had designs on his life. An attempt was made to suspend Caesar's law for the distribution of Campanian land.

Alarmed at Pompey's suspicions and truculence, Crassus set off to meet Caesar at Ravenna, and Caesar in turn came to the limit of his province at Luca to meet Pompey. The Luca conference (56) prepared the ground for the next phase of triumviral cooperation: Pompey and Crassus were to secure election to the consulship for 55, for they, too, wanted five-year commands in the provinces, while Caesar's command was to be renewed for another five years. The three secured their ends by violence and corruption after a prolonged struggle. Early in 55 Pompey and Crassus were at last elected consuls, with most of the lesser magistracies going to their supporters. Caesar obtained the extension of his command, while Pompey and Crassus received commands in Spain and Syria, respectively. Pompey could stay on in Italy and govern his provinces by deputies. But the triumvirate was coming to an end. The death of Julia (54) destroyed the strongest bond between Pompey and Caesar, and Crassus suffered disastrous defeat and death in Mesopotamia. The triumvirate existed no longer; but Pompey as yet showed no inclination to break with Caesar.

Civil war. Meanwhile, from outside the walls of Rome, Pompey watched the anarchy in the city becoming daily more intolerable. He was prepared to wait without committing himself until the Optimates found an alliance with him unavoidable. He refused further offers from Caesar of a marriage alliance. There was talk in Rome as early as 54 of a dictatorship for Pompey. Street violence made it impossible to hold the elections. In January 52 Clodius was killed by armed followers of Titus Annius Milo, whose candidacy for the consulship was being bitterly opposed by both Pompey and Clodius. Now both factions exploded into even greater violence. The senate house was burnt down by the mob. With no senior magistrates in office, the Senate had to call on Pompey to restore order. It was the hour he had waited for. He speedily summoned troops from Italy. The nobles would not have him as dictator; they thought it safer to appoint him sole consul.

Pompey's legislation of 52 reveals his genuine interest in reform and the duplicity of his conduct towards Caesar. He reformed procedure in the courts and produced a panel of respectable jurors. A severe law against bribery at elections was made retrospective to 70 and, for all Pompey's protests, was rightly taken by Caesar's friends as aimed at him. Another useful law enforced a five-year interval between tenure of magistracies in Rome and assumption of provincial commands. But this law and another, which prohibited candidature in absence, effectively destroyed the ground of Caesar's expectation that he should become designated consul, and so safe from prosecution, before he had to disband his army in Gaul. Several attempts were made in the years 51–50 to recall Caesar before the expiration of his second term in Gaul. They were frustrated by the assertiveness of Caesar's faction and agents in Rome. Pompey, for all his growing fear and suspicion of Caesar's ambitions, did not come out openly against Caesar until late in 51, when he suddenly made clear his intentions. He declared that he would not consider the suggestion that Caesar should become designated consul while still in command of his army. His proposals for a compromise date for Caesar's recall were unacceptable to Caesar, whose sole resource now was to use the wealth he had accumulated in Gaul to buy men who could obstruct his enemies in the Senate. When war came, the Senate was evenly divided between Caesar and Pompey. The consulars were solidly for Pompey, although they saw him simply as the lesser evil. Late in 50 the consul Gaius Marcellus, failing to induce the Senate to declare Caesar a public enemy, visited Pompey with the consuls designate and placed a sword in his hands. Pompey accepted their invitation to raise an army and defend the state. Caesar continued to offer compromise solutions while preparing to strike. On Jan. 7, 49, the Senate finally decreed a state of war. Four days later Caesar crossed the Rubicon.

Pompey's strategic plan was to abandon Rome and Italy to Caesar and rely on his command of the sea and the resources of the East to starve out the Caesarians in Italy; but he did not have the disciplined loyalty and full cooperation of his Optimate allies, and Caesar's swift advance southward only just failed to prevent his withdrawal from Italy. Across the Adriatic at Dyrrhachium the wisdom of Pompey's strategy became clear. Caesar, after a hazardous crossing in pursuit, found himself cut off from his base in Italy by sea and facing superior land forces. Pompey, however, eventually had to abandon his naval blockade of the rest of Caesar's forces in Brundisium and failed to prevent their crossing to join Caesar. Caesar's army was repulsed in an assault on Pompey's camp at Dyrrhachium and, failing a quick decision in the West, Caesar was obliged to move eastwards into Thessaly. Pompey followed and joined forces with the Senate's army there under Scipio, rendering Caesar's position untenable. At this juncture, Pompey, under pressure from his Optimate allies, decided for battle, a sensible enough decision if his opponent had not been a commander of genius. Pompey suffered a disastrous defeat on the plain of Pharsalus (48). He fled from his camp as the enemy stormed it and made his way to the coast. His supporters were to rally and involve Caesar in strenuous fighting in Africa, Spain, and the East for three more years; but Pompey did not live to play a part in this struggle. Hurried on by Caesar's rapid pursuit, he lost contact with his own fleet. He moved on southward to Cilicia, Cyprus, and Egypt. He decided to land at Pelusium and seek the assistance of Ptolemy, his former client. The King marched down to the coast, ostensibly to welcome him; but he and his counsellors had chosen not to risk offending the victorious Caesar. Pompey's small squadron lay offshore while Pompey, bidding farewell to his wife, Cornelia, complied with an insidious invitation to enter, with several companions, a small boat sent to bring him to land. As he prepared to step ashore he was treacherously struck down and killed (Sept. 28, 48 BC).

Assessment. Pompey's name cast a lasting shadow. His end inspired some of Lucan's finest verses. In the empire he acquired official respectability, and the greatness of his achievement was fully appreciated by the great writers. But there are few clear-headed or unbiassed accounts of Pompey by his own contemporaries. Caesar would have his readers believe that he wrote of Pompey more in sorrow than in anger; his propaganda was discreet and subtly damaging to his rival's reputation. Cicero's veering, day-to-day judgments of Pompey reveal his inability to see clearly through the distorting medium of his own vanity. The inflated eulogies of Pompey in Cicero's speeches are punctured by his persistent sniping at him in his letters. Yet he looked up to him for leadership and, in the moment of decision, joined him. But Pompey was neither a revolutionary nor a reactionary, willing to wreck the fabric of the commonwealth for the advantage of self or class. He expected a voluntary acceptance of his primacy but was to discover that the methods he had used to get his commands had permanently alienated the dominant nobility. So year after year he had to play a passive role, covertly intriguing or waiting for successive occasions to arise that would force them to accept his leadership. Some thought his waiting game duplicity, others, sheer political incompetence. He was an ineffective politician, not from incapacity for intrigue or ruthless action but from lack of candour and consistency in speech and action.

As a military leader, Pompey fell short of real greatness, lacking Caesar's genius, his dynamism and panache, and his geniality in personal relationships. He was circumspect and thorough—the perfect administrator. His vision of empire was no narrower than Caesar's. Like many a more recent imperialist, he was satisfied with the ideal of efficient and clean-handed administration and justice, and many of his contemporaries believed that he went far to achieve that aim in his own practice. Pompey, the wealthiest man of his age, invested his millions prudently; his landed estates were distributed throughout Italy in manageable units. For all the extravagance of his triumphal shows and the inexcusable heartlessness of the contests in slaughter with which he entertained the populace, he was a plain-living man, friend and admirer of the Stoic Panaetius. His third wife, Mucia, bore him two sons, Gnaeus and Sextus, and a daughter, Pompeia, before he divorced her for infidelity (62). Julia was the wife he loved most dearly; Cornelia outlived him and mourned his death. (E.W.G./Ed.)

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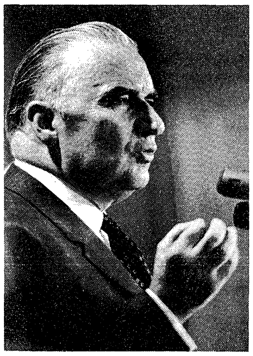
Pompidou, Georges (-Jean-Raymond) (b. July 5, 1911, Montboudif, Fr.—d. April 2, 1974, Paris), French statesman, bank director, and teacher who was premier of the Fifth French Republic from 1962 to 1968 and president from 1969 until his death.

The son of a schoolteacher, Pompidou graduated from the École Normale Supérieure and then taught school in Marseilles and Paris. During World War II he fought as a lieutenant and won the Croix de Guerre. In late 1944 he



Pompidou
Dennis Brack—Black Star/EB Inc.

was introduced to Charles de Gaulle, who was then head of the provisional French government. At this time Pompidou was a complete stranger to politics, but he soon proved adept at interpreting and presenting de Gaulle's policies. Pompidou served from 1944 to 1946 on de Gaulle's personal staff and remained a member of his "shadow Cabinet" after de Gaulle's sudden resignation from the premiership in January 1946. He then was assistant to the general commissioner for tourism (1946–49) and also held the post of *maître des requêtes* at the Conseil d'État, France's highest administrative court (1946–57).

In 1955 he entered the Rothschild bank in Paris where, again without professional qualifications, he rose rapidly to become director general (1959). De Gaulle had never lost touch with Pompidou, and, on his return to power at the time of the Algerian crisis (June 1958), he took Pompidou as his chief personal assistant (June 1958–January 1959). Pompidou played an important part in drafting the constitution of the Fifth Republic and in preparing plans for France's economic recovery. When de Gaulle became president (January 1959), Pompidou resumed his private occupations. In 1961 Pompidou was sent to conduct secret negotiations with the Algerian Front de Libération Nationale (FLN), a mission that finally led to a cease-fire between the French troops and Algerian guerrillas in Algeria.

The Algerian crisis resolved, de Gaulle decided to replace Michel Debré as premier and appointed Pompidou, then virtually unknown to the public, in his place (April 1962). Defeated in a vote of censure in the National Assembly (October 1962), Pompidou resumed office after de Gaulle's victory that same month in the plebiscite on the election of the president by universal suffrage. The second Pompidou administration (December 1962–January 1966) was succeeded by the third (January 1966–March 1967) and the fourth (April 1967–July 1968). Pompidou had thus been premier for six years and three months, a phenomenon that de Gaulle noted had been unknown in French politics for four generations.

Pompidou's standing was probably highest at the time of the French student–worker revolt of May 1968, at which time he participated in negotiations with workers and employers, persuaded de Gaulle to make the necessary reforms, and concluded the Grenelle Agreement (May 27) that finally ended the strikes. Pompidou's campaign calls for the restoration of law and order enabled him to lead the Gaullists to an unprecedented majority in the National Assembly elections of June 30, 1968. Although he was unexpectedly dismissed from the premiership by de Gaulle in July 1968, Pompidou retained his prestige and influence in the Gaullist party. When de Gaulle abruptly resigned the presidency in April 1969, Pompidou campaigned for the office and was elected on June 15, 1969, receiving more than 58 percent of the second-round votes.

During his term as president, Pompidou was largely successful in continuing the policies initiated by de Gaulle. He maintained friendship and economic ties with Arab states, but he was less successful with West Germany and did not significantly improve relations with the United States. For almost five years he provided France with a stable government and strengthened its economy. He also supported Great Britain's entry into the EEC. His death was unexpected despite the growing evidence of his rapidly failing health.

Pompidou Centre, French CENTRE POMPIDOU, in full CENTRE NATIONAL D'ART ET DE CULTURE GEORGES POMPIDOU ("Georges Pompidou National Art and Cultural Centre"), French national cultural centre on the Rue Beaubourg and on the fringes of the historic Marais section of Paris. It is named after the French president Georges Pompidou, under whose administration the museum was commissioned.

The Pompidou Centre was formally opened on Jan. 31, 1977, by the French president, Valéry Giscard d'Estaing. Its overpowering industrial-looking exterior, which dwarfs its surroundings, attracted notoriety for its brightly coloured exterior pipes, ducts, and other exposed services. The architects were Renzo Piano of Italy and Richard Rogers of Britain. The Pompidou Centre quickly became an enormous popular attraction and was reckoned to be the most frequently visited cultural monument in the world.

Primarily a museum and centre for the visual arts of the 20th century, the Pompidou Centre houses many separate services and activities. Its museum of modern art brought under one roof several public collections of modern art previously housed in a number of other Paris galleries. There are also frequent temporary exhibitions devoted to modern themes. In addition there is a large public library, a centre for industrial design, a film museum, and an important musical centre associated with the French conductor and composer Pierre Boulez, known as the Centre for Musical and Acoustical Research (Ircam). The music centre comprises rehearsal rooms, studios, and a concert hall and presents concerts devoted primarily to modern music.

Pompilius, Numa (8th–7th-century-BC traditional Roman king): *see* Numa Pompilius.

Pomponazzi, Pietro (b. Sept. 16, 1462, Mantua, Marquisate of Mantua—d. May 18, 1525, Bologna), philosopher and leading representative of Renaissance Aristotelianism, which had developed at Italian universities after the close of the 13th century.

Pomponazzi was educated in philosophy and medicine at the University of Padua, and he taught philosophy there intermittently from 1487 to 1509. He also taught at Ferrara and at Bologna until his death. Thoroughly versed in Aristotle and his commentators, particularly Thomas Aquinas and Averroës, Pomponazzi interpreted Aristotle in the light of the Humanism of his own time. His treatise on the immortality of the soul, *Tractatus de immortalitate animae* (1516), was attacked but not officially condemned; and he was allowed to publish a defense of his position in his *Apologia* (1518) and *Defensorium* (1519).

He contended that the immortality of the individual soul cannot be demonstrated on the basis of Aristotle or of reason, but must be accepted as an article of faith. In developing this view, he maintained that moral action is the only proper goal of human life. Appealing to the Stoic philosophers, rather than to Aristotle, he declared that virtue is its own reward and vice its own punishment. In Pomponazzi's typically Humanist view, man's special dignity consists in his moral virtue. A master of the Scholastic treatise, which formulates objections to its thesis and proceeds to overcome them, Pomponazzi was also the author of the lengthy treatises *De incantationibus* (1556; "On Incantations"), which proposed a natural explanation of several reputedly miraculous phenomena, and *De fato* (1567; "On Fate"), which discusses predestination and free will.

Pomponius Mela: *see* Mela, Pomponius.

Ponape (Pacific island): *see* Pohnpei.

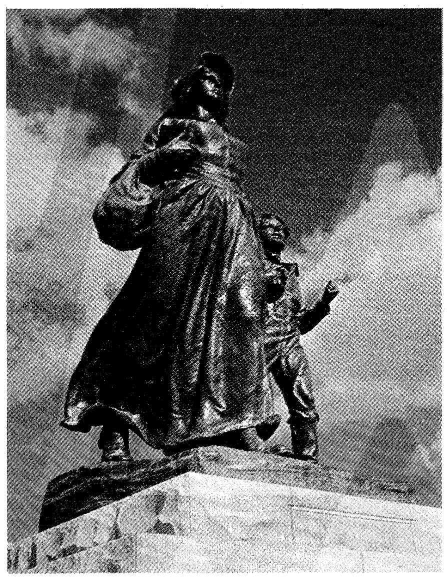
Ponca, North American Indian people of the Dhegiha branch of the Siouan linguistic stock. Under pressure of settlement by whites, the Ponca migrated westward from the Atlantic coast, settling first in Virginia and the Carolinas. After a time they moved to what is now western Missouri. The Ponca then moved north to present-day Minnesota, where they lived until the late 17th century, when they were driven farther west by the Dakota. They then settled in villages in southwestern Minnesota and the Black Hills of South Dakota.

In their semipermanent villages the Ponca lived in earth-covered lodges and engaged in farming. In spring and autumn they moved into portable tepees for the hunting season.

The Ponca were never a large tribe; an early estimate places their number at 800. By 1804, when they were encountered by Lewis and Clark, a smallpox epidemic had reduced the tribe to about 200. In 1865 they were guaranteed a reservation on their homelands, but, after tragic bureaucratic blundering, the land was awarded to the Dakota, and the Ponca were forcibly removed to Indian Territory (present-day Oklahoma). The tribe found living conditions unbearable, and, led by their chief, Standing Bear, they traveled north on foot for 600 miles (965 km) to eastern Nebraska, where they were given asylum by the

Omaha. They were arrested, but after a court battle sponsored by whites sympathetic to their cause and by a young Omaha woman named Susette La Flesche (*q.v.*), they were freed. They settled in Oklahoma. In the late 20th century they numbered somewhat fewer than 1,000.

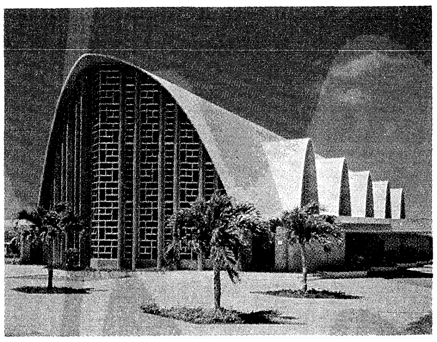
Ponca City, city, Kay County, northern Oklahoma, U.S. It lies along the Arkansas River, near the Kansas border. Founded overnight in 1893 with the opening of the Cherokee Strip, it was named for the Ponca Indians, who moved in 1879 to a reservation south of the townsite. Surrounded by farm and ranch lands, the city boomed with the oil discoveries of the 1920s. Its diversified industries include oil refining, manufacture of petrochemicals and metal products, and servicing of diesel engines. Its "Pioneer Woman" statue, honouring the courage of the women who helped settle



"Pioneer Woman" statue, Ponca City, Okla.
By courtesy of the Oklahoma Tourism and Information Division

the West, is at the Pioneer Woman Museum. Kaw Lake, immediately northeast, is a major reservoir on the Arkansas River. Inc. village, 1895; city, 1899. Pop. (1984 est.) 28,616.

Ponce, major city and principal port of southern Puerto Rico. The third most populous centre of the island, after San Juan and Bayamón, the city is situated 3 miles (5 km) north of its port, Playa de Ponce. Founded in either 1670 or 1680 as Nuestra Señora de Guadalupe de Ponce, it was raised to the status of town in 1692, to that of *villa* in 1848, and to that of city in 1877. In 1897 Spain's overseas minister designated Ponce as the capital of the southern region, one of the island's two major districts. In 1898 Ponce fell with the rest of



The church of Santa María Reina on the campus of the Catholic University of Puerto Rico, Ponce, Puerto Rico
Arthur Griffin—EB Inc.

the island to the United States, which made extensive harbour improvements to it.

Among the major industries of Ponce are canning, sugar refining, and the production of cement, paper, iron, shoes, textiles, and rum; there is also diamond cutting and the manufacture of ball bearings, electrical devices, tools and dies, and aluminum windows. The city is linked to Mayagüez and Guayama by rail and to San Juan by regular air service. Cultural facilities include the Catholic University of Puerto Rico (1948), a regional college of the University of Puerto Rico, and the Museum of Art. The city has also preserved many old Spanish homes and churches.

Sugarcane, coffee, cocoa, fruits, and grazing flourish in the area around Ponce despite a rainfall that varies from only 15 to more than 40 inches (375 to 1,000 mm) annually. Pop. (1980) city, 161,739 (1984 est.) mun., 190,-900.

Ponce de León, Juan (b. 1460, Tierra de Campos Palencia, Leon—d. 1521, Havana), Spanish explorer who founded the oldest settlement in Puerto Rico and later discovered Florida (1513) while searching for the mythical fountain of youth.

Born into a noble family, Ponce de León was a page in the royal court of Aragon and later fought in a campaign against the Moors in Granada. It is possible that he began his career of exploration in 1493 as part of Christopher Columbus' second expedition to the New World. In 1502 he was in the West Indies as a captain serving under Nicolás de Ovando, governor of Hispaniola. As a reward for suppressing an Indian mutiny, Ponce de León was named by Ovando to be the provincial governor of the eastern part of Hispaniola. Hearing persistent reports of gold to be found on Puerto Rico, Ponce de León in 1508–09 explored and settled that island, founding the colony's oldest settlement, Caparra, near what is now San Juan. He then returned to Hispaniola and was named governor of Puerto Rico but was soon displaced from the governorship through the political maneuvering of rivals.

The Spanish crown encouraged Ponce de León to continue searching for new lands. He learned from Indians of an island called Bimini (in the Bahamas) on which there was a miraculous spring or fountain that could rejuvenate those who drank from it (the fountain of youth). In search of this fountain, he led a privately outfitted expedition from Puerto Rico in March 1513 and in April of that year landed on the coast of Florida near the site of modern St. Augustine. At the time he did not realize that he was on the mainland of North America and instead supposed he had landed on an island. He named the region Florida because it was discovered at Easter time (Spanish: Pascua Florida) and because it abounded in lush, florid vegetation. He coasted southward, sailing through the Florida Keys and ending his search near Charlotte Harbor on Florida's west coast. He then returned to Puerto Rico and thence to Spain, where he secured the title in 1514 of military governor of Bimini and Florida with permission to colonize those regions.

In 1521 Ponce de León sailed again for Florida with two ships and 200 men, landing near Charlotte Harbor. On this occasion he was wounded by a Seminole arrow during an Indian attack, and he died after being returned to Cuba. Puerto Rico's third largest city, Ponce, is named in his honour.

Ponce de León, Pedro (b. 1520?—d. 1584) Spanish Benedictine monk believed to have been the first person to develop a method for teaching deaf-mutes.

Ponce achieved his first success with Gaspard Burgos, who, because of his affliction, had been denied membership in the Benedictine order. Under Ponce's tutelage, Burgos learned to speak so that he could make his confession; Burgos later wrote a number of books. Ponce taught several other deaf-mutes to speak and write, although details of his methods either were never recorded or have been lost. He apparently traced letters and indicated pronunciation with lip movements to introduce and develop speech among his students.

Poncelet, Jean-Victor (b. July 1, 1788, Metz, Fr.—d. Dec. 22, 1867, Paris), French mathematician and engineer who was one of the founders of modern projective geometry.

Poncelet, detail of a lithograph by Patout, 1849
By courtesy of the Bibliotheque Nationale, Paris

As a lieutenant of engineers in 1812, he took part in Napoleon's Russian campaign, in which he was abandoned as dead at Krasnoy and imprisoned at Saratov. He returned to France in 1814.

During his imprisonment Poncelet studied projective geometry and wrote *Applications d'analyse et de géométrie*, 2 vol. (1862–64; "Applications of Analysis and Geometry"). This work was originally planned as an introduction to his celebrated *Traité des propriétés projectives des figures* (1822; "Treatise on the Projective Properties of Figures"), for which Poncelet is regarded as one of the greatest projective geometers. His development of the pole and polar lines associated with conics led to the principle of duality and a dispute over priority for its discovery. His principle of continuity, a concept designed to add generality to synthetic geometry, led to the introduction of imaginary points.

From 1815 to 1825 Poncelet was occupied with military engineering at Metz, and from 1825 to 1835 he was professor of mechanics at the *école d'application* there. He applied mathematics to the improvement of turbines and waterwheels. Although the first inward-flow turbine was not built until 1838, he proposed such a turbine in 1826. From 1838 to 1848 he was professor to the faculty of sciences at Paris, and from 1848 to 1850 he was commandant of the École Polytechnique, with the rank of general.

Poncet, Charles-Jacques (b. Franche-Comté—d. 1706, Persia), French resident pharmacist in Cairo known for the account of his travels in Ethiopia, which was closed to Europeans after about 1630.

Poncet was summoned to Gonder, the Ethiopian capital, to treat the emperor Iyasu I and his son for leprosy. His account of the journey, *A Voyage to Ethiopia in the Years 1698, 1699 and 1700,* is the only European source for the history of Ethiopia in this period. Poncet, who had lived in Egypt since 1687, departed for Ethiopia in May 1698. He ascended the Nile River and turned south through the Nubian Desert, reaching Gonder in July 1699. He cured the Emperor and his son and made a detailed description of the country during his nine-month stay.

An attempt to establish diplomatic relations between the Emperor and Louis XIV of

France came to nothing, and Poncet's account of his voyage was unfairly discredited. In 1702 Poncet left France to return to Ethiopia, but a civil war in Ethiopia prevented his return.

Ponchielli, Amilcare (b. Aug. 31 or Sept. 1, 1834, Paderno Fasolaro, near Cremona, Lombardy [Italy]—d. Jan. 16, 1886, Milan), Italian composer, best-known for his opera *La gioconda.*

Ponchielli studied at Milan and produced his first opera, *I promessi sposi* (after Manzoni), in 1856; its revised version was popular in Italy and abroad. Between 1873 and 1875 he wrote two ballets and four operas. *La gioconda* (1876), on a libretto by Arrigo Boito based on Victor Hugo's *Angelo,* achieved wide success at the end of the 19th century. Later remembered chiefly for its ballet, *Dance of the Hours,* it returned to the repertory of Italian opera houses in the 1950s. From 1881 to 1886 Ponchielli was music director at Bergamo Cathedral; there he wrote several sacred works.

poncho, cloak worn by men or women, made of a square or rectangle of cloth with a hole in the middle for the head. The original poncho, consisting of a rough, brightly coloured, handloomed woolen cloth, was worn by Latin-American Indians. Ponchos, with the edges hanging either parallel or diagonally, forming

Mexican charro wearing a poncho
Dick Davis—Photo Researchers/EB Inc.

a diamond shape, became fashionable in the second half of the 20th century. The poncho can also be a similarly designed garment made of a waterproof material, often hooded, worn chiefly as a raincoat.

Pond, John (b. 1767, London—d. Sept. 7, 1836, Blackheath, Kent, Eng.), sixth astronomer royal of England, who organized the Royal Greenwich Observatory to an efficiency that made possible a degree of observational precision never before achieved.

Pond was elected a fellow of the Royal Society in 1807 and served from 1811 to 1835 as astronomer royal. During Pond's term, obsolete and worn-out instruments at Greenwich were replaced and the staff increased from one to six, enabling him to complete in 1833 a catalog of positions of 1,112 stars with an ac-

John Pond, detail from an engraving by Benjamin Smith after a portrait by Thomas Parkinson, 18th century
By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

curacy previously unknown. He was a member of the Royal Astronomical Society from the time of its founding in 1820.

pond duck: *see* dabbling duck.

pond scum (algae): *see* Spirogyra.

pond skater (insect): *see* water strider.

pond turtle, any of several freshwater turtles of the family Emydidae: two of the best known are the Pacific, or western, pond turtle (*Clemmys marmorata*) and the European pond turtle (*Emys orbicularis*). The term is

European pond turtle (*Emys orbicularis*)
Joe B. Blossom—Photo Researchers/EB Inc.

sometimes used collectively to refer to members of the genus *Clemmys* (*see* spotted turtle; wood turtle).

The Pacific pond turtle is one of the few turtles native to the western coast of North America. It is found from southern Canada to southern California and usually inhabits ponds and other quiet waters. It has been widely sold for food in California. The smooth, broad upper shell of the Pacific pond turtle reaches a length of about 15–25 cm (6–10 inches) and is brown or blackish with yellow spots and streaks. The lower shell is yellow and black. The Pacific pond turtle is a highly aquatic, wary reptile. It feeds on both plant and animal material, basks in the sun, and is frequently hooked by fishermen.

The European pond turtle, also known as the swamp turtle, or swamp tortoise, is found in Europe, northern Africa, and western Asia. It is primarily aquatic and is said to be carnivorous. The upper shell, which reaches a length of about 12–13 cm (5 inches), is brownish or blackish with yellow speckling and sometimes resembles that of the Pacific pond turtle.

Pondicherry, union territory of India, formed in 1962 from the four former French colonies of Pondicherry, Kārikāl, Yanam, and Mahe. Pondicherry, Kārikāl, and Yanam are scattered along the southeastern coastal region known as the Coromandel Coast, and Mahe lies opposite Pondicherry on the southwestern shoreline known as the Malabar Coast. The total area of the union territory is 190 square miles (492 square km), and the town of Pondicherry is the administrative capital.

A brief treatment of Pondicherry follows. For full treatment, *see* MACROPAEDIA: India.

One of the smallest of the union territories, Pondicherry is united by little other than the Hindu religion; the Tamil language predominates in Pondicherry and Kārikāl, while Malayālam is spoken in Mahe and Telugu in Yanam. All of the former colonies are noted seaside tourist resorts. Agriculture—including the growing of rice, peanuts (groundnuts), sugarcane, and cotton—and some industries (mainly in Pondicherry) provide the territory's economic basis. Pop. (1981) 604,471.

Pondicherry, town and capital of Pondicherry union territory, surrounded by Tamil Nādu state, southeastern India.

The town of Pondicherry lies on the Coromandel Coast 105 miles (170 km) south of Madras. It originated as a French trade centre in 1674, when it was purchased from a local ruler. Now a seaside tourist resort, Pondicherry contains the Hindu ashram (religious retreat) of Sri Aurobindo, now an international study centre, and several colleges affiliated with the University of Madras. The colony of Pondicherry was the scene of frequent fighting among the French and Dutch in the late 17th century, and by 1761 the British had driven the French from the region. Pop. (1981) 162,639.

Pondo (people): *see* Mpondo.

Pondoland, region on the African coast of the Indian Ocean, located in the republic (not internationally recognized) of Transkei, South Africa, between the Mtamvuna and Umtata rivers, bordering Natal province in the north. Settled by the Mpondo (Pondo) peoples at the end of the 16th century AD, it is divided by the Umzimvuhu River into East Pondoland and West Pondoland. The region was annexed to the Cape Colony by Sir Henry George Elliot in 1894.

Pondoland occupies a narrow strip about 30 miles (50 km) wide, extending from the coast across the thornveld (thorn trees, bushes, and grasses) to the interior plateaus in the west. The vegetation of the coastal areas is mainly subtropical evergreens. Interior Pondoland is regarded as the richest cattle country in Transkei and has the most fertile lands in the republic; corn (maize), tobacco, sugarcane, tea, coffee beans, cotton, and tropical fruits are grown. In the deep forests and other remote areas, the narcotic *dagga* (Indian hemp) is cultivated. The region is served by good roads, and the rivers also provide inland transport.

pondweed, any of several cosmopolitan freshwater plants sometimes grown in ponds or aquariums. They belong to two families: the Potamogetonaceae (pondwood family) and the Aponogetonaceae (lattice plant family), both of which have species that develop submerged or floating leaves but frequently have emergent flowering shoots. The former group includes frog's lettuce (*Potamogeton densus*), of Europe and southern Asia, and *P. crispus,* of Europe but naturalized in the eastern United States and in California. Cape pondweed (*Aponogeton distachyus*), of the family Aponogetonaceae, has several varieties grown for ornament in pools or greenhouses. Many species of these families serve as food for waterfowl and as cover for fishes.

Ponferrada, city, León province and region, Castile-León *comunidad autónoma* ("autonomous community"), northwestern Spain, at the confluence of the Sil and Boeza rivers, west of the city of León. Identified with the Roman Interamnium Flavium, Ponferrada was refounded in the 11th century as a station on the pilgrimage route to Santiago de Compostela. The city's historic monuments include the castle of the Knights Templars (12th–14th centuries), a fine example of medieval military architecture; the 10th-century Mozarabic church of Santo Tomás de las Ollas; and the Gothic church of Santa María de la Encina. Located in a coal- and iron-mining district, Ponferrada has steel mills and manufactures coal briquettes. Pop. (1981) 52,499.

Poṅgal, important Hindu festival in South India marking the beginning of the Tamil New Year. It is celebrated on the winter solstice, when, according to the traditional Hindu system of reckoning, the Sun, having reached its southernmost point, turns to the north again and reenters the sign of *makara* (Capricorn).

The month preceding Poṅgal is considered to be made up entirely of inauspicious days and the month following Poṅgal of auspicious days. The name of the festival comes from the Tamil word meaning "to boil"; rice is boiled in milk and offered first to the gods, then to the cows, and then to family members. During the exchange of visits that mark all Hindu festivals, the anticipated greeting, "Has the rice boiled?" is answered, "It has boiled." Cows are especially venerated during Poṅgal: their horns are painted, and they are garlanded with flowers and fruit, taken in procession, and allowed to graze freely.

Pongidae, family of anthropoid primates including the orangutan, chimpanzee, and gorilla (*qq.v.*); Hylobatidae, the family of apes that includes the gibbon and siamang (*qq.v.*), is sometimes considered to be a subfamily of Pongidae. The Pongidae inhabit tropical Africa and Southeast Asia. *See also* ape.

Poniatowski, Józef Antoni (b. May 7, 1763, Vienna—d. Oct. 19, 1813, Leipzig), Polish patriot and military hero, who became a marshal of France.

Initially an officer in the Austrian army, Poniatowski was transferred to the Polish army in 1789 at the request of his uncle, King Stanisław II August Poniatowski of Poland. He distinguished himself against the Russians in 1792 and took part in Tadeusz Kościuszko's anti-Russian revolt in 1794. Poniatowski retired in 1795, after the Third Partition of Poland, but he was named commander in chief of the Duchy of Warsaw by Napoleon in 1807. He led a Polish corps in Napoleon's Russian campaign of 1812 and during the Battle of Leipzig (Oct. 16–19, 1813) was made a marshal of France. On the last day of the battle the wounded marshal died in an attempt to cross the Elster River on horseback.

Józef Poniatowski, detail of a portrait by M. Bacciarelli; in the Lanckoronski collection

By courtesy of the Polish Institute and Sikorski Museum, London; photograph, J.R. Freeman & Co. Ltd.

Poniatowski, Stanisław (b. Sept. 15, 1676—d. Aug. 3, 1762, Ryki, Pol.), Polish soldier and state official who supported the Swedes against the Poles in the Great Northern War (1700–21) and was later a reconciled leader in Polish military and political affairs.

Grandson of Jan Ciołek Poniatowski (d. *c.* 1676), founder of the princely family of Poniatowskis, he was the first of the family to distinguish himself politically and militarily. At the outbreak of the Great Northern War, he joined the powerful Sapieha family in siding with the Swedes against the Saxon king of Poland, Augustus II the Strong. He was a major general in the Swedish army and a strong supporter of Stanisław Leszczyński, installed on the Polish throne by the Swedes in 1704 as Stanisław I. After the war Poniatowski reconciled himself with the restored Augustus II and became grand treasurer of Lithuania in 1722. From 1728 he was commander in chief of the Polish army, and in 1731 he became palatine of Mazovia. His son Stanisław August was king of Poland as Stanisław II August Poniatowski (reigned 1764–95).

Poniatowski, Stanisław (king of Poland): *see* Stanisław II August Poniatowski.

Ponnaiyār River, river in southern India, rising as the Southern Pinakim on the eastern slope of Nandidrug Mountain, in the Chennakaseva Hills of Karnātaka state. It flows southward for 50 miles (80 km) through Karnātaka to Tamil Nādu state, where it turns southeastward and flows 200 miles (320 km) to enter the Bay of Bengal at Cuddalore. Major tributaries are the Chinnār, Mārkanda, Vaniar, and Pamban.

Heavy rains at the river's source cause sudden, but short-lived, floods. The river is extensively dammed for irrigation, especially in Tamil Nādu. There are also reservoirs at Krishnagiri and Sathanur. The Ponnaiyār is considered sacred by Hindus, and festivals are held during the Tamil month of Tai (January–February).

Ponnāni River, river in central Kerala state, southwestern India. The Ponnāni rises in the Western Ghāts range northeast of Pālghāt town. Flowing first southwest and then west across the coastal plain, the river empties into the Arabian Sea at Ponnāni after a course of about 100 miles (160 km).

The Ponnāni River near Ponnāni, Kerala, India

B.L. Wilson—Shostal/EB Inc.

pons, plural PONTES, a portion of the mammalian brain lying above the medulla oblongata and below the cerebellum and the cavity of the fourth ventricle. The pons is a broad, horseshoe-shaped mass of transverse nerve fibres that connect the medulla with the cerebellum. It is also the point of origin or termination for four of the cranial nerves that transfer sensory information and motor impulses to and from the facial region and the brain. The pons also serves as a pathway for nerve fibres connecting the cerebral cortex with the cerebellum.

Pons, Lily, byname of ALICE JOSÉPHINE PONS (b. April 12, 1904, Draguignan, near Cannes, Fr.—d. Feb. 13, 1976, Dallas, Texas, U.S.), American coloratura soprano known for her vocal range, musical skill, and warmth of expression. She was associated with the Metropolitan Opera in New York City for more than 30 years.

Pons studied piano at the Paris Conservatoire but later studied voice with Albert di Gorostiaga. In 1928 she made her opera debut at the Mulhouse Opera in Alsace in the title role of Léo Delibes' *Lakmé,* subsequently appearing in a series of French provincial houses. She auditioned for Giulio Gatti-Casazza, general director of the Metropolitan Opera, who asked her to sing the title role in Gaetano Donizetti's *Lucia di Lammermoor* there in 1931. She remained with the Metropolitan for more than three decades as a principal soprano famed for French and Italian coloratura parts, including those in Donizetti's *La figlia del reggimento* and Vincenzo Bellini's *La sonnambula.* She was the first soprano in 50 years who could reach the high F that Delibes wrote in the "Bell Song" in *Lakmé.*

Pons sang on radio and on television and also appeared in several motion pictures. During World War II she performed on North African and Asian battlefronts, and a community in Maryland was named Lilypons in her honour.

Ponselle, Rosa, original name ROSA MELBA PONZILLO (b. Jan. 22, 1897, Meriden, Conn., U.S.—d. May 25, 1981, Baltimore), American coloratura soprano of great breadth of range and expressive ability, who is probably best-known for her performance in the title role of Vincenzo Bellini's *Norma.*

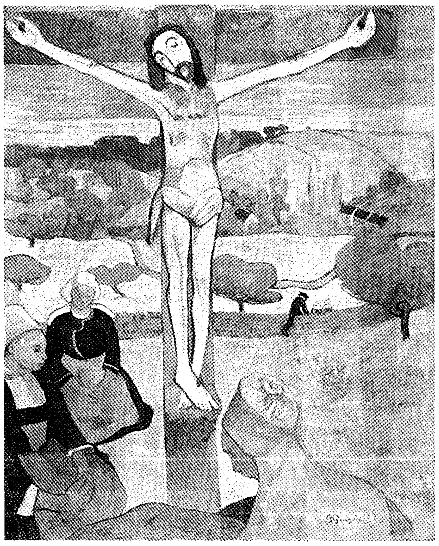
As a teenager Ponselle played the piano for silent motion pictures and at the age of 16 began singing in vaudeville. At the age of 21 she came to the attention of Enrico Caruso and made her first operatic appearance at the Metropolitan Opera in New York City in the challenging role of Leonora in Giuseppe Verdi's *La forza del destino.* She studied for the role with Romano Romani, who remained her principal vocal coach and teacher for the rest of her career.

Most of Ponselle's career was spent at the Metropolitan, although she sang at Covent Garden in London (1929–30) and also at the Maggio Musicale in Florence (1933). During her 19 seasons at the Met, she sang a total of 22 dramatic and dramatic-coloratura roles. She retired from the opera stage in 1937. After retiring she taught and served as artistic director for the Civic Opera of Baltimore.

Pont-Aven school, group of young painters that espoused the style known as Synthetism and united under Paul Gauguin's tutelage at Pont-Aven, Brittany, Fr., in the summer of 1888. The artists included Émile Bernard, Charles Laval, Maxime Maufra, Paul Sérusier, Charles Filiger, Meyer de Haan, Armand Séguin, and Henri de Chamaillard.

Gauguin and Bernard were the first to reject Impressionist and Pointillist techniques in favour of Synthetist methods. The paintings executed by these artists in the years between 1886, when they first met at Pont-Aven, and 1888 show an overall simplification, a highly expressive use of colour, and an intensely spiritual subject matter. In their Breton landscapes, Gauguin and Bernard employed bright areas of colour surrounded with heavy, dark outlines that give the painted surface the appearance of medieval enamel and stained-glass work. Gauguin's emulation of the simpler, more religious life practiced by the Breton peasants served as an example to the rest of the Pont-Aven school. The content of their paintings was often derived in abstracted form from the everyday life of the Breton people.

Gauguin's disciples, enthusiastically accepting his advice not to paint exclusively from nature, gradually abandoned the Neo-Impressionist styles that they had adopted originally. In their revolt against Naturalism, the early Synthetist painters emphasized the decorative potentials of colour and line: a painting was to be primarily a flat surface upon which colour was laid ornamentally. "Landscape at the Bois d'Amour at Pont-Aven," painted by Paul Sérusier under the direct guidance of Gauguin, became the talisman of the young disciples. Gauguin had instructed Sérusier not only to paint the landscape from memory but to be certain to paint the different-coloured areas as intensely as possible. Upon the return of the Pont-Aven school to Paris in the fall of 1888, the members met regularly to discuss new developments in French art, particularly Symbolism. In 1889 Gauguin arranged an important exhibition of Impressionist and Synthetist art that featured his own and other works.



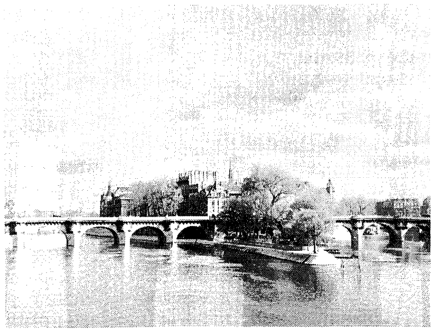
"The Yellow Christ," Pont-Aven school painting by Paul Gauguin, oil, 1889; in the Albright-Knox Art Gallery, Buffalo
By courtesy of the Albright-Knox Art Gallery, Buffalo

At one point in the existence of the Pont-Aven school, the idea of an artistic and communal society had seemed feasible, but once Gauguin decided to leave for Tahiti, hopes for this to materialize were abandoned. The members of the original Pont-Aven school became increasingly involved in the development of Symbolist art theories and techniques. Artists such as Sérusier eventually became active in the Académie Julian and in the Nabis.

Pont-l'Évêque, one of the classic cow's-milk cheeses of Normandy, France, named for the eastern Normandy village in which it is produced. The traditional form of Pont-l'Évêque is a small, approximately four-inch (10-centimetre) square, with a golden-brown rind crisscrossed by marks from the straw mats on which it is ripened.

The finely holed, golden-yellow interior is semisoft when young but after six to eight weeks softens, becoming almost, but not quite, runny. The aroma becomes increasingly pungent as the cheese ripens, and the rind becomes sticky. It should not, however, be rank or discoloured.

Pont Neuf, second-oldest bridge across the Seine River via the Île de la Cité in Paris, built, with interruptions in the work, from 1578 to 1607. It was designed by Baptiste Du Cerceau and Pierre des Illes, who may have made use of an earlier design by Guillaume Marchand.



Pont Neuf, Paris
Ewing Galloway

For centuries the Pont Neuf, filled with shops and traffic, was the centre of Paris life. Its "long arm" consisted of seven arches from the right bank of the Seine to the western end of the Île de la Cité; its "short arm" of five arches from the island to the left bank. The foundations were completely rebuilt under Napoleon III, together with the arches of the long arm, which were made elliptical. At the same time the shops were removed from the roadway.

Ponta Delgada, capital and largest city of the *região autónoma* (autonomous region) of the Azores, consisting of the three districts (one of which is Ponta Delgada) of the Azores archipelago of Portugal in the North Atlantic. The city, on the south coast of Ilha (island) de São Miguel, became São Miguel's second capital (Vila Franca do Campo was the first) in 1540. It was severely damaged in 1839 by a tidal wave and has since been rebuilt. The Holy Christ of the Miracles Church is a noted place of pilgrimage. A mild climate and lush vegetation have made the city an important winter tourist resort. Its harbour has a breakwater nearly a mile long and serves as a fuelling supply station and offers minor repair facilities to transatlantic ships. Ponta Delgada is the Azores' leading commercial centre, exporting pineapples, oranges, tea, wine, cereals, vegetables, and dairy products. Sugar refining and liquor distilling are its primary industries. Sperm whale oil is also produced. The University of the Azores was founded in the city in 1976. A local shipping line maintains regular services with continental Portugal, northern Europe, and the United States.

Avenue Infante Henrique along the harbour at Ponta Delgada, Azores
Gianni Tortoli—Photo Researchers

Ponta Delgada district comprises the islands of São Miguel and Santa Maria and the unpopulated Rocas (rocks) Formigas. Apart from Ponta Delgada city, it is basically agricultural. Pop. (1981) city, 22,200; district, 203,914.

Ponta Grossa, town, east central Paraná state, southeastern Brazil, located on a plateau at an altitude of 2,930 ft (893 m). It serves as a commercial centre, exporting maté (tea), timber, tobacco, rice, bananas, and *xarque* (jerked beef) through the Atlantic ports of Antonina (100 mi [160 km] east) and Paranaguá, and as a distribution centre for the interior of the state. It is also a rail and road centre for hog raising and lumbering activities. Industries include meat-packing; lard, coffee, and maté processing; and sawmilling and woodworking. Ponta Grossa is the site of the Universidade Estadual de Ponta Grossa (1970) and of a government agricultural experimental station. Pop. (1980 prelim.) 171,111.

Pontano, Giovanni, Latin JOVIANUS PONTANUS (b. May 7, 1426, Cerreto di Spoleto, near Perugia, Papal States—d. September 1503, Naples), Italian prose writer, poet, and royal official, whose works reflect the diversity of interests and knowledge of the Renaissance. His supple and easy Latin style is considered, with that of Politian, to be the best of Renaissance Italy.

He studied language and literature in Perugia. From 1447 to 1495 he served the Aragonese kings of Naples as adviser, military secretary, and, after 1486, as chancellor, an office he handled with great distinction. He was dismissed in 1495 for negotiating peace with the French and, though pardoned, he did not return to power.

Pontano became a major literary figure in Naples after 1471 when he assumed leadership of the city's Humanist academy. Called the Accademia Pontaniana, it became one of the major Italian literary academies of the 15th century. Pontano's writings, all in Latin, include a historical work (*De bello neapolitano*); philosophical treatises (*De prudentia, De fortuna*); an astrological poem (*Urania*); dialogues on morality and religion, philology and literature; and many lyrical poems, of which the most important are *Lepidina,* a charming account of the wedding between a river god and a nymph, with a distinctly Neapolitan flavour, and a collection called *De amore coniugali,* a warm and personal series of poems on the joys and sorrows of family life.

Pontardawe, locality, Lliw Valley district, West Glamorgan County, Wales. Located in the Tawe Valley 8 mi (13 km) north of Swansea, Pontardawe originated as a mining community and grew rapidly during the 18th- and 19th-century exploitation of the South Wales coalfield. There are several stone circles and cairns in the area, and to the west in a pre-Roman earthworks.

In addition to coal mining, copper smelting was an important industry during the 18th century, succeeded by tinplate manufacture in the late 19th and early 20th centuries. With the decline of mining, new industries have been introduced as part of a government attempt to shield the valley communities from its impact.

Pontchartrain, Lake, lake, southern Louisiana, U.S., 40 mi (64 km) long and 25 mi wide, with an area of 625 sq mi (1,619 sq km) and a mean depth of 10 to 16 ft (3 to 5 m). More a tidal lagoon than a lake, since it connects eastward with the Gulf of Mexico by a narrow passage called the Rigolets, Lake Pontchartrain is brackish and teems with game fish. It was discovered by Pierre Le Moyne,

Lighthouse on Lake Pontchartrain in southern Louisiana
Alan Pitcairn from Grant Heilman—EB Inc.

sieur d'Iberville, in 1699. Fontainebleau State Park and many small resorts are around the lakeshore. Pontchartrain Causeway, a 24-mi multispan concrete bridge completed in 1956, crosses the lake north from New Orleans. The lake receives floodwaters from the Mississippi via the Bonnet Carré Spillway (*q.v.*).

Ponte, Antonio da (b. 1512, Venice—d. *c.* 1595), architect-engineer who built the Rialto Bridge, Venice.

Though he was undoubtedly the builder of many previous structures, Antonio's earlier works are entirely unknown. He won a competition in 1587 for a design for a permanent bridge over the Grand Canal at the busy Rialto. His broad, single-arch span, covered with arcaded shops, at once became one of the city's foremost monuments. Two years later Antonio built another Venetian landmark, the famed Bridge of Sighs, to replace a span that had been destroyed by a fire.

Ponte-Corvo, Jean-Baptiste Bernadotte, prince de: *see* Charles XIV John *under* Charles (Sweden).

Ponte Vecchio, first segmental arch bridge built in the West (the first of which the

Ponte Vecchio, Florence
J. Allan Cash

arches describe an arc smaller than a semicircle), crossing over the Arno River, Florence, and an outstanding engineering achievement of the European Middle Ages. Its builder, Taddeo Gaddi, completed the bridge in 1345. Requiring fewer piers in the stream than the Roman semicircular-arch design, the segmental arch offered less obstruction to navigation and freer passage to floodwaters. The Ponte Vecchio roadway carries a two-story gallery, the upper gallery connecting the neighbouring Pitti, Uffizi, and other palaces, the lower providing space for shops. During World War II the Ponte Vecchio bridge over the Arno River was the only one spared from destruction by the retreating German army.

Pontecorvo, Guido (b. Nov. 29, 1907, Pisa), Italian geneticist who discovered the process of genetic recombination in the fungus *Aspergillus*.

Pontecorvo was educated at the universities of Pisa (doctorate in agricultural sciences, 1928), Edinburgh (Ph.D., 1941), and Leicester (D.Sc., 1968). Influenced in 1938 by U.S. geneticist Hermann Muller, he designed a method for studying genetic differences among species that ordinarily produce sterile hybrids when interbred. That method permitted him to study evolutionary divergence in the fruit fly *Drosophila*. The conviction that research in microbial genetics could lead to increased production of the drug penicillin, much needed in World War II, led him in 1943 to the genetics of fungi. In 1950 he found that recombination of genes can occur in the filamentous fungus *Aspergillus nidulans* without sexual reproduction. Nonsexual gene recombination became a useful technique in probing the nature of gene action.

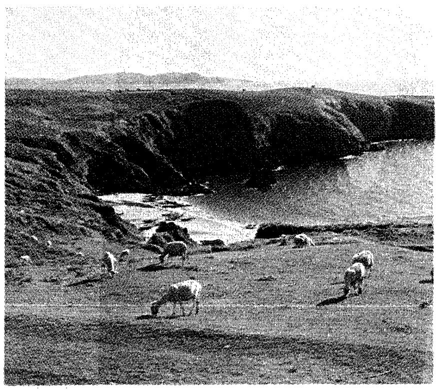
Pontecorvo was elected a fellow of the Royal Society of Edinburgh (1946) and the Royal Society of London (1955). He received honorary degrees from several universities, and he was awarded the Hansen Foundation prize for microbiology (1961) and the Royal Society's Darwin Medal (1978). Pontecorvo was appointed to the first chair of genetics at the University of Glasgow in 1955 after serving for ten years as the head of that university's newly created genetics department. In 1968 he moved to London to work at the Imperial Cancer Research Fund Laboratories where he remained until his retirement in 1975.

Pontedera, Andrea da: *see* Pisano, Andrea.

Pontefract, locality and historic market town (1194), Wakefield district, county of West Yorkshire, England. It lies east of the Pennine foothills, 4 mi (6 km) south of the Calder River above its confluence with the Aire. It grew around a Norman castle (1069) as the market centre of a rich agricultural area. The castle, an important stronghold, sustained three sieges in the mid-17th-century English Civil War before the Royalists surrendered.

With the development of coal mining in the locality in the 19th century, it acquired industries, especially engineering. Still a market and service centre, it manufactures licorice confectionery (Pomfret cakes) and has a well-known racecourse. Pop. (1981) 29,047.

Pontevedra, province, northwestern Spain, smallest of the four provinces of the autonomous community (region) of Galicia, with an area of 1,729 sq mi (4,477 sq km). It is mountainous, with an Atlantic coastline deeply indented by the picturesque *rías bajas* (inlets) of Arosa, Pontevedra, and Vigo. Numerous traditional fiestas held throughout the province contribute, with the scenic beauty and fine beaches, to its attractions for tourists. Cattle, timber, agricultural produce, fish, and shellfish are exported. Vigo, with one of the best harbours in Europe, is a port of call for transatlantic shipping and is also Spain's most important fishing port. Other ports are Villagarcía (also a resort), Marín (with a naval aca-



Goats grazing along the coast in Pontevedra province, Spain
G. Mairani

demy), and Pontevedra, the provincial capital. Pop. (1982 est.) 915,152.

Pontevedra, city, capital of Pontevedra province, in the autonomous community (region) of Galicia, northwestern Spain, on the Río Lérez at its entry into the Ría (inlet) de Pontevedra, an Atlantic inlet. The city's port and shipyards were important in the Middle Ages, and it is probable that Columbus' ship, the "Santa Maria," was built there. It has also been claimed as the birthplace of Columbus. Legend says that it was founded by a Greek, Teukro, who called it Helenes; but more likely it was of Roman origin, hence its old name Pons Vetus ("old bridge"), from the 11-arch bridge that, with modifications, still spans the Lérez. Noteworthy buildings include the Plateresque church of Santa María la Mayor (1520–59), a national monument; the 14th-century Gothic convents of San Francisco (also a national monument) and Santa Clara; the Rococo Santuario de La Peregrina (1778–92); and the ruins of the 14th-century convent of Santo Domingo, now an archaeological museum.

Industries include the manufacture of cloth, hats, leather, pottery, fertilizers, timber, and cellulose; and there is an active trade in grain, wine, and fruit. Pop. (1982 est.) 70,223.

Consult the INDEX *first*

Ponti, Gio(vanni) (b. Nov. 18, 1891, Milan—d. Sept. 15, 1979, Milan), Italian architect and designer associated with the development of modern architecture and modern industrial design in Italy.

Ponti graduated in 1921 from the Milan Polytechnic. From 1923 to 1938 he did industrial design for the Richard-Ginori pottery factory. In 1928 he founded the magazine *Domus*, which influenced interior decoration, serving as its editor until 1946.

In 1933 Ponti was appointed to the executive committee of the Fifth Milan Triennale, an international exhibition stressing the work of young Milanese avant-garde architects. Among his important buildings of the 1930s were the Institute of Mathematics, University of Rome (1934); the Catholic Press Exhibition, Vatican City (1936); and the first office block of the Montecatini company, Milan (1936). Thereafter he carried out a series of projects in various parts of the world. His best known architectural work, the Pirelli Building, Milan (1955–59, with Pier Luigi Nervi and others), is notable for its hexagonal plan.

Simultaneously with his architecture, Ponti was active in painting, the graphic arts, design for the theatre—including costumes and scenery for Milan's La Scala opera—and motion pictures, and interior design.

Pontiac (b. *c.* 1720, on the Maumee River, in Ohio—d. April 20, 1769, Cahokia, Ill.), Ottawa Indian chief who became a great intertribal leader when he organized a combined resistance—known as Pontiac's War (1763–64)—to British power in the Great Lakes area.

Little is known of Pontiac's early life, but by 1755 he had become a tribal chief. His commanding manner and talent for strategic planning also enabled him to become the leader of a loose confederacy among the Ottawa, the Potawatomi, and the Ojibwa. In 1760 he met Maj. Robert Rogers, a British colonial ranger on his way to occupy Michilimackinac (St. Ignace, Mich.) and other forts surrendered by the French during the French and Indian War of 1754–63. Pontiac agreed to let the British troops pass unmolested on condition that he be treated with respect.

He soon came to realize, however, that under the British rule his people would no longer be welcome in the forts and that they would ultimately be deprived of their hunting grounds by aggressive settlers encroaching upon their ancestral lands. Thus, in 1762 Pontiac enlisted support from practically every Indian tribe from Lake Superior to the lower Mississippi for a joint campaign to expel the British. In what the English called "Pontiac's Conspiracy," he arranged for each tribe to attack the nearest fort (May 1763) and then to combine to wipe out the undefended settlements.

The shrewd and daring leader elected to capture Detroit himself, and it is for this military action that he is particularly remembered. When his carefully laid plans for a surprise attack (May 7) were betrayed to the commanding officer, he was forced to lay siege to the fort. On July 31 Pontiac won a brilliant victory at the Battle of Bloody Run, but the besieged fort was nevertheless able to receive reinforcements, and on October 30 Pontiac withdrew to the Maumee River.

Pontiac's larger plan was more successful. Of the 12 fortified posts attacked by the united tribes, all but 4 were captured; most of the garrisons were wiped out, several relief expeditions were nearly annihilated, and the frontier settlements were plundered and laid desolate. By 1764 continuing British action began to take its toll, however, and Pontiac finally agreed to conclude a treaty of peace in July 1766.

Three years later, while he was visiting in Illinois, a Peoria Indian stabbed and killed him. His death occasioned a bitter war among the tribes, and the Illinois group was almost annihilated by his avengers.

Pontiac, city, seat (1847) of Livingston County, central Illinois, U.S., on the Vermilion River. Settled *c.* 1830, it was laid out in 1837 and named for the famous Ottawa Indian chief. A state reformatory, established there in 1871, is now the Pontiac Correctional Center. The community's basically agricultural economy—corn and soybeans—is supplemented by light industry, including the manufacture of furniture, industrial storage equipment, lawn mowers, gloves, and shoe heels, and by commercial printing. Inc. village, 1856; city, 1872. Pop. (1980) 11,227.

Pontiac, city, seat (1820) of Oakland County, southeastern Michigan, U.S., on the Clinton River, 25 mi (40 km) northwest of Detroit. Named for the Ottawa Indian chief, it was located on the Saginaw Trail and became an important wagon and carriage production centre in the 1880s. It later turned to the manufacture of automobiles, auto parts, buses, and trucks. The Oakland Pioneer and Historical Society is headquartered in the Governor Moses Wisner House (1845). Oakland University (1959) in nearby Rochester is the site of the summer Meadow Brook Music Festival. Pontiac is the site of the Silverdome, a sports arena, that seats 80,600 persons. Inc. village, 1837; city, 1861. Pop. (1980) 76,715.

Pontian, SAINT, Latin PONTIANUS (b. Rome—d. *c.* 236, Sardinia; feast day November 19), pope from 230 to 235 who summoned the Roman synod that confirmed the condemnation of Origen, one of the chief theologians of the early Greek Church. At the beginning of the persecution of Christians under the Roman emperor Maximinus in 235, Pontian was exiled to the mines of Sardinia with St. Hippolytus, who had opposed both Pope St. Urban I and Pontian.

While sharing their exile, Pontian and Hippolytus became reconciled. On Sept. 28, 235, Pontian abdicated to St. Anterus, who was quickly executed. Pontian died a short while afterward with Hippolytus. Their deaths are traditionally thought to have been the result of ill treatment. His epitaph in the catacomb of St. Calixtus, Rome, was found in 1909; the inscription of the date of his resignation is noted as the first specific date in papal history.

Pontian Stage, major division of Miocene rocks and time (the Miocene Epoch began about 26,000,000 years ago and lasted about 19,000,000 years). It was named for deposits near the Black Sea (Latin: Pontus Euxinus). The Pontian deposits are representative of a freshened lagoonal environment, in contrast to the preceding Sarmatian Stage, in which inland, salt-sea deposits dominate.

The Pontian faunal assemblage is the ancestral fauna of the present Caspian Sea. It is of limited variety, though it is locally abundant. Mollusks are dominant, especially clams.

Pontian rocks were deposited in a series of basins that were exposed at first to a period of extensive flooding by a transgressing sea and then to more pronounced isolation and freshening as the seas withdrew and the basins became freshwater or brackish-water lakes.

Pontianak, *kotamadya* (city), *kabupaten* (regency), and capital, Kalimantan Barat *propinsi* (West Borneo province), Borneo, Indonesia, just inland from the western coast on the Sungai (river) Kapuas-ketjil. Founded in 1772, the city was formerly the capital of the sultanate of Pontianak, a trading station that later became the chief gold city of Borneo. Houses are built on piles to avoid the regular flooding of the river; the hinterland is tropical forest and swampland, and the area is one of great humidity. A major industry is shipbuilding, and palm oil, rubber, and sugar are processed. Other products of the region include pepper, rice, corn (maize), cassava, and tobacco. Air service is from nearby Supadio airport. Pop. (1980) city, 304,778; regency, 608,893.

Pontic Mountains, mountains rising out of the northern side of the Asia Minor peninsula, Turkey, in an area once occupied by the ancient country of Pontus. The range reaches a maximum height of 12,917 ft (3,937 m) and makes a gentle double bend, reflected in the outline of the southern shore of the Black Sea.

Dense pine forests cover the hills. On the cultivated land near the sea, tobacco, hazelnuts, tea, and citrus fruits predominate.

pontifex (Latin: "bridge builder"), plural PONTIFICES, member of a council of priests in ancient Rome. The college, or *collegium*, of the *pontifices* was the most important Roman priesthood, being especially charged with the administration of the *jus divinum* (*i.e.,* that part of the civil law that regulated the relations of the community with the deities recognized by the state), together with a general superintendence of the worship of gens and family. Whether the literal meaning of the name indicates any special connection with the sacred bridge over the Tiber (Pons Sublicius) cannot now be determined.

The college existed under the monarchy, when its members were probably three in number; they may be considered as having been legal advisers of the *rex* in all matters of religion. Under the republic they emerge into prominence under a *pontifex maximus*, or supreme priest, who took over the king's duties as chief administrator of religious law. During the republican period the number of *pontifices* increased until by the time of Julius Ceasar there were 16. Included in the *collegium* were also the *rex sacrorum*, the *flamines*, three assistant *pontifices* (*minores*), and the Vestal Virgins, who were all chosen by the *pontifex maximus.* Vacancies in the body of *pontifices* were originally filled by co-optation; but from the second Punic War onward the *pontifex maximus* was chosen by a peculiar form of popular election, and in the last age of the republic this was true for all the members. They all held office for life.

The immense authority of the *collegium* centred in the *pontifex maximus*, the other *pontifices* forming his *consilium*, or advising body. His functions were partly sacrificial or ritualistic, but these were the least important; the real power lay in the administration of the *jus divinum*, the chief departments of which may briefly be described as follows: (1) the regulation of all expiatory ceremonials needed as the result of pestilence, lightning, etc.; (2) the consecration of all temples and other sacred places and objects dedicated to the gods by the state through its magistrates; (3) the regulation of the calendar both astronomically and in detailed application to the public life of the state; (4) the administration of the law relating to burials and burying places and the worship of the Manes, or dead ancestors; (5) the superintendence of all marriages by *confarreatio* (*i.e.,* originally, of all legal patrician marriages) (6) the administration of the law of adoption and of testamentary succession. They had also the care of the state archives and of the lists of magistrates and kept records of their own decisions (*commentarii*) and of the chief events (*annales*).

It is obvious that a priesthood with such functions and holding office for life must have been a great power in the state, and for the first three centuries of the republic it is probable that the *pontifex maximus* was in fact its most powerful member. The office might be combined with a magistracy, and, though its powers were declaratory rather than executive, it may be described as quasi-magisterial. Under the later republic it was coveted chiefly for the great dignity of the position; Julius Caesar held it for the last 20 years of his life, and Augustus took it after the death of Lepidus in 12 BC, after which it became inseparable from the office of the reigning emperor.

Pontine Islands (Italy): *see* Ponza Islands.

Pontine Marshes, Italian AGRO PONTINO, reclaimed area in Latina province, Lazio (Latium) region, south central Italy, extending between the Alban Hills (Colli Albani), the Monti (mountains) Lepini, and the Tyrrhenian Sea, and traversed by the Appian Way. Two tribes, the Pomptini and the Ufentini, lived in this district in early Roman times, but the region was already marshy and malarial during the later years of the Roman Republic. Several emperors and popes made unsuccessful attempts at reclamation, but throughout modern history the marshes remained unhealthy, inhabited by a handful of shepherds, with small fields on the higher eastern edge where peasants from towns high on the Monti Lepini cultivated wheat. Rough pasture and *maquis* (a tough scrub) covered most of the area.

In 1928 the Fascist government of Benito Mussolini launched a drive to drain the marshes, clear the vegetation, and settle several hundred families. Towns were built in the former wilderness: Littoria (now Latina) in 1932, Sabaudia in 1934, Pontinis in 1935, Aprilia in 1937, and Pomezia in 1939. On the eve of World War II the only areas in which the original vegetation remained were in the Monte Circeo National Park. Damage done to the farms and drainage works and canals during World War II was later repaired, and the Agro Pontino (area about 300 sq mi [777 sq km]) is now one of the most productive in Italy, yielding cereals, sugar beets, fruit, vegetables, and livestock. Light industry was established in the area from 1960 onward with subsidies from a regional development program, the Cassa per il Mezzogiorno (Fund for the South).

Pontoise, town, capital (since 1964) of Val-d'Oise *département*, Paris region, northern France, on the right bank of the Oise River, northwest of Paris. In 1966 it became an episcopal see, and its cathedral, formerly Saint-Maclou church, dates from the 12th century. It has a Flamboyant Gothic facade and a tower with a Renaissance dome. The double northern aisle is a Renaissance masterpiece. Pontoise was acquired by Philip I in 1064 and became the capital of the French Vexin region. It played a conspicuous part in the Hundred Years' War (1337–1453) and was twice in English hands in the first half of the 15th century. The Parliament of Paris met there several times in the 16th and 17th centuries. It was occupied by the Germans in 1870–71 and was damaged in World War II. Metallurgical and chemical industries form part of the city's economic base. Just south of the city the new town of Cergy is being developed. Pop. (1982) 27,885.

pontoon bridge, floating bridge, used primarily but not invariably for military purposes. A pontoon bridge was constructed in 480 BC by

Persian engineers to transport Xerxes' invading army across the Hellespont (Dardanelles). According to Herodotus, the bridge was made of 676 ships stationed in two parallel rows with their keels in the direction of the current. Alexander the Great is said to have crossed the Oxus by rafts made of his soldiers' tents of hide stuffed with straw.

More modern armies, such as Napoleon's, carried prefabricated pontoons of wood, copper, or other material either closed or open. The U.S. Army in the 19th century experimented with pneumatic rubber pontoons and discarded them as less serviceable than wood or metal but returned to their use in an improved form serviced by air compressors during World War II.

Because they obstruct navigation, floating bridges are limited in non-military applications, yet several long-span floating bridges have been built in modern times. Notable examples are concrete-pontoon bridges over Lake Washington (Seattle, Wash.), 6,560 feet (2,000 metres) long; over the Derwent (Tasmania), 3,165 ft long; and over the Golden Horn (Istanbul), 1,500 ft long.

Pontoppidan, Henrik (b. July 24, 1857, Fredericia, Den.—d. Aug. 21, 1943, Ordrup, near Copenhagen, Den.), Realist writer who shared with Karl Gjellerup the Nobel Prize for Literature in 1917 for "his authentic descriptions of present-day life in Denmark."

Pontoppidan, 1917
By courtesy of the Nobel Foundation, Stockholm

Pontoppidan's novels and short stories—informed with a desire for social progress but despairing, later in his life, of its realization—present an unusually comprehensive picture of his country and his epoch.

The son of a clergyman, Pontoppidan partly revolted against his environment by studying engineering in Copenhagen in 1873. In 1879 he broke off his studies and became for several years a teacher. His first collection of stories, *Stækkede Vinger*, was published in 1881, and thereafter he supported himself by writing, until 1900 partly as a journalist with various Copenhagen papers.

Pontoppidan's output—mainly novels and short stories written in a cold, aloof, epic style—stretches over half a century and covers most aspects of Danish life.

His first books were about country-town life. *Landsbybilleder* (1883), *Fra Hytterne* (1887), and *Skyer* (1890) are all characterized by social indignation though also by ironic appreciation of the complacency and passivity of country people. The trilogy *Det Forjættede Land*, 3 vol. (1891, 1895; *The Promised Land*, 1896) describes the religious controversies in country districts. In the 1890s Pontoppidan wrote short novels on psychological, aesthetic, and moral problems (*e.g., Nattevagt,* 1894; *Den Gamle Adam*, 1895; and *Højsang*, 1896). These were followed by a major work, the novel *Lykke-Per* (1898–1904), in which the chief character bears some resemblance to Pontoppidan himself. He is a clergyman's son who rebels against the puritanical atmosphere of his home and seeks his fortune in the capital as an engineer. The book's theme is the power of environment, and national tendencies toward daydreaming and fear of reality are condemned.

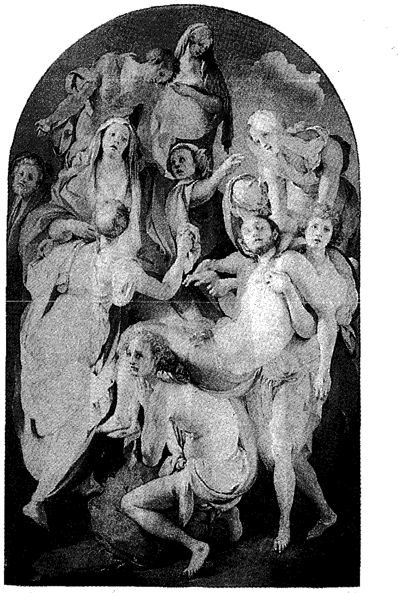
Pontoppidan's third great novel cycle, *De dødes rige*, 5 vol. (1912–16; "The Empire of Death"), shows dissatisfaction with political developments after the liberal victory of 1901, and anxiety over the barrenness of the new era. The bitter novel *Mands Himmerig* (1927) describes neutral Denmark during World War I and attacks carefree materialism. His last important work was the four volumes of memoirs that he published between 1933 and 1940 and that appeared in a collected and abridged version entitled *Undervejs til mig selv* (1943).

Pontormo, Jacopo da, original name JACOPO CARRUCCI (b. May 24, 1494, Pontormo, near Empoli, Republic of Florence—buried Jan. 2, 1557, Florence), Florentine painter who broke away from High Renaissance Classicism to create a more personal, expressive style that is sometimes classified as early Mannerism.

Pontormo was the son of Bartolommeo Carrucci, a painter. According to Vasari he was apprenticed to Leonardo da Vinci and afterward to Albertinelli and Piero di Cosimo. At the age of 18 he entered the workshop of Andrea del Sarto, and it is this influence that is most apparent in his early works. In 1518 he completed an altarpiece in the church of S. Michele Visdomini, Florence, that reflects in its agitated—almost neurotic—emotionalism a departure from the balance and tranquillity of the High Renaissance. His painting of "Joseph in Egypt" (*c.* 1515; National Gallery, London), one of a series for Pier Francesco Borgherini, suggests that the revolutionary new style appeared even earlier.

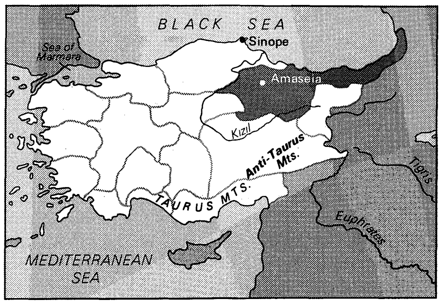
Pontormo was primarily a religious painter, but he painted a number of sensitive portraits and in 1521 was employed by the Medici family to decorate their villa at Poggio a Caiano with mythological subjects. In the Passion cycle (1522–25) for the Certosa near Florence (now in poor condition), he borrowed ideas from Dürer, whose engravings and woodcuts were circulating in Italy. His mature style is best exemplified in the "Deposition" painted soon after this for Sta. Felicità, Florence.

Pontormo became more and more of a recluse in later life. A diary survives from 1554 to 1557, but the important frescoes in S. Lorenzo on which he worked during the last decade of his life are now known only from drawings; in these the influence of Michelangelo is apparent. Numerous drawings survive, and paintings are to be found in various galleries in Europe and America, as well as in Florence.



"Deposition," oil on panel by Jacopo da Pontormo, 1525–28; in the church of Sta. Felicità, Florence
SCALA—Art Resource/EB Inc.

Pontus, ancient district in northeastern Anatolia adjoining the Black Sea; in the 1st century BC it briefly contested Rome's hegemony in Anatolia. An independent Pontic kingdom with its capital at Amaseia (modern Amasya)



Pontus
From W. Shepherd, *Historical Atlas*, Harper & Row, Publishers (Barnes & Noble Books), New York City; revision copyright © 1964 by Barnes & Noble, Inc.

was established at the end of the 4th century BC in the wake of Alexander's conquests. Superficially Hellenized, the kingdom retained its Persian social structure, with temple priests and Persianized feudal nobles ruling over a heterogeneous village population. In the 3rd and 2nd centuries BC Pontus gradually asserted itself among the petty Hellenistic states of Anatolia, annexing Sinope (modern Sinop; *q.v.*) as its new capital (183 BC). The Pontic kingdom reached its zenith under Mithradates VI Eupator (*c.* 115–63 BC), whose program of expansion brought him into disastrous conflict with Rome, resulting in the virtual extinction of the Pontic kingdom and its incorporation into the Roman Empire (63–62 BC).

Pontypool, town, seat of Torfaen district, Gwent county, Wales, in the valley of the Afon Lwyd. Lying on the eastern edge of the South Wales coalfield, it was an early metalworking centre, with iron smelting (from 1577) and also tinplate manufacture; in the 18th century it produced lacquered ironware known as Pontypool ware. Today it has both steel and glass industries, some rubber manufacturing, and a large nylon factory. Pop. (1981) 36,301.

Pontypool ware, japanned (varnished) tinplate produced in Wales at the Allgood family factory in Pontypool and later in Usk, Monmouthshire. It is distinguished from other japanned tinware by its distinctive lustre and unique durability. These features are the results of the experiments by craftsmen of the Allgood family, who also developed their own tinplating technique. The Pontypool factory was established by Edward Allgood in about 1732. Thin sheets of iron were dipped into molten tin, then worked into domestic utensils, such as teapots, trays, and dishes, or into ornaments. The pieces were japanned with a preparation made from linseed oil, umber (a brown oxide of iron), litharge (a lead monoxide), and, for the dark ground on which the colourful decoration is based, asphalt, or coal-tar pitch. When the pieces had been decorated with several coats, they were fired repeatedly at a low temperature, often over periods of up to three weeks, leaving the finish almost totally resistant to heat. The Allgood partnership broke up in 1761, another factory being established at Usk and producing a similar ware.

The decorative subjects used on Pontypool ware were largely Chinese scenes and figures, but those on the Usk ware included sporting and rustic scenes. The Pontypool factory had closed by 1822, and the Usk factory continued only for another 40 years. The most comprehensive collections of Pontypool ware are to be seen at the National Museum of Wales, Cardiff, and the Newport Museum and Art Gallery, Gwent.

Pontypridd, town, seat of Taff-Ely district, Mid Glamorgan county, Wales, at the confluence of the rivers Rhondda and Taff. Pontypridd is a shopping centre for the Rhondda and middle Taff valleys. Industrially, its coal-mining and chain-making interests have been largely superseded by a variety of light engineering and other factories, especially on the Treforest Industrial Estate (1937). A single-span, 140-ft (43-m) bridge over the Taff, no longer in use, was constructed in 1756 by William Edwards, a local stonemason. Pop. (1981) 29,796.

pony, any of several breeds of small horses standing less than 14.2 hands high (a hand equals 4 inches, or about 10 centimetres) and noted for gentleness and endurance. Among the common pony breeds are the Shetland, whose docile nature and good endurance make it desirable as a pack animal and a riding horse for children; the Welsh, a hardy breed with fine endurance and style; the Welsh Cob, noted for its high-stepping action; the Exmoor and Dartmoor, native to the moors of Somerset, Devon, and Cornwall, England, and now used to breed polo ponies; and the Highland, a thick, gray saddle animal.

Pony Express, in U.S. history, system of mail delivery by continuous horse and rider relays between St. Joseph, Mo., and Sacramento, Calif. (April 1860–October 1861). Although a financially disastrous, brief enterprise for the sponsoring firm of Russell, Majors, and Waddell, the Pony Express and its most famous riders, William ("Buffalo Bill") Cody and "Pony Bob" Haslam, gave rise to one of the most colourful episodes of the American West.

The approximately 1,800-mile (2,897-kilometre) route normally required about 10 days to cover, with riders changing horses six to eight times between stations, of which there were 157. The service ceased with the completion of the transcontinental telegraph system.

Ponza Islands, also called PONTINE ISLANDS, Italian ISOLE DI PONZA, Latin INSULAE PONTIAE, volcanic island group in the Tyrrhenian Sea off the west coast of south central Italy, part of Latina province. The islands include Ponza (the largest), Palmarola, and Zannone in a western cluster and Ventotene and Santo Stefano in an eastern group, with a total area of 4.2 sq mi (10.9 sq km). The highest point of the island of Ponza is Monte Guardia (928 ft [283 m]).

Regular steamer services connect Ponza with Naples and, in the summer, with Anzio and Formia. Kaolin and bentonite are mined on the islands, which have become popular as summer resorts. Used since ancient times as places of exile, Ventotene has a prison and Ponza was used as a place of banishment for political prisoners under the Fascist regime. Pop. (1981 prelim.) 3,653.

Ponzillo, Rosa (singer): *see* Ponselle, Rosa.

poodle, breed of dog thought to have originated in Germany. It grew so popular in France, however, that it became the national dog of that country. The poodle was developed as a water retriever, and the distinctive clipping of its heavy coat was initiated to increase the animal's efficiency in the water. The dog has been used as a performer and as a truffle hunter, whose job it was to scent and dig up the edible fungus.

An elegant-looking dog, often ranked as one of the most intelligent of all breeds, the poodle has been bred in three size varieties—

Standard poodle
Sally Anne Thompson—EB Inc.

standard, miniature, and toy. All three are judged by the same standard of appearance, which calls for a well-proportioned dog with a long, straight muzzle, heavily haired, hanging ears, a docked pompon tail, and a characteristic springy gait and proud manner of carrying itself. The coat consists of a woolly undercoat and a dense, wiry topcoat; if allowed to grow, the hair forms ropelike cords, and the dog is called a corded poodle. The coat should be solid, not variegated, and may be any of a number of colours, among them gray, white, black, brown, apricot, and cream. The standard poodle stands more than 15 inches (38 centimetres); the miniature is 10 to 15 inches (25.5 to 38 centimetres); the toy is under 10 inches (25.5 centimetres). Weight variations range from as much as 55 pounds (25 kilograms) to as little as 7 pounds (3 kilograms). The standard and miniature poodles are classed by the American Kennel Club as nonsporting dogs, the toy as a toy dog.

Pool, *région* of southern Congo, west central Africa, bordered by Zaire (south and east). It covers an area of 13,100 sq mi (34,000 sq km) and includes seven districts: Kinkala, Boko, Mindouli, Kindamba, Mayama, Ngamaba, and Ngabé. The capital is Kinkala.

The Djoué River bisects the *région* from northwest to southeast and joins the Congo River just below Brazzaville (the national capital, an administratively distinct commune within the boundaries of Pool). Northeast of the Djoué River, the Plateau Batéké is comparatively empty and undeveloped except near Brazzaville. Southwest of the Djoué, by contrast, a dense rural population supplies meat, dairy products, fruits, and vegetables for the Brazzaville market. Pool's savanna grassland supports one-quarter to one-third of the Congo's goats, pigs, sheep, cattle, and poultry. Truck farming is widespread around Kinkala in the Plateau des Cataracts, between the Congo River and the Brazzaville–Pointe-Noire railway. Further north, around Kindamba in the upper Niari River basin, paddy rice and tobacco are cultivated. Because of the proximity of the capital, transportation networks are among the most highly developed in the country. Pop. (1980 est.) 208,420.

pool, British billiards game in which each player uses a cue ball of a different colour and tries to pocket the ball of a particular opponent, thus taking a "life." Players have three lives and pay into a betting pool at the start of the game. The last player with a life wins the pool. During play, a player who takes a life wins a stake from that opponent. There are also a number of other forfeits paid into the pool for such errors as pocketing one's own ball or knocking a ball off the table.

Pool was a forerunner of the game snooker. *See also* Sporting Record: *Billiards.*

pool (U.S. billiards): *see* pocket billiards.

pool, method of gambling in which all money bet on the result of a particular event by a number of people is awarded to one or more winners according to conditions established in advance (taxes, operating expenses, and other charges may be deducted from the total pool before prizes are awarded).

Pools on football and other professional sports are popular in various forms throughout the world, including areas where they are illegal. In Great Britain and several other countries, football pools are in effect a national lottery, with the government taking more than 30 percent of total receipts. Prizes have been as high as £100,000 on a shilling bet, and gambling winnings by citizens are not taxed. Usually the bettor's task is to select the winning teams or tie games, to predict the correct score in several specified games, or, in baseball, to predict the number of hits or runs each named team will make during a week. A baseball pool called "13" has players taking one of 26 teams, the pool going to the holder of the first team that scores 13 runs in one game.

In U.S. football pools, illegal in most states, selection of winners is made more difficult by handicapping—inferior teams are allotted a certain number of points (point spread), which the other team's winning margin must surpass to score a win in the pool. Payoffs range from 3 to 1 when the actual odds are 15 or 16 to 1 and up to 100 to 1 when the actual odds are 300 to 1. The largest payoffs are made when the odds are as much as 250,000,000 to 1 against the bettor. Such winnings have occurred in Great Britain only as often as might mathematically be expected, considering that about 150,000,000 such bets are made each year.

Pool Checkers (game): *see* Spanish Checkers.

Poole, district (borough), county of Dorset, England, adjoining the major British resort of Bournemouth. The old town occupies a site on the north shore of an extensive, almost landlocked tidal harbour. Extending 25 sq mi (64 sq km), the harbour is a major English yachting centre, and Poole still functions as a small port, mainly for British coastal traffic. There is an old-established pottery, and other industries include boatbuilding, the making of chemicals, and engineering. On the east the town has been greatly extended by modern residential growth in the communities of Parkstone and Branksome to coalesce with its modern larger neighbour, Bournemouth. Largest of the islands in Poole Harbour is Brownsea, a bird sanctuary given to the National Trust in 1962. Pop. (1981) 119,316.

Poole, Elijah: *see* Muhammad, Elijah.

Poole, William Frederick (b. Dec. 24, 1821, Salem, Mass., U.S.—d. March 1, 1894, Evanston, Ill.), U.S. bibliographer and library administrator whose indexing of periodicals became authoritative.

As a student at Yale, Poole learned the principles of indexing from John Edmands (1820–1915), afterward librarian of the Philadelphia Mercantile Library, whom Poole succeeded as librarian of a college literary society. While still in college, Poole prepared *An Alphabetical Index to Subjects Treated in the Reviews and Other Periodicals* . . . (1848), which was revised and enlarged as *Poole's Index to Periodical Literature* (1887–1908).

After directing successively two libraries in Boston (1852–69), Poole organized and served as chief librarian of the public libraries of Cincinnati (1871–73) and Chicago (1874–87),

Poole

By courtesy of the Public Library of Cincinnati and Hamilton County, Ohio

building the circulation of the Chicago library to the largest in the United States in its time. Subsequently he organized the Newberry Library, Chicago.

Poona (India): *see* Pune.

Poona Pact (Sept. 24, 1932), agreement between Hindu leaders in India granting new rights to untouchables. The pact resulted from the communal award of Aug. 4, 1932, made by the British government on the failure of the India parties to agree, which allotted seats in the various legislatures of India to the different communities. Mahatma Gandhi objected to the provision of separate electorates for the "scheduled castes" (untouchables), which in his view separated them from the whole Hindu community. Though in prison, Gandhi announced a fast unto death, which he began on September 18.

B.R. Ambedkar, the untouchable leader, who felt that his group's special interests might be advanced by the government's system, resisted concessions until Gandhi was near death. He and the Hindu leaders then agreed to the pact, which withdrew separate electorates but gave increased representation to the scheduled castes for a 10-year period. Ambedkar complained of blackmail, but the pact marked the start of movement against untouchability within the Indian nationalist movement.

Poonch (India): *see* Pūnch.

Poopó, Lake, Spanish LAGO POOPÓ, lake in Oruro department, west central Bolivia, occupying a shallow depression in the Altiplano, or high plateau, at 12,090 ft (3,686 m) above sea level. It is the country's second largest lake and covers approximately 1,000 sq mi (2,600 sq km) at low stage. It is about 56 mi (90 km) long and 20 mi wide but only 8 to 10 ft deep.

The Desaguadero and del Márquez rivers feed the lake, and its only visible outlet is the Río Lacajahuira. During floods (high stage) it spills into the Salar de Coipasa, a salt flat 50 mi to the southwest. Salt content of the water is heavy because of excessive evaporation. Settlement on its shores, made marshy by filtration of water into the lake bed, is sparse.

poor house: *see* almshouse.

Poor Knights of Christ and of the Temple of Solomon: *see* Templar.

Poor Law, body of laws undertaking to provide relief for the poor, developed in 16th-century England and maintained, with various changes, until after World War II. The Elizabethan Poor Laws, as codified in 1597–98, were administered through parish overseers, who provided relief for the aged, sick, and infant poor, as well as work for the able-bodied in workhouses. Late in the 18th century, this was supplemented by the so-called Speenhamland system of providing allowances to workers who received wages below what was considered a subsistence level. The resulting increase in expenditures on public relief was so great that a new Poor Law was enacted in 1834, based on a harsher philosophy that regarded pauperism among able-bodied workers as a moral failing. The new law provided no relief for the able-bodied poor except the misery of the workhouse, with the object of stimulating workers to seek regular employment rather than charity. The growth of humanitarian feeling in the 19th century helped to mitigate the harshness of the law in practice, and the phenomenon of industrial unemployment in the 20th century showed that poverty was more than a moral problem. The social legislation of the 1930s and 1940s replaced the Poor Laws with a comprehensive system of public welfare services. *See also* workhouse.

poor-me-one, bird also known as the common potoo. *See* potoo.

Poor Richard, unschooled but experienced homespun philosopher, a character created by Benjamin Franklin and used as his pen name for the annual *Poor Richard's* almanac, edited by Franklin from 1732 to 1757. Although the Poor Richard of the early almanacs was a dim-witted and foolish astronomer, he was soon replaced by Franklin's famous Poor Richard, a country dweller, dutifully pious, quiet, and rather dull, who is a rich source of prudent and witty aphorisms on the value of thrift, hard work, and the simple life. Among his practical proverbs are "God helps those who help themselves" and "Early to bed and early to rise, makes a man healthy, wealthy, and wise."

The Way to Wealth (1757) is a collection of Poor Richard's advice on getting ahead in business and public life. Poor Richard is the precursor of later horse-sense characters such as Sam Slick, Josh Billings, and Davy Crockett, who belong to a tradition of typically American humour.

poorwill (*Phalaenoptilus nuttallii*), nocturnal bird of North America belonging to the nightjar family (Caprimulgidae). The poorwill, named for its call, is about 20 centimetres (8 inches) long and has mottled gray plumage, a short tail with a bit of white at the corners, and a narrow bib, white in the male, buffy in the female. This bird catches flying insects at night. It breeds in arid country west of the Mississippi River, north to British Columbia, laying two white eggs on the ground. It winters from California to central Mexico.

The poorwill is one of the few examples of hibernators among birds. It clings to the walls of rock crevices in a torpid state during the unfavourable winter months.

Pop art, largely British and American cultural phenomenon from the late 1950s, named by the art critic Lawrence Alloway in reference to the prosaic iconography of its painting and sculpture. Pop art, according to Richard Hamilton, one of its exponents in England, was "Popular/Transient/Expendable/Low-Cost/Mass-Produced/Young/Witty/Sexy /Gimmicky/Glamorous/Big Business . . . ." Works by such Pop artists as the Americans Roy Lichtenstein, Andy Warhol, Claes Oldenburg, Tom Wesselman, James Rosenquist, and Robert Indiana and the Englishmen David Hockney and Peter Blake, among others, were characterized by their portrayal of any and all aspects of popular culture that had a powerful impact on contemporary life; their iconography—taken from television, comic books, movie magazines, and all forms of advertising—was presented emphatically and objectively, without praise or condemnation but with overwhelming immediacy, and by means of the precise commercial techniques used by the media from which the iconography itself was borrowed. Pop art represented an attempt to return to a more objective, universally acceptable form of art after the dominance in both the United States and Europe of the highly personal American Abstract Expressionism (*q.v.*). It was also iconoclastic, rejecting both the supremacy of the "high art" of the past and the pretensions of other contemporary avant-garde art. Pop art became a cultural event because of its close reflection of a particular social situation and because its easily comprehensible images were immediately accepted and exploited by the mass media. Although Pop art has been described as vulgar, sensational, nonaesthetic, and a joke, it has also been seen as an art directly responsive to life, an art that is democratic and nondiscriminatory, bringing together both connoisseurs and untrained viewers.

Pop art is a descendant of Dada (*q.v.*), a nihilistic movement current in the 1920s that ridiculed the seriousness of contemporary Parisian art and, more broadly, the political and cultural situation that had brought war to Europe. Marcel Duchamp, the champion of Dada in the United States, who tried to narrow the distance between art and life by celebrating the mass-produced objects of his time, was the most influential figure in the evolution of Pop art. Other 20th-century artists who influenced Pop art were Stuart Davis, Gerard Murphy, and Fernand Léger, all of whom depicted in their painting the precision, mass-production, and commercial materials of the machine-industrial age. The immediate predecessors of the Pop artists were Jasper Johns, Larry Rivers, and Robert Rauschenberg, American artists who in the 1950s painted flags, beer cans, and other similar objects, though with a painterly, expressive technique.

Some of the more striking forms that Pop art took were Roy Lichtenstein's faithful reproductions, down to the colour dots used in commercial printing, of comic-strip pictures; Andy Warhol's meticulously literal paintings and silk-screen prints of soup can labels, soap cartons, and rows of soft drink bottles; Claes Oldenburg's soft plastic sculptures of objects such as bathroom fixtures, typewriters, and gigantic hamburgers; Tom Wesselman's "Great American Nudes," flat, direct paintings of faceless sex symbols; and George Segal's constructed tableaux featuring life-sized plaster-cast figures placed in actual environments (*e.g.,* lunch counters and buses) retrieved from junkyards.

Most Pop artists aspired to an impersonal, urbane attitude in their works. Some examples of Pop art, however, were subtly expressive of social criticism—for example, Oldenburg's drooping objects and Warhol's monotonous

"Brillo Box," silk screen ink on wood by Andy Warhol, Pop art, 1964; in the Leo Castelli Gallery, New York City

By courtesy of Leo Castelli Gallery, New York City repetitions of the same banal image have an undeniably disturbing effect—and some, such as Segal's mysterious, lonely tableaux, are overtly expressionistic.

American Pop art tended to be emblematic, anonymous, and aggressive; English Pop, more subjective and referential, expressed a somewhat romantic view of Pop culture fostered perhaps by England's relative distance from it. English Pop artists tended to deal with technology and popular culture primarily as themes, even metaphors; some American Pop artists actually seemed to live these ideas. Warhol's motto, for example, was, "I think everybody should be a machine," and he tried in his art to produce works that a machine would have made.

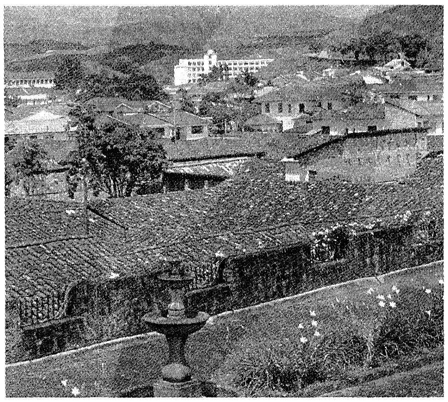
Pop art was not taken seriously by the public, but it found critical acceptance as a form of art suited to the highly technological, mass-media oriented society of Western countries.

Pop Warner Football, in full POP WARNER JUNIOR LEAGUE FOOTBALL, American football program in which boys aged 8 to 15 compete under safety-first rules. Teams are matched by age and weight and must comply with strict equipment standards. The program was founded in 1929 and named for Glenn Scobey ("Pop") Warner, a prominent and innovative coach of the early 1900s. By the late 20th century several thousand teams in local leagues were participating in the United States and Mexico. League headquarters are in Philadelphia.

Popa, Mount, also called POPA HILL, extinct volcano, central Myanmar (Burma), at the northern end of Pegu Mountain Range. It rises to 4,985 feet (1,519 m), has a mile-wide crater, and is the highest point in the range. Mount Popa is believed to be the home of the 37 nats, or spirits, that are a part of Burmese animist religion.

Popayán, capital of Cauca *departamento,* southwestern Colombia, at the base of Puracé Volcano (15,603 feet [4,756 m]) on a tributary of the Cauca River, 5,702 feet (2,241 m) above sea level. Founded in 1535, the city has always been an administrative centre. During the colonial era, landowners and mining entrepreneurs resided there, giving it major cultural and religious importance and its architecture a distinctive Spanish flavour. Its various educational institutions include the University of Cauca (1827).

The changing pattern of development in Colombia since independence has reduced



Popayán, Colom.
Carl Frank

Popayán's economic significance. Its industrial activity is focused largely on the processing of food and beverages and the manufacture of clothing and building materials. Popayán is the southern terminus of the railway running north to Cali and Medellín and is on the Simón Bolívar Highway and a part of the Pan-American Highway connecting the Cauca valley with Ecuador. It is the node of an extensive departmental road network. Indian peoples make up a large part of the population. Pop. (1985) 141,964.

popcorn, a variety of corn (maize), the kernels of which, when exposed to heat or microwaves, are exploded into large fluffy masses. The corn used for popping may be any of about 25 different varieties of *Zea mays;* the two major types are rice popcorn, in which the grains are pointed at both base and apex, and pearl popcorn, in which the grains are rounded and compact. A popcorn kernel has an extremely hard hull and hard outer endosperm, and within there is a mass of moist, starchy, white endosperm. The moisture is optimally about 13.5 percent. When such kernels are heated to about 400° F (about 200° C), the moisture in the starch turns into steam and builds up pressure until the kernel explodes inside out into a white fluffy, irregular mass, about 20 to 40 times the original size.

Popcorn is native to the Western Hemisphere. Thousand-year-old kernels of popcorn have been found by archaeologists in Peru and Utah. The first European explorers of the New World described the toasting of popcorn by the Indians for food, for scattering in religious ceremonies, and for wearing as decoration in the hair. Today the United States grows almost all the world's popcorn.

As a snack food, popcorn is commonly buttered and salted. It may instead be glazed with variously flavoured and coloured candy syrups that harden, or be mixed with peanuts or almonds, or be coated with melted cheese.

Popé (d. 1692, San Juan Pueblo New Spain [now in New Mexico, U.S.]), Tewa Pueblo medicine man who led an all-Indian revolt in 1680 against the Spanish invaders in what is now the southwestern United States, driving them out of Santa Fe and temporarily restoring the old Pueblo way of life.

Little is known of Popé's life before 1675. In that year he was imprisoned by Spanish authorities on suspicion of witchcraft and of killing several missionaries. After his release from prison, he hid in Taos Pueblo to plan and organize what came to be known as the Pueblo Revolt. Popé believed that he was commanded by tribal ancestral spirits (kachinas) to restore traditional native customs, and other villages enthusiastically responded to news of the planned uprising.

On Aug. 10, 1680, Popé led a united attack of almost all the Pueblo Indian tribes on the Spanish capital of Santa Fe, killing nearly 500. After 10 days nearly 1,000 besieged residents abandoned the city and fled to El Paso del Norte. Popé immediately set about erasing all vestiges of Spanish culture and the Christian religion. Restoring ancestral ways, he traveled from one pueblo to another in ceremonial dress. For a time he was accorded great honour, but success made him despotic; and after a few years, drought, enemy tribe forays, and internal dissension combined to depose him. He was, however, reelected Pueblo leader in 1688, shortly before his death. Although Spanish rule was reestablished in 1692, the alien domination was never as strong as before the time of Popé.

pope (Latin *papa,* from Greek *pappas,* "father"), an ecclesiastical title expressing affectionate respect, formerly given, especially from the 3rd to the 5th century, to any bishop and sometimes to simple priests. The title is still used in the East for the Orthodox patriarch of Alexandria and for Orthodox priests, but, since about the 9th century, it has been reserved in the West exclusively for the bishop of Rome. (*See also* papacy. The article contains a list of popes and antipopes.)

The *Annuario Pontificio* (official directory of the Holy See) describes the office of the pope by the following titles: Bishop of Rome, Vicar of Jesus Christ, Successor of the Prince of the Apostles, Supreme Pontiff of the Western Church, Patriarch of the West, Primate of Italy, Archbishop and Metropolitan of the Province of Rome, Sovereign of the State of Vatican City. The title pope or *papa* (abbreviated PP.) is officially used only as a less solemn style.

Doctrinally, in Catholic churches, the pope is regarded as the successor of St. Peter, who was head of the Apostles. The pope, as bishop of Rome, thus is seen to have full and supreme power of jurisdiction over the universal church in matters of faith and morals, as well as in church discipline and government.

The twofold basis of this doctrine of papal primacy is the place of Peter in the New Testament (in which there are various metaphors expressing his prerogatives) and the place of the Roman church in history. The understanding of papal primacy developed as the church developed, two notable factors being the role of Rome as the imperial city until the 5th century and the religious and political role of the bishop of Rome afterward.

The teaching of the Second Vatican Council (1962–65) on the role of bishops counterbalanced the emphasis on papal prerogatives while maintaining the view that the authority of the bishops as a body cannot be separated from that of the pope as its head. Although the Eastern Orthodox have long been willing to give the bishop of Rome the primacy of honour accorded to patriarchs, and, although many Protestants have appreciated the moral leadership shown by some recent popes, the Catholic doctrine was still a major obstacle to ecumenical efforts in the 20th century.

Pope, Alexander (b. May 21, 1688, London, Eng.—d. May 30, 1744, Twickenham, near London), poet and satirist of the English Augustan period, best known for his poems *An Essay on Criticism* (1711), *The Rape of the Lock* (1712–14), *The Dunciad* (1728), and *An Essay on Man* (1733–34). He is one of the most quotable of all English authors.

Pope's father, a wholesale linen merchant, retired from business in the year of his son's birth and in 1700 went to live at Binfield in Windsor Forest. The Popes were Roman

Alexander Pope, portrait by Thomas Hudson; in the National Portrait Gallery, London
By courtesy of the National Portrait Gallery, London

Catholics, and at Binfield they came to know several neighbouring Catholic families who were to play an important part in the poet's life. Pope's religion procured him some lifelong friends, notably the wealthy squire John Caryll (who persuaded him to write *The Rape of the Lock,* on an incident involving Caryll's relatives) and Martha Blount, to whom Pope addressed some of the most memorable of his poems and to whom he bequeathed most of his property. But his religion also precluded him from a formal course of education; he was trained at home by Catholic priests for a short time and attended Catholic schools at Twyford, near Winchester, and at Hyde Park Corner, London, but he was mainly self-educated. He was a precocious boy, eagerly reading Latin, Greek, French, and Italian, which he managed to teach himself, and an incessant scribbler, turning out verse upon verse in imitation of the poets he read. The best of these early writings are the "Ode on Solitude" and a paraphrase of St. Thomas à Kempis, both of which he claimed to have written at the age of 12.

Early works. Windsor Forest was near enough to London to permit Pope's frequent visits there. He early grew acquainted with former members of John Dryden's circle, notably William Wycherley, William Walsh, and Henry Cromwell. By 1705 his "Pastorals" were in draft and were circulating among the best literary judges of the day. In 1706 Jacob Tonson, the leading publisher of poetry, had solicited their publication, and they took the place of honour in his *Poetical Miscellanies* in 1709.

This early emergence of a man of letters may have been assisted by Pope's poor physique. As a result of too much study, so he thought, he acquired a curvature of the spine and some tubercular infection, probably Pott's disease, that limited his growth and seriously impaired his health. His full-grown height was four feet six inches; but the grace of his profile and fullness of his eye gave him an attractive appearance. He was a lifelong sufferer from headaches, and his deformity made him abnormally sensitive to physical and mental pain. Though he was able to ride a horse and delighted in travel, he was inevitably precluded from much normal physical activity, and his energetic, fastidious mind was largely directed to reading and writing.

When the "Pastorals" were published, Pope was already at work on a poem on the art of writing. This was *An Essay on Criticism,* published in 1711. Its brilliantly polished epigrams (*e.g.,* "A little learning is a dangerous thing," "To err is human, to forgive, divine," and "For fools rush in where angels fear to tread"), which have become part of the proverbial heritage of the language, are readily traced to their sources in Horace, Quintilian, Boileau, and other critics, ancient and modern, in verse and prose; but the charge that the poem is derivative, so often made in the past, takes insufficient account of Pope's success in harmonizing a century of conflict in critical thinking and in showing how nature may best be mirrored in art.

The well-deserved success of the *Essay on Criticism* brought Pope a wider circle of friends, notably Richard Steele and Joseph Addison, who were then collaborating in *The Spectator.* To this journal Pope contributed the most original of his pastorals, "The Messiah" (1712), and perhaps other papers in prose. He was clearly influenced by its policy of correcting public morals by witty admonishment, and in this vein he wrote the first version of his mock-epic, *The Rape of the Lock* (two cantos, 1712; five cantos, 1714), to reconcile two Catholic families. A young man in one family had stolen a lock of hair from a young lady in the other. Pope treated the dispute that followed as though it were comparable to the mighty quarrel between Greeks and Trojans, which had been Homer's theme. Telling the story with all the pomp and circumstance of epic made not only the participants in the quarrel but also the society in which they lived seem ridiculous. Though it was a society where

> . . . Britain's statesmen oft the fall foredoom
> Of foreign tyrants, and of nymphs at home;

as if one occupation concerned them as much as the other; and though in such a society a young lady might do equally ill to

> . . . Stain her honour, or her new brocade;
> Forget her pray'rs, or miss a masquerade;

Pope managed also to suggest what genuine attractions existed amid the foppery and glitter. He acknowledged how false the sense of values was that paid so much attention to external appearance, but ridicule and rebuke slide imperceptibly into admiration and tender affection as the heroine, Belinda, is conveyed along the Thames to Hampton Court, the scene of the "rape":

> But now secure the painted vessel glides,
> The sunbeams trembling on the floating tides:
> While melting music steals upon the sky,
> And soften'd sounds along the waters die;
> Smooth flow the waves, the zephyrs gently play,
> Belinda smil'd, and all the world was gay.

A comparable blend of seemingly incompatible responses—love and hate, bawdiness and decorum, admiration and ridicule—is to be found in all Pope's later satires.

Pope had also been at work for several years on "Windsor-Forest." In this poem, completed and published in 1713, he proceeded, as Virgil had done, from the pastoral vein to the georgic and celebrated the rule of Queen Anne as the Latin poet had celebrated the rule of Augustus. In another early poem, "Eloisa to Abelard," Pope borrowed the form of Ovid's "heroic epistle" (in which an abandoned lady addresses her lover) and showed imaginative skill in conveying the struggle between sexual passion and dedication to a life of celibacy.

Homer and "The Dunciad." These poems and other works were collected in the first volume of Pope's *Works* in 1717. When it was published, he was already far advanced with the greatest labour of his life, his verse translation of Homer. He had announced his intentions in October 1713 and had published the first volume, containing the *Iliad,* Books I–IV, in 1715. The *Iliad* was completed in six volumes in 1720. The work of translating the *Odyssey* (vol. i–iii, 1725; vol. iv and v, 1726) was shared with William Broome, who had contributed notes to the *Iliad,* and Elijah Fenton. The labour had been great, but so were the rewards. By the two translations Pope cleared about £10,000 and was able to claim that, thanks to Homer, he could " . . . live and thrive/Indebted to no Prince or Peer alive."

The merits of Pope's Homer lie less in the accuracy of translation and in correct representation of the spirit of the original than in the achievement of a heroic poem as his contemporaries understood it; a poem Virgilian in its dignity, moral purpose, and pictorial splendour, yet one that consistently kept Homer in view and alluded to him throughout. Pope offered his readers the *Iliad* and the *Odyssey* as he felt sure Homer would have written them had he lived in early 18th-century England.

Political considerations had affected the success of the translation. As a Roman Catholic his affiliations were Tory rather than Whig; and though he retained the friendship of such Whigs as William Congreve, Nicholas Rowe, and Charles Jervas the painter, his ties with Steele and Addison grew looser owing to the political animosity at the end of Queen Anne's reign, and he found new and lasting friends in Tory circles—Jonathan Swift, John Gay, John Arbuthnot, Thomas Parnell, the Earl of Oxford, and Viscount Bolingbroke. With the first five he was associated (1713–14) in the Scriblerus Club to write joint satires on pedantry, later to mature as *Peri Bathouse, Or the Art of Sinking in Poetry* (1728) and the "Memoirs of Martinus Scriblerus" (1741); and these were the men who encouraged his translation of Homer. The Whigs, who associated with Addison at Button's Coffee-House, put up a rival translator in Thomas Tickell, who published his version of *Iliad,* Book I, two days after Pope's. Addison preferred Tickell's manifestly inferior version; his praise increased the resentment Pope already felt owing to a series of slights and misunderstandings; and when Pope heard gossip of further malice on Addison's part, he sent him a satirical view of his character, published later as the character of Atticus, the insincere arbiter of literary taste in the "Epistle to Dr. Arbuthnot" (1735).

Even before the Homer quarrel, Pope had found that the life of a wit was a perpetual warfare. There were few years when either his person or his poems were not objects of attacks from the critic John Dennis, the bookseller Edmund Curll, the historian John Oldmixon, and other writers of lesser fame. The climax was reached over his edition of Shakespeare. He had emended the plays, in the spirit of a literary editor, to accord with contemporary taste (1725); but his practice was exposed by the scholar Lewis Theobald in *Shakespeare Restored* (1726). Though Pope had ignored some of these attacks, he had replied to others with squibs in prose and verse. But he now attempted to make an end of the opposition and to defend his standards, which he aligned with the standards of civilized society, in the mock-epic *The Dunciad* (1728). Theobald was represented in it as the Goddess of Dullness' favourite son, a suitable hero for those leaden times; and others who had given offense were preserved like flies in amber. Pope dispatches his victims with such sensuousness of verse and imagery that the reader is forced to admit that if there is petulance here, as has often been claimed, it is, to parody Wordsworth, petulance recollected in tranquility. Pope reissued the poem in 1729 with an elaborate mock-commentary of prefaces, notes, appendixes, indexes, and errata; this burlesque of pedantry whimsically suggested that *The Dunciad* had fallen a victim to the spirit of the times and been edited by a dunce.

Life at Twickenham. Pope and his parents had moved from Binfield to Chiswick in 1716. There his father died (1717), and two years later he and his mother rented a villa on the Thames at Twickenham, at that time a small country town where several Londoners had retired to live in rustic seclusion. This was to be Pope's home for the remainder of his life. There he entertained such friends as Swift, Bolingbroke, Oxford, and Jonathan Richardson the painter. These friends were all enthusiastic gardeners, and it was Pope's pleasure to advise and superintend the laying out of their landscape grounds on the best contemporary principles, formulated in his "Epistle to the Right Honourable Richard Earl of Burlington" (1731). This poem, one of the most characteristic works of his maturity, is a rambling discussion in the manner of Horace on false taste in architecture and design, with some suggestions for the worthier employment of a nobleman's wealth.

Pope now began to contemplate a new work on the relations of man, nature, and society that would be a grand organization of human experience and intuition, but he was destined never to complete it. *An Essay on Man* (1733–34) was intended as the introductory book discussing the overall design. The poem has often been charged with shallowness and philosophical inconsistency, and there is indeed little that is original in its thought, almost all of which can be traced in the work of the great thinkers of Western civilization. Subordinate themes were treated in greater detail in "Of the Use of Riches, An Epistle to Bathurst" (1732), "An Epistle to Cobham, Of the knowledge and characters of men" (1733), and "Of The Characters of Women: an Epistle to a Lady" (1735). He was deflected from this "system of ethics in the Horatian way" by the renewed need for self-defense. Critical attacks drove him to consider his position as satirist. He chose to adapt for his own defense the first satire of Horace's second book, where the ethics of satire are propounded, and after discussing the question in correspondence with Dr. John Arbuthnot, he addressed to him an epistle in verse (1735), one of the finest of his later poems, in which were incorporated fragments written over several years. His case was the satirist's traditional case, that depravity in public morals had roused him to stigmatize outstanding offenders beyond the reach of the law, concealing the names of some and representing others as types, that he was innocent of personal rancour and habitually forbearing under attack.

The success of his "First Satire Of the Second Book Of Horace, Imitated" (1733) led to the publication (1734–38) of 10 more of these paraphrases of Horatian themes adapted to the contemporary social and political scene. Pope's poems followed Horace's satires and epistles sufficiently closely for him to print the Latin on facing pages with the English; but whoever chose to make the comparison would notice a continuous enrichment of the original by parenthetic thrusts and compliments, as well as by the freshness of the imagery. The series was concluded with two dialogues in verse, republished as the "Epilogue to the Satires" (1738), where, as in the "Epistle to Dr. Arbuthnot," Pope ingeniously combined a defense of his own career and character with a restatement of the satirist's traditional apology. In these imitations and dialogues Pope directed his attack upon the materialistic standards of the commercially minded Whigs in power and upon the corrupting effect of money, while restating and illustrating the old Horatian standards of serene and temperate living. His anxiety about prevailing standards was shown once more in his last completed work, *The New Dunciad* (1742), reprinted as the fourth book of a revised *Dunciad* (1743), in which Theobald was replaced as hero by Colley Cibber, the poet laureate and actor-manager, who not only had given more recent cause of offense but seemed a more appropriate representative of the degenerate standards of the age. In *Dunciad,* Book IV, the Philistine culture of the city of London was seen to overtake the court and seat of government at Westminster, and the poem ends in a magnificent but baleful prophecy of anarchy. Pope had begun work on *Brutus,* an epic poem in blank verse, and on a revision of his poems for a new edition, but neither was complete at his death.

Assessment. Pope's favourite metre was the 10-syllable, iambic pentameter rhyming (heroic) couplet. He handled it with increasing skill and adapted it to such varied purposes as the epigrammatic summary of the *Essay on Criticism,* the pathos of "Verses to the Memory of an Unfortunate Lady," the mock-heroic of *The Rape of the Lock,* the discursive tones of the *Essay on Man,* the rapid narrative of the Homer translation, and the Miltonic sublimity of the conclusion of *The Dunciad.* But his greatest triumphs of versification are found in the "Epilogue to the Satires," where he moves easily from witty, spirited dialogue to noble and elevated declamation, and in the "Epistle to Dr. Arbuthnot," which opens with a scene of domestic irritation suitably conveyed in broken rhythm:

> Shut, shut the door, good John! fatigu'd, I said:
> Tie up the knocker, say I'm sick, I'm dead.
> The Dog-star rages! nay 'tis past a doubt,
> All Bedlam, or Parnassus, is let out:
> Fire in each eye, and papers in each hand,
> They rave, recite, and madden round the land;

and closes with a deliberately chosen contrast of domestic calm, which the poet may be said to have deserved and won during the course of the poem:

> Me, let the tender office long engage
> To rock the cradle of reposing age,
> With lenient arts extend a mother's breath,
> Make languor smile, and smooth the bed
> of death,
> Explore the thought, explain the asking eye,
> And keep a while one parent from the sky!

Pope's command of diction is no less happily adapted to his theme and to the type of poem, and the range of his imagery is remarkably wide. He has been thought defective in imaginative power, but this opinion cannot be sustained in view of the invention and organizing ability shown notably in *The Rape of the Lock* and *The Dunciad.* He was the first English poet to enjoy contemporary fame in France and Italy and throughout the Continent and to see translations of his poems into modern as well as ancient languages.

(J.E.Bu./Ed.)

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Pope, John (b. March 16, 1822, Louisville, Ky., U.S.—d. Sept. 23, 1892, Sandusky, Ohio), Union general in the American Civil War who was relieved of command following the Confederate triumph at the Second Battle of Bull Run.

A graduate of the U.S. Military Academy at West Point in 1842, Pope served as a topographical engineer with the Army throughout most of the 1840s and 1850s. He did, however, see combat during the Mexican War, serving with distinction in the campaigns of General Zachary Taylor.

Following the outbreak of the Civil War, Pope was appointed brigadier general of volunteers in 1861 and was promoted to major general in 1862. After securing the Mississippi River for the Union almost as far south as Memphis, Pope attracted the admiration of President Abraham Lincoln. He was made a brigadier general of the regular army and transferred to Washington, D.C., where he was given command of the Army of Virginia.

In August 1862 a Confederate force under General Stonewall Jackson moved toward Pope's army. Jackson's force was reinforced by troops under generals James Longstreet

John Pope

By courtesy of the Library of Congress, Washington, D.C.

and Robert E. Lee, and Pope—misgauging the number and location of the enemy—issued muddled and confusing orders. The result was the decisive defeat at the Second Battle of Bull Run, August 29–30, and the loss of about 15,000 Union troops. Pope attempted to blame his subordinate officers—especially General Fitz-John Porter—for the debacle, but in September Pope was relieved of his command and sent to Minnesota to quell a Sioux uprising.

After the Civil War, Pope served in various posts, notably as commander of the Department of the Missouri (1870–83), in which he was primarily engaged in protecting settlers in the Northwest and Southwest from Indian attacks. On Oct. 26, 1882, he was promoted to major general of the regular army, a rank he held until he retired in 1886.

Pope, John R(ussell) (b. April 24, 1874, New York City—d. Aug. 27, 1937, New York City), American architect whose most important design was the National Gallery of Art (completed in 1941 and since 1978 known as the West Building of the National Gallery) in Washington, D.C.

Trained at the American Academy at Rome and later at the École des Beaux-Arts (Paris), Pope became a leading exponent of academic eclecticism—the duplication of historic architectural styles through painstaking scholarship. Following his studies, Pope began practice in New York City in 1900. His designs included the Scottish Rite Temple in Washington, D.C., the Baltimore Museum of Art, and the Richmond, Va., Terminal Station.

Immensely popular as a designer, he also was chosen architect of many memorials throughout the country, including memorials for Theodore Roosevelt in Washington, D.C., and New York City and the Lincoln Memorial in Hodgenville, Ky.

Popish Plot (1678), in English history, a totally fictitious but widely believed plot in which it was alleged that Jesuits were planning the assassination of King Charles II in order to bring his Roman Catholic brother, the duke of York (afterward King James II), to the throne. The allegations were fabricated by Titus Oates (*q.v.*), a renegade Anglican clergyman who had feigned conversion to the Roman Catholic Church the year before and spent a few months as a student at two English seminaries abroad, from both of which he was expelled.

Encouraged by a fanatically anti-Catholic acquaintance, Israel Tonge, Oates informed the government of the imagined plot and eventually gained access to the Privy Council, where the king's questioning showed Oates to be lying. But meanwhile, Oates also made a sworn deposition of his "evidence" (Sept. 28, 1678) to a Westminster justice of the peace, Sir Edmund Berry Godfrey, and when the latter was found murdered in October, a popular panic was engendered. Ramifications of the plot were imagined everywhere, and in all about 35 innocent people were executed. Eventually, Oates was discredited, and the panic died down.

poplar, any of several shrubs and trees belonging to the genus *Populus,* family Salicaceae. The trees are mostly native to north temperate areas and are valued for their pulp, quick shade, and beauty. They have alternate, oval- or heart-shaped leaves, drooping catkins, seeds with silky hairs, and buds usually sticky with resin.

Two well-known species of Eurasia are the white and the black poplar, both naturalized in North America. White poplar (*P. alba*)—also known as silver poplar, for its white, felted leaves and twigs, and as maple leaf poplar, for its lobed leaves—is widely spreading in form, reaching 30 metres (100 feet) in height. Bolle's poplar (*P. alba* variety *bolleana*) is a colum-

Bolle's poplar (*Populus alba* variety *bolleana*)
Miles C. Labrum

nar variety. Black poplar (*P. nigra*) with oval, fine-toothed leaves, is long trunked and 35 m tall. Lombardy poplar is a columnar form (*P. nigra* variety *italica*).

Balsam poplar, or tacamahac (*P. tacamahaca* or *P. balsamifera*), native throughout northern North America in swampy soil, is distinguished by its aromatic, resinous buds. The buds of the similar balm of Gilead poplar (*P. candicans* or *P. gileadensis*) are used to make an ointment. Western balsam poplar, or black cottonwood (*P. trichocarpa*), 60 m tall, is one of the largest deciduous trees of northwestern North America.

poplin, strong fabric produced by the rib variation of the plain weave and characterized by fine, closely spaced, crosswise ribs. It is made with heavier filling yarns and a greater number of warp yarns and is similar to broadcloth, which has even finer, more closely spaced ribs.

Though originally made with a silk warp and a heavier wool filling, poplin is now made of a variety of fibres, including silk, cotton, wool, and man-made types, and with combinations of such fibres. It is used for shirts, pajamas, women's wear, and sportswear and also as a decorative fabric.

Popocatépetl, dormant volcano, México–Puebla state line, central Mexico. On Mexico's volcanic axis at the southern edge of the Mexican Plateau, 10 mi (16 km) south of its twin, Iztaccíhuatl, and 45 mi southeast of Mexico City, the perpetually snowcapped, symmetrical cone of Popocatépetl (Nahuatl: "smoking mountain") rises to a height of 17,930 ft (5,465 m). The only higher Mexican volcano is Citlaltépetl.

The first Spanish ascent of Popocatépetl is thought to have been made by one of Cortés' men in 1519. Although the volcano has not erupted since 1802, it emits large clouds of smoke from time to time.

Popol Vuh, Maya document, an invaluable source of knowledge of ancient Mayan mythology and culture. Written in Quiché (a Guatemalan Mayan language) with Spanish letters by a Mayan author or authors between 1554 and 1558, it chronicles the creation of man, the actions of the gods, the origin and history of the Quiché people, and the chronology of their kings down to 1550.

The original book was discovered at the beginning of the 18th century by Francisco Jiménez (or Ximénez), parish priest of Chichicastenango in highland Guatemala. He both copied the original Quiché text (now lost) and translated it into Spanish. His work is now in the Newberry Library, Chicago.

Popolare, plural POPOLARI, member of PARTITO POPOLARE ITALIANO (PPI; Italian Popular Party), an Italian political party organized in 1919 and inspired by Christian Socialist principles. The formation of the party marked the entrance of Catholics, alienated since the government's seizure of papal lands in 1860–70, into Italian political life as an organized force.

Led by the Sicilian priest Don Luigi Sturzo, the Popolari espoused a program of local administrative autonomy, agricultural reform, recognition of the right of workers to organize, election (rather than appointment) of the Senate, and extension of suffrage to women. In the general election of 1919, they scored a major victory, winning more than 100 seats and becoming the second largest party in the Chamber of Deputies. The party, however, was weakened by lack of internal unity and so failed to exert the influence on government that its numbers deserved. During the period of crisis for Italian democracy in the early 1920s, the Popolari were unwilling to cooperate with either the Socialists on the left or the liberals on the right to block the rise of Fascism. With the Fascist suppression of parliamentary government in the mid-1920s, the party was dissolved. Its principles were revived after World War II in the Christian Democratic Party, led by the former Popolare Alcide De Gasperi.

popolo (Italian: "people"), in the communes (city-states) of 13th-century Italy, a pressure group instituted to protect the interests of the commoners (actually, wealthy merchants and businessmen) against the nobility that up to then had exclusively controlled commune governments. It was one of a number of groups competing for power in the commune and in some cities succeeded in dominating the government in the late 13th century.

The *popolo* was organized either on a territorial basis (by quarters or districts) or on a corporative basis (by guilds); in some cities, notably Florence, a combination of both types developed. It gradually developed its own officials, who paralleled those of the commune. In the mid-13th century the office of *capitano del popolo* ("captain of the people") became prominent. This official was charged with leading the military forces of the *popolo* and ensuring justice to injured members; like the communal officer the *podestà,* he was usually a native of another city. The effective leaders of the *popolo* were the local representatives, the *anziani,* or "elders" (sometimes known as priors).

In Florence the organization of the *popolo* developed early and became quite powerful. From 1250 to 1260 it controlled the government (in the regime known as *il primo popolo*), and after the seizure of power in 1282 its power was firmly established. By the beginning of the 14th century, its priors, chosen from among guild members, formed the supreme executive of the commune.

In the writings of medieval chroniclers and modern historians, the term *popolo grasso* ("fat people") refers to the wealthy middle class of merchants and businessmen that dominated the economic and political life of the Italian communes. The term *popolo minuto* ("small or common people") refers to the lower middle class of proprietors of small shops and small merchants denied direct participation in government; it is sometimes extended to include the wage-earning proletariat, the most economically deprived group.

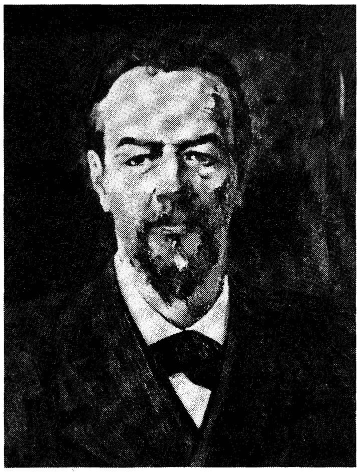
Popoloca, Middle American Indians of southern Puebla in central Mexico (not to be confused with the Popoluca of southern Mexico). The Popoloca language is most closely related to Ixcatec and Chocho, and to Mazatec, all spoken nearby in northern Oaxaca. The territory of the Popoloca is mostly flat and dry; vegetation is the semidesert type. The people are agricultural, growing corn and black beans as staples, supplemented by grains and fruit. Settlements are loosely congregated around village centres; houses are typically built of vertically placed poles or of lumber, with thatched roofs. A few are built of mud blocks. Characteristic crafts are ceramics and palm-fibre weaving; a limited amount of textile weaving is also done. Traditional costume has almost entirely disappeared, replaced by commercially made clothing.

Religion is Roman Catholic, with few remaining pagan elements. Belief in witchcraft persists, and there are fertility rituals. The social institution of the *compadrazgo,* or godparent ritual, is widespread and occurs in several forms. The godparent takes economic responsibility for the baptismal ceremony of the godchildren.

Popondetta, town, administrative headquarters of Northern province, Papua New Guinea.

The town, on a tributary of the Girua River, was a U.S. air base during World War II; the field now allows regular air service. In addition, Popondetta is the focus of a road network 300 mi (500 km) long, extending from the port of Oro Bay to Kokoda, in the Owen Stanley Range of the central highlands. The area produces cocoa, coffee, rubber, and palm oil. There is some tourism centred on the nearby peaks, one of which, Mt. Lamington (20 mi south) erupted in 1951, killing 3,000 persons and destroying the town of Higaturu. Popondetta has a high school, vocational institute, and agricultural college. Pop. (1984 est.) 7,400.

Popov, Aleksandr Stepanovich (b. March 16 [March 4, old style], 1859, Turinskiye Rudniki, Perm, Russia—d. Jan. 13, 1906 [Dec. 31, 1905, O.S.], St. Petersburg), physicist and electrical engineer acclaimed in the Soviet Union as the inventor of radio. Evidently he built his first primitive radio receiver, a lightning detector (1896), without knowledge of the contemporary work of the Italian inventor Guglielmo Marconi. The genuineness and the value of Popov's successful experiments are not seriously doubted, but Marconi's priority is usually conceded outside the Soviet Union.



Aleksandr Popov, detail of a painting by P.D. Korin
Sovfoto

Popov was the son of a village priest. He received his early education in an ecclesiastical seminary school and planned to enter the priesthood. But in 1877 his interests changed to mathematics, and he entered the University of St. Petersburg, from which he was graduated with distinction in 1883. Joining the teaching faculty of the university, he lectured in mathematics and physics in preparation for a professorship.

Popov's main interest soon changed to electrical engineering, however; and because Russia in that period lacked colleges that taught the subject, he became an instructor at the Russian Navy's Torpedo School at Kronstadt (presently Kronshtadt), near St. Petersburg (presently Leningrad), where students were trained to take charge of electrical equipment on warships. Popov took advantage of the school's library, which was stocked with foreign books and periodicals, and also of its well-equipped laboratory to follow scientific developments abroad and carry out experiments. Recognizing the importance of German physicist Heinrich Hertz's discovery of electromagnetic waves, Popov began to work on methods of receiving them over long distances.

Popov constructed an apparatus that could register atmospheric electrical disturbances and, in July 1895, installed it at the meteorological observatory of the Institute of Forestry in St. Petersburg. In a paper published a few months later, Popov suggested that such an apparatus could be used for the reception of signals from a man-made source of oscillations, provided a sufficient power source became available. In March 1896, he appeared before the St. Petersburg Physical Society and demonstrated the transmission of Hertzian waves—as they were then termed—between different parts of the University of St. Petersburg buildings. Evidence suggests that on that occasion the words "Heinrich Hertz" were transmitted in Morse code and that the aural signals received were transcribed on a blackboard by the society's president, who was the chairman of the meeting.

During the academic year 1895–96 at the Torpedo School, however, Popov became interested in setting up experiments on Röntgen rays (X-rays), which had just been discovered. Therefore, he discontinued for a time the further development of his lightning, or thunderstorm, detector. During the summer of 1896, Popov worked as electrical engineer in charge of the power plant at the annual fair in Nizhnii Novgorod (presently Gorky), where the demonstration of his storm detector won him a prize. He then read the first newspaper accounts of Marconi's demonstrations in September 1896. It seems clear that neither Marconi nor Popov was aware of the close similarity between their experiments.

The news of Marconi's work, as disclosed in his patent of June 1896, aroused Popov to fresh activity. Working in conjunction with the Russian Navy, he effected ship-to-shore communication over a distance of 6 miles (10 kilometres) by 1898. The distance was increased to about 30 miles (50 kilometres) by the end of the following year, during which he had also visited wireless stations in operation in France and Germany.

Popov was given remarkably little support by the Russian government until 50 years later, when national attitudes and enthusiasms had changed. On May 7, 1945, the Bolshoi Theatre was packed with a distinguished audience to celebrate the 50th anniversary of the "invention of the radio" by A.S. Popov. On the stage sat scientists, marshals, admirals, commissars, leaders of the Communist Party, and Popov's daughter. It was announced that in the future, the 7th of May would be celebrated as the day of the radio.

Although it is agreed that Popov's experimental work in connection with Hertzian waves is deserving of recognition, it has not been generally accepted that radio communication was actually invented by Popov. Thus, while it is true that historical research has brought to light indirect evidence that Popov demonstrated the transmission of intelligible signals in March 1896, there is comparable evidence that Marconi demonstrated the transmission of intelligible signals at an even earlier date, though not before an audience of scientists.

In 1901 Popov returned to St. Petersburg as a professor at the electrotechnical institute, of which he was later elected director. He died five years later. (R.L.S.-R.)

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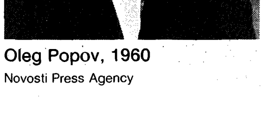
Popov, Alexey Dmitriyevich (b. March 12, 1892, Nikolavsk, Russia—d. Aug. 18, 1961, Moscow), Soviet director and prominent exponent of Socialist Realism whose monumental productions were notable for their meticulous attention to naturalistic detail.

Popov began his career as an actor with the Moscow Art Theatre and then moved to Kostroma to be managing director of a studio formed to follow the ideas of Konstantin Stanislavsky. At Kostroma he directed standard plays from the world repertoire, such as Charles Dickens' *The Cricket on the Hearth*, as well as the type of Soviet propaganda piece for which he would become noted, such as *An Evening Dedicated to the Paris Commune.* Popov returned to Moscow to direct, with few exceptions, new Soviet plays at the Vaktangov Theatre (1923–30) and the Theatre of the Revolution (1930–35). He introduced Lydia N. Seifullina and V.P. Pravdukhin's *Virineia* (1925), Boris Lavrenev's *The Break* (1927), and, most especially, Nikolay F. Pogodin's *Poem of the Ax* (1931), *My Friend* (1932), and *After the Ball* (1934). Popov was made head of the Central Theatre of the Red Army in 1935, a position he held until 1960. Although Popov did a few Shakespearean plays and also revived Russian classics, his productions invariably were monumental in scope and shaded to teach moral lessons regarding class struggle from the Soviet viewpoint. Popov's principal interest was in staging more overtly propagandistic pieces. Among the new plays that he directed were *The Year Nineteen* by Eosif L. Prut (1936), *The Men of Stalingrad* by Yury Chepurin (1944), *The Wide Steppe* by Nikolay G. Vinnikov (1949), and *Virgin Soil Upturned*, in a dramatized version of the novel by Mikhail Sholokhov (1957). Popov, honoured as a People's Artist of the U.S.S.R. in 1948, received a doctorate of art studies in 1957, as well as many other prizes and medals in his later years.

Popov, Oleg Konstantinovich (b. July 3, 1930, Vyrubovo, near Moscow), member of the Moscow Circus, the most popular clown in the Soviet Union.

Popov studied at the Moscow Circus School (1944–49) and then joined the circus as an eccentric tightrope walker. In 1952 he first appeared as a clown when the regular clown was injured. Using the film comedian Charlie Chaplin's tramp character as a model, Popov portrayed a gentle little man baffled by the big, precarious world; his act also incorporated his skills as an acrobat, juggler, and animal trainer.

He first appeared abroad in 1955 at Warsaw; toured France, Belgium, and England in 1956; appeared in 1958 at the Brussels Exposition; in 1957 appeared on American television from Moscow; and in 1963 and 1972 toured the United States with the Moscow Circus.



Oleg Popov, 1960
Novosti Press Agency

popover, in American cuisine, light muffin that puffs up into a nearly hollow bubble as it bakes (hence the name). Popovers are made from a thin unleavened batter that is poured into individual cups and placed in a very hot oven to ensure the rising of the batter. The baking is sometimes completed at a lower temperature. The batter for popovers is nearly identical to that for Yorkshire pudding (*q.v.*), the traditional British accompaniment to roast beef.

Popovich, Pavel Romanovich (b. Oct. 5, 1930, Uzin, Ukrainian S.S.R.), Soviet cosmonaut who piloted the Vostok 4 spacecraft, launched Aug. 12, 1962. He and Andriyan G. Nikolayev, who was launched a day earlier in Vostok 3, became the first two men to be in space simultaneously.

Popovich, a herdsman in his early youth, graduated from a technical school in Magnitogorsk, Russian S.F.S.R., in 1951, when he entered the Army. He quickly transferred to the Air Force and in 1954 was graduated from the Stalingrad Air Force College. He became a pilot, and in 1960 he was among the first to enter cosmonaut training.

Popovich was also the command pilot of the Soyuz 14 mission (July 3–19, 1974), on which he was accompanied by Yury P. Artyukhin. The cosmonauts docked their craft with Salyut 3, a space station that had been placed in orbit on June 25, and engaged in a 15-day program of scientific experiments. Popovich wrote an autobiographical book, *Vyletayu utrom* (1974; "Takeoff in the Morning.").

Pöppelmann, Matthäus Daniel (b. May 3, 1662, Herford, Westphalia—d. Jan. 17, 1736, Dresden, Saxony), German architect, best known for his design of the Zwinger, an open-air arena in Dresden that is considered one of the most successful realizations of the Baroque aesthetic. He was one of the first indigenous Baroque architects of central Europe.

Pöppelmann was a student of Wolf Caspar von Klengel, who participated in rebuilding Alt-Dresden after a fire in 1685. Pöppelmann carried on the work following von Klengel's death and in 1691 was put in charge of the project. In 1704 he became sculptor-architect to the court of Augustus II (Augustus the Strong) of Saxony, for whom he made a series of plans to rebuild the Royal Palace in Dresden.

The Zwinger in Dresden (begun 1709), originally planned as part of a large palace, is an outdoor theatre intended for opera, dance, tournaments, and other royal entertainments. The basic element of the structure is a square court, with U-shaped extensions of the transverse axes, bounded by airy, glass-enclosed pavilions. At one end of the main axis is the celebrated Kronentor (Crown Gate). *Langgalerien*, or galleries, extending from its sides to meet the pavilions, were probably inspired by the Grand Trianon at Versailles, which Pöppelmann visited in 1715.

Among Pöppelmann's works outside of Dresden are the Joachimstein Castle near Zittau (begun 1713); two bridges, the Niedertorbrücke and Frauentorbrücke, in Zwickau; and the castle on the Elbe at Pillnitz. After the mid-1720s he worked mainly in Dresden. His Augustusbrücke (1727-31) is considered among the most beautiful bridges in Europe.

Popper, Sir Karl (Raimund) (b. July 28, 1902, Vienna), Austrian-born British philosopher of natural and social science who subscribed to antideterminist metaphysics, believing that knowledge evolves from experience of the mind.

Although his first book, *Logik der Forschung* (1934; *The Logic of Scientific Discovery*), was published by the Vienna Circle of logical positivists, he rejected their inductive empiricism and developmental historicism. After studying mathematics, physics, and psychology at the University of Vienna, Popper taught philosophy at Canterbury University College, New Zealand (1937–45). In 1945 he became a reader in logic at the London School of Economics, and he served there as professor of logic and scientific method from 1949 until his retirement in 1969.

Popper's principal contribution to the philosophy of science rests on his rejection of the inductive method in the empirical sciences. According to this traditional view, a scientific hypothesis may be tested and verified by obtaining the repeated outcome of substantiating observations. As the Scottish empiricist David Hume had shown, however, only an infinite number of such confirming results could prove the theory correct. Popper argued instead that hypotheses are deductively validated by what he called the "falsifiability criterion." Under this method, a scientist seeks to discover an observed exception to his postulated rule. The absence of contradictory evidence thereby becomes proof of his theory. According to Popper, such pseudo-sciences as astrology, metaphysics, Marxist history, and Freudian psychoanalysis are not empirical sciences, because of their failure to adhere to the principle of falsifiability.

Popper's later works include *The Open Society and Its Enemies* (1945), *The Poverty of Historicism* (1957), and *Postscript to the Logic of Scientific Discovery,* 3 vol. (1981–82). He was knighted in 1965.

Poppo (pope): *see* Damasus II.

poppy, any of several ornamental flowering plants of the poppy family (Papaveraceae), especially species of the *Papaver* genus, which have lobed or dissected leaves, milky sap, nodding buds on solitary stalks, and four- to six-petaled flowers with numerous stamens surrounding the ovary. The two sepals drop off as the petals unfold. The ovary develops into a short, many-seeded capsule that opens in dry weather, permitting the small seed to escape when it is shaken by the wind.

Opium, from which morphine, heroin, codeine, and papaverine are derived, comes from the milky fluid in the capsule of the opium poppy (*Papaver somniferum*), native to Anatolia. An annual plant, it bears 12.7-centimetre- (5-inch-) wide blue-purple or white flowers on plants 1 to 5 m (about 3 to 16 feet) tall, with lobed or toothed silver-green foliage. The opium poppy also is grown for its nonnarcotic seeds, used for seasoning, oil, and birdseed. Red-flowered and double and semidouble strains are garden ornamentals.

About 50 other species of *Papaver* are grown for their attractive papery flowers or interestingly cut foliage. The Oriental poppy (*P. orientale*), native to the Middle East, has 15.2-centimetre scarlet, salmon, pink, white, or red blooms on 1.2-metre-tall, long-lived perennial plants. The white and red or white and pink Shirley poppy is an annual variety developed from the corn poppy (*P. rhoeas*). The Iceland poppy (*P. nudicaule*), from Arctic North America, is a short-lived perennial with fragrant white, orange, reddish, or bicoloured 7.6-centimetre flowers that are 30 cm tall. Peacock poppy (*P. pavoninum*), an annual with dark-spotted, scarlet, 2.5-centimetre blooms on 30-centimetre-tall plants, is from Afghanistan. The poppy family is well represented in western North America, especially in California, where about 20 native species are found. The best-known of these is the California poppy (*Eschscholtzia californica*), an annual with brilliant orange-coloured flowers, extensively naturalized in California, Australia, and India.

Poppy (*Papaver dubium*)
Ingmar Holmasen

Other ornamental members of the poppy family include the matilija poppy (*Romneya coulteri*) with 15.2-centimetre, white, fragrant flowers on a 2.4-metre-tall perennial herbaceous plant, native to southwestern North America; the plume poppies, members of the oriental genus *Macleaya,* grown for their giant, interestingly lobed leaves and 2-metre-tall flower spikes; plants of the tropical America genus *Bocconia,* woody, mild-climate shrubs prized for their large, cut leaves; the snow poppy (*Eomecon chionantha*), a perennial from China, with white, cuplike flowers in sprays; and the flaming poppy (*Stylomecon heterophylla*), a purple-centred, brick-red annual plant from western North America. Meconopsis (*q.v.*) includes the Welsh poppy.

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poppy seed, tiny dried seed of the opium poppy, used as food, food flavouring, and the source of poppy-seed oil. Poppy seeds have no narcotic properties, because the fluid contained in the bud that becomes opium is present only before the seeds form. The plant, *Papaver somniferum,* is an herbaceous annual native to Greece and the Orient. Poppy seed is an ancient spice; the seed capsules have been found in Switzerland in the remains of prehistoric lake dwellings.

The seeds are small (about 1 mm in length), kidney-shaped, and grayish blue to dark blue in colour. They have a faint nutlike aroma and a mild, nutty taste especially popular in breads and other baked goods. Poppy seed contains from 44 to 50 percent fixed oil, the principal components of which are linoleic and oleic acids.

Poprad, city, Poprad *okres* (district), western Východoslovenský *kraj* (region), Slovakia, eastern Czechoslovakia. Located in the Poprad River valley between the Vysoké Tatra Mountains, the Nizké Tatry Mountains, and the Levočské Mountains, it is a centre for the valley's agricultural area, where potatoes, barley, oats, and flax are grown and sheep are reared. Lumbering is an important local industry. The city also has automobile assembly and food-processing plants and a brewery. More industry is located in Svit, 4 miles (7 km) to the west, where there are chemical, textile, meat-packing, and food-processing plants.

Poprad is the regional transportation centre and also a starting point for tours into the Vysoké Tatra Mountains; it is a rail and road junction and has an airport. The Tatra Museum, with natural history exhibits of the mountain area, is located in Poprad. Spišská Sobota, a small town and now a suburb of Poprad, is noted for its 13th-century Gothic church of St. Egidius, which has a 14th-century fresco showing the Vysoké Tatra Mountains; the church is located on a square surrounded with Renaissance and Baroque houses with steeply pitched shingle roofs. Pop. (1988 est.) 50,375.

popular art, any dance, literature, music, theatre, or other art form intended to be received and appreciated by the largest possible audience. Popular art in the 20th century is usually dependent on such reproductive technology as printing, photography, phonograph and tape recording, films, radio, and television, as well as on large, concentrated populations that occur in societies dominated by urban culture.

Popular art in general tends to be narrative, to reinforce uncontroversial beliefs and sentiments, to support popular institutions, and to create identity in a social group. It is distinguished by the rapidity of its changes of style, by its revivals from earlier periods, and by its constant borrowings from elite art, folk art, foreign cultures, and modern technology for its song tunes and lyrics, radio and television broadcasts, novels, dances, and many other current entertainments, objects, trends, and fads.

Popular dance. Dancing performed in public or in private solely for the enjoyment of the participants is known as popular dance, or as social dance. It was practiced as early as 3,000 years ago at both community and family levels. Dancers arranged themselves in circles, or sometimes lines, which gradually developed into chain dances. From the Middle Ages in Europe there was a widening gap between country dances, which subsequently tended to survive in a folk tradition, and the genteel court variety, which influenced social developments in recreation from the Industrial Revolution onward.

In 16th-century Europe the stately pavane and energetic galliard were popular in Renaissance court circles. Such dances by then were performed in couples, side by side, and utilized swaying movements, hops, and complex capers. At the 17th-century French court of Louis XIV, new dances were notated for the first time. Such measures as the minuet and gavotte emerged, and in England Charles II imported many such dances after 1660. The cotillion, originally a lively measured square dance from the French court, became popular in the late 18th century. It was performed by four couples arranged in a square facing inward, with pairs of couples alternately executing various geometric figures.

The main century of the waltz lasted from the Napoleonic period to World War I. The waltz—performed by turning couples in a step–slide–step pattern—originated in central Europe and was popular in Vienna and Paris during the Napoleonic Wars. Ultimately the whole of western Europe adopted the measure, and it became socially acceptable for a man publicly to hold a woman in his arms while dancing.

"Cheek-to-cheek" dancing became popular in the second decade of the 20th century. Such exotic numbers as the turkey trot, the bunny hug, and the maxixe were popularized by the exhibition dancers Vernon and Irene Castle. The tango, purged of its more erotic elements, became acceptable to the clientele of the *thé dansant* (tea dance), and the charleston epitomized the Jazz Age. When the quickstep and the slow fox-trot emerged, competitions began to be held, reflecting dancing's wide attraction as a leisure activity.

During the Great Depression in the United States the dance marathon flourished—a ghastly parody of enjoyment, with couples struggling to be the last competitors left upright. Large public ballrooms flourished in the 1930s and '40s, especially in Britain and North America, while private dances grew relatively infrequent. It also became fashionable to go to hotels, nightclubs, restaurants, and wherever else there were large dance floors.

The late 1930s, the early '40s, and World

War II (with its large population dislocations) saw the spread of American cultural influence. The jive, jitterbug, and many such dances that were virtually improvisational originated in the United States, often among the black population, and were subsequently adopted in Europe.

Mainstream popular dance in the 1950s adopted Latin rhythms—including the rumba, samba, and cha-cha-cha. In general from about 1960, starting with the twist, popular dance among the young became more of a solo performance. White and black ethnic music created soul and reggae, and dancing partners no longer touched. By the late 1970s and early '80s, discotheques had taken the place of the old fashioned *palais de danse*, or ballroom. Echoes of many styles could be seen in disco dances, but popular dancing had become essentially improvisatory and eclectic.

Popular literature. Popular literature includes those writings intended for the masses, those that find favour with large audiences, and those that originate from the masses. It can be distinguished from artistic literature in that it is designed primarily to entertain. Popular literature, unlike high literature, generally does not seek a high degree of formal beauty or subtlety, and is not intended to endure. The growth of popular literature has paralleled the spread of literacy through education and has been facilitated by technological developments in printing. With the Industrial Revolution, works of literature, which were previously produced for consumption by small, well-educated elites, became accessible to large sections and even majorities of the members of a population.

The boundary between artistic and popular literature is murky, with much traffic between the two categories according to current public preference and later critical evaluation. While he was alive Shakespeare could be thought of as a writer of popular literature, but he is now regarded as a creator of artistic literature. Indeed, the main, though not invariable method of defining a work as belonging to popular literature is whether it is ephemeral, that is, losing its appeal and significance with the passage of time.

The most important genre in popular literature is and always has been the romance, extending as it does from the Middle Ages to the present. The most famous type of romance describes the obstacles encountered by two people (usually young) engaged in a forbidden love. Another common genre is that of fantasy, or science fiction. Novels set in the western frontier of the United States in the 19th century, and called Westerns, are also popular. Finally, the detective story or murder mystery is a widely read form of popular literature. Popular literature has also come to include such genres as comic books and cartoon strips.

In Communist countries popular literature encounters obstacles to its development not normally met in the West. Literature must be approved by the government to be published, and decisions to publish or not to are made by bureaucrats, sometimes without reference to public taste and preferences. This leads to a situation in which the government can exclude certain works from circulation if it is felt that they are inimical to the interests of the state, even though they may be of interest to the population.

Popular music. Unlike folk music, popular music is written by known individuals, usually professionals, and does not evolve through the process of oral transmission. In the West, since the 1950s, "pop" music has come to mean the constantly changing styles derived from the electronically amplified music form known as rock 'n' roll.

Historically, popular music was any non-folk form that acquired mass popularity—from the songs of the medieval minstrels and troubadours to those elements of fine art music originally intended for a small, elite audience but that became widely popular. After the Industrial Revolution, true folk music largely disappeared, and the popular music of the Victorian era and the early 20th century was that of the music hall and vaudeville, later replaced by songs from stage musicals.

Western popular music of the past century has been dominated by developments in the United States, particularly in the music of black Americans, who incorporated elements of African folk music and rhythms into the most important new musical style of the century, jazz.

In the late 1930s the swing style of the big bands dominated the larger record market, and in the 1940s the bands' vocalists, developing what became known as crooning, attracted attention. Meanwhile, the exclusively black American musical form known as the blues was also changing: black singers from the South moved north to industrial cities to seek work, and their music was transformed to the harsher style of urban blues or rhythm and blues. The blues bands that emerged in Chicago in the 1940s used amplified electric guitars, often backed with electric bass and drums—the instruments borrowed later by many rock 'n' roll bands.

Developing alongside these black styles was a white rural music—country, a dance and narrative style partly derived from the Anglo-Celtic ballads of white immigrants from Europe. Country music was sometimes influenced by black jazz styles (as with the Texas fusion "western swing"), and in the 1950s country singers meshed their music with black rhythm and blues to form "rockabilly."

Rock 'n' roll, which emerged in the 1950s, adapted the slow and powerful rhythms and melancholy vocalizations of urban blues to a quicker tempo and an exuberant emotional tone. In the 1960s more complex forms of rock 'n' roll became known simply as rock. Styles varied from gentle, vocal-harmony songs (soft rock) to new songs written in a traditional style and given amplified backing (folk rock), and a secular black ballad style influenced by gospel music (soul).

British rock became influential in the 1960s, through the work of four- or five-piece pop groups rather than solo performers. At first the British groups copied black rhythm and blues styles, but then developed their own more experimental styles, which in turn became popular in the United States. The Beatles, the most influential group, were partly responsible for rock music's growing intellectual respectability in the 1960s and '70s.

Popular theatre. The term popular theatre denotes live performances—in the tradition of the music hall, vaudeville, burlesque, follies, revue, circus, musical comedy, and musical performance—as distinguished from legitimate, high, or artistic theatre. The singers, dancers, comedians, clowns, puppeteers, jugglers, acrobats, conjurers, and ventriloquists of popular theatre make up much of what is known as "show business."

Music, movement, and humour are all essential ingredients used by popular theatre throughout its history. The physical element most often presents itself through eroticism, exaggeration, or acrobatics. England's traditional music hall, virtually identical to vaudeville, originated in working-class alehouses but became a standard entertainment for all classes of society. As with revue and vaudeville, it generally offered a variety of short pieces—sentimental and patriotic songs, dances, comic turns, and magicians, jugglers, and acrobats.

Humour itself may distort reality—crudely, as in slapstick, or corrosively, as in the mockery of a stand-up comic. Its effect—earthy, ribald laughter—has been sought in all kinds of theatre, and the greatest playwrights have blended both laughter and tears in their interpretations of life. Sometimes a popular performer has managed to achieve an interpretation of wider significance so as to bridge the gap between popular theatre and elite art. Charlie Chaplin and Buster Keaton are outstanding examples.

The effect of music as a form of communication has always been highly valued in popular theatre, whether with a large orchestra in a gilded auditorium or in a crowded taproom with only an upright piano. Music aids the suspension of disbelief and joins performer and viewer more closely in a shared event in which there is no pretense of realism. Musical comedy evolved from a wide variety of musical, dramatic, and dance styles going back to the Elizabethan dramatists, who used simple ballads to reinforce their narratives, through the tradition of Viennese operetta and the comic operas of Gilbert and Sullivan in England. The 20th century saw these traditions, although Americanized, flowering again in the United States in a seemingly endless procession of popular Broadway musicals.

Popular Democratic Front for the Liberation of Palestine (PDFLP), Arabic AL-JABHA AL-SHAʿBĪYAH AL-DIMUQRĀṬĪYAH LI-TAḤRĪR FILASṬĪN, one of several organizations associated with the Palestine Liberation Organization (*q.v.*), which has engaged in terrorist activities in addition to maintaining a Marxist-Leninist orientation which asserts that the peasants and working classes should be educated in socialism in order to bring about a democratic state of Jews and Arabs free of Zionism and imperialism.

Originating in the leftist swing of the 1960s and founded by a Jordanian Orthodox Christian, Naʾif Hawatimah, in 1969, the PDFLP was envisioned as a political movement distinct from the Popular Front for the Liberation of Palestine (*q.v.*), which had been founded to provide a front for diverse militant Palestinian groups. The PDFLP stood ideologically to the left of the PFLP and claimed that its enemies were Zionist upper-class imperialists, although in 1974 it took credit for the terrorist attacks in Maʿalot and Beth Shean. The PDFLP is also wary of Arab governments and critical of other pro-Palestine groups for ignoring "reactionary" forces within the Arab world.

popular front, any coalition of working-class and middle-class parties united for the defense of democratic forms against a presumed Fascist assault. In the mid-1930s European Communist concern over the gains of Fascism, combined with a Soviet policy shift, led Communist parties to join with Socialist, liberal, and moderate parties in popular fronts against Fascist conquest. In France and Spain, popular front governments were formed.

The early successes of Fascism in Italy and Germany had been regarded with equanimity by the Soviet Communist leadership. In the 1930s, when the Stalinist purges were in progress and deviations from current Stalinist norms were officially deemed more dangerous to the ultimate success of the proletarian revolution than the assaults of the far right, the Soviet attitude was shared by European Communists; in Germany, for instance, the Communists joined with the Nazis in bringing down the Weimar Republic.

In time, however, the clear Fascist determination to annihilate Communist cadres, coupled with the Communist realization that the divided state of the left had greatly facilitated the achievements of the right, aroused among European Communists considerable sentiment favouring alliance with at least the non-Communist left to combat Fascism.

For a time the Soviet leadership, consistently placing Soviet national interests above other considerations in its foreign policy, maintained cordial diplomatic relations with Fascist states, refusing in each case to let a government's domestic persecution of Communists affect the Soviet Union's relations with that government. Growing awareness of the danger of a German attack on the U.S.S.R., however, led the Soviets to seek allies among the Western capitalist nations. This policy shift, which saw the Soviets join the League of Nations in 1934, was a decisive factor in bringing the Soviet leadership to its advocacy of the popular front. At the same time, Stalin began to pursue a clandestine policy of seeking an alliance with Hitler—which bore fruit in August 1939.

The seventh and last congress of the Comintern (*see* International, Third), meeting in 1935, proclaimed the new policy, which went beyond the concept of a "united front" of Communists and Socialists to advocate the formation of popular fronts comprising not only leftists but also liberals, moderates, and even conservatives opposed to Fascism. The goal of revolution was deferred until the immediate battle at hand was won, and Communists were urged not to frighten away the non-Communists in the coalition with revolutionary rhetoric.

In France, for example, the Communist Party joined in the forming of a popular front in 1934. In 1936 a popular front government, led by the Socialist Léon Blum, was elected. Though the Communists refused ministerial appointments, they pledged full parliamentary support and cooperation. The regime succeeded in implementing an extensive program of social reform, including the institution of the 40-hour work week. The financial situation deteriorated, however, and Blum was replaced in June 1937, whereupon the liberals began to exclude other members of the coalition, including the Communists, from the government. In 1938 Blum once again attempted, unsuccessfully, to establish a popular front ministry. Though it may have prevented socio-economic conditions in France from becoming fertile ground for any domestic Fascist movement, the French Popular Front did little in the international arena to stop the march of Fascism.

A broad-based popular front government was elected in Spain in February 1936. Considerable turmoil followed, however, and in July 1936 Gen. Francisco Franco led a Fascist insurrection against the legal government. At first the Soviets, and indeed Léon Blum's French Popular Front, advocated non-intervention in the conflict. Eventually the Soviets did intervene, supplying limited military aid to the republican forces. Soon Stalin, however, for reasons that are unclear, conducted a violent purge of the Spanish extreme left, including Anarchists, Syndicalists, and Trotskyites.

Ironically, the effect of the popular fronts in the West was the opposite of Stalin's intention. The social changes that they tried to institute and the unrest that occurred while they held power combined to exacerbate Western capitalists' fear and distrust of the Soviets.

Popular Front for the Liberation of Palestine (PLFP), Arabic AL-JABHA AL-SHAʿBĪYAH LI-TAḤRĪR FILASṬĪN, organization providing an institutional framework for militant organizations associated with the Palestine Liberation Organization (*q.v.*), notable for its internal conflicts between ideology and military action.

It was established as the Arab Nationalist Movement (ANM) by George Habash, who was born into a Greek Orthodox family in Jerusalem and attended medical school at the American University in Beirut, at about the same time as Yāsir ʿArafāt was co-founding al-Fatah in the early 1950s. The PLFP was an amalgamation of several groups, each of which had its own aims, and between which little compromise was possible, although all were engaged in militant activities. By the late 1970s some of these groups, such as the Popular Front for the Liberation of Palestine–General Command (PFLP-GC), were being supported by Libya and Syria in their acts of terrorism on an international scale, and the PFLP was still promoting a Marxist-Leninist line of a liberated Palestine of progressive Israelis and Jews uniting with the Arabs.

Popular Republican Movement, French MOUVEMENT RÉPUBLICAIN POPULAIRE (MRP), French social reform party whose policies correspond largely to the European Christian Democratic tradition.

Founded on Nov. 26, 1944, just after the German occupation of France during World War II, the MRP consistently won some 25 percent of the vote in the elections of the remainder of the 1940s, and it served as a bulwark of the early governments of the Fourth Republic. As a centre party, however, the MRP lost votes to both the right and the left as political opinions began to polarize during the East–West Cold War; in the 1951 elections it won only 12.6 percent of the votes cast and never regained its former popularity.

In October 1965 the MRP joined other right-centre parties to support the presidential candidacy of Jean Lecanuet, who came in a poor third to Gen. Charles de Gaulle and the candidate of the left, François Mitterrand. Lecanuet attempted to solidify the parties that supported him, including the MRP, into a centre party, the Centre Démocrate, founded in February 1966. Legislative elections in 1967 and 1968, however, brought fresh defeats for the centre, which failed to win more than 13 percent of the vote in either election. By the end of 1967 the MRP had become little more than a political club.

popular sovereignty, also called SQUATTER SOVEREIGNTY, in U.S. history, a controversial political doctrine that the people of federal territories should decide for themselves whether their territories would enter the Union as free or slave states. Its enemies, especially in New England, called it "squatter sovereignty."

It was first applied in organizing the Utah and New Mexico territories in 1850; its most crucial application came with the passage of Sen. Stephen A. Douglas' Kansas–Nebraska Act of 1854, which repealed the prohibition of slavery north of latitude 36°30′ (established in the Missouri Compromise of 1820). The violent struggle that followed for control of the Kansas Territory (*see* Bleeding Kansas) illustrated the failure of popular sovereignty as a possible ground for agreement between proslavery and anti-slavery factions in the country. *See also* Dred Scott decision.

Populares (ancient Roman political group): *see* Optimates and Populares.

population, in biology, the number of individuals of a species living in a restricted area, or the total number or combined weight of members of a plant species present in a given area.

A brief treatment of biological populations follows. For full treatment, *see* MACROPAEDIA: Biosphere.

The study of biological populations involves the observation of the number and other characteristics of particular species of plants and animals within a defined environmental region, and the analysis of fluctuations in population size, density, and other variables and of their causes. The population biologist's task is complicated by the ambiguity of natural boundaries, the frequent difficulty of direct observation, the sparse evidence generally available to support conclusions about population changes, and the number of factors whose combined impact may be responsible for those changes. A decrease in the population of a bird species, for instance, may be the result of a diminished food supply, an increase in the population of predators, climatic changes, or an interaction among these and other considerations.

The means available to biologists for monitoring population sizes include actual counting—most practical for plant species and large animals active during the day—and capturing and marking representative samples whose characteristics can be compared with those of samples recaptured later. Population density and breeding patterns are often assessed in fish and insect species by capturing or killing the entire population of a highly restricted, representative area, without affecting the population of the region as a whole. Most population studies take place under conditions that have been modified in some way by human presence.

The population size of most species fluctuates only slightly from a condition of stability, where equilibrium is maintained between natality (birth) and mortality (death) rates. Instability refers to a period of rapid population growth toward overpopulation or decline toward extinction. Both trends are relatively infrequent. It is generally agreed that factors that maintain stable growth rates are closely linked to a species' population density in a given region relative to the numbers the region can support. Thus, periods of expansion or decline are usually followed by compensatory periods of change in the reverse direction.

The mechanism that regulates natality in order to maintain stable density may either be genetic or a consequence of natural selection. In most species reproductive rates and the rate of recruitment (the onset of breeding in adults) are closely related to both current population density and environmental conditions. Birds may respond to a scarcity of food, for instance, by maturing later and producing fewer but larger, or smaller but more numerous eggs than when sustenance is more plentiful; mammals will reproduce later in life and have smaller or fewer litters. Since most fish mature according to size rather than age, lack of nutrients will naturally impede their recruitment rate, and may induce limitations on the number of eggs they lay; similarly, insects lay fewer eggs when food supplies are limited, and the proportion of larvae that reach maturity and breed will also be reduced. For any population in a limited area, an increase in natality reduces the amount of food available to each individual, which results either in expansion outside the area or in an equivalent increase in mortality. Seasonal cycles can also induce fluctuations in population density, especially in species that reproduce once per year during a particular season, or that only live for a single year. Under controlled conditions, populations of predators and their prey can exhibit parallel density cycles, though other naturally interacting forces produce less predictable variations.

While populations normally maintain stability through an equivalence of birth and death rates, density can also be regulated through four types of movement: dispersal, which helps to expand the range of a species; dispersion, by which breeding adults redistribute themselves within a region; migration, a recurring cycle of movement from and back to a specific area in response to seasonal changes; and emigration, or relocation to more fertile, less heavily predated, or less densely populated areas, without a pattern of return.

Population biology is also concerned with modes of interaction among members of a species, such as the cooperation displayed in flocking and herding behaviour and the competition sometimes involved in feeding and mating. Interactions between species can also be cooperative—such as in the symbiotic exchange between some microbes and their hosts—or negative, as in predatory and parasitic relationships. Competition between species that require the same types of food and shelter generally results in the exclusion of all but one from a habitable territory.

The study of biological populations is crucial for an understanding of the natural balances in the environment of which humans are a part and for the prevention of unexpected and potentially disastrous upsets that can result from their modifications. Knowledge of the patterns of interaction among species and of the factors that influence population variables has enabled people to control and preserve numerous plants and animals and has facilitated agricultural and other advances that would otherwise be unattainable.

population, in human biology and physical anthropology, the whole number of people or inhabitants occupying an area (such as a country or the world) and continually being modified by increases (births and immigrations) and losses (deaths and emigrations). The size of any biological population is limited by the supply of food, the effect of diseases, and other environmental factors. Human populations are further affected by social customs governing reproduction and by the technological developments, especially in medicine and public health, that have reduced mortality and extended the life span.

A brief treatment of population follows. For full treatment, *see* MACROPAEDIA: Population; Evolution, Human.

Changes in population are traced by keeping track of fertility rates, mortality rates, and migration. The fertility rate, or the actual birth rate, is lower than the biologically possible birth rate in all populations because of physical circumstances and social custom. Stillbirths and abortions reduce the number of fetuses that come to term. Late marriage, widowhood, and celibacy limit a woman's child-bearing years, while the use of contraception can reduce the chance of pregnancy during sexually active periods. Human populations have widely varying fertility rates, ranging from an average of 10 children per woman in some Third World communities to 2 children per woman in the developed Western countries.

As with fertility, mortality in different populations varies in degree and kind. The risk of death is generally high for infants, decreases to its lowest point in young children, and increases significantly after the age of 25. Developments in medical technology over the past two centuries have dramatically decreased the infant mortality rate and extended the average life span, especially in the developed countries. Whereas the average life span in ancient Greece was probably in the vicinity of 28 years, the average life span in modern industrialized nations has approached as high as 80 years for females and the low 70s for males.

Migration, or permanent change of residence, also influences population size. Migration patterns differ in societies with different levels of technological development. For example, when human populations became predominantly agricultural, the pattern of continuous migration typical of hunter-gatherer and slash-and-burn societies dwindled. Mass migrations that have significantly altered large populations are often the result of threatening ecological or social circumstances. Modern migration patterns show that regular migration occurs from the less-developed nations to the more-developed and from rural areas to urban centres.

The rate of natural increase, measured by comparing the rate of fertility and the rate of mortality, usually does not exceed 4 percent per year for any national population. Even a 4- or 3-percent figure, however, signifies rapid natural increase over a period of years. For example, a rate of 3 percent will cause a population to double in only 23 years. Population growth statistics take into account both the rate of natural increase and the effects of migration.

In addition to being examined in terms of numerical change, populations can be studied for their composition by age, sex, ethnicity, or geographical distribution. Different kinds of populations have different age profiles. Aberrations in these profiles are most often due to dramatic excesses in the fertility rate or dramatic declines in the mortality rate, as in the late-20th-century population explosions in Kenya, Ethiopia, Mexico, and a number of other Third World countries. Changes in the age profile have social ramifications when it alters the proportion of the working population to the dependent population of children and older people. Dramatic differences in the sex ratio, caused by large-scale wars or the hardship of migration, can affect marriage patterns and therefore affect the growth rate of a population. More detailed analyses by race, ethnicity, and geographical distribution provide important basic information for sociological study of any population.

Various theories about population have tried to explain its cultural influence and the reasons for dramatic population changes. Most ancient theories, conceived in societies where mortality rates were high, were pronatalist ("Be fruitful and multiply"). In the mercantilist theories of the 16th to the 18th century, large populations were also deemed beneficial, since they provided a large and therefore cheap labour force as well as a large market. The Physiocrats of the 18th century viewed population growth as the result, not the cause, of economic wealth, because their economic theory related wealth to abundant land rather than population. Utopian thinkers of the same period assumed that humans would determine their own best population levels just as they would perfect other aspects of their society.

It was not until the English economist Thomas Robert Malthus developed his theory of population growth in the late 18th century that the pessimistic implications of continued growth became commonplace. In his pamphlet *An Essay on the Principle of Population,* Malthus saw overpopulation as a primary cause of the poverty that accompanied urbanization and industrialization in Britain. He considered a large population a potential burden on the economy and prescribed a conscious limitation on reproduction. Malthus advocated such moral restraints on fertility as delayed marriage and warned that institutionalized charity could be counterproductive. Neo-Malthusians used his ideas to promote contraception as a means of limiting fertility, marking the beginning of the modern birth-control movement. Socialist thinkers led by Karl Marx rejected Malthus' claim that poverty was the result of overpopulation and contended that any population could be sustained as long as the society's material wealth was evenly distributed.

One of the most significant trends in modern populations has been the decline in fertility that followed industrialization. The theory of demographic transition demonstrated how, in industrialized, urbanized societies, the functions of family and children were so altered that the average fertility rate for individual families was affected. The fertility decline was explained in socioeconomic terms. More recent theories have tried to incorporate cultural belief systems into the theory, showing how traditions have, in practice, modified the socioeconomic model.

The growth of the human population and its ecological implications have become an increasing concern since medical technology has decreased the mortality rate. Population growth has accelerated since about 1750. The most rapid growth from the 18th to the early 20th century occurred in Europe, North America, Australia, and New Zealand. After World War II the highest population growth rates yet documented occurred in the already densely populated countries of Asia, Latin America, and Africa.

For international statistical data on the populations of countries and their first-order administrative subdivisions, *see* the BRITANNICA WORLD DATA ANNUAL.

population inversion, in physics, the redistribution of atomic energy levels that takes place in a system so that laser action can occur. Normally, a system of atoms is in temperature equilibrium and there are always more atoms in low energy states than in higher ones. Although absorption and emission of energy is a continuous process, the statistical distribution (population) of atoms in the various energy states is constant. When this distribution is disturbed by pumping energy into the system, a population inversion will take place in which more atoms will exist in the higher energy states than in the lower.

population size, effective: *see* effective population size.

Populations I and II, in astronomy, two broad classes of stars and stellar assemblages devised in the early 1950s by the German-born astronomer Walter Baade. The members of these stellar populations differ from each other in various ways, most notably in age, chemical composition, and location within galactic systems.

Population I consists of younger stars, clusters, and associations—*i.e.,* those that formed about 1,000,000 to 100,000,000 years ago. Certain stars, such as the very hot, blue-white O and B types (some of which are less than 1,000,000 years old), are designated as extreme Population I objects. All known Population I members occur near and in the arms of the Milky Way system and other spiral galaxies. They also have been detected in some young irregular galaxies (*e.g.,* the Magellanic Clouds). Population I objects are thought to have originated from interstellar gas that has undergone various kinds of processes, including supernova explosions, which enriched the constituent matter. As a result, such objects are relatively rich in iron, nickel, and certain other heavier elements.

Population II consists of the oldest stars and clusters, which formed about 1,000,000,000 to 15,000,000,000 years ago. Members of this class presumably were created from interstellar gas clouds that emerged shortly after the big bang, a state of extremely high temperature and density from which the universe is believed to have originated. These stellar objects are relatively rich in hydrogen and other light elements but are poor in metals because such heavier elements had not yet been created at the time of their formation. RR Lyrae variable stars and other Population II stars are found in the halos of spiral galaxies and in the globular clusters of the Milky Way system. Large numbers of these objects also occur in elliptical galaxies.

Since the early 1970s, astronomers have found that a number of stars do not fall into either the Population I or the Population II category. These objects, designated Common Stars, are from about 100,000,000 to 5,000,000,000 years old. They are concentrated in the regions between the arms of spiral galaxies. The Sun is considered a good example of a Common Star.

Populist (Russian history): *see* Narodnik.

Populist Movement, in U.S. history, politically oriented coalition of agrarian reformers in the Middle West and South that advocated a wide range of economic and political legislation in the late 19th century.

Throughout the 1880s local political action groups known as Farmers' Alliances sprang up among Middle Westerners and Southerners, who were discontented because of crop failures, falling prices, and poor marketing and credit facilities. Although it won some significant regional victories, the alliances generally proved politically ineffective on a national scale. Thus in 1892 their leaders organized the Populist, or People's, Party, and the Farmers' Alliances melted away. While trying to broaden their base to include labour and other groups, the Populists remained almost entirely agrarian-oriented. They demanded an increase in the circulating currency (to be achieved by the unlimited coinage of silver), a graduated income tax, government ownership of the railroads, a tariff for revenue only, the direct election of U.S. senators, and other measures designed to strengthen political democracy and give farmers economic parity with business and industry.

In 1892 the Populist presidential candidate, James B. Weaver, polled 22 electoral votes and more than 1,000,000 popular votes. By fusing with the Democrats in certain states, the party elected several members to Congress, three governors, and hundreds of minor officials and legislators, nearly all in the northern Middle West. In the South, however, most farmers refused to endanger white supremacy by voting against the Democratic Party. Additional victories were won in the 1894 midterm election, but in 1896 the Populists allowed themselves to be swept into the Democratic cause by their mutual preoccupation with the Free Silver Movement (*q.v.*). The subsequent defeat of Democratic presidential candidate William Jennings Bryan signalled the collapse of one of the most challenging protest movements in the U.S. since the Civil War. Some of the Populist causes were later embraced by the Progressive Party.

To make the best use of the Britannica, consult the INDEX *first*

Populonia, ancient Roman city that had originally been Etruscan and named Pupluna or Fufluna after the Etruscan wine god, Fufluns. It was situated on the western coast of central Italy on the Monte Massoncello Peninsula—the only large Etruscan city directly on the sea. The reason for the city's existence is found in the vast slag remnants from the smelting of silver and iron ores from the nearby island of Elba. The city became wealthy and prominent and was the first city in Etruria to coin silver (second half of the 5th century BC).

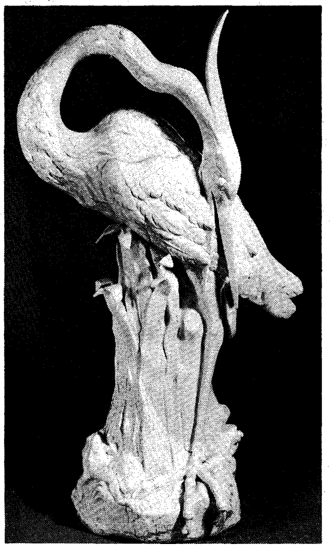
The city was taken over by the Romans and suffered greatly in the wars between Rome and the Boii (282 BC) and later in the civil wars between Marius and Sulla in the 1st century BC. Afterward, the older part of the city, on the hills of Molino and Del Castello, was made a municipium. In the Middle Ages Populonia became a dependency of Lucca under the Lombards; at the end of the 8th century Charlemagne gave the city as a gift to Pope Hadrian I.

Poquelin, Jean-Baptiste: *see* Molière.

Porbandar, town, Junāgadh district, Gujarāt state, west central India, on the Arabian Sea. The birthplace of Mahatma Gandhi, it was controlled by the Jethwa Rājputs from about the 16th century. Porbandar was the capital of the former princely state of Porbandar (1785–1948) before it became a district. It is famous for its building stone, and it also produces a variety of manufactures. The town is served by major highways, is a railway terminus, and has an airport. Pop. (1981) town, 118,646; metropolitan area, 136,184.

porbeagle, species of mackerel shark (*q.v.*).

porcelain, vitrified pottery with a white, fine-grained body that is usually translucent, as distinguished from earthenware, which is porous, opaque, and coarser. The distinction between porcelain and stoneware, the other class of vitrified pottery material, is less clear. In China, porcelain is defined as pottery that is resonant when struck; in the West, it is a material that is translucent when held to the



"Heron," white paste porcelain by Johann Kändler, 1731; in the Edward M. Pflueger Collection

By courtesy of Mr. and Mrs. Edward M. Pflueger

light. Neither definition is totally satisfactory; some heavily potted porcelains are opaque, while some thinly potted stonewares are somewhat translucent. The word porcelain is derived from *porcellana,* used by Marco Polo to describe the pottery he saw in China.

The three main types of porcelain are true, or hard-paste, porcelain; artificial, or soft-paste, porcelain; and bone china. Porcelain was first made in China—in a primitive form during the T'ang dynasty (618–907) and in the form best known in the West during the Yüan dynasty (1279–1368). This true, or hard-paste, porcelain was made from petuntse, or china stone (a feldspathic rock), ground to powder and mixed with kaolin (white china clay). During the firing, at a temperature of about 1,450° C (2,650° F), the petuntse vitrified, while the kaolin ensured that the object retained its shape. Attempts by medieval European potters to imitate this translucent Chinese porcelain led to the eventual discovery of artificial, or soft-paste, porcelain, a mixture of clay and ground glass requiring a "softer" firing (about 1,200° C, or 2,200° F) than hard-paste porcelain. Although there is a superficial resemblance, artificial porcelain can generally be distinguished from true porcelain by its softer body. It can be cut with a file, for example, whereas true porcelain cannot; and dirt accumulated on an unglazed base can be removed only with difficulty, if at all, whereas it is easily removed from true porcelain.

The first European soft-paste porcelain was made in Florence about 1575 at workshops under the patronage of Francesco I de' Medici, but it was not until the late 17th and 18th centuries that it was produced in quantity. The secret of true porcelain, similar to the porcelain of China, was discovered about 1707 at the Meissen factory in Saxony by Johann Friedrich Böttger and Ehrenfried Walter von Tschirnhaus. The standard English bone china body was produced around 1800, when Josiah Spode the Second added calcined bones to the hard-paste porcelain formula. Although hard-paste porcelain is strong, its vitreous nature causes it to chip fairly easily, whereas bone china does not. Hard-paste porcelain is preferred on the European continent, bone china in Britain and the United States.

Glaze, a glasslike substance originally used to seal a porous pottery body, is used solely for decoration on hard-paste porcelain, which is nonporous. When feldspathic glaze and body are fired together, the one fuses intimately with the other. Porcelain fired without a glaze, called biscuit porcelain, was introduced in Europe in the 18th century. It was generally used for figures. In the 19th century biscuit porcelain was called Parian ware. Some soft-paste porcelains, which remain somewhat porous, require a glaze. After the body has been fired, the glaze, usually containing lead, was added and fired to vitrify it. Unlike feldspathic glaze, it adheres as a relatively thick coating.

Painted decoration on porcelain is usually executed over the fired glaze. Because painting under the glaze—that is, on a fired, unglazed body—must be fired at the same high temperature as body and glaze, many colours would "fire away." Thus underglaze painting on porcelain is largely limited to the extremely stable and reliable cobalt blue found on Chinese blue-and-white wares. Most porcelain colours—called overglaze, enamel, or low-temperature colours—are painted over the fired glaze and fired at a much lower temperature.

porcelain enamelling, also called VITREOUS ENAMELLING, process of fusing a thin layer of glass to a metal object to prevent corrosion and enhance its beauty. Porcelain-enamelled iron is used extensively for such articles as kitchen pots and pans, bathtubs, refrigerators, chemical and food tanks, and equipment for meat markets. In architecture it serves as facing for buildings. Being a glass, porcelain enamelling has the properties of glass: a hard surface, resistance to solution, corrosion, and scratching. Enamelware is usually quite resistant to acid and impact, but may crack if the base metal is deformed.

In general, base items consist of fabricated steel, iron castings such as bathtubs and stoves, or, for kitchenware, a good grade of low-carbon sheet iron formed in the shape of the utensil by pressing or drawing, by spinning, and by trimming, with handles, spouts, and ears welded in place. The base items are cleaned by physical means such as sandblasting or by pickling in acid. Next a coating mixture of ground glass, clay, and water is applied and dried. The ware then is fired in a furnace. For cast-iron dry-process enamels, powdered glass is dusted over the hot ware; as it melts it forms a continuous layer of enamel. For wet-process enamels, a second liquid layer of cover enamel is applied.

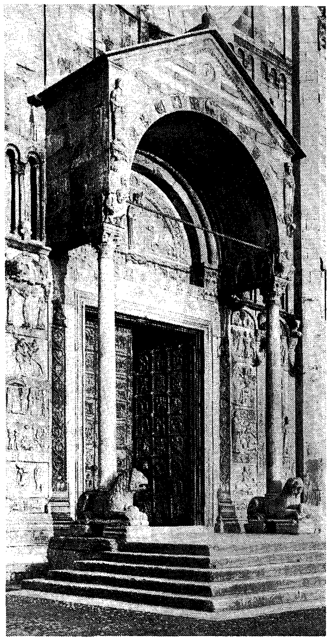
For enamelling in art, *see* enamel, encrusted; enamel, painted; enamelwork.

porcellanite, also spelled PORCELANITE, hard, dense rock that takes its name from its resemblance to unglazed porcelain. Frequently porcellanite is an impure variety of chert containing clay and calcareous matter; when of this nature it is composed chiefly of silica (*see* chert and flint).

The porcellanite of some authorities is a silicified tuff, a rock composed of volcanic fragments that has been altered to silica, or even metamorphosed marl, calcareous rock fragments altered by heat and pressure (*see also* hälleflinta). One porcellanite, common in lignite deposits, is formed from the fusion of shales and clay on the floor, walls, and roof of burned coal seams.

porch, roofed structure, usually open at the sides, projecting from the face of a building and used to protect the entrance. It is also known in the United States as a veranda and is sometimes referred to as a portico. A loggia (*q.v.*) may also serve as a porch.

There are few extant remains of the porch



Porch of S. Zeno Maggiore, Verona, by Nicolaus, 12th-century sculptor
Alinari—Art Resource/EB Inc.

before the period of classical antiquity, though Egyptian wall paintings seem to indicate its occasional use on houses. One of the most important Greek porches is that of the Tower of the Winds at Athens (100 BC), in which two columns of a simple Corinthian order carry a pediment. Roman houses sometimes had long colonnades facing the street, which served as porches, a type that carried over to the Early Christian basilicas and that was probably used as a formal entrance to the narthex, itself a porchlike structure, in buildings such as the Basilica of Old St. Peter's (Rome, AD 330).

During the Romanesque period, the stately colonnaded church entrance was replaced with a simple projecting porch covering the western doors, as in S. Zeno Maggiore at Verona, Italy (12th century), in which the columns are carried on marble lions, a motif frequently seen in Lombardy.

In France, especially in Burgundy, the porch developed into a vaulted structure of great height and importance, two or more bays long and sometimes as wide as the entire church. The porch of the abbey church at Vézelay (1132–40) is a large and particularly fine example of this type, which is sometimes called an antechurch.

During the Gothic era, two main porch types were developed in English ecclesiastical buildings. The first was a small, gabled porch that projected from the north or south walls of the nave rather than from the west doors, which, in contrast to the west doors of the great French cathedrals, were often small and undistinguished. The other type of porch, which was called a galilee, was developed to such an extent that it almost became a separate building. Galilees in medieval churches may have been used as courts of law or as places in which corpses lay before interment, but they probably served chiefly as chapels for penitents before their admission to the body of the church.

In Germany churches of the Flamboyant Gothic period were frequently decorated with western porches of the most fantastic richness, with a great use of cusping, tracery, and canopy work, as in the double-arched entrance of the Ulm cathedral (*c.* 1390) and the triangular porch of the cathedral at Regensburg, Switz. (1482–86).

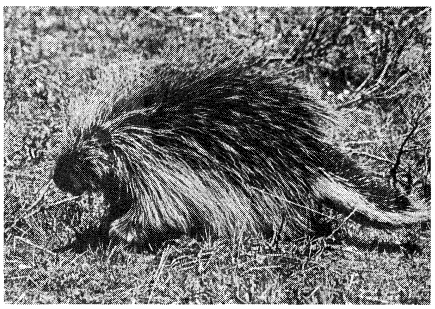
During the Renaissance, the porch was usually treated as a colonnaded portico. Simple porches of two or four columns were exceedingly common features of domestic architecture in England and the United States, dating from the late 18th century.

porcupine, also called QUILL PIG, any of the large, quill-bearing rodents of the families Erethizontidae and Hystricidae (order Rodentia). Porcupines are heavyset, relatively short-legged rodents, essentially nocturnal and herbivorous in habit. The New World species (Erethizontidae) are arboreal, and the Old World species (Hystricidae) terrestrial.

The North American porcupine (*Erethizon dorsatum*), best known of the New World species, is a compact, slow-moving animal found in woods from Canada to northern Mexico. It is about 75 centimetres (29 inches) long, with the thick, muscular tail an additional 20 cm or so. The quills, which are modified hairs, are stiff, barbed spines about 7.5 cm long. They are white, tipped with black, and are interspersed among the dark, coarse guard hairs of the back and tail.

When approached, the North American porcupine presents its rear to the enemy; if attacked, it drives its powerful tail against the assailant. The quills are easily detached from its skin and remain embedded in the attacker. The animal does not throw its quills, but some may become detached when the porcupine shakes itself.

The North American porcupine is a solitary but not antisocial animal. It shows a preference for eating the tender layer of tissue beneath the bark of trees and at times completely girdles, and thus kills, trees. It may also gnaw used ax handles, canoe paddles, and



Porcupine (*Erethizon dorsatum*)
Les Blacklock

other items for the salt and oil they contain. The porcupine breeds in fall or early winter, and the female bears one or two young, born with soft quills, about seven months later.

The family Erethizontidae also includes the prehensile-tailed, or tree, porcupines (*Coendou*) of forests from Mexico to South America; the short-tailed porcupine (*Echinoprocta rufescens*) of Colombia; and the thin-spined porcupine (*Chaetomys subspinosus*) of Brazil.

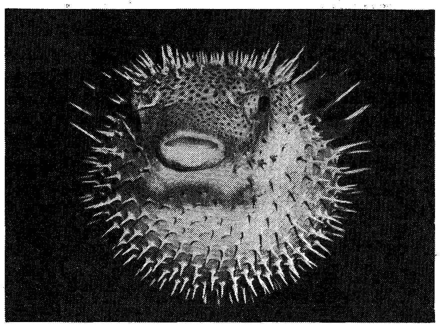
Crested porcupines (*Hystrix*), the typical Old World porcupines, are distributed through southern Europe, Africa, and Asia. Usually solitary animals, crested porcupines live in burrows and eat roots, fruit, and other vegetation, sometimes damaging cultivated plants. They often breed twice a year, the female bearing one to four young after about two months' gestation. When disturbed, these porcupines turn away from the attacker and rattle their quills. If the threat persists, they run backward, quills erect, and attempt to impale the enemy.

The largest terrestrial rodent in Europe and Africa is the African crested porcupine (*H. cristata*), which attains a total length of about 80 cm and a weight of about 27 kilograms (60 pounds). It has two types of quills: long, flexible, usually white, quills up to 35 cm long; and shorter, stout quills banded with black or brown. The African and certain other crested porcupines have long neck and shoulder quills they can erect to form a crest.

There are three other genera of Old World porcupines: the long-tailed and Indonesian porcupines (*Trichys* and *Thecurus*) of Asia, and the brush-tailed porcupines (*Atherurus*) of Africa and Asia.

porcupine fish, any of the spiny, shallow-water fishes of the family Diodontidae, found in seas around the world, especially the species *Diodon hystrix*. They are related to the puffers and, like them, can inflate their bodies when provoked.

Porcupine fishes are short and broad-bodied, with large eyes, beaklike teeth, and skins set with spines, hence the name. These spines are short and permanently erect in some species,



Porcupine fish (*Diodon hystrix*)
Carl Roessler

such as the burrfishes of the genus *Chilomycterus*. In the others, such as those of the genus *Diodon*, the spines lie against the body except when the fish is inflated. The skins of porcupine fishes, inflated, dried, and sometimes provided with a light bulb inside, are commonly sold as curios. The porcupine fish (*Diodon hystrix*) is a common and widely distributed member of the family. Found throughout the world, it is a dark-spotted, brownish fish reaching a maximum length of about 90 centimetres (3 feet).

Porcupine River, major tributary of the Yukon River, in northern Yukon Territory, Can., and northeastern Alaska, U.S. Discovered in 1842 by John Bell of the Hudson's Bay Company, the Porcupine rises in the Mackenzie Mountains of west central Yukon Territory and flows for 448 mi (721 km) in a great arc, first north and then west across the international boundary and into the Yukon River near Fort Yukon, Alaska. Navigable to Old Crow, Can., the centre of a fur-producing area, the Porcupine serves as a main transportation link between northern and southern Yukon Territory. Major tributaries include the Bell, Old Crow, Coleen, Sheenjek, and Black rivers.

Pordenone, original name GIOVANNI ANTONIO DE' SACCHIS (b. *c.* 1483, Pordenone, Republic of Venice—d. 1539, Ferrara, Duchy of Ferrara), High Renaissance Italian painter chiefly known for his frescoes of religious subjects.

Pordenone was a pupil of Pellegrino da S. Daniele and other Friulian masters, but his early style is founded on Venetian models and in particular on Andrea Mantegna. Later he was influenced by Titian, Correggio, and also by the Roman works of Michelangelo and Raphael. It is assumed, therefore, that he went to Rome, probably about 1515/16.

Pordenone worked throughout northern Italy. In Venice his work was so popular that for a short time he was a serious rival to Titian himself. His frescoes in Venice have perished, but his "Passion" frescoes (after 1521; Cremona cathedral) and his frescoes in Treviso cathedral (1520–22) are rendered in broad strokes of vibrant colour and reveal a grave, but sometimes violent, temperament. His frescoes at Piacenza (1531; Madonna di Campagna) are painted in the illusionistic manner of Correggio and exhibit a more brilliant palette and precise technique. Pordenone had no significant followers, but Titian and Rubens borrowed ideas from his work.

Pordenone, city, capital of Pordenone province, Friuli-Venezia Giulia region, northeastern Italy, on a small tributary of the Meduna, southwest of Udine.

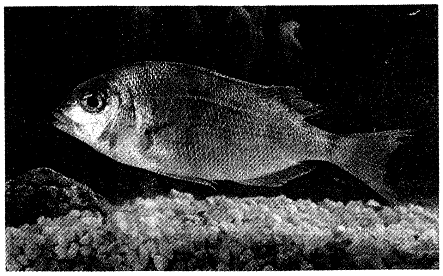
Originating as the Roman and medieval river port of Portus Naonis, it was a bulwark of the Trevisani in their war against Aquileia until it was destroyed by the latter in 1233. It later became a fief of the Holy Roman Empire, passed to Venice in 1508, and became part of the Kingdom of Italy in 1866. In 1968 it became the capital of the newly created Pordenone province.

It has many fine Roman–Gothic and Venetian palaces, including the Palazzo Comunale (1291) with its picture gallery. The 13th–14th-century campanile of the 15th-century cathedral is a national monument. Both cathedral and gallery contain paintings by Giovanni Antonio de' Sacchis, called Pordenone.

The principal industrial centre of Friuli, the city manufactures motor vehicles, domestic appliances, textiles, ceramics, and cutlery. Pop. (1983 est.) mun., 51,978.

pore fungus: *see* Polyporales.

porgy, any of about 100 species of marine fishes of the family Sparidae (order Perciformes). Porgies, sometimes called sea breams, are typically high-backed, snapper- or grunt-like fishes. They have a single dorsal fin,



Northern porgy (*Stenotomus chrysops*)
Runk/Schoenberger from Grant Heilman—EB Inc.

and their small mouths, equipped with strong teeth, can handle a diet of fishes and hard-shelled invertebrates.

Porgies are generally shallow-water fishes and are found throughout tropical and temperate waters. Most do not exceed a size of about 30 centimetres (one foot), but some may grow to four times that length. The family is represented by a number of food and game fishes. South Africa, with an exceptional variety of species, is the home of the musselcrackers—popular sport fishes growing as heavy as 45 kilograms (100 pounds). In Australia, several important food species are known as snappers and belong to the genus *Chrysophrys;* in Japan, a related species, the red tai (*C. major*), is another important food fish.

In Europe, there are several valuable species, such as the red sea bream (*Pagellus centrodontus*), a reddish or golden-silvery fish of rather deep waters. And in the western Atlantic, there are such species as the scup, or northern porgy (*Stenotomus chrysops*), a small fish, brownish above and silvery below, and the sheepshead (*Archosargus probatocephalus*), a black-banded, grayish fish growing to about 75 centimetres and 9 kilograms, both valued for food and sport.

Pori, Swedish BJÖRNEBORG, city, Turun ja Porin *lääni* (Turku ja Pori province), southwestern Finland, on the Kokemäenjoki (river) near the Gulf of Bothnia, north-northwest of Turku. Originally settled in the 12th century farther up the Kokemäenjoki and chartered as Ulvila in 1365, it was moved to its present site in 1558. It was destroyed by fire in the 16th and 19th centuries but was rebuilt both times because of its ideal commercial location. Modern Pori contains a theatre (1884), the Satakunta Museum (founded 1888), and Finland's largest shortwave wireless transmitting station. A year-round seaport, Pori exports lumber and wood products. Other industry includes nickel and copper refineries, machine factories, and cotton mills. The city is connected by rail with Tampere and has air service to Turku and Helsinki. Pori has port facilities on the Kokemäenjoki and two outports, Mäntyluoto and Reposaari, on the Gulf of Bothnia. Pop. (1983 est.) mun., 78,978.

Porifera (animal phylum): *see* sponge.

Porirua, city in southern North Island, New Zealand, located about 13 mi (21 km) north of Wellington, at the head of Porirua Harbour. The earliest inhabitants were aboriginal moa hunters in the 12th century. European whalers and traders occupied nearby Mana Island from 1832 to 1834, and in 1836 a permanent whaling station was built near Porirua.The city is now the site of the largest single vehicle assembly plant in New Zealand, which opened in 1975. Other local industries produce clothing, chemicals, and electrical machinery. The city is connected by rail and a highway with Wellington, the national capital. Pop. (1983 est.) 40,800.

pork, flesh of hogs, usually slaughtered between the ages of six months and one year. The most desirable pork is grayish pink in colour, firm and fine-grained, well-marbled, and covered with an outer layer of firm white fat. About 30 percent of the meat is consumed as cooked fresh meat; the remainder is cured or smoked for bacon and ham, used in sausage, and rendered to produce lard. Because pigs may be infected by the parasitic disease trichinosis, pork must be thoroughly cooked until its internal colour changes to light gray in order to destroy the disease-causing organism.

Pork carcasses are graded according to the amount of edible meat they will yield. In the United States, where individual cuts are not graded, a U.S. Number 1 carcass is one having the most satisfactory ratio of fat to lean; Number 2, Number 3, and Number 4 have a higher proportion of fat, reducing the amount of lean. Utility, usually from mature animals, has too little fat and is less firm. The main cuts are hams, spareribs, loin roasts and chops, bellies, picnic shoulders, and shoulder butts.

Pork, one of the most versatile of meats, is consumed around the world. Because it is proscribed by the dietary laws of Judaism and Islām, however, pork is virtually unknown in the cuisines of the Middle East and those of local populations in Asia and Africa. The chief pork-consuming countries (on a per capita basis) are Germany, Denmark, Poland, and Austria.

In Western cooking fresh pork is commonly roasted, choice cuts being the loin, leg, and rib sections known as spareribs. Chops from the loin and ribs are usually grilled or pan-fried. A spit-roasted whole young piglet, or suckling pig, is a delicacy in central and eastern Europe; wild pigs have traditionally been cooked in a similar manner throughout the Pacific. Less desirable parts—ears, tail, hocks, feet, brains—and the fatty portions of the back of the carcass (fatback), cooked with various greens, are common in the diet of low-income groups, especially in the southern United States; although originating in economic necessity, this distinctive style of pork cookery has an important place in American regional cuisine.

In China and Southeast Asia pork is commonly shredded or cubed and stir-fried with vegetables and spices. Pork-and-vegetable mixtures are also used to stuff a variety of small rolls, buns, and dumplings.

porkpie, round hat with a turned-up brim and a flat crown. The porkpie, so called because of its shape, became popular with both men and women in the mid-19th century, though a similarly shaped hat had been worn in the Middle Ages.

The porkpie worn by men sometimes had ribbons flowing down the back. Women wore tiny porkpies, tipped forward over the forehead because of the elaborate coiffures at the back of the head. These hats were often decorated with flowers, ribbons, and feathers.

pornography, the representation of erotic behaviour in books, pictures, statues, motion pictures, etc., that is intended to cause sexual excitement. The word pornography, derived from the Greek *porni* ("prostitute") and *graphein* (" to write"), was originally defined as any work of art or literature depicting the life of prostitutes.

Little is known of the origins and earliest forms of pornography because it was customarily not thought worthy of transmission or preservation. One of the first clear historical evidences of pornography in Western culture can be found in the salacious songs performed in ancient Greece at festivals honouring the god Dionysius. Indisputable evidence of graphic pornography in Roman culture is found at Pompeii, where erotic paintings dating from the 1st century AD cover walls sacred to bacchanalian orgies. A classic of written pornography is the Roman poet Ovid's *Ars amatoria* (*Art of Love*), a treatise on the art of seduction, intrigue, and sensual arousal.

During the Middle Ages pornography was widespread but held in low repute, finding expression mostly in riddles, common jokes, doggerel, and satirical verses. A notable exception is the *Decameron* of Boccaccio, some of whose 100 stories are licentious in nature. A principal theme of medieval pornography was the sexual license of monks and other clerics, along with their attendant displays of hypocrisy.

The invention of printing led to the rebirth of ambitious pornographic written works. These frequently contained elements of humour and romance and were written to entertain as well as to arouse. Many of these works harked back to classical writings in their treatment of the joys and sorrows of marital deception and infidelity. The *Heptameron* of Margaret of Angouleme is similar to the *Decameron* in that it uses the device of a group of people telling stories, some of which are salacious.

In 18th-century Europe there appeared the first modern works that were both devoid of literary value and designed solely to arouse sexual excitement. A small underground traffic in such works became the basis of a separate publishing and bookselling business in England. A classic of this period was the widely read *Fanny Hill; or, Memoirs of a Woman of Pleasure* (1749) by John Cleland. At about this time erotic graphic art began to be widely produced in Paris, eventually coming to be known as French postcards.

Pornography flourished in the Victorian era despite, or perhaps because of, the prevailing taboos on sexual topics. In 1834 an investigation in London established the presence of 57 pornographic shops on Holywell Street alone. A notable work of Victorian pornography is the massive and anonymous autobiography *My Secret Life* (1890), which is both a social chronicle of the underside of a Puritanical society and a minutely detailed recounting of one English gentleman's lifelong pursuit of sexual gratification. Special literatures of flagellation and homosexuality made their appearance at this time.

The development of photography and later of motion pictures contributed greatly to the proliferation of pornographic materials. Pornography in the 20th century is unprecedented in the variety of media used and the enormous volume of works produced. Since World War II, written pornography has been largely superseded by explicit visual representations of erotic behaviour that are considered lacking in redeeming artistic or social values.

Pornography has long been the target of moral and legal sanction in the belief that it may tend to deprave and corrupt minors and adults and cause the commission of sexual crimes. Occasionally, important works of art or even of religious significance may be banned by a state or other jurisdiction because they are considered pornographic under such assumptions. Those assumptions have been challenged on legal and scientific grounds. Nonetheless, the production, distribution, or possession of pornographic materials may be prosecuted in many countries under statutes dealing with obscenity (*q.v.*).

Porongos (Uruguay): *see* Trinidad.

Póros, island of the Saronic group, lying close to the Argolis peninsula of the Peloponnese, part of the *nomós* (department) of Attikí, Greece. It actually comprises two islands totalling 9 sq mi (23 sq km), the larger of which is wooded, limestone Kalávria, separated from the village of Galatás on the mainland by a narrow channel, or *poros,* whence the collective name. Between the channel and Kalávria is the small, bare volcanic (trachyte) mass of Póros, an Athenian resort joined to Kalávria by a bridge. Calauria (modern Kalávria) on the central plateau was known for a temple of Poseidon (6th century BC), now a ruin, and was the centre of an amphictyony, or joint council, of maritime states. Demosthenes took refuge there, committing suicide to avoid arrest. In 1828 English, French, and Russian plenipotentiaries met on Póros to discuss the future of the Greek state.

The harbour at Póros, Greece
J. Allan Cash—EB Inc.

Porphyra (algae): *see* laver.

porphyria, any of a group of diseases characterized by the marked overproduction and excretion of porphyrins or of one or another of their precursors. The porphyrins are reddish constituents of heme, the deep red iron-containing pigment of hemoglobin, the oxygen-carrying protein of the red blood cells. The deposition of porphyrin compounds in body tissues, notably the skin, gives rise to a variety of symptoms, the nature of which depends on the specific compound that is abnormally metabolized.

Two main groups of porphyria are recognized: (1) erythropoietic and (2) hepatic. In the first, the overproduction occurs in relation to hemoglobin synthesis by cells in the bone marrow; in the second, the disturbance is in the liver.

There are two principal types of erythropoietic porphyria: (1) In congenital erythropoietic porphyria, or Günther's disease, the excretion of pinkish urine is noted shortly after birth; later, the skin becomes fragile, and blisters may appear in body areas exposed to light; the teeth and bones are reddish brown. Anemia and enlargement of the spleen are frequently noted. The condition is thought to be transmitted as a recessive trait. (2) In erythropoietic protoporphyria, the skin becomes inflamed and itchy after short exposures to sunlight, but usually there are no other impairments, and this form of porphyria, which is transmitted as a dominant trait, is compatible with normal life expectancy.

There are three types of hepatic porphyria: (1) In acute intermittent porphyria, also called porphyria hepatica, affected persons have recurrent attacks of abdominal pain and vomiting, weakness or paralysis of the limbs, and psychic changes resembling hysteria. Attacks may be precipitated by a variety of drugs, including barbiturates and contraceptives, and possibly alcohol. This condition is transmitted as a dominant trait; it is possibly the most common form of porphyria, with an overall incidence of approximately one per 100,000 population; people of Scandinavian, Anglo-Saxon, and German ancestry seem more susceptible than others. (2) In variegate porphyria, affected individuals suffer from chronic skin lesions that tend to heal slowly. Acute transient attacks of abdominal pain and nervous system symptoms may also be present. The condition is inherited as a dominant trait, being especially common in the white population of South Africa. (3) Porphyria cutanea tarda symptomatica, or cutaneous porphyria, is more common in males, and usually begins insidiously later in life, in the fourth to eighth decade. The exposed skin is fragile and sensitive to light and other factors. Liver function impairment, if the patient also suffers from chronic alcoholism, is present in the majority of affected individuals; abstinence, in alcoholic patients, results in marked improvement or disappearance of the porphyria; the tendency to develop this form of porphyria also appears to be inherited.

In addition to hereditary porphyria, there have also been rare instances of acquired hepatic porphyria, caused by intoxications. There is generally no specific treatment for porphyria; therapy is aimed at alleviating the symptoms and preventing skin injury and attacks.

porphyrin, any of a class of water-soluble, nitrogenous biological pigments (biochromes), derivatives of which include the hemoproteins (porphyrins combined with metals and protein). Examples of hemoproteins are the green, photosynthetic chlorophylls of higher plants; the hemoglobins in the blood of many animals; the cytochromes, enzymes that occur in minute quantities in most cells and are involved in oxidative processes; and catalase, also a widely distributed enzyme that accelerates the breakdown of hydrogen peroxide.

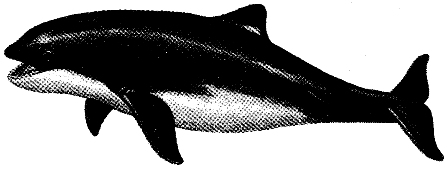
Evidence indicates that, in various animals, certain porphyrins may be involved in activating hormones from the pituitary gland of the brain, including those concerned with the period of sexual heat in certain female animals. Porphyrins in the integument (skin) of some mollusks and cnidarians are regarded as being photosensitive receptors of light.

Porphyry, original name MALCHUS (b. *c.* 234, Tyre or Batanaea, Palestine—d. *c.* 305, Rome?), Neoplatonist Greek philosopher, important both as an editor and as a biographer of Plotinus and for his commentary on Aristotle's *Categories,* which set the stage for medieval developments of logic and the problem of universals. Boethius' Latin translation of the introduction (*Isagoge*) became a standard medieval textbook.

Porphyry's original Syrian name (meaning "king") was hellenized at Athens by Cassius Longinus, his teacher of rhetoric (the new name signifying "imperial purple," an allusion to "king"). Porphyry studied philosophy (263–268?) in Rome under Plotinus, who gently rescued him from a suicidal depression. In 301 he produced his most important work, *Enneads,* a systematized and edited collection of the works of Plotinus to which was prefixed a biography, unique for its reliability and informativeness. Porphyry's voluminous writings extended to philosophy, religion, philology, and science and show scholarly care in citing authorities. Surviving fragments of his *Against the Christians,* condemned in 448 to be burned, marked him as a fierce critic of the new religion. He was also lecturer on Plotinus and tutor to Iamblichus, wrote a life of Pythagoras, and preserved precious fragments of earlier philosophy in his *On Abstinence* (1965 translation by T. Taylor), a plea for vegetarianism. In medieval textbooks, the "Porphyrian Tree" illustrated his logical classification of substance. A life, *Vie de Porphyre* (1913) by J. Bidez, was reprinted in 1964.

porphyry copper deposit, blanket-like replacement deposit of copper minerals that are disseminated throughout a large mass of fractured rock. Porphyry copper deposits commonly contain tens of millions of metric tons of ore that averages a fraction of 1 percent copper by weight; although they are low-grade, they are important sources because they may be worked on a large scale at low cost. They have been formed by the dissemination of copper minerals in the crushed or fractured periphery of intrusive igneous bodies of such granitic rocks as quartz monzonite and diorite porphyry. Large porphyry copper deposits are worked in the southwestern U.S. (where molybdenum is produced as a by-product), the Solomon Islands, Canada, Peru, Chile, Mexico, and other parts of the world.

porpoise, specifically, any of the small whales of the genera *Phocoena, Phocoenoides,* and *Neomeris;* in a broader sense the name is applied, especially in North America, to various other small whales more widely known



Common, or harbour, porpoise (*Phocoena phocoena*)
Painting by Richard Ellis

as dolphins (*see* dolphin). Porpoises are distinguished externally from dolphins by their chubbier shape, usually smaller size (maximum length about two metres [seven feet]), and blunt, rather than beaklike, snout. Some authorities consider them a distinct family, Phocoenidae (or Phocaenidae); others as part of the dolphin family (Delphinidae).

There are seven species of porpoises. Four, the common, or harbour, porpoises, are of the genus *Phocoena.* These animals are found in pairs or large groups along coasts and occasionally in rivers. Primarily fish eaters, they are gray or black above and white below. The species *P. phocoena,* the best known, is found throughout much of the northern hemisphere. It is shy, generally avoids boats, and rarely leaps above the water. It is hunted in some regions and in the Middle Ages was considered a royal delicacy. The other species in the genus, more restricted in distribution, are *P. sinus* of California and *P. spinipinnis* and *P. dioptrica* of South America.

The Dall and True porpoises (*Phocoenoides dalli* and *P. truei*) are active, gregarious whales that often swim ahead of ships. They eat cephalopods (primarily squid) and fish and usually live in groups of 2 to 20. Both are black with a large white patch on each side. The Dall porpoise is found on both sides of the North Pacific. The True porpoise, considered by some authorities a subspecies, *P. dalli truei,* is found near Japan.

The black finless porpoise, *Neomeris* (or *Neophocoena*) *phocoenoides,* is a small, slow porpoise of coastal waters and rivers along the Pacific and Indian oceans. It is black above and paler below; it has a rounded head and, unlike other porpoises, lacks a dorsal fin. Little is known of its habits. It lives alone or in small groups and eats crustaceans, fish, and squid.

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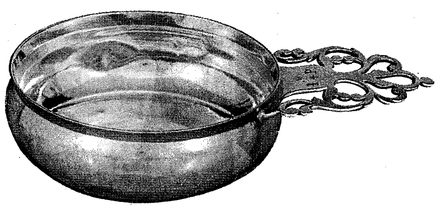
Porpora, Nicola (Antonio Giacinto) (b. Aug. 17, 1686, Naples—d. March 3, 1768, Naples), leading Italian teacher of singing of the 18th century and noted composer of operas in the elegant, lyrical Neapolitan style. He taught singing in Venice and Naples; among his pupils were the poet and librettist Pietro Metastasio and the celebrated castrati Antonio Uberti (known as "Porporino"), Farinelli, and Caffarelli.

Porpora was maestro at the Ospedale degli Incurabili, the famous music school for girls, from 1726 to 1733. In 1733 he went to London as chief composer to the Opera of the Nobility, a company formed in competition to Handel's opera company. In London he wrote five operas, among them *Polifemo, Davide e Bersabea,* and *Ifigenia in Aulide,* with parts for his remarkable pupil Farinelli. When the Opera of the Nobility and Handel's company closed, Porpora left England, in 1736. He taught in Venice and Naples, where he produced two comic operas. In 1747 he was in Dresden and from 1748 to 1751 was chapelmaster there. He went to Vienna in 1752, where he gave composition lessons to the young Haydn, and in 1758 returned to Naples. A revision of his opera *Il Trionfo di Camilla* (first produced 1740) was given there in 1760 but failed, and Porpora's last years were spent in poverty. In addition to about 50 operas, he composed a number of oratorios, masses, motets, and instrumental works.

Porres, Saint Martín de (b. 1579, Lima—d. Nov. 3, 1639, Lima; canonized 1962; feast day November 3), Peruvian national patron of social justice.

Born of a liaison between a Spanish grandee and a free black woman, Martín de Porres became a Dominican oblate, or lay monastic, in 1601. Although it was not customary then to receive a mulatto into a religious order in Peru, Martín was considered an exception and became a Dominican lay brother in 1610. As a friar, he was noted for his kindness, his nursing of the sick, his obedience, and his charity. For the youth of Lima he established a school, considered by some to be his monument. He was beatified in 1837 by Pope Gregory XVI and canonized by Pope John XXIII. G. Cavallini's *St. Martin de Porres: Apostle of Charity* appeared in 1963.

porringer, a shallow, round bowl with one or two flat, horizontal handles set on opposite



Silver porringer by Paul Revere, *c.* 1740–50; in the Yale University Art Gallery
By courtesy of the Yale University Art Gallery, William Inglis Morse Collection, gift of his daughter, Mrs. Frederick W. Hilles; photograph, Joseph Szaszfai

sides of the rim and, usually, a shallow lid. In recent usage, the word has also been used to refer to late 16th- and early 17th-century English silver vessels of cylindrical form with two vertical scroll handles. The precise purpose of porringers, or *écuelles,* as they are known in France, is in dispute; but it is thought that they were used to hold broth or gruel.

Porris, Georg Joachim de (mathematician): *see* Rheticus, Georg Joachim.

Porsangen, fjord, indenting the coast of Finmark *fylke* (county), extreme northern Norway on the Arctic Ocean. An inlet of the Barents Sea, the fjord is approximately 80 mi (130 km) long and lies well north of the Arctic Circle. Adjacent to the mouth of the fjord is a largely uninhabited area, Sværholtklubben, which serves as home to thousands of seabirds. Many islands are found in Porsangen; and Magerøya (island), just west of the mouth, contains North Cape (Nordkapp) and the northernmost point in Europe. The region around Porsangen is sparsely populated; Kistrand, Banak, Lakselv, and Børselv are the main villages. All are located along the southern shores. Fishing and reindeer herding are the major activities of the Lapp people who live in the region.

Porsche, Ferdinand (b. Sept. 3, 1875, Maffersdorf, Austria—d. Jan. 30, 1951, Stuttgart, W. Ger.), Austrian automotive engineer who designed the popular Volkswagen car.

Porsche became general director of the Austro-Daimler Company in 1916 and in 1923 moved to the Daimler Company in Stuttgart. He left in 1931 and formed his own firm to design sports and racing cars. Porsche became deeply involved in Hitler's project for a "people's car" and with his son Ferdinand, known as Ferry, was responsible for the initial design of the Volkswagen in 1934. During World War II the Porsches designed military vehicles, notably the Tiger tank. After the war the elder Porsche was imprisoned by the French for a time. In 1950 the Porsche sports car was introduced.

Porsgrunn, town, Telemark *fylke* (county), southern Norway, at the mouth of the Skienselva (river) on Frierfjorden. Established as a customs post in 1652 with the name Porsgrund, it received its town charter in 1842. An export and industrial centre, it contains the huge Norsk Hydro chemical factories, a factory that produces Norway's finest porcelain, shipyards, metalworks, and lumber mills. Tourist sites include the Østre Porsgrunn (1760) and the Vestre Porsgrunn (1758) churches, both of which exemplify the Rococo style in their interior design. Pop. (1983 est.) mun., 31,247.

Porson, Richard (b. Dec. 25, 1759, East Ruston, Norfolk, Eng.—d. Sept. 25, 1808, London), British master of classical scholarship during the 18th century, the most brilliant of the English school that devoted itself to the task of freeing Greek texts from corruption introduced through the centuries. His special critical talent lay in his insight into Greek metre and his unusual appreciation of the fine points of Greek diction.

Porson began his serious critical studies at Trinity College, Cambridge, which he attended from 1778 to 1785, and was appointed professor of Greek there in 1792. His edition of the plays of Aeschylus was printed in Glasgow the same year. He later edited four plays of Euripides: *Hecuba* (1797; reprinted with a famous critical supplement in 1802), *Orestes* (1798), *Phoenissae* (1799), and *Medea* (1801). Porson drank to excess, was addicted to late hours, took no care of his health and appearance, and could be rude and boorish in company; however, his friends delighted in his wit and learning and his store of anecdotes and quotations and admired him for his devotion to truth, his indifference to worldly success, and his readiness to communicate knowledge. His work is marked by a sureness of touch

Porson, detail of an oil painting by John Hoppner, 1796; in the Cambridge University Library
By courtesy of the University Library, Cambridge, Eng.

and economy of expression that give the impression of effortlessness and conceal the hard work that lay behind it.

port, also called PORTO, specifically, a sweet, fortified, usually red wine of considerable renown from the Douro region of northern Portugal, named for the town of Oporto where it is aged and bottled; also, any of several similar fortified wines produced elsewhere. The region of true port production is strictly delimited by Portuguese law. The soil and grapes, and the skill of Oporto vintners in blending, produce wines of remarkable character, with types running through a series of flavours. Vintage port, the finest, is not blended; but harvests deemed worthy to produce it are rare. The full richness of the port taste is found in dark vintage and vintage character ports; these types are taken from the cask after two or three years and complete their aging in the bottle. Vintage character port is a blend of best wines, sometimes called crusted port because, as with vintage port, it forms a crust within the bottle. Ruby port is a blend of younger wines. Tawny port is blended and matures in cask, changing its colour.

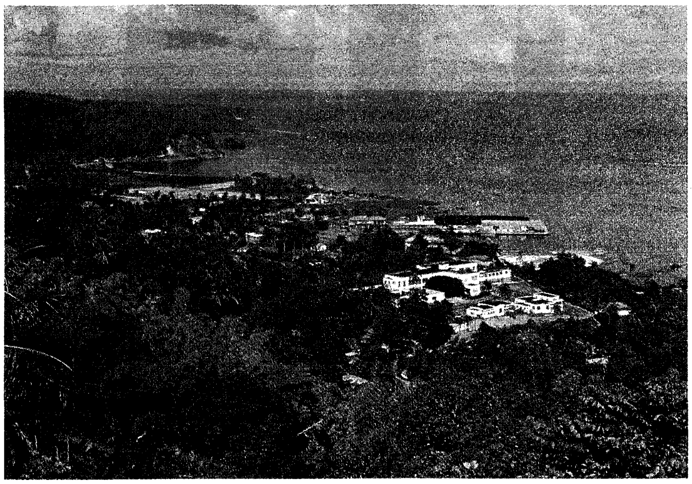
Peculiar to the vinification of port is a large dosage of brandy given to the still fermenting must, by which the character of the wine is greatly changed. Much time is needed for the maturing of ports; in 1950, for example, 1912 port was still excellent. There is some white port, usually made from white grapes, but it is not of equal distinction. The name port has been appropriated by certain wines of other countries, sometimes not aged, often not from the same grapes.

Port, le, in full LE PORT DES GALETS, town, major port of the French overseas *département* of Réunion in the western Indian Ocean. Situated on the northwest side of the island, it is connected to all other major points by a paved road along the circumference. The port was artificially excavated in the 1880s when Saint-Denis, the capital, proved to be insufficiently sheltered. It can handle large vessels but has a narrow right-angle turn at the entrance that requires ships to be roped in from the shore. Until 1962 it was linked to Saint-Denis by rail, as well as by paved road; discontinuation of the railway was followed by considerable improvement of the road. Pop. (1982 prelim.) 30,131.

Port Adelaide, chief port of South Australia, on an estuarine-tidal inlet of Gulf St. Vincent, just northwest of Adelaide. Visited in 1831 by Capt. Collet Barker, the harbour, sheltered by a long sand spit to the west, was made the port for Adelaide in 1837. Port Adelaide was incorporated as a town in 1855 and became a city in 1901. The Inner Harbour, with extensive wharves, has a minimum depth of 33 ft (10 m) and is reached by a dredged channel between the spit and Torrens Island; it can accommodate vessels of up to 12,500 tons. Larger ships berth in the Outer Harbour, which has a passenger terminal and container handling facilities. Petroleum products, phosphate rock, and limestone are imported; bulk grain and soda ash are exported. The city centre has been designated a conservation area to protect its fine 19th-century stone buildings. Pop. (1981) 35,407.

Port Angeles, city, seat of Clallam County, northwestern Washington, U.S., on Juan de Fuca Strait, linked by ferry to Victoria, B.C., 18 mi (29 km) north across the strait. Located at the base of Ediz Hook (a 3½ mi-long, curving sand bar), the site was visited in 1791 by Francisco Eliza who founded an Indian village and named it Puerto de Nuestra Señora de los Angeles. Permanently settled in 1862, it has sheltered harbour facilities that serve the fishing industry; the city also has lumber, paper, and food-processing plants. Dairy farms are in the vicinity. Port Angeles is headquarters for nearby Olympic National Park and is known for its Salmon Derby (held every Labor Day weekend). It is the site of Peninsula College (1961) and a U.S. Coast Guard Air Rescue Station. Inc. 1890. Pop. (1980) 17,311.

Port Antonio, chief town of the Parish of Portland, on the northeastern coast of Jamaica, 60 mi (97 km) northeast of Kingston. The island's third largest port, it is a shipping point for bananas, coconuts, and cacao and is one of Jamaica's oldest and least commercialized tourist resorts. It lies on a bay divided by a promontory into East and West Harbours; the latter is sheltered by the small Navy Island. There are fine beaches in the vicinity and excellent deep-sea fishing, sailing, and skin diving, especially at Blue Hole Lagoon. The town is the site of the annual International Marlin Tournament, which attracts many sports fishermen. A curiously surrealistic intrusion into this tropical paradise is Folly, the decaying ruins of a Roman-style villa built by an ill-fated American millionaire at the turn of the century. Pop. (1982 prelim.) 17,201.



Port Antonio, Jamaica
J. Allen Cash—EB Inc.

Port Apra (Guam): *see* Apra Harbor.

Port Arthur, inlet of the Tasman Sea on the south coast of the Tasman Peninsula, Tasmania, Australia. It is known for the penal settlement established there in 1830 by Sir George Arthur, then lieutenant governor, who attempted to centralize the several settlements in Van Diemen's Land (Tasmania). A model reformatory for boys also existed from 1835 to 1849 at Point Puer, a rocky headland in the inlet. Although transportation of convicts ceased in 1853, the colony was not abandoned for another 24 years, and 30,000 prisoners were held there at one time or another. The partially restored ruins of the penal colony, including a church, designed by convict architect James Blackburn and built by convicts (1836–40), and the spot called "Isle of the Dead" (with unmarked convict graves), are now prime tourist attractions. Port Arthur is accessible from Hobart, 63 mi (101 km) northwest, by the Arthur Highway. The whole Tasman Peninsula is registered as part of Australia's National Estate (places preserved as part of Australia's national heritage).

Church built by convicts, Port Arthur, Tasmania
Frederick Ayer—Photo Researchers

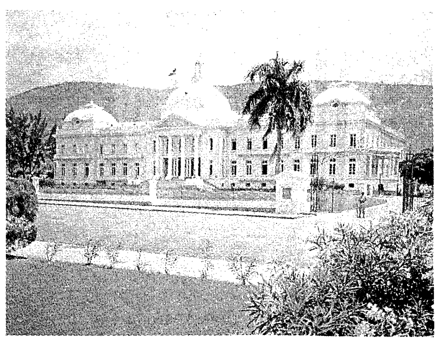
Port Arthur (China): *see* Lü-shun.

Port Arthur, city, Jefferson County, southeastern Texas, U.S.; it is a major deepwater port on Sabine Lake and the Sabine–Neches and Gulf Intracoastal waterways, 9 mi (14 km) from the Gulf of Mexico. With Beaumont and Orange, it forms the "Golden Triangle," an important petrochemical complex. Earlier unsuccessful settlements in the area included Aurora (1840). In 1895 Arthur E. Stilwell organized a town (which was named for him) as a port and terminus for the Kansas City, Pittsburg, and Gulf Railroad (now Kansas City Southern Railway). In 1899 a canal was dredged for oceangoing vessels. Two years later the gusher Spindletop blew a few miles away, and the port became a major outlet for oil and a wide range of other products. Industrial activities include oil refining, ship building, and the manufacture of chemicals. CavOILcade is the city's annual (October) salute to the petroleum industry. Lamar University at Port Arthur originated in 1909 as Port Arthur College. Inc. 1898. Pop. (1980) city, 61,195; (1982 est.) Beaumont–Port Arthur metropolitan area (SMSA), 387,700.

Port-au-Prince, capital, chief port, and commercial centre of the West Indian republic of Haiti and the seat of Ouest *département.* It is situated on a magnificent bay at the apex of the Golfe de la Gonâve (Gulf of Gonaïves), which is protected from the open sea by the island of Gonâve. The city was laid out in a grid pattern in 1749 by the French and called L'Hôpital. It has suffered frequently from earthquakes (especially in 1751 and 1770), fires, and civil strife. It replaced Cap-Haïtien as the capital of the old French colony Saint-Domingue in 1770. In 1807 its port was opened to foreign commerce. Sanitary conditions were improved during U.S. occupation (1915–34). The city's bicentennial was commemorated in 1949 by an international exposition, the site of which is now a palm-fronted promenade.

Textile, cottonseed oil, flour, and sugar mills are located in or near the city, and, to encourage cattle and horse breeding, the government established a stock-feeding station in 1959. There are air services to the main Caribbean islands, Canada, the United States, and Switzerland, and several luxury hotels have been built. Tourism fluctuates with political conditions.

The National Palace (rebuilt in 1918), the army barracks, and an imposing statue of



National Palace, Port-au-Prince, Haiti
Arthur Griffin—EB Inc.

Jean-Jacques Dessalines, hero of the wars of independence, dominate the Place du Champ-de-Mars in the centre of the city. The most picturesque site is the brash and bustling Iron Market, where the vendors are mostly women. Other notable landmarks include the Cathedral of Notre Dame, with the adjacent colonial cathedral, and the National Archives, National Library, and National Museum. Port-au-Prince is the centre of the political and intellectual life of the nation and is the seat of the University of Haiti (established in 1944).

Most of the elite (nearly all mulatto or nonblacks) live in the city, where most of the cultural amenities and public utilities—including the only sewer system in the country—are concentrated. Squalor and neglect surround most of the black urban working class even more than the subsistence farmer. There is virtually no middle class. Recreation for the privileged centres around European-style social clubs, but the house of the local voodoo priest is still the heart of the urban poor community, and constant migration from the countryside continues to exacerbate its misery. Pop. (1982 prelim.) 449,831.

Port Augusta, city and former port, southeastern South Australia, at the head of Spencer Gulf. Founded in 1852 and named for the wife of Sir Henry Fox Young, an early colonial governor of South Australia, Port Augusta was incorporated as a town in 1875 and linked to Adelaide, 191 mi (307 km) southeast, by rail in 1878; it became a city in 1963. Terminus of both the Central and Trans-Australian railways, its port facilities, somewhat restricted by a shallow approach, still serve some coastal shipping, but it ceased to be registered as a port in 1973. Its Aboriginal name, Kurdnatta, means "place of drifting sand." An important service centre for a large area of the Outback (backcountry sheeplands), Port Augusta provides an outlet for wheat and wool produced in those districts. Industries include railroad workshops, salt manufacture, and power generation. The last is based on low-grade coal brought from Leigh Creek (240 mi north) and accounts for the greatest part of the state's electricity. Port Augusta is also the location of the state headquarters of the Royal Flying Doctor Service and the School of the Air. Pop. (1981) 15,254.

Port Authority of New York and New Jersey, formerly PORT OF NEW YORK AUTHORITY, self-supporting corporate agency formed in 1921 by agreement between the states of New York and New Jersey for the purpose of developing and operating trade and transportation facilities in the northern New Jersey–New York City region. Twelve nonsalaried commissioners, six appointed by the governor of each state, plan and oversee the operations of a variety of services and facilities. This responsibility includes the maintenance and management of the Lincoln and Holland tunnels under the Hudson River and of the bridges linking the two states. Kennedy, Newark, La Guardia, and Teterboro airports also are under the jurisdiction of the Port Authority, as are three bus–truck terminals, seven marine-passenger ports, and a heliport. During the 1970s the Port Authority constructed the twin-towered World Trade Center in Lower Manhattan to house firms and agencies engaged in international trade in an effort to further encourage commerce in the region.

Port aux Basques (Canada): *see* Channel-Port aux Basques.

Port Borden (Canada): *see* Borden.

Port-Bouët, commune within the city of Abidjan and autonomous municipality, Ivory Coast, West Africa. It is in the southeastern quarter of Abidjan, the national capital. Until the opening of the Vridi Canal in 1950, its meagre harbour facilities served as Abidjan's port. It is the site of Abidjan's international airport. Pop. (1975) 72,616.

Port Brabant (Canada): *see* Tuktoyaktuk.

Port-Cartier, town, Côte-Nord (North Shore) region, eastern Quebec province, Canada, on the north shore of the St. Lawrence River, at the mouth of the Rivière aux Rochers. Originating in 1918 as a small sawmilling community known as Shelter Bay, it was transformed into a modern ocean port 26 mi (42 km) southwest of Sept-Îles by the Quebec Cartier Mining Company in the 1950s and 1960s. Port-Cartier is now the southern terminus of a 195-mi railway from Gagnon, the centre of the Lac-Jeannine iron-ore mining region. Its man-made harbour, from which the ore concentrates are exported, was opened in 1961. Inc. 1958. Pop. (1981) 8,191.

Port Colborne, city, Regional Municipality of Niagara, southeastern Ontario, Canada, a few miles south of Welland on the north shore of Lake Erie at the upper entrance of the Welland Ship Canal and opposite Humberstone Lock, one of the world's largest lift locks. The first settlement of 1832 was known as Gravelly Bay; it was later renamed in honour of Sir John Colborne, lieutenant governor of Upper Canada (1828–36). The city is a modern industrial port and a transshipping point for cargoes moving west from Montreal. Industries include a large nickel-producing plant, iron smelters, and cement works. Inc. village, 1870; town, 1917. Pop. (1981) 19,225.

Port Davey, inlet of the Indian Ocean, indenting southwestern Tasmania, Australia. It is a glacial fjord, its entrance flanked by Point Vincent (north) and Hillyard Head. The inlet comprises two main arms, the shorter extending north to form Kelly Basin and the other stretching 20 mi (32 km) east along Bathurst Channel to Bathurst Harbour. Passed in 1798 by the British explorer Matthew Flinders, it was entered in 1815 by James Kelly, who named it after the Tasmanian lieutenant governor Thomas Davey (1813–17). Port Davey receives the Davey, Spring, and North rivers and lies in an almost uninhabited region comprising mountain, forest, and moor. It is accessible only by sea and by a walking track.

port de bras (French: "carriage of the arms"), in classical ballet, both the general arm movements of a dancer and a designated set of exercises designed to improve the quality of these movements. The *port de bras* of classical ballet is meant to be a graceful and harmonious accent to the movements of the legs.

The position of the dancer's head and shoulders (*épaulement*) is important to the total grace of the *port de bras*. The arms together have five basic positions, and each one singly has five positions.

Port-de-Paix, port and capital of Nord-Ouest *département,* northwestern Haiti, on the Atlantic coast opposite Tortuga Island. It was founded in 1665 by French filibusters, fomenters of insurrection who had been driven from Tortuga Island by the British. The original settlement was located near Môle Saint-Nicolas, where Christopher Columbus landed on Dec. 6, 1492. The site of the first Negro slave revolt (1679), Port-de-Paix was for a time capital of the colony and prospered during the 19th century. It was almost totally destroyed by fire in 1902 and never regained its former prestige. Coffee, bananas, sisal, tobacco, rice, and cacao are cultivated locally. There is subsistence fishing, and agricultural produce, hides, and logwood are exported. A major import is dried sea-snail meat from the Caicos Islands, a cheap and popular source of protein. Pop. (1982 prelim.) 17,633.

Port Dickson, town, southwestern Negeri Sembilan state, West Malaysia (Malaya), on the Strait of Malacca. The port, now in decline, was used extensively during the late 19th century to export the tin mined in the foothills of the state. Now chiefly a seaside resort with a fishing village, it is connected by rail with the inland entrepôt of Seremban, 17 mi (27 km) northeast. Oil refineries are concentrated along the sandy coastline; tankers anchor off shore. Tanjung Tuan (formerly Cape Rachado) to the south has a lighthouse, and the old fort of Lukut is a few miles inland. Pop. (1980) 24,389.

Port Elizabeth, port city, Cape Province, South Africa, on Algoa Bay of the Indian Ocean. Port Elizabeth was established in 1820 as a British settlement around Ft. Frederick (1799), the oldest British building in southern Africa; and was named by Sir Rufane Donkin, the acting governor of the Cape Colony, for his deceased wife, Lady Elizabeth. Completion of the Kimberley Railroad (1873) spurred development of the port, which at times handles imports for Zambia and Zimbabwe and exports manganese and iron ore, wool, coal, and citrus fruit. Its deepwater harbour is enclosed by a breakwater. The city climbs the foot of a 200- to 300-ft (60- to 90-m) plateau and occupies both banks of the small Baakens River. The residential area is on flat tableland, with an industrial sector at the north end. Port Elizabeth is dotted with parks, notably St. George's Park and Settlers' Park Nature Reserve, and is known for its oceanarium. The University of Port Elizabeth was founded in 1964. Excellent communications, cheap power, and water combine to create one of the country's busiest manufacturing centres, mainly concerned with the automotive industry. Tourists are attracted by fine beaches, excellent surfing, and the nearby Addo Elephant National Park. Inc. town, 1861; city, 1913. Pop. (1983 est.) mun., 560,061.

Port Essington, inlet of the Arafura Sea, indenting the north shore of the Cobourg Peninsula, at the extreme north of the Northern Territory, Australia. About 11 mi (30 km) long and 7 mi wide, it was surveyed in 1818 by Capt. Phillip Parker King of the Royal Navy, who named it for Adm. Sir William Essington. In 1824 it was the site of Britain's third attempt to settle the north coast. The attempt failed, and another settlement, named Victoria, survived only from 1838 until 1849. Relics of the settlement are preserved in the Cobourg Peninsula National Park. There have been some attempts at pearl cultivation in the inlet.

Port-Étienne (Mauritania): *see* Nouadhibou.

Port Fairy, town, Victoria, Australia, at the mouth of the Moyne River, on a headland east of Portland Bay (an inlet of the Indian Ocean). A settlement established there in 1835 was called Belfast for a time until it was renamed for a ship, the "Fairy," that had sheltered in its harbour in 1810. Port Fairy became Victoria's first municipality (1852) and was proclaimed a borough in 1863. Connected to Melbourne (150 mi [240 km] northeast) and Adelaide by road and rail, it is a regional agricultural centre (sheep, cattle, dairying, and vegetable farming). Industries include engineering, food processing, and the production of woollens and antibiotics. Port Fairy is also a resort, and its harbour, which served as a whaling station in the 19th century, is now the base of a large fishing fleet. Nearby are Battery Hill (an old fort), the extinct volcanoes Tower Hill and Mt. Eccles, and seal and muttonbird rookeries. Pop. (1981) 2,276.

Port-Francqui (Zaire): *see* Ilebo.

Port-Gentil, capital of Bendjé *département* and of Ogooué-Maritime province, western Gabon, located on Île Lopez (in the mouth of the navigable Ogooué River) and on a bay sheltered by Cape Lopez, which juts into the Atlantic Ocean. The nation's chief port and industrial centre, it is linked by air with Paris and major West African centres as well as with many Gabonese towns.

The Portuguese navigator Lopo Gonçalves first rounded Cape Lopez in 1473. By the end of the 19th century several commercial houses were established there, and okoumé wood (Gabonese mahogany) was exported. The discovery of oil offshore at nearby Ozouri and Pointe Clairette in 1956 stimulated Port-Gentil's commercial and industrial growth. A petroleum port was constructed, and an oil refinery and training school for the workers opened at Pointe Clairette. In addition, sawmilling and the production of plywood and veneer (the principal industry of Gabon until 1960) are also important. In addition to okoumé (by far the largest timber resource), ebony and kevazingo woods and other products from Ndjolé and Lambaréné on the Ogooué River are shipped to Port-Gentil for export. Other industries include a brewery, a construction company, a chemical plant for industrial gases, and factories for making furniture and for processing whale oil, fish, rice, and palm oil. Port-Gentil is the site of a secondary school, a modern hospital, Roman Catholic and Protestant churches, and a mosque. Pop. (1950) 9,313; (1978 est.) 103,300.

Port-Gentil, Gabon
Agence HOA-QUI

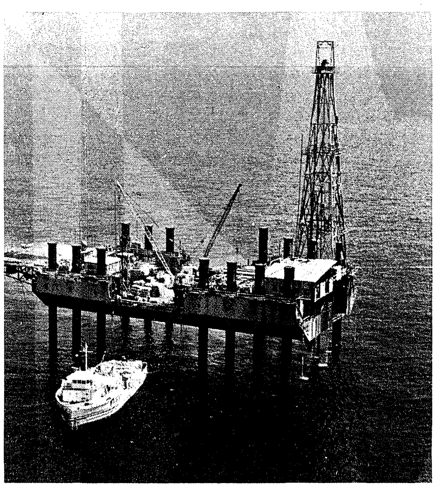
Port Gibson, city, seat (1817) of Claiborne County, southwestern Mississippi, U.S., 28 mi (45 km) south of Vicksburg, near the Mississippi River on a curve of the Bayou Pierre. It was founded in 1788 by Samuel Gibson, whose cotton plantation became a meeting place for early river travellers. The town (inc. 1842) has many antebellum buildings whose survival lends credence to General Grant's remark "it is too beautiful to burn," said as he marched his Union troops through to Vicksburg after his victory (known as the Battle of Port Gibson) on May 1, 1863, over the Confederates at nearby Magnolia Church. The local Ruins of Windsor (22 Gothic columns) are all that remain of what was considered to be the state's most extravagant Greek Revival mansion (completed 1860; burned 1890). The Grand Gulf State Military Park (8 mi northwest), occupying the townsite of the former Grand Gulf on the banks of the Mississippi, was the site of Confederate forts Cobun and Wade and the scene of several Civil War engagements.

Port Gibson's modern economy is based on cotton and lumber. The Grand Gulf Nuclear Station was under construction in the 1980s. Alcorn Agricultural and Mechanical College (founded in 1871 as Alcorn University) is a few miles southwest. Pop. (1980) 2,371.

Port Harcourt, capital of Rivers State and port town, southern Nigeria, on the Bonny River (an eastern distributary of the Niger), 41 mi (66 km) upstream from the Gulf of Guinea. Founded in 1912 on the site of the abandoned village of Obomotu in an area traditionally inhabited by the Ijaw people, it began to serve as a port (named for Lewis Harcourt, then colonial secretary) after the opening of the rail link to the Enugu coalfields in 1916. Now one of the nation's largest ports, its modern deepwater (23 ft [7 m]) facilities handle the export of palm oil and kernels and timber from the surrounding area, coal from Anambra State, tin and columbite from the Jos Plateau, peanuts (groundnuts) from the northern states, and, since 1958, petroleum from fields in the eastern Niger Delta. Port Harcourt has bulk storage facilities for both palm oil and petroleum. In the 1970s the port was enlarged with new facilities at nearby Onne.

Port Harcourt is now one of Nigeria's leading industrial centres. The Trans-Amadi Industrial Estate, 4 mi north, is a 2,500-ac (1,000-ha) site where tires, aluminum products, glass bottles, and paper are manufactured. The town manufactures cigarettes, steel structural products, corrugated tin, paints, plastics, enamelware, wood and metal furniture, cement, concrete products, and several other goods, and it has truck and bicycle assembly plants. Nigeria's first oil refinery (1965) is at Alesa-Eleme, 12 mi southeast, and pipelines carry oil and natural gas to Port Harcourt and to the port of Bonny, 25 mi south-southeast, and refined oil to Makurdi in Benue State. Port Harcourt is the site of traditional boat-building and fishing industries, and it now has fish-freezing facilities. The town also has a dairy and there is a poultry farm located nearby.

The University of Port Harcourt (1975) and Rivers State University of Technology (1971, university status 1980) serve the town, and nearby Onne is the site of the Nigerian Naval College. A number of specialized and general hospitals provide medical services. The town is the centre of the state radio and television broadcasting service, and it also has a sports stadium. It is the starting point of the eastern branch of the Nigerian Railways main line and also of the trunk highway network serving eastern Nigeria. There is an international airport located 7 mi northeast along the road and railway to Aba. Pop. (1983 est.) 296,200.



Offshore oil rig near Port Harcourt, Nigeria
Walter Weiss—Ostman Agency

Port Hawkesbury, town, Inverness county, northeastern Nova Scotia, Canada, on the Strait of Canso, at the southern end of Cape Breton Island, 36 mi (58 km) east of Antigonish. Originally called Ship Harbour, the town was renamed in 1860, possibly for Charles Jenkinson, Baron Hawkesburg (1729–1808). It was a transportation hub, serving as the island terminus for the rail and highway ferries to the mainland until 1955, when the Canso Causeway, 7,000 ft (2,100 m) long and 3 mi northwest, was completed. Port Hawkesbury is now economically dependent upon sulfite pulp milling, supplemented by concrete production, boatbuilding and repair, and mixed farming. Inc. 1889. Pop. (1981) 3,850.

Port Hedland, town and port, northwestern Western Australia, on the North West Coastal Highway. The port is built on a tidal island (8 mi by 1 mi [13 km by 1½ km]) from which three causeways lead to the mainland and one to a jetty installation for loading iron ore from Mt. Goldsworthy, 70 mi east. Founded in 1863, it was named after Peter Hedland, the first European to reach the harbour (1857). It grew as a pearling port and, beginning in 1888, as the outlet for the tin and gold of the Pilbara field (150 mi southeast), to which it was connected (1912–51) by rail. During World War II, when it was attacked from the air by the Japanese (1942), Port Hedland was extremely active, handling war supplies of tin, tantalite, columbite, and manganese mined in the Pilbara. In the late 1950s, new manganese discoveries brought a degree of renewed prosperity.

After 1964, with the development of iron ore deposits in the Hamersley Range to the southwest, Port Hedland became one of the state's most active ports. Massive dredging was undertaken to increase the port's capacity, and wharves were built capable of handling ore carriers of 150,000 tons. After exhausting the island's space, the community began expanding onto the mainland. Private railways bring iron ore to the port from Newman and Shay Gap, in the interior, and by the 1980s about 35,000,000 tons of iron ore were being exported annually through Port Hedland. Evaporation works produce salt for export. Pop. (1981) 12,948.

Port Herald (Malaŵi): *see* Nsanje.

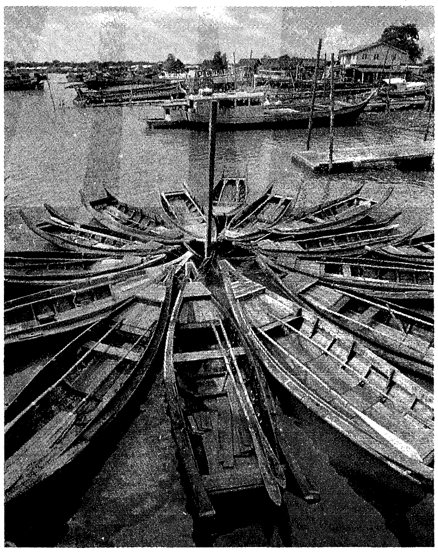
Port Hueneme, city and seaport terminal, in Ventura County, southwestern California, U.S. Founded in 1874 by Thomas R. Bard, U.S. senator (1900–05), as Hueneme (Chumash Indian: "half-way"), it did not develop until 1940 when its man-made deepwater harbour was opened as Port Hueneme. The government purchased the facility in 1942 and established the U.S. Naval Construction Battalion (Seabee) Center for Pacific operations; the Seabee Museum is in the city. After 1961 portions of the coast were commercially developed for the Oxnard Harbor District. The Channel Islands National Monument is offshore, and the Point Mugu Naval Air Station is 7 mi (11 km) southeast. Inc. 1948. Pop. (1980) 17,803.

Port Huron, city, seat (1871) of St. Clair County, eastern Michigan, U.S., at the lower end of Lake Huron, on the St. Clair River, opposite Sarnia, Ont., with which it is connected by the Blue Water International Bridge and a railroad tunnel. In 1814 Ft. Gratiot was built on the site of the earlier French Ft. St. Joseph (1686), and a village was established. Port Huron was created (1837) by a unification of four villages (Peru, Desmond, Gratiot, and Huron). Fort Gratiot Lighthouse (1829; oldest on the Great Lakes, with an 80-ft [24-m] tower and surrounded by a seawall) marks the St. Clair Straits. Originally a lumber and shipbuilding centre, the city is now a railway and St. Lawrence Seaway terminal, with one of the few natural deepwater ports on the Great Lakes. Diversified industries include the production of salt, cement, machinery, tools, and auto parts. St. Clair County Community College originated in 1923 as Port Huron Junior College. Thomas Edison spent his early years in the city and worked on the Grand Trunk Railroad, which ran from Port Huron to Detroit. Inc. village, 1849; city, 1857. Pop. (1980) 33,981.

Port Jackson, also called SYDNEY HARBOUR, inlet of the Pacific, 12 mi (19 km) long with a total area of 21 sq mi (55 sq km), one of the world's finest natural harbours and principal port of New South Wales, Australia. It has minimum and maximum depths of 30 ft (9 m) and 155 ft at low water, and its irregular foreshores extend more than 150 mi, affording extensive docking facilities. Its principal wharves are near Sydney's business district.

Its entrance (1 1/2 mi wide) is between North and South Heads, where naval and military stations are located. The Parramatta River, Cockatoo Island (shipyards), and Middle Harbour Creek form the inlet's western and northern branches. Sydney Harbour Bridge (1932), one of the world's largest steel-arch types, with a span of 1,650 ft, connects Sydney on the south shore with its northern suburbs. The Sydney Opera House (1973), whose design suggests billowing sails, is located on Bennelong Point east of the bridge. The harbour was sighted in 1770 by Capt. James Cook, who named it in honour of Sir George Jackson, an Admiralty secretary.

Port Kelang, formerly PORT SWETTENHAM, the leading port of Malaysia, in Selangor state, on the Strait of Malacca midway between the major ports of Pinang and Singapore. It is the port of Kuala Lumpur, the federal capital,



Local craft moored in the harbour at Port Kelang, Malaysia
Bernard Pierre Wolff—Photo Researchers

23 mi (37 km) east-northeast, with which it is connected by road and rail. At the mouth of the Sungai (River) Kelang, it is accessible to oceangoing vessels via the Selat Kelang Utara (North Kelang Strait). Sheltered by two long mangrove islands (Kelang and Lumut), its hinterland contains the rich rubber and tin areas of Kuala Lumpur and Seremban.

Developed by the Malayan Railway, the port was named for Sir Frank Swettenham, Selangor's British resident (representative) after 1882, and was intended to serve west central Malaya, making the railway independent of Singapore and Penang. Within two months of its opening in 1901, the port was closed because of malaria. Major development occurred between World Wars I and II, and in the 1960s and 1970s new deepwater berths were constructed with wharves suitable for handling container as well as conventional cargoes. The harbour is closely linked to subsidiary west coast ports. Industrial development includes the nearby Pandamaran Industrial Estates (more than 20 companies). Pop. (1980) 192,080.

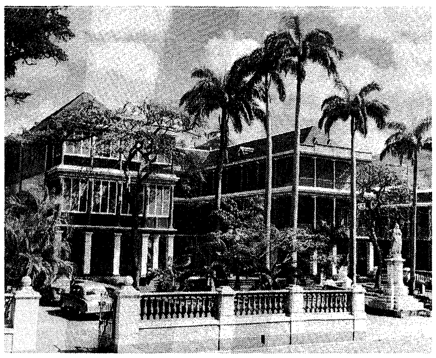
Port Láirge (Ireland): *see* Waterford.

Port Lavaca, city, seat (1886) of Calhoun County, on Lavaca Bay of the Gulf of Mexico, southern Texas, U.S., 70 mi (113 km) northeast of Corpus Christi. The site was settled by Spaniards in 1815. Some refugees from a Comanche raid (1840) on nearby Linnville sought sanctuary there and helped develop the settlement. By 1886 it was known as Port Lavaca, a name believed to have been derived from the French *les vaches* ("the cows") for the buffalo in the area. (It was probably named by the French explorer La Salle, who landed in Texas in 1685 at nearby Indianola [commemorated by a monument] and established Ft. St. Louis.) Because of hurricanes and Gulf storms, a seawall was built in 1920 to protect the city. For many years a processing and marketing centre for seafood, the community took a new economic turn in the 1960s—first, with the construction of aluminum and chemical plants across the bay at Point Comfort (with which it is linked by causeway), and second, with the completion of a deepwater ship channel through Matagorda Peninsula and Bay, a system that permits oceangoing vessels from the Gulf of Mexico to enter the harbour of Port Lavaca–Point Comfort. Tourism (fishing and duck hunting) and local oil and gas wells are added economic factors. Pop. (1980) 10,911.

Port Lincoln, city, south central South Australia, on the east shore of Eyre Peninsula, west of Adelaide. Visited in 1802 by the explorer Matthew Flinders, this fine natural harbour with deepwater anchorage was named by him after his native English county of Lincoln. The town was surveyed in 1839. Lying on Spencer Gulf, the port is the principal outlet for wheat, barley, wool, and mutton produced on the peninsula. It is also one of Australia's largest fishing centres, with catches of tuna, whiting, and salmon, and holds a popular annual Tunarama Festival. The town is a rail terminus and has fish canneries, railway workshops, a fertilizer factory, an abattoir, butter and bacon works, engineering works, and timber mills. Pop. (1981) 10,675.

Port Louis, city, capital and main port of the island of Mauritius in the western Indian Ocean. It lies between a well-sheltered, deepwater harbour, accessible to ships through a break in the coral reef, and a semicircle of mountains.

Port Louis was founded around 1736 by the French as a calling place for ships rounding the Cape of Good Hope (South Africa) to and from Asia and Europe. British occupation of the island during the Napoleonic Wars (1800–15) was a strategic factor in securing control of the Indian Ocean, but the building of the Suez Canal in 1869 resulted in the port being bypassed by shipping. Port activity increased during the closure of the Suez Canal, 1967–75, and the harbour was modernized in the late 1970s. The town is the central collecting and clearing point for all imports and exports



Government house, Port Louis, Mauritius
Camera Press—Pictorial Parade/EB Inc.

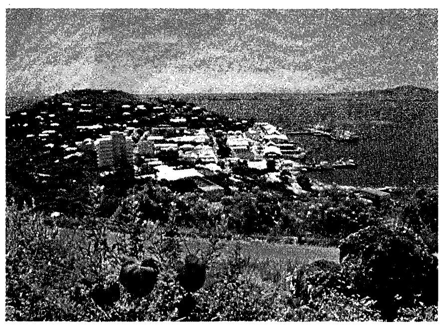
from Mauritius and its dependencies and is connected by road to the rest of the island. Sugar accounts for over 90 percent of domestic export value.

The town is dominated by an old fortress, the Citadel (1838), built on a hill almost in the centre. A small racecourse is located on the eastern side. Port Louis possesses Anglican and Roman Catholic cathedrals, a natural history museum and an art gallery, and several libraries, educational institutions, publishers, and research institutes. The University of Mauritius (1965) and the Sugar Industry Research Institute (1953) are at Réduit, just south of Port Louis. Pop. (1983 prelim.) 132,200.

Port-Lyautey (Morocco): *see* Kenitra.

Port Macquarie, town and seaside resort of northeastern New South Wales, Australia, at the coastal mouth of the Hastings River. The location of what is now the port was sighted by the explorer John Oxley and named by him after the colonial governor Lachlan Macquarie. A penal colony was established there in 1821, and, after it was abandoned in 1830, Port Macquarie received free settlers and developed an export trade in wheat, corn (maize), and cedarwood. The completion in 1840 of a road from the New England district stimulated the town's growth as a shipping point, and it was proclaimed a municipality in 1887. Just off the Pacific Highway, Port Macquarie has air and rail links to Sydney (198 mi [319 km] southwest) and serves an area of fruit and dairy farming, and lumbering. Its fishing fleet lands bream, and oysters are cultivated. Remains of the penal settlement include a church designed by the convict architect Francis H. Greenway. The Easter time carnival of the pines is an annual local event. Pop. (1981) 19,581.

Port Moresby, city and capital of Papua New Guinea, on the eastern shore of Port Moresby Harbour of the Gulf of Papua, whose built-up area is within the 93-sq-mi (240-sq-km) National Capital District. The harbour



Port Moresby and Port Moresby Harbour, Papua New Guinea
Milt and Joan Mann—Cameramann

was explored in 1873 by Capt. (later Adm.) John Moresby, who named it for his father, Adm. Sir Fairfax Moresby. The British annexed the area in 1883–84, and the town became a main Allied base and a primary Japanese objective during World War II.

After 1945, as the administrative capital of the Australian external territory of Papua and of the Australian-administered UN Trust Territory of New Guinea, it developed from a drab port into a well-planned city with modern amenities. The National Capital District, coterminous with the city of Port Moresby, was established in 1974. When Papua New Guinea attained independence in 1975, Port Moresby became its capital. Government buildings are located in both the city centre and outer suburbs. Water is supplied from Laloki River, site of a hydroelectric plant. There are radio and telegraph facilities, a university (University of Papua New Guinea, founded 1965), shipping services to Sydney and coastal ports, an international airport (Jackson's Airport), and a good network of all-weather roads to Sogeri, Kwikila, and Rouna Falls (a tourist centre). Bowana War Cemetery is nearby. The city's population includes a sizable Chinese community. Pop. (1980 prelim.) built-up area, 117,991; (1984 est.) National Capital District, 144,300.

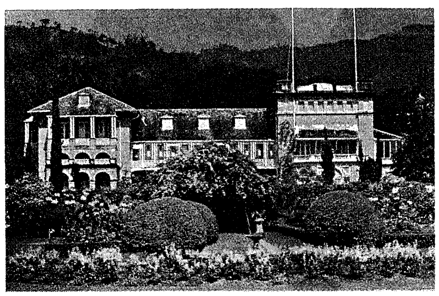
Port Natal (South Africa): *see* Durban.

Port Nicholson, also called WELLINGTON HARBOUR, inlet of Cook Strait indenting southern North Island, New Zealand. The almost circular bay measures 7 mi (11 km) by 6 mi and covers a total of 20,000 ac (8,000 ha). With at least 60 ft (18 m) of water over most of its extent, the bay is one of the world's finest natural harbours. The Hutt River enters it from the north; and to the south, a deep passageway, 1 mi wide, joins it with Cook Strait. Entered by Capt. James Cook in 1773, the inlet was named after Capt. John Nicholson, harbourmaster at Sydney (1826), Australia. The port, first used by sealers and whalers, was chosen in 1839 to be the site of the initial New Zealand Company settlement. European settlers arrived in 1840 and established Britannia at the mouth of the Hutt but later moved southwest to Lambton Harbour, around which the city of Wellington has grown.

Port Nolloth, town and Atlantic port, northwestern Cape Province, South Africa, in the hot, arid Namaqualand south of the South West Africa/Namibia border. It was founded in 1855 to serve as a harbour for the copper mines in the vicinity, especially those at Okiep, to which it was connected first by rail and later by road. The town declined in the early 1900s but revived with the discovery of alluvial diamonds in the area in 1926. The harbour was deepened and enlarged in the 1970s and diamond mines continue to operate in the area. There are also rock-lobster canning factories in the town. Pop. (1983 est.) 3,780.

Port-of-Spain, capital city and chief port of Trinidad and Tobago, in the southern Caribbean Sea. It is on the western coast of Trinidad island below the northern peninsula on the Gulf of Paria, which separates the island from the northeastern coast of Venezuela. The city itself is laid out in geometric patterns with parks and squares, and on the hills behind Port-of-Spain are residential suburbs. The business district near the Gothic Holy Trinity Cathedral and Queen's Park Savannah is at the centre of the old city on Woodward Square. From it radiate many of the most important streets, and around it are several buildings of historical and architectural interest, including the former government house, which stands in the grounds of the Royal Botanical Gardens; Whitehall, which houses the office of the prime minister of Trinidad and Tobago; the palace of the Roman Catholic archbishop of Port-of-Spain; Knowsley House, which accommodates some government ministries; All Saints Church; and the neo-Renaissance Red House, built in 1906, which houses the Supreme Court and government offices. There are Muslim mosques and Hindu and Jewish temples in the city. Among educational institutions are Queen's Royal College, Fatima College, and St. Mary's College. The college of engineering and tropical agriculture of the University of the West Indies is situated at St. Augustine, 8 mi (13 km) east of the city.

Port-of-Spain is not dependent on tourism, as are many Caribbean islands, but has a diversified industrial base, including the production of rum, beer, margarine and oils, cigarettes, plastics, and building materials. There are also sawmills, textile mills, and citrus canneries. Angostura Bitters, known around the world, is produced only in Port-of-Spain, its formula a closely guarded secret. Technical institutes train workers for various industries. Port-of-Spain is linked by good roads with other parts of Trinidad. The port has a key position on world shipping routes and is a centre of trade within the West Indies. During the 1970s the container and berthing facilities were modernized, and office high-rises were constructed. At Piarco, 16 mi east of the city, is the chief airport of the Caribbean. Pop. (1980 prelim.) 65,906.



Governor's Mansion in Port-of-Spain, Trinidad
Harrison Forman

Port Phillip Association (1836–39), organization of settlers from Van Diemen's Land (Tasmania) formed to purchase and develop the grazing land of the unsettled Port Phillip District (later the colony of Victoria) of southeastern Australia; its efforts precipitated the large-scale colonization of the area.

Originally consisting of 15 members who, in May 1835, had secured 600,000 acres (about 250,000 hectares) of grazing land from the Port Phillip Aborigines in exchange for an assortment of tools, clothes, and trinkets, the association was formally initiated in June 1835 as the Geelong and Dutigalla Association—after the Aboriginal names of its "purchased" tracts; it was known as the Port Phillip Association after April 1836. Each association member undertook to provide a certain number of sheep and herders for the evenly divided acres.

The organization's enterprise was successful but from the start illegal. It violated the British Colonial Office's 1829 Nineteen Counties order, which had limited the area open to settlement. Moreover, New South Wales governor Richard Bourke (1831–37), prompted by the association's action, voided all European-Aboriginal land deals in August 1835. Although the members of the association were in effect squatters, the government provided the association with a large indemnity for its trouble. By 1839 only three members remained; the name of the association was changed to the Derwent Company. This successor to the original enterprise dissolved in 1842.

While the Port Phillip Association itself was ill fated, it led to large-scale and rapid colonization of the area, both from Van Diemen's Land and from New South Wales.

Port Phillip Bay, inlet of Bass Strait on the south central coast of Victoria, Australia, extending about 30 mi (50 km) north–south and 25 mi east–west. Its entrance, known as "the Rip" (1¾ mi wide), between Points Lonsdale to the west and Nepean to the east, leads into a navigation channel 3,600 ft (1,100 m) wide and 45 ft deep, with access northward to Hobson Bay (Port Melbourne) and westward to Corio Bay (the harbour of Geelong). Rivers entering the bay include the Little, Werribee, and Yarra. It was visited in 1802 by Lieut. John Murray of the Royal Navy, who named it Port King to honour Capt. P.G. King, then governor; it was later renamed for Capt. Arthur Phillip, first governor of New South Wales.

Port Phillip District (1802–51), the original name of the area of the Australian colony and present commonwealth state of Victoria. It was discovered in 1802 by Lieut. John Murray of the Royal Navy and soon afterward named for Gov. Arthur Phillip of New South Wales, of which the area became part. It remained unsettled until 1835, when a group of Tasmanian sheepmen (the Port Phillip Association) defied a government ban on settlement and moved large flocks to the district. This action unleashed a flood of settlers from Tasmania and New South Wales and the Sydney authorities recognized the development by sending civil officials to the district in 1836. The district quickly grew around the city of Melbourne, and in 1851 it became the self-governing colony of Victoria.

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Port Pirie, city, second most important seaport of South Australia (after Port Adelaide), on the eastern shore and near the head of Spencer Gulf. Founded in 1848, it is named after the "John Pirie," a vessel which had brought settlers there three years before. Incorporated as a municipality in 1876, it developed as the natural port for the export of lead ore from Broken Hill, New South Wales (220 mi [354 km] northeast). Lead smelting began at Port Pirie in 1889. The growth of this industry and the subsequent opening of zinc smelters have been largely responsible for the city's growth. Port Pirie has a plant to process rare-earth oxides from beach sands (once used to extract uranium from ores of Radium Hill, northeast). In addition, silver and gold are refined, copper-lead alloys and sulfuric acid are produced, and wheat is stored for export. Port Pirie is connected by rail to Adelaide (125 mi southeast), Kalgoorlie, and Broken Hill. Inc. 1953. Pop. (1981) 14,695.

Port Rois (Northern Ireland): *see* Portrush.

Port Royal, historic harbour town on the southern coast of Jamaica, once the busiest trading centre of the British West Indies and infamous for general debauchery. The town was founded on a natural harbour at the end of a 10-mi (16-km) sand spit between the modern Kingston Harbour and the Caribbean Sea. In the late 17th century it came to serve as the base of operations for buccaneers and privateers who raided the Spanish islands and ships. When the notorious Capt. Henry Morgan established his headquarters there, the plundered gold poured in, followed by merchants and artisans who eagerly catered to all the appetites of the pirates. There were more than 8,000 inhabitants living in fine brick houses of two and three stories in this "richest and wickedest city in the New World." Ultimately, however, the government in England and the landowners in Jamaica saw prospects of greater profit in a regularized trade with Spain and a stable economy based on agriculture, and they appointed Morgan the governor of Jamaica, in which capacity he prosecuted his former comrades until his death.

An earthquake devastated the city in 1692, sinking much of it beneath the sea. The few survivors rebuilt on the site of the present Kingston, across the bay. In 1735 a naval base was established once more at Port Royal for the British West Indies Squadron in its struggle against the French.

Today Port Royal is a quiet little town, with only a few relics of its romantic past: Fort Charles at the entrance to the harbour once under the command of Horatio Nelson, St. Peter's Church, and a museum displaying some treasures resurrected from the sea. Pop. (1982 prelim.) 1,469.

Port Royal (Nova Scotia): *see* Annapolis Royal.

Port Royal, island and town of Beaufort County, southern South Carolina, U.S., at the head of Port Royal Sound on the Atlantic Intracoastal Waterway. One of the Sea Islands, its principal town is Beaufort. The town of Port Royal is on the southern tip of the island, which is about 13 mi (21 km) long and 7 mi wide.

The port was named Santa Eleana by Spanish explorers in the early 16th century. In 1562 the French Huguenot Jean Ribaut renamed it Port Royal and left 30 settlers on Parris Island, 3 mi from the present town of Port Royal. After two years the settlers killed their leader and returned to Europe. The Spanish occupied the area more or less continuously from 1566 to 1650, maintaining garrisons and Indian missions. English claims to Carolina grew with the settlement of Charleston in 1670, and gradually planters moved into the area; in 1710 the present town of Beaufort was established. In January 1779, during the American Revolution, the British occupied the area but were soon dislodged. Early in the Civil War (Nov. 6–7, 1861) 56 Union vessels and 12,000 men under Gen. Thomas W. Sherman reduced the Confederate fortifications and used the port as a Union coaling and repair station for the remainder of the war.

The economy now depends mainly on fishing, lumbering, and truck farming. The U.S. Marine Corps installation at nearby Parris Island and tourism are additional economic assets. Pop. (1980) town, 2,977.

Port-Royal, in full PORT-ROYAL DES CHAMPS, celebrated abbey of Cistercian nuns that was the centre of Jansenism (*q.v.*) and of literary activity in 17th-century France. It was founded about 1204 as a Benedictine house by Mathilde de Garlande on a low, marshy site in the valley of Chevreuse, south of Versailles. Its church was built in 1230.

In 1609 the young abbess Jacqueline-Marie-Angélique Arnauld began a much-needed reform. In 1625–26, because of the unhealthy atmosphere of the site, Mère Angélique established her community in Paris, where new buildings were erected, including a Baroque church. In 1638 the deserted building was occupied by the Solitaires (hermits), pious laymen and secular priests who lived without vows or a definite rule under the spiritual guidance of Jean Duvergier de Hauranne (*q.v.*), abbot of Saint-Cyran and a friend of Cornelius Jansen. Among the Solitaires were several members of the Arnauld family (*q.v.*). The Solitaires began to teach a few boys and established the Petites Écoles, which provided a type of education that differed in important ways from that of the Jesuits. In 1648 a group of nuns returned to occupy the buildings, and the Solitaires moved to Les Granges on a neighbouring hillside. The Little Schools survived until 1660.

In 1665 most of the nuns of Port-Royal de Paris, having refused to sign the formulary condemning Jansen, were sent to Port-Royal des Champs, where they were confined and denied the sacraments. The Solitaires dispersed and went into exile or hiding. In 1669, however, a compromise was reached with Clement IX, and a 10-year period of calm, called the Peace of the Church, prevailed. The houses of Paris and Les Champs were separated, the latter enjoying the protection of the Duchesse de Longueville, a cousin of Louis XIV. After her death in 1679, persecution was renewed, and the community was forbidden to receive novices. In 1705 the bull *Vineam Domini* of Clement XI renewed measures against the Jansenists, and the remaining nuns refused to submit. The community was dispersed on Oct. 29, 1709, and the nuns were exiled to various other convents. Between 1710 and 1712 the buildings were destroyed, and corpses in the cemetery were exhumed and thrown into a common grave at Saint-Lambert nearby.

The land was purchased in 1824 by a lawyer named Louis Silvy and transferred after his death to a private society that uncovered the ruins of the church and built a small museum. Port-Royal de Paris became a prison during the Revolution, and in the 19th century the Hôpital de la Maternité. The buildings are in a good state of preservation, and both the chapter house and the choir have been restored.

Port Said, Arabic BŪR SAʿĪD, port city, northeastern Egypt, at the northern end of the Suez Canal. Situated largely on man-made land, the city was founded in 1859 on a low sandy strip separating the Mediterranean from Buḥayrat (lake) al-Manzilah. Mud and sand dredged from the harbour and huge, artificial stones capable of resisting saltwater action were added to the strip; its breakwaters were completed in 1868, a year before the canal was completed. The city was named after Khedive (viceroy) Muḥammad Saʿīd (ruled 1854–63) who selected the site of the town. Consisting initially of a grid-pattern European quarter and a native Egyptian sector, the town early established its cosmopolitan character. The outer harbour, 570 ac (231 ha) in area, was carefully designed so that its two protecting moles or breakwaters prevent coastal currents from silting up the canal. The main channel is 2½ mi (4 km) long, flanked by open basins. To house workmen of the several huge dry docks built between 1903 and 1909, a new quarter, now named Būr Fuʾād (Port Fuad), for Fuʾād I, sultan of Egypt (1917–22; king, 1922–36), was built opposite the city proper on the eastern shore between the canal and the eastern extension of Buḥayrat al-Manzilah.

By the late 19th century Port Said was the world's largest coal-bunkering station, catering almost exclusively to the Suez Canal traffic. After the standard-gauge railway from Cairo via Ismailia was completed (1904), it became Egypt's chief port after Alexandria; in addition to canal traffic, it handled cotton and rice exports from the eastern delta. A frozen seafood plant for the export trade has been added to the port's fishing facilities. The city still retains the main workshops of the canal administration. During the Sinai War of 1956, which followed Egyptian nationalization of the canal, Port Said was severely damaged by the air attacks (October 31) and landings (November 5) of French and British forces. The colossal bronze statue of Ferdinand de Lesseps, builder of the canal, which stood at the base of the western mole, was destroyed in the Anglo-French attack. Britain and France were compelled to withdraw under strong United Nations pressure, and the canal was reopened; the damages of the brief campaign were repaired, and the city's trade resumed. In the Six-Day War of June 1967, Israeli forces occupied the eastern bank of the canal, which then remained closed until 1975.

With the promulgation of President Sadat's "Open Door" policy of 1975, the city was restored, new housing was built for the returning refugees of the wars with Israel, and a tax-free industrial zone was opened. The city's industries produce textiles, clothing, glass, china, automobile batteries and tires, watches, and cosmetics. It has two gas-fired electrical generating plants, as well as computer, construction, and publishing industries. There are also port and shipyard facilities, and in 1980 a by-pass north of the city on the Suez Canal opened. The city is served by a railroad linking it to the other canal cities and by the main railway system via Ismailia. Pop. (1983 est.) 364,000.

Port Salut cheese, also called TRAPPIST CHEESE, semisoft cow's-milk cheese first made by Trappist monks on the west coast of France in the early 1800s; the name later became the trademark for Saint-Paulin, a generic cheese type similar to the original Port Salut, with a mild, savoury flavour and a smooth, semisoft texture.

Port Salut is produced in thick disks of about nine inches (23 centimetres) in diameter, weighing about 5 pounds (2.3 kilograms). It keeps well for several weeks or longer if securely wrapped. Port Salut is widely imitated; U.S. versions tend to be milder, and those from Denmark are generally stronger than the French. Oka cheese, first made at a Trappist monastery at the village of Oka in Quebec, is a popular Canadian version.

Port Stanley (Falkland Islands): *see* Stanley.

Port Stephens, lagoon and inlet of the Tasman Sea (Pacific Ocean), indenting east central New South Wales, Australia, 20 mi (32 km) northeast of Newcastle. Extending 15 mi inland and averaging 2 mi in width, it has an area of 23 sq mi (60 sq km). Partly closed off from the sea by a series of sandbars crowned by dunes, its entrance is via a ½-mi-wide channel between two sand hills, North Head and South Head (717 ft [219 m] and 529 ft), to an outer harbour (60 ft deep). Further in lies Soldier's Point, so named because troops were once stationed there to intercept escaping convicts; the inner harbour (30 ft deep) is beyond the point. The bay, sighted in 1770 by Capt. James Cook, who named it for Sir Philip Stephens, then secretary of the Admiralty, receives the Karuah, Myall, and Ward rivers. Economic activities include tourism, oyster and tomato farming, and game fishing. Nelson Bay is the main town.

Port Sudan, Arabic BŪR SŪDĀN, city, principal seaport of The Sudan and capital of al-Baḥr al-Aḥmar *mudīrīyah* (province) on the Red Sea coast, 295 mi (475 km) by rail northeast of the Nile Valley at ʿAṭbarah. Built between 1905 and 1909 to replace Sawākin (Suakin)—the historic, coral-choked Arab port—Port Sudan has an oil refinery, an international airport, and modern docking facilities that handle the bulk of the country's external trade. The harbour is in the mouth of a gulf continuing seaward through a coral-free channel 60–85 feet (18–26 m) deep. Imports include machinery, vehicles, fuel oil, and building materials. Cotton, gum arabic, oilseeds, hides and skins, and senna are the chief exports. An oil pipeline about 528 mi in length, between the port and Khartoum city, was completed in 1977. Port Sudan has a near-desert climate, necessitating the acquisition of freshwater from Khawr (wadi) Arbaʿāt in the Red Sea Hills and from salt-evaporating pans. The population, mainly Arab or Nubian Sudanese, includes the indigenous Beja, West Africans, and small minorities of Asians and Europeans. Pop. (1983 prelim.) 230,000.

Port Swettenham (Malaysia): *see* Port Kelang.

Port Talbot, town and port, seat of Afan district, West Glamorgan county, Wales, on the Bristol Channel. Early growth, as an outlet for the Afan Valley collieries after a dock was built in 1837, was intensified when rail links were established with neighbouring mining areas (including the Rhondda), but the town's dominant concern in the 20th century has been steelmaking. The coal trade declined drastically after 1918 and after 1953 was diverted from Port Talbot completely. Pre-1939 steelworks were supplemented in 1947 by the building of the gigantic Margam Abbey Works and hot strip mill as part of the modernization of the South Wales steel and tinplate industry. A deepwater harbour for ore carriers up to 100,000 tons was opened in 1970. The town has also become a popular seaside resort. Pop. (1981 prelim.) 47,313.

Port-Vila (Vanuatu): *see* Vila.

Port Washington, unincorporated community in the town (township) of North Hempstead, Nassau County, New York, U.S., on the north shore of Long Island overlooking Manhasset Bay, a summer yachting centre. Savoia Marchetti seaplanes were constructed there after 1929 and Port Washington became an early seaplane base from which the Pan American Dixie Clipper left for France on June 28, 1939, inaugurating one of the world's first transatlantic passenger airline services. During World War II the Grumman Aircraft Engineering Corporation established an important aircraft industry there. Port Washington North is an adjacent residential village, incorporated in 1932. Pop. (1980) 14,521.

Porta, Giacomo della (b. *c.* 1537, Rome—d. 1602, Rome), Italian architect whose work represents the development in style from late Mannerism to early Baroque. He was the chief Roman architect during the latter third of the 16th century and contributed to most of the major architectural projects undertaken in Rome during that period.

Della Porta was a follower of Michelangelo and continued two of his greatest architectural projects, the Piazza del Campidoglio and St. Peter's in the Vatican at Rome. Working with Domenico Fontana, the architect to Pope Sixtus V, Della Porta gave a higher, more pointed profile than Michelangelo had intended to the dome of St. Peter's; it became the prototype of the Baroque dome. He also added the facade to Giacomo da Vignola's Gesù, mother church of the Jesuits, which was widely copied by Jesuit missionaries and became the model of many Baroque church facades. Della Porta made Il Gesù's facade dramatic and lively by gradually increasing the number of architectural elements toward the centre of his design, thus creating a sense of tension released by entrance into the building's seemingly vast interior. He designed a number of palaces, the most famous being the Villa Aldobrandini (1598–1604; Frascati), his last work, notable for its huge broken pediment and elegant fenestration.

Porta, Giambattista della, also called GIOVANNI BATTISTA DELLA PORTA (b. 1535?—d. Feb. 4, 1615, Naples), natural philosopher who was the first scientist to recognize the heating effects of light rays; he was also the author of some of the best Italian comedies of his age. He founded the Accademia dei Segreti, which was later suppressed by the Inquisition, and in 1610 he took part in the reconstitution of the Accademia dei Lincei. He travelled widely in Italy, France, and Spain.

His major work is *Magia naturalis* (4 books, 1558; "Natural Magic"; 2nd ed., in 20 books, 1589), in which he treats magic as a technique to be acquired in order to control natural phenomena. The work also discusses such questions as demonology, magnetism, and the camera obscura (prototype of the camera), which made him one of the pioneers in the use of the lens. His other works include: *De furtivis literarum notis: Vulgo de ziferis* (1563); *Arte del ricordare* (1566); *Villae* (1583–92), an agricultural encyclopaedia; *De humana physiognomonia* (1586); *De refractione, optices parte* (1593); *Pneumaticorum* (1601), which was augmented in the Italian translation (*De' spiritali,* 1606) with a description of a steam engine anticipating that of Thomas Savery of 1698; *Caelestis physiognomoniae* (1601), a confutation of judicial astrology; and *De distillatione* (1609), containing various chemical discoveries.

Portage, city, seat (1846) of Columbia County, south central Wisconsin, U.S., on the Wisconsin River, 33 mi (53 km) north of Madison. The 1½-mi overland portage there between the Wisconsin and Fox rivers was first crossed by Louis Jolliet and Jacques Marquette in 1673; the route, vital to linking the Great Lakes with the Mississippi River, is now followed by the Portage Canal. Ft. Winnebago was built (1828) at the site when conflict with the Winnebago Indians threatened; its Surgeon's Quarters have been restored as a museum, and the nearby Garrison School (1850) is preserved with original desks and equipment. The Old Indian Agency House (1832) of John Kinzie, an early pioneer, has been restored.

Modern Portage (inc. 1854) is the business centre of a diversified farming area and has acquired some manufacturing (mobile homes, plastics, and hosiery). The author Zona Gale (1874–1938) was born in Portage, which was the setting for several of her earlier short-story collections; her autobiographical narrative, begun as *When I Was a Little Girl* (1913), was completed under the title of *Portage, Wisconsin* (1928). Pop. (1980) 7,896.

Portage la Prairie, city, southern Manitoba, Canada, near the Assiniboine River, on the Trans-Canada Highway, 52 mi (84 km) west of Winnipeg. The name was given by early French fur traders who portaged their goods across the prairie between the river and Lake Manitoba, a short distance to the north. Fort-La Reine was built (1738) near the site by the French trader and explorer La Vérendrye. Settlement began in about 1851, and by 1870 Portage la Prairie was a village of more than 100 people. Now an agricultural market and transportation centre, it processes grain, soups, and dairy foods and manufactures clothing, concrete, electric cables, and glassware. A game preserve is located within its boundaries, and a waterfowl research establishment and a Royal Canadian Air Force station are nearby. Fort La Reine Pioneer Museum and Village is just outside the city. Inc. town, 1880; city, 1907. Pop. (1981) 13,086.

Portal (of Hungerford), Charles Frederick Algernon Portal, 1st Viscount (b. May 21, 1893, Hungerford, Berkshire, Eng.—d. April 23, 1971, Chichester, Sussex), British air marshal and chief of the British Air Staff during World War II.

Educated at Winchester and Christ Church, Oxford, he joined the Royal Engineers as a dispatch rider during World War I, and in 1915 he was commissioned in the Royal Flying Corps. He distinguished himself as a fighter pilot by shooting down several enemy aircraft; for this he was awarded the Distinguished Service Order and Bar and the Military Cross. Between the wars his posts in the Royal Air Force (RAF) included those of commander of the British forces, Aden; instructor at the Imperial Defence College; and director of organization and air member for personnel at the Air Ministry.

In 1940 for a short time he held the appointment of air officer commander-in-chief, Bomber Command. Soon after he became chief of the air staff, the highest post in the RAF, which he held until 1945. In addition to his duties at the Air Ministry, directing the policy and operations of the RAF, he took a prominent part in all the important Allied conferences as a member of the Chiefs of Staffs Committee. From 1946 to 1951 Lord Portal was responsible for administering the atomic research facilities at Harwell. He was created a baron in 1945 and a viscount in 1946.

portal vein, large vein through which oxygen-depleted blood from the stomach, the intestines, the spleen, the gallbladder, and the pancreas flows to the liver. The principal tributaries to the portal vein are the lienal vein, with blood from the stomach, the greater omentum—a curtain of membrane and fat that hangs down over the intestines—the pancreas, the large intestine, and the spleen; the superior mesenteric vein, with blood from the small intestine and part of the large intestine; the pyloric veins, with blood from the stomach; and the cystic veins, with blood from the gallbladder. In the liver the blood from the portal vein flows through a network of microscopic vessels called sinusoids in which the blood is relieved of worn-out red cells, bacteria, and other debris and in which nutrients are added to the blood or removed from it for storage. The blood leaves the liver by way of the hepatic veins.

Portalegre, town, capital, and *concelho* (municipality), Portalegre district, Portugal, on the western slopes of the Serra de São Mamede, near the Spanish border northeast of Lisbon. It originated as the Roman Amoea or Ammaia. The Medóbriga (Aramenha) ruins, 12 mi (19 km) north, contain Celtic and Roman artifacts. The town is noted for its 17th- and 18th-century architecture characterized by glazed blue tile (azulejo) mosaics and murals; its cathedral (1556) has a huge 18th-century facade. The production of woollen tapestries and of silks constituted important local industries in the 16th and 17th centuries. Contemporary economic pursuits include the weaving of woollen goods, woodworking, and cork processing.

The district (2,342 sq mi [6,065 sq km]) produces olives, cork, cereals, and Brazil nuts and supports cattle and pigs. Pop. (1981) town, 15,876; *concelho* 27,701; district, 142,141.

Portales, city, seat (1903) of Roosevelt County, eastern New Mexico, U.S., in the High Plains (4,022 ft [1,226 m] above sea level), near the Texas border. It was founded by Josh Morrison in 1898 and named for nearby Portales Springs, a watering place on the Fort Sumner Trail and so called because the waters flow from a series of cave openings that resemble "porches" of adobe houses. Irrigated farming, food processing, and ranching are the economic mainstays. Portales is the site of Eastern New Mexico University, founded 1934. Oasis State Park is 7 mi (11 km) northwest. The nearby Blackwater Draw Museum exhibits 12,000-year-old artifacts from adjacent archaeological sites. Inc. 1930. Pop. (1980) 9,940.

Portales, Diego (José Víctor) (b. June 26, 1793, Santiago, Chile—d. June 6, 1837, Valparaíso), Chilean politician and for seven years virtual dictator who was instrumental in establishing political order and instituting economic progress in Chile. Hated by the people during his lifetime, he became a symbol of Chilean unity after his death.

Portales, lithograph by A. Legrand
By courtesy of the Library of Congress, Washington, D.C.

The son of a wealthy family, Portales amassed his own fortune early in life. In 1824 he was awarded a monopoly on tobacco, tea, and liquors that proved immensely profitable but aroused the anger of the Chilean workers. Upon termination of the monopoly after a few years, Portales founded two newspapers to expound his doctrines of extreme conservatism. When the Conservative Party entered office in 1830, he was as chief minister the real power in the land. Disdainful of democracy and political freedoms, he imprisoned his opponents, silenced the opposition press, and subdued the army. Portales ruled through the constitution of 1833, a document that created a centralized state dominated by the church and the landed oligarchy.

Disturbed by increasing trade competition from Lima and the threat of a combined Peru–Bolivia empire, Portales initiated war with the Peru–Bolivia confederation in 1836. This trade-inspired war was ultimately won by Chile, but Portales was assassinated while reviewing his troops. Nonetheless, he had set Chile on a path of political stability and economic progress that was to last for many decades.

Portalis, Jean-Étienne-Marie (b. April 1, 1746, Le Beausset, Fr.—d. Aug. 25, 1807, Paris), French lawyer and politician, one of the chief draftsmen of the Code Civil des Français, or Code Napoléon, which is the basis of the French legal system.

A lawyer and provincial administrator at

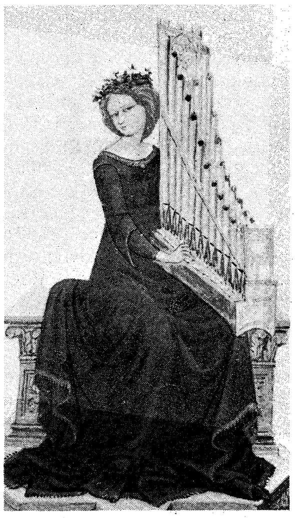
Portalis, engraving by Ambroise Tardieu

H. Roger-Viollet

Aix-en-Provence, Portalis went to Paris in 1793, after the First Republic had been proclaimed following the Revolution. In 1795 he was elected to the legislative body called the Conseil des Anciens, and later he became its president. In 1800 Napoleon Bonaparte, then first consul, made Portalis a councillor of state and a member of the four-man commission charged with drawing up the Code Civil, which was promulgated March 21, 1804. Considered the most hardworking of the four, Portalis wrote several of the most important articles of the code, notably those on marriage and succession to property. His effort was to permeate the code with the ideals of Roman law.

In 1801 Portalis was placed in charge of *cultes*, or state-controlled public worship. In that office, he drew up much of the concordat of July 15, 1801, between Napoleon I and Pope Pius VII.

portative organ, small musical instrument played from the 12th through the 16th century, popular for secular music. It had one rank of flue pipes (producing a flutelike sound), sometimes arranged in rows to save space, and was slung from the player's neck by a strap. The keys and pipes lay at right angles to the player, who used two fingers of his right hand to play melodies. With his left hand he worked a bellows at the back of the instrument. Except for occasional drones (sustained notes played against a melody), the



Allegorical figure of Music playing a portative organ, from a manuscript, 14th century; in the Biblioteca Nazionale, Naples (MS. V.A. 14)

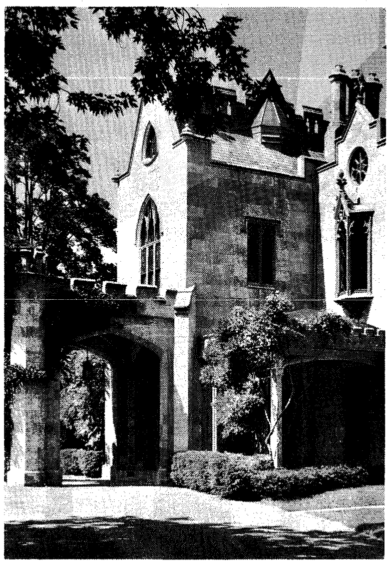
By courtesy of the Biblioteca Nazionale, Naples; photograph, Antonio Beuf

portative organ played music consisting only of a melodic line. Its compass was from two to three octaves.

Porte (Ottoman Empire): *see* Sublime Porte.

porte-cochère (French: "doorway for a coach"), in Western architecture, either of two elements found in large public and private buildings, popular in the late Renaissance and Renaissance revival periods of architectural design. A *porte-cochère*, as the French name indicates, was originally an entrance or gateway to a building large enough to permit a coach to be driven through it into the interior courtyard beyond. These gateways are common features of homes and palaces built in the grand and elegant style of kings Louis XIV and XV of France.

Later, the term was applied to a porch roof built over a driveway at the entrance to a building (usually known as the carriage entrance). This roof had to be both high enough and wide to accommodate a carriage or other wheeled vehicle, since its purpose was to provide shelter for those getting in or out of the vehicle.



Porte-cochère of Lyndhurst, Tarrytown, N.Y., designed by Alexander Jackson Davis, 1838–65

Wayne Andrews

Porteous Riots (1736), celebrated riots that erupted in Edinburgh over the execution of a smuggler. The incident had Jacobite overtones and was used by Sir Walter Scott in his novel *The Heart of Midlothian.*

On April 14, 1736, a smuggler, Andrew Wilson, who had won popular sympathy in Edinburgh by helping a friend to escape from Tolbooth Prison, was hanged. A small riot broke out at the execution, and the city guard fired into the crowd, killing a few and wounding a considerable number of persons. John Porteous, captain of the city guard, who was accused of both shooting and giving the order to fire, was brought to trial in July and sentenced to death. After he had sent a petition for pardon to Queen Caroline, then acting as regent in the absence of George II, his execution was postponed. The granting of a reprieve was hotly resented by the people of Edinburgh, and on the night of September 7 an armed body of men in disguise broke into the prison, seized Porteous, and hanged him on a signpost in the street. It was said that persons of high position, some with Jacobite sympathies, were involved; but, although the government offered rewards, no one was ever convicted of participation in the murder. The sympathies of the people and even, it is said, of the clergy, throughout Scotland, were so unmistakably on the side of the rioters that the original stringency of the bill introduced into Parliament for the punishment of the city of Edinburgh had to be reduced to the levying of a fine of £2,000, to be paid to Porteous' widow, and the disqualification of the provost from holding any public office.

Porter, Cole (b. June 9, 1892, Peru, Ind., U.S.—d. Oct. 15, 1964, Santa Monica, Calif.), U.S. composer and lyricist who brought a worldly *élan* to the American musical comedy stage and who embodied in his life the sophistication of his songs.

Cole Porter, 1938

Culver Pictures

Porter was the grandson of a millionaire speculator, and the affluent circumstances of his life probably contributed to the poise and urbanity of his musical style. He began violin study at the age of six and piano at eight; he composed an operetta in the style of Gilbert and Sullivan at 10 and saw his first composition, a waltz, published a year later. As a student at Yale University, he composed two football songs, "Bull Dog" and "Bingo Eli Yale," and wrote college shows; later he studied at Harvard Law School (1914) and Harvard Graduate School of Arts and Sciences in music (1915–16). He made his Broadway debut with the musical comedy *See America First* (1916).

He then went to North Africa, where he was awarded the Croix de Guerre for entertaining

French desert troops. After military service in 1917–18, he was an itinerant playboy in Europe, intermingling his social life with music lessons in Paris from the composer Vincent d'Indy. He married in 1931.

With *Fifty Million Frenchmen* (1929) he became a dominant Broadway writer, his shows including *The Gay Divorcee* (1932); *Anything Goes* (1934); *Dubarry Was a Lady* (1939); *Panama Hattie* (1940); *Kiss Me Kate* (1948, based on Shakespeare's *Taming of the Shrew*); *Can-Can* (1953); and *Silk Stockings* (1955). Concurrently working in motion pictures, he wrote such glittering songs and lyrics as "I Get a Kick Out of You" (1934), "Begin the Beguine" and "I've Got You Under My Skin" (1936), "In the Still of the Night" (1937), and "I Concentrate on You" (1940). He was especially adept at the catalog song, his best efforts being "Let's Do It" (1928) and "You're the Top" (1934).

Porter was one of the wittiest of all lyricists, with a subtlety of expression and a mastery of the interior rhyme. Together with Ira Gershwin and Lorenz Hart, he appropriated the tradition of W. S. Gilbert for the American theatre. His work continues to stand as the epitome of sophisticated, civilized detachment in the popular song form. His large output might have been even more vast had not a riding accident in 1937 necessitated 30 operations and the eventual amputation of a leg.

Porter was the subject of a movie biography, *Night and Day* (1946); and a revue based on his songs, *The Decline and Fall of the Entire World as Seen Through the Eyes of Cole Porter Revisited,* opened in New York City in 1965 for a long off-Broadway run.

Porter, David (b. Feb. 1, 1780, Boston—d. March 3, 1843, Pera, Tur.), U.S. naval officer who commanded the frigate "Essex" on its two-year expedition against British shipping during the War of 1812.

Young Porter early accompanied his father—who had been a Revolutionary War naval commander—on sea voyages. He became a midshipman in 1798, was promoted to lieutenant in 1799, and took part in the unde-

David Porter, portrait by Charles Willson Peale, 1818–19

By courtesy of the Independence National Historical Park Collection, Philadelphia

clared war against France (1799) and the war with Tripoli (1801–05).

Promoted to captain in 1812, Porter won a formidable reputation as commander of the "Essex." His was the first U.S. warship to become active in Pacific waters. He captured a large number of British whaling vessels and took possession of Nuku Hiva, the largest of the Marquesas Islands (November 1813). Finally (February 1814), he was blockaded by British frigates in the harbour of Valparaíso, Chile, and was defeated at the end of March.

After serving on the new Board of Naval Commissioners (1815–23), Porter commanded a squadron sent to the West Indies to suppress piracy. When one of his officers landed in Puerto Rico and was imprisoned by the Spanish authorities, Porter sent in an armed force and demanded an apology. For this unauthorized action, he was recalled (December 1824), court-martialled, and suspended from duty. Resigning his commission, he accepted appointment as commander in chief of the Mexican Navy (1826–29), then fighting Spain.

Upon returning to the United States, he was sent to Algiers as U.S. consul general (1830), and then to Constantinople (1831), where in 1841 he became minister. He was the father of U.S. naval officer David Dixon Porter.

Porter, David Dixon (b. June 8, 1813, Chester, Pa., U.S.—d. Feb. 13, 1891, Washington, D.C.), U.S. naval officer who held important Union commands in the U.S. Civil War (1861–65).

The son of Commo. David Porter, David Dixon Porter served in the Mexican War (1846–48). Promoted to commander early in the Civil War, he participated in Union ex-

David Dixon Porter, photograph; in the Mathew Brady collection

By courtesy of the Library of Congress, Washington, D.C.

peditions against New Orleans and Vicksburg (April–June 1862) under his foster brother, Comdr. David Farragut. In January 1863 Porter commanded gun vessels during the capture of the Arkansas Post.

In the spring of 1863 Porter succeeded in running his fleet past the Confederate fortress at Vicksburg, halfway between Memphis and New Orleans on the Mississippi River. He next overcame the Confederate forts at Grand Gulf, enabling the North to control the river and arrange a meeting with the troops of the invading Union army under Gen. Ulysses S. Grant at Bruinsburg. Grant's troops then took the city, and the joint army-navy effort effectively cut the Confederacy in two. Porter received the thanks of Congress for "opening the Mississippi" and was promoted to rear admiral. He next cooperated in the Red River Campaign (March–May 1864), in which his gunboats, held above Alexandria, La., by shallow water and rapids, narrowly escaped isolation. In October he assumed command of the North Atlantic blockading squadron and was eventually responsible for the fall of Ft. Fisher, N.C. (January 1865), for which he again received the thanks of Congress.

From 1865 to 1869 Porter was superintendent of the U.S. Naval Academy at Annapolis, Md. He also served in the Navy Department (1869) and was promoted to admiral in 1870. He wrote several naval books and two novels.

Porter, Edwin S(tratton) (b. 1869/70, Scotland—d. April 30, 1941, New York City), pioneer U.S. film director who introduced the technique of dramatic editing (piecing together scenes shot at different times and places).

Porter emigrated to the United States as a young sailor and worked as a mechanic before joining the laboratory of Thomas Alva Edison as a cameraman and general handyman in 1895/96. Working there until 1911, Porter revolutionized filmmaking. He directed the first U.S. documentary film, *The Life of an American Fireman,* in 1903. Into stock footage of actual fire scenes, he interpolated scenes of actors playing a fire-chief hero and a trapped mother and child. To heighten suspense, he cut back and forth from the terrified mother to the coming rescuers.

The Great Train Robbery (1903) was the most successful and influential of the early story films and established Porter as an outstanding figure in motion pictures. The eight-minute film depicts a robbery, the formation of a posse, and its pursuit and elimination of the gunmen. It standardized the length of the U.S. film, set the pattern for the western, used the first close-up—a shot of a gunman shooting—and gave the impetus for other directors to explore the function and power of film editing and camera placement. The work of the French director Georges Méliès influenced *Dream of a Rarebit Fiend* (1906). In 1907 Porter gave D.W. Griffith his first acting role in *Rescued from an Eagle's Nest.* Porter left the Edison Company in 1911 to found his own company, Rex Films, but the next year he joined Adolph Zukor's Famous Players Film Company. After directing his last film, *The Eternal City* (1915), he retired from moviemaking.

Porter, Fitz-John (b. Aug. 31, 1822, Portsmouth, N.H., U.S.—d. May 21, 1901, Morristown, N.J.), Union general during the American Civil War who was court-martialled and cashiered—but later vindicated—for disobeying orders at the Second Battle of Bull Run.

Porter was educated at Phillips Exeter Academy and at West Point, graduating from the latter in 1845. He fought in the Mexican War (1846–48) and from 1849 to 1855 was an instructor at West Point. After the outbreak of the Civil War, Porter was made a brigadier general of volunteers (May 1861). He distinguished himself during Gen. George B. McClellan's 1862 Peninsular Campaign, but on August 29 of that year he failed to comply with Gen. John Pope's orders to attack the right flank of Stonewall Jackson's forces at the Second Battle of Bull Run. Pope claimed that the subsequent Confederate victory resulted from Porter's disobedience and misconduct.

In November 1862, Porter was relieved of his command and court-martialled. The trial continued on into January 1863, Porter claiming that Pope's orders had been vague, contradictory, and impossible to execute. But on January 21, Porter was found guilty and immediately cashiered.

After the end of the war, Porter entered the mercantile business in New York. He later served as commissioner of public works, police commissioner, and fire commissioner of New York City. The most notable aspect of Porter's postwar career, however, was his dogged pursuit of vindication for his alleged misdeeds at Bull Run. No sooner was his court-martial concluded than he started efforts to clear his name. Finally, in 1879, he won a review of his case, a review that supported his claim of innocence. But it was not until 1886 that he was reappointed an army officer and placed, at his own request, on the retired list.

Porter, Sir George (b. Dec. 6, 1920, Stainforth, Yorkshire, Eng.), English chemist, co-recipient with fellow Englishman Ronald George Wreyford Norrish and Manfred Eigen of West Germany (*qq.v.*) of the 1967 Nobel Prize for Chemistry. All three were honoured for their studies in flash photolysis, a technique for observing the intermediate stages of very fast chemical reactions.

After undergraduate work at Leeds, Porter earned his doctorate at the University of Cambridge under Norrish. He continued on there, conducting the prizewinning work with Norrish between 1949 and 1955. Porter specifically studied the equilibrium of chlorine atoms and molecules. In 1955 he joined the faculty of chemistry at the University of Sheffield, where he taught until 1966, becoming in that year director of the Royal Institution of Great Britain and Fullerian Professor of Chemistry. Porter held honorary and visiting professorships at institutions throughout Britain. He was named a Fairchild Distinguished Scholar at the California Institute of Technology, Pasadena, Calif., in 1974 and held a Hitchcock Professorship at the University of California at Berkeley in 1978. He was knighted in 1972.

Porter, Hal (b. Feb. 16, 1911, Albert Park, Vic., Australia—d. Sept. 29, 1984, Melbourne), Australian novelist, playwright, and poet who is noted for his style and honesty.

After completing his education, Porter became a schoolmaster in 1927, teaching at various schools until 1951. In 1951–52 he was a producer, actor, and costume and set designer at the Theatre Royal in Hobart, Tasmania. After 1953 he worked as a librarian, becoming chief regional librarian at the Shepparton Regional Library, Shepparton, Victoria. From 1961 he was a full-time writer.

His short stories first appeared in the *Adelaide Advertiser* in 1953 and were later published in several collections, among them *Fredo Fuss Love Life* (1974) and *The Clairvoyant Goat* (1980). Collections of his poems include *The Hexagon* (1956), *Elijah's Ravens* (1968), and *In an Australian Graveyard* (1974). Among his novels are *A Handful of Pennies* (1958), *The Titled Cross* (1961), and *The Right Thing* (1971). He also edited literary anthologies and wrote television plays and magazine articles. His successful, multivolume autobiography, which includes *The Watcher on the Cast-Iron Balcony* (1963), *The Paper Chase* (1966), and *The Extra* (1975), was well received. Porter received the Britannica Literary Award in 1976 and many Commonwealth Literary Fund fellowships before being granted emeritus fellowship in 1981.

Porter, Katherine Anne (b. May 15, 1890, Indian Creek, Texas, U.S.—d. Sept. 18, 1980, Silver Spring, Md.), American novelist and short-story writer, a master stylist whose long short stories have a richness of texture and complexity of character delineation usually achieved only in the novel.

Educated in a convent and at private schools, she worked as a newspaperwoman in Chicago and Denver, Colo., before leaving in 1920 for Mexico, the scene of several of her stories. "Maria Concepcion," her first published story (1922), was included in her first book of stories, *Flowering Judas* (1930), enlarged in 1935 by other stories.

Her next collection, *Pale Horse, Pale Rider* (1939), is a poignant tale of youthful romance brutally thwarted by the young man's death in the influenza epidemic of 1919. In it and the two other stories of the volume, "Noon Wine" and "Old Mortality," appears for the first time her semiautobiographical heroine, Miranda, a spirited and independent woman. *The Leaning Tower* (1944) depicts in its title story a young Texas artist in Berlin during the rise of Nazism. The ascendancy of Nazism also haunts *Ship of Fools* (1962), Porter's only novel. Conceived as early as 1931 on a trip from Veracruz, Mex., to Germany, the book was perfected while she worked as a teacher and free-lance writer. It deals with the complex interrelations of a group of international, but predominantly German, passengers during a long voyage. Though it won her a large readership, it was not as wholeheartedly accepted by critics as her stories had been.

Katherine Anne Porter, 1970
Paul Porter

Collected Short Stories (1965) won the National Book Award and the Pulitzer Prize for fiction. Her essays, articles, and book reviews were collected in *The Days Before* (1952; augmented 1970). Her last work, published in 1977, when she suffered a disabling stroke, was *The Never-Ending Wrong,* dealing with the celebrated Sacco–Vanzetti case (*q.v.*) of the 1920s.

Porter, Keith Roberts (b. June 11, 1912, Yarmouth, Nova Scotia, Can.), Canadian-born American cell biologist who developed techniques for electron microscope studies to determine the internal structure and organization of cells and tissues. He studied biology at Acadia University (Wolfville, N.S., Can.) and Harvard University, obtained a Ph.D. from Harvard in 1938, and was a National Research Council fellow at Princeton University for one year. From 1939 to 1961 he was a member of the Rockefeller Institute in New York. During that period he worked with tissue cultures and devised methods for obtaining high-resolution pictures of individual cells. He published many articles describing and interpreting fine structures of cells, especially those comprising the cellular transport system known as the endoplasmic reticulum, cellular surfaces, and intracellular microtubules.

In 1961–70 Porter was a member of the biology department at Harvard, serving as its chairman (1965–67). From 1968 to 1975 he chaired the newly-formed department of molecular, cellular, and developmental biology at the University of Colorado, at Boulder. He then served for several years as director of the Marine Biological Laboratory at Woods Hole, Mass. He wrote, with Mary Bonneville, *An Introduction to the Fine Structure of Cells and Tissues* (1963; 4th ed., *Fine Structure of Cells and Tissues,* 1973). He was the founding president of both the Tissue Culture Association and the American Society of Cell Biologists.

Porter, Peter (Nevill Frederick) (b. Feb. 16, 1929, Brisbane, Queensland, Australia), Australian-born British poet whose works are characterized by a formal style and rueful, epigrammatic wit.

Educated in Australia, Porter worked as a news reporter, clerk, and bookshop assistant and in the advertising business before settling in London in 1951. His first volumes of poetry, published in the 1960s, reflect a satirical approach to modern society and to his own experiences. Porter's works include *Once Bitten, Twice Bitten* (1961), *Poems Ancient & Modern* (1964), *A Porter Folio* (1969), *The Last of England* (1970), *Preaching to the Converted* (1972), *A Share of the Market* (1973), *Living in a Calm Country* (1975), *The Cost of Seriousness* (1978), and *English Subtitles* (1981). With Anthony Thwaite, he compiled *The English Poets: From Chaucer to Edward Thomas* (1974).

Porter, Rodney Robert (b. Oct. 8, 1917, Newton-le-Willows, Lancashire, Eng.—d. Sept. 7, 1985, Winchester, Hampshire), British biochemist who, with Gerald M. Edelman, received the 1972 Nobel Prize for Physiology or Medicine for his contribution to the exact determination of the chemical structure of an antibody.

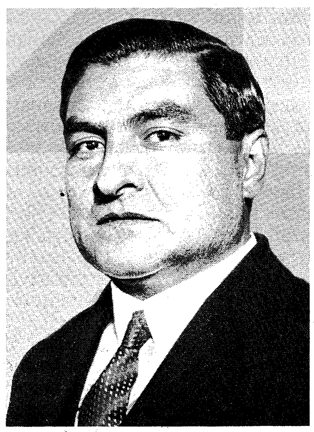
Porter approached the problem of antibody structure by using an enzyme, papain, to cleave the blood's immunoglobulin molecule into functionally different fragments, which were then amenable to structural analysis. Edelman, working independently, used different methods to break up the molecule, and concluded that rather than a single chain of amino acids, it was a multichain entity. Porter and his research team were then able to determine the now universally accepted four-chain model of the antibody. Using his fragmentation technique, Porter studied the chains of the molecule separately, while Edelman worked on the whole molecule. By 1969 a complete model of the molecule, comprising more than 1,300 amino acids, had been achieved.

Porter was educated at Liverpool University and the University of Cambridge, and worked at the National Institute for Medical Research at Mill Hill from 1949 to 1960. He served as professor of immunology at St. Mary's Hospital Medical School, London, until 1967, when he joined the faculty at the University of Oxford.

Porter, William Sydney: *see* Henry, O.

Portes Gil, Emilio (b. Oct. 3, 1891, Ciudad Victoria, Mex.—d. Dec. 10, 1978, Mexico City), Mexican political leader and diplomat who was provisional president of Mexico from Dec. 1, 1928, after the assassination of President-elect Alvaro Obregón, to Feb. 5, 1930.

From late 1914 Portes Gil worked for the revolutionary movement led by Venustiano



Portes Gil, 1932
AP/Wide World Photos

Carranza, but he supported Alvaro Obregón against Carranza in the presidential elections of 1920. After Obregón was elected president for the first time, Portes Gil became provisional governor of Tamaulipas. He also was governor of that state from 1925 to 1928, during the presidency of Plutarco Elías Calles.

In 1930–31 Portes Gil was president of Mexico's sole political party, the National Revolutionary Party (PNR). Subsequently, he was minister to France and delegate to the League of Nations (1931–32), attorney general, and foreign minister. He retired from politics in 1936.

Porteur (people): *see* Carrier.

Porthcawl, coastal resort, Ogwr district, Mid Glamorgan County, Wales. Situated on a low, limestone headland overlooking the Bristol Channel, Porthcawl originated as a coal port during the 19th century, but its trade was soon taken over by more rapidly developing ports such as nearby Barry. Northwest of the town in the dunes known as Kenfig Burrows are hidden the last remnants of the town and castle of Kenfig, which were overwhelmed by sand *c.* 1400. Porthcawl is a leading holiday resort in southern Wales and has one of the largest trailer parks in Europe. Tourist attractions in the area include plentiful sandy beaches, a Grand Pavilion, a miniature railway leading to Coney Beach (modelled after Coney Island in New York City), and a golf course. Pop. (1981 prelim.) 15,566.

Portici, town, Napoli province, Campania region, southern Italy, on the Bay of Naples, southwest of Vesuvius (volcano) and just southeast of Naples. As a medieval fief Portici was owned by various princely families before passing to the Kingdom of Naples. It was completely destroyed by the eruption of Vesuvius in 1631. Italy's first railway (Portici–Naples) was inaugurated there in 1839. Portici's most famous landmark is the ornate royal palace, begun in 1738 by Charles of Bourbon, king of the Two Sicilies (later Charles III, king of Spain), which houses the agriculture faculty of the University of Naples and relics from the nearby archaeological site of Herculaneum.

Portici is on the Naples–Salerno railway and has a small but busy port. Fishing and agriculture (apples, pears, olives, nuts, and hemp) are carried on, and wine, fertilizer, and silk are produced. Pop. (1981 prelim.) mun., 79,259.

portico, colonnaded porch or entrance to a structure, or a covered walkway supported by regularly spaced columns. A portico may stand unattached to a building.

The portico is a principal feature of Greek temple architecture, and thus a prominent element in Roman and all subsequent classically inspired structures. The types of portico furnish the main terms for describing Greek temples. There are two basic plans. If the lateral walls of a temple extend past the cella, or sanctuary, to form the side walls of the porch or anteroom, these long walls often terminate with antas, an anta being a corner post or pilaster of the architectural order employed in the structure. The open end of the porch, or portico, is then supported by between one and four columns in antis, that is to say, "between the antas." The temples so constructed are called henostyle (one column), distyle (two columns), tristyle (three columns), or tetrastyle (four columns). No more than four columns were ever used.

If the temple has a porch before it open at the sides as well as the front, with freestanding columns across the entire portico, the temple is said to be prostyle. The smallest number of columns found supporting a prostyle portico is 4 (tetrastyle), followed by 5 (pentastyle), continuing through 10 (decastyle), and including 12 and 14.

An amphiprostyle temple has porticoes in front and in back, and a peripteral temple has a colonnade running completely around it. The Temple of Artemis Propylaea at Eleusis would therefore be described as tetrastyle amphiprostyle and the older Parthenon and Hephaesteum at Athens as hexastyle (six-columned) peripteral.

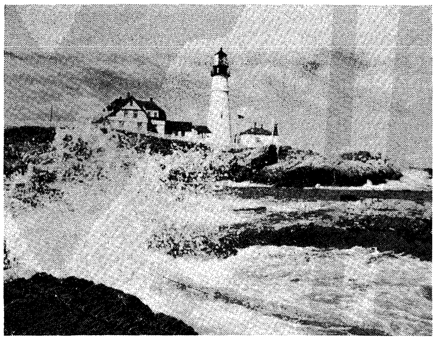
Porţile de Fier (gorge, Yugoslavia–Romania): *see* Iron Gate.

Portimão, also called VILA NOVA DE PORTIMÃO, town, port, and *concelho* (municipality), Faro district, southern Portugal, at the head of the Ribeira de Arade estuary. An important fishing port (sardine and tuna canning) and international coastal resort (Praia da Rocha is 2 mi [3 km] to the south), the town also has a cork industry. A long bridge connects Ferragudo across the estuary with Portimão. The estuary is overlooked by two 15th-century castles. Pop. (1981) town, 19,413; *concelho*, 35,438.

Portland, town, southern Victoria, Australia, on Portland Bay, an inlet of the Indian Ocean. The bay was first visited by Europeans in 1800 and named after the Duke of Portland by James Grant, a British naval officer; two years later Nicolas Baudin, a French navigator, called it Tourville, a name that persists. The first permanent European settlement in Victoria was made on the site by the Henty family, who established a sheep and whaling station in 1834. It became a borough in 1863 and a town in 1949.

Connected to Adelaide and Melbourne (185 mi [298 km] northeast) by rail and by the Prince's Highway, Portland has the only deepwater harbour between the two cities. With improved port facilities trade increased after 1950, with oil as the major import commodity and wool, wheat, and frozen meat as the main exports. A fishing fleet supplies a cannery in town. Pop. (1981) 9,353.

Portland, city, seat (1760) of Cumberland County, southwestern Maine, U.S.; the state's largest city, it is the hub of a standard metropolitan statistical area that includes



Portland Headlight, Cape Elizabeth, Portland, Maine
Grant Heilman—EB Inc.

the cities of South Portland and Westbrook and the towns of Falmouth, Cape Elizabeth, Cumberland, Freeport, Gorham, Scarborough, Windham, and Yarmouth; and, in York County, the city of Saco and the town of Old Orchard Beach. The city is built largely on two hilly peninsulas overlooking Casco Bay and its many islands.

Portland was first settled in 1632 by the Englishmen Richard Tucker and George Cleeve. During its early years it was known by several names (Machigonne, Indigreat, Elbow, The Neck, Casco, and Falmouth). It was raided in 1676 by Indians and in 1690 by French and Indians. In 1775 the settlement (then known as Falmouth) was bombarded and burned by the British as punishment for patriotic activities. Rebuilt, it was incorporated as a town in 1786 and named for the Isle of Portland in Dorsetshire, Eng. When Maine became a state in 1820, Portland served as the capital until 1832. A fire that resulted from an Independence Day celebration destroyed much of the city centre in 1866. Reconstruction soon took place, however, and the city continued to grow.

Portland's traditional fishing, shipping, and commercial activities were increasingly supplemented by the development of manufacturing industries. Naval shipbuilding was important in World Wars I and II. Portland is now a busy transportation and commercial centre and is a major petroleum port and the eastern terminus of the Portland–Montreal oil pipeline. It has an extensive foreign and coastal trade. Diversified manufactures include pulp and paper, textiles, lumber and wood products, footwear, chemicals, metal goods, and machinery. There is considerable shipbuilding, printing, and publishing; commercial fishing is also a significant economic factor. The city is the seat of the University of Maine at Portland-Gorham (founded 1878) and Westbrook College (1831), and has museums of art and natural history. Colonial landmarks include the former home (1785) of the poet Henry Wadsworth Longfellow, Tate House (1755), and the Portland Headlight, erected in 1791 on orders from George Washington, and one of the oldest lighthouses in the U.S. The Two Lights and Crescent Beach state parks are nearby. Inc. city, 1832. Pop. (1980) 61,572; metropolitan area (SMSA), 215,789; (1982 est.) 218,100.

Portland, port and largest city of Oregon, U.S., seat (1854) of Multnomah County, just south of Vancouver, Wash., on the Willamette River near its confluence with the Columbia, 100 mi (160 km) from the Pacific. Settled in 1829 on the site of an early Indian campground, it was laid out in 1844 and, after two of its early citizen flipped a penny, named for Portland, Maine, rather than Boston, Mass. Early growth was stimulated by a number of gold rushes and the flow of immigrants along the Oregon Trail. Portland's position at the junction of the Columbia River and the main north–south route from California to Puget Sound made it a valuable commercial centre handling the farm and forest produce of the Cascade Range, Willamette Valley, and Columbia Basin. Construction of deepwater port facilities capable of harbouring oceangoing vessels, completion of the Northern Pacific transcontinental railroad, and the introduction of cheap hydroelectric power encouraged shipbuilding, chemical, and metallurgical (principally aluminum) industries. Food processing, meat-packing, electronics, lumber, and textile manufacturing are important.

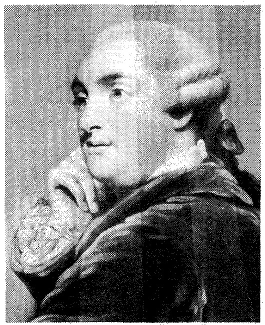
The downtown district, site of the original settlement, is connected to the newer parts of the city by eight bridges. Residential development has been steady. This heavily forested city is the home of basketball's Trail Blazers, the University of Portland (1901), Reed College (1911), Lewis and Clark College (1867), Warner Pacific College (1937), Portland State University (1955), Columbia Christian College (1956), Portland Community College (1961), and the University of Oregon Health Sciences Center.

Its annual Rose Festival (June) is widely acclaimed, and the Pacific International Livestock Exposition is held each autumn. Nearby points of scenic interest include the 850-ft (259-m) Multnomah Falls and Bonneville Dam, reached by the Columbia River Highway, east of the city. Portland is headquarters for the Mt. Hood National Forest; snow-capped Mt. Hood is 48 mi east-southeast, and Mt. Rainier, Mt. St. Helens, and Mt. Adams in Washington are visible from the city. Inc. 1851. Pop. (1980) city, 366,383; (1982 est.) metropolitan area (SMSA), 1,331,600.

Portland, Isle of, craggy peninsula of the English Channel coast of the county of Dorset, England. Its greatest length is 4 mi (6 km), and it has a width of 1 3/4 mi and an area of 4 1/2 sq mi (11 sq km). The peninsula is connected to the mainland by Chesil Beach, an unbroken shingle ridge about 30 ft (9 m) high and 200 yd (180 m) wide, stretching 10 mi west as far as Abbotsbury. The island's precipitous shores render it virtually inaccessible from the sea, except toward the south. Its highest point is Verne Hill (490 ft). At its southern tip, the Bill of Portland, there are storm-worn caves, a raised beach, and the Pulpit Rock.

The peninsula is a royal manor whose Court Leet (a medieval legal entity) still functions. Portland Castle, built by Henry VIII in 1520, is open to the public. The remains of the Norman Bow and Arrow Fortress (Rufus Castle) stand in the grounds of Pennsylvania Castle, which was built about 1800. There is a prison (Verne Prison) and an institution for youthful offenders. The breakwaters, constructed by convict labour, were started by the Admiralty in 1847–62; two more were added after 1895. The completely enclosed harbour covers 2,233 ac (904 ha). After World War II an additional naval establishment was built toward the Bill of Portland. Pop. (1981 prelim.) town, 10,915.

Portland, William Henry Cavendish Bentinck, 3rd Duke of, MARQUESS OF TITCHFIELD, EARL OF PORTLAND, VISCOUNT WOODSTOCK, BARON OF CIRENCESTER (b. April 14, 1738, Bulstrode, Buckinghamshire, Eng.—d. Oct. 30, 1809,



Portland, detail of an engraving by John Murphy after a painting by Sir Joshua Reynolds

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

Bulstrode), British prime minister from April 2 to Dec. 19, 1783, and from March 31, 1807, to Oct. 4, 1809; on both occasions he was merely the nominal head of a government controlled by stronger political leaders.

The eldest son of William, 2nd Duke of Portland (whom he succeeded in 1762), he was educated at Westminster and Christ Church, Oxford. In 1761 he entered Parliament and from July 1765 to December 1766 was lord chamberlain of the household. Appointed by the then prime minister, Charles Watson-Wentworth, 2nd Marquess of Rockingham, Portland served briefly (April–August 1782) as lord lieutenant of Ireland. On the fall of the ministry of Lord Shelburne (afterward 1st Marquess of Lansdowne) in 1783, Portland was selected by Lord North and Charles James Fox as titular chief of their coalition government, in which North was home secretary and Fox foreign secretary. Portland was dismissed after the House of Lords, at the insistence of King George III, rejected Fox's reform bill for India.

As home secretary (1794–1801) in the first administration of William Pitt the Younger, Portland, despite the British fear of subversion while Great Britain was at war with Revolutionary France, distinguished himself by his restraint in applying arbitrary laws against sedition and treason. He nevertheless suppressed the Irish Rebellion of 1798. Later (1801–05) he was lord president of the council. His second ministry was dominated by the foreign secretary, George Canning, and the secretary for war and the colonies, Viscount Castlereagh (afterward 2nd Marquess of Londonderry). Their disagreements (culminating in a duel) and Portland's ill health caused him to resign shortly before his death.

portland cement, binding material in the form of a finely ground powder, usually gray, that is manufactured by burning and grinding a mixture of limestone and clay or limestone and shale. The inventor Joseph Aspdin, of England, patented the basic process in 1824, naming it for the resemblance of the cement when set to portland stone, a limestone from the Isle of Portland. When mixed with water, the anhydrous calcium silicates and other constituents in the portland cement react chemically with the water, combining with it (hydration) and decomposing in it (hydrolysis) and hardening and developing strength. *See* concrete.

Portland Inlet, arm of the Pacific Ocean, indenting western British Columbia, Canada; it is an extension of Dixon Entrance and Chatham Sound, north of Prince Rupert. Named in 1793 by the English navigator George Vancouver in honour of the ducal house of Portland, the inlet is 25 miles (40 km) long and up to 8 miles (13 km) wide. Portland Inlet contains Pearse, Wales, and Somerville islands, receives the 236-mile- (380-kilometre-) long Nass River, and is continued north-northeast by the 30-mile- (48-kilometre-) long Observatory Inlet and Portland Canal (a 70-mile [112-kilometre] channel that is one of the world's longer fjords). Since 1903 Pearse Canal, north of the islands, and Portland Canal have served as the boundary between British Columbia and Alaska (U.S.). Copper is mined along the inlet's eastern shores.

Portland Vase, Roman vase (1st century AD) of dark blue glass decorated with white figures, the finest surviving Roman example of cameo glass (*q.v.*). Originally owned by the Barberini family (and sometimes called the Barberini Vase), it came into the possession of the Duke of Portland in the 18th century. The vase has been extensively copied, particularly during the Victorian period. The most accurate copies, however, were those made by Josiah Wedgwood, who, in 1790, copied it in jasperware with white figures in relief, and by

Portland Vase, Roman cameo glass, 1st century AD; in the British Museum

By courtesy of the trustees of the British Museum

John Northwood of Stourbridge, Eng., who copied it in glass (completed 1876). In 1845, while in the British Museum (where it is now), the original vase was smashed, necessitating skillful and painstaking restoration.

Portlaoise, also called PORT LAOISE ("Fort of the Descendants of Laois"), or MARYBOROUGH, county town (seat) of County Laoighis, Ireland, on the River Triogue. Established as Fort Protector during the reign of Mary I (1533–58), it was granted a charter in 1570. The main industries of the town are flour milling and the manufacture of worsteds and sports equipment. The Rock of Dunmase, just to the east, was the seat of the ancient kings of Leinster. Pop. (1986) 3,773.

Porto, also called OPORTO, capital and port, Porto district, northern Portugal. The city lies along the Douro River, 2 miles (3 km) from the river's mouth and 175 miles (280 km) north of Lisbon. World famous for its port wine, Porto is Portugal's second largest city and is the commercial and industrial centre for the zone north of the Mondego River. The city lies chiefly on the Douro River's north bank, with the older district on a hill to the east. The red-tiled warehouses of the town of Vila Nova de Gaia, where vast quantities of port wine are blended and stored, are on the south bank; other suburbs include Matosinhos, Leça da Palmeira, and Aguas Santas to the north and Gondomar and Oliveira do Douro to the southeast. The Douro River is spanned by the Dom Luís I Bridge (591 feet [180 m]), built in 1881–85 by the French engineer Alexandre-Gustave Eiffel, with one of the largest arches in Europe; by the Maria Pia Bridge (1876–

Boat loaded with kegs of port wine on the Douro River at Porto, Port.

Eric Carle—Shostal/EB Inc.

77), carrying the Lisbon railway line; and by the Arrábida Highway Bridge (885 feet [270 m]), which had the world's longest arch when it was completed in 1962.

Porto was the Portus Cale of Roman times and was earlier a flourishing settlement on the Douro's south bank; the nomadic Alani tribe later founded the city of Castrum Novum on the north bank. The Visigoths took possession of the site in about 540 but yielded in 716 to the Moors. In 997 the Christians recaptured Porto, which for a time became the capital of the counts of Portucalense during Moorish rule in southern Portugal. The Moors again held the city briefly, but in 1092 it was brought finally under Christian domination. In the 14th century the city became an important port, and Henry the Navigator was born there in 1394. During the Peninsular War, British forces under the Duke of Wellington there crossed the Douro, routed the French, and captured the city on May 12, 1809.

Porto's cathedral, on the site of the Visigothic citadel, was originally a 12th-century Romanesque building with 14th-century Gothic cloisters, but it was largely rebuilt in the 17th–18th centuries. The Romanesque and early Gothic Church of São Martinho de Cedofeita, notable for the curiously carved capitals of its pillars, occupies the site of a church said to have been built by Theodomir, king of the Visigoths, in 559 to receive St. Martin of Tours's relics from France. Also notable are the Torre dos Clérigos, an 18th-century granite tower, 246 feet (75 m) high; and the Gothic Basilica of São Francisco (from 1410).

An episcopal see, Porto has a university (founded 1911), district archives, museums including the Soares do Reis National Museum (prehistoric and Roman artifacts, sculpture, paintings, and numismatics), an opera house, a fine-arts school, a symphony orchestra, and several scientific institutes. The Crystal Palace, a large glass and iron structure, was built for the industrial exhibition of 1865. Modern public buildings include the county hall, university hospital, and football stadium.

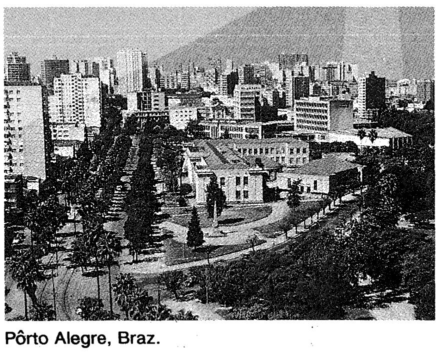
Porto is chiefly famous for the export of the wine named for it, possibly the world's most popular dessert wine, with a rich, sweet flavour. It is fortified with brandy while fermenting, then aged. The trade in port was begun in 1678 and was firmly established under the terms of the Methuen Treaty (1703) between England and Portugal. An act of 1906 defined port as a wine produced in the Douro district and exported from Porto and with an alcoholic strength of more than 16.5 percent.

About a third of the population is engaged in manufacturing, and fisheries are also important. Just northwest of Porto, on the Atlantic coast in Matosinhos, is the deepwater artificial Porto de Leixões. Porto is also famous for its sea-bathing facilities.

The population density of Porto is only slightly less than that of Lisbon, and overcrowding is common. Large-scale planning and development since World War II, including a number of housing projects, have improved conditions. The coastal railroad, running beside the coastal expressway, is electrified between Porto and Lisbon. A highway and railroad also extend east to Bragança. The Crestuma hydroelectric project on the Douro River is located about 19 miles (30 km) from Porto. The city has a domestic airport.

Porto district, lying between the Douro and Ave rivers, has an area of 925 square miles (2,395 square km). It comprises a narrow coastal plain stretching from the Ave Valley to south of the Douro River, an inland undulating plateau, and an eastern mountainous section traversed by northwest–southeast valleys, notably that of the Tâmega River. The mild, moist climate and generally fertile soils have encouraged an intensive use of land. Mixed farming, including winter and summer cereals, vegetables, and tree crops (cork oak and olive), permits large peasant families to live on small holdings fragmented into tiny parcels, some less than an acre in size. Timber and its associated resin industry is, with the production of *vinho verde* (an acidic, slightly effervescent wine), often the only source of a cash income for the peasants in the remoter valleys. Pop. (1986 est.) city and coterminous *concelho* (municipality), 344,500; district, 1,644,400.

Pôrto Alegre, city, capital of Rio Grande do Sul state, southern Brazil. It lies near the Atlantic coast at the northern end of the freshwater Lagoon dos Patos along an arm of the lagoon known as the Guaíba River. The city is situated at the junction of five short but deep rivers that flow into the Lagoon dos Patos. Founded in 1742–43 by colonists from the Azores, it was first known as Pôrto dos Casais (or Pôrto dos Cazaes). In 1825 the first German immigrants settled near the site, to be joined later by Italian settlers. The administrative centre of Rio Grande do Sul was moved in 1773 from Rio Grande to Pôrto Alegre, which officially became the state capital in 1807.



Pôrto Alegre, Braz.
Plessner International

One of the nation's largest cities, it is second only to São Paulo in commercial and industrial importance in southern Brazil. Its rural hinterland yields a variety of agricultural and pastoral products, including meat and hides, wool, rice, *feijão* (beans), cashews, avocados, wheat, grapes, and tobacco; from the forests comes lumber. The city's industries are chiefly concerned with processing these products and include meat-packing, lard refining, leather tanning, shipbuilding, and the manufacturing of textiles, metallurgic goods, electrical and communications equipment, plastics, pharmaceuticals, perfume, beer, and chemicals. Power comes from coal mined at nearby São Jerônimo and from a hydroelectric plant at Salto. An oil terminal and petrochemical complex were built in the late 1970s. The city has many business and financial institutions and is also an educational centre, being the seat of the Catholic University of Rio Grande do Sul (founded 1948) and the Federal University of Rio Grande do Sul (1934). Points of interest include the Governor's Palace and Nossa Senhora das Dores church.

Pôrto Alegre's growth has stemmed from its strategic location. Because the lower courses of the rivers forming the Guaíba River are all navigable, the city has become Brazil's most important centre of inland navigation. Its products can be shipped across the Lagoon dos Patos and transferred to ocean vessels at Pelotas or Rio Grande. The city's railroad service is excellent, with connections to Uruguayan and Argentine lines as well as to São Paulo and Rio de Janeiro (via Santa Maria). All-weather highways also link the city with the rest of Brazil and with neighbouring countries, as does domestic and international air service. Pop. (1985 est.) 1,275,483.

Porto Grande (Cape Verde): *see* Mindelo.

Porto-Novo, city, capital of Benin (formerly Dahomey), on the Gulf of Guinea, western Africa. Situated on a coastal lagoon at the extreme southeastern part of the country, it was probably founded in the late 16th century

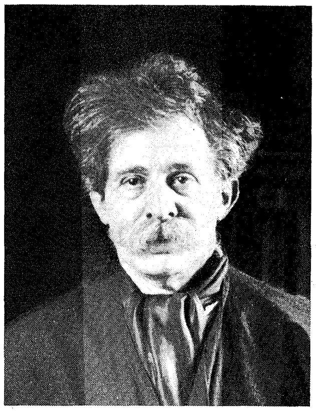
The old Portuguese cathedral in Porto-Novo, Benin
Art Resource—EB Inc.

as the centre of the kingdom of Porto Novo and flourished as a result of slave trade with the Portuguese. The ruins of some old African palaces remain, and there are many colonial-style buildings, including the old Portuguese cathedral.

The city is the administrative capital of the government of Benin. Government buildings include the national archives and the library. Porto-Novo is connected by road and rail to the nation's main industrial centre at Cotonou and by road to Lagos, Nigeria. It has been somewhat bypassed for commercial and industrial development since the building of a railway to the interior and the improvement of deepwater harbour facilities in Cotonou. Numerous African artisans and guilds are in the city. Pop. (1982 est.) 208,258.

Porto-Riche, Georges de (b. May 20, 1849, Bordeaux, Fr.—d. Sept. 5, 1930, Paris), French playwright who began as a writer of historical dramas but made his most original contribution with psychological plays produced at the new realistic Théâtre-Libre of André Antoine in the 1890s.

Porto-Riche came to public notice when *La Chance de Françoise* became the first of his plays to be produced at the Théâtre-Libre, in 1888. His subsequent works were acute psychological studies of what he considered to be the inevitable conflict between the sexes. His theme was sensual love, which he studied mainly in the maladjusted married couple. This is the subject of his best plays, *Amoureuse* (1891), *Le Passé* (1897), and *Le*



Porto-Riche, *c.* 1906
Harlingue—H. Roger-Viollet

Vieil Homme (1911), all of which examine the eternal triangle of the wife, the husband, and the lover. The so-called *théâtre d'amour* that Porto-Riche innovated was highly influential and was much imitated for some years. He was elected to the Académie Française in 1923.

Porto Torres, Latin TURRIS LIBISONIS, town, Sassari province, northwestern Sardinia, Italy. It lies along the Gulf of Asinara (an inlet of the Mediterranean) at the mouth of the Mannu River, just northwest of Sassari city, for which it is the port. Originally a Phoenician port, it was later controlled by the Carthaginians and by the Romans, who called it Turris Libisonis. In the Middle Ages it was the chief town of the *giudicato* (judiciary circuit, a territorial division) of Torres until Saracen raids led to the removal inland to Tathari (Sassari) of many of its inhabitants in the 12th century. Its archbishop was transferred to Sassari in 1441. There are remains of a Roman bridge nearby, and the so-called Palazzo del Re Barbaro may be the ruins of a Roman temple of Fortuna. The former cathedral, San Gavino, dates from the 11th and 12th centuries and is one of Sardinia's most notable churches.

Commerce and fishing are important, and the port has passenger connections to Corsica. Pop. (1984 est.) mun., 21,295.

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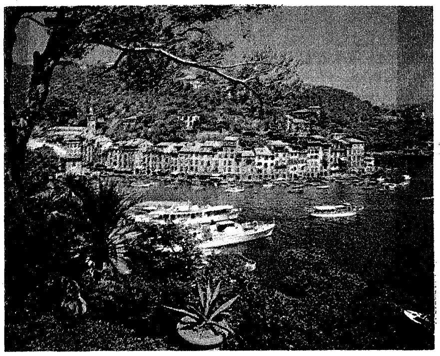
Pôrto Velho, city, capital of Rondônia state, western Brazil. It lies along the south bank of the Madeira River, a tributary of the Amazon. It was installed as the municipal seat in 1915. Pôrto Velho serves as its region's commercial, transportation, and communications centre. It is the head of navigation on the Madeira and is the northern terminus of the 228-mile (367-kilometre) Estrada de Ferro Madeira–Mamoré, a railroad built in 1913 to circumvent rapids between Pôrto Velho and Guajará-Mirim and to carry rubber from Mato Grosso state and northeastern Bolivia, the borders of which lie 100 miles (160 km) southwest. Tin ore is mined in the vicinity. Lumber and medicinal plants and oils are also exported from Pôrto Velho, which has a commercial airport. Pôrto Velho is on the highway between Manaus and Rio Branco, with a highway extending to São Paulo. Pop. (1980 prelim.) 101,644.

Portobelo, also spelled PUERTO BELLO, village situated along the Caribbean coast of east-central Panama. The name Portobelo, meaning "beautiful harbour," was given by Columbus in 1502; the village was founded in 1597. It grew to become a strongly fortified town at the north end of the old Gold Road. As a point of transshipment and exchange for the colonial merchandise of Spain and South America, Portobelo was famous for its annual fairs and notorious for its high prices, congested quarters, and tropical fevers. Once the busiest city in the New World, it was attacked many times by English buccaneers. The abandonment by Spain of the treasure fleet system and fairs in the 18th century, the building of the Panama railroad in the 1850s, and the opening of the Panama Canal brought about its eclipse. It has ruins of great historic interest. Pop. (1980 prelim.) village, 2,657; district 5,086.

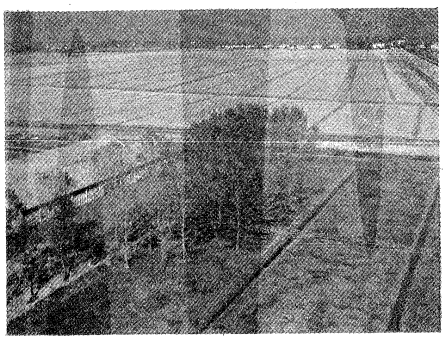
Portofino, village, Genova province, Liguria region, northwestern Italy, on the Riviera di Levante, at the southeast end of the small promontory of Portofino, which encloses the Golfo di Rapallo on the west. A picturesque fishing village with a small port at the head of an inlet lined with brightly colour-washed houses, Portofino has a heavy tourist traffic.



Portofino, Italy
SCALA—Art Resource/EB Inc.

Pillow lace is made to traditional 18th-century patterns. To the north (1.5 mi [2.5 km]) is the monastery of La Cervara, where Pope Gregory XI rested on his way from Avignon, Fr., to Rome (1377) and Francis I of France was imprisoned after the Battle of Pavia (1525). Southeast is the church of S. Giorgio, said to contain relics of St. George brought by crusaders from the Holy Land. Pop. (1981 prelim.) mun., 742.

Portogruaro, town, Venezia province, Veneto region, northeastern Italy, on the Lemene River. The town has old houses (dating from the 14th century), ancient gates and arcades, and a cathedral with a slender campanile that is slightly askew. The Palazzo Comunale is



Wheat fields ready for planting near Portogruaro, Italy
R. De Santo—Shostal/EB Inc.

a 14th-century Gothic building. An archaeological museum contains objects from the nearby excavated Roman colony of Concordia Sagittaria. It is an agricultural market. Its manufactures include textiles and chemicals. Pop. (1981 prelim.) mun., 24,375.

Portolá, Gaspar de (b. *c.* 1717–23, Balaguer, Spain—d. *c.* 1784, Mexico or Spain), Spanish military officer, governor of Upper California, and founder of Monterey and San Diego.

The son of a noble family, Portolá entered the Spanish army in 1734. After 30 years' service in Europe, he rose to the rank of captain. In 1767 the Spanish monarchy sent him to California as governor. Soon after his arrival, Portolá assumed command of an expedition to establish missions in Upper California and secure claims to the area.

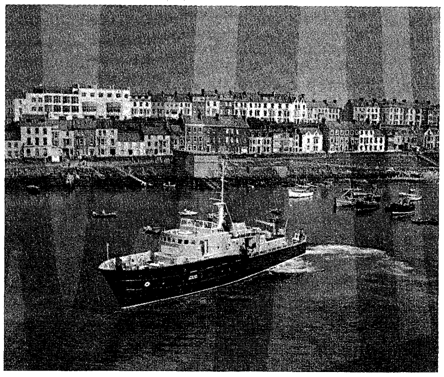
On May 15, 1769, Portolá, accompanied by Father Junípero Serra, began his journey from Velicate in Lower California. The expedition joined another Spanish party at San Diego in late June; and, after establishing a mission there, Portolá and 40 men proceeded to march northward. The group reached the Bay of Monterey early that autumn; but Portolá, failing to realize that he had reached his destination, returned to San Diego in January 1770 after a gruelling march. He was assured that he had indeed reached his objective, so he returned to the region by ship the following May. There he founded the presidio and mission of Carmel. He left the new settlement on June 9, 1770, to return to Lower California. In 1777 he was chosen governor of the city of Puebla, and he served in that post for seven years.

portolan chart, also called HARBOUR-FINDING CHART, COMPASS CHART, or RHUMB CHART, medieval (1300 to 1500) navigational chart. The earliest dated navigational chart extant was produced at Genoa by Petrus Vesconte in 1311 and is said to mark the beginning of professional cartography. The portolan charts were characterized by rhumb lines, lines that radiate from the centre in the direction of wind or compass points and that were used by pilots to lay courses from one harbour to another. The charts were usually drawn on vellum and embellished with a frame and other decorations. Of the roughly 130 portolans surviving, most were made in Italy or Catalonia and a few in Portugal. The Italian portolans tend to encompass only western Europe and the Mediterranean basin, but some Catalan charts can be considered world maps.

Portoviejo, capital of Manabí province, western Ecuador, in the Pacific lowlands on the eastern bank of the Río Portoviejo. Founded by Spanish colonists in 1535 near the coast, it was moved inland to its present site in 1628 because of Indian attacks.

The town is a commercial centre in an agricultural and lumbering region the products of which include coffee, in particular, as well as cacao, sugarcane, cotton, and balsa wood. Portoviejo also has some light industry, including tanning and the manufacture of Panama hats, baskets, and hammocks. Portoviejo is the seat of a bishopric (created in 1871) and of a technical university (established in 1952). It is connected by road and air with Quito and Guayaquil. Pop. (1982 prelim.) 121,600.

Portrush, Irish PORT ROIS, town, Coleraine district (established 1973), formerly in County Antrim, Northern Ireland, at the end of the Antrim Coast Road, on the basaltic peninsula of Ramore Head. Offshore are The Skerries, a rocky group of islets, forming a natural breakwater. The headland, or rocky projectory, Giant's Causeway, is 7 mi (11 km) east along the coast beyond the White Rocks, with their caves. Nearby is Dunluce Castle (14th century), situated on a rock separated from the mainland by a chasm, which is spanned by a footbridge. Portrush has been an important tourist centre, and there is commercial



Portrush harbour, Coleraine district, Northern Ireland
Tourist Photo Library, London

fishing. It is the seaport for Coleraine. Pop. (1981) 5,114.

Portsmouth, district (city), county of Hampshire, England, with an area of 14 sq mi (37 sq km). It is a major naval base and, with Southsea, a popular holiday resort. Portsmouth Harbour opens into Spithead, the eastern end of The Solent, which separates the Isle of Wight from the mainland. The naval station and Royal Dockyard occupy the southwestern part of Portsea Island, which lies between Portsmouth and Langstone harbours. It is connected to the mainland by road and railway bridges.

Portsmouth owes its origin to the retreat of the sea from the earlier settlement of Portchester at the head of Portsmouth Harbour. No town existed until 1194, when the strategic importance of Portsea Island induced Richard I to build a settlement and to grant a charter, fair, and market. The borough is governed by a royal charter of 1627, modified by later municipal acts.

The dockyard, the principal source of employment, dates from 1496, when the town was already a naval base. It was greatly expanded after 1698 and now covers more than 300 ac (120 ha). In the 1860s four conspicuous defensive masonry forts were built along the Spithead.

The tourist trade, centred primarily on Southsea, is of great importance for vacationers. Lord Nelson's flagship at the Battle of Trafalgar (1805), HMS "Victory," lies in the dockyard, along with the nearby Victory Museum. The Guildhall, seriously damaged (like much of Portsmouth) during World War II, was reopened in 1959; it serves as civic headquarters, concert hall, and conference hall. Other notable buildings include a cathedral dating from the 12th century, Southsea Castle, and the birthplace of Charles Dickens.

The commercial port at Camber Docks and Portsea Island's airport are municipally owned. Shipbuilding and aircraft engineering are also important. Pop. (1983 est.) 191,600.

Portsmouth, city, Rockingham County, southeastern New Hampshire, U.S., across the Piscataqua River from Kittery, Maine, on the Atlantic coast. It is New Hampshire's oldest settlement, second oldest city, first capital, and only seaport. In 1623 a fishing settlement was planted at the river's mouth. First called Piscataqua and then Strawbery Banke, it became a bustling colonial port. The town, incorporated by Massachusetts in 1653 and named for Portsmouth, Eng., served as the seat of New Hampshire's provincial government until the American Revolution. The state's first newspaper, the *New Hampshire Gazette* (1756), began publication there. The Portsmouth Naval Yard, dating from the 1790s, though actually in Kittery, Maine, has been an important factor in the city's economic growth. The yard was the site of the 1905 treaty negotiations ending the Russo-Japanese War. Since 1900 it has been a centre for the building and repair of submarines. Connected with it are a naval hospital and prison. Pease Air Force Base is also located in Portsmouth.

Portsmouth is the trade centre for an agricultural and resort region and has light manufacturing. A port of entry, it is a major factor in New England seaborne commerce. The adjacent Pease Air Force Base has been an economic asset to the area. Historic buildings include the John Paul Jones House (1758), where the naval commander boarded, and the homes of the author Thomas Bailey Aldrich (1790) and of John Langdon (1784), five times governor of New Hampshire. The Wentworth-Coolidge Mansion, a national historic landmark 2 miles (3 km) south of Portsmouth, was the home and council chamber of New Hampshire's first royal governor (1741–67). Strawbery Banke is a 10-acre (4-hectare) restoration on the original site of colonial houses and shops. St. John's Church (1807) has an early Bible (1717) and a pipe organ dating from 1708. Inc. city, 1849. Pop. (1988 est.) city, 27,755; Portsmouth–Dover–Rochester MSA, 220,400.

Articles are alphabetized word by word, not letter by letter

Portsmouth, city, seat of Scioto county, southern Ohio, U.S., on the Ohio River at the mouth of the Scioto River, 91 miles (146 km) south of Columbus. It was founded in 1803 by Major Henry Massie, a land speculator, who named the place for his hometown of Portsmouth, Va. Its early growth was spurred by the opening (1832) of the Ohio and Erie Canal when it became a point of transfer from canal barges to river packets. With the end of the steamboat era it developed as a railway centre; the first railroad arrived in 1853. A bridge now connects the city to South Portsmouth and Fullerton, in Kentucky. Following disastrous river floods in 1937, a 77-foot (23-metre) floodwall was built (completed 1950) to protect the city. The Greenup Locks and Dam complex is 10 miles (16 km) up the Ohio River.

Nearby sandstone quarries have supplied material for many notable structures, including the Canadian Parliament buildings at Ottawa. Diversified manufactures include steel, shoes, chemicals, plastics, firebricks, and iron castings. The U.S. Department of Energy operates a large gaseous diffusion plant at Piketon, 25 miles (40 km) north. The city has a branch of Ohio University and is the seat of Shawnee State General and Technical College (1976). Horseshoe Mound is in the city, and Shawnee State Forest and Portsmouth State Park are nearby. The River Days Festival and the National Outboard Motor Boat Championship Races are annual events. Inc. village, 1815; city, 1851. Pop. (1988 est.) 23,868.

Portsmouth, town (township), Newport county, southeast Rhode Island, U.S., on the northern end of Rhode (Aquidneck) Island and on the Sakonnet River. It was founded in 1638 by William Coddington, John Clarke, Anne Hutchinson, and associates from Massachusetts Bay Colony and was first called Pocasset, an Algonkian Indian word pertaining to the width of the river. The Portsmouth Compact, by which the settlers established a democratic government, is inscribed on a stone marker at Founders' Brook. The settlement was incorporated as a town in 1640 and was probably renamed for Portsmouth, Eng. During the Revolutionary War period the British general Richard Prescott was captured on July 9, 1777, by Colonel William Barton at Overing House in Portsmouth; Butts Hill Fort (remnants remain) was the scene of a delaying action by colonial forces during the Battle of Rhode Island (1778).

Now mainly a residential suburb of Newport city, Portsmouth includes the villages of Bristol, Ferry, and South Portsmouth and Prudence and Patience islands. There is some industry, including the manufacture of electronic equipment and aluminum products and boatbuilding, but many of the town's working people are employed at the Newport naval installations. Pop. (1988 est.) 15,567.

Portsmouth, independent city and port, southeastern Virginia, U.S., on Hampton Roads, separated from Norfolk (to the east) by the Elizabeth River. It was the seat of Norfolk county from 1803; the county ceased to exist in 1963, when it was divided into independent cities. Founded in 1752 by Colonel William Crawford, justice of Norfolk county, it was named after the English port. The town was occupied alternately by British and American troops during the American Revolution. A shipyard, built in 1767 by Andrew Sprowle, a wealthy Scottish merchant, was reestablished in 1801 as the Norfolk Navy Yard by the U.S. government. When Federal troops evacuated the navy yard in 1861, the South fell heir to great stores of equipment and built the Confederate ironclad *Virginia* from the hull of the scuttled USS *Merrimack.* The yard was recaptured by Federal troops in 1862.

Shipbuilding and repairing in the navy yard, officially called the Norfolk Naval Shipyard, are the main economic activities, augmented by varied manufactures, including chemicals, fertilizers, processed foods, and wood products. Tidewater Community College (1968) is in the city. Naval relics are displayed in the Portsmouth Naval Shipyard Museum. The U.S. Naval Hospital (1830) is on Hospital Point, site of old Fort Nelson (a former British stronghold). Many colonial buildings have survived including Trinity Episcopal Church (1762) and Monumental Church (1772; Methodist). Inc. town, 1752; city, 1858. Pop. (1988 est.) 111,818.

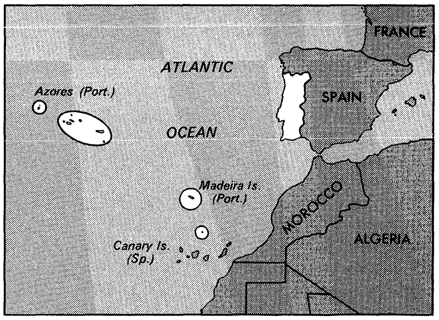
Portsmouth, Louise-Renée de Kéroualle, Duchess of, COUNTESS OF FAREHAM, BARONESS PETERSFIELD, DUCHESSE (duchess) D'AUBIGNY (b. September 1649, near Brest, Brittany, Fr.—d. Nov. 14, 1734, Paris), French mistress of Charles II of Great Britain, the least popular with his subjects but the ablest politician.

Daughter of a Breton nobleman, Guillaume de Penancoet, sieur de Kéroualle, she entered the household of Henrietta Anne, Duchess d'Orléans, the sister of Charles II, in 1668 and accompanied her to England in May 1670 for the festivities that disguised the secret Treaty of Dover. The sudden death of the duchess (in June) left her unprovided for, but Charles placed her among the ladies in waiting of his own queen. It was said in later times that she had been selected by the French court to fascinate the king of England, but for this there seems to be no evidence. Yet when there appeared a prospect that the king would show her favour, the French ambassador, Colbert de Croissy, and Lord Arlington, the principal secretary of state, united in promoting her for the sake of French interests, and it was at the latter's country house at Euston, in Suffolk, that the liaison was consummated in October 1671. A son, Charles Lennox, later Duke of Richmond, was born in July 1672.

The support that she received from the French envoy was given on the understanding that she should serve the interests of her native sovereign. The bargain was confirmed by gifts and honours from Louis XIV, who conferred upon her the duchy of Aubigny in 1673. Louise also continued in Charles's favour for many years; her English titles of Baroness Petersfield, Countess of Fareham, and Duchess of Portsmouth were bestowed in 1673, and in 1674 she was assured of an income of at least £10,000 a year. She proved skillful in safeguarding her position through leading politicians such as the earls of Danby, Sunderland, and Shaftesbury and used her considerable influence with the king on their behalf. However, her unequaled rapacity made her unpopular, and in 1678 her Roman Catholic, French connection placed her in some danger during the Popish Plot. Nevertheless she remained close to Charles until his death (Feb. 6, 1685), and she may have assisted in his reception into the Roman Catholic Church. Soon after his death she retired to France, where, except for one short visit to England during the reign of James II, she remained. Her emoluments were lost in her later years, which were spent at Aubigny, but she was protected from her creditors by Louis XIV.

Portsmouth, Treaty of (Sept. 5 [Aug. 23, Old Style], 1905), peace settlement signed at Kittery, Maine, U.S., ending the Russo-Japanese War (*q.v.*) of 1904–05. According to the terms of the treaty, which was mediated by U.S. President Theodore Roosevelt, the defeated Russians recognized Japan as the dominant power in Korea and turned over their leases of Port Arthur and the Liaotung Peninsula, as well as the southern half of Sakhalin Island, to Japan. Both powers agreed to restore Manchuria to China.

Portugal, officially PORTUGUESE REPUBLIC, Portuguese PORTUGAL, or REPÚBLICA PORTUGUESA, country lying along the Atlantic coast of the Iberian Peninsula in southwestern Europe and covering an area of 35,672 square miles (92,389 square km). Administratively, the Atlantic islands of the Azores and Madeira



Portugal

are also part of Portugal. The capital is Lisbon. Iberian Portugal is bordered on the east and the north by Spain and on the west and the south by the Atlantic Ocean. The population in 1990 was estimated to be 10,434,000.

A brief treatment of Portugal follows. For full treatment, *see* MACROPAEDIA: Portugal.

For current history and for statistics on society and economy, *see* BRITANNICA WORLD DATA ANNUAL.

Iberian Portugal is divided roughly in half by the Tagus River, which enters the country midway along its eastern boundary with Spain and flows southwestward to one of the country's few natural harbours at Lisbon. Highlands exceeding 2,300 feet (700 m) in elevation occupy less than 12 percent of the country and rise mostly north of the Tagus and stretch northeastward into Spain. The country's highest point, 6,539 feet (1,993 m) above sea level, is located in the Serra da Estrela, the most prominent of Portugal's ranges. Northward from the Serra da Estrela, the westward extension of the Spanish Meseta (a major plateau region) blends into the coastal littorals as they stretch southward along the Atlantic seaboard. South of the Tagus River the coastal lowlands combine with the gently rolling landscape inland to form a predominantly low-lying countryside. The southern lowlands average only about 500 feet (150 m) above sea level, and only 3 percent rise to more than 1,300 feet (400 m). The country's only seismically active region lies offshore along the mostly submerged Gibraltar–Azores Ridge. One of Europe's most severe earthquakes occurred along this ridge in 1755, creating a tidal wave that inundated Lisbon and killed at least 60,000 persons.

Portugal has mild, humid winters and relatively equable, dry summers. Lisbon has an average daily temperature in January of 52° F (11° C) and in July of 72° F (22° C); it receives 28 inches (700 mm) of precipitation annually.

Nearly one-third of Portugal's land area is arable, and more than one-third of it is devoted to cereal crops (mostly wheat and corn [maize]). The extremely dry summer months of June through August receive less than 4 percent of the annual rainfall, and 20 percent of all cropland must be irrigated. Although only 6 percent of its land area is in permanent pasture, Portugal supports sheep, pigs, and cattle. The 40 percent of the land area covered by forests and woodland lies mostly in the northern highlands. Forests of oak, beech, chestnut, and pine are found in the north, cork and holm oaks in the central areas, and steppelike brush and grasslands in the south. Both cultivated and wild olives thrive throughout the country. Wildlife is sparse, but wild goat, wild pig, deer, and some wolves can still be found in remote mountainous areas.

Portugal is poor in natural resources, with its major minable resource, tungsten, contributing less than 4 percent of the world's supply. Its Moncorvo iron-ore deposits have not been fully developed. Totally lacking in petroleum and natural-gas reserves, Portugal's energy resources comprise modest reserves of anthracite coal and uranium.

The people. The population of Iberian Portugal is one of the most homogeneous in Europe, having physical characteristics common to circum-Mediterranean peoples. Portugal's location at the western extremity of Europe made it a gathering place for invaders by land, and its long coastline invited settlement by seafarers. The Romans, Suebi, Visigoths, Moors, and Jews all exerted influence on the territory. Most Portuguese are of slightly smaller than average stature (for Europeans), with brown eyes, dark wavy hair, and a pallid or brunet skin. Freedom of worship is permitted, and most of the population is Roman Catholic. Portuguese is a Romance language and the principal language of the country. The Azores and Madeira are inhabited by persons of Portuguese descent.

Portugal is still largely (70 percent) rural. Population and settlement patterns reveal striking contrasts between the more densely populated north and the more sparsely populated south. A number of rural areas have suffered considerable population losses, particularly in parts of the north, the central east, and the southern coastal areas. The coastal zones between Braga and Setúbal, with their low-lying plains and urban development, have attracted a large proportion of the population. Areas such as Minho, the central plains, and the coastal areas of the Algarve are seriously overpopulated.

The nation has one of the highest birth rates in Europe; its infant mortality rate is also high. Almost one-fourth of the population is under 15 years of age. Life expectancy at birth is about 70 years for men and 77 years for women.

The economy. Portugal has an industrialized economy in which both the public and the private sectors participate. Major industries were nationalized after the coup of 1974, and extensive land reform was initiated. Beginning in the late 1980s the government's policy was eventually to return most of the firms nationalized since 1975 to the private sector and to compensate former owners of appropriated land. The gross national product (GNP) is growing more rapidly than the population. The GNP per capita, however, is the lowest in western Europe.

Agriculture accounts for less than one-tenth of the GNP and provides jobs for approximately one-fifth of the work force. Agricultural output declined sharply after the chaotic implementation of land reform in 1975, and during the 1980s Portugal had to import much of its food. Portugal's investments in irrigation, fertilizer, and agricultural machinery are inadequate, and its agricultural productivity is among the lowest in Europe. Production of wheat, the chief staple, and corn (maize) do not meet domestic demand. Agricultural exports include port and Madeira wines, tomato paste, figs, and cork. Production of beef, pork, cheese, and butter falls short of domestic demand.

Tungsten is the only mineral mined in large quantities for export. Construction materials are quarried primarily for local use. Small quantities of coal are mined, but petroleum and natural gas must be imported.

The manufacturing sector accounts for more than one-fourth of the GNP and employs more than one-fifth of the work force. Light industries predominate, and most factories employ fewer than five workers. Major manufactures include textiles and clothing, footwear, paper products, canned fish, cork and wood products, electrical appliances, and chemicals. Heavy industries are concentrated around Lisbon and specialize in the construction and repair of ships. Approximately one-half of the nation's electricity is generated from hydroelectric power and the remainder from imported fuels. Per capita consumption of electricity is below that of most European countries.

More than 16,000,000 tourists visit Portugal each year and are a major source of foreign exchange. Machinery and transport equipment, crude petroleum, iron and steel products, and chemicals dominate imports; clothing and wearing apparel, footwear, paper and paper products, ships and boats, and cork and other wood products are the chief exports. The nations of western Europe are Portugal's chief trading partners; trade with former Portuguese colonies is negligible.

Government and social conditions. Portugal is a republic with a parliamentary form of government. Its 1976 constitution (revised in 1982) vests legislative power in the unicameral Assembly of the Republic, which has 250 members directly elected to four-year terms. The president is the head of state, and the prime minister, who heads the Council of Ministers (cabinet), is the head of government. The president is directly elected to a five-year term; he names the prime minister, who must have the support of the majority of the Assembly. Portugal has a diversity of political parties, and coalition governments predominate. The judicial system is composed of the Supreme Court, courts of appeal, and district and special courts.

Portugal's social security provisions include old-age and disability pensions; sickness, maternity, and unemployment benefits; and family allowances. Contributors to the national health insurance scheme receive free medical consultation; plans exist to provide free medical services evenly throughout the country. Public health standards are high, though somewhat lower than those of other western European countries. Modern medical facilities are widely available, and the number of health personnel is adequate. The most serious infectious diseases have been eradicated or controlled.

Primary education is free and compulsory between the ages of 6 and 14; modest fees are charged in state secondary schools, but scholarships are available. Technical and vocational education is well developed, and there are numerous universities. Portugal's oldest institution of higher education, Coimbra University, was founded in 1290 in Lisbon.

Most daily newspapers are privately owned. The constitution guarantees freedom of the press, and overt censorship has largely ended. Radio and television, nationalized in 1975, were partly returned to private ownership in the 1980s.

Cultural life. The tendency of modern Portuguese fiction toward realism can be seen in the works of José Maria Eça de Queirós and José Maria Ferreira de Castro, but traditional lyric poetry still flourishes. Painting and sculpture in the 20th century have been experimental. Maria Helena Vieira da Silva is an acclaimed contemporary abstract painter. Folk traditions survive; folk music and dancing and the traditional *fado,* a song form that expresses the sad, romantic mood of the nation, remain the country's fundamental forms of musical expression.

History. Human habitation in the Iberian Peninsula is at least 500,000 years old, but the first distinct culture found in Portugal dates from about 5500 BC. In the 1st millennium BC, Celtic peoples settled the peninsula, frequently intermarrying with the indigenous population to form the Celtiberians. The Portuguese Celts, known as Lusitanians, had not engaged in such intermarriage. Despite their fierce resistance, the Romans subdued them in about 140 BC.

Roman authority waned in the opening years of the 5th century AD, and a Germanic people, the Suebi, overran much of the peninsula. In 469 the Romans sent the Visigoths to subdue them and the Suebi monarchy was destroyed. They regained a measure of autonomy about a hundred years later, but a Muslim invasion in 711 left only the northern part of Portugal

Kings and queens regnant of Portugal

House of Burgundy	
Henry (Henrique)	1095–1112
Afonso I	1112–85
Sancho I	1185–1211
Afonso II	1211–23
Sancho II	1223–*c.* 1246
Afonso III	*c.* 1246–79
Dinis	1279–1325
Afonso IV	1325–57
Peter I (Pedro)	1357–67
Ferdinand I (Fernando)	1367–83
Leonor Teles (regent)	1383–85
House of Avíz	
John I (João)	1385–1433
Edward (Duarte)	1433–38
Afonso V	1438–81
John II (João)	1481–95
Manuel I	1495–1521
John III (João)	1521–57
Sebastian (Sebastião)	1557–78
Henry (Henrique)	1578–80
House of Habsburg (union with Spain)	
Philip I (Filipe)	1580–98
Philip II (Filipe)	1598–1621
Philip III (Filipe)	1621–40
House of Bragança (Braganza)	
John IV (João)	1640–56
Afonso VI	1656–67
Peter II (Pedro)	1667–1705
John V (João)	1705–50
Joseph (José)	1750–77
Maria I and Peter III (Pedro)	1777–1816
John VI (João)	1816–26
Peter IV (Pedro)	1826
Maria II	1826–28
Michael (Miguel)	1828–34
Maria II (restored) and Ferdinand II (from 1837)	1834–53
House of Saxe-Coburg-Gotha-Koháry	
Peter V (Pedro)	1853–61
Louis (Luis)	1861–89
Charles (Carlos)	1889–1909
Manuel II	1909–10

in Christian hands. This area was known as the county of Portugal and was the point from which the reconquest of what was to become modern Portugal began. Not until 1179, under Afonso Henriques, did the county of Portugal become a kingdom. Subsequent kings continued the reconquest until 1270, when under Afonso III the boundaries of modern continental Portugal were completed.

The throne passed to the house of Aviz in 1385. Under the Aviz monarchs, Portugal became one of Europe's first centralized states. The Aviz monarchy also encouraged an exploratory bent that eventually took Portuguese voyagers to Africa, India, Indonesia, China, the Middle East, and South America. When the Aviz line died out in 1580, the throne passed to Spain through marriage. Spanish rulers neglected Portugal, and revolution in 1640 removed them and gave the throne to the Portuguese Bragança family.

The Napoleonic Wars of the early 19th century forced the removal of the royal family to Brazil in 1807. Brazil was elevated to kingdom status in 1815 and united with Portugal. In the absence of the monarch, a constitutional assembly met in Portugal in 1820. It completed a document accepted by John VI, who returned from Brazil in 1821. Strife between constitutionalists and absolutists developed, and a dynastic civil war followed. Though the civil war came to an end in 1834, political instability continued until a revolution overthrew the monarchy in 1910 and a republic was established. The republic also had a stormy existence and was replaced by a military coup in 1926. This government ultimately fell into the hands of António de Oliveira Salazar, who, as minister of finance (1928–40) and premier (1932–68) ruled Portugal as a virtual dictator. His colonial policies embittered military leaders who were forced to wage difficult battles in Africa, and they staged a coup in 1974. Decolonization followed rapidly. Originally Marxist oriented, the military establishment became more centrist by the early 1980s. A revision of the constitution in 1982 excluded left-wing phraseology as civilian rule resumed.

Portugalete, town, Vizcaya (Biscay) *provincia,* in the autonomous Basque Country (País Vasco), northern Spain. The town, a northwestern suburb of Bilbao, lies at the mouth of the Nervión River, on the western side of Bilbao Bay. It was founded in 1322 by María Díaz de Haro, wife of the infante Don Juan, prince of Castile, and was named for its function as a *portus galorum* (Latin: "galley-slave port").

Portugalete has metalworks, a boiler factory, and a soybean-processing plant. It is linked to Las Arenas (Guecho) on the opposite shore of the Nervión Estuary by a lofty transporter–suspension bridge, Vizcaya Bridge, built (1893) by Alberto Palacio, a native son. The town's Gothic church of Santa María dates from the 13th century. Pop. (1981) 57,534.

Portuguesa, *estado* ("state"), northwestern Venezuela, bordered by the states of Lara (north), Cojedes (east), Barinas (south), and Trujillo (west). The northwestern portion of the territory of 5,900 square miles (15,200 square km) is in the Cordillera de Mérida, the rest being in the Llanos (plains). Although livestock raising dominates the economy, rice, coffee, cotton, tobacco, cocoa, and corn (maize) also are grown. At Turén Viejo a government-sponsored agricultural community was established to develop methods, including the application of modern technology, to bring the vast Llanos under cultivation. The shrine of Our Lady of Coromoto, patron of Venezuela, is associated with the parish church in Guanare, the state capital, and thousands visit the city annually to pay homage to the venerated image. Acarigua is the principal commercial centre. Both Guanare and Acarigua are served by all-weather highways. Pop. (1989 est.) 589,421.

Portuguese East Africa: *see* Mozambique.

Portuguese language, Portuguese PORTUGUÊS, Romance language spoken in Portugal, Brazil, and Portuguese colonial and formerly colonial territories. Galician, spoken in northwestern Spain, is a dialect of Portuguese. Written materials in Portuguese date from a property agreement of the late 12th century, and literary works appeared in the 13th and 14th centuries.

Standard Portuguese is based on the dialect of Lisbon. Dialectal variation within the country is not great, but Brazilian Portuguese varies from European Portuguese in several respects, including several sound changes and some differences in verb conjugation and syntax; for example, object pronouns occur before the verb in Brazilian Portuguese, as in Spanish, but after the verb in standard Portuguese. The four major dialect groups of Portuguese are Northern Portuguese, or Galician, Central Portuguese, Southern Portuguese (including the dialect of Lisbon), and Insular Portuguese (including Brazilian and Madeiran). Portuguese is often mutually intelligible with Spanish despite differences in phonology, grammar, and vocabulary.

Typical of the Portuguese sound system is the use of nasal vowels, indicated in the orthography by *m* or *n* following the vowel (*e.g., sim* "yes," *bem* "well") or by the use of a tilde (~) over the vowel (*mão* "hand," *nação* "nation"). In grammar its verb system is quite different from that of Spanish. Portuguese has a conjugated or personal infinitive and a future subjunctive and uses the verb *ter* (Latin *tenere,* Spanish *tener* "to have, to hold") as an auxiliary verb instead of *haver* (Latin *habere,* Spanish *haber* "to have"; in Spanish used only as an auxiliary verb).

Portuguese literature, the body of writings in the Portuguese language by the peoples of Portugal and the isles of Madeira and Azores. Portuguese is also the language of Brazil, Angola, Mozambique, Guinea-Bissau, and Cape Verde.

A brief treatment of Portuguese literature follows. For full treatment, *see* MACROPAEDIA: Portuguese Literature.

Portuguese emerged as a Romance language in the 13th century, and in about 1350 the language spoken in the areas of Coimbra and Lisbon was adopted as standard speech. Portuguese literature showed great originality in the lyric poetry of the early medieval period. The love poems expressing the yearnings of a young woman for her beloved were deeply rooted in the oral tradition and distinguished themselves among the many influences that dominated the peninsula. Written in Galician-Portuguese, these poems have a freshness of their own that contrasts with the more sophisticated love-songs that followed Provençal and French models. In the 15th century the Italian fashions of poetry brought by the Renaissance began to alter the established patterns and introduced a new concern with nature and death. Following the end of the national war against Castile (1411), the post of official chronicler was created by the crown. Historiography became a major genre in Portugal in which objective reporting and the portraiture of kings and great men stood out as its most important features. Fernão Lopes was the great chronicler of the 15th century and remains unsurpassed in his description of the crowded events of the time.

The voyages of discovery and the overseas expansion of the 16th century provided a wide subject to Lopes' successors. They were to introduce a note of exoticism and adventure in their work, which later appeared in poetry and the pastoral novel. The winds of change carried by the Renaissance were tempered by the national mood and the awareness of historic deeds that were being performed by the Portuguese. Luís de Camões expressed better than any other national poet both in lyric and epic verse the individual anguishes and the glories of the age. In the early 16th century court drama also made its appearance. Gil Vicente wrote and produced charming plays of a genuinely popular inspiration with a strong appeal to his public that was never lost to the new classical drama.

Nearly 50 years after the discovery of Brazil in 1500, the Portuguese established themselves firmly on the coast and began to develop their South American colony. After King Sebastian's death in 1578, Portugal became part of Spain, remaining so until 1640. This was a difficult period for Portuguese literature, but the Spanish influence did not stifle literature in the vernacular. In Brazil the Portuguese moved inland, expanding the borders of the new country. Antônio Vieira was the great orator and prose writer who kept the unity of Brazil under Portuguese influence. Inside Portugal the tradition of pastoral poetry was brilliantly maintained and the religious and moral dialogue attained a highly refined style.

In the 18th century Portuguese literature went through a period of renewal and came under the influence of French literary and philosophical ideas. Neoclassicism in poetry was strictly formalist, having lost all the vitality of true classicism. In the late 18th century the individual voice of the poet broke through literary conventions and heralded a new style and mood in lyric verse. The theatre was retrieved from gradual decline by the work of Antônio José da Silva, the Brazilian-born author, whose enormous popularity and socially critical plays made him a victim of the Inquisition.

Romanticism came in the wake of the 19th-century liberal revolution that introduced a constitutional monarchy into the country. It was an age of revival and innovation in a climate of intellectual freedom. Drama and fiction flourished while poetry became introspective and concerned with great social questions. In 1870 a young generation of writers added a new impetus to the task of modernizing Portugal. They brought a new critical attitude to literature that fostered the appearance of realism in fiction and poetry. José Maria de Eça de Queirós and Cesário Verde are the most distinguished representatives of this movement.

In the 20th century modernism and literary experimentation have given a new outlook to Portuguese literature. The poetry of Fernando Pessoa has won universal acclaim, and women novelists broaden the scope of a narrative fiction that has entered a period of brilliant innovation.

In 1822 Brazil won independence from Portugal and developed an exciting literature of its own. In the 20th century—with such writers as Gilberto Freyre, Graciliano Ramos, Jorge Amado, and Érico Veríssimo—Brazil became perhaps the centre of the most vigorous literature in the Portuguese language. (*See also* Latin-American literature.)

Portuguese man-of-war (genus *Physalia*), any of various invertebrate, jellylike marine animals of the class Hydrozoa (phylum Cnidaria) noted for their floating habit and powerful sting.

The man-of-war, although found in warm seas throughout the world, occurs most commonly in the Gulf Stream of the northern Atlantic Ocean and in the tropical and subtropical regions of the Indian and Pacific oceans; it is sometimes found floating in groups of thousands. *Physalia physalis* is the only widely distributed species. *P. utriculus,*

Portuguese man-of-war (*Physalia physalis*) eating a fish
Douglas P. Wilson

commonly known as the bluebottle, occurs in the Pacific and Indian oceans.

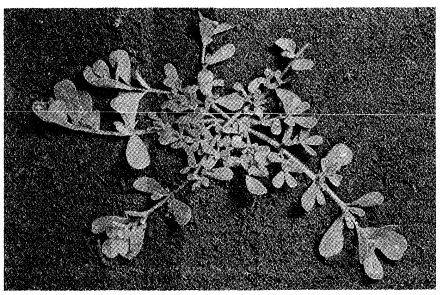
The body consists of a gas-filled, bladderlike float, which may be 9 to 30 centimetres (3 to 12 inches) long and may extend 15 centimetres above the water. It is a translucent structure tinted pink, blue, or violet. Beneath the float are clusters of polyps, from which hang tentacles of up to 50 metres (about 165 feet) in length. The polyps are of three types: dactylozooid, gonozooid, and gastrozooid, concerned, respectively, with capturing prey, with reproducing, and with feeding.

The animal moves by means of its crest, which functions as a sail. The reproductive habits of *Physalia* are not fully understood.

Tentacles of the dactylozooids bear nematocysts, stinging structures, that paralyze small fish and other prey. The gastrozooids then attach to the immobilized victim, spread over it, and digest it. The Portuguese man-of-war, in turn, is eaten by other animals, including the loggerhead turtle (*Caretta caretta*). The fish *Nomeus gronovii,* about eight centimetres long, lives among the tentacles of *Physalia* and is almost immune to the poison from the stinging cells. *Nomeus* feeds on the tentacles, which are constantly regenerated; sometimes the fish is eaten by *Physalia.*

The sting of *Physalia* is very painful to man and can cause serious effects, including fever, shock, and interference with heart and lung action.

Portulacaceae, the purslane family of flowering plants, in the order Caryophyllales, with about 15 genera and 500 species of herbs or small shrubs, native primarily to the Pacific coast of North America and southern South



Purslane (*Portulaca oleracea*)
Grant Heilman—EB Inc.

America. Members of the family have leaves that often are fleshy and sometimes form rosettes at the base of the plant. There are no true petals; each flower has two to six sepals (petallike structures).

Portulaca is a genus of about 100 species of weedy, small-leaved plants. Rose moss (*P. grandiflora*), a trailing fleshy species, is cultivated as a garden ornamental for its bright coloured, sometimes doubled flowers. Purslane, or pusley (*P. oleracea*), is a common garden weed with small yellow flowers and thick, shiny, spoon-shaped leaves. Spring beauty (*Claytonia virginica*) is a white-flowered, slender wild flower sometimes cultivated in wild gardens. Plants of the genus *Lewisia,* such as bitterroot (*L. rediviva*), are often planted in rock gardens, as are rock pink (*Talinum calycinum*) and rock purslane or red maids (species of *Calandrinia*). Plants of the genus *Montia* are grown as ornamentals, and the leaves of miner's lettuces, or winter purslane (*M. perfoliata*), are edible.

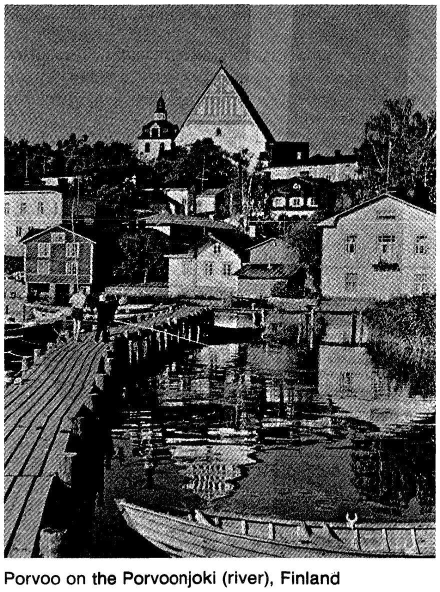
Portus, harbour town of imperial Rome. The artificial harbour at Portus, constructed by the emperor Claudius I (AD 41–54) to replace Ostia (*q.v.*), was connected to Rome by canal and the Tiber River.

After about 200 ships were lost in the harbour during a storm in AD 62, Trajan added a second harbour, a landlocked inner basin, joined to the Claudian harbour by canal. Portions of its facilities remained in use until modern times.

Porus (fl. 4th century BC), Indian prince who ruled the region between the Hydaspes (Jhelum) and Acesines (Chenāb) rivers at the time of Alexander III the Great's invasion (327–326 BC) of the Punjab. Unlike his neighbour, Āmbhi, the king of Taxila (Takṣaśilā), Porus resisted Alexander. But with his elephants and slow-moving infantry bunched, he was outmatched by Alexander's mobile cavalry and mounted archers in the battle of the Hydaspes. Impressed by his techniques and spirit, Alexander allowed him to retain his kingdom and perhaps even ceded some conquered areas to him. Thereafter a supporter of Alexander, Porus held the position of a Macedonian subordinate ruler when he was assassinated, sometime between 321 and 315 BC, by Eudamus' agents after the death of Alexander.

Not known in Indian sources, the name Porus has been conjecturally interpreted as standing for Paurava; *i.e.,* the ruler of the Pūrus, a tribe known in that region from ancient Hindu Vedic times.

Porvoo, Swedish BORGÅ, city, Uudenmaan *lääni* (Uusimaa province), southern Finland, at the mouth of the Porvoonjoki (river) on the Gulf of Finland, northeast of Helsinki. A large number of the population is Swedish speaking. One of Finland's oldest communities, it



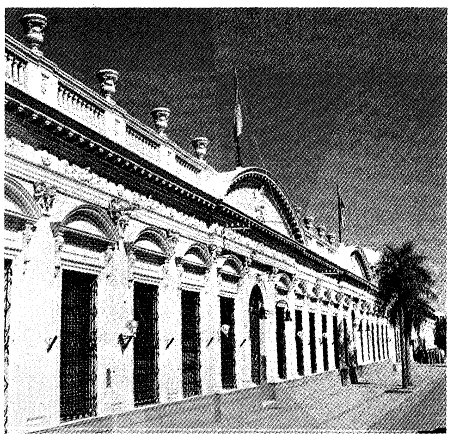
Porvoo on the Porvoonjoki (river), Finland
By courtesy of the Embassy of Finland, Washington, D.C.

has been a trade centre since the early 14th century and received town rights in 1346. It has been the seat of a bishopric since 1723. In 1809 the Finnish Diet, in session at Porvoo, swore allegiance to Tsar Alexander I of Russia, who there granted Finland semiautonomy as a grand duchy. Porvoo's development has suffered from war, fires, and its proximity to prosperous Helsinki. Best known as a cultural centre, it was the home of the national poet Johan Ludvig Runeberg and the sculptor Walter Runeberg. The medieval granite cathedral (1414–18) houses a bronze commemorating Finland's allegiance to Alexander I. The town hall dates from 1764. Local industries include lumber mills, shipping, wood and ceramic works, and one of Finland's largest publishing houses. Pop. (1982 est.) mun., 19,226.

Posada, José Guadalupe (b. Feb. 2, 1851, Aguascalientes, Mex.—d. Jan. 20, 1913, Mexico City), printmaker whose works, often expressionistic in content and style, were influential in the development of 20th-century Mexican art.

As a child Posada worked as a farm labourer and in a pottery factory. He taught school for a short time and then began to draw, inspired largely by posters for the Rea Circus. Gradually he was attracted to printmaking; he became a kind of pictorial journalist with the publication of thousands of broadside illustrations and popular book and song covers. Most of his works were engraved or etched in relief on type metal.

Posadas, city, capital of Misiones province, Argentina, bordered (north and east) by the



The Governor's Palace, Posadas, Arg.
Art Resource—EB Inc.

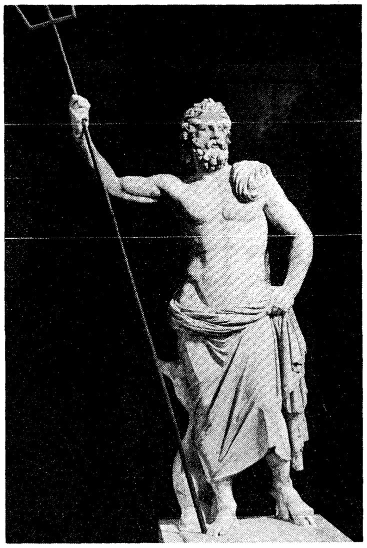
Río Paraná, which separates it from Encarnación, Paraguay. The settlement originated as a Paraguayan trading post and river port, known as Trinchera de los Paraguayos (Trench of the Paraguayans). In 1869, during the Paraguayan War (War of the Triple Alliance), however, the name was changed to Trinchera de San José. In 1879 the city was named after the national hero, Gervasio Antonio Posadas (1757–1833). An administrative centre, with a substantial portion of its population working in public service, Posadas is also important for manufacture of wood and iron products. A ferry between Posadas and Encarnación links Argentinian and Paraguayan railways. Pop. (1980 prelim.) 139,941.

Poseidon, in Greek religion, god of the sea and of water generally; he is to be distinguished from Pontus, the personification of the sea and the oldest Greek divinity of the waters. The name Poseidon means either "husband of earth" or "lord of the earth." Traditionally he was a son of Cronus, an ancient chief god, and Rhea, a fertility goddess, and was brother of Zeus, the chief god, and Hades, god of the underworld. When the three brothers deposed their father, the kingdom of the sea fell by lot to Poseidon. His weapon was the trident, but it may originally have been a long-handled fish spear.

Poseidon was also the god of earthquakes, and many of his oldest places of worship in Greece were inland. He was, in addition, closely associated with horses. He was the father of the winged horse Pegasus by the winged monster Medusa. Most scholars agree that Poseidon was brought to Greece as the god of the earliest Hellenes, who also introduced the first horses to the country.

Although Poseidon lost a contest for sovereignty over Attica to the goddess Athena, he was also worshiped there, particularly at Colonus, as *hippios* ("of horses"). Elsewhere he was associated with freshwater springs. Poseidon was the father of Pelias and Neleus by Tyro, the daughter of Salmoneus, and thus became the divine ancestor of the royal families of Thessaly and Messenia. Otherwise his offspring were mostly giants and savage creatures, such as Orion, Antaeus, and Polyphemus. The general view of his character was violent.

The chief festival in Poseidon's honour was the Isthmia, the scene of famous athletic contests, celebrated in alternate years near the Isthmus of Corinth. His character as a sea god became the most prominent in art, and he was represented with the attributes of the



Poseidon, marble statue from Melos, 2nd century BC; in the National Archaeological Museum, Athens

Alinari—Art Resource/EB Inc.

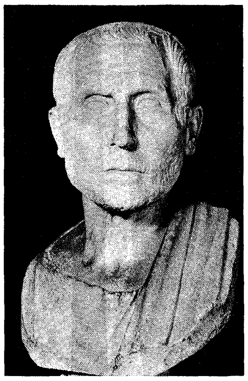
trident, the dolphin, and the tunnyfish. The Romans, ignoring his other aspects, identified him as sea god with Neptune (*q.v.*).

Poseidon missile, U.S. submarine-launched ballistic missile introduced in 1971 to replace the Polaris missile. The two-stage Poseidon had about the same range as its predecessor (2,800 miles [4,500 km]), but it could carry up to 14 independently targetable nuclear warheads and deliver them with twice the accuracy. The multiple warheads effectively quadrupled the arsenal of each submarine, while the greater accuracy allowed each warhead to be reduced to a blast effect, or yield, of 50 kilotons (one-quarter that of each Polaris warhead).

At the height of the Poseidon program, 31 nuclear-powered submarines carried 16 missiles each. In 1979 the Poseidon began to be phased out in favour of the longer-range Trident missile.

Poseidonia (Italy): *see* Paestum.

Poseidonius, also spelled POSIDONIUS (b. *c.* 135 BC—d. *c.* 51 BC), Greek philosopher, considered the most learned man of his time and, possibly, of the entire Stoic school.



Poseidonius, bust; in the Museo Archeologico Nazionale, Naples

By courtesy of the Museo Nazionale, Naples

Poseidonius, nicknamed "the Athlete," was a native of Apamea in Syria and a pupil of the Greek Stoic philosopher Panaetius. He spent many years in travel and scientific research in Spain, Africa, Italy, Gaul (modern France), Liguria, and Sicily. When he settled as a teacher at Rhodes, his adopted Greek city, his fame attracted numerous scholars. By his writings and his personal relations, he did more to spread Stoicism in the Roman world than anyone else except Panaetius. He was known to many leading men of his time, including the Roman statesman Cicero, who studied under him in 78–77 and whom he mentioned as a friend. Such other Roman writers as Strabo and Seneca provide the major source of knowledge about his life; until the 20th century scholars accorded him only a minor place in the development of Stoicism.

The titles and subjects of more than 20 of his works, now lost, are known. Like other Stoics of the middle period in the school's history, Poseidonius was an eclectic who combined the views of older Stoics and of Plato and Aristotle. His well-known ethical doctrine diverged from contemporary Stoicism, however, in asserting that human passions are inherent qualities, not mere faulty judgments. Also interested in natural science, geography, astronomy, and mathematics, Poseidonius tried to calculate the diameter of the Earth, the influence of the Moon on tides, and the distance and magnitude of the Sun. His history of the period 146–88 BC filled 52 volumes and was undoubtedly a storehouse of knowledge for early writers. A gifted dialectician, Poseidonius was notable for his powers of observation, his travel reports, his ironic humour, and his practice of Stoic doctrine.

To make the best use of the Britannica, consult the INDEX *first*

Posen (Poland): *see* Poznań.

posey (floral bouquet): *see* nosegay.

position vector, straight line having one end fixed to a body and the other end attached to a moving point and used to describe the position of the point relative to the body. As the point moves, the position vector will change in length or in direction or in both length and direction. If drawn to some scale, the change in length will signify a change in the magnitude of the vector, while a change in direction will signify a rotation of the vector. Changes in magnitude and direction are the only changes that a position vector can experience, and the velocity of the point is defined as the time rate of change of the position vector.

For a point moving on a straight path, a position vector coinciding with the path is the most convenient; the velocity of the point is equal to the rate at which the magnitude of the vector changes with respect to time, and it will be a vector lying along the line. For a point moving on a circular path, a position vector coinciding with a radius of the circle is the most convenient; the velocity of the point is equal to the rate at which the direction of the vector changes with respect to time, and it will be a vector at right angles to the position vector. For a point moving on a noncircular curved path, the position vector changes in both magnitude and direction; the velocity of the point is the sum of the two rates of change, one a vector along the position vector and the other a vector at right angles to it.

positive organ (from Latin *ponere:* "to place"), in Western music, small organ used in liturgical and, at times, in secular music from the 10th to the 17th century. It had short legs and was set on a table or the floor; two persons with a cart could move it. Two persons were also needed to operate it, the player and a second person who worked hand or foot bellows. There was one manual, or keyboard, and a limited selection of flue (flutelike) stops and, later, reed stops.

The positive organ declined as technical improvements were made in large church organs;

Positive organ, 15th century, engraving by Israel van Meckenem; in the Bibliothèque Nationale

By courtesy of the Bibliotheque Nationale, Paris

in the 20th century, positives were occasionally reintroduced into small churches. The secular positive organ developed into the 18th-century chamber organ.

positivism, in philosophy, generally, any system that confines itself to the data of experience and excludes a priori or metaphysical speculations. More narrowly, the term positivism designates the philosophy of Auguste Comte (1798–1857).

A brief treatment of positivism follows. For full treatment, *see* MACROPAEDIA: Philosophical Schools and Doctrines, Western.

In its general sense the term is commonly applied to the empiricist philosophers, although in fact reservations ought to be made (John Locke and David Hume accept mathematics, Locke and George Berkeley accept a knowledge of the soul and of God, on nonempirical grounds). John Stuart Mill's "experience philosophy" is positivistic in this sense. Positivists have usually held that theological and metaphysical questions arise but cannot in fact be answered by any method available to men. Other positivists, however, have dismissed such questions as meaningless. This second view connects with pragmatism and with logical positivism and also with the hints to be found in Berkeley and in Hume of an experience test of meaning. Positivism emphasizes the achievements of science, but questions arise even within the sciences that do not seem to be answerable by experimental methods. Ernst Mach attempted to assign an experience meaning to such theoretical questions and to relate theories directly to the evidence for them.

The positivism of Auguste Comte held that human thought had passed inevitably through a theological stage into a metaphysical stage and was passing into a positive, or scientific, stage. Comte held that the religious impulse would survive the decay of revealed religion and ought to have an object. He projected a worship of man, with churches, calendar, and hierarchy. Disciples (Frederic Harrison, Richard Congreve, and others) founded such a church in England, but Mill, who inclined to accept the religion, repudiated Comte's organization.

positron, also called POSITIVE ELECTRON, any positively charged subatomic particle having the same mass and magnitude of charge as the electron and constituting the antiparticle of a negative electron. Positrons were the first of the antiparticles to be predicted and discovered. P.A.M. Dirac postulated their existence (1930–31) to account for the otherwise superfluous negative energy states of the electron that were predicted by his relativistic electron theory (1928), and Carl David Anderson established their existence (1932) while studying cloud-chamber photographs of cosmic rays.

Stable in a vacuum, positrons quickly react with the electrons of ordinary matter by annihilation to produce gamma radiation. Positrons are emitted in the positive beta decay of proton-rich (neutron-deficient) radioactive nuclei and are formed in pair production, in which the energy of a gamma ray in the field of a nucleus is converted into an electron-positron pair.

positron emission tomography (PET), imaging technique used in diagnosis and biomedical research. It has proved particularly useful for studying brain and heart functions and certain biochemical processes involving these organs (*e.g.,* glucose metabolism and oxygen uptake). In PET, a chemical compound "labeled" with a short-lived, positron-emitting radionuclide of carbon, oxygen, nitrogen, or fluorine is injected into the body. The activity of such a radiopharmaceutical is quantitatively measured throughout the target organs by means of photomultiplier-scintillator detectors. As the radionuclide decays, positrons are annihilated by electrons, giving rise to gamma rays that are detected simultaneously by the photomultiplier-scintillator combinations positioned on opposite sides of the patient. The data from the detectors are analyzed, integrated, and reconstructed by means of a computer to produce images of the organs being scanned.

positronium, short-lived hydrogen-like atom composed of an electron and a positron (rather than an electron and a proton) arising as a positron is slowed down in matter and captured by an electron. Two forms are known. Parapositronium, in which the spins of the positron and electron are oppositely directed, decays by annihilation into two photons, with a mean life of about one-tenth of a nanosecond (or 10^{-10} second; a nanosecond is 10^{-9} second); and orthopositronium, in which the spins are in the same direction, annihilates into three photons with a mean life of about 100 nanoseconds (10^{-7} second). The properties of positronium corroborate the quantum theory of electrodynamics for a two-particle system.

posse comitatus (Latin: "force of the county"), ancient English institution consisting of the shire's force of able-bodied private citizens summoned to assist in maintaining public order. The posse comitatus, originally raised and commanded by the sheriff, became a purely civil instrument as the sheriff's office lost its military functions. From time to time, legislation gave authority to other peace officers and magistrates to call upon the power of the county.

In early times, attendance at the posse comitatus was enforced by the penalty of culvertage, or turntail, involving forfeiture of property and perpetual servitude. Although the primary object of the posse comitatus was then to maintain peace and pursue felons under the command of the sheriff, it was also bound to obey a summons for the military defense of the country.

In the United States the posse comitatus was perhaps most important on the Western frontier (there known as a posse), but it has been preserved as an institution in many states. Sheriffs and other peace officers have the authority to summon the power of the county. In some counties it is a crime to refuse assistance. In general, members of a posse comitatus have been permitted to use force if necessary to achieve a posse's legitimate ends, but state laws differ as to the legal liability of one who in good faith aids an officer himself acting beyond his authority.

possession, in law, the acquisition of either a considerable degree of physical control over a physical thing, such as land or chattel, or the legal right to control intangible property, such as a credit—with the definite intention of ownership. With respect to land and chattel, possession may well have started as a physical fact, but possession today is often an abstraction. A servant or an employee, for instance, may have custody of an object, but he does not have possession; his employer does, even though he may be thousands of miles from the object he owns. Furthermore, except in the most abstract way, it is not possible to speak of the possession of intangible property.

In the development of the civil (or Roman) legal system, possession tended to assume more importance than proprietary rights, and the same is true of the common-law (or Anglo-American) system. Thus, possession tends to be regarded as prima facie evidence of the right of ownership; it gives this right against everyone except the rightful owner. Mere possession by a finder is sufficient to provide grounds for an action against one who deprives him of the object with no better right than his own.

possession, in religious and folk traditions, condition characterized by unusual behaviour and a personality change that is interpreted as evidence that the person is under the direct control of an external supernatural power. Symptoms of spirit possession include violent unusual movements, shrieking, groaning, and uttering disconnected or strange speech. Occasionally a normally pious member of a religious body becomes incapable of prayer, utters blasphemies, or exhibits terror or hatred of sacred persons or objects. Christianity and some other religions allow for the possibility that some of these states have an evil transcendental cause (*see* exorcism). Most scientific studies treat them as psychophysical manifestations to be dealt with medically or in terms of social psychology. Some conditions historically termed demonic possession have come to be treated as epilepsy, hysteria, somnambulism, schizophrenia, or other organic or psychological forms of illness.

In some traditions, the "possessed" individual becomes ill and is regarded by his community as having committed some spiritual transgression; recovery is held to require expiation of his sin, often by a sacrifice. In other traditions, the "possessed" person is conceived as a medium for the controlling spirit and functions as an intermediary between spirits and men. His major role is usually to diagnose and heal other spirit-afflicted individuals. In this tradition the trance behaviour of the medium is often self-induced (autohypnotic); it may be stimulated by drugs, drumming, or collective hysteria. In his trance the medium appears genuinely insensible to ordinary stimuli.

possum, in Australia, any member of the phalanger (*q.v.*) family of marsupial mammals. For phalangers called flying possums, *see* glider. For American marsupials of similar name, *see* opossum.

possum shrimp: *see* opossum shrimp.

Post, C(harles) W(illiam) (b. Oct. 26, 1854, Springfield, Ill., U.S.—d. May 9, 1914, Santa Barbara, Calif.), American manufacturer noted for his development of breakfast cereals.

Post grew up in Illinois. His first job, as a traveling salesman for an agricultural concern, took him to the West, but he returned to Illinois at age 26. His interests were wide-ranging, from real-estate investment in Texas to the establishment of La Vita Inn, an institute for healing by means of mental suggestion in Battle Creek, Mich. The business for which he is best known, food manufacturing, was started in 1895.

After a number of experiments, Post produced and marketed his first product—the cereal beverage called Postum—founding the Postum Cereal Co. Ltd. (later [1922], General Foods Corporation), in Battle Creek. Other profitable products were soon developed, notably Grape Nuts (1897) and Post Toasties (1904, originally called Elijah's Manna). His extensive and perceptive advertising campaigns brought him rapid success in the food industry, and he turned his attention to fighting unions, a cause in which he remained active until the end of his life. In 1914 he had surgery for the removal of his appendix, and, while in the process of recovery, he committed suicide.

Post, Emily, *née* PRICE (b. Oct. 27, 1872, Baltimore, Md., U.S.—d. Sept. 25, 1960, New York, N.Y.), authority on social behaviour whose major work, *Etiquette: The Blue Book of Social Usage,* first published in 1922 as *Etiquette in Society, in Business, in Politics and at Home,* had undergone 10 editions and 90 printings by the time of her death.

The daughter of a distinguished architect, Bruce Price, she was born to wealth and social position. When she was five, her family

Emily Post
Brown Brothers

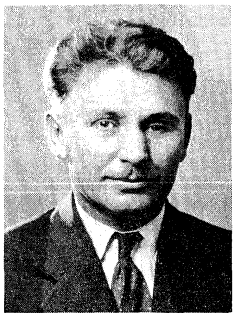
moved to New York City. In 1893 she married a banker, Edwin M. Post, who lost his fortune in the Panic of 1901 and from whom she was afterward divorced, leaving her in straitened circumstances. She began her professional career as a writer of light fiction and magazine articles but then wrote *Etiquette* at the suggestion of her publisher, and the book met with immediate success. While earlier writers on the subject had assumed affluence and elegance on the part of the reader, Post directed her commonsense views to the ordinary person who was aware of the universal need for good manners and consideration for others. A vast flow of letters requesting advice on specific situations inspired her syndicated newspaper column, which eventually appeared in more than 200 papers. For several years she also conducted a radio program.

Post, Pieter (b. 1608, Haarlem, Holland—d. 1669, The Hague), architect who, along with Jacob van Campen, created the sober, characteristically Dutch Baroque style.

By 1633, in collaboration with van Campen, he designed the exquisite Mauritshuis at The Hague, showing in it his mastery of the Dutch Baroque style. In 1645 he became architect to the stadholder Frederick Henry. With van Campen he designed the House in the Wood (Huis ten Bosch) at The Hague (1645–47) and, independently, Swanenburg House (1645), Nieuwkoop almshouses at The Hague (1658), and the weighhouse in Leiden (1658). Post's town hall at Maastricht (1656) is one of the outstanding buildings of the 17th century in the Netherlands. Like van Campen, Post is notable for anticipating some of the architectural refinements of 18th-century France and for the influence he exerted on English architecture.

Post, Wiley (b. Nov. 22, 1899, near Grand Saline, Texas, U.S.—d. Aug. 15, 1935, near Point Barrow, Alaska), one of the most colourful figures of the early years of U.S. aviation, who set many records, including the first solo flight around the world.

Post made his first around-the-world flight June 23–July 1, 1931, accompanied by Harold



Wiley Post, 1931
By courtesy of the Library of Congress, Washington, D.C.

Gatty as navigator; later that year their account of the trip was published as *Around the World in Eight Days.* Post achieved his solo record two years later—July 15–22, 1933. He covered a total of 15,596 miles (25,089 kilometres) in 7 days, 18 hours, 49 minutes. On this flight Post proved the value of navigation instruments, including the automatic pilot.

Two years later he and a passenger, the humorist Will Rogers, were killed when his plane crashed in Alaska.

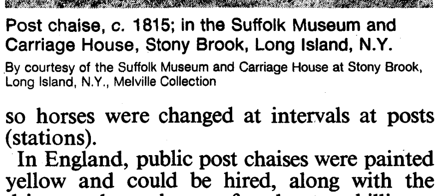
post-and-lintel system, in building construction, a system in which two upright members, the posts, hold up a third member, the lintel, laid horizontally across their top surfaces. All structural openings have evolved from this system, which is seen in pure form only in colonnades and in framed structures, because the posts of doors, windows, ceilings, and roofs normally form part of the wall.

The lintel must bear loads that rest on it as well as its own load without deforming or breaking. Brick or stone, weak in tensile strength (inelastic and brittle), can provide only a short lintel; steel can be used for long lintels. Masonry lintels, depending on the cohesiveness of mortar, are especially weak; therefore, in masonry construction, lintels of monolithic (single slab) stone, wood, and stronger materials are used.

The posts must support the lintel and its loads without crushing or buckling. Post material must be especially strong in compression. Stone has this property and is more versatile in its use as a post than as a lintel. Under heavy loads, stone is superior to wood but not to iron, steel, or reinforced concrete. Masonry posts, including those of brick, may be highly efficient, because loads compress the joints and add to their cohesiveness. Monolithic stone columns are uneconomical to produce for large structures; columns are usually built up of a series of drums (cylindrical blocks). Such ancient structures as Stonehenge, in Britain, were constructed on the post-and-lintel system, which was the basis of architecture from prehistoric to Roman times. The interiors of Egyptian temples and the exteriors of Greek temples are delineated by columns covered by stone lintels. The Greeks substituted wooden beams for stone because the wood required fewer supports and opened up the interior spaces.

The post and lintel were not fundamentally altered until the production of cast-iron columns, which were stronger yet smaller in circumference, thus greatly reducing the mass and weight of buildings. Much modern construction in steel and concrete is based on the post-and-lintel system, restoring the formal simplicity of the oldest structures to modern architecture. The original concept, however, of the duality of post and lintel has been abandoned and post-and-lintel has become a unit with the stresses distributed throughout.

post chaise, four-wheeled, closed carriage, containing one seat for two or three passengers, that was popular in 18th-century England. The body was of the coupé type, appearing as if the front had been cut away. Because the driver rode one of the horses, it was possible to have windows in front as well as at the sides. At the post chaise's front end, in place of the coach box, was a luggage platform. The carriage was built for long-distance travel, and

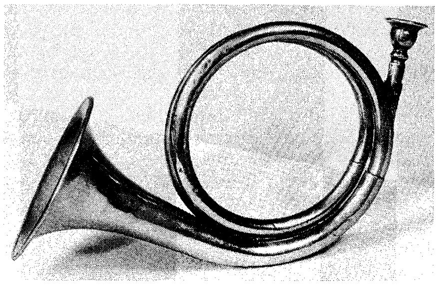


Post chaise, *c.* 1815; in the Suffolk Museum and Carriage House, Stony Brook, Long Island, N.Y.
By courtesy of the Suffolk Museum and Carriage House at Stony Brook, Long Island, N.Y., Melville Collection

so horses were changed at intervals at posts (stations).

In England, public post chaises were painted yellow and could be hired, along with the driver and two horses, for about a shilling a mile. The post chaise is descended from the 17th-century two-wheeled French chaise.

post horn, brass musical instrument of cylindrical bore, used by guards of mail coaches in the 18th and early 19th centuries. At the end of the 18th century, post horns were crescent-shaped, coiled, or straight. The notes they sounded were at most six (harmonics 2 to 7). The post horn gave rise to the cornet in the 19th century, when valves were applied to it.



Coiled post horn, pitched in D, English, 19th century; in the Horniman Museum, London
By courtesy of the Horniman Museum, London, A. Carse collection (86)

The coach horn, which was like a straight post horn, though longer, was made of copper and was of conical bore. It was used on the London–Oxford mail coach until 1914.

postal system, institution, usually under the control of a governmental or quasi-governmental agency, that makes it possible to send a letter, packet, or parcel to any addressee, in the same country or abroad, with the expectation that it will be received.

A brief treatment of postal systems follows. For full treatment, *see* MACROPAEDIA: Postal Systems.

The earliest references to postal systems are from Egypt in about 2000 BC and the Chou dynasty in China 1,000 years later. China is also believed to have developed the first posthouse relay system. Various centralized systems for relaying messages were also instituted in the Roman Empire. During the Middle Ages there were no centralized postal systems, but royal houses, municipalities, religious orders, and universities maintained corps of messengers. During the Renaissance the growth of trade, as well as the development of the printing press, gave rise to private postal services—most notably that of the Thurn and Taxis family in the Holy Roman Empire—that were speedy, efficient, and highly profitable. The organization of nation-states led to government monopolization of these services and to the establishment of national systems.

The efficiency of these systems improved steadily, especially after the extensive road building of the 18th century made way for the introduction of the stagecoach. Another major milestone in postal progress was the idea, first proposed by the British educator and tax reformer Rowland Hill in 1837, of charging a single uniform rate for delivery based on weight rather than distance and using prepaid adhesive postage stamps. The implementation of these and other reforms during the mid-19th century vastly simplified postal organization and were the key to the speed and economy of modern postal systems.

The introduction of steamships and railroads in the 19th century greatly facilitated the delivery of mail between nations. Until mid-century, however, there was no real international cooperation: postal relations between states consisted of a bewildering array of bilateral treaties, which were further confused by the diversity of currencies and units of weight. Serious steps toward reform began in the 1860s, culminating in the establishment by treaty of the General Postal Union in 1875 (in 1878 the name was changed to the Universal Postal Union). Each member country was allowed to retain the postage it collected on international mail while agreeing to treat foreign mail the same way it treated its own. A major alteration of this convention was made in 1969, when it was decided that redress payments would be made to certain countries where there was an imbalance between incoming and outgoing mail.

The two most significant advancements of the 20th century have been the development of reliable airmail service and the introduction of automated mail handling. After some experimentation in air delivery before World War I, regular international service (between Paris and London) began in 1919. In the United States regular transcontinental service began in 1924. On the eve of World War II regular service across the North Atlantic had been inaugurated, but the boom in global airmail service did not begin until after the war.

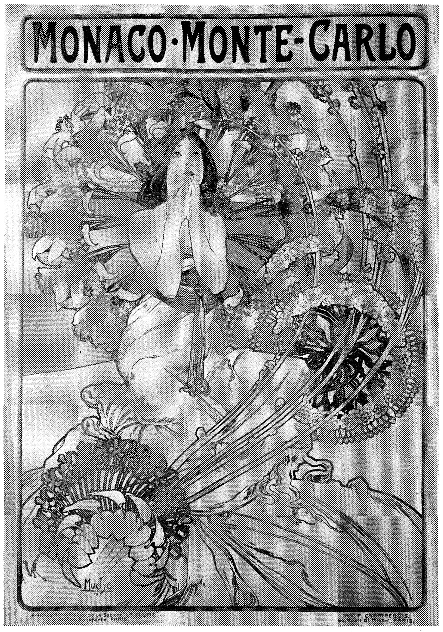
The improvements in mail transport and the expansion of industry and commerce that accompanied the Industrial Revolution have resulted in a tremendous increase in the volume of mail that postal systems must handle. Beginning with the introduction of the railway post office in England in 1838, in which mail was sorted en route to its destination, postal services have sought to implement technology to speed up mail handling.

In the 20th century mechanical equipment has been developed that can handle mail in bulk form, cull letters from other mail, face and cancel letters, and code and sort letters. Machines have also been devised that can read elements of a letter's address electronically. Further advances in computer and data-transmission technology have given rise to new methods of postal handling and delivery. Since 1980 electronically produced facsimile transmission has become available in a number of countries. Teleimpression services have also been developed to transmit bulk correspondence in electronic form to regional postal printing centres.

poster, printed paper announcement or advertisement that is exhibited publicly. Whether promoting a product, event, or sentiment (such as patriotism), a poster must immediately catch the attention of the passerby. There is no set way to accomplish this; success can stem, for example, from the instantaneous impact of a concise, striking design or from the sumptuous appeal of an ornate work of art. By extension, the term poster is used to denote a paper panel printed for display as a novelty or as a work of art.

Although printed public advertisements can be traced to the 15th century, the poster as it is understood today did not emerge until around 1860, given impetus by the invention of lithography, which allowed brilliantly coloured posters to be produced cheaply and easily. The first of the great modern poster artists, Jules Chéret, began his career in 1867 with a theatrical poster announcing a performance by Sarah Bernhardt. His captivating depictions of the entertainers of Parisian night life, rendered in clear, radiant colours, dominated Paris displays for the last 30 years of the 19th century and also attracted others to the medium. The result was extraordinary diversity of style, from the folk art imagery of anonymous lithographers to major works by the best known of the poster artists, Henri de Toulouse-Lautrec. Lautrec's posters of the 1890s, characterized by bold, dramatic designs, are lively and sensitive depictions of Parisian personalities.

Interest in the poster was heightened by the appearance in the 1890s of the style known as Art Nouveau, characterized by flowing, organic lines, elegant grace, and a richly complex symbolism. Because it combined decorative brilliance with a faith that fine art could be popular and useful, the movement found the poster a natural form. The undisputed master of Art Nouveau was a Czech living in Paris, Alphonse Mucha. His first poster was for Sarah Bernhardt; its exotic Byzantine ornament and subtle use of colour brought him overnight success; it was the first of a legacy of posters by him, ranging from grand



Art Nouveau poster advertising Monte-Carlo, lithograph by Alphonse Mucha, 1897

theatre announcements to advertisements for cigarette papers and chocolate, that remain unsurpassed in beauty and inventiveness. Among the many other manifestations of the Art Nouveau poster were, in Paris, the elegant works of Georges de Feure and Eugène Grasset; in The Netherlands, the stylized posters of Jan Toorop; in Austria, the elegantly ordered works of Koloman Moser and Alfred Roller; and, finally, the work of Will Bradley, who brought the style to the United States.

With the outbreak of World War I in 1914, the poster became an art that could influence history. Prior to the ascendancy of motion pictures and television, it was politically the most important of all visual media. It was easily produced and immediate in impact, and it could be posted wherever there was a public to see it. Given such a role, posters of war and revolution may be quite forceful, varied, and revealing. The propagandistic posters of the early years of the Soviet Union, for example, aimed at a largely illiterate population, are blunt and powerful; those of the late Austro-Hungarian Empire have a lyrical medieval gallantry; and those of World War I America display a swaggering hometown naïveté. All reveal a need to embody not only the aspirations of the group that produced them but of the entire people to whom they were addressed. An outstanding example is James Montgomery Flagg's famous U.S. recruiting poster of Uncle Sam pointing directly at the viewer, a forceful call to patriotism during World War I.

The industrial boom of the early 20th century gave rise to advertising posters for virtually every conceivable product and event. Many express the spirit or stylistic excess of their day, from the primitive and folk art quality of early circus posters to the sophisticated and streamlined travel posters of the 1930s. The onslaught of radio and television and an almost complete reliance on photography in advertising, however, brought about an eclipse in poster art.

From the 1960s on, a regeneration of popular art forms, beginning with popular music, led to a new interest in posters. In San Francisco, where the movement was strongest, posters announcing weekly dance hall concerts echoed the golden age of the poster of the 1890s.

Postimpressionism, in Western painting, movement in France that represented both an extension of Impressionism and a rejection of that style's inherent limitations. The term Postimpressionism was coined by the English art critic Roger Fry for the work of such late 19th-century painters as Paul Cézanne, Georges Seurat, Paul Gauguin, Vincent van Gogh, Henri de Toulouse-Lautrec, and others. All of these painters except van Gogh were French, and most of them began as Impressionists; each of them abandoned the style, however, to form his own highly personal art. Impressionism (*q.v.*) was based, in its strictest sense, on the objective recording of nature in terms of the fugitive effects of colour and light. The Postimpressionists rejected this limited aim in favour of more ambitious expression, admitting their debt, however, to the pure, brilliant colours of Impressionism, its freedom from traditional subject matter, and its technique of defining form with short brushstrokes of broken colour. The work of these painters formed a basis for several contemporary trends and for modern art in general.

After a phase of uneasy dissension among the Impressionists, Paul Cézanne withdrew from the movement in 1878 in order "to make of Impressionism something solid and durable like the art of the museums." In contrast to the passing show depicted by the Impressionists, his approach imbued landscape and still life with a monumental permanence and coherence. He abandoned the Impressionists' virtuoso depiction of evanescent light effects in his preoccupation with the underlying structures of natural forms and the problem of unifying surface patterns with spatial depth. His art was the major inspiration for Cubism, which was concerned primarily with depicting the structure of objects. In 1884, at the Salon des Indépendants in Paris, Georges Seurat revealed an intention similar to Cézanne's with paintings that showed more attention to composition than those of the Impressionists and that delved into the science of colour. Taking as a point of departure the Impressionist practice of using broken colour to suggest shimmering light, he sought to achieve luminosity through optical formulas, placing side by side tiny bits of contrasting colour chosen to blend from a distance into a dominant colour. This extremely theoretical technique, called Pointillism, was adopted by a number of contemporary painters and formed the basis of the style of painting known as Neo-Impressionism (*q.v.*).

The Postimpressionists often exhibited together but, unlike the Impressionists who were a close-knit, convivial group, they painted mainly alone. Cézanne painted in isolation at Aix-en-Provence in southern France; his solitude was matched by that of Gauguin, who in 1891 took up residence in Tahiti, and of van Gogh, who painted in the countryside at Arles. Both Gauguin and van Gogh rejected the indifferent objectivity of Impressionism in favour of a more personal, spiritual expression. After exhibiting with the Impressionists in 1886, Gauguin renounced "the abominable error of naturalism." With the young painter Émile Bernard, he led a self-conscious return to the aesthetic of primitive art, for which he believed imagination and ideas were the primary inspiration and the representation of nature merely a vehicle for their expression. Copying the pure, flat colour, heavy outline, and decorative quality of medieval stained glass and manuscript illumination, the two artists explored the expressive potential of pure colour and line, Gauguin especially using exotic and sensuous colour harmonies to poetically depict the Tahitians he eventually lived among. Arriving in Paris in 1886, the Dutch painter Vincent van Gogh quickly adapted Impressionist techniques and colour to express his acutely felt emotions. He transformed the contrasting short brushstrokes of Impressionism into curving, vibrant lines of colour, exaggerated even beyond Impressionist brilliance, that convey his emotionally charged and ecstatic responses to the natural landscape.

Less closely connected with the Impressionists were Henri de Toulouse-Lautrec and Odilon Redon. Concerned with perceptive portraiture and decorative effect, Toulouse-Lautrec used the vivid contrasting colours of Impressionism in flat areas enclosed by a distinct, sinuous outline. Redon's still-life florals were somewhat Impressionistic, but his other works are more linear and Symbolistic. In general, Postimpressionism led away from a naturalistic approach and toward the two major movements of early 20th-century art that superseded it: Cubism and Fauvism, which sought to evoke emotion through colour and line.

postmortem, also called POSTMORTEM EXAMINATION: *see* autopsy.

Postojna, German ADELSBERG, Italian POSTUMIA, town in western Slovenia, Yugoslavia, on the Pivka River northeast of Trieste. Long a local market centre, it is on the rail line and road from Trieste to Ljubljana, having become part of Yugoslavia in 1947. Its prime importance is as a tourist centre for its Postojna Cave, an internationally famous cave system considered by experts to be the best example in Europe of karst phenomena—heavily and irregularly eroded limestone structures and underground streams.

A mile from the town is the entrance to the vast cave system, which is divided into several branches. The Pivka River enters the Postojna cavern 60 feet (18 m) below its mouth, runs underground, and reappears as a spring in the Planina Plain. The cavern has 9.1 miles (14.6 km) of corridors and grottoes containing spectacular stalactite and stalagmite formations. In parts of the system is found a remarkable eyeless, colourless, snakelike subterranean amphibian, *Proteus anguinus,* growing to 1 foot (30 cm) in length, which lives on snails and worms and has both lungs and gills. An upper gallery was the scene of a famous exploit during World War II, in which Partisans exploded a German fuel dump; the smoke-blackened walls are still visible. Northwest of Postojna is the medieval Predjamski Grad, a castle built into the cave, which houses an extensive archaeological collection. Pop. (1981) mun., 19,892.

postpartum pituitary necrosis: *see* Sheehan's syndrome.

Postromantic music, musical style typical of the last decades of the 19th century and first decades of the 20th century and characterized by exaggeration of certain elements of the musical Romanticism of the 19th century. Postromanticism exhibits extreme largeness of scope and design, a mixture of various musical forms (*e.g.,* opera and symphony), and heightened contrapuntal complexity (*i.e.,* a long or vast array, or both, of simultaneous but independent musical lines or events). Often Postromanticism also embraces vivid religious or mystical fervour, a sense of longing, and a sense of the grim and the grotesque.

Some composers often considered Postromantic include Gustav Mahler, Anton Bruckner, Ferruccio Busoni, Max Reger, Arnold Schoenberg, and Kaikhosru Sorabji. Postromanticism overlaps Neoromanticism, although the former term is more often applied to compositions showing important links in style and approach between Romanticism and early 20th-century modernism.

postsynaptic potential (PSP), a transient change in the electric polarization of the membrane of a nerve cell (neuron). The result of chemical transmission of a nerve impulse at the synapse (neuronal junction), it can lead to the firing of a new impulse.

When an impulse arrives at the synapse from an activated neuron, a chemical substance known as a neurotransmitter causes the opening of channel-shaped molecules in the membrane of the resting neuron. Ions flowing through the channels create a shift in the resting polarization, which usually has a slightly more negative charge inside the membrane than outside. Hyperpolarization—that is, an increase in negative charge on the inside—constitutes an inhibitory PSP, because it draws the neuron away from the firing of an impulse. Depolarization—a decrease in negative charge—constitutes an excitatory PSP because, if it brings the neuron to the crucial threshold potential, it can excite the generation of a nerve impulse (action potential).

The PSP is a graded potential; that is, its degree of hyperpolarization or depolarization varies according to the activation of ion channels. The ability to integrate multiple PSPs at multiple synaptic connections into an overall membrane potential is an important property of neurons, as it enables the nervous system to respond coherently to multiple stimuli.

The equivalent of the PSP at nerve-muscle synapses is called the end-plate potential. *See also* action potential; synapse.

Postumus, Marcus Cassianius Latinius (d. 268), Roman general who, by setting himself up as an independent emperor in Gaul, in about 258–268, became a rival to the emperor Gallienus.

Postumus and another general, Silvanus, stayed behind in Colonia (Cologne) with Gallienus' son Saloninus after the emperor had left the Rhine for the Danube in about 258. When Silvanus demanded that all booty be handed back to the treasury and its original owners, the reluctant troops proclaimed Postumus emperor, defeating and killing both Silvanus and Saloninus. Postumus successfully defended the Rhine frontier and withstood Gallienus' attempts to recover Gaul. Later he took Victorinus (who succeeded him) as his colleague, perhaps as joint emperor. Postumus was killed in a mutiny of the legion of Mogontiacum (now Mainz, Ger.).

Potagos, Panayotis (b. July 1839, Vytina, Greece—d. 1903), physician and traveler attached to the Egyptian Service who explored the Uele River system in northern Zaire.

Potagos began his travels in 1867, visiting Mesopotamia, Persia (now Iran), Afghanistan, the Gobi Desert (in China), and India. He arrived in Egypt in 1876 and began his African expeditions. He ascended the Nile to southern Sudan and then crossed into the Congo River basin through what is now the Central African Republic, reaching the Uele River in 1877.

potash, various potassium compounds, chiefly crude potassium carbonate. The names potash, potash lye, and caustic potash are frequently used for potassium hydroxide (*see* potassium). In fertilizer terminology, potassium oxide is called potash. Potash soap is a soft soap made from the lye leached from wood ashes.

potash clay: *see* hydrous mica.

potash mica: *see* muscovite.

potassium (K), chemical element of Group Ia of the periodic table, the alkali metal group, indispensable for life. Potassium was the first metal to be isolated by electrolysis, by the English chemist Sir Humphry Davy, when he obtained the element (1807) by decomposing molten potassium hydroxide (KOH) with a voltaic battery.

Properties, occurrence, and uses. Potassium metal is soft and white with a silvery lustre, has a low melting point, and is a good conductor of heat and electricity. Potassium imparts a lavender colour to a flame, and its vapour is green. It is the seventh most abundant element in the Earth's crust, comprising 2.6 percent of its material. Most potassium is present in minerals such as muscovite and orthoclase feldspar that are insoluble in water, making potassium difficult to obtain, but it can be prepared commercially by electrolysis from some refinable minerals, such as carnallite, kieserite, and polyhalite.

There is little commercial demand for potassium metal itself, though it is used for preparing potassium superoxide KO_2, which refreshens exhaled air by liberating oxygen and removing carbon dioxide and water vapour, and for alloying with sodium as a liquid metallic heat-transfer medium. Potassium reacts vigorously with water, liberating hydrogen (which ignites) and forming a solution of potassium hydroxide KOH. In plant metabolism, potassium compounds are absorbed from soil in the form of tartrates and oxalates, which may be converted to potassium carbonate (potash) when the plants are burned. In higher animals potassium ions (K^+) together with sodium ions act at cell membranes in transmitting electrochemical impulses in nerve and muscle fibres and in balancing the activity of food intake and waste removal from cells. Too little or too much potassium in the body is fatal, but potassium in the soil ensures the presence of this indispensable element in food.

Natural potassium consists of three isotopes: potassium-39 (93.26 percent), potassium-41 (6.73 percent), and about 0.01 percent of radioactive potassium-40; six artificial isotopes have been prepared. Because potassium easily loses the single 4*s* electron and no others, it has a valence of one in all its compounds.

Principal compounds. Potassium compounds are very important in agriculture and to lesser extent in the manufacture of explosives. Potassium chloride, also known as potash muriate, KCl, is a naturally occurring potassium salt that is used as fertilizer and as a raw material for the production of other important potassium compounds. Electrolysis of potassium chloride yields potassium hydroxide (also called caustic potash), which readily absorbs moisture and is employed in making liquid soaps and detergents and in preparing many potassium salts. Reactions of iodine and potassium hydroxide produces potassium iodide, KI, which is added to table salt and animal feed to protect against iodine deficiency.

Other potassium compounds of economic value include potassium nitrate, also known as saltpetre, or nitre, KNO_3, which has wide use as a fertilizer and in fireworks and explosives and serves as a food preservative; and potassium sulfate, K_2SO_4, which is used in the production of fertilizers, rubber, and potassium carbonate and in medicine as a laxative.

atomic number	19
atomic weight	39.102
melting point	63.65° C
boiling point	774° C
specific gravity	0.862 (20° C)
valence	1
electronic config.	2-8-8-1 or $1s^22s^22p^63s^23p^64s^1$

potassium-argon dating, method of determining the time of origin of rocks by measuring the ratio of radioactive argon to radioactive potassium in the rock. This dating method is based upon the decay of radioactive potassium-40 to radioactive argon-40 in minerals and rocks; potassium-40 also decays to calcium-40. Thus, the ratio of argon-40 and potassium-40 and radiogenic calcium-40 to potassium-40 in a mineral or rock is a measure of the age of the sample. The calcium-potassium age method is seldom used, however, because of the great abundance of nonradiogenic calcium in minerals or rocks, which masks the presence of radiogenic calcium. On the other hand, the abundance of argon in the Earth is relatively small because of its escape to the atmosphere during processes associated with volcanism.

The potassium–argon dating method has been used to measure a wide variety of ages. The potassium–argon age of some meteorites is as old as 4,500,000,000 years, and volcanic rocks as young as 20,000 years old have been measured by this method.

potassium deficiency, condition in which an organism fails to receive an adequate supply of potassium, a mineral that forms positive ions (electrically charged particles) in solution and is closely related to the holding and exchange of cellular fluids. The relationship between potassium and the metabolism of nitrogen compounds is not completely understood, but potassium is known to be important to this process. Storage of potassium in body cells is dependent on maintenance of a proper ratio with calcium and sodium. As is true of most minerals in body function, potassium is important to normal muscle and nerve responsiveness, heart rhythm, and, in particular, intracellular fluid pressure and balance. About 8 percent of potassium food intake is retained by the body; the rest is readily excreted.

Deficiency problems are not usually a result of poor nutrition but may arise in areas where populations subsist on starvation diets. Rapid excretion of potassium in severe diarrhea, diabetes, and prolonged administration of cortisone medications are among the causes of non-dietary deficiencies. A lack of potassium is known to exaggerate the effects of sodium in decreases and increases of normal activity. In one form of potassium depletion, which is the loss of adequate potassium in the tissues, including the blood, the potassium has not left the body but has shifted into the body cells from the fluid surrounding them.

Almost all foods contain adequate amounts of this mineral for body needs.

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potato (*Solanum tuberosum*), one of approximately 150 tuber-bearing species of the genus *Solanum* (family Solanaceae). The potato (common potato, white potato, or Irish potato), considered by most botanists to be a

Potato (*Solanum tuberosum*)
Grant Heilman—EB Inc.

native of the Peruvian-Bolivian Andes, is one of the main food crops of the world, differing from others in that the edible part of the plant is a tuber (*i.e.,* the swollen end of an underground stem).

The potato plant is a herbaceous annual, 50–100 centimetres (20–40 inches) high. Leaf arrangement is spiral; leaves are compound and 20–30 cm inches long, consisting of a terminal leaflet and two to four pairs of leaflets, each 6–10 cm long.

Underground stems (stolons) extend from the stem below ground. The ends of the stolons may enlarge greatly to form a few to more than 20 tubers, of variable shape and size, usually ranging in weight up to 300 grams (10 ounces) but occasionally to more than 1.5 kilograms (3.3 pounds). The skin varies in colour from brownish white to deep purple; the flesh normally ranges in colour from white to yellow, but it, too, may be purple. The tubers bear spirally arranged buds (eyes) in the axils of aborted leaves, of which scars remain. These buds may remain dormant after the tuber is fully grown, even under conditions favourable to development, for up to more than 10 weeks. They grow into plants identical with the plant that bore the tubers. Vegetative propagation of desired characteristics is thus possible, and this method is always used commercially because of the great variation that results when plants are grown from true seed.

The potatoes cultivated in South America as early as 1,800 years ago probably consisted of a mixture of varieties; in the same area today, as many as 60 varieties may be distinguished in a single village market. Encountered by the invading Spaniards, potatoes were introduced into Europe during the second half of the 16th century. By the end of the 17th century the newcomer was a major crop in Ireland, and by the end of the 18th it was a major crop in continental Europe, particularly Germany, and in the west of England. The Irish economy itself became dependent upon the potato. It continued to spread, both in Western and Eastern hemispheres, during the first four decades of the 19th century, but the disastrous failures of the Irish crop in 1845 and 1846, because of late blight (*q.v.*; *Phytophthora infestans*), and the ensuing famine led to a more cautious attitude toward dependence on it.

Potatoes are frequently served whole or mashed as a cooked vegetable and are also ground into potato flour, used in baking and as a thickener for sauces. Potatoes are highly digestible. They also supply vitamin C, amino acids, protein, thiamin, and nicotinic acid.

potato beetle (*Lema trilineata*), one of the most destructive potato beetles until the advent of the Colorado potato beetle (*q.v.*) in the 1850s. The potato beetle is a member of the subfamily Criocerinae of the leaf beetle family Chrysomelidae (order Coleoptera). This yellow beetle is about 6 millimetres (less than $\frac{1}{4}$ inch) long and has three black stripes on its wing covers.

Eggs are laid on the underside of a potato leaf, on which both larvae and adults feed. The larvae are camouflaged by the excrement the beetles pile on their backs. Two generations occur each year, the second of which spends the winter in the ground in the pupal stage.

potato bug: *see* Colorado potato beetle.

Potawatomi (Algonkian: People of the Place of the Fire), Algonkian-speaking tribe of North American Indians who were living in what is now northeastern Wisconsin when first observed by whites in the 17th century; they later spread south into lands that became Michigan, Wisconsin, Illinois, and Indiana. The Potawatomi were semi-sedentary, living in agricultural villages in summer and separating into family groups in autumn to move to their winter hunting grounds. Men hunted and fished; women planted and harvested crops and collected vegetable foods. Village dwellings were large bark-covered houses or dome-shaped wigwams; the latter were also used at winter sites. The Potawatomi were divided into several politically independent, territorial bands that were, however, linked by kinship and language. Numerous exogamous clans whose members traced their descent from a common ancestor through the male line were distributed among the various bands.

Crowded by settlers, the Potawatomi ceded their lands and moved west of the Mississippi River. Many in Indiana refused to leave until driven out by the U.S. military, and some of these escaped into Canada. In 1846 most Potawatomi were removed by soldiers to a

Potawatomi girl in traditional dress
By courtesy of the Oklahoma Historical Society, Oklahoma City

Kansas reservation, where they became known as the Prairie band. During the westerly trek they borrowed such features as the communal bison hunts and associated camp organization from the Plains Indians. In the late 1860s many of the Kansas band moved to Oklahoma Indian Territory, where they were known as the Citizen Potawatomi. The Prairie band has preserved much of the aboriginal culture; the Citizens have largely accepted the dominant U.S. culture. Other Potawatomi groups currently reside in Wisconsin and Michigan.

Potchefstroom, town, southwestern Transvaal, South Africa, on the Mooi River, southwest of Johannesburg. It was founded in 1838 as the first capital of the Transvaal and remained the capital until Pretoria displaced it in 1855. British troops held the town in the First Boer War (1880–81) and the South African War (1899–1902). Gold mining has been important in the extended area since 1933. Known historically as a significant educational, ecclesiastical, and newspaper publishing centre, Potchefstroom is the seat of several secondary schools and the Potchefstroom University for Christian Higher Education (1869; independent status, 1951). A large proportion of the residents are young adults. There are many recreational facilities, and a large military camp is nearby. Pop. (1983 est.) mun., 77,560.

Potemkin, Grigory Aleksandrovich, KNYAZ (Prince) TAVRICHESKY, REICHSFÜRST (Imperial Prince) (b. Sept. 24 [Sept. 13, old style], 1739, Chizovo, Russia—d. Oct. 16 [Oct. 5, O.S.], 1791, Bessarabia), Russian Army officer and statesman, for two years Empress Catherine II's lover and for 17 years the most powerful man in the empire. An able administrator, licentious, extravagant, loyal, generous, and magnanimous, he was the subject of many anecdotes.

Educated at the University of Moscow, Potemkin entered the horseguards in 1755. He helped bring Catherine II to power as empress and was given a small estate. He shone in the Turkish War of 1768–74 and became Catherine's lover in 1774. Made commander in chief and governor general of "New Russia" (the southern Ukraine), he remained friendly with her, and his influence was unshaken despite Catherine's later lovers.

Potemkin was deeply interested in the question of Russia's southern boundaries and so in the fate of the Turkish Empire. In 1776 he sketched the plan for the conquest of the Crimea, which was subsequently realized; and he was busy with the so-called Greek project, which aimed at restoring the Byzantine Empire under one of Catherine's grandsons.

Potemkin, engraving by James Walker, 1789, after a portrait by Johann Baptist Lampi
Reproduced by courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co., Ltd.

In many of the Balkan lands he had well-informed agents.

After he became field marshal, in 1784, he introduced many reforms into the army and built a fleet in the Black Sea, which, though constructed of bad materials, did excellent service in Catherine's second Turkish War (1787-92). His stupendous activity had admirable results: the arsenal of Kherson, begun in 1778, the harbour of Sevastopol, built in 1784, and the new fleet of 15 ships of the line and 25 smaller vessels were monuments of his genius. But there was exaggeration in all his enterprises. He spared neither men, money, nor himself in attempting to carry out a gigantic scheme for the colonization of the Ukrainian steppes; but he never calculated the cost, and most of the design had to be abandoned when but half finished. Even so, Catherine's tour of the south in 1787 was a triumph for Potemkin, for he disguised all the weak points of his administration—hence the apocryphal tale of his erecting artificial villages to be seen by the Empress in passing. ("Potemkin village" came to denote any pretentious facade designed to cover up a shabby or undesirable condition.) Joseph II of Austria had already made him a prince of the Holy Roman Empire (1776); Catherine made him prince of Tauris in 1783.

When the second Turkish War began, the founder of New Russia acted as commander in chief. But the army was ill-equipped and unprepared; and Potemkin, in a fit of depression, would have resigned but for the steady encouragement of the Empress. Only after A.V. Suvorov had valiantly defended Kinburn did he take heart again and besiege and capture Ochakov and Bendery. In 1790 he conducted the military operations on the Dnestr and held his court at Iaşi with more than Asiatic pomp. In 1791 he returned to St. Petersburg, where, along with his friend A.A. Bezborodko, he made vain efforts to overthrow Catherine's new and last favourite, Platon Zubov. The empress grew impatient and compelled him (1791) to return to Iaşi to conduct the peace negotiations as chief Russian plenipotentiary. He died while on his way to Nikolayev.

potential, electric: *see* electric potential.

potential energy, stored energy that depends upon the relative position of various parts of a system. A spring has more potential energy when it is compressed or stretched. A steel ball has more potential energy raised above the ground than it has after falling to the Earth. In the raised position it is capable of doing more work. Potential energy is a property of a system and not of an individual body or particle; the system composed of the Earth and the raised ball, for example, has more potential energy as the two are farther separated.

Potential energy arises in systems with parts that exert forces on each other of a magnitude dependent on the configuration, or relative position, of the parts. In the case of the Earth-ball system, the force of gravity between the two depends only on the distance separating them. The work done in separating them farther, or in raising the ball, transfers additional energy to the system, where it is stored as gravitational potential energy.

Potential energy also includes other forms. The energy stored between the plates of a charged capacitor is electrical potential energy. What is commonly known as chemical energy, the capacity of a substance to do work or to evolve heat by undergoing a change of composition, may be regarded as potential energy resulting from the mutual forces among its molecules and atoms. Nuclear energy is also a form of potential energy.

The potential energy of a system of particles depends only on their initial and final configurations; it is independent of the path the particles travel. In the case of the steel ball and the earth, if the initial position of the ball is ground level and the final position is ten feet above the ground, the potential energy is the same, no matter how or by what route the ball was raised. The value of potential energy is arbitrary and relative to the choice of reference point. In the case given above, the system would have twice as much potential energy if the initial position were the bottom of a ten-foot-deep hole.

Gravitational potential energy near the Earth's surface may be computed by multiplying the weight of an object by its distance above the reference point. In bound systems, such as atoms, in which electrons are held by the electric force of attraction to nuclei, the zero reference for potential energy is a distance from the nucleus so great that the electric force is not detectable. In this case, bound electrons have negative potential energy, and those just free of the nucleus and at rest have zero potential energy.

Potential energy may be converted into energy of motion, called kinetic energy, and in turn to other forms such as electrical energy. Thus, water behind a dam flows to lower levels through turbines that turn electric generators, producing electric energy plus some unusable heat energy resulting from turbulence and friction.

Historically, potential energy was included with kinetic energy as a form of mechanical energy so that the total energy in gravitational systems could be calculated as a constant.

Potentilla, genus of flowering plants known also by their common name, cinquefoil (*q.v.*).

Potenza, Latin POTENTIA, city, capital of Potenza province and of Basilicata region, southern Italy, 2,684 ft (819 m) above sea level in the Apennines near the upper Basento River, east of Salerno. The Roman Potentia (founded 2nd century BC), which stood on a lower site than the modern city, was an important road junction and became a flourishing imperial municipium (organized Roman community). In the 6th century it passed to the Lombard dukes of Benevento and thereafter to a succession of feudal owners. In 1806 the French made Potenza the capital of the Basilicata. In 1860 it was the first southern Italian town to drive out the Bourbon rulers of the Kingdom of the Two Sicilies. The town has been rebuilt several times after earthquakes, the latest in 1980. It is an episcopal see, and its notable churches include the cathedral, retaining rose windows and an apse from the original 12th-century structure; S. Francesco (1274) with magnificent carved wooden doors; and S. Michele (11th–12th century). The Museo Provinciale Lucano has an important archaeological collection.

A railway junction on the Salerno–Taranto line, Potenza is an agricultural centre, and much of the abundant market gardening and orchard produce is exported. Pop. (1983 est.) mun., 64,802.

Potgieter, Everhardus Johannes (b. June 27, 1808, Zwolle, Neth.—d. Feb. 3, 1875, Amsterdam), Dutch prose writer and poet who tried to set new standards and encourage national consciousness in his journal *De gids*

Everhardus Johannes Potgieter, lithograph by P. Blommers after a portrait by N.J.W. de Roode
By courtesy of the Iconographisch Bureau, The Hague

("The Guide"), which was founded in 1837, and who anticipated the literary revival of the 1880s.

Potgieter was a thoroughgoing Romantic who eulogized the Holland of the 17th century. As a businessman, he was at the same time convinced that trade expansion was all-important for the rebirth of the Dutch nation. His initial optimism is evident in *Jan, Jannetje en hun jongste kind* (1842; "Jan, Jannetje and their Youngest Child"), an allegory satirizing the people's mental inertia; and in *Het Rijksmuseum* (1844), a homage to 17th-century Holland and to the prose style of Pieter Corneliszoon Hooft, which it imitates.

His subsequent work includes *Onder weg in den regen* (1864; "On the Way in the Rain"), the best of many subtle and often humorous sketches; *Florence* (1868), a long poem in tercets; and *De nalatenschap van den landjonker* (1875; "The Inheritance of the Country Squire"), a poem cycle by a fictitious aristocrat.

Potgieter, (Andries) Hendrik (b. Dec. 19, 1792, Graaff-Reinet district, Cape Colony—d. Dec. 16, 1852, Schoemansdal, Transvaal), Boer leader in the Great Trek; he took his party from the Cape Colony to settle the Transvaal and became a prominent figure in the early history of that state.

He was a well-to-do sheep farmer until the vacillating frontier policy of the British caused him to opt for leaving the colony. Others joined Potgieter and elected him commandant as they moved toward the Vaal River. Potgieter's gifts as a military leader were demonstrated in his battles with the Ndebele (Matabele) and other native peoples. His victory at Marico River (November 1837) opened the high veld beyond the Vaal to the Boers.

When trek leader Piet Retief and his men were massacred by King Dingane's Zulus (February 1838) in Natal, Potgieter led an unsuccessful commando raid against the Zulus. Returning to his settlement in Winburg north of the Orange River (May 1838), he was convinced that the future of the Boers was north in the Transvaal rather than east in Natal. He founded other settlements in the Transvaal: Potchefstroom (1838), Andries-Ohrigstad (1845), and, to the far north, Soutpansberg (1848).

In those early days the Transvaal settlements were torn by internal dissensions. Potgieter, as head commandant and leader of the military party, supported local autonomy rather than centralized authority. (Potgieter's behaviour at this time is still a matter of controversy.) When the Sand River Convention, in which Britain recognized Transvaal independence, was negotiated by his Boer rival Andries Pretorius in January 1852, Potgieter remained aloof and refused to ratify the treaty until March. During an arduous campaign against a Pedi chief, Potgieter died from overexertion.

Pothier, Dom Joseph (b. Dec. 7, 1835, Bouzemont, Fr.—d. Dec. 8, 1923, Conques, Belg.), French monk and scholar who, together with his contemporaries, reconstituted the Gregorian chant.

Pothier took vows as a Benedictine monk at Solesmes in 1860, was prior of Ligugé in 1893, and in 1898 was appointed abbot of Saint-Wandrille. Soon after he entered Solesmes he collaborated with Dom Paul Jausions on a new edition of the choir books based on manuscripts of the Gregorian chant. Dom Jausions died in 1870, but his contribution was acknowledged in the preface to Dom Pothier's publication *Les Mélodies grégoriennes d'après la tradition* (1880), which became the standard work on the subject. In 1883 he published the *Liber gradualis,* which also included research earlier undertaken by Dom Jausions and which, with the *Mélodies grégoriennes,* marked the beginning of a reform in liturgical chant. In 1889 he was associated with his disciple Dom André Mocquereau (1849–1930) in the foundation of the publication *Paléographie musicale* for the dissemination of medieval liturgical manuscripts. In 1904 Pope Pius X appointed him chairman of a commission for the reconstitution of the music of the Roman Catholic Mass. Many of the controversial theories regarding the intervention of Gregorian chant were published in the *Revue du chant grégorien* (1892–1914), of which Dom Pothier was editor.

pothos, also called GOLDEN POTHOS, or DEVIL'S IVY (*Scindapsus aureus* or *Epipremnum aureum*), hardy indoor climbing foliage plant of the arum family (Araceae), native to southeastern Asia. It resembles, and thus is often confused with, the common philodendron.

Pothos has thick, waxy green heart-shaped leaves with splashes of yellow. 'Marble Queen,' with white variegations of greater extent than in the species, and 'Tricolor,' with shades of green, deep yellow, and creamy white, are popular varieties.

Poti, city, Georgian Soviet Socialist Republic, on the Black Sea at the mouth of the Rioni River and on the site of the ancient Greek colony of Phasis. The modern city developed in the 1880s, when an artificial harbour and a rail link were built. The city has a fishing fleet, a fish-processing works, and a dredger-building works. Manufactures include hydraulic and electrical equipment. Pop. (1974 est.) 51,000.

P'ot'isarat (Laotian king): *see* Photisarath.

potlatch, ceremonial distribution of property and gifts to affirm or reaffirm social status, as uniquely institutionalized by the American Indians of the Northwest Pacific coast. The potlatch reached its most elaborate development among the southern Kwakiutl from 1849 to 1925. Although each group had its characteristic version, the potlatch had certain general features. Ceremonial formalities were observed in inviting guests, in speechmaking, and in the distribution of goods by the donor according to the social rank of the recipients. The size of the gatherings reflected the rank of the donor. Great feasts and generous hospitality accompanied the potlatch, and the efforts of the kin group of the host were exerted to maximize the generosity. The proceedings gave wide publicity to the social status of donor and recipients because there were many witnesses.

A potlatch was given by an heir or successor to assert and validate his newly assumed social position. Important events such as marriages, births, deaths, and initiations into secret societies were also occasions for potlatches; but trivial events were used just as often, because the main purpose of a potlatch was not the occasion itself but the validation of claims to social rank. The potlatch was also used as a face-saving device by individuals who had suffered public embarrassment and as a means of competition between rivals in social rank.

Potocki, Ignacy, Hrabia (Count) (b. Feb. 28, 1750, Podhajce, Pol.—d. Aug. 30, 1809, Vienna), statesman, grand marshal of Lithuania, and a member of one of Poland's oldest aristocratic families.

Potocki played a prominent part from 1773 in the Polish Commission of National Education; from 1781 to 1784 he was the grand master of Polish freemasonry. As a leader of the patriotic faction, he engineered a national alliance with Prussia (1790), pressed for broad administrative reforms, and, with his fellow reformer Hugo Kołłątaj, wrote the major provisions of the centralizing constitution of May 3, 1791.

After the invasion of Poland by Russian troops (May 1792) and the installation of a Russian client regime (July 1792)—the Confederation of Targowica—Potocki fled to Dresden, where he planned a national uprising with Kołłątaj and the military leader Tadeusz Kościuszko. Returning to Poland in 1794, he conducted foreign affairs for the insurrectionary government, but was unable to win external support for the Polish cause. After the fall of Warsaw to the Russians in November 1794, he was sent as a state prisoner to St. Petersburg (now Leningrad). On his release in 1796 he returned to Poland. He died while on a diplomatic assignment to present a petition to Napoleon for the incorporation of Galicia in the Grand Duchy of Warsaw.

Potocki, Stanisław Szczęsny (b. 1751/52—d. March 15, 1805, Tulczyn, Pol., Russian Empire), Polish statesman and general during the breakup of the elective Kingdom of Poland.

The son of Franciszek Salezy Potocki, palatine of Kiev, of the Tulczyn line of the Potocki family, he entered public service in 1774, became palatine of Russia in 1782, and lieutenant general and then general (1789) of artillery. Though considered a liberal aristocrat, he identified the public welfare with the welfare of the magnates and thus opposed every project for reform in the Diet, or Parliament. Unsuccessful in his obstructionism, he went first to Vienna and then to St. Petersburg, where, with the connivance of the empress Catherine, he formed the Confederation of Targowica for the maintenance of the ancient institutions of Poland (May 14, 1792), of which he was the marshal, or dictator, directing its operations from his castle at Tulczyn.

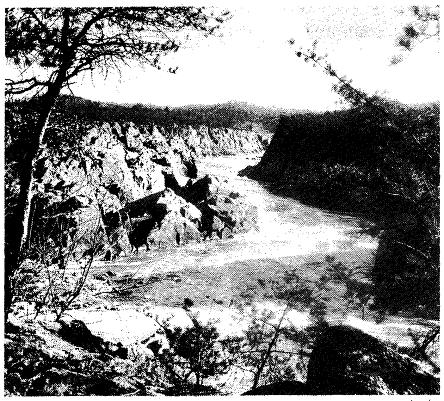
When the liberal May Constitution in Poland was overthrown and the Prussians were already in occupation of Great Poland, Potocki went on a diplomatic mission to St. Petersburg (March 1793) but, finding himself duped and set aside, retired to Vienna until 1797, when he settled down at Tulczyn and devoted himself for the remainder of his life to the improvement of his estates.

Potocki, Wacław (b. Wola Łużeńska, Pol., 1621—d. July 9, 1696, Łużna), Polish author of a vigorous epic poem, *Wojna chocimska* ("The Chocim War"), and famous also for his epigrams, collected in *Ogród fraszek* ("Garden of Rhymes," written 1670–95; published 1907), which gives a lively picture of ideas and manners among the gentry at a time of political and religious conflict.

Potocki, a country squire with little formal education, wrote most of his verse (about 300,000 lines) to please himself. A Unitarian (Adrian), he was given a choice between exile and conversion to Roman Catholicism when a decree banished all Unitarians from Poland. He chose reluctantly to convert, but his wife refused and he spent many years fearing for her life.

Wojna chocimska, finished in 1670 but not published until 1850, describes the defense in 1621 of the city of Chocim by 65,000 Poles and Cossacks against a Turkish army estimated at 400,000. Historically accurate, though idealizing the Polish heroes, the epic reveals Potocki's gift for poetic condensation.

Potomac River, river in the east central United States, rising in North and South branches in the Appalachian Mountains of West Virginia. The two branches (95 mi [150 km] and 130 mi long, respectively) flow generally northeast and unite southeast of Cumberland, Md., to continue southeast through the District of Columbia into Chesapeake Bay.



Mather Gorge in the Potomac River downstream from Great Falls
Authenticated News International

The river drains an area of approximately 14,500 sq mi (37,600 sq km). Its course is 383 mi, of which 117 mi are tidal. With the North Branch it forms the boundary between Maryland and West Virginia from its source to Harpers Ferry, W.Va., and from there to its mouth it is the boundary between Maryland and Virginia. The Potomac's tributaries include the Shenandoah at Harpers Ferry, the Monocacy in the Piedmont region, and the Anascostia at Washington, D.C. The District of Columbia lies on the left (east) bank at the head of the tidewater. The river is navigable to Washington, D.C., above which it descends from the Piedmont in a series of rapids and falls, including Great Falls, a cataract about 35 ft (11 m) high.

The Potomac, noted for its beauty, is also rich in historical significance. Mount Vernon, home of George Washington, is on its banks below Washington, D.C. The river's name derives from "Patawomeck," as it was recorded by the colonist John Smith in 1608; its origin and meaning are unknown. The Chesapeake and Ohio Canal, paralleling the Potomac, was completed in 1850 from Georgetown in the District of Columbia to Cumberland, Md.; traffic ceased in the early 1920s, but the canal's route remains a scenic and recreational area.

potoo, any of about five species of nocturnal birds of Middle and South America of the genus *Nyctibius*, constituting the family Nyctibiidae and related to the nighthawks, nightjars, and frogmouths. The potoo clings upright to a post or branch during the day. At night it makes short flights to capture aerial insects. The potoo has a wide gape but lacks bristles around the mouth. Its middle claws are not comb-edged as they are in the nightjars and nighthawks. Its legs are short, and its wings and tail moderately long. Its name imitates the wailing cry, "po-TOO," made by some species. A shy and solitary bird of woods and grasslands, it lays a single egg on a stump or ledged tree trunk.

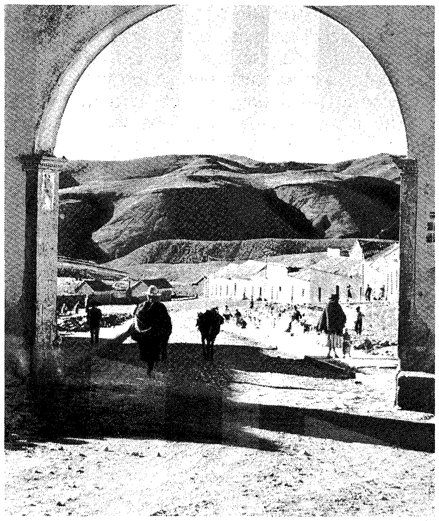
Best known of the five species is the common potoo (*N. griseus*), sometimes called poor-me-one. It is a mottled, gray-brown bird 40 centimetres (16 inches) long. It inhabits jungles of Jamaica, Hispaniola, and southern Mexico to Trinidad, Peru, and northern Argentina. The largest species is the 50-cm (20-in.) great potoo (*N. grandis*) of Guatemala to Peru and southern Brazil.

Potosí, department, southwestern Bolivia, bounded west by Chile and south by Argentina. Its territory of 45,644 sq mi (118,218 sq km) spans the Occidental and Oriental cordilleras of the Andes and the cold Altiplano (high plateau) between the two ranges. Vegetation on the rugged surface is sparse, and there is little water for irrigation. To the east the department is drained mainly by affluents of the Río Pilcomayo. Potosí is noted for its great mineral wealth. In 1540, Spaniards began mining silver at Porco. The discovery 5 years later of Cerro Potosí, a conical mountain rising 15,680 ft (4,779 m) above sea level and consisting of one of the world's richest ore bodies, established Potosí as a foremost silver-producing region.

Potosí declined in importance as the more readily accessible ores were depleted but regained its status at the end of the 19th century with the rise of tin mining. Lead, zinc, antimony, copper, bismuth, silver, gold, and tungsten are also worked in the region (particularly at Potosí city, Tupiza, and Uyuni), as are extensive deposits of solid salt, most notably at the Salar de Uyuni (*see* Uyuni, Salar de) and the Salar de Coipasa. Air, railroad, and highway facilities are well developed, and one of the highest railways in the world, a branch line of the Antofagasta (Chile)–La Paz railway (15,800 ft at Cóndor), extends to Potosí city, the departmental capital. Pop. (1982 est.) 823,485.

Potosí, capital, Potosí department, southern Bolivia. One of the world's highest cities (altitude 13,045 ft [3,976 m]), it stands on a cold and barren plateau in the shadow of the fabled Cerro Potosí, a mountain of ore, honeycombed with thousands of mines. The city came into existence after the discovery of silver there in 1545 and quickly became famous for its wealth. Legend attributes its name to *potojchi,* a Quechua Indian word meaning "to explode," because of rumblings inside the mountain. Population declined (after peaking at 160,000 in about 1650) as silver production waned, until the rise of tin mining in the 19th century.

Potosí has now become the leading industrial city of Bolivia. Soft drinks, furniture, electrical products, and mosaics supplement mining (tin, lead, copper, silver) and refining industries. Although floods and an occasional earthquake have taken their toll, Potosí retains its colonial charm. Narrow, sometimes winding streets originate in the central plaza, around



Colonial archway in Potosí city, Bolivia
Carl Frank

which are grouped the government house, city hall, mint, treasury, and cathedral, dating back to colonial times. The city is also the seat of Universidad Boliviana "Tomás Frías" (1892). It is on a highway, and the Sucre–Potosí railway connects with the Antofagasta (Chile)–La Paz line. Pop. (1982 est.) 103,183.

potpourri (French: "miscellaneous mixture"), also called CASSOLETTE, in pottery, a decorative ceramic vessel with a perforated cover originally made to hold a liquid mixture of aromatic spices, fruits, and the petals of flowers that produced a pleasant scent as the mixture mouldered. The vessel was later used for dried spices and petals. Ball-shaped ones, frequently made of metal, are known as pomanders. *See also* pouncet-box; vinaigrette.

Potrerillos, mining area, Atacama region, northern Chile. The open-pit copper mine lies in the Andean Atacama Desert, 9,440 ft (2,877 m) above sea level and 75 mi (120 km) inland from the port of Chañaral, to which it is linked by rail. Although the deposits are smaller and the ores of poorer quality than at Chuquicamata, the mine and smelter at Potrerillos contribute a substantial portion of Chile's copper.

Potresov, Aleksandr Nikolayevich (b. Sept. 13 [Sept. 1, old style], 1869, Moscow—d. July 11, 1934, Paris), Russian Social Democrat, one of the leaders of the Mensheviks, who opposed the Bolsheviks in the political struggle leading up to the Russian Revolution of 1917.

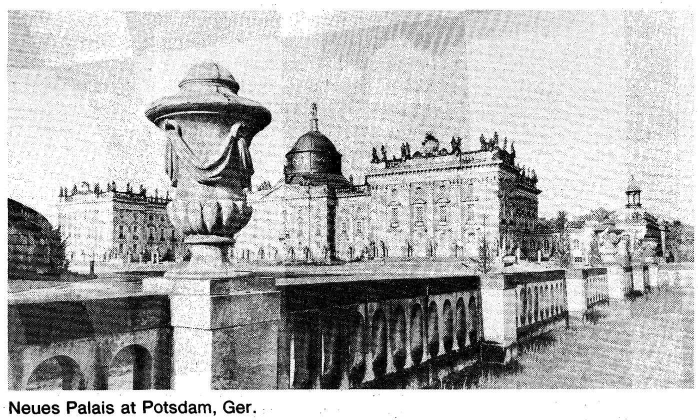
Potresov, the son of a general, joined the Marxists in the early 1890s and was briefly exiled in 1898. In 1900 he helped Lenin found the newspaper *Iskra*, which was intended to unite the Social Democrats against revisionists. However, at the Second Congress of the Russian Social Democratic Labour Party in 1903, Potresov and the Mensheviks broke with Lenin over the latter's demand for a highly centralized, authoritarian party. After 1908 Potresov became a leader of the so-called liquidationists (a pejorative term devised by Lenin), who advocated political activity by legal means, in contrast to the conspiratorial methods of the Bolsheviks.

After the abdication of the Tsar in 1917 Potresov became a co-director of the newspaper *Den*, which opposed the Bolsheviks. Following the October Revolution he emigrated and contributed to Aleksandr Kerensky's anti-Bolshevik newspaper.

Potsdam, until 1990 a *Bezirk* (district), central East Germany, formed in 1952 from the western part of the former Brandenburg *Land* (state) and a small part of Saxony-Anhalt in the south, with an area of 4,854 square miles (12,572 square km). The *Bezirk* centred around the Havelland, the broad, marshy valley of the Havel River and its lakes. In the north lie the plateaus of the Prignitz and the Ruppinerland, to the south the flat lowlands of the Fläming Heide (heathland). The region has a high concentration of canals connecting Berlin and the Havel with the Elbe, Spree, and Oder rivers. Although the soils are generally poor, the region is largely agricultural. Livestock raising, dairy farming, and market gardening are important; rye, oats, potatoes, and some wheat and barley are grown. Engineering industries predominate; the principal towns, after Potsdam (the capital), are Brandenburg (*q.v.*), Luckenwalde, and Rathenow. Pop. (1989 est.) 1,123,759.

Potsdam, city, capital of Brandenburg *Land* (state), eastern Germany, on the southwest border of Berlin where the Nuthe River flows into the Havel River, which becomes a series of lakes. First mentioned in 993 as a Slav settlement known as Poztupimi, it was chartered in 1317. It became an electoral residence in 1640 under Frederick William, the Great Elector, and a royal residence under Frederick the Great, during whose reign (1740–86) it was an intellectual and military centre and virtual capital of Prussia. In the 18th century a colony of Dutch immigrants gave their quarter of the city, and some other parts as well, a distinctly Dutch flavour. The city suffered severe damage in World War II, but many monuments survived and others were restored. The Cecilienhof Palace was the scene (July 17–Aug. 2, 1945) of the Potsdam Conference of the Allied leaders, U.S. Pres. Harry S. Truman, British Prime Minister Clement Attlee, and Soviet Premier Joseph Stalin. From 1952 to 1990 the city was capital of the Potsdam *Bezirk* (district) of East Germany.

Notable landmarks include the Sans Souci Palace (1745–47), a masterpiece of German Rococo architecture; the Neue Kammern (1747); the Bildergalerie (1755–63); the



Neues Palais at Potsdam, Ger.
W. Krammisch—Bruce Coleman Inc./EB Inc.

Orangerie (1851–60); and the Neues Palais (1763–69). The Church of St. Nicholas (1830–37) and the Brandenburg Gate (1770) escaped serious damage, and the Garrison Church (1731–35) was restored. Potsdam has scientific institutes, a meteorological service, an academy of political science and law, a college of finance, a college of education, institutes of agriculture and medicine, two observatories, a conservatory, and the Central Institute for Astrophysics.

Potsdam has locomotive-building and boat-building, engineering, electrotechnical, textile, and food-processing industries. The incorporated suburb of Babelsburg is a centre of the German film industry. Pop. (1989 est.) 142,-862.

Potsdam, village and town (township), St. Lawrence County, northern New York, U.S., on the Raquette River, 30 mi (48 km) east of Ogdensburg. The village was settled in 1803–04 as a cooperative community (disbanded 1810). The State University College at Potsdam (founded 1816 as St. Lawrence Academy) and Clarkson College of Technology (1896) give it an academic atmosphere.

The town was organized in 1806 and got its name from its reddish sandstone deposits, which were similar to those of Potsdam, Prussia. The quarries, abandoned in 1922, were once important, and Potsdamian was the name given by U.S. geologists to the Late Cambrian and Early Ordovician rock formations. The village was separately incorporated in 1831. The community has a large dairy industry, several electric-power developments, and a paper plant. Pop. (1980) 10,635.

Potsdam Conference (July 17–Aug. 2, 1945), Allied conference of World War II held at Potsdam, a suburb of Berlin. The chief participants were Pres. Harry S. Truman, Prime Minister Winston Churchill (or Clement Attlee, who became prime minister during the conference), and Premier Joseph Stalin, leaders of the United States, Great Britain, and the Soviet Union, respectively.

The conferees discussed the substance and procedures of the peace settlements in Europe, but did not attempt to write peace treaties. That task was left to a Council of Foreign Ministers. The chief concerns of the Big Three, their foreign ministers, and their staffs were the immediate administration of defeated Germany, the western boundaries of Poland, the occupation of Austria, Russia's role in eastern Europe, reparations, and the war against Japan. The amity and good will that had largely characterized former wartime conferences was missing at Potsdam, for each nation was most concerned with its own self-interest, and Churchill particularly was suspicious of Stalin's motives and unyielding position.

The Potsdam Declaration on Germany stated, "It is the intention of the Allies that the German people be given the opportunity to prepare for the eventual reconstruction of their life on a democratic and peaceful basis." The four zones decided at the Yalta Conference (*q.v.*) were set up, each to be administered by the commander-in-chief of the Soviet, English, U.S., or French army of occupation. Berlin, Vienna, and Austria were also divided into four occupation zones. A Control Council made up of representatives of the four Allies was to deal with matters affecting Germany and Austria as a whole. Its policies were dictated by the "five Ds" decided upon at Yalta: demilitarization, denazification, democratization, decentralization, and deindustrialization. Reparations were to be taken from each country's occupation zone, although Russia was permitted 10–15 percent of the industrial equipment in the western zones in exchange for agricultural and other natural products from its zone.

Poland's boundary became the Oder and Neisse rivers in the west, and the country received part of former East Prussia. This necessitated moving millions of Germans in those areas to Germany. The governments of Romania, Hungary, and Bulgaria were already controlled by Communists, and Stalin was adamant in refusing to let the Allies interfere in the Balkan states. He also wanted the lands seized by Turkey in 1921 to be returned, and he wanted a military base on the Dardanelles, but these requests were turned down.

While in Potsdam, Truman told Stalin about the United States' "new weapon," which it intended to use against Japan. On July 26 an ultimatum was sent to Japan demanding unconditional surrender and acceptance of the Potsdam Declaration. It was rejected as "unworthy of notice"; but, after the United States dropped two atomic bombs and the Soviet Union entered the war, the Japanese government capitulated on August 10.

Pott, August (Friedrich) (b. Nov. 14, 1802, Nettelrede, Hanover—d. July 5, 1887, Halle, Ger.), German linguist who was one of the founders of Indo-European historical linguistics. He established modern etymological studies on the basis of the correspondence of sounds occurring in related words in Indo-European languages.

As a theology student at the University of Göttingen, Pott became interested in philology. In 1827, while teaching at the *Gymnasium* at Celle, he completed his doctoral dissertation, *De relationibus quae praepositionibus in linguis denotantur* (1827; "Concerning the Relations That Are Denoted in Languages by Prepositions"). That same year he went to the University of Berlin to study with Franz Bopp, one of the most important early scholars of Indo-European linguistics, and in 1830 he became an unsalaried lecturer in general linguistics at the university. The first volume of his major work, *Etymologische Forschungen auf dem Gebiete der indo-germanischen Sprachen, mit besonderem Bezug auf die Lautumwandlung im Sanskrit, Griechischen, Lateinischen, Litauischen und Gotischen* (1833–36; "Etymological Researches in the Field of Indo-European Languages, with Special Reference to Sound Change in Sanskrit, Greek, Latin, Lithuanian, and Gothic"), was published in 1833. That year he became a professor of general linguistics at the University of Halle, where he remained for the rest of his life. In addition to his Indo-European etymological studies, Pott also wrote books and articles about the languages of southern Africa, Java, and Japan. For his writings on Romany, the language of the Gypsies, he is considered the most important 19th-century philologist in that language.

Pottawatomie Massacre (May 24–25, 1856), murder of five men from a proslavery settlement on Pottawatomie Creek, Franklin County, Kan., U.S., by an anti-slavery party led by the Abolitionist John Brown and composed largely of men of his family. The victims were associated with the Franklin County Court established by the proslavery territorial government. The incident was one of several that stirred national controversy over Bleeding Kansas (*q.v.*) and slavery in the U.S. territories during the mid-1850s.

Potter, (Martha) Beatrice (English socialist): *see* Webb, Sidney and Beatrice.

Potter, (Helen) Beatrix (b. July 28, 1866, South Kensington, Middlesex, Eng.—d. Dec. 22, 1943, Sawrey, Lancashire), English author of children's books, who created Peter Rabbit, Jeremy Fisher, Jemima Puddle-Duck, Mrs. Tiggy-Winkle, and other animal characters.

Beatrix, the daughter of cotton heirs, spent a lonely and repressed childhood, enlivened only by annual holidays in Scotland or the English Lake District, which inspired her love of animals and stimulated her imaginative watercolour drawings. She began sending illustrated animal stories to a sick child, and these letters about the Flopsey Bunnies, Tom Kitten, Miss Moppet, and their friends proved to be so popular that she privately published

Beatrix Potter, detail of an oil painting by Delmar Banner, 1938; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

The Tale of Peter Rabbit (1900) and *The Tailor of Gloucester* (1902). A publisher saw their potential and reprinted them immediately. *The Tale of Squirrel Nutkin* (1903), *The Tale of Benjamin Bunny* (1904), and others followed, in English—and then in French, German, Spanish, and Welsh translations. The tiny books, which she designed so that even the smallest children could hold them, combined a deceptively simple prose, concealing dry north-country humour, with illustrations in the best English watercolour tradition.

Potter wed her solicitor, William Heelis, and spent the last 30 years of her life in the village of Sawrey, extending her farm property and breeding sheep. She bequeathed her land to the National Trust, which maintains Hilltop, her original farmhouse.

Potter, Paul, Paul also spelled PAULUS (b. Nov. 20, 1625, Enkhuizen, Neth.—d. Jan. 17, 1654, Amsterdam), Dutch painter and etcher, celebrated chiefly for his paintings of animals. Animals appear prominently in all of Potter's works, sometimes singly but usually in small groups silhouetted against the sky, or in greater numbers with peasant figures and rustic buildings in an extensive landscape. Potter is one of the minor Dutch masters—charming, with a range of subject matter limited by his own choice. He was more sensitive than most of his contemporaries to the passing moods of nature and to the countryside's harmony of beast, landscape, and weather. Potter observed the landscape of his country with a deep love and understanding. In addition, he possessed a feeling for design, expressed in the grouping of his forms and in his use of silhouette, dark on light or light on dark.

Potter entered the Guild of St. Luke at Delft in 1646. In 1649 he moved to The Hague, where in the following year he married Adriana, daughter of the architect Claes van Balkeneynde. In 1652 Potter settled in Amsterdam. He probably received his early training from his father, the painter Pieter Potter (*c.* 1597–1652), but his style shows little dependence upon that of earlier masters. In so short a career there was little development in style between the earlier and the later works, but 1647 seems to mark a peak in his achievement, for many of the finest paintings bear this date. Among works that depart from his normal scale or style, the huge "Young Bull" (1647; Mauritshuis, The Hague), which is life-size, is his most celebrated, though not necessarily his finest work, while "Orpheus

Charming the Beasts" (1650; Rijksmuseum, Amsterdam) is an excursion into a poetic world. Potter's etchings of animals show all the skill and sympathy of his paintings.

Potteries, The, region in northern Staffordshire, England, the country's main producer of china and earthenware. It extends for about 9 miles (14 km) from southeast to northwest and 3 miles (5 km) from northeast to southwest and includes the former towns of Tunstall, Burslem, Hanley, Stoke-upon-Trent, and Longton (the "Five Towns" portrayed in a series of novels by Arnold Bennett), and Fenton. The six were federated in 1910 as the municipal borough of Stoke-on-Trent (made a city in 1925). Wedgwood and Minton are the two famous family names connected with the area's china industry. Coal from the north Staffordshire coalfield and coarse clay are the only local products used in the industry.

potter's mark, also called FACTORY MARK, device for the purpose of identifying commercial pottery wares. Except for those of Wedgwood, stonewares before the 20th century were not often marked. On some earthenware, potters' marks are frequently seen, but signatures are rare. One of the few found on ancient Greek vases reads: "Exekias made and painted me." The red pottery of Roman times is signed by means of stamps. Potter's marks are most commonly found on porcelain. Chinese porcelain marks usually record the dynasty and the name of the emperor; but they are unreliable because the Chinese often used the mark of an earlier dynasty as a sign of veneration for the products of antiquity and, in recent times, for commercial gain.

Most European pottery factories adopted an identifying device, the earliest example of which is the mark of a cathedral and an *F* on some Florentine wares of about 1573–87; but these devices also cannot be regarded as a guarantee of authenticity. Not only were false marks added to contemporary forgeries but the smaller 18th-century factories often copied the proprietary marks of their more august competitors.

pottery, one of the oldest and most widespread of the decorative arts, consisting of objects made of clay and hardened with heat. The objects are commonly useful ones, such as vessels for holding liquids and plates or bowls from which food is served. Earthenware is the oldest and simplest form of pottery; stoneware is a pottery compound that is fired at a sufficiently high temperature to cause it to vitrify and become extremely hard; and porcelain, finer than stoneware and generally translucent, is made by adding feldspar to kaolin and then firing at a high temperature.

A brief treatment of pottery follows. For full treatment, *see* MACROPAEDIA: Decorative Arts and Furnishings.

Throughout history different cultures have made pottery objects using local materials and traditional techniques. Undoubtedly the most sophisticated pottery culture was in China, where pottery has been made since the Neolithic Period. Porcelain was made in China as early as the 9th century, but its secret was not discovered by Europeans until the 18th century. Chinese porcelain, or "china" as it was commonly called, was widely exported to Europe and had a profound influence on European manufactures and on taste.

Clay is easily modeled into almost limitless shapes. Sun-dried pottery does not harden as heat-fired clay does, and a clay vessel that has only been sun-dried will soften if filled with water. Firing, in an oven known as a kiln, at extremely high temperatures renders the clay vessel virtually immune to deterioration, though brittle. After the first firing, pottery remains porous, and eventually liquids such as water or wine will transpire through it. For this reason, pottery is frequently glazed with a powdered glass that is applied to the hardened pottery and fired again at high temperatures.

The intense heat causes the glaze to melt and fuse to the clay body, rendering the surface of the object vitreous. Glazes can be either clear or opaque. Tin glaze—used on maiolica, faience, or delft—gives a white opaque surface like paint. Glazing is also a commonly used type of decoration, and it can be applied in a variety of colours and designs. Sometimes pottery or porcelain objects are painted before glazing (a technique called underglaze decoration), and other times the painted decoration is applied after glazing. Other decorative techniques include slip painting, which is a method whereby a thin mixture of clay and water, called slip, is used like paint, in different colours and for a myriad of effects. Incising, carving, or piercing the raw clay or adding separately modeled appendages are other types of decoration. The well-known Wedgwood jasperware is ornamented with applied reliefs. Coloured oxides are added to glaze to create different colours. Ferrous iron oxide, for example, creates the greenish glaze characteristic of Far Eastern celadon wares. The techniques of shaping pottery objects are equally varied and include the coiling of clay "ropes" as in coiled basketry, molding by hand or in a plaster mold, and turning with the aid of the potter's wheel.

Pottery objects are among the oldest manmade artifacts discovered, often preserved virtually unchanged after thousands of years. Pottery is not prone to the corrosion or disintegration that affects metal, wood, or cloth. Pottery dating from the Neolithic Period has been recovered, and the history of pottery made by ancient cultures in China and the Middle East has been extensively documented.

In the West the art of pottery reached an early high point in classical Greece in the making and decorating of vases. The two techniques of vase painting were "black figure," in which the decorative design was painted in shiny black pigment onto the reddish clay, and "red figure," in which the design was left reserved in red clay and the surface outside the design was covered with black paint.

The Islāmic cultures of the Middle East developed sophisticated forms of pottery, yielding some important technical achievements such as the rediscovery of tin glaze (first used by the Assyrians) in the 9th century and the development of lustre painting, which simulated the effect of precious metals. Chinese potters influenced those of Islām, and Islāmic potters in turn greatly influenced Europeans and also passed some technical innovations on to China.

In Europe tin-glazed ware was perfected from the 15th to the 18th century. The technique was introduced in Italy in the 13th century from the Middle East via Spain. Italian tin-glazed ware was called maiolica and by the 15th and 16th centuries was elaborately painted in strong, vibrant colours by some of the best Italian artists. The technique spread to France, where the wares were called faience, and to the Netherlands, where objects were decorated in imitation of Chinese designs, usually in blue and white, and called delft, or delftware.

In the 17th and early 18th centuries, many potters sought the secret of true, or hard, translucent Chinese porcelain, which had become widely imported into Europe, but this type of porcelain was not made in Europe until about 1707 in Germany and slightly later in England. Soft porcelain, an imitation, was made both in Italy and in France, where the most important factory, at Sèvres, began production in 1745. Its elaborately decorated wares painted with decorative designs of the highest quality received royal patronage.

In Germany important porcelain factories developed at Meissen and Nymphenburg and in England at Chelsea and Bow. Josiah Wedgwood started his famous manufactory in Staffordshire, Eng., in the mid-18th century in an area that was to become the centre of that country's pottery industry. By 1765 Wedgwood was well-known for producing a type of earthenware called creamware, which rapidly replaced tin-glazed ware in popularity. He also introduced jasperware, an unglazed stoneware, in about 1775 and bone china, a porcelain to which ground bone was added for hardness, in about 1800.

In China fine pottery was made in the T'ang period, but it was only in the Yüan dynasty that the best white porcelain ware was widely made. Japanese porcelain was influenced by that of China and Korea, the finest being made from the 16th to the 18th century. Two decorative styles, Kakiemon and Imari, became popular in the West.

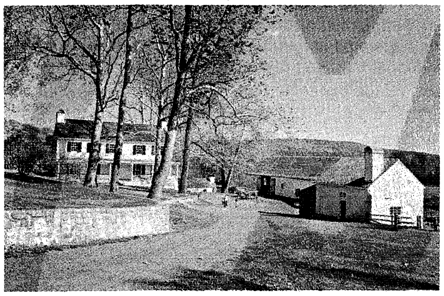
Pottle, Frederick A(lbert) (b. Aug. 3, 1897, Lovell, Maine, U.S.—d. May 16, 1987, New Haven, Conn., U.S.), American scholar who became the foremost authority on the 18th-century English biographer James Boswell.

Pottle graduated from Colby College in 1917 and earned a Ph.D. from Yale University in 1925. He taught at Yale from 1925 until his retirement in 1966, becoming a full professor there in 1930. Almost Pottle's entire scholarly career was devoted to the editing and publication of Boswell's journals and letters, 13,000 pages of which were purchased by Yale in 1949. The publication of these materials under Pottle's guidance began in 1950 with *Boswell's London Journal, 1762–1763*, and continued thereafter, with plans for a total of 30 to 35 volumes to be published. Thirteen such volumes were published under Pottle's editorship. Among Pottle's other works are *James Boswell, The Earlier Years, 1740–1769* (1966).

potto, also called BUSH BEAR, TREE BEAR, or SOFTLY-SOFTLY (*Perodicticus potto*), tropical African primate, family Lorisidae. The potto is a slow-moving, nocturnal tree dweller. It has a strong grip and clings tightly to the branches, moving quickly only in emergencies. It feeds on fruit, small animals, and insects and curls up to sleep by day in tree hollows. The potto is about 37 cm (15 inches) long excluding its furry, 5–10-centimetre (2–4-inch) tail. It has large eyes, sturdy limbs, stublike second fingers and toes, and a ridge of spines, of uncertain function, formed by the neck vertebrae. Its dense, woolly fur is grizzled reddish. Little is known of its breeding; one young is typical.

Potto (*Perodicticus potto*)
Tierbilder Okapia, Frankfurt am Main

Pottstown, borough, Montgomery County, southeastern Pennsylvania, U.S., on the Schuylkill River, 37 mi (59 km) northwest of Philadelphia. The region's first iron forge (known as Pool) was erected there (1716) by Thomas Rutter, and the Coventry forge pro-



Hopewell Village National Historic Site, near Pottstown, Pa.
Marvin Mort—Shostal/EB Inc.

duced the first commercial steel in Pennsylvania in 1732. The town, founded and laid out in 1752 by John Potts (an ironmaster whose father, Thomas, had been associated with Rutter), was known as Pottsgrove until 1815, when it was incorporated as a borough and the present name adopted. Arthur St. Clair lived there when he was elected president of the Continental Congress (1787).

Pottstown is the trading centre for a farm, dairy, and industrial region with manufactures including structural steel, auto parts, rubber and plastic products, dies, and textiles. Pottsgrove Mansion (1752) was used briefly as headquarters by George Washington during the winter of 1777–78. The Pollock Auto Showcase has a collection of antique automobiles. Hopewell Village National Historic Site (a restored iron-making community of 1830), Augustus Lutheran Church (1743), and French Creek and Singing Rocks parks are nearby. Pop. (1980) 22,729.

Pottsville, city, seat (1851) of Schuylkill County, east central Pennsylvania, U.S., at the gap of the Schuylkill River through Sharp Mountain, on the southern edge of the Pennsylvania anthracite-coal region, 35 mi (56 km) north of Reading. The first settlers were massacred (1780) by Indians; other settlers arrived in 1800 and became engaged in iron production. John Pott, for whom the city was named, acquired and expanded the iron works shortly after his arrival in 1806 and laid out the town in 1816. With the discovery of coal in the vicinity, Pottsville became a boom town. In the 1860s and '70s it was a rallying point for the Molly Maguires, a secret miners' society that struggled to improve mining conditions, often with violent methods; a trial in Pottsville (1877) resulted in six hangings and numerous prison sentences of suspected members of the society.

Following the decline of the coal industry, the manufacture of textiles, aluminum and steel products, and shoes became the city's economic mainstay. American novelist John O'Hara was born there and reportedly used Pottsville as the model for Gibbsville in *Appointment in Samarra* (1934) and other works. Inc. borough, 1828; city, 1913. Pop. (1980) 18,195.

Pottsville Series, in geology, division of the Pennsylvanian Period, which began about 325,000,000 years ago and lasted about 45,000,000 years. It was named for exposures studied in the region of Pottsville, in the anthracite coal district of Pennsylvania. Found from Pennsylvania to Ohio and from Maryland to Virginia, the Pottsville Series is the lowermost major division of the Pennsylvanian in the area and underlies rocks of the Allegheny Series. It has been divided into three groups of strata that attain an aggregate thickness of about 1,100 metres (3,600 feet) and consist largely of sandstones, shales, coal beds, and some limestones. Pottsville coals frequently are of substantial economic significance. A number of cyclothems, rhythmically alternating stratigraphic sequences, occur in the Pottsville Series. Abundant terrestrial plant remains have been useful for purposes of stratigraphic correlation and provide a glimpse of environmental conditions during Pottsville time.

Potwar Plateau, tableland in Rāwalpindi, Attock, and Jhelum districts, Punjab Province, Pakistan. Lying between the Indus and Jhelum rivers and bounded on the north by the Hazāra Hills and on the south by the Salt Range, its varied landscape is constantly affected by erosion. Its elevation varies from 1,000 to 2,000 ft (300 to 600 m) in a system of residual hills and hillocks formed from glacial debris as remnants of the Ice Age. The Kāla Chitta Range thrusts eastward across the plateau toward Rāwalpindi; the valleys of the Haro and Soān rivers cross the plateau from the eastern foothills to the Indus. Most of the hills and rivers are bordered by dissected ravine belts. The streams, due to constant rejuvenation, are deep set and of little use for irrigation. Agriculture is dependent largely on rainfall, which averages 15 to 20 in. (380 to 510 mm) annually; rainfall is greatest in the northwest and declines to arid conditions in the southwest. The chief crops are wheat, barley, sorghum, and legumes; onions, melons, and tobacco are grown in the more fertile areas near the Indus.

The Potwar Plateau is one of the most densely populated areas of Pakistan. It contains the ancient city of Rāwalpindi and the new national capital, Islāmābād, built since 1961. The plateau is the location of Pakistan's major oil fields, the first of which were discovered at Khaur (1915) and Dhuliān (1935); the Tut field was discovered in 1968, and exploration continued in the area in the 1970s. The oil fields are connected by pipeline to the refinery at Rāwalpindi.

pouch flower: *see* slipper flower.

pouched rat, any of several African rodents, belonging to the family Muridae (order Rodentia), characterized by cheek pouches in which their food is carried. Pouched rats belong to three genera, one of which, *Beamys*, is little known. The giant pouched rat (*Cri-*

Giant pouched rat (*Cricetomys gambianus*)
Jane Burton—Bruce Coleman Inc.

cetomys gambianus), the only member of its genus, is the largest, attaining a maximum length of about 75 centimetres (29 inches) including the long tail. A large-eared rodent with a rather long head, it is brown or gray-brown, with light underparts and white on the terminal half of its naked tail. It is vegetarian and lives in burrows in forests, fields, gardens, and thickets. A gentle animal, it is reputed to make a pleasing pet. It is also hunted for food.

Pouched rats of the genus *Saccostomus* are thickset, short tailed, and about 10 to 15 cm long without the tail. Gray above and white below, they are plant-eating burrowers and are found from eastern to southern Africa, often in or near cultivated land.

Pouchet, Félix-Archimède (b. Aug. 26, 1800, Rouen, Fr.—d. Dec. 6, 1872, Rouen), French naturalist who was a leading advocate of the idea of the spontaneous generation of life from nonliving matter.

Pouchet was director of the Rouen Museum of Natural History and the Rouen Jardin des Plantes (1828) and later a professor at the School of Medicine at Rouen (1838). In his major work, *Hétérogénie* (1859), he detailed the conditions under which living organisms supposedly were produced by chemical processes such as fermentation and putrefaction. His supporters were primarily among those whose religious or philosophical beliefs required the concept of spontaneous generation. Pouchet's theory was discredited when Louis Pasteur proved the existence of microorganisms in the air. Today Pouchet's elaborate arguments are mere curiosities.

Poughkeepsie, city, seat of Dutchess County, eastern New York, U.S., on the east bank of the Hudson River (there bridged to Highland), 75 mi (121 km) north of New York City. It was settled by the Dutch in 1683; its name, of Indian origin, means "waterfall." Poughkeepsie served as the temporary state capital, and the federal Constitution was ratified there in 1788. Its importance as a river grain port declined after completion of the Erie Canal in 1825, and the city became a manufacturing and commercial centre. The Smith Brothers (William and Andrew, the nationally advertised bearded "Trade" and "Mark") made their first cough drops *c.* 1850 in Poughkeepsie. Industry now includes computer assembly and research, printing and lithography, and the production of dairy equipment, electronic devices, business machines, clothing, chemicals, and ball bearings.

Poughkeepsie is the home of Vassar College (founded 1861), Marist College (1929), and Dutchess Community College (1958). The Franklin D. Roosevelt and Vanderbilt Mansion national historic sites are at Hyde Park, 5 mi (8 km) north. Inc. village, 1799; city, 1854. Pop. (1980) 29,757.

Poujade, Pierre (-Marie) (b. Dec. 1, 1920, Saint-Céré, Fr.), French bookseller, publisher, and politician who led a much publicized right-wing protest movement in France during the 1950s.

Poujade served (1939–40) in the aviation wing of the French Army during World War II. He fled to Morocco in 1942 and then to England, where he joined the Royal Air Force in 1943. With the end of the war in 1945, he returned to Saint-Céré, where he opened a book and stationery store, and in 1951 was elected to the municipal council. In 1953 he organized a local shopkeepers' strike to protest heavy taxation and the prospective visit of government tax collectors. Expanding his activities to other towns in southern France, he enrolled 800,000 members in his Union de Défense des Commerçants et des Artisans (Union for the Defense of Tradesmen and Artisans). Poujadisme, as his movement was called, succeeded in reducing tax collection drastically in the south of France and led to various tax concessions by the National Assembly in 1955. His support came largely from discontented peasants and small merchants. The peak of Poujadisme occurred during the elections of January 1956, when Poujadiste candidates won 52 of 595 Assembly seats and received 2,576,133 votes. Thereafter his influence waned, and his candidates (with a fraction of their previous popular vote) won no seats in the elections of November 1958. Poujade himself was never a candidate for the Assembly but remained a municipal councillor. *J'ai choisi le combat* (1956; "I Have Chosen to Fight") was his published manifesto.

During the 1970s and into 1980 Poujade founded and led both an organization dedicated to increasing the purchasing power of non-union workers to protect their rights and an association that is chiefly concerned with the protection and efficient use of French energy resources.

Poulenc, Francis (b. Jan. 7, 1899, Paris—d. Jan. 30, 1963, Paris), composer whose work illustrates a trend in French music after World War I and whose songs are considered among the best composed during the 20th century.

Poulenc
By courtesy of Angel Records; photograph, Lipnitzki

His first compositions—*Rapsodie Nègre* (1917), *Trois Mouvements Perpétuels,* for piano, and *Sonata for Piano Duet* (1918), and his settings of Guillaume Apollinaire's *Bestiaire* and Jean Cocteau's *Cocardes* (1919)—were witty pieces with streaks of impudent parody. Humour remained an important characteristic of his music, as in the Surrealistic comic opera *Les Mamelles de Tirésias* (1947; *The Breasts of Tiresias*), based on a farce by Apollinaire.

In 1920 the critic Henri Collet grouped Poulenc with five other young French composers, calling them "Les Six." The others were Arthur Honegger, Darius Milhaud, Georges Auric, Germain Tailleferre, and Louis Durey; although they reacted in the same way to the emotionalism of 19th-century music and the Impressionism of Debussy, they were in fact united by friendship more than by aesthetic ideals. Poulenc studied with the influential composer and teacher Charles Koechlin from 1921 to 1924. His ballet *Les Biches* (English title *The Houseparty*) was produced by Diaghilev in 1924. He composed his song cycles *Poèmes de Ronsard* and *Chansons galliardes* in 1924 and 1926. There followed more than 100 songs, chiefly on poems by Apollinaire (*e.g.,* "Banalités," 1940), and Paul Éluard (*e.g.,* "Tel jour, telle nuit," 1937).

In 1934 he appeared as piano accompanist to the baritone Pierre Bernac in the first of many recitals over several years, an experience that Poulenc felt deepened his understanding of the song as an art form. His songs, which range from parody to tragedy, are admired for their lyricism and for their sensitive integration of vocal line and accompaniment. His *Concert champêtre* for harpsichord (or piano) and orchestra (1928) was written at the suggestion of harpsichordist Wanda Landowska. Like many of his keyboard works it mingles the light, urbane character of 18th-century French keyboard music with 20th-century harmonies. During the 1930s Poulenc wrote many religious works, including *Litanies à la Vierge Noire de Rocomadour* (1936), the first of his religious choral compositions; *Mass in G Major* (1937) and *Stabat Mater* (1951). He participated in the French resistance movement during World War II. *Figure humaine* (performed 1945), a cantata based on poems by Éluard, voiced the spirit of the resistance and was secretly printed during the Nazi occupation. His opera *Dialogues des Carmélites* (1953–56, libretto by Georges Bernanos) is considered one of the finest operas of the 20th century. Other widely performed works by Poulenc were the *Sextet* for piano and wind quintet (1930–32), *Organ Concerto* (1938), and *Oboe Sonata* (1962).

Poulet, Georges (b. Nov. 29, 1902, Chênée, Belg.), major exponent of the *nouvelle critique* ("new criticism") of French literature that developed after World War II.

Poulet was educated at the University of Liège, where he received an LL.D. (1925) and a Ph.D. (1927). He began his academic career as professor of French at the University of Edinburgh (1928–51) and later taught at Johns Hopkins University, Baltimore, Md. (1952–57), and at the University of Zürich (from 1958).

Poulet was influenced by the ideas of Gaston Bachelard, who explored the relationship of Existentialism and psychology to literature. Poulet examined the perception of time in literature in his *Études sur le temps humain* (1949, reprinted 1972; *Studies in Human Time,* 1956, reprinted 1970) and the imagery of the circle in *Les Métamorphoses du cercle* (1961; *The Metamorphoses of the Circle,* (1966). Other works by Poulet include *La Distance intérieure* (1952; *The Interior Distance,* 1959), *L'Espace proustien* (1963; *Proustian Space,* 1977), *Le Point de départ* (1964), *Trois essais de mythologie romantique* (1966; reprinted 1971), *Les Chemins actuels de la critique* (1968; reprinted 1973), and *La Conscience critique* (1971).

Poulsen, Emil and Olaf (respectively b. July 9, 1842, Copenhagen—d. June 3, 1911, Helsinger, Den.; b. April 26, 1849, Copenhagen—d. March 26, 1923, Fredensborg, Den.), prominent members of a famous Danish theatrical family. The distinguished brothers made their acting debuts on the same night in 1867 at the Danske Kongelige Teater (Danish Royal Theatre).

Olaf, one of Denmark's most popular comic actors, was critically acclaimed for his appearances in works by Ludvig Holberg and for a myriad of Shakespearean roles, including Falstaff, Bottom in *A Midsummer Night's Dream,* and Sir Toby in *Twelfth Night.* Emil excelled in such serious roles as Macbeth and Shylock and gained equal prominence as a director. Emil's sons Adam and Johannes Poulsen (*q.v.*) were successful actors, and another son, Olaf, was a professional ballet dancer, as was Johannes' wife, Ulla.

Poulsen, Johannes (b. Nov. 17, 1881, Copenhagen—d. Oct. 14, 1938, Copenhagen) actor and director with the Danske Kongelige Teater (Royal Danish Theatre) and perhaps the primary member of a famous theatrical family.

Poulsen made his professional acting debut at the Dagmarteater in Copenhagen in 1901 with his older brother, the actor Adam Poulsen (1879–1969). Johannes joined the Kongelige Teater in 1909 and became popular for his interpretations of serious and comic roles in Shakespeare (particularly for Julius Caesar and for Petruchio in *The Taming of the Shrew*) and in plays by Ludvig Holberg, Adam Oehlenschläger, and Kaj Munk. As a director Johannes followed the style of staging introduced by Austrian producer Max Reinhardt and was acclaimed for the elegance, realistic detail, and spectacle of his scenic design, costumes, and make-up.

Johannes' father, Emil, and his uncle Olaf were also noted Danish actors (*see* Poulsen, Emil and Olaf). His brother Adam was also a successful actor, and his brother Olaf was a professional ballet dancer. His wife, Ulla Poulsen (*née* Iversen), was a principal dancer with the Royal Danish Ballet.

Poulsen, Valdemar (b. Nov. 23, 1869, Copenhagen—d. July 1942, Copenhagen), Danish engineer who in 1903 developed the first device for generating continuous radio waves, thus aiding the development of radio broadcasting.

After completing his education, Poulsen joined the Copenhagen Telephone Company as an assistant in the technical section. While working there, he invented the telegraphone, an electromagnetic phonograph capable of registering human speech by the alternating magnetization of a wire. He applied for a patent on this device, a forerunner of the modern magnetic sound recorder, on Dec. 1, 1898; a working model created great interest at the Paris Exposition in 1900. Even with this encouragement, he could not find financial backers in Europe. In 1903, with U.S. associates, he founded the American Telegraphone Company for the manufacture and sale of an improved version of his device. The telegraphone recorded continuously for 30 minutes on a length of steel piano-wire moving at a speed of 84 inches (213 centimetres) per second. The device did not have wide application, however.

Also in 1903 Poulsen obtained an English patent on his adaptation of a "singing arc" for radio purposes. Invented by the Englishman W. Duddell, the singing arc could generate continuous audio waves (hence its name). Poulsen transformed this device so that it could generate radio waves; the arc was formed between a copper cathode (positive terminal) and a carbon anode (negative terminal) in an atmosphere of a hydrocarbon gas and a transverse magnetic field. Subsequent efforts with this device by Poulsen and others made long-wave radio broadcasting possible by 1920.

poultry: *see* fowl.

pouncet-box, small silver box, the sides of which are "pounced," or pierced, with holes, containing a sponge soaked in pungent vinegar to ward off diseases and offensive odours. The box was carried by English gentlemen from about the mid-16th to the early 17th century. An early example in the Victoria and Albert Museum, London, is decorated with the Tudor arms. *See also* pomander; potpourri; vinaigrette.

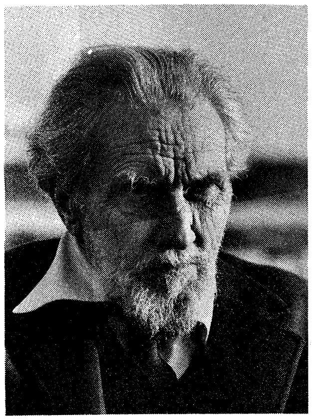
pound, unit of avoirdupois weight, equal to 16 ounces, 7,000 grains, or 0.4536 kilograms, and of troy and apothecaries' weight, equal to 12 ounces, 5,760 grains, or 0.37 kilograms. The Roman ancestor of the modern pound, the libra, is the source of the abbreviation lb. In early England several derivations of the libra vied for general acceptance. Among the earliest of these, the Tower pound, so called because its standard was kept in the Royal Mint in the Tower of London, was applied to precious metals and drugs. The troy pound, named after Troyes, Fr., superseded the lighter Tower pound in 1527 as the gold and silver standard. Increased trade with France led also to the adoption of the 16-ounce avoirdupois pound in the 16th century.

The British monetary pound is historically linked with the minting of silver coins (sterlings) from the Tower pound. Large payments were reckoned in "pounds of sterlings," later shortened to "pounds sterling."

pound (monetary unit): *see* pound sterling.

Pound, Ezra (Loomis) (b. Oct. 30, 1885, Hailey, Idaho, U.S.—d. Nov. 1, 1972, Venice), U.S. poet and critic, often called the "poet's poet" because of his profound influence on 20th-century writing in English. His pro-Fascist broadcasts in Italy during World War II led to his postwar arrest and confinement until 1958.

Early life and career. Pound was born in a small mining town in Idaho, the only child of a Federal Land Office official, Homer Loomis Pound of Wisconsin, and Isabel Weston of New York City. In about 1887 the family



Ezra Pound
Life Magazine—David Lees, © 1964, Time Inc.

moved to the eastern states, and in June 1889, following Homer Pound's appointment to the U.S. Mint in Philadelphia, they settled in nearby Wyncote, where Pound lived a normal middle-class childhood.

After two years at Cheltenham Military Academy, which he left without graduating, he attended a local high school. From there he went for two years (1901–03) to the University of Pennsylvania, where he met his lifelong friend, the poet William Carlos Williams. He took his Ph.B. (bachelor of philosophy) degree at Hamilton College, Clinton, N.Y., in 1905 and returned to the University of Pennsylvania for graduate work. He received his M.A. in June 1906 but withdrew from the university after working one more year toward his doctorate. He left with a knowledge of Latin, Greek, French, Italian, German, Spanish, Provençal, and Anglo-Saxon, as well as of English literature and grammar.

In the autumn of 1907, Pound became professor of Romance languages at Wabash Presbyterian College, Crawfordsville, Ind. Although his general behaviour fairly reflected his Presbyterian upbringing, he was already writing poetry and was affecting a bohemian manner.

His career came quickly to an end, and in February 1908, with light luggage and the manuscript of a book of poems that had been rejected by at least one American publisher, he set sail for Europe.

He had been to Europe three times before: with his great aunt in 1898, with his parents in 1902, and alone in the summer of 1906, when he had gathered the material for his first three published articles: "Raphaelite Latin," concerning the Latin poets of the Renaissance, and "Interesting French Publications," concerning the troubadours (both published in the *Book News Monthly,* Philadelphia, September 1906); and "Burgos, a Dream City of Old Castile" (October issue).

Now, with little money, he sailed to Gibraltar and southern Spain, then on to Venice, where in June 1908 he published, at his own expense, his first book of poems, *A lume spento.* About September 1908 he went to London, where he was befriended by the writer and editor Ford Madox Ford (who published him in his *English Review*), entered William Butler Yeats's circle, and joined the "school of images," a modern group presided over by the philosopher T.E. Hulme.

Success abroad. In England, success came quickly to Pound. A book of poems, *Personae,* was published in April 1909; a second book, *Exultations,* followed in October; and a third book, *The Spirit of Romance,* based on lectures delivered in London (1909–10), was published in 1910.

After a trip home—a last desperate and unsuccessful attempt to make a literary life for himself in Philadelphia or New York City—he returned to Europe in February 1911, visiting Italy, Germany, and France. Toward the end of 1911 he met an English journalist, Alfred R. Orage, editor of the Socialist weekly *New Age,* who opened its pages to him and provided him with a small but regular income during the next nine years.

In 1912 Pound became London correspondent for the small magazine *Poetry* (Chicago); he did much to enhance the magazine's importance and was soon a dominant figure in Anglo-American verse. He was among the first to recognize and review the poetry of Robert Frost and D.H. Lawrence and to praise the sculpture of the modernists Jacob Epstein and Henri Gaudier-Brzeska. As leader of the Imagist movement of 1912–14, successor of the "school of images," he drew up the first Imagist manifesto with its emphasis on direct and sparse language and precise images in poetry and edited the first Imagist anthology, *Des Imagistes* (1914).

A shaper of modern literature. Though his friend Yeats had already become famous, Pound succeeded in persuading him to adopt a new leaner style. In 1914, the year of his marriage to Dorothy Shakespear, daughter of Yeats's friend Olivia Shakespear, he began a collaboration with the then unknown James Joyce. As unofficial editor of *The Egoist* (London) and later as London editor of *The Little Review* (New York City), he saw to the publication of Joyce's *Portrait of the Artist as a Young Man* and *Ulysses,* thus spreading Joyce's name and securing financial assistance for him. In that same year he gave T.S. Eliot a similar start in his career as poet and critic.

He continued to publish his own poetry (*Ripostes,* 1912; *Lustra,* 1916) and prose criticism (*Pavannes and Divisions,* 1918). From the literary remains of the great Orientalist Ernest Fenollosa, which had been presented to Pound in 1913, he succeeded in publishing highly acclaimed English versions of early Chinese poetry, *Cathay* (1915), and two volumes of Japanese Nō plays (1916–17) as well.

Unsettled by the slaughter of World War I and the spirit of hopelessness he felt was pervading England after its conclusion, Pound decided to move to Paris, publishing before he left two of his most important poetical works, "Homage to Sextus Propertius," in the book *Quia Pauper Amavi* (1919), and *Hugh Selwyn Mauberley* (1920). "Propertius" is a comment on the British Empire in 1917, by way of Propertius and the Roman Empire; *Mauberley,* a finely chiselled "portrait" of one aspect of British literary culture in 1919, is one of the most praised poems of the 20th century.

In Paris (1921–24) Pound met and helped the young American novelist Ernest Hemingway; wrote an opera, *Le Testament,* based on poems of François Villon (performed in Paris in 1926 and by the BBC, London, in 1931 and 1962); assisted T.S. Eliot with the editing of his long poem *The Waste Land;* and acted as correspondent for the New York literary journal *The Dial.*

"The Cantos." In 1924 he tired of Paris and moved to Rapallo, Italy, which was to be his home for the next 20 years. In 1925 he had a daughter, Maria, by the expatriate American violinist Olga Rudge, and in 1926 his wife, Dorothy, gave birth to a son, Omar. The daughter was brought up by a peasant woman in the Italian Tirol, the son by relatives in England. In 1927–28 Pound edited his own magazine, *Exile,* and in 1930 he brought together, under the title *A Draft of XXX Cantos,* various segments of his ambitious long poem "The Cantos," which he had begun in 1915.

The 1930s saw the publication of further volumes of "The Cantos" (*Eleven New Cantos,* 1934; *The Fifth Decad of Cantos,* 1937; *Cantos LII–LXXI,* 1940) and a collection of some of his best prose (*Make It New,* 1934). A growing interest in music caused him to arrange a long series of concerts in Rapallo

during the 1930s, and, with the assistance of Olga Rudge, he played a large part in the rediscovery of the 17th-century Italian composer Antonio Vivaldi. The results of his continuing investigation in the areas of culture and history were published in his brilliant but fragmentary prose work *Guide to Kulchur* (1938).

Following the worldwide depression of the 1930s, he turned more and more to history, especially economic history, a subject in which he had been interested since his meeting in London in 1918 with C.H. Douglas, the founder of Social Credit, an economic theory stating that maldistribution of wealth due to insufficient purchasing power is the cause of economic depressions. Pound had come to believe that a misunderstanding of money and banking by governments and the public, as well as the manipulation of money by international bankers, had led the world into a long series of wars. He became obsessed with monetary reform (*ABC of Economics,* 1933; *Social Credit,* 1935; *What Is Money For?,* 1939), involved himself in politics, and declared his admiration for the Italian dictator Benito Mussolini (*Jefferson and/or Mussolini,* 1935). The obsession affected his "Cantos," which even earlier had shown evidence of becoming an uncontrolled series of personal and historical episodes.

Anti-American broadcasts. As war in Europe drew near, Pound returned home (1939) in the hope that he could help keep the peace between Italy and the United States. He went back to Italy a disappointed man, and between 1941 and 1943, after Italy and the United States were at war, he made several hundred broadcasts over Rome Radio on subjects ranging from James Joyce to the control of money and the U.S. government by Jewish bankers and often openly condemned the U.S. war effort. He was arrested by U.S. forces in 1945 and spent six months in a prison camp for army criminals near Pisa. Despite harsh conditions there, he translated Confucius into English (*The Great Digest & Unwobbling Pivot,* 1951) and wrote *The Pisan Cantos* (1948), the most moving section of his long poem-in-progress.

Returned to the United States to face trial for treason, he was pronounced "insane and mentally unfit for trial" by a panel of doctors and spent 12 years (1946–58) in Saint Elizabeths Hospital for the criminally insane in Washington, D.C. During this time he continued to write on "The Cantos" (*Section: Rock-Drill,* 1955; *Thrones,* 1959), translated ancient Chinese poetry (*The Classic Anthology,* 1954) and Sophocles' *Trachiniai* (*Women of Trachis,* 1956), received visitors regularly, and kept up a voluminous and worldwide correspondence. Controversy surrounding him burst out anew when, in 1949, he was awarded the important Bollingen Prize for his *Pisan Cantos.* When on April 18, 1958, he was declared unfit to stand trial and the charges against him were dropped, he was released from Saint Elizabeths. He returned to Italy, dividing the year between Rapallo and Venice.

Out of his 60 years of publishing activity came 70 books of his own, contributions to about 70 others, and more than 1,500 articles. (N.St.)

MAJOR WORKS. *Poems. A lume spento* (1908); *Personae* (1909); *Exultations* (1909); *Provença* (1910); *Canzoni* (1911); *Ripostes* (1912); *Lustra* (1916); *Quia Pauper Amavi* (1919); *Hugh Selwyn Mauberley* (1920); *Umbra* (1920), collected early poems; *Poems 1918–1921* (1921); *A Draft of XVI Cantos* (1925); *Personae* (*The Collected Poems*) (1926); *A Draft of the Cantos 17–27* (1928); *A Draft of XXX Cantos* (1930); *Eleven New Cantos* (1934); *The Fifth Decad of Cantos* (1937); *Cantos LII–LXXI* (1940); *The Pisan Cantos* (1948); *The Cantos* (collected edition, 1948); *Section:*

Rock-Drill, cantos 85–95 (1955); *Thrones, 96–109 de los cantares* (1959); *Redondillas, or Something of That Sort* (1967), unpublished long poem of 1911; *The Cantos* (1970).

Prose. *The Spirit of Romance* (1910); *Gaudier-Brzeska* (1916); *Pavannes and Divisions* (1918); *Instigations* (1920); *Indiscretions* (1923); *Antheil and the Treatise on Harmony* (1924); *Imaginary Letters* (1930); *How to Read* (1931); *ABC of Economics* (1933); *ABC of Reading* (1934); *Make It New* (1934); *Social Credit: An Impact* (1935); *Jefferson and/or Mussolini* (1935); *Polite Essays* (1937); *Guide to Kulchur* (1938); *What Is Money For?* (1939); *"If This Be Treason . . ."* (1948); *Literary Essays* (1954); *Pavannes and Divagations* (1958); *Impact* (1960), economic, political, and cultural essays.

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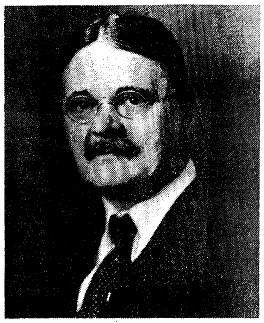
Pound, Roscoe (b. Oct. 27, 1870, Lincoln, Neb., U.S.—d. July 1, 1964, Cambridge, Mass.), jurist, botanist, and educator, chief U.S. advocate of "sociological jurisprudence" and a leader in the reform of court administration.



Roscoe Pound
By courtesy of the Library of Congress, Washington, D.C.

After studying botany at the University of Nebraska (B.A., 1888; Ph.D., 1897) and law at Harvard (1889–90), he was admitted to the Nebraska bar and practiced law while teaching at the state university (1890–1903). During his term as director of the state botanical survey (1892–1903), he discovered a rare fungus, later named *Roscopoundia.*

Pound also served as commissioner of appeals for the state supreme court (1901–03) and commissioner on uniform state laws for Nebraska (1904–07). He taught at Northwestern University, Chicago (1907–09), and at the University of Chicago (1909–10), after which he went to Harvard, where he was professor of law (1910–37) and dean of the law school (1916–36). On his resignation as dean, he received a "roving professorship" there and taught a variety of subjects until his retirement (1947). After World War II he spent some time in Formosa reorganizing the Nationalist Chinese judicial system.

Pound's theory of law required the adjustment of inherited legal codes and traditions to contemporary social conditions. His jurisprudence may have partially inspired, and was advanced by others as a justification of, Pres. Franklin D. Roosevelt's New Deal of the 1930s, which Pound nonetheless considered extreme. His numerous writings on legal and botanical subjects generated two bibliographies, by F.C. Setaro (1942) and G.A. Strait (1960).

Pound Quartzite, formation of Precambrian rocks found in the region of the Adelaide, South Australia (the Precambrian began about 4,600,000,000 years ago and ended 570,000,000 years ago). The Pound Quartzite consists of purple and green shales and siltstones, limestones, and quartzites; it is notable because from it a very early fossil assemblage, the Ediacara fauna, was recovered. The fossil assemblage evidences a variety of types, many of which are surprisingly complex and afford a rare glimpse at the diversity of Precambrian animal life and communities.

Consult the INDEX *first*

pound sterling, the basic monetary unit of Great Britain, divided (since 1971) decimally into 100 new pence. The term is derived from the fact that, in about 775, silver coins known as "sterlings" were issued in the Saxon kingdoms, 240 of them being minted from a pound of silver, the weight of which was probably about equal to the later troy pound. Hence large payments came to be reckoned in "pounds of sterlings," a phrase later shortened to "pounds sterling." After the Norman Conquest the pound was divided for accounting purposes into 20 shillings and into 240 pennies, or pence. In medieval Latin documents the words *libra, solidus,* and *denarius* were used to denote the pound, shilling, and penny, which gave rise to the use of the symbols £, *s.,* and *d.*

On Feb. 15, 1971, the pound sterling was officially decimalized into 100 new pence. The symbol £ was retained for the pound sterling; the letter *p.* was chosen for the new penny.

poundage (English subsidy): *see* tonnage and poundage.

Poundmaker (b. 1826, near Battleford, N.W. Terr.—d. July 4, 1886, near Gleichen, Alta.), Cree Indian chief of the western plains of Canada who took part in the 1885 Riel Rebellion—an uprising of Indians and Métis (persons of mixed Indian and European ancestry)—against the Canadian government.

When Sir John Douglas Sutherland Campbell, marquess of Lorne, governor general of Canada, made a tour of the Canadian northwest in 1881, Poundmaker served as his guide from Battleford to Calgary (now in Alberta). In 1881–85 Poundmaker led agitation of the Indians of north Saskatchewan for redress of their grievances, and in 1885 he joined the Riel Rebellion under the Métis leader Louis Riel. After Riel was captured later that year, Poundmaker surrendered and was sentenced to a three-year prison term. He was released after serving one year and died soon thereafter.

Pour le Mérite, English ORDER FOR MERIT, distinguished Prussian order established by Frederick II the Great in 1740, which had a military class and a class for scientific and artistic achievement. This order superseded the *Ordre de la Générosité* (French: Order of Generosity) that was founded by Frederick I of Prussia in 1667.

Frederick William III made the order solely military in 1810, but in 1842 Frederick William IV created a civilian division for the arts and sciences. In this division were such prominent Germans as Savigny, Lessing, Mendelssohn, Schelling, Schlegel, Tieck, Meyerbeer, Grimm, and Humboldt. Foreign members included such luminaries as Count Borghese, Chateaubriand, Faraday, Herschel, Daguerre, Liszt, Rossini, and Carlyle. During the Franco-Prussian War and World War I, the military division was the highest individual reward for gallantry in action. The order went into a period of stagnation after 1935 but was revived by the Federal Republic of Germany in 1952.

Currently the order is awarded to men and women who have made outstanding achievements in either the arts or sciences. Membership is limited to 30 German citizens, of whom 10 must be in the philosophic-scientific field, 10 in the natural sciences, and 10 in the arts. Foreigners (not more than 30) may become supernumerary members. The order, which has only one class, is administered by a chancellor elected by the members. If a place becomes vacant, the members themselves elect a new member.

The badge is a gold medallion of the Prussian eagle surrounded by a blue-enamelled scroll with the inscription *Pour le Mérite* (French: "For Merit"). An arrangement of F's and II's (for Frederick II) surrounds the eagle, and the scroll bears four crowns. The insignia are returned on the death of the holder.

Pousseur, Henri (b. July 23, 1929, Malmédy, Belg.), 20th-century Belgian composer whose works include several seemingly contradictory types of music. He wrote music for many different combinations of performers as well as for electronic instruments only; his *Electre* (1959) uses sounds produced both by live performers and by electronic machines.

Influenced by such composers as Anton von Webern (1883–1945), Pousseur wrote serial music, in which various musical elements are rigidly controlled. Yet he also composed aleatoric, or chance, music, involving many types of highly unpredictable events. In *Répons pour sept musiciens* (1960; *Responses for Seven Musicians*), the course of the composition is partly determined by lottery and by the players' free choice based on moves on a checkerboard. In Pousseur's opera-like *Miroire de votre Faust* (1961–62; *The Mirror of Your Faust*), the Faust story is given new twists; which one of four possible denouements a particular performance presents is determined by audience vote.

Pousseur taught music widely in Europe and the United States. He also helped establish electronic music studios in Cologne (1954), Milan (1956), and Brussels (1958). In his theoretical writings, such as *Fragments théoriques I sur la musique expérimentale* (1970; "Theoretic Pieces I: Experimental Music"), he argues that certain older methods of discussing and appraising music are no longer valid for recent music that makes use of certain new musical aims, resources, and techniques. Pousseur's later works include *Couleurs croisées* (1967; *Crossed Colors*), a series of unusual variations on the civil rights song "We Shall Overcome"; *Croisées des couleurs croisées* (1970; *Crosses of Crossed Colors*), a sequel to *Couleurs croisées* for female voice, pianos, tape recorders, and two radio receivers dialled randomly to Indian and black prose and poetry recitals and political speeches; *Invitation à l'Utopie* (1971; *Invitation to Utopia*); *Vue sur les jardins interdits* (1974; *View on the Forbidden Gardens*); and *19√8/4* (1975), for solo cello.

Poussin, Gaspard: *see* Dughet, Gaspard.

Poussin, Nicolas (b. 1594, Villers, northwest of Paris—d. Nov. 19, 1665, Rome), 17th-century French painter, a leader of pictorial classicism in the Baroque period. Except for two years as court painter to Louis XIII, he spent his entire career in Rome. His paintings (*e.g.,* "The Adoration of the Shepherds," *c.* 1637) and aesthetic philosophy influenced generations of French painters, including Jacques-Louis David, Eugène Delacroix, and Paul Cézanne.

"Holy Family on the Steps," oil on canvas by Nicolas Poussin, 1648; in the National Gallery of Art, Washington, D.C.

By courtesy of the National Gallery of Art, Washington, D.C., Samuel H. Kress Collection, 1952

Childhood and early travels. Poussin was born in a hamlet near the small town of Les Andelys, on the Seine River. He was the son of poor parents who earned a scanty living as small farmers, although his father once had been a soldier. Poussin spoke of the good education he received at Les Andelys, yet it seems that he was not even instructed in a trade or craft until his 16th year. He apparently did not show any interest in the arts until the painter Quentin Varin (1570–1634) visited the village in 1612 to produce several paintings for the church of Le Grand Andely. Poussin's interest in the arts was awakened, and he decided to become a painter. As this was impossible in Les Andelys, he left his home, going first to Rouen and then to Paris to find a suitable teacher. His poverty and ignorance made this search very difficult. He found no master who appeared satisfactory and studied at different times under several minor painters who were either Mannerists in the Dutch tradition or portraitists. In another respect Poussin was more successful. A young nobleman from the French province of Poitou asked Poussin to come to his château and paint several pictures for him. But the nobleman's mother tried to use Poussin as an ordinary servant, so the young artist secretly left the estate to return to Paris. Travelling on foot and without any means, Poussin endured, according to his own statement, the greatest hardship and fatigue. He did not reach Paris but had to return to his paternal home, where he arrived not only very ill but also much humiliated.

Recovering after a year, Poussin again set out for Paris, not only to continue his studies but also to pursue another aim. While previously resident in the French capital, he had met a chamberlain of the queen mother, Marie de Médicis, an amateur of high rank who introduced him to the art of the Italian High Renaissance through reproductions of Raphael's paintings. These engravings, according to his biographer Passeri, inspired him with "that light he had ever longed for." He yearned, therefore, to go to Rome, which was then the centre of the European art world. Only after three attempts was he successful in reaching the papal city. His first attempt to reach Rome met with disaster in Florence, the second at Lyon, where he was stopped by police because of debts he had left unpaid in Paris. His third and final attempt to get to Rome was aided by the cavalier Giambattista Marino, the Italian court poet to Marie de Médicis.

Marino, then a sick elderly man, took a liking to the young Poussin and ordered him to make a series of mythological drawings illustrating the *Metamorphoses* by the ancient Roman poet Ovid. He discussed with him the theoretical fundamentals common to poetry and painting, as they were seen at that time, and tried to pave his way to Rome, recommending him to Cardinal Francesco Barberini, a nephew of the reigning pope, Urban VIII. Marino had also intended to introduce Poussin personally to several Roman connoisseurs, as he was himself about to go to Rome (1623). But his plan failed; he fell ill and had to leave for Naples before Poussin arrived from Paris. The painter was left to rely on his own abilities and again underwent a time of severe privation.

First Roman period. Between Poussin's arrival in Rome in 1624 and his departure for France in 1640 he came to know many of Rome's most influential people. Perhaps the most important of his new acquaintances was the commendatore Cassiano dal Pozzo, secretary to Cardinal Barberini, who had a decisive influence upon his art. Pozzo was a well-known antiquarian who owned a rich collection of antique artifacts. According to Poussin's own testimony, these antiquities taught him most of what he came to know about classical art. Through Pozzo, who became Poussin's patron, the French painter became a fervent admirer of ancient Roman civilization. Voluntarily exiled from his native country, he developed an unreasonable hatred of French culture and an artistic style that, by its thoroughly Roman character, markedly contrasted with that of the other French artists then living in Rome or France.

Poussin continued the vagrant life of a bachelor, often changing his Roman address for unknown reasons. Toward the end of the 1620s he contracted a serious illness (according to Passeri, syphilis) that forced him to change his life-style. Suffering intense pain and socially abandoned, he was finally looked after by the family of a French confectioner and his Italian wife. Possibly impelled by a sense of gratitude after his recovery in 1630 or perhaps for mere convenience, he married their daughter, Anne-Marie Dughet, who was 18 years younger than himself. With Anne-Marie he lived in a childless marriage until she, passionately lamented by the painter, died a few years before his own death. He then began to lead a modest, silent, almost hidden petit bourgeois life, in a small house to which hardly anybody was admitted.

Although his art was much appreciated and he was known as one of the great painters in Rome, Poussin retired from active participation in artistic circles, as well as from the French community. His retirement from the artistic life of Rome did not result from fear nor from doubts about his artistic talent; on the contrary, it was based on an enormous self-confidence. While other artists followed the general movement of the Roman Baroque with the intention of attaining a certain significance in the general trend of the day, Poussin endeavoured to overcome the fashionable style on a higher level, inspired by Roman pre-Christian architecture and Latin books on moral conduct as well as by the nobility and greatness of Raphael's works, which, as he believed, had renewed the spirit of antiquity.

Painter to Louis XIII. Between 1638 and 1639 his achievements in Rome attracted the attention of the French court. Louis XIII's powerful minister Cardinal Richelieu tried to persuade Poussin to return to his homeland and become a member of the Académie Royal de Peinture et de Sculpture that he was trying to establish. In spite of a long preliminary correspondence, including an official invitation and a personal letter written by the King, Poussin showed no intention of following the summons. For a year and a half he made all sorts of excuses, knowing only too well how little the atmosphere of the French court would be compatible with the life he was used to and with the art he produced. But he finally yielded to the continued intense pressuring of Richelieu, Louis XIII, and Fréart de Chambray, a connoisseur of high rank and a collector, who was sent to Rome to conduct the negotiations. On Oct. 28, 1640, Poussin sailed for France with several assistants. He left his wife in Rome, indicating how much he distrusted his future appointment as a *peintre du roi,* "painter to the king."

Received with great honours, Poussin nevertheless soon found himself in trouble with the ministers of the king as well as with the French artists, whom he met with the utmost arrogance. He was offered commissions for kinds of work he was not used to nor really qualified to execute: altarpieces, book covers, and designs for tapestry and for the decoration of the Grande Galérie of the Louvre palace. What he produced did not elicit the praise he expected, so he left Paris in September 1642, not triumphantly as he had arrived but defeated, alone, in the *coche de Lyon* (*i.e.,* ordinary stagecoach), and perhaps more humiliated than ever before. Unfortunately he did not live to see his personal style glorified by the French Academy in the late 17th century.

Second Roman period. During Poussin's second Roman period, his personal appearance and behaviour changed. How he wished to be seen is evident from his two self-portraits, painted 1649 and 1650: a noble man with an assertive air that stemmed from his self-esteem. During this last creative period Poussin concentrated his efforts on highly sophisticated themes of classical mythology as well as on biblical subjects.

Growing rather pessimistic with respect to human existence in general, he followed only from a great distance the events of Roman life and the political difficulties of his native land. His health declined, but the more his body decayed, the more his spiritual and artistic faculties rose. From 1660 onward, Poussin's complaints about his declining health became more numerous, and continuous pain interrupted his activities. Early in 1665 he ceased to paint, and after his death that fall he was buried in San Lorenzo in Lucina, his Roman parish church. (K.Ba.)

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Poussinist, French POUSSINISTE, any of the supporters of the supremacy of *disegno* ("drawing") over colour in the "quarrel" of colour versus drawing that erupted in the French Royal Academy of Painting and Sculpture in Paris in 1671. The quarrel was over the preeminent importance of drawing (*i.e.,* the use of line to depict form) or colour in the art of painting. The Poussinists (followers of Nicolas Poussin) supported the Platonic concept of the existence in the mind of ideal objects that could be reconstructed in concrete form by a reasoned selection of beautiful parts from nature. Colour to the Poussinists was temporary, inessential, and only a decorative accessory to form. The Poussinists extolled the virtues of antiquity and Raphael, the Carracci, and the severe art of Poussin and were opposed by the party of the Rubenists, who had as their ideal masters Titian, Correggio, and Peter Paul Rubens.

As Poussin was a Frenchman, sometimes referred to as the "French Raphael," and Rubens was a Fleming who had been expelled from France when it was suspected that he was spying for the Spanish Netherlands, there was a strong nationalistic stake in the Poussinists' motivation. In 1672 the debate between colour and drawing was temporarily halted by the chancellor of the Academy, Charles Le Brun, who stated officially that "the function of colour is to satisfy the eyes, whereas drawing satisfies the mind." *Compare* Rubenist.

pout (fish): *see* bib.

Poŭthĭsăt, formerly PURSAT, town, west-central Cambodia. Poŭthĭsăt lies along the Poŭthĭsăt River. It is linked to Phnom Penh, the national capital, and to neighbouring towns by a national highway and a rail line. Poŭthĭsăt lies southwest of Sap Lake, in an area of rich, well-watered soils that is one of the most important rice-growing centres in Cambodia. Corn (maize), potatoes, bananas, mulberry, vegetables, cotton, china-grass, and jute are also grown. Pop. (latest est.) town, 14,736.

Považská Bystrica, Hungarian VÁGBESZTERCE, town, Stredoslovenský *kraj* (region), western Slovakia, eastern Czechoslovakia, situated 15 miles (24 km) southwest of Žilina on the Váh River. The town is a popular excursion centre because of its location near the picturesque Javorníky Mountains. Economic activities include the manufacture of heavy munitions. One of the town's notable structures is a Gothic church with tombstones dating to the European Renaissance. Pop. (1988 est.) 39,256.

Poveda Burbano, Alfredo (b. Jan. 24, 1926, Ambato, Ecuador—d. June 7, 1990, Miami, Fla., U.S.), head of the military junta that overthrew the regime of Ecuadorian President Guillermo Rodríguez Lara in a bloodless coup on Jan. 11, 1976, and held power until the return to civilian rule in 1979. Poveda was vice admiral of the navy at the time.

Poveda was educated at the Ecuadorian and Argentine naval academies, at the Royal Naval Gunnery School in England, and at the Brazilian Naval War College. From 1973 to 1975 he was minister of the interior, a position regarded as second in authority to the presidency. He also served as chief of the armed forces (1975–76) and as the Ecuadorian naval commander (1975–79). Frustrated by the economic ineptitude of the regime of Lara, who himself had seized power in a 1972 military coup, Poveda and other military officers overthrew it, promising a return to civilian rule within two years. Although in theory Ecuador was ruled by a triumvirate composed of Poveda, Guillermo Durán Arcentales, and Luis Leoro Franco, in reality Poveda ruled alone. He was one of the five Andean leaders who, on Aug. 8, 1978, signed the Declaration of Bogotá, which restated the intentions of the Andean group to seek further economic integration. He ensured the orderly transfer of power to the democratically elected regime of Jaime Roldós Aguilera by insisting repeatedly that the armed forces' decision to surrender power to the winner of the election held on April 29, 1979, was irrevocable. When Roldós assumed power four months later, Poveda resigned as head of the navy.

poverty, the condition that is said to exist when people lack the means to satisfy their basic needs. In this context, the identification of poor people, then, first requires a determination of what constitutes basic needs. These may be defined as narrowly as "those necessary for survival" or as broadly as "those reflecting the prevailing standard of living in the community." The first criterion would cover only those people near the borderline of starvation or death from exposure; the second would extend to people whose nutrition, housing, and clothing, though adequate to preserve life, do not measure up to those of the population as a whole. The problem of definition is further compounded by the noneconomic connotations that the word poverty has acquired. Poverty has been associated, for example, with poor health, low levels of education or skills, an inability or an unwillingness to participate in society, high rates of disruptive or disorderly behaviour, and improvidence. While all of these attributes have often been found to exist with poverty, their inclusion in a definition of poverty would tend to obscure the relation between them and the inability to provide for one's basic needs. Whatever definition one uses, authorities and laymen alike commonly assume that the effects of poverty are harmful both to individuals and to society.

Poverty can be classified according to a number of dimensions, such as time or duration (long- or short-term or cyclical) or distribution (widespread, concentrated, individual).

Cyclical poverty. Cyclical poverty refers to poverty that may be widespread throughout a population, but the occurrence itself is of limited duration. In nonindustrial societies (present and past), this sort of inability to provide for one's basic needs rests upon temporary food shortages caused by natural phenomena or poor agricultural planning.

In industrialized societies the standard of living is related to fluctuations in the ability of business, industry, and government to sustain high levels of employment at adequate wages. This ability, in turn, is dependent on, among other factors, fiscal policy, international-trade balances, and, in capitalist countries, the optimism or pessimism of investors. Throughout the 19th and early 20th centuries, the industrialized nations of the world experienced business panics and recessions. The United States' experience in the Great Depression of the 1930s, though unique in some of its features, exemplifies this kind of poverty. The Depression was rooted in the war debts of U.S. allies, reparations payments by Germany, and the tariff policies following World War I, as well as in runaway stock-market speculation. Its effects, like those of prior depressions, included high unemployment rates, lowered wholesale prices, and reduced national production and income. Although business depressions affect all segments of society, their impact is most severe on people of the lowest strata, because of their marginal resources.

For many years, poverty resulting from business fluctuations was accepted as an inevitable consequence of a natural process of market regulation. Relief (in the form of either temporary public-works projects or provision of food) was granted reluctantly to tide people over until the business cycle again entered an upswing. As the causes of business depressions came to be more clearly understood, relief and public works were replaced in importance by programs intended to avert business depressions or to hasten recovery from them through manipulation of fiscal policy, regulation of the stock market, and international-trade agreements.

Collective poverty. In contrast to cyclical poverty, which is temporary, "collective" poverty involves a relatively permanent insufficiency of means to secure basic needs—a condition that may be so general as to describe the average level of life in a society or that may be concentrated in relatively large groups in an otherwise prosperous society. Both generalized and concentrated collective poverty may be transmitted from generation to generation, parents passing their poverty on to their children.

Poverty is relatively general and lasting in much of Asia, the Middle East, most of Africa, and large parts of South America and Central America. Life for the bulk of the population in these societies is at a minimal level. Nutritional deficiencies cause disease seldom seen by doctors in the West. Low life expectancy, high levels of infant mortality, and poor health characterize life in these societies.

This type of poverty is usually related to economic underdevelopment. The total resources of many of these nations would be insufficient to support the population adequately, even if they were equally divided among all of the citizens. Proposed remedies are twofold: expansion of the gross national product through improved agriculture or industrialization, or both, and population limitation. Thus far, both population control and induced economic development in many countries have proved difficult and disappointing in their results.

Increase of the gross national product does not necessarily lead to an improved standard of living for the population at large—for a number of reasons. (1) The most apparent of these is that, in the short run, as the food supply increases, the population generally increases at a higher rate. (2) Many underdeveloped nations are also characterized by a long-standing system of unequal distribution of wealth—a system likely to continue despite marked increases in the gross national product. Some authorities suggest that, for some time to come, a larger portion of any increase will be siphoned off by persons who are already wealthy or in comfortable circumstances than will trickle down to the larger part of the population living at the near-starvation level. This, for instance, has often been the fate of aid from advanced nations. (3) The problem of financing agricultural and industrial improvements is one that cannot be met through the resources of the underdeveloped nations themselves but is dependent on investments from outside. It can be anticipated that a sizable portion of any increase in productivity will be paid as interest on these investments, again reducing the surplus available to the masses of poor in these countries. Industrializing nations are also especially vulnerable to the effects of poverty due to crop failures created by droughts, floods, or other natural afflictions. Their development plans have often been aborted because they have been forced to take funds earmarked for investment and use them instead for the purchase of food from other nations.

In many industrialized, relatively affluent countries, particular demographic groups are vulnerable to long-term poverty. In city ghettos, in regions bypassed or abandoned by industry, and in areas where agriculture or industry is inefficient and cannot compete profitably, there are found victims of concentrated collective poverty. These people, like those afflicted with generalized poverty, have high mortality rates, poor health, and so forth, when compared with the more affluent members of society. Efforts at amelioration focus on ways to bring the deprived groups into the mainstream of economic life by attracting new industry, introducing improved agricultural methods, and raising the level of skills of the employable members.

Case poverty. Similar to collective poverty in relative permanence but different from it in terms of distribution, case poverty refers to the inability of an individual or family to secure basic needs even in social surroundings of general prosperity. This inability is generally related to the lack of some basic attribute that would permit the individual to maintain himself. How severe the physical or mental handicap or how deficient the education and skill must be to make one unemployable depends on the range of jobs available in the society. Physical strength and endurance are crucial in countries depending more on labour than on capital, whereas in industrialized societies skill, education, and social adaptability have become more important. Those who have handicaps in social adaptability have long been associated—often unfairly—with improvidence, a label covering such behaviour as the inability to manage money, laziness, drunkenness, and producing too many children.

Physical and mental handicaps are usually regarded sympathetically, as being beyond the control of the people who suffer from them. Efforts to ameliorate poverty stemming from physical causes focus on education, sheltered employment, and, if needed, economic maintenance. The socially handicapped, as can be judged from the language used to identify them, are stigmatized. Their handicaps are felt, in many instances, to be within the control of the individual, if he chooses to control them, and his poverty, then, is regarded as the outcome of the individual's own failures. The person is often dealt with punitively, given financial aid only reluctantly, and pressed to accept casework services to help him change his ways. Two attitudes toward the poor—sympathy and hostility—have permeated the literature on poverty.

Poverty Bay, inlet of the southern Pacific Ocean, bounded by eastern North Island, New Zealand. The town of Gisborne is situated on its northern shore.

Poverty Bay is 6 miles (10 km) long and 4 miles (6 km) wide. Named by Captain James Cook, it is the site of the explorer's first landing (1769) in New Zealand. Botanists Joseph Banks and Daniel Solander were among the scientists who sailed with Cook on the *Endeavour,* and they participated in the historic landing. While there they collected, drew, and described a great number of plants found in the Poverty Bay region. In addition to the *Primitive Florae Novae Zelandiae* (never published), Banks wrote detailed descriptions of the appearance of the Maoris who were encountered at Poverty Bay. Some Maori lives were lost in the encounter. The Poverty Bay area was also the site of warfare in the mid-1800s, when the Maoris resisted the European attempts to appropriate Maori lands.

Póvoa de Varzim, town and *concelho* (township), northwestern Portugal, on the Atlantic coast, north of Porto. Primarily a fishing community retaining old customs and picturesque dress, the town is also a popular bathing resort and has a casino and racetrack. Local industries produce rope and small boats.

Póvoa de Varzim was the birthplace of Portugal's great novelist José Maria de Eça de Queirós, whose writing expressed the Portuguese sentiment *saudade* ("the longing for what might have been"). Pop. (1981) town, 23,846; *concelho,* 54,069.

POW: *see* prisoner of war.

powder metallurgy, fabrication of metal objects from a powder rather than casting from molten metal or forging at softening temperatures. In some cases the powder method is more economical, as in fashioning small metal parts such as gears for small machines, in which casting would involve considerable machining and scrap loss. In other cases melting is impractical because of the very high melting point of the metal—*e.g.,* tungsten—or because an alloy is desired of mutually insoluble materials such as copper and graphite. Finally, powder metallurgy is used to produce a porous product that will allow a liquid or gas to permeate it.

In the bonding process, powder particles are first compressed to the desired shape, then heated (sintered) at a temperature below the melting point of the metal or, in the case of an alloy, of the metal with the highest melting point. Metal powders are produced by either chemical or mechanical means. In chemical powdering, either a compound of the metal is reduced by a chemical agent or a liquid solution containing the metal is electrolyzed. In mechanical powdering, the metal is usually milled by power hammers or by balls in a rotating container.

Ductile metals are usually combined in an alloy of two or more metals with a lubricant and then pressed or briquetted by a hard steel die. Refractory metals, those with high melting points, are compacted with an added binder, such as paraffin wax. Cemented carbides are formed by bonding the hard, heat-resistant particles together with a metal, usually cobalt. *See* metallurgy.

powder-post beetle, any member of the approximately 90 species of the small, widely distributed insect family Lyctidae (order Coleoptera). These beetles range in colour from reddish brown to black and in size from 1 to 7 mm (up to 0.3 inch). The larvae bore through seasoned wood, reducing it to a dry powder; they do not, however, enter varnished or painted wood. Powder-post beetle holes are often erroneously considered to be evidence of the antiquity of a wooden object.

Powder River, stream of the northwestern United States. It rises in several headstreams in foothills of the Bighorn Mountains in Wyoming and flows northward for 486 miles (782 km) to join the Yellowstone River near Terry, Mont. Tributaries include the Little Powder River and Crazy Woman Creek.

Powderly, Terence V(incent) (b. Jan. 22, 1849, Carbondale, Pa., U.S.—d. June 24, 1924, Washington, D.C.), American labour leader who served as leader of the Knights of Labor from 1879 to 1893.

The son of Irish immigrants to the United States, Powderly went to work at the age of 13 for the railroad in Carbondale, Pa. At 17 he became a machinist's apprentice and then worked at that trade until age 28. He meanwhile had joined the Machinists' and Blacksmiths' Union in 1871 and steadily rose in the organization. In 1874 he joined the secret order of the Knights of Labor, in which he advanced rapidly. In 1879 he was chosen grand master workman (after 1883, general master workman), the union's highest post. In addition to his union activities, Powderly was elected mayor of Scranton, Pa., three times as a Greenback-Labor candidate, serving from 1878 to 1884.

Like his predecessor, Uriah Stephens, Powderly saw the Knights as a vehicle to lead the workers of America out of the bondage of wage labour. He presided over the Knights in the period of their greatest numerical strength—the mid-1880s—but never understood that much of the Knights' appeal derived as much from the weakness of traditional trade unions as from the distinctiveness of the Knights' approach, which emphasized secrecy and the disavowal of strikes. In the spring of 1886, the Knights claimed a membership of 700,000; but, within a year, counterattacks led by men such as financier Jay Gould began to dissipate the organization's tenuous strength, and membership began a decline that was never arrested. Powderly became absorbed in internal disputes and finally resigned in 1893.

In the remaining years of his career, he practiced law, tried his hand at business, and served in several government posts. His first book, *Thirty Years of Labor,* was published in 1889; his autobiography, *The Path I Trod,* was published posthumously in 1940.

powdery mildew, plant disease of worldwide occurrence, caused by many specialized races of fungal species in the genera *Erysiphe, Microsphaera, Phyllactinia, Podosphaera, Sphaerotheca,* and *Uncinula.* Hundreds of species of trees, shrubs, vines, flowers, vegetables, fruits, grasses, field crops, and weeds can be affected by powdery mildew.

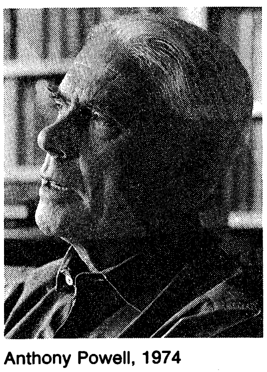
A superficial, white or light gray, powdery to felty growth of intertwined hyphae (fungus strands) forms on the surface of leaves, buds, young shoots, fruits, and even flowers. The white, powdery appearance is due to large numbers of microscopic spores (conidia) borne in chains. These wind-borne spores

Powdery mildew (*Erysiphe cichoracearum*) on zinnia leaf
M.B. Cook

uniquely do not require free water for germination and infection. New crops of conidia can be produced every 3 to 14 days. If the disease is severe, the mildewed plant parts may be stunted and distorted. Leaves commonly turn yellow and wither, flowers are distorted or fewer in number, and fruit yield and quality are reduced. The mildew is often more unsightly than harmful, especially on trees. It is most severe in crowded, shady, poorly aerated locations when nights are cool and days are warm. At maturity, or in the fall, round black specks, which are sexual fruiting bodies, or cleistothecia, may form in the mildew. In the spring the cleistothecia crack open to release one or more spore sacs (asei) containing ascospores that blow to nearby plant parts and initiate infection. Overwintering also occurs as mycelial mats on crops or weeds. Sulfur dust, lime sulfur, and dinocap (Karathane) are effective against many powdery mildews but should not be applied in hot weather.

Powell, Anthony (Dymoke) (b. Dec. 21, 1905, London), British novelist, best known for his autobiographical and satiric 12-volume series of novels, "A Dance to the Music of Time."

As a child Powell lived wherever his father, a regular officer in the Welch Regiment, was stationed. He attended Eton from 1919 to 1923 and Balliol College, Oxford, from 1923 to 1926. Thereafter he joined the London publishing house of Duckworth, which published his first novel, *Afternoon Men* (1931); the book was a satire of the aimless and disorderly lives of would-be artists and other bohemians in Chelsea.



Anthony Powell, 1974
Fay Godwin

Powell left publishing for journalism in 1936, writing for the *Daily Telegraph* and other newspapers. He then published *What's Become of Waring?* (1939), a polished comic treatment of scandal and financial crisis within a minor publishing firm.

After serving in World War II, Powell published *John Aubrey and His Friends* (1948), a biographical study of the 17th-century author of *Brief Lives.* In 1951 he published *A Question of Upbringing,* the first part of his 12-volume novel. The series' first-person narrative reflects Powell's own outlook and experiences; he observes and describes English society in the decades before and after World War II with wit and insight, using a subtle, low-key style. The 12-volume series ended with the publication of *Hearing Secret Harmonies* in 1975. Powell afterward continued to write novels and also authored several original dramas.

Powell, Bud, byname of EARL POWELL (b. Sept. 27, 1924, New York City—d. Aug. 1, 1966, New York City), American jazz pianist who emerged in the mid-1940s as one of the first pianists to play lines originally conceived by bebop horn players.

Powell played with the Cootie Williams band (1943–44) and sat in on the jam sessions

Bud Powell
Magnum

at Minton's Playhouse in Harlem. Crafting a style from pianists Art Tatum, Billy Kyle, and Thelonius Monk, trumpeter Dizzy Gillespie, and saxophonist Charlie Parker, Powell soon became one of the most influential jazz pianists of the era, having profound impact on such giants as Horace Silver and Hampton Hawes.

In his soloing, Powell was among those who did away with most accepted functions of the left hand; he reduced it to playing brief, often syncopated, jabs of two- or three-note chords supporting long, single lines by the right hand, which became the accepted approach for modern jazz of the next 20 years. At his prime, Powell had the speed and dexterity to almost keep up with Parker and Gillespie in his soloing. Although his facility began to deteriorate during a series of nervous breakdowns in the 1950s, he still turned out creative piano improvisations.

Powell, Cecil Frank (b. Dec. 5, 1903, Tonbridge, Kent, Eng.—d. Aug. 9, 1969, near Milan), British physicist and winner of the Nobel Prize for Physics in 1950 for his development of the photographic method of studying nuclear processes and for the resulting discovery of the pion (pi-meson), a heavy subatomic particle. The pion proved to be the hypothetical particle proposed in 1935 by Yukawa Hideki of Japan in his theory of nuclear physics.

In 1928 Powell was appointed research assistant at the Henry Herbert Wills Physical Laboratory at the University of Bristol. He became professor of physics at Bristol in 1948 and director of the Wills Laboratory in 1964. Between 1939 and 1945 he developed the necessary techniques for using sensitive photographic emulsions to record the paths of cosmic rays. In plates exposed at the top of high mountains or sent up in high-altitude balloons, cosmic ray interactions were recorded, and, in 1947, the data revealed the existence of the pion (π^+) as well as the process whereby it decays into two other particles, an antimuon (mu-meson) and a neutrino. Powell also discovered the antipion (π^-) and, in 1949, the modes of decay of kaons (K-mesons).

Powell, (John) Enoch (b. June 16, 1912, Birmingham, Eng.), British politician and member of Parliament, noted for his outspoken racist views.

Powell was the son of schoolteachers of Welsh ancestry. He attended Trinity College, Cambridge, and became a professor of Greek at Australia's University of Sydney at age 25. During World War II he served in the British army, rising from private to brigadier. In 1950 he won a seat in Parliament as a Conservative. He rose through minor posts to minister of health (1960–63) and unsuccessfully challenged Edward Heath for party leadership in 1965 and 1968. In 1968, in what came to be called his "River of Blood" speech, Powell first evoked the British race question. The Nationality Act, he argued, was flooding London and Midlands ghettos with Indian, Pakistani, African, and West Indian immigrants, who could claim British citizenship because of their Commonwealth status. In time the influx, he charged, would cause a bloody race war. As a result of this speech, he was ejected from the shadow Cabinet. In February 1974 he gave up the Wolverhampton seat he had held for 24 years, joined the Ulster Unionists, and from October 1974 onward was returned to Parliament from a Protestant Northern Ireland district.

Powell authored a number of books, including translated and annotated editions of ancient texts, several volumes of poems, and political commentaries, biographies, and histories, such as *Common Market: The Case Against* (1970), *Joseph Chamberlain* (1977), and *A Nation or No Nation?: Six Years in British Politics* (1979).

Powell, John Wesley (b. March 24, 1834, Mount Morris, N.Y., U.S.—d. Sept. 23, 1902, Haven, Maine), American geologist and ethnologist. He conducted major geographical surveys of the Rocky Mountain region, published the first classification of American Indian languages, and was the first director of the U.S. Bureau of Ethnology.

After fighting in the American Civil War, Powell joined Illinois Wesleyan University as professor of geology. In 1867 he became a lecturer at Illinois Normal College (now Illinois State University at Normal) and began a series of expeditions to the Rocky Mountains and the canyons of the Green and Colorado rivers. From 1871 to 1879 he directed a federal geologic and geographic survey of western lands in the public domain and encouraged the government to initiate land-utilization projects. During this period he published three major works. In *Exploration of the Colorado River of the West and Its Tributaries* (1875; rev. ed., *Canyons of Colorado,* 1895) he originated and formalized a number of concepts that became part of the standard working vocabulary of geology. His *Introduction to the Study of Indian Languages* (1877) firmly established him as an anthropologist. It contained a linguistic classification and grouped words according to use and emotion. Powell's *Report on the Lands of the Arid Region of the United States* (1878; reprinted 1962) is regarded as a landmark in conservation literature.

When the U.S. Bureau of Ethnology of the Smithsonian Institution, Washington, D.C., was established in 1879, Powell became its first director and remained with it until his death. Continuing the study of Indian ethnology and languages, he published the first complete and still-authoritative classification and distribution map of 58 language stocks of the United States and Canada (1891). Powell also served as director of the U.S. Geological Survey (1881–92), working extensively on the mapping of water sources and advancing irrigation projects. His daring and perilous three-month-long expedition through the Grand Canyon in 1869 is treated in F.S. Dellenbaugh's *A Canyon Voyage* (1908) and in M.T. Place's *John Wesley Powell: Canyon's Conqueror* (1963).

Powell, Lewis F(ranklin), Jr. (b. Sept. 19, 1907, Suffolk, Va., U.S.), associate justice of the United States Supreme Court from 1972 to 1987.

Powell graduated from Washington and Lee University, Va., in 1929 and obtained his law degree from that institution in 1931. He then earned a master's degree in law from Harvard in 1932. He joined a Virginia law firm that same year and in 1938 became a partner. After World War II he took up his law practice again and also began to serve in a number of civic posts. In 1959, as chairman of the Richmond, Va., public school board, he peacefully integrated that city's schools while other school districts in Virginia were experiencing bitter disruption in the process. He served as president of the American Bar Association from 1964 to 1965.

Widely respected in legal circles, the thoughtful, pragmatic, and conciliatory Powell was nominated in October 1971 by President Richard M. Nixon to a seat on the Supreme Court. He was easily confirmed by the Senate in December and took his seat on the court in January 1972. Powell was one of the more conservative members of the court during the 1970s and early '80s, but he came to occupy a key balancing position in the ideological centre as President Ronald W. Reagan's appointments shifted the court's makeup to the right. Powell took a moderate-to-liberal stance on such issues as legalized abortions, the separation of church and state, and civil rights questions but was basically a conservative on matters of crime and law enforcement. He retired in 1987 because of his uncertain health.

Powell River, district municipality, southwestern British Columbia, Canada. It is located on the east side of the Strait of Georgia, 80 miles (130 km) northwest of Vancouver. Named for Israel Wood Powell, who was Indian superintendent for British Columbia in the 1870s, the settlement developed at the mouth of the Powell River as a pulp-and-paper-milling centre after 1910. In 1955 the town of Powell River and several surrounding communities amalgamated to form a district municipality of 16 square miles (41 square km). The district is one of the world's largest producers of newsprint, its industry served by hydroelectric plants on the Powell and Lois rivers. Pop. (1981) 13,423.

Powell River, river rising in Wise County, southwestern Virginia, U.S., and flowing southwest through Big Stone Gap in the Cumberland Plateau into Tennessee to enter the Clinch River at Norris Dam, 20 miles (32 km) northwest of Knoxville, Tenn. Approximately half of its total length of about 150 miles (240 km) is now an extension of Norris Reservoir, impounded by the dam. Originally called Beargrass River, it was probably renamed for Ambrose Powell, an explorer of the 1750s whose name was found carved on a tree near its bank.

power, in science and engineering, time rate of doing work or delivering energy, expressible as the amount of work done W, or energy transferred, divided by the time interval t—or W/t. A given amount of work can be done by a low-powered motor in a long time or by a high-powered motor in a short time. Units of power are those of work (or energy) per unit time, such as foot-pounds per minute, joules per second (or watts), and ergs per second. Power is expressible also as the product of the force applied to move an object and the speed of the object in the direction of the force. If the magnitude of the force F is measured in pounds and the speed v in feet per minute, the power equals Fv foot-pounds per minute.

Most machines have rotating shafts, and, in terms of the twisting moment, or magnitude of torque (T), on a shaft and the angular speed ω of the shaft, the power is given by $T\omega$. T is usually expressed in inch-pounds, ω in radians per second, and power in inch-pounds per second. Another unit of mechanical power is the horsepower (hp), which is equal to 33,000 foot-pounds per minute, or 6,600 inch-pounds per second.

power, balance of, in international relations, the posture and policy of a nation or group of nations protecting itself against another nation or group of nations by matching its power against the power of the other side. States can pursue a policy of balance of power in two ways: by increasing their own power, as when engaging in an armaments race or in the competitive acquisition of territory; or by adding to their own power that of other states, as when embarking upon a policy of alliances.

The term balance of power came into use to denote the power relationships in the European state system from the end of the Napoleonic Wars to World War I. Within the European balance of power, Great Britain played the role of the "balancer," or "holder of the balance." It was not permanently identified with the policies of any European nation, and it would throw its weight at one time on one side, at another time on another side, guided largely by one consideration—the maintenance of the balance itself. Naval supremacy and its virtual immunity from foreign invasion enabled Great Britain to perform this function, which made the European balance of power both flexible and stable.

The balance of power from the early 20th century onward underwent drastic changes that for all practical purposes destroyed the European power structure as it had existed since the end of the Middle Ages. Prior to the 20th century, the political world was composed of a number of separate and independent balance-of-power systems, such as the European, the American, the Chinese, and the Indian. But World War I and its attendant political alignments triggered a process that eventually culminated in the integration of most of the world's nations into a single balance-of-power system. This integration began with the World War I alliance of Britain, France, Russia, and the United States against Germany and Austria-Hungary. The integration continued in World War II, during which the fascist nations of Germany, Japan, and Italy were opposed by a global alliance of the Soviet Union, the United States, Britain, and China. World War II ended with the major weights in the balance of power having shifted from the traditional players in western and central Europe to just two non-European ones: the United States and the Soviet Union. The result was a bipolar balance of power across the northern half of the globe. In the postwar decades the nations of western Europe generally sided with the United States in the NATO military alliance, while the Soviet Union's satellite-allies in central and eastern Europe became unified under Soviet leadership and domination in the Warsaw Pact.

Because the balance of power was now bipolar and because of the great disparity of power between the two superpowers and all other nations, the European countries lost that freedom of movement that previously had made for a flexible system. Instead of a series of shifting and basically unpredictable alliances with and against each other, the nations of Europe now clustered around the two superpowers and tended to transform themselves into two stable blocs.

There were other decisive differences between the postwar balance of power and its predecessor. The moral and cultural consensus that had regulated and softened 19th-century European struggles for power had been replaced by the mid-20th century with a fierce ideological struggle between two hostile and seemingly incompatible political philosophies and ways of life. Fortunately, the fear of mutual destruction in a global nuclear holocaust injected into the foreign policies of the United States and the Soviet Union a marked element of restraint. A direct military confrontation between the two superpowers and their allies on European soil was an almost-certain gateway to nuclear war and was therefore to be avoided at almost any cost. So instead, direct confrontation was largely replaced by (1) a massive arms race whose lethal products were never used and (2) political meddling or limited military interventions by the superpowers in Third World nations. Each superpower had its client states and allies among the developing nations, each channeled military and financial aid to them to maintain its influence and friendly ties and its access to forward military bases, and each jockeyed and maneuvered to bring to power or maintain in power those Third World governments that would look favourably upon the superpower's own economic and strategic interests.

In the late 20th century, a number of international developments seemed to affect the bipolarity of the postwar balance of power—most notably, the efforts by some Third World nations to resist the advances of the superpowers and maintain a nonaligned stance in international politics. The breakaway of the People's Republic of China from Soviet influence and its cultivation of a nonaligned but covertly anti-Soviet stance lent a further complexity to the bipolar balance of power in the late 20th century.

power, electric: *see* electric power.

Power, Tyrone (Edmund) (b. May 5, 1914, Cincinnati, Ohio, U.S.—d. Nov. 15, 1958, Madrid), American actor, best-known for his motion-picture action-adventure roles.

Power's Irish great-grandfather and namesake, Tyrone (1795–1841), was a popular actor and comedian; his granduncle Maurice (d. 1849), a Shakespearean actor; and his father, Frederick Tyrone (1869–1931), an actor on stage and in Hollywood. Before Power's Broadway debut in 1935 in *Romeo and Juliet,* he had toured for several years with the Shakespeare Repertoire Company and taken minor film roles. His first motion-picture success, *Lloyd's of London* (1936), was followed by starring roles in a series of diverse hits that included *Thin Ice* and *Cafe Metropole* (1937), *Alexander's Ragtime Band* and *In Old Chicago* (1938), *Jesse James* and *The Rains Came* (1939), *Johnny Apollo* and *Brigham Young* (1940), and *A Yank in the R.A.F.* and *Blood and Sand* (1941).

After serving in the U.S. Marine Corps during World War II, Power returned to the screen in such vehicles as *The Razor's Edge* (1946), *Nightmare Alley* (1947), *Prince of Foxes* (1949), *The Black Rose* (1950), *The*

Eddie Duchin Story (1956), and *Witness for the Prosecution* (1957). He died while filming *Solomon and Sheba* on location in Spain.

Between films Power kept returning to the stage. His most notable performances there were in *Saint Joan* (1936), *Mr. Roberts* (1950), *The Devil's Disciple* (1950), *John Brown's Body* (1952), *The Dark Is Light Enough* (1955), and *Back to Methuselah* (1958).

power lifting, a type of weight lifting, an offshoot of the classical sport that emphasizes sheer strength without regard to form and balance.

Power lifting was developed primarily in the United States and Canada by weight lifters whose concentration on power alone, they felt, was excluded from formal competition. In 1967 the Amateur Athletic Union began national supervision of the sport in the United States, and the International Powerlifting Federation, made up of groups from the United States and 12 other nations, was created in 1972.

A competition consists of three events. The bench press lift, done from a prone position, demonstrates upper-body strength. The squat, or deep-knee bend lift, shows leg power. The two-handed dead lift, in which the lifter raises the weight from the ground to hip level in one movement, displays low-back and gripping power.

power of attorney: *see* attorney, power of.

power series, in mathematics, infinite series that can be thought of as a polynomial with an infinite number of terms, such as $1 + x + x^2 + x^3 + \ldots$ ad infinitum. Usually, a given power series will converge (that is, approach a finite sum) for all values of x less than a certain constant and diverge for all values greater than that constant (*See also* convergence). This constant can be determined by the ratio test for infinite series (*q.v.*): If $a_0 + a_1x + a_2x^2 + \ldots$ represents a general power series with given coefficients a_i, then, by the ratio test, the series will converge for all values of x such that

$$|x| < \lim_{n\to\infty} |a_n/a_{n+1}| = r$$

called the radius of convergence. For instance, the series $1 + x + x^2 + x^3 + \ldots$ has a radius of convergence of 1 and is called the geometric series, being equal to $1/(1 - x)$ in closed form. The series $1 + x/1! + x^2/2! + x^3/3! + \ldots$ converges for all x the magnitude of which is less than

$$\lim_{n\to\infty} |(1/n!)/(1/(n+1)!)| =$$

$$\lim_{n\to\infty} |n + 1| = \infty,$$

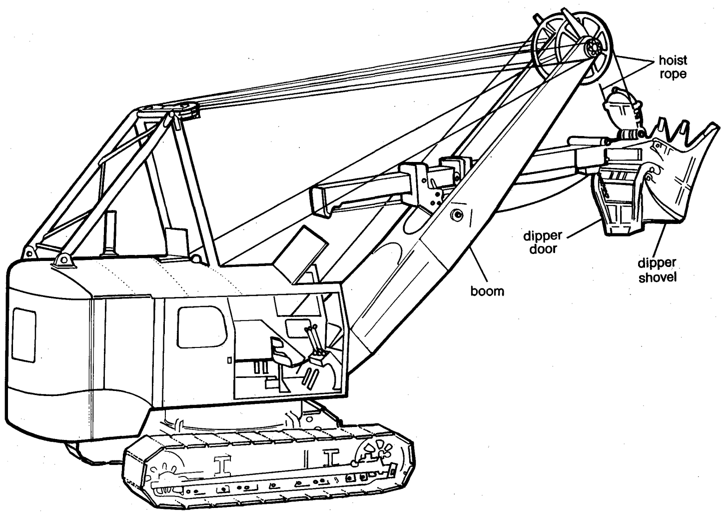
so that the series converges for any value of x.

Most functions can be represented by a power series in some interval. The coefficients of such a series can be determined by the method of undetermined coefficients thus: If $f(x) = a_0 + a_1x + a_2x^2 + \ldots$, then it follows that $f(0) = a_0$, $f'(0) = a_1$, $f''(0) = 2a_2$, and, in general, the ith derivative satisfies $f^{(i)}(0) = i!a_i$. For example, if $f(x) = \sin x$, then $f(0) = \sin 0 = 0$, $f'(0) = \cos 0 = 1$, $f''(0) = -\sin 0 = 0$, $f'''(0) = -\cos 0 = -1$, etc., giving the series for $\sin x$ as $x - x^3/3! + x^5/5! - \ldots$, which converges for any value of x.

Although a series may converge for all values of x, the convergence may be so slow for some values that using it to approximate a function will require a large number of terms. Instead of powers of x, powers of $(x - c)$ can be used, in which c is some value near the desired value to be computed, such that the derivatives of the function can be calculated for the value c. In this case, the coefficients of the power series will be $a_i = f^{(i)}(c)/i!$. To use this for calculating $\sin 65°$, for example, let $c = \pi/3$ radians ($= 60°$); then $x - c = \pi/36$ radians ($= 5°$), giving $\sin 65° = 3/2 + (1/2)(\pi/36) - (3/2)(\pi/36)^2 - \ldots$.

Power series are useful for approximating functions as above, for calculating constants such as π and e, and for solving differential equations by the method of undetermined coefficients.

power shovel, digging and loading machine consisting of a revolving deck with a power plant, driving and controlling mechanisms, sometimes a counterweight, and a front attachment, such as a boom or crane, supporting a handle with a digger at the end. The whole mechanism is mounted on a base platform with tracks or wheels. Power shovels are used principally for excavation and removal of debris.



Power shovel
By courtesy of Northwest Engineering Company

Mechanical cable-operated shovels apply engine power to the base and to the attachment by means of clutches, gears, shafts, winch drums, and cable. Electric cable-operated shovels have several electric motors supplied with current by a power line, or more rarely, by a deck-mounted generator, replacing the engine and most of the clutches, gears, and shafts of the mechanical shovel. Hydraulic shovels have engine-driven pumps to provide pressure for rams and motors. Mechanical shovels may include some electrical or hydraulic functions.

There are five principal types of front attachments, which may be interchangeable in small and medium-sized machines of the cable type. The dipper shovel, the oldest and most important excavating machine (rail-mounted, steam-powered units were in use in 1835), is for hard digging and truck loading. It consists of a heavy, relatively short boom and a dipper stick (a beam that pivots on the boom) with digging bucket attached. The bucket has a hinged bottom that can be opened by the operator. Forward and upward motion fills the bucket. If a long boom is unnecessary and the ground is hard and unyielding, the most suitable excavators are the dipper shovels. The hoe, or backhoe, attachment may replace the boom, stick, and bucket of the dipper shovel for digging below working level; it pulls the load toward the deck of the shovel instead of away from it. Modern hydraulically powered hoes may be mounted on any shovel carrier or on the rear of a tractor. A lifting crane can be attached in place of the digging shovel to raise heavy loads, move them laterally by swinging or travelling, and then lower them into new locations. Specially constructed lifting cranes are designed for hydraulic machines. The dragline excavator has a long boom of lattice design that extends from the cab at an angle of about 35° with the ground. From its end is suspended a hoist cable, at the end of which is the digging bucket. The dragline runs from the cab directly to the bucket; when the bucket is lowered, a pull on the dragline causes it to dig into the earth. The machine then swings the loaded bucket into a disposal area and tips its contents. On soft and watery land, particularly in building power dams, the long reach of the dragline is more effective than bulldozers and other surface-earth removers. The clamshell is a bucket with two hinged jaws carried by a crane suspended from the boom by two lines: one raises and lowers the bucket, and the other pulls the jaws together against gravity for digging action. It is used chiefly for deep, narrow excavations, as in well digging, for piling materials up high, and for rehandling loose material, such as sand or gravel, but it can do almost any type of digging.

power steering, system to aid the steering of an automobile by use of a hydraulic device (driven from the engine) that amplifies the turning moment, or torque, applied to the steering wheel by the driver. To reduce the torque required from the driver as cars became heavier and tires softer, gears were introduced between the steering wheel shaft and the linkage that turns the wheels. The gears multiplied the torque supplied by the driver to a much greater torque on the shaft that drives the front wheels to right or left. A disadvantage arose, however, in the higher steering ratio required; *i.e.*, amount of turn of the steering wheel needed.

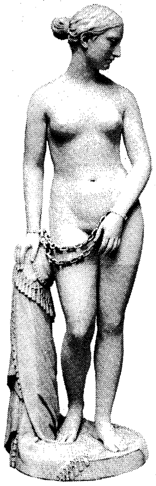
To make steering easy for the driver without using high steering ratios, power steering devices were introduced in the early 1930s. Most modern power-steering systems consist of hydraulic boosts applied to either the steering linkage or the steering gear. Rotation of the steering wheel activates a valve that directs oil, pressurized by a pump driven by the engine, to act on a piston. The hydraulic boost acts only while the steering wheel is moving.

powers, delegation of, in law, the transfer of authority by one person or group to another person or group. For example, the U.S. Congress may create government agencies to which it delegates authority to promulgate and enforce regulations pursuant to law. More specifically, in U.S. constitutional law, delegation of powers refers to the different powers granted respectively to each of three branches of government—executive, legislative, and judicial. Exercise by one branch of a power delegated to another violates the separation of powers provided for in the Constitution; *i.e.*, it is unconstitutional. Constitutional powers may be classified as enumerated, implied, inherent, resulting, or sovereign—designations that explain the nature of a given power, its origin, and its scope of influence.

Powers, Francis Gary (b. Aug. 17, 1929, Jenkins, Ky., U.S.—d. Aug. 1, 1977, Encino, Calif.), pilot who was captured on May 1, 1960, while on a reconnaissance flight deep inside the Soviet Union. The capture, known as the U-2 Affair (*q.v.*), resulted in the cancellation by the Soviet Union of a conference with the United States, Great Britain, and France.

Powers was tried and convicted of espionage and was sentenced to 10 years in prison. He was released in 1962, however, in exchange for the Soviet spy Rudolf Abel. Powers returned to the United States and wrote of his view of the incident in *Operation Overflight* (1970). He died in the crash of a helicopter that he flew as a reporter for a Los Angeles television station.

Powers, Hiram (b. June 29, 1805, Woodstock, Vt., U.S.—d. June 27, 1873, Florence), U.S. sculptor who worked in the Neoclassical style during the mid-1800s. He is best remembered for his "Greek Slave"—a white marble statue of a nude girl chained after her capture by the Turks.



"Greek Slave," marble statue by Hiram Powers, 1843; in the Corcoran Gallery of Art, Washington, D.C.

By courtesy of the Corcoran Gallery of Art, Washington, D.C.

Powers first studied with Frederick Eckstein. About 1829 he was a general assistant and artist in a waxworks museum in Cincinnati, where his ingenious representations of scenes from Dante's *Inferno* met with extraordinary success. At the end of 1834 Powers went to Washington, D.C., where he modelled a portrait of Andrew Jackson (Metropolitan Museum of Art, New York City). He started for Italy in 1835, and in 1837, after a few months residence in Paris, he settled permanently in Florence. In 1843 he sculptured the "Greek Slave" (Corcoran Gallery of Art, Washington, D.C.), which caused a sensation when exhibited at the Crystal Palace Exposition in London in 1851. It was this statue, of which six replicas were made, that placed him among the most popular sculptors of his time. An artist of amazing technical ability, he commanded high prices for his work. He produced many portrait busts of prominent American visitors to his Florentine studio.

powers, separation of, division of the legislative, executive, and judicial functions of government among separate and independent bodies. Such a separation, it has been argued, limits the possibility of arbitrary excesses by government, since the sanction of all three branches is required for the making, executing, and administering of laws.

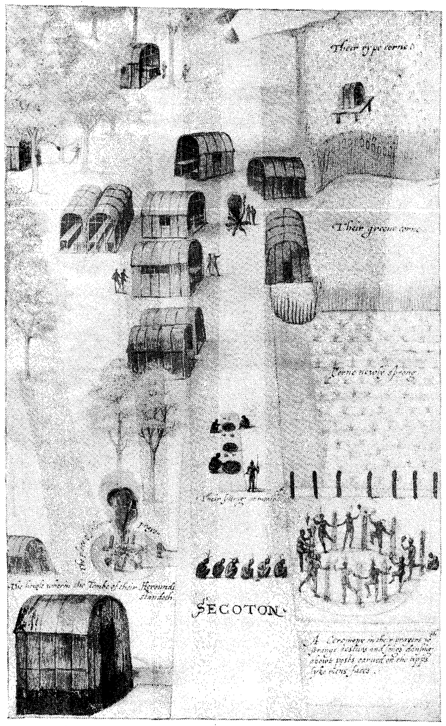
The doctrine may be traced to ancient and medieval theories of mixed government, which argued that the processes of government should involve the different elements in society such as monarchic, aristocratic, and democratic interests. The first modern formulation of the doctrine was that of the French writer Montesquieu in *De l'esprit des lois* (1748), although the English philosopher John Locke had earlier argued that legislative power should be divided between king and Parliament.

Montesquieu's argument that liberty is most effectively safeguarded by the separation of powers was inspired by the English constitution, although his interpretation of English political realities has since been disputed. His work was widely influential, most notably in America, where it profoundly influenced the framing of the Constitution. The U.S. Constitution further precluded the concentration of political power by providing staggered terms of office in the key governmental bodies.

Modern constitutional systems show a great variety of arrangements of the legislative, executive, and judicial processes, and the doctrine has consequently lost much of its rigidity and dogmatic purity. In the 20th century, and especially since World War II, governmental involvement in numerous aspects of social and economic life has resulted in an enlargement of the scope of executive power. Some who fear the consequences of this for individual liberty have favoured establishing means of appeal against executive and administrative decisions (for example, through an ombudsman), rather than attempting to reassert the doctrine of the separation of powers.

Poweski, Piotr Skarga: *see* Skarga, Piotr.

Powhatan, confederacy of at least 30 Algonkian-speaking North American Indian tribes that once occupied most of what is now tidewater Virginia, the eastern shore of the Chesapeake Bay, and possibly southern Maryland. The confederacy had been formed by and named for a powerful chief, Powhatan, shortly before the colonial settlement of Jamestown in 1607. The tribes of the confederacy provided military support and paid taxes in the form of food, pelts, copper, or pearls to Powhatan. Many of these villages, consisting of long dwellings covered with bark or reed mats, were palisaded; they were situated near fields in which women cultivated corn (maize), beans, squash, and other vegetables. Men were occupied with hunting and warfare.



Secoton, a Powhatan village; watercolour drawing by John White, *c.* 1587, showing various aspects of life in the Indian village; in the British Museum

By courtesy of the trustees of the British Museum

Hostilities developed between the Powhatans and the English settlers and resulted in intermittent fighting until 1676. Long-standing Iroquois hostility ended with a treaty in 1722, but the greatly reduced Powhatan population continued to decline. Those on the eastern shore of Virginia, who had become racially mixed with blacks, were driven off in 1831 during the disturbances caused by the Nat Turner slave rebellion. In the late 20th century an estimated 3,000 Powhatans were reported, largely scattered along the Virginia coast.

Powhatan, also called WAHUNSONACOCK, or WAHUNSENACAWH (d. April 1618, Virginia), North American Indian chief, father of Pocahontas.

Powhatan was the son of an Algonkin chief whose tribe had migrated to Virginia during the 16th century. His father had vanquished five of the resident tribes and established a six-tribe confederacy. After Powhatan succeeded his father, he brought two dozen other tribes into the confederacy; at the peak of his power, he allegedly controlled 128 villages with about 9,000 inhabitants. The boundaries of the Powhatan Confederacy at the time of the founding of Jamestown in 1607 extended from the Potomac River to the Great Dismal Swamp, with its capital at the village of Werowocomoco. Powhatan was a bright and energetic ruler, but he was also noted as being cruel.

Powhatan initially did not oppose the English settlement at Jamestown. In 1607 he released the captured Capt. John Smith following the alleged intercession of his daughter, Pocahontas. Because of efforts by the English to maintain cordial relations with the Indians, he was presented with a royal crown and gifts in 1609 on the recommendation of the Virginia Company. Yet despite those honours and his own declarations of goodwill, Powhatan's tribesmen persistently attacked isolated groups of settlers and refused to sell food to them. In April 1614, Pocahontas married the planter John Rolfe, and shortly thereafter Powhatan negotiated a peace agreement; it resulted in generally friendly relations between the English and the Indians and persisted for a while after his death.

Powhatan War (1622–44), relentless struggle between the Powhatan Indian confederacy and early English settlers in the tidewater section of Virginia and southern Maryland. The conflict resulted in the destruction of the Indian power. English colonists who had settled in Jamestown (1607) were at first strongly motivated by their need of native corn (maize) to keep peace with the Powhatans, who inhabited more than 100 surrounding villages. The emphasis on cooperation was strengthened by the efforts of the Powhatan chief Powhatan and his daughter Pocahontas.

By the time of Powhatan's death (1618), settlers had discovered the highly profitable tobacco crop and were pressing increasingly into Indian territory for rich new land to cultivate. In resistance to this incursion, the confederacy's new chief, Opechancanough, Powhatan's elderly brother, in 1622 led his people in a sudden attack against colonists throughout the area, massacring 347 of a total of about 1,200. Intermittent warfare followed for 14 years; an uneasy calm was shattered in 1644 with a final Indian uprising in which 500 whites were slain. Determined British opposition, aided by Christianized Indians, broke the power of the warring confederacy the same year, and Opechancanough was killed.

Powles, Matilda Alice, LADY DE FRECE: *see* Tilley, Vesta.

Powys, county of east central Wales, created in 1974 from the former counties of Montgomery and Radnor and most of Brecon. The administrative seat is Llandrindod Wells (*q.v.*). Powys has three districts (Brecknock, Montgomery, and Radnor) and covers an area of 1,960 sq mi (5,077 sq km).

The county is named after the Welsh princedom Powys, which was at its most powerful in the 12th century but unable to gain ascendancy in Wales because of its location in the Marches (border country). Here the cultures of Wales and England intermingle, for mountains and fertile river valleys, such as the Severn Valley (Vale of Powys), extend east and west across the border. The fact that communications tend to be along the valleys has forged links with England, especially with the market towns of Shrewsbury and Hereford. In the eastern part of the county few people speak Welsh, although along its western edge most people speak the language.

The main elements in the landscape are the valley lowlands leading to Shrewsbury and Hereford, the highlands typified by Radnor Forest, and the intermediate plateaus. These features are reflected in differing agricultural pursuits, especially cattle fattening in the lowlands and sheep rearing on the high slopes. Evidence of earlier settlement is apparent in remains of the Iron Age and of Roman forts in the borderlands, and of features associated with the Celtic princes and missionaries. The eastern limit of the power of the princes is marked by Offa's Dyke (8th century), still prominent in the landscape and now the course of an official "walk" for the energetic tourist. The Normans later built castles at Montgomery, Presteigne, Brecon, and other sites.

Today the major towns are service and light industry centres. Newtown on the Severn has been designated a "new town" (1967), to be expanded with light industries in an endeavour to develop the Vale of Powys and check persisting rural depopulation. Welshpool and Brecon continue to be the county's chief rural market centres. Pop. (1983 est.) 110,600.

Powys, John Cowper (b. Oct. 8, 1872, Shirley, Derbyshire, Eng.—d. June 17, 1963, Blaenau Ffestiniogg, Merioneth, Wales), Welsh novelist, essayist, and poet, known chiefly for his long panoramic novels, including *Wolf Solent* (1929), *A Glastonbury Romance* (1932), and *Owen Glendower* (1940). He was the brother of the authors T.F. Powys and Llewelyn Powys.

Following his education at Sherborne School and the University of Cambridge, Powys was a university extension lecturer for about 40 years, 30 of them in the United States. His works include a striking *Autobiography* (1934) and books of essays, among them *The Meaning of Culture* (1930), *The Pleasures of Literature* (1938), and *The Art of Growing Old* (1943).

pox disease, any of a complex of viral diseases in human beings and domestic animals, marked chiefly by eruptions of the skin and mucous membranes. Sheep pox and rabbit pox are spread by airborne infectious particles that are inhaled. Horse pox, fowl pox, and mouse pox usually are spread by skin contact. Cowpox (vaccinia) and pseudo-cowpox (paravaccinia), localized on the udder and teats of cows, are transmissible to human beings by skin contact. Horse pox (contagious pustular stomatitis) is now rare. Swine pox, of two types, is prevalent but rarely fatal. Sheep pox, the most severe pox disease of domestic animals, and goat pox are now confined to parts of southeastern Europe, North Africa, and Asia.

Smallpox, a pox disease known in human beings as early as 1122 BC, was declared eradicated in 1977 by the World Health Organization. Effective vaccines are available for most pox diseases.

poxvirus, any of a group of viruses constituting the family Poxviridae, responsible for a wide range of pox diseases in human beings and other animals. Poxvirus was the cause in human beings of smallpox (*q.v.*), which was declared eradicated worldwide in 1977. (Chicken pox of human beings is caused by a herpesvirus; *q.v.*) The virus particle is somewhat brick-shaped, with the longest dimension as much as 250 nanometres (nm; 1 nm $= 10^{-9}$ metre). It is surface-studded with hollow spikes; and contains deoxyribonucleic acid (DNA). Unlike other DNA-viruses, poxviruses appear to develop entirely within the cytoplasm of affected cells. The virus of rabbit pox, or infectious myxomatosis (*q.v.*), has been used with mixed success in Australia to control the wild-rabbit population.

Poyet, Guillaume (b. *c.* 1473, Angers, Fr.—d. April 1548, Paris), chancellor of France (from 1538) who sought to reform legal procedures in France during the reign of Francis I.

After practicing successfully as a barrister at Angers and Paris, he was instructed by Louise of Savoy, mother of King Francis I, to uphold her rights against the constable Charles, duc de Bourbon, in 1521. This was the beginning of his fortunes. Through the influence of the Queen Mother he obtained the posts of advocate-general (1530) and president of the Parlement of Paris (1534) and became chancellor of France in 1538. He was responsible for the legal reform contained in the ordinance of Villers-Cotterets (1539), the object of which was to shorten procedure; it ordered the keeping of registers of baptisms and deaths and enjoined the exclusive use of the French language in legal procedure. With the constable Anne, duc de Montmorency, he organized an intrigue to ruin Admiral Chabot and procured his condemnation in 1541; but after the Admiral was pardoned, Poyet was himself thrown into prison, deprived of his offices, and sentenced to a fine of 100,000 livres. He recovered his liberty in 1545 and died in April 1548.

Poynings, Sir Edward (b. 1459, Southwark?, near London—d. October 1521, Westenhanger, Kent, Eng.), lord deputy of Ireland from September 1494 to December 1495, mainly remembered for the laws—"Poynings' Laws"—that subjected the Irish Parliament to the control of the English king and council.

A grandson of William Paston, he was a rebel (1483) against Richard III and attached himself to Henry Tudor, earl of Richmond, who employed him after his accession as Henry VII in military offices at Calais and elsewhere. Yorkist pretenders against Henry VII having secured support in Ireland, Henry decided to experiment with a regime of military and financial experts who would attack the Yorkists in the field, take statutory steps to prevent the King's government in Dublin being utilized against him, and endeavour to revive the royal revenue that had virtually disappeared. In 1494 Poynings was put in charge of this program.

From the military standpoint, Poynings' efforts were only partly successful, and his revenue measures were so unsuccessful that he was recalled to England. Poynings' legislative measures, however, earned him a lasting, if unsought, fame. Of these, two measures were notably associated with his name. The first applied all recent English public laws to Ireland; the second and more famous one subjected the meetings and legislative drafts of the Irish Parliament to the control of the English king and of his English council (but not of the English Parliament). Thereafter until 1782 Parliament could not legally meet in Ireland until licensed to do so by the English lord chancellor and until the causes for the meeting and the bills to be put before it had first been approved by the king and his English council. Moreover, because draft legislation had to be approved by the king in council before being put before the Irish Parliament, amendments to government measures could not be introduced in Ireland.

Poynings was subsequently appointed warden of the Cinque Ports. Under Henry VIII he helped to negotiate the Holy League in 1513.

Poynting, John Henry (b. Sept. 9, 1852, Monton, Lancashire, Eng.—d. March 30, 1914, Birmingham, Warwickshire), British physicist who introduced a theorem that assigns a value to the rate of flow of electromagnetic energy known as the Poynting vector.

He was a professor of physics at Mason Science College, later the University of Birmingham, from 1880 until his death. In papers published in 1884–85, he showed that the flow of energy at a point can be expressed by a simple formula in terms of the electric and magnetic forces at that point. This is Poynting's theorem. He also wrote papers on radiation and the pressure of light. After 12 years of experiments he determined in 1891 the mean density of the Earth and in 1893 the gravitational constant, a measure of the effect of gravity. He published his results in *The Mean Density of the Earth* (1894) and *The Earth; Its Shape, Size, Weight and Spin* (1913).

Poynting vector, a quantity describing the magnitude and direction of the flow of energy in electromagnetic waves (*q.v.*), named after John Henry Poynting, an English physicist, who introduced it in 1884.

The magnitude S of the Poynting vector ($\boldsymbol{S}$) is proportional to the strength E of the electric field denoted by $\boldsymbol{E}$, the electric vector, the strength B of the magnetic field ($\boldsymbol{B}$), the magnetic vector, and the sine of the angle (symbolized by the Greek letter theta, θ) subtended by the two vectors representing them; *i.e.,* $S = (1/\mu)EB \sin \theta$, in which the constant symbolized by the Greek letter mu, μ, is called the permeability of the medium through which the radiation passes. The direction of the Poynting vector is perpendicular to the plane determined by the vectors $\boldsymbol{E}$ and $\boldsymbol{B}$. For a travelling electromagnetic wave, the Poynting vector points in the direction of the propagation of the wave.

Poza Rica, in full POZA RICA DE HIDALGO, city, north central Veracruz state, east central Mexico, on the Río Cazones, approximately 200 ft (60 m) above sea level, northeast of Mexico City. The hot, humid climate is inhospitable, but the city is a major petrochemical centre in one of Mexico's most important petroleum-producing regions.

Poza Rica was the scene of a major air pollution disaster in 1950, in which 22 persons were killed and more than 200 hospitalized, when hydrogen sulfide was accidentally vented into the air under a low-altitude temperature inversion. The city is linked by highway to the ports of Tuxpan and Tecolutla and is served by domestic airlines. Pop. (1980) 196,000.

Poznań, *województwo* (province), west central Poland, established 1975, embracing an area of 3,147 sq mi (8,151 sq km). It is bordered by the provinces of Piła on the north; Bydgoszcz, Konin, and Kalisz on the east; Leszno on the south; and Zielona Góra and Gorzów Wielkopolski on the west. The city of Poznań (*q.v.*) is the provincial capital and a *miasto-województwo* (city-province).

The province lies in the Great Poland Lakeland (Pojezierze Wielkopolskie) among gently rolling farm and forest lands dotted with nu-

Plains of Poznań province, Poland
Z. Wdowidski

merous lakes. The Warta, flowing southeast–northwest through the middle part of Poznań, is the most important river; other rivers include the Maskawa and the Obra in the south and the Wełna in the north. The economy is diversified, with about half of the work force engaged in agriculture (wheat, rye, potatoes, and sugar beets) and the raising of livestock. Industries include metalworking, coal mining, food processing, and the production of chemicals and textiles. Health and recreational resorts are located near lakes in the south central part of the province and along the banks of the Warta River. About three-fourths of the population live in urban areas including Gniezno, Września, and Śrem. Pop. (1982 est.) 1,249,000.

Poznań, German POSEN, *miasto-województwo* (city-province) and capital of surrounding Poznań *województwo* (province), west central Poland, on the Warta River near its confluence with the Cybina.

Beginning as a small stronghold in the 9th century, it became the capital of Poland (with Gniezno) and the residence of Poland's first two sovereigns. The first Polish cathedral was erected there in 968. In the 13th century a new section, now known as Old Town, developed on the left bank of the Warta. The town received municipal rights in 1253. With duty-free trade privileges, Poznań became a major European trade centre, its economic and cultural growth reaching a peak in the 15th and 16th centuries. It declined during the 17th century through fires and wars.

In 1793 Poznań was annexed to Prussia, intensifying a Germanization that had begun as early as the 13th century, with the arrival of the first German immigrants. Poznań was under Russian administration from 1807 to 1815 as part of the Grand Duchy of Warsaw, then reverted to Prussian control. Anti-Polish and anti-Catholic measures were enacted by Otto von Bismarck in the 1870s. In 1886 a commission of colonization was organized to buy Polish land for German colonists, but the Poles established cooperative credit organizations and continued to defeat Prussian efforts to control Poznań. At the beginning of the 20th century much building was done to give the city a Prussian complexion, and Poznań was renamed Posen.

Meanwhile, Poznań progressed economically, with its population tripling between 1871 and 1910, and in 1918 its citizens defeated their Prussian overseers. Poznań prospered somewhat between the two world wars, but, with the return of the Germans in 1939, the city was devastated; its inhabitants were deported or exterminated. Russian forces defeated the Germans during the siege of 1945, leaving the city in ruins. Poznań was rebuilt after World War II and has become the administrative, industrial, and cultural centre of western Poland. One of Poland's largest industrial centres, Poznań's varied industry includes the Cegielski metallurgical works; textile mills; clothing and food-, metal-, and rubber-processing plants; and chemical facilities. Since 1921 it has been the site of a major international trade fair.

Poznań is a cultural and academic centre, with several schools of higher education (including the Lubrański Academy of Literature, founded in 1518); numerous scientific institutes sponsored by the Polish Academy of Sciences; operatic, orchestral, and dance centres; Poland's oldest zoological garden; and a number of theatres. It has excellent transportation connections to major cities in Poland and the remainder of Europe. In 1956 the city became an independent administrative unit. Pop. (1982 est.) 558,000.

Poznań Riots (June 1956), uprising of Polish industrial workers that caused a crisis among the Polish Communist leadership as well as in the Soviet bloc and resulted in the establishment of a new Polish regime headed by Władysław Gomułka.

After the death of the Soviet leader Joseph Stalin (March 1953), the rigidly authoritarian Communist regime in Poland relaxed some of its policies. It abolished the powerful and tyrannical Ministry of Security, demoting or arresting many of its chief officials, and declared an amnesty for 100,000 political prisoners. These changes stimulated a popular desire for more radical reforms, but the Polish leadership, which included a substantial number of conservative Stalinists, was reluctant. Consequently, the impatient industrial workers of Poznań staged a general strike on June 28, 1956. Demanding bread and freedom, 50,000 demonstrators marched through the city. Riots soon broke out, the local offices of the secret police and party functionaries were attacked, and a police security officer was lynched. The following day the minister of defense, Konstantin Rokossovsky (a former Soviet officer), ordered the local military commander to suppress the uprising; and within a few days 53 people were killed, more than 200 were wounded, and order was restored in Poznań.

Although the spontaneous uprising remained localized and could not be sustained, it convinced the Central Committee of the Polish United Workers' Party (PZPR) that significant policy changes had to be undertaken. In the next several months, despite a series of internal party disputes, a visit by Khrushchev and a Soviet delegation to Warsaw (Oct. 19–20, 1956), and the threat of a Soviet invasion of Poland, the Central Committee elected Gomułka first secretary of the party (Oct. 21, 1956).

Pozo Colorado, town, capital (since 1973) of Presidente Hayes department, west central Paraguay, just south of an economically important forest zone. The town is the centre of the department's livestock activity and processes a major portion of the country's beef production.

Pozo Colorado is located at the intersection of roads traversing the department east–west, connecting it with the Paraguay River, and southeast–northwest, connecting it with Villa Hayes near the confluence of the Río Pilcomayo and the Paraguay River. A battalion of military engineers is headquartered in the town, which is a designated centre of development for the largely unpopulated Chaco Boreal. Pop. (1982 prelim.) district, 3,878.

Pozsony (Czechoslovakia): *see* Bratislava.

Pozzo di Borgo, Charles-André, comte (count), original Italian CARLO ANDREA POZZO DI BORGO (b. March 8, 1768, Alata, Corsica—d. Feb. 15, 1842, Paris), Corsican nobleman who entered the Russian diplomatic service and promoted French interests after the Napoleonic Wars in the courts of the Russian emperors Alexander I (ruled 1801–25) and Nicholas I (ruled 1825–55).

Pozzo di Borgo, detail of a lithograph, 19th century
H. Roger-Viollet

A native of Corsica, Pozzo favoured its political incorporation into France and, after Corsica was declared a *département* of France, served as Corsican delegate to the French Legislative Assembly (1791–92); after his return to Corsica, however, he supported a rebellion to make the island a British protectorate (1793). Following the end of British rule (1796), Pozzo accompanied Sir Gilbert Elliot, the former British viceroy in Corsica, to Vienna (1798), where he stayed until, in anticipation of Russia's entry into an anti-Napoleonic coalition, he entered the Russian service.

Subsequently, Pozzo went on sensitive diplomatic missions to Vienna and Constantinople. When Alexander made peace with Napoleon (Treaty of Tilsit; 1807), however, Pozzo resigned and retired to Vienna. Only after Alexander and Napoleon resumed their hostilities and Alexander had recalled him, did Pozzo rejoin the Russian service (1812), obtain Sweden's collaboration against the French, and become a general in the Russian army.

After Napoleon's defeat and the accession of Louis XVIII to the throne of France (1814), Pozzo was appointed Russia's ambassador to the French court and one of the Russian representatives to the Congress of Vienna. During the Hundred Days, when Napoleon returned to France (1815), Pozzo joined Louis at his temporary refuge at Ghent, Belg.; after Napoleon's final defeat Pozzo became a champion of French interests, for which service the French government made him a count and peer (1818).

Although his influence in Paris declined during the reactionary reign of Charles X (ruled France 1824–30), Pozzo remained at his post; after the French Revolution of 1830 had deposed Charles, he maintained cordial relations between Russia and France despite Emperor Nicholas' overt reluctance to recognize Louis-Philippe as the new king of the French. Transferred to London in 1835 because his excessive sympathy for the French was considered potentially damaging to Russian interests, Pozzo became ill and retired to Paris (1839).

pozzolana, also spelled POZZUOLANA or POZZOLAN, hydraulic cement discovered by the Romans and still used in some countries, made by grinding pozzolana (a type of slag that may be either natural—*i.e.,* volcanic—or artificial, from a blast furnace) with powdered hydrated lime. Roman engineers used two parts by weight of pozzolana mixed with one part of lime to give strength to mortar and concrete in bridges and other masonry and brickwork. During the 3rd century BC, the Romans used pozzolana instead of sand in concrete and mortared rubblework, giving extraordinary strength. Used with an aggregate of broken tuff, travertine, brick, or marble, the material contributed to the evolution of new architectural forms in such monumental constructions as the Pantheon and the Baths of Caracalla at Rome.

Pozzolana was first found at Puteoli (modern Pozzuoli), near Naples, where there are still extensive beds, and also around Rome. Natural pozzolana is composed mainly of a fine, chocolate-red volcanic earth. An artificial pozzolana has been developed that combines a fly ash and water-quenched boiler slag.

Pozzuoli, Latin PUTEOLI, town and episcopal see, Napoli province, Campania region, southern Italy. It occupies a promontory that projects into the Gulf of Pozzuoli (an inlet of the Bay of Naples), just west of Naples. It was founded *c.* 529 BC by Greek emigrants who called it Dicaearchia ("City of Justice"). Captured by Rome in the Samnite wars, it was vainly besieged by the Carthaginian general Hannibal in 214 BC and had the status of a Roman colony from 194 BC. The Romans called the city Puteoli. Its port made it a leading commercial centre and a cosmopolitan city, but it declined with the fall of the Roman Empire, and local volcanic and seismic activity caused most of its inhabitants to move to Naples. Many traces of the Roman city survive, including a well-preserved amphitheatre (1st century AD), baths, and a necropolis with stuccoed and painted underground chambers. Intense local volcanicity has given rise to thermal springs and to changes in the level of the land, which have caused temple porticoes along the shore to be submerged beneath the sea. The old Roman market (erroneously called the Temple of Serapis) of the 1st century AD is also partially submerged. The cathedral of San Procolo incorporates several columns of the ancient Temple of Augustus. In it is buried the composer G.B. Pergolesi, who died at the neighbouring monastery of San Gennaro in 1736. Inland, to the northeast, is the famous Solfatara (called by the Romans the Forum Vulcani), a semiactive volcano that exhales sulfurous vapours and gives vent to liquid mud and hot mineral springs. Along the coast is the Monte Nuovo, a volcanic cone that arose after eruptions in 1538.

Pozzuoli is on the Rome–Naples railway line and has a small commercial port. The fertile countryside supports an important food-processing industry, and the people also engage in fishing and the manufacture of machinery. Many work in the iron- and steelworks at nearby Bagnoli. The local volcanic material is used for making the fine cement that is called pozzolana after the town. Pozzuoli is also a bathing resort and hydromineral spa. Pop. (1984 est.) mun., 71,052.

PPG Industries, Inc., formerly (1883–1968) PITTSBURGH PLATE GLASS COMPANY, leading American producer of flat glass. Headquarters are in Pittsburgh.

The company was incorporated in 1883 as the Pittsburgh Plate Glass Company at a time when European producers had a virtual monopoly on the production of plate glass, and that year the company constructed the first commercial plate-glass factory in the United States, at Creighton, Pa. In 1902 the company became one of the first American firms to set up European operations, buying a glassworks in Belgium. The company subsequently expanded into diversified glass products and other products and assumed its present name in 1968.

PPG provides glass and other products principally to the automotive and building industries. It also produces specialty glass for automotive and architectural uses. The company is a leading producer of chlorine and caustic soda; in addition, it manufactures other chemicals used as ingredients in antifreeze and antiknock compounds for gasoline. In 1975 it acquired from Du Pont the trademarks and patent rights to Zerex and Zerone antifreeze. Other products of PPG include protective and decorative coatings and resins for autos, appliances, and buildings; fibreglass; and consumer paints.

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Pra, river of southern Ghana, western Africa. The Pra River rises in the Kwahu Plateau near Mpraeso and flows 150 miles (240 km) southward to enter the Gulf of Guinea (Atlantic Ocean) at Shama. Its main tributaries are the Ofin, Anum, and Birim. Constantly broken by cataracts—especially the Bosomasi Rapids at Anyinabrim—the river is unnavigable even by canoe for most of its length. Oda is the commercial centre of the river's northern basin, while Swedru serves southern Ghana.

The Pra flows through a rich cocoa- and food-producing area and valuable timber forests. The Birim Valley is rich in diamonds, and the northern reaches of the Pra were formerly worked for gold.

Prabalingga (Indonesia): *see* Probolinggo.

Prabhupada, Swami: *see* Bhaktivedanta, A(bhay) C(haranaravinda).

Prachin Buri, also called PACHIM, or PRACHIM, town, south-central Thailand. Prachin Buri lies along the Bang Pakong River and is a collecting centre for rice and sugar. It also trades in hardwoods and charcoal and is linked to Bangkok, 60 miles (97 km) southwest, by rail. Pop. (1983 est.) 20,908.

Practical Learning (Korea): *see* Silhak.

pradakṣiṇa, in Hinduism and Buddhism, the rite of circumambulating in a clockwise direction an image, relic, shrine, or other sacred object. The worshiper, by beginning in the east and keeping the sacred object on his right-hand side, proceeds to the south, thus moving in the direction followed daily by the course of the sun. Pilgrimages sometimes consist of circumambulating an entire town, such as the sacred city of Vārānasi (Benares), a 36-mile (58-kilometre) journey, or the Ganges River from source to sea and back, a trip that when undertaken on foot requires several years.

Explanations of the rite vary from the delineation of an area for a particular sacred purpose to an attempt to influence the course of events and produce good fortune by imitating the auspicious journey of the sun. Circumambulating in a counterclockwise movement—*i.e.,* keeping the left shoulder toward the central object—called *prasavya,* is observed in funeral ceremonies.

pradhāna (Indian philosophy): *see* prakṛti.

Pradist Manudharm, Luang (Thai political leader): *see* Pridi Phanomyong.

Prado Museum, Spanish MUSEO DEL PRADO, art museum in Madrid housing the world's richest and most comprehensive collection of Spanish painting, as well as masterpieces of other schools of European painting, especially Italian and Flemish art. The Prado's building had its start in 1785 when Charles III commissioned the architect Juan de Villanueva to design a natural science museum. The construction of the Neoclassical-style building was interrupted during the Napoleonic Wars, but it was completed under Ferdinand VII in 1819 and was opened to the public as the Royal Museum of Painting. In 1868 it became the National Museum of the Prado after the exile of Isabella II, who had enlarged the collection with paintings from the royal palaces and the Escorial.

The Prado's holdings originally consisted of the art collected by the Habsburg and Bourbon monarchs of Spain. The collection of Charles V (reigned 1516–56) was enlarged by Philip II (1556–98); both of these kings were important patrons of Titian. The royal holdings were further enlarged by Philip IV (1621–65), who commissioned his court painter, Diego Velázquez, to purchase paintings in Italy for him. Philip V (1700–46) added many French Baroque works to the collection, and Ferdinand VII assembled together all the paintings from the various royal collections (except those in the Escorial) in the new building of the Prado. In 1872 the museum acquired many notable paintings that were formerly owned by Spanish convents and monasteries. Further additions to the collections, as well as to the building, have been made in the 20th century.

The Prado contains the most complete collections of the works of El Greco, Velázquez, and Francisco de Goya in the world, as well as of such lesser Spanish masters as José de Ribera and Francisco de Zurbarán. The museum also has important works by Hiëronymus Bosch, Pieter Bruegel the Elder, Raphael, Tintoretto, Paolo Veronese, Peter Paul Rubens, Rembrandt, Anthony Van Dyck, Nicolas Poussin, Claude Lorrain, and Antoine Watteau. It also has a fine collection of Greco-Roman statuary.

Praeconinus, Lucius Aelius Stilo (Roman philologist): *see* Stilo Praeconinus, Lucius Aelius.

Praed, Winthrop Mackworth (b. July 26, 1802, London—d. July 15, 1839, London), British politician and poet remembered for his light verse.

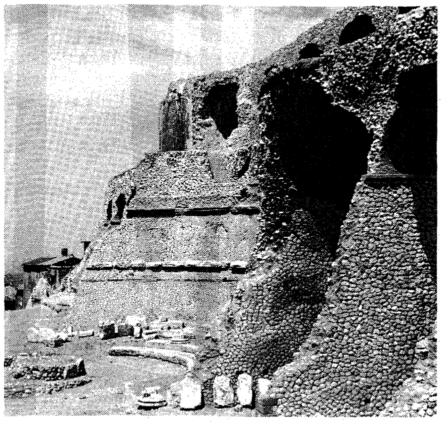
As a satirist and love poet Praed lacked passion. He excelled in blending humour, sentiment, and social satire, in, for example, "Good Night to the Season"; grim humour ("The Red Fisherman"); and the urbane, scissor-sharp verse epistle. After a brilliant career at Eton College and at the University of Cambridge, Praed entered Parliament in 1830 as a Tory. Expectations of a great political future were frustrated by his death at age 37 from tuberculosis.

Praed, detail of a watercolour by Daniel Maclise; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

praefectus (Roman official): *see* prefect.

Praeneste, modern PALESTRINA, ancient city of Latium, located 23 miles east-southeast of Rome on a spur of the Apennines, home of the great temple to Fortuna Primigenia. After the Gallic invasion (390 BC), Praeneste fought many battles with Rome; defeated in the Latin War (340–338), it lost part of its territory and became Rome's ally. After 90 BC it received



Ruins of the hemicycle of the IV terrace of the sanctuary of Fortuna Primigenia at Praeneste, *c.* 100 BC

By courtesy of the Deutsches Archaeologisches Institut, Rome

Roman citizenship and became a *municipium*. In the civil wars the younger Marius was blockaded in the town by the Sullans (82 BC), who took the city, massacred its males, and settled a colony of Sulla's veterans on part of its territory, moving the remainder of the people to lower ground.

Under the empire, Praeneste became a favourite summer resort of wealthy Romans, including Augustus, Hadrian, and the younger Pliny.

The city was a major cultic centre for the worship of the goddess Fortuna Primigenia. Her sanctuary and temple oracle were surrounded by an immense complex of buildings rising up the hillside like a pyramid of terraces, visible even from the sea. The cult was flourishing by 241 BC, but the time during which the great buildings were constructed is a matter of debate.

Praesepe, also called BEEHIVE (catalog numbers NGC 2632 and M 44), open, or galactic, cluster of several hundred stars in the zodiacal constellation Cancer. Visible to the unaided eye as a small patch of bright haze, it was first distinguished as a group of stars by Galileo. It was included by Hipparchus in the earliest known star catalog, *c.* 129 BC.

The name Praesepe (Latin: "Cradle," or "Manger") was used even before Hipparchus' time. The name Beehive is of uncertain but more recent origin.

praetor, plural PRAETORS, or PRAETORES, in ancient Rome, a judicial officer who had broad authority in cases of equity, was responsible for the production of the public games, and, in the absence of consuls, exercised extensive authority in the government.

The institution of consuls arose *c.* 510 BC with the expulsion of the kings. There were two consuls, who not only controlled the treasury and held supreme authority in government but also led troops, necessitating their absence from Rome for extended periods. Originally, the title praetor was restricted to a magistrate, but *c.* 337 BC the office was opened to plebeians. Until *c.* 242 BC there was only one praetor who handled matters of equity between Roman citizens. At that time a second praetor was established to handle suits in which one or both parties were foreigners. The original office was renamed *praetor urbanus*, and the new office was called *praetor peregrinus*. At various times subsequently, the number of praetors varied. About 227 BC two more peregrine praetors were appointed for Sicily and Sardinia, and about 197 BC two more were appointed to administer Spain. Early in the 1st century BC the consul Lucius Cornelius Sulla increased the number of praetors to eight. Two continued to preside over civil matters while the six additional ones were assigned to specific courts: extortion, bribery, embezzlement, treason, assault, murder, and forgery. After one year of service they customarily went on to become provincial governors.

From early times the praetor as a civil administrator issued an edict stating the procedure by which he would be guided. About 67 BC, he became bound by law to follow his edict. Ultimately, the edict, as modified over centuries, became one of the most important factors in molding and adapting the Roman law to new conditions and to the principles of equity and good faith. Under the emperor Hadrian in the 2nd century AD a "perpetual edict" was codified and published. By that time, however, praetorian jurisdiction had been circumscribed by the emperor. In the late Roman Empire most praetorships disappeared, but the *praetor urbanus* remained, with the responsibility of providing the public games.

Praetorian Guard, Latin COHORS PRAETORIA, household troops of the Roman emperors. The *cohors praetoria* existed by the 2nd century BC, acting as bodyguards for Roman generals. In 27 BC the emperor Augustus created a permanent corps of nine cohorts, stationing them around Rome; in 2 BC he appointed two equestrian prefects to command them, but in AD 23 Tiberius' powerful prefect Sejanus became their sole commander. He concentrated them in fortified barracks outside the walls of Rome, gaining significant political influence for them.

Subsequently, they generally participated in appointing emperors and were responsible for the accession of Claudius (41); the disorders of 68–69; the lynching of Domitian's murderers (97); and the murders of Pertinax (193), Elagabalus (222), and Balbinus and Maximus (238). Septimius Severus reorganized the guard in 193, recruiting its members from the legions. Constantine I disbanded them in 312.

Praetorius, Michael, original name MICHAEL SCHULTHEISS (b. Feb. 15, 1571, Kreuzberg, Silesia—d. Feb. 15, 1621, Wolfenbüttel, Brunswick-Wolfenbüttel), German music theorist and composer whose *Syntagma musicum* (1614–20) is a principal source for knowledge of 17th-century music and whose settings of Lutheran chorales are important examples of early 17th-century religious music.

He studied at Frankfurt an der Oder and was organist and *Kapellmeister* to the Bishop of Halberstadt and, after 1612, *Kapellmeister* at the court of Wolfenbüttel. Zealous for the advancement of music, he admired Italian music and had a predilection for rich and varied settings for voices and instruments. His output was considerable and varied. The most significant collections of his works are *Musae Sioniae* (nine parts, 1605–10), consisting of more than 1,200 settings of chorales, partly for 8 to 12 voices in Venetian double choir style, partly in simple two-, three-, and four-part style; and the *Puericinium* (1621), where the chorale strophes receive varied treatment, foreshadowing the chorale cantata. Praetorius published much music other than his own, and in his collection *Terpsichore* (1612) he introduced several hundred foreign dance pieces to Germany.

Of the three surviving parts of the *Syntagma musicum*, the most important is Vol. II, which describes and classifies many ancient and all existing musical instruments. They are lavishly illustrated in an appendix.

Pragmatic Sanction of Bourges (July 7, 1438), decree issued by King Charles VII of France after an assembly had examined the decrees of the Council of Basel (*see* Basel, Council of). It approved the decree *Sacrosancta* of the council, which asserted the supremacy of a council over the pope, and established the "liberties" of the Gallican Church, restricting the rights of the pope and in many cases making his jurisdiction subject to the will of the king. Revoked by Louis XI in 1461 but reasserted from time to time, the Pragmatic Sanction was ultimately superseded by the Concordat of Bologna, negotiated by Francis I and Pope Leo X in 1516.

Pragmatic Sanction of Emperor Charles VI (April 19, 1713), decree promulgated by the Holy Roman emperor Charles VI with the intent that all his Habsburg kingdoms and lands descend as an integral whole without partition. It stipulated that his undivided heritage go to his eldest son, should he have one, or, failing a son, to his eldest daughter and then, if she should die without issue, to his deceased brother Joseph I's daughters and their descendants. A son was born to Charles in 1716 but died in the same year, and Charles's subsequent children were both daughters (Maria Theresa, born in 1717, and Maria Anna, born in 1718). Accordingly, in 1720, the Pragmatic Sanction was published, embodying Charles's decision of 1713. On its publication the decree received the assent of the individual estates of the Habsburg dominions, so that it came to be a constitutional law of the developing Habsburg monarchy and a bond between the lands belonging to the Holy Roman Empire (the Austrian and Bohemian lands) and the lands outside the empire (those under the crown of Hungary).

Austrian diplomacy in the last decades of Charles's reign was directed toward securing acceptance of the Pragmatic Sanction from all the European powers. Joseph I's daughters and their husbands (the electors of Saxony and Bavaria), the Diet of the Empire, Russia, Spain, Great Britain, France, Prussia, the Netherlands, Denmark, and Sardinia did in fact recognize the Pragmatic Sanction.

On the death of Charles VI in October 1740, however, the Pragmatic Sanction was promptly contested by two of the powers that had guaranteed it: Charles Albert of Bavaria and Frederick the Great of Prussia. The resultant War of the Austrian Succession cost the Habsburgs most of Silesia, part of the Duchy of Milan, and the duchies of Parma and Piacenza (Treaty of Aix-la-Chapelle, 1748). On the other hand, Maria Theresa was left in possession of the rest of the Habsburg inheritance, and her husband, Francis Stephen of Lorraine, was recognized as Holy Roman emperor, with the style of Francis I.

Pragmatic Sanction of King Ferdinand VII (March 29, 1830), decree of Ferdinand VII of Spain, which promulgated his predecessor Charles IV's unpublished decision of 1789 revoking the Salic law of succession, which had denied royal succession to females. The Pragmatic Sanction was intended to permit his unborn child to succeed to the throne, even if it were female.

Ferdinand, still childless on the death of his third wife, María Josefa Amalia, in 1829, married María Cristina I of the Two Sicilies in that year and, in so doing, threatened the mounting hopes of his brother Don Carlos regarding the succession. The birth of a daughter, Isabella, in October 1830 greatly complicated the issue. By the ancient law of Castile and Leon women could rule in their own right. This right had, however, been abrogated by an act of 1713 designed to prevent any union of the crowns of Spain and France; and, although Charles IV had restored the former position in 1789, his enactment had never before been published, and its validity was now hotly disputed. Hence the birth of Carlism, the movement by which the supporters of Don Carlos and his heirs were known, which was for more than half a century to be a disrupting factor in the history of Spain. When, on Sept. 29, 1833, Ferdinand died, his daughter was proclaimed queen as Isabella II. The First Carlist War (1833–39) broke out almost immediately.

pragmatism, school of philosophy, dominant in the United States during the first quarter of the 20th century, based on the principle that the usefulness, workability, and practicality of ideas, policies, and proposals are the criteria of their merit. It stresses the priority of action over doctrine, of experience over fixed principles; and it holds that ideas borrow their meanings from their consequences, and their truths from their verification. Thus, ideas are essentially instruments and plans of action.

A brief treatment of pragmatism follows. For full treatment, *see* MACROPAEDIA: Philosophical Schools and Doctrines, Western.

The pragmatist position was first systematized by the American philosophers Charles Sanders Peirce (1839–1914) and William James (1842–1910), who agreed on the practical nature of meaning but differed as to the implications of such a doctrine. For Peirce, pragmatism was primarily an investigation of the proper methods of procedure in the natural sciences, a reductive doctrine equating the meaning of theoretical terms with their impact upon experience. Peirce's is a highly theoretical view of the proper meaning of ideas, derived from Immanuel Kant and the British empiricists. By contrast, James moved in a much more practical and moralistic direction. The virtues of belief, including truth, became in his view matters of their efficiency in enabling a person to cope with the problems of living. The vital good of a belief in one's whole life became its justification. James could thus write: "On pragmatic principles, if the hypothesis of God works satisfactorily, in the widest sense of the word it is 'true.'" The antirational implications of this statement shocked many critics, including G.E. Moore and Bertrand Russell, who saw it as an invitation to wish-fulfillment and self-deception. That religious beliefs exhibit certain consoling and uplifting effects and work well in the lives of particular believers is an unarguable fact; but it is another matter entirely to assert that such attributes substantiate the beliefs themselves. Even James's fellow pragmatists, including Peirce, drew back from this identification of utility with truth.

Controversies over truth continued to dog the movement. Peirce's own account of truth was "that which is fated ultimately to be agreed by all who investigate"; in this view, truth represents a kind of limit of scientifically formed opinion. But Peirce's definition failed to account for those "facts" that are inaccessible to actual investigation. The real intention of the definition is to stress the role of practically motivated inquiry in shaping concepts and judgments and the particular truths accepted on their basis.

The more practical aspects of pragmatism were followed up in the works of the American philosopher and theorist of education John Dewey (1859–1952). Dewey developed what he saw as a new attitude toward experience. In Dewey's view, the phenomenon of experience, which empiricists tended too often to regard as a passive, mechanistic reflection of the world, was in actuality an active, social process. Knowing, he asserted, is primarily a matter of knowing how. Inquiry tells us how to transform situations for the better; thus, knowledge is assertion warranted by inquiry. This insight was probably more influential on the practice of education than on philosophy, particularly after the logical positivists made their mark on the philosophy of science. However, specific emphasis on practice and technique regained prominence in American philosophy during the second half of the 20th century. It dominated the later work of Ludwig Wittgenstein (1889–1951), who saw possession of any kind of language as mastery of a body of techniques; the famous slogan that to look for the meaning of a term one must look for its use could have been endorsed by any of the pragmatists. W.V. Quine argued that the considerations that mold changes of theory are largely pragmatic and not, for instance, dictated by previously fixed concepts and meanings that interact with raw experience. The picture of truth that emerges from Quine's works, and the works of those influenced by him, is that the truth of any individual assertion is itself secondary. It is a derivative virtue of sentences that are members of theories which themselves work, as efficient means to practical ends. Whereas the positivists hoped to reduce the content of scientific theory, this kind of instrumental view concedes to theories their own irreducible role but still sees their fundamental virtue as that of working in practice.

Prague, Czech PRAHA, city, capital of Czechoslovakia. Situated on the Vltava River, Prague is the country's major economic and cultural centre and has a rich architectural heritage that dates to the 9th century. From small original settlements, Prague has spread over hills, up tributary valleys, and along riverside terraces.

A brief treatment of Prague follows. For full treatment, *see* MACROPAEDIA: Prague.

Prague has been prominent in Czechoslovakia's economic life since the intensive development in the 19th century of the textile and machinery industries. Manufacturing is still the largest employer, followed by commerce, construction, education, culture, administration, transport and communications, and science and research. Principal industries include heavy and precision engineering and the production of food (including the famous Prague beer), electronics, and chemicals.

The Vltava River cuts a north-south path through central Prague. On its left (west) bank are located the Royal Garden, Hradčany (Prague Castle), and the Malá Strana ("Lesser Quarter"), which is blanketed by gardens and parks. The right (east) bank of the Vltava is dominated by the Staré Město ("Old Town," dating from the 12th century) and the Nové Město ("New Town," 14th century). Both are rich in historical monuments and churches, and the latter is responsible for Prague's description as the "city of a hundred spires." The narrow streets, small taverns, and restaurants of the older sections contrast with the broad sweep of Václevské Square and with modern parks and housing developments. New housing estates, for example (referred to as "towns"), have been erected on the periphery to alleviate Prague's housing shortage.

Architectural treasures range from the Romanesque (the 10th-century Church of St. George) through the Gothic (St. Vitus' Cathedral and Týn Church) to the Baroque (the Vald-štejn and Clam-Gallas palaces), Rococo (the Golz-Kinský Palace), Classical (the Bedřich Smetana Museum and the Belvedere Palace), and Neoclassical (the National Museum and the National Theatre). The Old-New Synagogue and the Old Jewish Cemetery—Europe's oldest—testify to the strong Jewish tradition in Prague's life. The architectural harmony of the city has been enhanced by post-1945 planning, which has preserved the ancient core of the city and has supervised all modern building.

Prague is famed for its cultural life, particularly in music and literature. The music of the great Czech composers Bedřich Smetana, Antonín Dvořák, and Leoš Janáček is commemorated annually in a spring festival. The city's fine orchestras—the Prague Symphony and the Czech Philharmonic—are world-renowned. The writers Franz Kafka, Rainer Maria Rilke, and Jaroslav Hašek, all born in Prague, became internationally famous. In the democratic revolution of 1989, which peacefully overthrew the communist government of Czechoslovakia, Vaclav Havel, a Prague playwright, became the nation's president.

Institutions of higher education include Charles University (1348), the oldest in central Europe. Scientific study, promoted by the Czechoslovak Academy of Sciences, is built on the tradition of such Prague scholars as Tycho Brahe, Johannes Kepler, and Albert Einstein. The Academy of Arts and the Academy of Music are also located in the city.

Bus, streetcar, and subway provide public transportation. Rail lines radiate in all directions, and passenger boats ply the Vltava. The city's international airport is at nearby Ruzyně. Area city, 192 square miles (496 square km); metropolitan area, 301 square miles (780 square km). Pop. (1990 est.) city, 1,214,-772; (1985 est.) metropolitan area, 1,256,092.

Prague, Defenestration of (May 23, 1618), incident of Bohemian resistance to Habsburg authority that preceded the beginning of the Thirty Years' War. In 1617 Roman Catholic officials in Bohemia closed Protestant chapels that were being constructed by citizens of the towns of Broumov and Hrob, thus violating the guarantees of religious liberty laid down in the Letter of Majesty (Majestätsbrief) of Emperor Rudolf II (1609).

In response, the defensors, appointed under the Letter of Majesty to safeguard Protestant rights, called an assembly of Protestants at Prague, where the imperial regents, William Slavata and Jaroslav Martinic, were tried and found guilty of violating the Letter of Majesty and, with their secretary, Fabricius, were thrown from the windows of the council room of Hradčany (Prague Castle) on May 23, 1618. Although inflicting no serious injury on the victims, that act, known as the Defenestration of Prague, was a signal for the beginning of a Bohemian revolt against the Habsburg emperor Ferdinand II, which marked one of the opening phases of the Thirty Years' War.

Prague, University of: *see* Charles University.

Prague school, school of linguistic thought and analysis established in Prague during the early 20th century. It included among its most prominent members the Russian linguist Nikolay Trubetskoy and the Czech-born American linguist Roman Jakobson; the school was most active during the 1920s and '30s. Linguists of the Prague school stress the function of elements within language, the contrast of language elements to one another, and the total pattern or system formed by these contrasts, and they have distinguished themselves in the study of sound systems. They developed distinctive-feature analysis of sounds; by this analysis, each distinctive sound in a language is seen as composed of a number of contrasting articulatory and acoustic features, and any two sounds of a language that are perceived as being distinct will have at least one feature contrast in their compositions. The concept of distinctive-feature analysis in studying the sound systems of languages has also been incorporated within the standard model of transformational grammar.

The Prague school is also renowned for its interest in the application of functionalism—the study of how elements of a language accomplish cognition, expression, and conation—to syntax and the structure of literary texts.

Prague Zoological Garden, also called PRAGUE ZOO, Czech ZOOLOGICKA ZAHRADA PRAHA, zoological garden 4 km (2.5 miles) from downtown Prague, noted for breeding the rare Przewalski's horse. This municipal zoo, opened in 1931, occupies 45 hectares (111 acres) and houses more than 2,300 specimens of about 465 species. Besides serving as a conservation centre for the Przewalski's horse, it has a strong collection of Asiatic animals; South American and Australian species are also well represented. Notable breeding success has been achieved with maned wolves, two-toed sloths, cheetahs, and kulan, a species of endangered Asiatic wild ass.

The zoo attempts to create a parklike setting, and there are few major buildings aside from those for elephants, carnivores, primates, and small mammals. Otherwise, the rocky, steep grounds of the zoo are exploited. The rare markhor and goral, for example, are exhibited on cliff faces similar to those of their native mountains. A chair lift is used to carry visitors from the lower zoo grounds to the paddocks on the upper slopes.

Praguerie, revolt of princes and other nobles against Charles VII of France in 1440, named in allusion to similar contemporary movements in Prague and elsewhere in Bohemia. As early as April 1437, a number of princes, excluded from the royal council, had unsuccessfully plotted to reassert their influence. When the King issued an ordinance forbidding the raising or maintenance of troops without his permission (1439), the first of his great ordinances for military reform, mercenary captains who felt their livelihood threatened joined with the rebellious princes. Led by Charles I, duc de Bourbon, and Jean II, duc d'Alençon, with the 16-year-old dauphin (later Louis XI) as their figurehead, the rebels began the revolt in Poitou in February 1440. Soon outgeneraled by Constable de Richemont, they withdrew to Bourbon territory, where they were again defeated and in July made peace, on very generous terms, at Cusset.

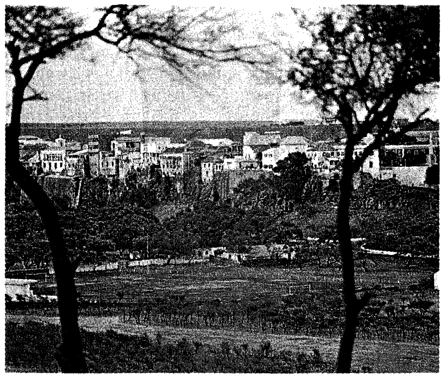
Although the rebels proposed peace with England and a lessening of taxation, the towns and the people stood loyally by the King. An attempt to renew the Praguerie through an assembly at Nevers in 1442 was thwarted by Charles VII's diplomacy.

Praha (Czechoslovakia): *see* Prague.

Prahova, *judeţ* (district), south central Romania, occupying an area of 1,802 sq mi (4,694 sq km). The forested Bucegi, Ciucaş, and Buzăului mountain ranges, part of the Eastern Carpathians, and the sub-Carpathians occupy most of the district. Ploieşti (*q.v.*), long a major centre of Romania's petroleum-processing industry, is the district capital. Oil wells are in Filipeşti de Pădure, Boldeşti, and Podeni, and there are major refineries in Ploieşti, Brazi, and Cîmpina. Between 1890 and 1895, the first five oil derricks in Romania were built in Cîmpina. A refinery was added in 1897, destroyed during World War II (1939–45), and rebuilt after the war. Lignite is mined in Ceptura, and salt mines have operated in Slănic since the 17th century. Factories in Valea Călugărească produce chemicals, and rubber is manufactured in Floreşti. Metal products, building materials, and folk art (embroidery and wood carvings) are produced in Sinaia. The Sinaia Monastery and Peleş Castle (19th century) are historic features of the town. The 19th-century Cîmpina town is known for Hasdeu Castle, built in the shape of a cross, and for the house of Nicole Grigoresco (1838–1907), the landscape and genre painter. Doftana has a prison where peasants were confined after the 1907 rebellion.

The major agricultural activities of the district consist of cereal growing, livestock raising, and vineyard and orchard cultivation. An agricultural research station is located in Valea Călugărească, and an oil-drilling research station operates in Cîmpina. Highway and railway connections extend through Ploieşti. Pop. (1982 est.) 852,785.

Praia, port city and capital of Cape Verde on the south shore of Sao Tiago (Santiago) Island, in the Atlantic Ocean, about 400 mi (640 km) off the West African bulge. The port



Praia, capital of Cape Verde
Walter Imber

ships agricultural products (bananas, coffee, sugarcane, castor beans) and is a submarine cable station. Pop. (1980 prelim.) 37,676.

prairie, level or rolling grassland, especially that found in central North America. Decreasing amounts of rainfall, from 100 centimetres (about 40 inches) at the forested eastern edge to less than 30 centimetres (about 12 inches) at the desert-like western edge, affect the species composition of the prairie grassland. The vegetation is composed primarily of perennial grasses, with many species of flowering plants of the pea and composite families. Most authorities recognize three basic subtypes of prairie: tallgrass prairie; midgrass, or mixed-grass, prairie; and shortgrass prairie, or shortgrass plains. Coastal prairie, Pacific or California prairie, Palouse prairie, and desert plains grassland are primarily covered with combinations of mixed-grass and shortgrass species.

Tallgrass prairie, sometimes called true prairie, is found in the eastern, more humid region of the prairie that borders deciduous forest. The rich soil is laced with the deep roots of sod-forming tallgrasses such as big bluestem and prairie cordgrass, or slough grass, in the wet lowlands and the shorter roots of bunchgrasses such as needlegrass, or porcupine grass, and prairie dropseed on the drier upland sites.

Midgrass, or mixed-grass, prairie, supporting both bunchgrasses and sod-forming grasses, is the most extensive prairie subtype and occupies the central part of the prairie region. Species of porcupine grass, grama grass, wheatgrass, and buffalo grass dominate the vegetation. Sand hills are common in the western portion bordering the shortgrass plains.

Shortgrass plains occupy the driest part of the prairie and are covered primarily by species of buffalo grass and grama grass. Kentucky bluegrass, although not a native prairie species, is found in all three major prairie subtypes.

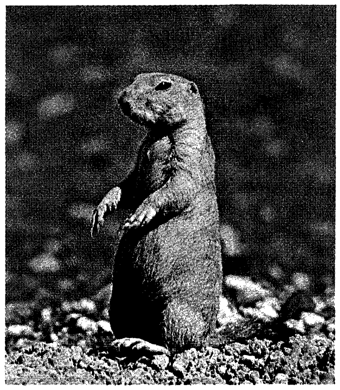
The bison, wolf, and most prairie chickens have disappeared from the prairie; but the coyote, prairie dog, jackrabbit, badger, horned lark, meadowlark, and various species of hawks and waterfowl are still common. Insects also are abundant, especially grasshoppers and flies.

In the past, a combination of high summer temperatures, strong winds, late summer drought, and accumulations of dead vegetation set the stage for many naturally caused fires, which prevented trees from becoming abundant in prairie vegetation. Now the fertile prairie soils (brunizem, chernozem, chestnut, and brown soils) are intensely cultivated (primarily corn in the eastern part and wheat in the central area) or grazed (especially the shortgrass region), and little native prairie remains, other than in small protected patches. *See also* plain.

prairie chicken, any of several North American game birds of the grouse family, Tetraonidae. *See* grouse.

prairie dog (*Cynomys*), any of five species of stout, burrowing rodents of the squirrel family, Sciuridae (order Rodentia), named for their sharp, barklike call. Short-tailed, yellowish-brown squirrels with small ears and short legs, prairie dogs are 30 to 43 centimetres (12 to 17 inches) long, including a 3- to 12-cm tail. They are gregarious and generally live in colonies that consist of well-defined territories, or coteries, occupied and defended by a male, several females, and immature young. Recognition "kissing" and grooming afford the frequent contact required to maintain social structure within coteries.

Once abundant throughout the plains of the western United States and northern Mexico, prairie dogs have been greatly reduced—by poisoning—in range and numbers. They have been hunted by man because they may damage crops and compete with livestock for grass, the main item in their diet. Protected colonies are located in Wyoming, Texas, Oklahoma, and South Dakota.



Black-tailed prairie dog (*Cynomys ludovicianus*)
Leonard Lee Rue III

There are two main species of prairie dogs. The black-tailed (*C. ludovicianus*), with a black-tipped tail, is more widespread, occurring sparsely over the Great Plains. Its colonies are characterized by the funnel-shaped entry mounds of the burrows. These mounds are carefully tended by the animals. They prevent flooding and serve as elevated lookout posts.

The white-tailed prairie dog (*C. leucurus*), a species with a white-tipped tail, inhabits higher altitudes than the black-tailed form. It hibernates in winter and is less colonial in habit. Both species breed in spring, the females bearing up to 10 young after about a month's gestation.

Prairie du Chien, city, seat (1818) of Crawford County, southwestern Wisconsin, U.S., on the Mississippi just above the influx of the Wisconsin River, 102 mi (164 km) west of Madison. The French and British each maintained a trading post (1673) and fort (1685) at the site before U.S. acquisition in 1783, making it the state's second oldest white settlement (after Green Bay). Named for an Indian chief, Alim (Dog, or *chien*), it became known as Prairie du Chien. As the western terminus of the Fox–Wisconsin river route to the Mississippi River system, it was long a rendezvous for explorers, missionaries, and traders. The Americans built Ft. Shelby there during the War of 1812 and Ft. Crawford in 1816. In 1820 Prairie du Chien became a depot for the American Fur Company. Villa Louis (1843), home of Hercules Dousman, the company's factor and regarded as Wisconsin's first millionaire, is preserved as a museum.

The city is now a distribution point for agricultural produce and also has light manufacturing. The Museum of Medical Progress, a restored military hospital of Ft. Crawford (where William Beaumont continued his experiments with the digestive system), is a national historic landmark. Inc. 1872. Pop. (1986 est.) 5,890.

Prairie Provinces, the Canadian provinces of Manitoba, Saskatchewan, and Alberta, in the northern Great Plains region of North America. They constitute the great wheat-producing region of Canada and are a major source for petroleum and natural gas. With British Columbia they form the Western Provinces.

Prairie style, in architecture, American style exemplified by the low-lying "prairie houses" such as Robie House (1908) that were for the most part built in the Midwest between 1900 and 1917 by Frank Lloyd Wright. Among the Midwest architects who were influenced by this style of design were Walter Burley Griffin, George Grant Elmslie, William Drummond, George Maher, Robert Spencer, Hugh Garden, Marion Mahony, Henry Trost, and Barry Byrne.

Prairie houses and other buildings were generally two-story structures with single-story wings. They utilized horizontal lines, ribbon windows, gently sloping roofs, suppressed, heavy-set chimneys, overhangs, and sequestered gardens.

prairie wolf: *see* coyote.

praise song, one of the most widely used poetic forms in Africa; a series of laudatory epithets applied to gods, men, animals, plants, and towns that capture the essence of the object being praised. Professional bards, who may be both praise singers to a chief and court historians of their tribe, chant praise songs such as these of the great Zulu chieftain Shaka:

He is Shaka the unshakeable,
Thunderer-while-sitting, son of Menzi.
He is the bird that preys on other birds,
The battle-axe that excels over other
battle-axes.
He is the long-strided pursuer, son of Ndaba,
Who pursued the sun and the moon.
He is the great hubbub like the rocks of
Nkandla
Where elephants take shelter
When the heavens frown. . . .
(trans. by Ezekiel Mphahlele)

Although he is expected to know all of the traditional phrases handed down by word of mouth in his tribe, the bard is also free to make additions to existing poems. Thus the praise songs of Shango, the Yoruba god of thunder and lightning, might contain a modern comparison of the god to the power and noise of a railway.

Among some Bantu-speaking peoples, the praise song is an important form of oral literature. The Sotho of Lesotho required all boys undergoing initiation to compose praises for themselves that set forth the ideals of action or manhood. Sotho bards also composed traditional praises of chiefs and warriors, and even a very young man was allowed to create praises of himself if he had performed feats of great courage.

These praise songs were recited as follows: the reciter stood in an open space, visible to all assembled. He then began reciting in a high voice, punctuating his victories in war by stabbing the ground with his spear, until he had set forth not only his lineage and the battles in which he had fought but his entire life history. Sotho praises are telegraphic, leaving much to the listener's imagination; their language is poetic, and the sequence of events not necessarily logical. Metaphor is a key device for suggesting worth (a reciter might call himself a ferocious animal), and poetic license is granted for coining new words.

To the subjects used by the Sotho, the Tswana of Botswana add women, tribal groups, domestic (especially cattle) and wild animals, trees, crops, various features of the landscape, and divining bones. Their praise songs consist of a succession of loose stanzas with an irregular number of lines and a balanced metrical form. Experiences such as going abroad to work for Europeans have become a subject of recent praise poems, and recitation has been extended from tribal meetings and ritual occasions such as weddings to the beer hall and labour camp.

In western Africa, also, praise songs have been adapted to the times, and a modern praise singer often serves as an entertainer hired to flatter the rich and socially prominent or to act as a master of ceremonies for paramount chiefs at state functions—*e.g.,* among the Hausa and Manding peoples. Thus praise-song poems, though still embodying and preserving a tribe's history, have also been adapted to an increasingly urbanized and Westernized African society.

Prajadhipok, also called PHRAPOKKLAO, or RAMA VII (b. Nov. 8, 1893, Bangkok, Siam [now Thailand]—d. May 30, 1941, Cranleigh, Surrey, Eng.), last absolute king of Siam (1925–35), under whose rule the Thai revolution of 1932 instituted the constitutional monarchy. Prajadhipok never expected to succeed to the throne. He was the 32nd and last son of King Chulalongkorn, the youngest of five sons by Queen Saowabha.

When King Vajiravudh died in 1925, Prajadhipok had been a likely heir to the throne for less than a year and the certain heir for only two days. He had been prepared for a military career at Eton College and the Royal Military Academy at Woolwich, Eng. Though personally convinced of the necessity of moving toward democratic political reforms, he allowed himself to be restrained by senior members of the royal family, and his inactivity brought on the Thai revolution of 1932, which bloodlessly ended the absolute monarchy. Prajadhipok welcomed the opportunity to reign as a constitutional monarch but was repulsed by growing military rule and abdicated on March 2, 1935. He died in exile in England.

Prajāpati (Sanskrit: "Lord of Creatures"), one of the creator figures of the Vedic period of ancient India; in the post-Vedic age he came to be identified with a major Hindu god, Brahmā, who gradually surpassed him in importance.

The frequent speculations on the creation of the world in the early Vedic literature allude to various primal figures, such as Hiraṇyagarbha ("Golden Egg") and Viśvakarman ("All-Accomplishing"), and the title of Prajāpati was applied to more than one such figure. Later it was used to signify one deity, the lord of all creatures. According to one of the stories of creation, Prajāpati produced the universe and all its beings after first preparing himself by undergoing *tapas* (ascetic practices); other stories allude to his own creation from the primal waters. His female emanation, who aided him in the creation of other beings, was Vāc, the personification of the sacred word, but sometimes his female partner is given as Uṣas, the dawn, who is also regarded as his daughter.

Collectively, the Prajāpati are the "mind born" children of Brahmā. They are generally considered to number 10, though some authorities reduce them to seven and relate them to the seven great *ṛṣis* (ancient sages).

Prajñāpāramitā (Sanskrit: "Perfection of Wisdom"), body of sutras and their commentaries that represents the oldest of the major forms of Mahāyāna Buddhism, one that radically extended the basic concept of ontological voidness (sunyata); the name also denotes the female personification of the literature or of wisdom, sometimes called the Mother of All Buddhas. In the *Prajñāpāramitā* texts, prajna (wisdom), an aspect of the original eightfold

Prajñāpāramitā, 13th-century stone sculpture from Singosari, East Java; in the Museum Pusat, Jakarta, Indonesia
By courtesy of the Rijksmuseum voor Volkenkunde, Leiden, Neth.

path, has become the supreme paramita (perfection) and the primary avenue to Nirvāṇa. The content of this wisdom is the realization of the illusory nature of all phenomena—not only of this world, as in earlier Buddhism, but of transcendental realms as well.

The main creative period of *Prajñāpāramitā* thought extended from perhaps 100 BC to AD 150. The best-known work from this period is the *Aṣṭasāhasrikā* ("8,000-Verse") *Prajñā-pāramitā.* The first Chinese translation appeared in AD 179. Later, some 18 "portable editions" were forthcoming, the best known of which is the *Diamond Sūtra* (*q.v.*). Still later, schematic and scholastic commentaries were produced in the Mādhyamika ("Middle Way") monasteries of eastern India, thus introducing into the *Prajñāpāramitā* movement the same confining rationalism against which it had reacted in the first place. The radically antiontological stance had been intended to free the spirit in its quest for experiential enlightenment.

The way of negation, however, is not the sole content of these texts. They incorporate, as aids to meditation, the numerical lists (*mātṛkā*) also found in *Abhidharma* (scholastic) literature. They also supplement their philosophical austerity with the personally appealing figures of mythology.

The Chinese traveler Fa-hsien described images of the personified *Prajñāpāramitā* in India as early as AD 400, but all known existent images date from 800 or later. She is usually represented yellow or white in colour, with one head and two arms (sometimes more), the hands in the teaching gesture (*dharmacakra-mudrā*) or holding a lotus and the sacred book. Also frequently associated with her are a rosary, sword (to cleave away ignorance), thunderbolt (*vajra,* symbolizing the emptiness of the void), or begging bowl (renunciation of material goods being a prerequisite to the obtaining of wisdom). Images of the deity are found throughout Southeast Asia and in Nepal and Tibet. In Tantric Buddhism she is described as the female consort of the Ādi-Buddha (first Buddha).

Prajñāpāramitāhṛdaya-sūtra: *see* Heart Sūtra.

prajñapti (Sanskrit: "designation by provisional naming"), Pāli PAÑÑATTI, in Buddhist philosophy, the denotation of a thing by a word. The concept of *prajñapti* is especially important in the Mādhyamika ("Middle View") and Vijñānavāda ("Consciousness-affirming") schools. *Prajñapti* is seen as a fictitious construction unrelated to ultimate reality, or *niṣ-*

prapañca (Sanskrit; Pāli *nippapañca:* "what is devoid of verbal manifoldness").

According to Mādhyamika and Vijñānavāda philosophers, the highest reality is nondifferential, beyond word and thought. Whatever is differentiated by *prajñapti* is regarded as only nominally existent. Since words denote no reality, empirical knowledge regarding worldly phenomena cannot be held as true in itself. This assertion results from the school's analysis of the process of cognition. When a person sees an object, there is only an immediate awareness that is yet undifferentiated into conceptions of perceptual judgment expressed in statements such as "This is that." There occurs no analysis of the awareness into subject and object or subject and predicate. Such an analysis is brought about by a conceptual construction, which associates a thing with a name of a conception. This is the cause of illusion, since verbal designation is denied reality, and all empirical knowledge is composed of such judgment.

Prakāsham, district, Andhra Pradesh state, southeastern India. It is bounded by Nellore district on the south, Kurnool and Cuddapah districts on the west and southwest, Mahbūbnagar district on the northwest, and Guntūr district on the north and northeast. Prakāsham district (about 6,800 sq mi [17,600 sq km]) borders the Bay of Bengal on the east and is part of the Andhra Plains. The coastal region consists of a monotonous plain rising gently toward the west to the foot of the Eastern Ghāts and is drained by the Palleru River.

Agriculture is the mainstay of the economy; rice, millet, coconuts, sugarcane, and tobacco are grown. Industries produce cotton goods, ceramics, and brass and aluminum utensils. Roads and railway link Giddalūr, Cumbum, Mārkāpur, Kandukūr, Vetapālem, and Chīrāla. Pop. (1981) 2,329,571.

Prākrit languages (Sanskrit *prākṛta:* "natural, usual, vulgar"), Middle Indo-Aryan languages that began as vernacular dialects and eventually developed distinct literary styles. These dialects were often distinguished by regional names, *e.g.,* Śaurasenī, Māgadhī, Mahārāṣṭrī.

Some scholars restrict the Prākrits to the languages used by Hindu and Jain writers; others include the Buddhist languages, such as Pāli and Buddhist Hybrid Sanskrit, and the inscriptional Prākrits. Other Prākrits include the Ardhamāgadhī of the Jain faith and Paiśācī, known through grammarians' statements. The modern languages of India developed from the Prākrits, of which Apabhraṃśa (*q.v.*) was perhaps the latest stage.

prakṛti (Sanskrit: "source"), also called PRADHĀNA ("principal"), in the Sāṃkhya school of Indian philosophy, material nature in its germinal state, eternal and beyond perception. *Prakṛti,* when it comes into contact with the "soul" (*puruṣa*), starts on a process of evolution that leads through several stages to the creation of the existing material world. *Prakṛti* is made up of three *guṇa*s ("strands," or constituent cosmic factors) that characterize all nature. In the Sāṃkhya view, only *prakṛti* is active, while the self is incarcerated in it and only observes and experiences. Release (*mokṣa*) consists in the self's extrication from *prakṛti* by the recognition of its total difference from it and noninvolvement in it. In early Indian philosophical texts the term *svabhāva* (Sanskrit: "own being") was used in a similar sense to mean material nature.

praline, French PRALIN, in French confectionery, a cooked mixture of sugar, nuts, and vanilla, often ground to a paste for use as a pastry or candy filling, analogous to marzipan; also, a sugar-coated almond or other nutmeat. In the cookery of the U.S. South, the term denotes a candy of sugared pecan meats or coconut.

Pecan pralines, usually made with brown sugar, have been produced for generations by the French-extracted Cajuns of Louisiana. The recipe for this variety calls for a mixture of sugar, light cream, and salt to be cooked to the so-called soft ball stage (*i.e.,* to the point at which a bit of the mixture thus tested retains its shape upon being dropped into cold water), whereupon the brown sugar and nut meats are added.

Praline paste is important in the commercial confectionery and bakery industries as a filling for chocolates, a flavouring for icings and creams, and an ingredient in various doughs. For this preparation, a mixture of sugar and almonds, or sometimes hazelnuts, is cooked and allowed to set. The cool solid is then broken into pieces and ground to an oily paste.

pramāṇa (Sanskrit: "measure"), in Indian philosophy, the means by which one obtains accurate and valid knowledge (*pramā, pramiti*) about the world. The accepted number of *pramāṇa* varies, according to the philosophical system or school; the exegetic system of Mīmāṃsā accepts five, whereas Vedānta as a whole proposes three.

The three principal means of knowledge are (1) perception, (2) inference, and (3) word. Perception (*pratyakṣa*) is of two kinds, direct sensory perception (*anubhava*) and such perception remembered (*smṛti*). Inference (*anumāna*) is based on perception but is able to conclude something that may not be open to perception. The word (*śabda*) is, in the first place, the Veda, the validity of which is self-authenticated. Some philosophers broaden the concept of *śabda* to include the statement of a reliable person (*āpta-vākya*). To these, two additional means of knowledge have been added: (4) analogy (*upamāna*), which enables one to grasp the meaning of a word by analogy of the meaning of a similar word; and (5) circumstantial implication (*arthāpatti*), which appeals to common sense: man does not see the sun move from hour to hour, but, as it is in a different place, it must be concluded that it has moved.

Pramāṇa-vārttika (Sanskrit: "Explanation of Evidence"), perhaps the foremost work on Buddhist logic and epistemology, written in the 7th century, when logic had become a dominant concern in Buddhist thought and Buddhism itself was losing ground in India. The *Pramāṇa-vārttika* is the chief work of Dharmakīrti, originally a southern Indian Brahman.

It is written in about 2,000 stanzas of mnemonic verse, and its four chapters deal, respectively, with inference, the validity of knowledge, sense perception, and syllogism. Composed as comprehensive commentaries on an earlier work by Dignāga, Dharmakīrti's treatises in turn stimulated a great number of commentaries and have become the standard works in their field, especially in Tibet.

Prambanan, village in the Special District of Yogyakarta (Indonesia) known for a large, nearby complex of temples built in the 9th and 10th centuries. The best known set of temples in the complex is that of Lara Jonggrang, also called Tjandi Prambanan (Prambanan Temple), because of its close proximity to the village.

The Lara Jonggrang was said to have been built by Dhaksa, a king of Mendang-Mataram (Hindu-Mataram) in the early 10th century, to worship the Hindu god Śiva (Shiva). It is the largest Śiva temple in Indonesia. Lara Jonggrang, meaning Slender Maiden, was the name given by the people of the neighbourhood to a large statue of the Hindu goddess Durgā (wife of Śiva) in the temple. The Lara Jonggrang was built on a four-square plane, surrounded by four walls with four large gates. The temples are subdivided into a higher and a lower terrace. On the higher terrace are major temples of Śiva, Vishnu, and Brahmā with three smaller temples of their animal vehicles. The temples of the gods are decorated with reliefs depicting the story of the *Rāmāyaṇa,* one of the great Hindu epics. On the lower terrace are four sets of smaller temples surrounded by an inner wall with four gates. Restoration of the Lara Jonggrang, which had been partly damaged, was completed in 1951.

prāṇa (Sanskrit: "breath"), in Indian philosophy, the body's vital "airs" or energies. A central conception in early Hindu philosophy, particularly as expressed in the *Upaniṣads*, *prāṇa* was held to be the principle of vitality and was thought to survive as a person's "last breath" for eternity or until a future life.

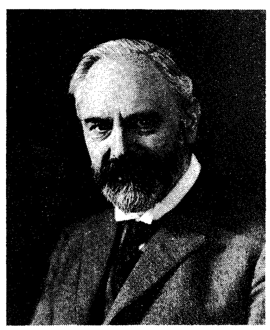
Prāṇa was at times identified with the self. It is also the first in a series of "five *prāṇa*s," windlike vital forces that are supposed to assist breathing, distribution of food in the body, and digestion. In Yoga philosophy emphasis is placed on full control of the *prāṇa*, through the practice of *prāṇayāma* (*q.v.*), in order to enable one to meditate without respiratory distraction and also for its therapeutic effect on disorders.

prāṇāyāma (Sanskrit: "breath control"), in the Yoga system of Indian philosophy, fourth of the eight stages intended to lead the aspirant to *samādhi,* a state of perfect concentration. The immediate goal of *prāṇāyāma* is to reduce breathing to an effortless, even rhythm, thus helping to free the individual's mind from attention to bodily functions.

The practitioners of Yoga recognize four states of consciousness—waking, sleep with dreams, sleep without dreams, and a state resembling cataleptic consciousness—each of which has its own respiratory rhythm. By prolonging each respiration as long as possible in simulation of the unconscious states during which respiration is slower than in the normal waking state, the *yogin* ultimately learns to pass from one state to another, without loss of consciousness. The ability to reduce respiration markedly is what enables the experienced practitioner of Yoga to be buried alive for periods of time.

Prandtl, Ludwig (b. Feb. 4, 1875, Freising, Ger.—d. Aug. 15, 1953, Göttingen), German physicist who is considered to be the father of aerodynamics.

In 1901 Prandtl became professor of mechanics at the University of Hannover, where he continued his earlier efforts to provide a sound theoretical basis for fluid mechanics. He served as professor of applied mechanics at the University of Göttingen from 1904 to 1953 and there established a school of aerodynamics and hydrodynamics that achieved world renown. In 1925 he became director of the Kaiser Wilhelm (later the Max Planck) Institute for Fluid Mechanics. His discovery (1904) of the boundary layer, which adjoins the surface of a body moving in air or water, led



Prandtl

By courtesy of the Archiv der Georg-August-Universitat, Gottingen, W.Ger.

to an understanding of skin friction drag and of the way in which streamlining reduces the drag of airplane wings and other moving bodies. His work on wing theory, which followed similar work by a British physicist, Frederick W. Lanchester, but was carried out independently, elucidated the process of airflow over airplane wings of finite span. That body of work is known as the Lanchester-Prandtl wing theory.

Prandtl made decisive advances in boundary-layer and wing theories, and his work became the basic material of aerodynamics. He was an early pioneer in streamlining dirigibles, and his advocacy of monoplanes greatly advanced heavier-than-air aviation. He contributed the Prandtl-Glaubert rule for subsonic airflow to describe the compressibility effects of air at high speeds. In addition to his important advances in the theories of supersonic flow and turbulence, he made notable innovations in the design of wind tunnels and other aerodynamic equipment. He also devised a soap-film analogy for analyzing the torsion forces of structures with noncircular cross sections.

Prapañcā, also spelled PRAPAÑCHA (fl. 14th century), Indonesian court poet and historian who was born to a family of Buddhist scholars. He was most famous as the author of the *Nāgarakṛtāgama*, a long descriptive poem written in 1365, detailing life in the kingdom of Java during the early reign of Hayam Wuruk, who ruled under the name of Rājasanagara from 1350 to 1389.

The poem, originally called the *Deśa warṇana* ("Description of the Country"), was found in manuscript form on the island of Lombok in 1894. It is an invaluable source for the legendary, historical, cultural, political, religious, and social aspects of the old Hindu-Javanese Majapahit Empire.

Prarthana Samaj (Sanskrit: Prayer Society), Hindu reform society established in Bombay in the 1860s. In purpose it is similar to, but not affiliated with, the more widespread Brahmo Samaj and had its greatest sphere of influence in and around Mahārāshtra state. The aim of the society is the promulgation of theistic worship and social reform, and its early goals were opposition to the caste system, the introduction of widow remarriage, the encouragement of female education, and the abolition of child marriage.

The immediate predecessor of the Prarthana Samaj in Bombay was the Paramahaṁsa Sabha, a secret society formed in 1849 for discussion, the singing of hymns, and the sharing of a communal meal prepared by a low-caste cook. The indignation aroused when the books of the society were stolen and made public in 1860 broke up the association. In 1864 Keshab Chunder Sen, founder of the Bharatvarshiya Brahmo Samaj, visited Bombay, and the interest he evoked bore fruit several months later when the new association was formed. The Prarthana Samaj differed from its Calcutta counterpart by its greater reluctance to break with orthodox tradition, and the Prarthana never required members to give up caste, idol worship, or the traditional religious sacraments. Early leaders of the movement were M.G. Ranade (1842–1901), who was a prominent social reformer and a judge of the Bombay High Court, and R.G. Bhandarkar (1837–1925), a noted scholar of Sanskrit.

Activities of the Prarthana Samaj include study groups, the support of missionaries, a journal, night schools for working people, free libraries, women's and student associations, and an orphanage. Its members were instrumental in the organization of other important social-reform movements that arose at the turn of the century, including the Depressed Classes Mission Society of India and the National Social Conference. Like that of the Brahmo Samaj and the Ārya Samāj, the success of the Prarthana Samaj in restoring the Hindu's self-respect was an important factor in the growth of nationalism, which led ultimately to political independence.

Prasad, Rajendra (b. Dec. 3, 1884, Zeradei, India—d. Feb. 28, 1963, Patna), first president of the Republic of India. A lawyer turned journalist, he was a comrade of Mahatma Gandhi in the earliest non-cooperation movements for independence and was also president of the Congress Party (1934, 1939, and 1947).

Raised in a landowning family of modest means, Prasad was married at 11 to a 7-year-old bride whom he had never seen, Shrimati Rajbansi Devi. A graduate of the Calcutta Law College, he practiced at the Calcutta High Court and in 1916 transferred to the Patna High Court and founded the *Bihār Law Weekly*. In 1917 he was recruited by Gandhi to help in a campaign to improve conditions for peasants exploited by British indigo planters in Bihār. He gave up his law practice in 1920 to join the Non-cooperation Movement. Becoming an active journalist in the nationalist interest, he wrote for *Searchlight* in English, founded and edited the Hindi weekly *Desh* ("Country"), and started his lifelong campaign to establish Hindi as the national language. Imprisoned several times for non-cooperation activities, he served nearly three years (August 1942–June 1945) in jail with the Congress Party's Working Committee. In September 1946 he was sworn in as minister for food and agriculture in the interim government preceding full independence. From 1946 to 1949 he presided over the Indian Constituent Assembly and helped to shape the constitution. He was unanimously elected president in 1950 and, after the first general election (1952), was chosen by an overwhelming majority of the new electoral college; in 1957 he was elected to a third term.

prasāda (Sanskrit: "favour"), in Hinduism, the food and water offered to a deity in worship (*pūjā*). It is believed that the deity partakes of and then returns the offering, thereby consecrating it. The offering is then distributed and eaten by the worshippers. The efficacy of the *prasāda* comes from its having been touched by the deity. Food left by the guru, or personal spiritual guide, is considered *prasāda* by his followers, as the guru is a living god. All food, if silently offered to God with the proper prayers before eating, becomes consecrated and thus *prasāda.*

Among the Sikhs of India, the distribution of *kaṛāh-prasād*, a sweet dish prepared from equal parts of wheat flour, sugar, and clarified butter, is customarily part of a worship service or of any special ceremony such as an initiation, wedding, or funeral. Communal eating reinforces the ideals of social equality that are an integral part of Sikh belief.

prase, translucent, leek-green variety of the silica mineral chalcedony. Coloured by hornblende fibres and chlorite, it was used by the ancients for engravings. Prase has been found at numerous localities.

praseodymium (Pr), chemical element, rare-earth metal of transition Group IIIb of the periodic table, used as the element in special alloys and, as its oxide, in glasses. Moderately soft, ductile, and malleable, this silvery metal rapidly displaces hydrogen from water and slowly reacts in air, developing a green oxide coating, which chips. For preservation the metal must be sealed in a plastic covering or kept in mineral oil. Praseodymium was discovered in didymia, a mixture of several rare-earth oxides. From it, by repeated fractional crystallization of ammonium didymium nitrate, Carl Auer von Welsbach separated (1885) salts of the elements praseodymium (the green fraction) and neodymium. Praseodymium is about one-third as abundant as lead and about a thousand times more plentiful than gold in the igneous rocks of the Earth's crust. It occurs in minerals such as monazite and bastnaesite and as one of the products of nuclear fission. Natural praseodymium is all stable isotope praseodymium-141. This element is commercially separated and purified by ion-exchange techniques; the reduction of the fluoride or chloride with calcium is one way in which the metal itself is prepared.

Praseodymium is a minor constituent of the alloy misch metal, used to make flints for cigarette lighters, and of high-strength, low-creep magnesium alloys for jet-engine parts. An alloying agent consisting primarily of praseodymium and neodymium gives magnesium alloys still higher strengths at all temperatures. A mixture of praseodymium and neodymium is the active component in didymium glass, used for goggles to protect the eyes of glassblowers and welders. Praseodymium compounds are used also to produce the yellow colour of some ceramics and other glasses.

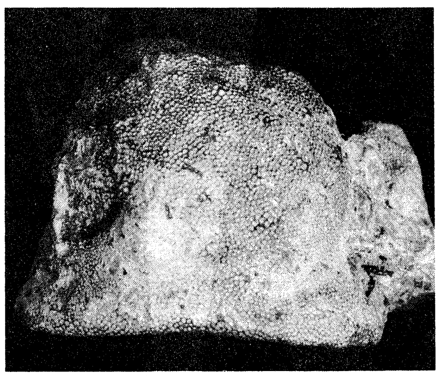
This element forms trivalent compounds such as the olive-green oxide Pr_2O_3, which dissolves readily in acids to yield green trivalent praseodymium salts. The tetravalent blackish-purple dioxide, PrO_2, is known, but the Pr^{4+} ion is unknown in aqueous solution.

atomic number	59
atomic weight	140.907
melting point	931° C
boiling point	3,212° C
specific gravity	6.772 (25° C)
valence	3
electronic config.	2-8-18-21-8-2 or (Xe)$4f^3 5d^0 6s^2$

Praslin Island, also called ÎLE DE PALME, island, second largest of the Seychelles archipelago, Republic of Seychelles, in the western Indian Ocean. The island is 2.5 mi (4 km) wide and 7 mi long, has an area of 16 sq mi (41 sq km), and is 25 mi northeast of Mahé Island. Praslin is granitic in origin and mountainous. Seven percent of the population of the Republic of Seychelles lives on the island. Copra, timber, vanilla, and vegetables—in particular tomatoes—are grown there. The Côte d'Or beach and the settlements of Grande Anse and Baie Sainte-Anne are centres of tourism.

Praslin is served by two parallel roads running the length of the island. Another road crosses the south central mountains, in which the virgin forest of the Vallée de Mai National Park is located. There is an airstrip at Amitié. Pop. (1982 est.) 4,500.

Prasopora, extinct genus of bryozoans, small colonial animals that formed mosslike or en-



Prasopora, of Ordovician age, found in St. Paul, Minn.

By courtesy of the trustees of the British Museum (Natural History); photograph, Imitor crusting growths, especially characteristic of the Ordovician Period, which began about 500,000,000 years ago. *Prasopora* generally is characterized by caplike colonies domed on top and flat on the bottom. The hard framework of the colony is composed of calcium carbonate, which formed the closely packed tubelike structures that housed the individual animals in the *Prasopora* colony.

Pratāp Singh (Hindu ruler): *see* Singh, Rana Pratāp.

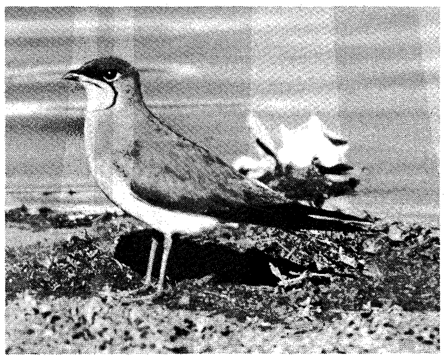
Pratāpgarh (India): *see* Partāpgarh.

Pratica di Mare (Italy): *see* Lavinium.

Pratihāra (Indian Hindu dynasty): *see* Gurjara-Pratihāra.

prātimokṣa (Buddhist code): *see* pātimokkha.

pratincole, also called SWALLOW PLOVER, any of six or seven Old World shorebird species that comprise the subfamily Glareolinae of the family Glareolidae, which also includes the coursers. Pratincoles are about 20 centimetres



Common pratincole (*Glareola pratincola*)
Robert Gilmour—Bruce Coleman Inc.

(8 inches) long, brown with a white rump; the tail is forked and the wings are long and pointed. Pratincoles feed on insects at twilight, flying over rivers and lakes in Europe, Africa, Asia, and Australia. They nest colonially, on the ground, often in hoofprints of grazing animals.

The common pratincole (*Glareola pratincola*) has reddish brown underwings and a yellowish throat outlined in black. The black-winged pratincole (*G. nordmanni*) of the Middle East is called locust bird in Africa, where it winters. Smaller species with less forked tails and shorter wings are sometimes separated as *Galachrysia;* these include the white-collared pratincole (*G. nuchalis*), of Africa, and the little Indian pratincole (*G. lactea*), of southern Asia. The Australian pratincole (*Stiltia isabella*) is a longer-legged bird, and, unlike other pratincoles, it frequents dry plains in the arid interior of the country.

Consult the INDEX *first*

pratītya-samutpāda (Sanskrit: "origination by dependence"), Pāli PAṬICCA-SAMUPPĀDA, the chain, or law, of dependent origination, or the chain of causation; a fundamental concept of Buddhism describing the causes of pain and the course of events that lead a being through rebirth, old age, and death.

Existence is seen as an interrelated flux of phenomenal events, material and psychical, without any real, permanent, independent existence of their own. These events happen in a series, one interrelating group of events producing another. The series is usually described as a chain of 12 links (Sanskrit *nidāna*s, "causes"), though some texts abridge these to 10, 9, 5, or 3. The first two stages are related to the past (or previous life) and explain the present, the next eight belong to the present, and the last two represent the future as determined by the past and what is happening in the present. The series consists of: (1) ignorance (Sanskrit *avidyā;* Pāli *avijjā*), specifically ignorance of the Four Noble Truths, of the nature of man, of transmigration, and of Nirvāṇa; which leads to (2) faulty thought constructions about reality (*saṃskāra/sankhāra*). These in turn provide the structure of (3) knowledge (*vijñāna/viññāṇa*), the object of which is (4) name and form—*i.e.,* the principle of individual identity (*nāma-rūpa*); the sensory perception of an object is had through (5) the six domains (*ṣaḍāyatana*)—*i.e.,* the five senses and their objects, and the mind as the coordinating organ of sense impressions; the presence of objects and senses leads to (6) contact (*sparśa/phassa*) between the two; which provides (7) sensation (*vedanā*). As this sensation is agreeable, it gives rise to (8) thirst (*tṛṣṇā/taṇhā*); and in turn to grasping (*upādāna*), as of sexual partners. This sets in motion (10) the process of becoming (*bhava*), which fructifies in (11) birth (*jāti*) of the individual and hence to (12) old age and death (*jarā-maraṇa*).

The formula is repeated frequently in early Buddhist texts, either in direct order (*anuloma*) as above, in reverse order (*pratiloma*), or in negative order (*i.e.,* "What is it that brings about the cessation of death? The cessation of birth," etc.). Gautama Buddha is said to have reflected on the series just prior to his Enlightenment, and a right understanding of the causes of pain and the cycle of rebirth leads to emancipation from the chain's bondage.

The formula gave rise to much scholastic discussion within the various schools of early Buddhism. Later, it came to be pictured as the outer rim of the wheel of becoming (*bhavacakra*), frequently reproduced in Tibetan painting.

Prato, also called PRATO IN TOSCANA, town, Firenze (Florence) province, in the Toscana (Tuscany) region of north central Italy, on the Bisenzio River, just northwest of Florence. Prato, of uncertain origin, became a free commune in the 11th century and prospered as a centre of commerce and wool manufacture. Later drawn into the orbit of Florence, it declined in importance after its final subjection by that city in 1350. It was sacked by the Spanish army in 1512 during the campaign to restore the Medici family.

The old episcopal town, still surrounded by 14th-century ramparts, is rich in 13th- and 14th-century buildings. It is dominated by the cathedral, a harmonious fusion of Romanesque (the nave, begun 1211) and Gothic (the transepts, 1317–20; perhaps by Giovanni Pisano); it contains works by Filippo Lippi and Andrea della Robbia and a splendid pulpit by Donatello and his partner Michelozzo. Other notable buildings are the Renaissance church of Sta. Maria delle Carceri (1485–93) by Giuliano da Sangallo, the Castello dell'Imperatore (1237–45), and the Palazzo Pretorio, housing the picture gallery. Prato is connected by rail with Florence, Pistoia, and Bologna. It is a leading centre for wool manufacture and has cement and textile machinery plants. Pop. (1981 prelim.) mun., 159,889.

Pratolini, Vasco (b. Oct. 19, 1913, Florence), Italian short-story writer and novelist, known particularly for compassionate portraits of the Florentine poor during the Fascist era, and as a major figure in Italian Neorealism (*see* Neorealism, Italian).

Pratolini was reared in Florence, the setting of nearly all his fiction, in a poor family. He held various jobs until his health failed. His illness forced his confinement in a sanatorium from 1935 to 1937. He had had no formal education but was an incessant reader, and during his confinement he began to write.

Pratolini went to Rome where he met the novelist Elio Vittorini, who introduced him into literary circles and became a close friend. Like Vittorini, Pratolini rejected Fascism; the Fascist government shut down Pratolini's literary magazine, *Campo di Marte,* within nine months of its founding in 1939.

His first important novel, *Il quartiere* (1944; *The Naked Streets,* 1952), is a vivid, exciting portrait of a gang of Florentine adolescents. *Cronaca familiare* (1947; *Two Brothers,* 1962), is a tender story of Pratolini's dead brother.

Cronache di poveri amanti (1947; *A Tale of Poor Lovers,* 1949), which has been called one of the finest works of Italian Neorealism, became an immediate best-seller and won two international literary prizes. The novel gives a panoramic view of the Florentine poor at the time of the Fascist triumph in 1925–26. *Un eroe del nostro tempo* (1949; London, *A Hero of Today,* N.Y., *A Hero of Our Time,* both 1951) attacks Fascism.

Between 1955 and 1966 Pratolini published three novels under the general title *Una storia italiana* ("An Italian Story"), covering the period 1875–1945. The first, *Metello* (1955; Eng. trans., 1968), considered the finest of the three, follows its working-class hero through the labour disputes after 1875 and climaxes with a successful building masons' strike in 1902. The second, *Lo scialo* (1960; "The Waste"), depicts the lassitude of the lower classes between 1902 and the mid-1920s preparatory to the Fascist takeover. The final volume, *Allegoria e derisione* (1966; "Allegory and Derision"), deals with the triumph and fall of Fascism, focussing on the moral and intellectual conflicts of the Florentine intelligentsia.

Pratt, Charles: *see* Camden, Charles Pratt, 1st Earl.

Pratt, E(dwin) J(ohn) (b. Feb. 4, 1883, Western Bay, Nfd.—d. April 26, 1964, Toronto), the leading Canadian poet of his time.

Trained for the ministry as a youth, Pratt taught and preached before enrolling at Victoria College in the University of Toronto (1907). He graduated in philosophy (1911) and took up the study of theology, in which he received a degree in 1916. Psychology was the next subject to occupy him; he was a psychologist on the staff of Victoria College till 1919, when he joined that school's English department and taught until his retirement in 1953.

E.J. Pratt
By courtesy of Mrs. E.J. Pratt

Pratt's earliest books of poetry, *Rachel* (privately printed 1917) and *Newfoundland Verse* (1923), deal with the challenge of the sea and the responses made by rugged men of the Newfoundland coast. Pratt turned to narrative in *The Witches' Brew* (1925) and *Titans* (1926). Pratt expounded the theme of shipwreck in *The Roosevelt and the Antinoë* (1930) and *The Titanic* (1935).

In *Brébeuf and His Brethren* (1940), Pratt reached the heights of his poetic career. In 12 books of blank verse, this chronicle records the martyrdom of Jesuit missionaries by the Iroquois. Pratt's publications of the World War II period reflect topical themes. These include: *Dunkirk* (1941), on the World War II Allied evacuation of France; *Still Life and Other Verse* (1943), short poems; *Collected Poems* (1944); and *They Are Returning* (1945), on the end of the war. *Behind the Log* (1947) commemorates the heroism of the Canadian convoy fleet running supplies to Murmansk during World War II.

Pratt's next work, *Towards the Last Spike* (1952), is a narrative of the building of the Canadian Pacific Railway (1870–85). His many awards include the highest civilian honour in Canada, the Companion of the Order of St. Michael and St. George (1946).

Pratt, John Jeffreys: *see* Camden, John Jeffreys Pratt, 2nd Earl and 1st Marquess.

Pratt, William Henry, also called CHARLES EDWARD PRATT (film actor): *see* Karloff, Boris.

pratyāhāra (Sanskrit: "withdrawal of the senses"), in the Yoga system of Indian philosophy, fifth of the eight stages intended to lead the aspirant to *samādhi,* the state of perfect concentration. The goal of *pratyāhāra* is to arrest the reaction of the senses to external objects, thus helping to isolate and free the mind from the involuntary intrusions caused by sensory activity. This does not mean that the mind ceases to experience external phenomena; merely that it experiences them directly through its own intensified powers of concentration instead of through the mediation of the senses.

pratyakṣa (Sanskrit: "that which is, or makes, evident"), in Indian philosophy, the first of the five means of knowledge, or *pramāṇa*s, that enable man to have correct cognitions of the world. *Pratyakṣa* is of two kinds, direct perception (*anubhava*) and remembered perception (*smṛti*). Some schools make a further distinction between indiscriminate (*nirvikalpaka*) perception, in which the object is perceived without its distinguishing features, and discriminate perception (*savikalpaka*), in which the distinguishing features are both observed and recognized. Indiscriminate perception is important to the followers of the Advaita (Nondualist) school of Vedānta, for it allows for the liberating perception of Brahman (ultimate reality), which is without features. *See also* pramāṇa.

pratyaya (Sanskrit: "cause"), Pāli PACCAYA, in Buddhist philosophy, an auxiliary, indirect cause, as distinguished from a direct cause (*hetu*). A seed, for example, is a direct cause of a plant, while sunshine, water, and earth are auxiliary causes of a plant. Sometimes *pratyaya* means the cause in general.

According to the 4th- or 5th-century text the *Abhidharmakośa,* all causes are classifiable into four types (*catvāraḥ pratyayāḥ*): (1) the direct cause (*hetu-pratyaya*); (2) the immediately preceding cause (*samanantara-pratyaya*), for, according to the Buddhist theory of universal momentariness (*kṣaṇikatva*), the disappearance of the mental activity of the first moment is regarded as the cause for the appearance of that of the second moment; (3) the object as a cause (*ālambana-pratyaya*), since the object present in the preceding moment becomes the cause of the mental activity for functioning; and (4) the superior cause (*adhipati-pratyaya*), which refers to all causes, except those stated above, that are effective to produce a thing or not to hinder the existence of it. In the latter sense of cause, every existence can be a cause of all existences except itself.

pratyeka-buddha (Sanskrit: "independent, or separate, Buddha"), Pāli PACCEKA-BUDDHA, in Buddhism, one who attains enlightenment through his own efforts, as distinct from the disciple (*śrāvaka*) who reaches the goal by listening to the teachings of a Buddha. The *pratyekabuddha* is also distinguished from the "complete Buddha" (*sammāsambuddha*), for he is not omniscient and is not capable of enlightening others.

In early Buddhism, the various recognized *yānas*, or ways, included the way of the disciple (*śrāvakayāna*) and the way of the self-enlightened Buddha (*pratyeka-buddhayāna*). The latter was retained only in the Theravāda tradition of Mahāyāna Buddhists who emphasize the ideal of the *bodhisattva,* who postpones his own final enlightenment while he works towards the salvation of others, and they consider both the *pratyeka-buddha* and the *arhat* (perfected master) to be too limited achievements.

prau, fast, sharp-ended rowing or sailing boat widely used in Malayan waters and once popular with Malayan pirates. The prau is long and narrow, rigged with one or two fore-and-aft sails.

Modern praus are usually open and relatively small. In earlier times they were decked and up to 60 feet (18 metres) long.

Prausnitz-Küstner antibody (biology): *see* reagin.

Pravda (Russian: "Truth"), daily newspaper published in Moscow and printed in 40 plants located around the Soviet Union, the official organ of the Central Committee of the Communist Party of the Soviet Union. Founded in 1912 in St. Petersburg as an underground newspaper, *Pravda* was initially produced by a three-person staff that included Lenin. It was repeatedly suppressed by the tsar's police, reappearing each time with a different name, finally emerging in Moscow in 1918 to assume its role as the official party paper.

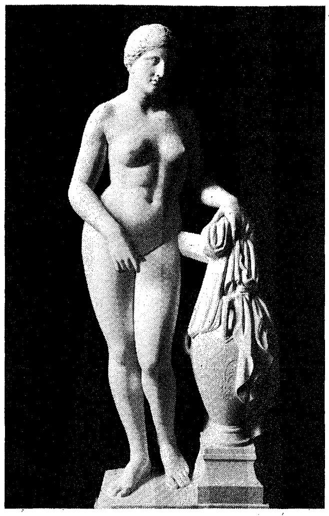
As the leading Soviet state newspaper and organ of information and education, *Pravda* offers its readers well-written articles and analyses on science, economics, cultural topics, and literature. There are letters from readers and officially sponsored and approved materials to indoctrinate and inform its readers on Communist theory and programs. Its treatment of foreign affairs generally is limited to domestic matters within foreign countries. International relations is left to the official Soviet government newspaper *Izvestiya* (*q.v.*). *Pravda*'s pages feature pleasing makeup, occasional photography, and attractive typography. It carries no Western-style scandal or sensational news; rather, it seeks to encourage unity of thought on the part of its readers by stressing and interpreting the party line. Many of its editorials are reprinted in other Soviet papers and carried by the Soviet news agency Tass to other countries in the Soviet bloc.

pravrajyā (Buddhism): *see* pabbajjā.

prawn, any of certain crustaceans of the shrimp suborder, Natantia. *See* shrimp.

Praxiteles, (fl. 370–330 BC), greatest of the Attic sculptors of the 4th century and one of the most original of Greek artists. By transforming the detached and majestic style of his immediate predecessors into one of gentle grace and sensuous charm, he profoundly influenced the subsequent course of Greek sculpture. Nothing is known of his life except that he apparently was the son of the sculptor, Cephisodotus the Elder, and had two sons, Cephisodotus the Younger and Timarchus, also sculptors.

His only known surviving work, the marble statue "Hermes Carrying the Infant Dionysus," is characterized by a delicate modelling of forms and exquisite surface finish. A few of his other works, described by ancient writers, survive in Roman copies.



"Aphrodite of Cnidus," Roman marble copy of Greek statue by Praxiteles, *c.* 350 BC; in the Vatican Museum, Rome

Alinari—Art Resource/EB Inc.

His most celebrated work was the "Aphrodite of Cnidus," which the Roman author Pliny the Elder considered not only the finest statue by Praxiteles but the best in the whole world. The goddess is shown naked, a bold innovation at the time. From reproductions of this statue on Roman coins numerous copies have been recognized; the best known are in the Vatican Museum, Rome, and in the Louvre, Paris. Another work that has been recognized in various Roman copies is the "Apollo Sauroctonus," in which the god is shown as a boy leaning against a tree trunk, about to kill a lizard with an arrow.

According to Pliny, when Praxiteles was asked which of his statues he valued most highly, he replied, " 'those to which Nicias [a famous Greek painter] has put his hand'—so much did he prize the application of colour [circumlitio] of that artist." To visualize the sculptures of Praxiteles, therefore, it is well to remember how much colour added to the general effect. Another ancient writer, Diodorus, says of him that "he informed his marble figures with the passions of the soul." It is this subtle personal element, combined with an exquisite finish of surface, that imparts to his figures their singular appeal. Through his influence, figures standing in graceful, sinuous poses, leaning lightly on some support, became favourite representations and were later further developed by sculptors of the Hellenistic Age.

prayer, an act of communication by a human being with the sacred or holy—God, the gods, the transcendent realm, or supernatural powers. Found in all religions throughout history, prayer may be a personal or corporate act.

A brief treatment of prayer follows. For full treatment, *see* MACROPAEDIA: Rites and Ceremonies, Sacred.

Prayer, directed to a person, seems to have originated independently of magic, which is wholly impersonal, although their paths perpetually crossed and indeed intermingled as they developed. The characteristic bodily attitudes (standing, kneeling, crouching, prostration, bowing of the head) and position of the hands (raised, outstretched, folded, crossed, clasped) associated with the act of praying and seen to signify an inward attitude of submission, homage, and devotion may also represent a survival of magical techniques designed to defend against a taboo or against a danger from the superhuman being.

Communication with divine beings in prayer is carried on in the same way as ordinary social intercourse, whether the divine being is a natural force (*e.g.*, a rain god), a patron of human activity (*e.g.*, a goddess of childbirth), an ancestor, or the highest power of all, the god of heaven and the creator. Thus the terms of address "Father," "Mother," "Lord," "King," are used in prayer, as are such forms of speech as confession of sins, requests, thanks, praise, reference to presents (sacrifice), or the promise of presents (a vow) if a request made in prayer is fulfilled. A characteristic feature of prayer at its primitive level is the desire to be free from earthly ills and dangers and to gain earthly goods.

This primitive prayer, whose simple forms are found among preliterate peoples, lived on into the ancient civilizations, where it developed from its spontaneous and free expression into fixed formularies. Another development was the hymn, which gradually escaped from ritual rigidity and formality into pure contemplation of God's working in nature and reached its highest point in the hymns to the sun of the Egyptian king Ikhnaton.

As religion became more spiritual and moral, man's prayer life developed comparably. Requests for earthly goods assumed much less importance and in some cases disappeared completely, while prayers for spiritual and moral qualities, for the knowledge and love of God, and for union with him came to the fore. Confession of sin, praise and thanksgiving, and expressions of trust and acceptance of the will of God also predominated. On a higher level, there arose the practice of wordless prayer, often called "spiritual prayer" or "prayer of the heart," the holy silence, which mystics experience as the purest form of adoration of the deity.

Public as well as private prayer is found at all stages in the development of religion. Among primitive peoples communal prayer takes the form of responses by the community to the prayers of their representative, who may be the head of a household, a chieftain, or a priest. An elaborate development of such communal prayer is found in Judaism after the destruction of the Second Temple (AD 70) and in Christianity, which carried on the Jewish tradition. Prayer in public worship is, first and foremost, praise of God for the creation and for the redemption.

After praise comes intercessory prayer for the needs of God's people and all of mankind. The apogee of communal prayer in Christianity is the Lord's Prayer (*q.v.*), which combines the chief petitions used by Jesus' Jewish contemporaries. Its central feature is the prayer for the coming of the Kingdom of God. A parallel prayer in Buddhism is the following: "May every living thing, movable or unmovable, tall, big, or medium-sized, clumsy or refined, visible or invisible, near or far, already born or aspiring to birth—may all beings have a happy heart."

The four prophetic religions, Judaism, Christianity, Islām, and Zoroastrianism, teach the observance of a daily set form of prayer for certain individuals, in addition to spontaneous private prayer and public worship in common. Every male Jew must twice a day recite the Shema, the commandment to love Yahweh as the only true God, and the so-called Prayer of 18 Requests (ʿAmida), also simply called "prayer" (Tefilla), which combines praise, thanksgiving, and petition. The latter must be recited three times a day by women, slaves, and children, as well as by men.

The canonical hours of the Christian Church, which developed out of these obligatory Jewish prayers, are said or sung communally by monks and nuns in convent chapels and said privately by secular priests. In the Anglican Communion and in Lutheran churches a simplified form of the canonical hours is used as a congregational service.

The Islāmic *salat*, more closely related to the obligatory Jewish prayers, is performed five times a day (at dawn, at midday, in the afternoon, immediately after sunset, and about two hours later) after the call to prayer made from the minaret. Ritual ablutions take place before the prayer. Strict regulations govern both the recital of the texts (the first *sura* of the Qurʾān, a prayer of praise, a confession of faith, a benediction of the prophet and the faithful) and the bodily postures (standing, bowing, prostration, crouching, raising or stretching out the hands, etc.). Similar recitations of formulas take place in Zoroastrianism. In all these religions, further, the repetitions of obligatory prayer formulas are regarded as particularly meritorious.

Where the same name may denote a person, place, or thing, the articles will be found in that order

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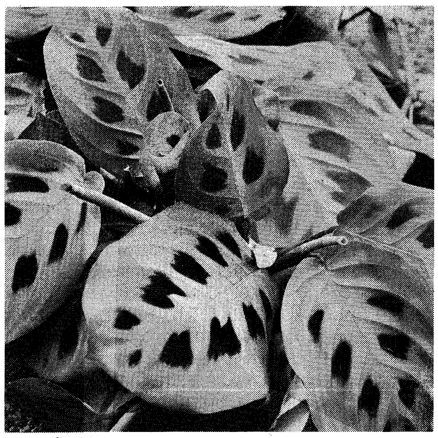
prayer plant, also called PRAYING HANDS (*Maranta leuconeura* variety *kerchoveana*), member of the family Marantaceae (order Zingiberales), native to the New World tropics. It has spreading leaves that turn upward toward evening. The plant is sometimes known as rabbits' tracks.

The brown blotches on either side of the midrib in young leaves change to emerald green and finally to moss green, contrasting with the medium green leaf. The underside of the leaf is gray-green. The purplish-green leaf sheaths are ranked in two vertical rows, and new leaves emerge from the youngest leaf sheaths. The larger half of the new leaf is rolled around the smaller half as it emerges from the leaf sheath below it. A thickened area or pulvinus is present between each petiole (leafstalk) and leaf base. The plant's stem



Prayer plant (*Maranta leuconeura* variety *kerchoveana*)
Sven Samelius

is spindly compared with the sturdier, long, overlapping leaf sheaths that partly obscure it. Distinct, fine venation is present in the almost transparent leaf sheaths.

prayer rug, Arabic SAJJĀDA, Persian NAMĀZLIK, one of the major types of rug produced in central and western Asia, used by Muslims primarily to cover the bare ground or floor while they pray. Prayer rugs are characterized by the prayer niche, or *miḥrāb*, an arch-shaped design at one end of the carpet. The *miḥrāb*, which probably derives from the prayer niche in mosques, must point toward Mecca while the rug is in use.

*Miḥrāb*s may appear in a variety of forms. Those on the prayer rugs of Anatolia, where the greatest number of these rugs have been made, are usually pointed and often have a step motif along their sides. *Miḥrāb*s on Persian rugs, however, are characteristically curvilinear and elegant, while those on Caucasian and Turkmen rugs are invariably rectilinear. Some prayer rugs have two or three *miḥrāb*s side by side and are known as "brothers' rugs." *Ṣaff*s, or large prayer rugs used simultaneously by a large number of persons, are subdivided into many small compartments, each of which has a miḥrāb.

Prayer rugs are often decorated with religious symbols that serve the worshipper as aids to memory. The lamps, for example, recall the lamps of mosques, and the comb and water pitcher are reminders that the Muslim is required to wash his hands and comb his beard before prayer. Often Caucasian rugs also show stylized hands on both sides of the miḥrāb to indicate where the hands are placed during prayer.

prayer wheel, Tibetan MAṆICHOS 'KHOR, in Tibetan Buddhism, a mechanical device the use of which is equivalent to the recitation of a mantra (sacred syllable or verse). The prayer wheel consists of a hollow metal cylinder, often beautifully embossed, mounted on a rod

Tibetan prayer wheel, gilt silver, 18th–19th century; in the Seattle (Washington) Art Museum
By courtesy of the Seattle Art Museum, Washington, Eugene Fuller Memorial Collection

handle and containing a consecrated written mantra. Each turning of the wheel by hand is equivalent in efficacy to the prayer's oral recitation.

Variants to the hand-held prayer wheel are large cylinders that can be attached to windmills or waterwheels and thus kept in continuous motion. The mantra on a prayer flag is similarly activated by the blowing of the wind.

praying hands (botany): *see* prayer plant.

praying mantid, also called PRAYING MANTIS (insect): *see* mantid.

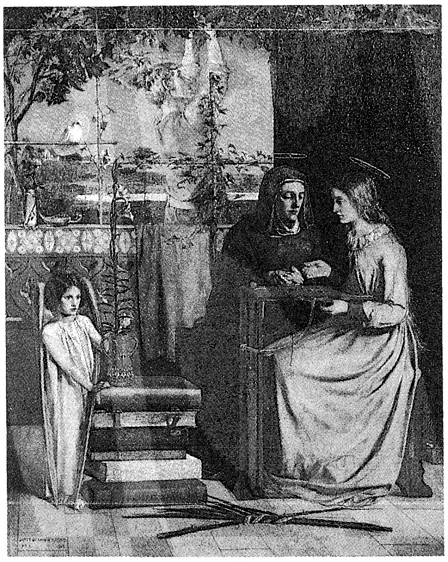
prazo, any of the great feudal estates acquired by Portuguese and Goan traders and soldiers in the valley of the Zambezi River in what is now Mozambique. Begun in the 16th century as an attempt at colonization, the *prazo* system was formalized in the mid-17th century. While giving titular obedience to the Portuguese crown, the *prazo*-holders built up private armies and virtually independent fiefdoms.

PRC 1 (Earth satellite): *see* China I.

pre-: *see below* and *see also* unhyphenated words with this prefix.

Pre-Boreal Climatic Interval, division of Holocene chronology (the Holocene Epoch began about 10,000 years ago and continues to the present). The Pre-Boreal Climatic Interval, as measured by radiocarbon dating, began about 10,000 years ago and ended about 9,500 years ago. The Pre-Boreal Climatic Interval preceded the Boreal Climatic Interval and was a time of increasing climatic moderation. Birch-pine forests were dominant; in Europe the forests were inhabited by such animals as bison and forest horse, while other forms, such as Irish elk and reindeer, were forced farther to the north.

Pre-Raphaelite Brotherhood, group of young British painters who banded together in 1848 in reaction against what they conceived to be the unimaginative and artificial historical painting of the Royal Academy and who purportedly sought to express a new moral



"The Girlhood of Mary Virgin," oil painting by Dante Gabriel Rossetti, one of the members of the Pre-Raphaelite Brotherhood, 1849; in the Tate Gallery, London

The Tate Gallery, London

seriousness and sincerity in their works. They were inspired by Italian art of the 14th and 15th centuries, and their adoption of the name Pre-Raphaelite expressed their admiration for what they saw as the direct and uncomplicated depiction of nature typical of Italian painting before the High Renaissance and, particularly, before the time of Raphael.

The Pre-Raphaelite Brotherhood was formed in 1848 by three Royal Academy students, Dante Gabriel Rossetti, who was a gifted poet as well as a painter, William Holman Hunt, and John Everett Millais, all under 25. The painter James Collinson, the painter and critic F.G. Stephens, the sculptor Thomas Woolner, and the critic William Michael Rossetti (Dante Gabriel's brother) joined them by invitation. The painters William Dyce and Ford Madox Brown were also notable practitioners of the Pre-Raphaelite style.

The Brotherhood began immediately to produce highly convincing and significant works. Their pictures of religious and medieval subjects emulated the deep religious feeling and naive, unadorned directness of 15th-century Florentine and Sienese painting. The style that Hunt and Millais evolved featured sharp and brilliant lighting, a clear atmosphere, and a near-photographic reproduction of minute details. They also frequently introduced a private poetic symbolism into their representations of Biblical subjects and medieval literary themes. Rossetti's work differed from that of the others in its use of blurred lines, a more sculptural and suggestive chiaroscuro, and a hazy, dreamlike atmosphere. Vitality and freshness of vision are the most admirable qualities of these early Pre-Raphaelite paintings.

The Brotherhood at first exhibited together anonymously, signing all their paintings with the monogram PRB. When their identity and youth were discovered in 1850, their work was harshly criticized by the novelist Charles Dickens, among others, not only for its disregard of academic ideals of beauty but also for its apparent irreverence in treating religious themes with an uncompromising realism. Nevertheless, the leading art critic of the day, John Ruskin, stoutly defended Pre-Raphaelite art, and the members of the group were never without patrons.

The members of the Pre-Raphaelite Brotherhood had ceased to exhibit together by 1854 and soon went their individual ways, but their style had a wide influence and gained many imitators during the 1850s and early '60s. In the late 1850s Dante Gabriel Rossetti became associated with the younger painters Edward Burne-Jones and William Morris and moved closer to a sensual and almost mystical romanticism. Millais, the most technically gifted painter of the group, went on to become an academic success. Hunt alone pursued the same style throughout most of his career and remained true to Pre-Raphaelite principles. Pre-Raphaelitism in its later stage is epitomized by the paintings of Burne-Jones, in which a lyrical if slightly insipid medievalism is given hauntingly sensuous overtones.

Pre-Romanticism, cultural movement in Europe from about the 1740s onward that preceded and presaged the artistic movement known as Romanticism (*q.v.*). Chief among these trends was a shift away from the idealization and elevated sentiments of Neoclassicism toward more natural forms of expression. This new emphasis partly reflected the tastes of the growing middle class, who found the art forms patronized by aristocratic society to be artificial; the bourgeoisie favoured more realistic art that was more emotionally accessible.

A major intellectual precursor of Romanticism was the French philosopher and writer Jean-Jacques Rousseau. He emphasized the free expression of emotion rather than polite restraint in friendship and love; repudiated aristocratic elegance and recognized the virtues of middle-class domestic life; helped open men's eyes to the beauties of nature; introduced the cult of religious sentiment among people who had discarded religious dogma; inculcated the belief that a person's moral development was fostered by his experiencing powerful sympathies; and introduced the idea that the free expression of the creative spirit is more important than strict adherence to formal rules and traditional procedures.

The new emphasis on genuine emotion can be seen in a whole range of Pre-Romantic trends. These included the development of the "wild," natural-appearing English garden in contrast to the geometrical vistas of the French formal garden; the graveyard school of English poetry of the 1740s, with Edward Young's and Thomas Gray's melancholy evocations of sorrow, bereavement, death, and decay; Samuel Richardson's *Pamela* (1740) and other sentimental novels that exploited the reader's capacity for tenderness and compassion; the "novel of sensibility" of the 1760s, with its emphasis on emotional sensitivity and deeply felt personal responses to natural beauty and works of art; the Sturm und Drang movement in Germany (1770–80), in which J.W. von Goethe and Friedrich Schiller rejected in their plays the conventions of French Neoclassical tragedy and instead exalted nature, feeling, and human individualism; the English Gothic novel of terror, fantasy, and mystery, as practiced by Horace Walpole in *The Castle of Otranto* (1765) and by Ann Radcliffe and Matthew Gregory Lewis in several works; and, finally, the ambitious efforts to collect and preserve folktales and ballads of all types. By the 1790s Pre-Romanticism had been supplanted by Romanticism proper.

Preakness Stakes, 1$^3/_{16}$-mile (about 1,900-metre) flat race for three-year-old Thoroughbred horses, held at Pimlico Race Course, Baltimore, Md., U.S., annually in mid-May. Fillies carry 121 pounds (55 kg), colts, 126 pounds (57 kg).

A Triple Crown race (following the Kentucky Derby and preceding the Belmont Stakes), the Preakness was first run as a 1$^1/_2$-mile event in 1873. The race was discontinued after the 1889 running at 1$^1/_4$ mile, then was renewed at 1$^1/_{16}$ mile at Gravesend, N.Y., in 1894. It was returned to Pimlico as a 1-mile event in 1909 and was run in two divisions in 1918. The present distance was established in 1925. *See* Sporting Record: *Horse racing.*

Preble, Edward (b. Aug. 15, 1761, Falmouth [now Portland], Maine—d. Aug. 25, 1807, Portland, Maine), commander of U.S. naval forces during much of the Tripolitan War.

After receiving an education at the Dummer Academy in Massachusetts, Preble ran off to sea at the age of 16. During the Revolution he served aboard several American ships and was briefly captured by the British in 1781. After the war's end Preble sailed for 15 years in the merchant service and then received a navy command in 1798 at the outbreak of the undeclared naval war with France. He provided valuable service in protecting American ships from French privateers.

In 1803 Preble sailed into the Mediterranean as commander of seven vessels whose aim was to stop the attacks of Barbary coast pirates on American merchant ships. He quickly resolved a matter of treaty violations by the sultan of Morocco, then sailed on to Tripoli. Preble blockaded Tripoli but lost one of his ships—the frigate *Philadelphia*—when it ran aground and was captured.

In August 1804 Preble began the bombardment of Tripoli. The attacks and running naval encounters carried into September, when Preble was replaced by Commodore Samuel Barron. Bitterly disappointed at not being able to see the war through to a successful conclusion, Preble returned to the United States.

In 1806 President Thomas Jefferson offered him the position of secretary of the navy, but Preble declined. For the brief remainder of his life, Preble built gunboats for the navy.

Precambrian time, interval of geologic time constituting the great bulk of the Earth's history and extending from about 3.8 billion years ago to the beginning of the Cambrian Period (the first division of the Paleozoic Era), about 570 million years ago. Thus, the Precambrian represents about 80 percent of all the time since the Earth's crust formed. Although well-preserved sedimentary rock successions of Precambrian age can be found today, the proportion of Precambrian time that they collectively represent is very small. Even in the sedimentary successions that do occur, the absence of suitable fossils prevents both a chronological subdivision of individual successions and a chronological correlation from one succession to another. The age of Precambrian rocks is, therefore, almost invariably given by reference either to radiometrically (isotopically) determined ages or age limits or to arbitrary time divisions. The only two universally accepted divisions of Precambrian time are the Archean Eon (3.8 to 2.5 billion years ago) and the Proterozoic Eon (2.5 billion to 570 million years ago), the latter spanning the time between the Archean Eon and the Cambrian Period. Both the Archean and Proterozoic are subdivided into three eras—Early, Middle, and Late.

A brief treatment of Precambrian time follows. For full treatment, *see* MACROPAEDIA: Geochronology.

Most of the rocks that form the present-day continents originated during the Precambrian, but they represent less than one-third of the rocks presently exposed at the surface of the Earth, owing to the cover of younger sedimentary and volcanic rocks. The most extensive exposures of Precambrian rocks are those that outcrop over roughly equidimensional areas many hundreds of kilometres across. These extensive outcrops are commonly known as continental shields (or simply shields, or provinces), the largest of which occur in Canada, Greenland, Scandinavia and adjoining parts of the Soviet Union (the Baltic Shield), Siberia, China, peninsular India, Brazil, Antarctica, Western Australia, and most of Africa south of the Atlas Mountains. Other Precambrian rocks known to be concealed by younger deposits include those below the North American plain, the lowlands of Germany, and the region south and east of the Baltic. Many of the buried Precambrian rocks covered by flat-lying younger deposits have undergone little change since Precambrian time and can be readily identified by age determinations made on specimens obtained by deep drilling. The term platform is commonly applied to such a mass of Precambrian rock overlaid by horizontal layers of younger rock material. Examples are the North American and Russian platforms, which are essentially buried extensions of the Canadian and Baltic shields, respectively. Precambrian rocks are found in still another form. They occur in mountain chains built since the Precambrian, where rocks of Precambrian age significantly altered by high temperatures and pressures may be found within belts of metamorphic gneisses and schists.

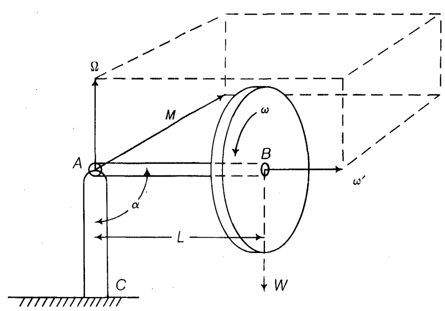
The oldest known terrestrial rocks have a radiometric age of 3.96 billion years and are of granitic composition. Some igneous rock material of this kind was redeposited to form sedimentary formations, which exhibit features illustrating probable deposition of the formations in shallow water. There is no evidence for the existence of continents at this time, and it is probable that the Earth's surface was covered by water, except where volcanic islands emerged. Volcanic activity was probably more intense than in later times because of the extra heat generated by the decay of relatively short-lived radioactive isotopes. A hydrosphere could not have developed without the prior development of an atmosphere. The composition of the atmosphere at this time is uncertain except that it contained little free oxygen. The free oxygen that makes up much of the present atmosphere evolved by two possible processes: (1) the Sun's ultraviolet radiation, which provided energy for breaking up water vapour into hydrogen, which escaped into space, and free oxygen, which remained in the atmosphere, and (2) organic photosynthesis, which was made possible by the emergence of such primitive organisms as blue-green algae, or cyanobacteria. The discovery of stromatolites (layered or conical structures formed by blue-green algae) in limestones roughly 3.5 billion years old indicates that cyanobacteria existed by this time. It took at least 2.2 billion years for enough oxygen to build up in the Earth's atmosphere to enable the evolution of a large number of life-forms.

The Archean-Proterozoic boundary (about 2.5 billion years ago) marks a major turning point in Earth history. Prior to this time, the Earth's crust was in the process of rapid growth, and no large stable continents developed. By 2.5 billion years ago, the intense tectonic processes of the Late Archean had ceased. The continental crust had for the first time reached a mature stage characterized by considerable rigidity and stability. The absence of any significant tectonic activity probably resulted in the amalgamation of many small continental blocks and island arcs into a single supercontinent. This vast landmass is thought to have fragmented during the course of the Early Proterozoic (from 2.5 to 1.6 billion years ago). Collisions between the resultant smaller continents gave rise to mountain building along their leading edges. The rapid crustal growth and the many orogenic belts that developed during this time produced large continental blocks, which in turn fused to form a new supercontinent in Late Proterozoic times. This second supercontinent broke up before the beginning of the Paleozoic Era some 570 million years ago.

The first evidence of terrestrial life was found in Early Archean sedimentary rocks (about 3.5 billion years old) in South Africa and western Australia. These oldest remains include not only the above-mentioned stromatolites but also two kinds of microfossils: (1) spherical carbonaceous aggregates that resemble algae and cysts of flagellates, and (2) carbonaceous filamentous threads. These Early Archean organisms were prokaryotes, which were not capable of cell division. They remained the dominant life-forms until roughly 1.3 billion years ago, when they were superseded by the eukaryotes. The latter were capable of cell division, which made it possible for the genetic coding material DNA to be transmitted to succeeding generations. The metazoa (multicelled organisms whose cells are differentiated into tissues and organs for specific functions) made their first appearance during the Late Proterozoic. These metazoa were of a very primitive type, having no skeletons. The impressions of these soft-bodied organisms that resembled present-day jellyfish, sea pens, and worms were found in shallow-water quartzite about 700 to 670 million years in age at the Ediacara Hills in the Flinders Range of South Australia.

precession, phenomenon associated with the action of a gyroscope or a spinning top and consisting of a comparatively slow rotation of the axis of rotation of a spinning body about a line intersecting the spin axis. The smooth, slow circling of a spinning top is precession, the uneven wobbling is nutation.

In the Figure the disk of weight W and the attached shaft are rotating at high speed about the spin axis AB. The angular speed ω, which is clockwise viewed from A, can be indicated



Precession

either by the curved arrow ω in the plane of the disk or by the vector ω' perpendicular to the disk and pointing to the right. The curved arrow ω and the vector ω' are analogous, respectively, to the rotation and advance of a right-hand screw in a nut; this is known as the right-hand rule. It is usually more convenient to represent rotations and turning moments (which tend to produce rotations) by vectors rather than by curved arrows.

The shaft and the stationary column AC are connected by a ball-and-socket joint at A, which permits the shaft to rotate about any line through A. In the arrangement shown in the Figure, the weight W creates a clockwise moment WL about A, which can be represented by a vector M of magnitude WL, acting at A and perpendicular to AB. Because of the moment, the shaft will precess (rotate slowly) about the axis of the column in a clockwise direction, viewed from C; the angular velocity of precession is indicated by the vector Ω. It should be noted that ω', M, and Ω are at right angles to one another and that the spin vector ω' always rotates toward the moment vector M. It can be shown that Ω, the angular velocity of precession, does not depend on the angle a, which, in the case of a spinning top, is close to 180 degrees.

The precession of tops is frequently accompanied by a phenomenon known as nutation, which is evidenced by a wavelike motion of the end of the spin axis caused by variations in the angle a.

preciosity, French PRÉCIOSITÉ, style of thought and expression exhibiting delicacy of taste and sentiment, prevalent in the 17th-century French salons. Initially a reaction against the coarse behaviour and speech of the aristocracy, this spirit of refinement and *bon ton* was first instituted by the Marquise de Rambouillet in her salon and gradually extended into literature. The wit and elegance of the *honnête homme* ("cultivated man") became a social ideal, which was expressed in the vivid, polished style of Vincent Voiture's poems and letters and in the eloquent prose works of Jean-Louis Guez de Balzac. This ideal revived the medieval tradition of courtly love, as expressed in the novels of Honoré d'Urfé. The success of his *L'Astrée* (1607–27; "The Astrea"), a vast pastoral set in the 5th century, was attributable as much to its charming analysis of the phases of love (*i.e.,* chivalrous, mystical) and the corresponding adventures and complications as to its portraits of members of contemporary society.

While the conceits and circumlocutions of the précieux, or "precious," writers were greatly admired by many, others mocked them for their pedantry and affectation; Molière ridiculed them in his comedy *Les Précieuses ridicules* (1659). Preciosity in France was eventually carried to excess and led to exaggeration and affectation (particularly by the burlesque writers), as it did in other countries—as seen, for example, in the movements Gongorism in Spain, Marinism in Italy, and Euphuism in England.

precious olivine (mineral): *see* peridot.

precipitation, all liquid and solid water particles that fall from clouds and reach the ground. These particles include drizzle, rain, snow, snow pellets, ice crystals, and hail.

A brief treatment of precipitation follows. For full treatment, *see* MACROPAEDIA: Climate and Weather.

The essential difference between a precipitation particle and a cloud particle is one of size. An average raindrop has a mass equivalent to about 1,000,000 cloud droplets. Because of their large size, precipitation particles have significant falling speeds and are able to survive the fall from the cloud to the ground.

The transition from a cloud containing only cloud droplets to one containing a mixture of cloud droplets and precipitation particles involves two basically different steps: the formation of incipient precipitation elements directly from the vapour state and the subsequent growth of those elements through aggregation and collision with cloud droplets. The initial precipitation elements may be either ice crystals or chemical-solution droplets.

Development of precipitation through the growth of ice crystals depends on the fact that cloud droplets can freeze spontaneously at temperatures below about −40° C, or −40° F. (The reduction of cloud droplets to temperatures below the normal freezing point is termed supercooling.) Within supercooled clouds, ice crystals may form through sublimation of water vapour on certain atmospheric dust particles known as sublimation nuclei. In natural clouds, ice crystals form at temperatures colder than about −15° C (+5° F). The exact temperature of ice-crystal formation depends largely on the physical–chemical nature of the sublimation nucleus.

Once ice crystals have formed within a supercooled cloud, they continue to grow as long as their temperature is colder than freezing. The rates of growth depend primarily upon the temperature and degree of vapour saturation of the ambient air. The crystals grow at the expense of the water droplets. In favourable conditions—*e.g.,* in a large, rapidly growing cumulus cloud—an ice crystal will grow to a size of about 0.13 millimetre (0.005 inch) in three to five minutes after formation. At this size, the rate of growth through sublimation slows down, and further growth is largely through aggregation and collision with cloud droplets.

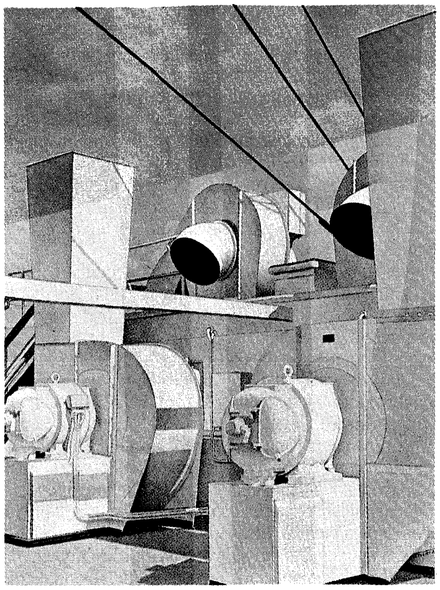
Small solution drops are also important as incipient precipitation particles. The atmosphere contains many small particles of soluble chemical substances. The two most common are sodium chloride swept up from the oceans and sulfate-bearing compounds formed through gaseous reactions in the atmosphere. Such particles, called condensation nuclei, collect water because of their hygroscopic nature and, at relative humidities above about 80 percent, exist as solution droplets. In tropical maritime air masses, the number of condensation nuclei is often very large. Clouds forming in such air may develop a number of large solution droplets long before the tops of the clouds reach temperatures favourable to the formation of ice crystals.

Regardless of whether the initial precipitation particle is an ice crystal or a droplet formed on a condensation nucleus, the bulk of the growth of the precipitation particle is through the mechanisms of collision and coalescence. Because of their larger size, the incipient precipitation elements fall faster than do cloud droplets. As a result, they collide with the droplets lying in their fall path. The rate of growth of a precipitation particle through collision and coalescence is governed by the relative sizes of the particle and the cloud droplets in the fall path that are actually hit by the precipitation particle and the fraction of these droplets that actually coalesce with the particle after collision.

precipitation, electrostatic: *see* electrostatic precipitation.

Precisionism, smooth, precise technique used by several American painters in representational canvases, executed primarily during the 1920s, depicting sharply defined forms. While Precisionism can be seen as a tendency present in American art since the colonial period, the 20th-century Precisionist painters' style had its origins in Cubism, Futurism, and Orphism (*qq.v.*). Unlike the artists affiliated with the latter movements, the Precisionists did not issue manifestos, and they were not a school or movement with a formal program; during the 1920s, however, many of them exhibited their works together, particularly at the Daniel Gallery in New York City. Among the artists associated with Precisionism were Charles Demuth, Charles Sheeler, Ralston Crawford, Preston Dickinson, Niles Spencer, and Georgia O'Keeffe.

The favourite subject matter of these artists was the skyline, either urban or rural, Manhattan, the industrial landscape of factories and smokestacks, buildings and machinery, and the country landscape with its grain elevators and barns or empty desert and sky. Because the Precisionists used these motifs primarily to create formal designs, there is a certain amount of abstraction in their works. Precisionism is thus not an art of social criticism. When the artist painted the city street, factory, or farm landscape, he was not making a comment on the environment depicted (though occasionally a faintly humorous approach is suggested by a witty title, such as Charles Demuth's "Modern Conveniences" [1921; Columbus Gallery of Fine Arts, Ohio], a painting that portrays a factory rooftop reached by a somewhat unstable ladderlike stairway); the scenes are always devoid of people or signs of human activity. Precisionism is a "cool" art, which keeps the viewer at a distance; the artist's attitude seems to be one of complete detachment, which he achieves largely by smoothing out his brushstrokes, erasing, as it were, his personal handwriting. The painting's light is idealized—brilliant and sharply clear—as in Charles Sheeler's "Upper Deck" (1929; Fogg Art Museum, Harvard University). The forms chosen are frequently geometric, either inherently, as in the cylinders of "Upper Deck" and the cylindrically shaped grain elevators of Demuth's "My Egypt" (1927; Whitney Museum of American Art, New York City), or because the artist exaggerates these qualities through Cubist techniques.



"Upper Deck," Precisionist painting by Charles Sheeler, oil, 1929; in the Fogg Art Museum, Cambridge, Mass.
By courtesy of the Fogg Art Museum, Harvard University, Purchase—Louise E. Bettens Fund

The Precisionists' style greatly influenced the American Magic Realists and the Pop artists; (*see* Pop art): Demuth's painting "I Saw the Figure 5 in Gold" (1928; Metropolitan Museum of Art, New York City) was particularly influential, in both technique and imagery, on the works of Jasper Johns and Robert Indiana.

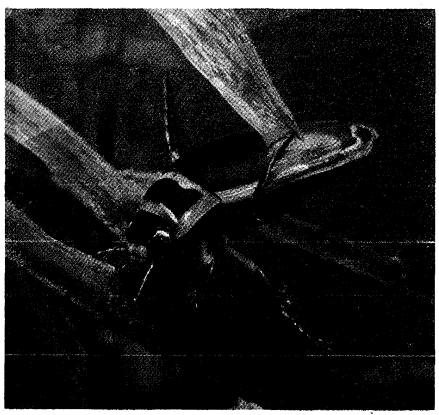
precognition, supernormal knowledge of future events, with emphasis not upon mentally causing events to occur but upon predicting those the occurrence of which the subject claims has already been determined. Like telepathy and clairvoyance, precognition is said to operate without recourse to the normal senses and thus to be a form of extrasensory perception (ESP).

There is a long tradition of anecdotal evidence for foreseeing the future in dreams and by various devices such as observing the flight of birds or examining the entrails of sacrificial animals. Precognition has been tested with subjects required to predict the future order of cards in a deck about to be shuffled or to foretell results of dice throws, but the statistical support for it has generally been less convincing than that from experiments in telepathy and clairvoyance.

Preconsecrated Offerings, Liturgy of the, also called LITURGY OF ST. GREGORY THE GREAT, a communion service used during Lent in Eastern Orthodox and Eastern-rite Catholic churches; the consecration is omitted, and bread and wine reserved from the previous Sunday's liturgy are distributed to the faithful.

The Liturgy of the Presconsecrated Offerings is based on the Liturgy of St. John Chrysostom and appeared in Byzantium as early as the 7th century. It begins with the Hesperion (vespers); omits the Epistle and Gospel, except on feast days; drops the Anaphora, or central portion of the liturgy; and, lacking the consecration, uses bread and wine consecrated at a full liturgy for Communion. The Liturgy of the Preconsecrated Offerings may be used in the Byzantine rite on any day of the Lenten season except Saturday and Sunday, though in actuality it is used only on Wednesdays and Fridays. Maronites and Malabarese use the Liturgy of the Preconsecrated Offerings only on Good Friday, while the Armenian, Coptic, and Ethiopic rites do not have such a liturgy at all.

predaceous diving beetle, also called DIVING BEETLE, or TRUE WATER BEETLE, any member of the cosmopolitan insect family Dytiscidae (order Coleoptera), containing more than 4,000 species. Diving beetles are oval and flat and range in length from 1.5 millimetres to more than 35 millimetres (0.06 to more than 1.4 inches). They are well adapted to an aquatic environment: the hind pair of legs is long, flattened, and fringed to provide surface area that aids in flotation, and the spiracles (openings through which the beetle breathes) are on the abdomen just under the tips of the wing covers (elytra). When in a resting position—below the water surface on an incline with the head down—the beetle raises the tips of the elytra and breathes through the spiracles. When ready to dive, it stores a supply of air under its wings for breathing while under water. Diving beetles are so streamlined that the males of some species have sucker-like cups on the first pair of legs so that they can hold on to the smooth surface of the female during mating. Predaceous diving beetles are carnivorous, preying on insects and other aquatic organisms, including fish larger than they.



Predaceous diving beetle (*Dytiscus marginalis*)
Jane Burton—Bruce Coleman Ltd.

The female deposits eggs in the water or on aquatic vegetation; the larvae, known as water tigers because of their voracious appetite, are long and slender and have sickle-shaped jaws. Through canals in its jaws the larva pumps digestive juices into its prey and sucks out the digested animal tissues. The larva, like the adult, breathes through spiracles on its abdomen and hangs suspended from the water surface film. In some species filamentous abdominal appendages function as gills, and the larva does not have to surface in order to breathe. Diving beetle larvae pupate in moist ground.

Two important worldwide genera (*Dytiscus* and *Cybister*), more than 35 mm (1.4 inches) long, are raised and eaten in the Orient. The eyeless genus *Siettitra* lives in deep wells. Diving beetles are not generally considered beneficial because they eat fish and compete with them for food and space without providing them with a major food source.

predation, in animal behaviour, the pursuit, capture, and killing of animals for food. Predatory animals may be solitary hunters, like the leopard, or they may be group hunters, like wolves.

The senses of predators are adapted in a variety of ways to facilitate hunting behaviour. Visual acuity is great in raptors such as the red-tailed hawk, which soars on high searching for prey. Even on a dark night owls can hear, and focus on, the rustling sound and movement of a mouse. Many insect-eating bats hunt by echolocation, emitting a pulsed, high-frequency sound—in the manner of a ship's sonar—while flying; the sensory data thus gained guides them to their prey. A flock of white pelicans will cooperate to form a semicircle and, with much flapping of wings, drive fish into shallow water where they are easily captured.

predestination, in Christianity, the doctrine that God has eternally chosen those whom he intends to save. In modern usage, predestination is distinct from both determinism and fatalism and is subject to the free decision of the human moral will; but the doctrine also teaches that salvation is due entirely to the eternal decree of God. In its fundamentals, the problem of predestination is as universal as religion itself, but the emphasis of the New Testament on the divine plan of salvation has made the issue especially prominent in Christian theology.

Christian doctrines of predestination may be considered explanations of the words of the Apostle Paul,

> For those whom he [God] foreknew he also predestined to be conformed to the image of his Son, in order that he might be the first-born among many brethren. And those whom he predestined he also called; and those whom he called he also justified; and those whom he justified he also glorified (Rom. 8:29–30).

Three types of predestination doctrine, with many variations, have developed. One theory (associated with Semi-Pelagianism, some forms of nominalism, and Arminianism) makes foreknowledge the ground of predestination and teaches that God predestined to salvation those whose future faith and merits he foreknew.

At the opposite extreme is the doctrine of double predestination, commonly identified with John Calvin but more correctly associated with the Synod of Dort, and appearing also in some of the writings of St. Augustine and Martin Luther and in the thought of the Jansenists. According to this doctrine, God has determined from eternity whom he will save and whom he will damn, regardless of their faith, love, or merit, or lack thereof.

A third doctrine was set forth in other writings of St. Augustine and Luther, in the decrees of the second Council of Orange (529), and in the thought of St. Thomas Aquinas. It ascribes the salvation of man to the unmerited grace of God and thus to predestination, but it attributes divine reprobation to man's sin and guilt.

predicable, in logic, something that may be predicated, especially, as listed in Boethius' Latin version of Porphyry's *Isagoge,* one of the five most general kinds of attribution: genus, species, differentia, property, and accident. It is based upon a similar classification set forth by Aristotle in the *Topics* (*a,* iv–viii), which has "definition," however, in place of "species."

Aristotle treated only statements of the form "*A* is *B,*" in which subject and predicate are both universal. He noted that in every true statement of this type the predicate either is convertible with the subject (*i.e.,* "*B* is *A*" follows from "*A* is *B*") or else it is not. If the predicate is convertible and states its essence, then it is the definition of the subject; whereas if it is convertible but does not state the essence, it is a property of the subject. On the other hand, if the predicate is not convertible with the subject but is part of the definition, it is the genus or differentia of the subject, for a definition always consists of genus and differentia. Finally, if the predicate is not convertible and is not part of the definition, it is an accident of the subject.

Some Aristotelian examples may be briefly mentioned. In the true statement "Man is a rational animal," the predicate is convertible with the subject and states its essence; therefore, "rational animal" is the definition of man. The statements "Man is an animal" and "Man is rational," while true, are not convertible; their predicate terms, however, are parts of the definition and hence are the genus and differentia of man. On the other hand, the statement "Man is capable of learning grammar" is true and convertible; but "capable of learning grammar" does not state the essence of man and is therefore a property of man. The true statement "Man is featherless" offers an example of an accident. Its predicate is not convertible with its subject, nor is it part of the definition; accordingly, it expresses only an accidental characteristic of man.

Porphyry gave the following examples of predicable relationships in which the subject is "man": of genus, animal; of differentia, rational; of property, risible; and of accident, white.

predicate calculus, also called LOGIC OF QUANTIFIERS, that part of modern formal or symbolic logic which systematically exhibits the logical relations between sentences that hold purely in virtue of the manner in which predicates or noun expressions are distributed through ranges of subjects by means of quantifiers such as "all" and "some" without regard to the meanings or conceptual contents of any predicates in particular. Such predicates can include both qualities and relations; and, in a higher-order form called the functional calculus, it also includes functions, which are "framework" expressions with one or with several variables that acquire definite truth-values only when the variables are replaced by specific terms. The predicate calculus is to be distinguished from the propositional calculus, which deals with unanalyzed whole propositions related by connectives (such as "and," "if . . . then," and "or").

The traditional syllogism is the most well-known sample of predicate logic, though it does not exhaust the subject. In such arguments as "All *C* are *B* and no *B* are *A,* so no *C* are *A,*" the truth of the two premises requires the truth of the conclusion in virtue of the manner in which the predicates *B* and *A* are distributed with reference to the classes specified by *C* and *B,* respectively. If, for example, the predicate *A* belonged to only one of the *B*'s, the conclusion then could possibly be false—some *C* could be an *A.*

Modern symbolic logic, of which the predicate calculus is a part, does not restrict itself, however, to the traditional syllogistic forms or to their symbolisms, a very large number of which have been devised. The predicate calculus usually builds upon some form of the propositional calculus. It then proceeds to give a classification of the sentence types that it contains or deals with, by reference to the different manners in which predicates may be distributed within sentences. It distinguishes, for example, the following two types of sentences: "All *F*'s are either *G*'s or *H*'s," and "Some *F*'s are both *G*'s and *H*'s." The conditions of truth and falsity in the basic sentence types are determined, and then a cross-classification is made that groups the sentences formulable within the calculus into three mutually exclusive classes—(1) those sentences that are true on every possible specification of the meaning of their predicate signs, as with "Everything is *F* or is not *F*"; (2) those false on every such specification, as with "Something is *F* and not *F*"; and (3) those true on some specifications and false on others, as with "Something is *F* and is *G.*" These are, respectively, the tautologous, inconsistent, and contingent sentences of the predicate calculus. Certain tautologous sentence types may be selected as axioms or as the basis for rules for transforming the symbols of the various sentence types; and rather routine and mechanical procedures may then be laid down for deciding whether given sentences are tautologous, inconsistent, or contingent—or whether and how given sentences are logically related to each other. Such procedures can be devised to decide the logical properties and relations of every sentence in any predicate calculus that does not contain predicates (functions) that range over predicates themselves—*i.e.,* in any first-order, or lower, predicate calculus.

Calculi that do contain predicates ranging freely over predicates, on the other hand—called higher-order calculi—do not permit the classification of all their sentences by such routine procedures. As was proved by Kurt Gödel, a 20th-century Moravian-born American mathematical logician, these calculi, if consistent, always contain well-formed formulas such that neither they nor their negations can be derived (shown tautologous) by the rules of the calculus. Such calculi are, in the precise sense, incomplete. Various restricted forms of the higher-order calculi have been shown, however, to be susceptible to routine decision procedures for all of their formulae. *See also* propositional calculus.

predication, in logic, the attributing of characteristics to a subject to produce a meaningful statement combining verbal and nominal elements. Thus, a characteristic such as "warm" (conventionally symbolized by a capital letter *W*) may be predicated of some singular subject, for example, a dish—symbolized by a small letter *d,* often called the "argument." The resulting statement is "This dish is warm"; *i.e.,* Wd. Using $\sim$ to symbolize "not," the denial $\sim Wd$ can also be predicated. If that of which "warm" is predicated is indefinite, a blank may be left for the predicate, *W*—, or the variable x may be employed, Wx, thus producing the propositional function "x is warm" instead of a definite proposition. By quantifying the function by $(\forall x)$, meaning "For every x . . . ," or by $(\exists x)$, meaning "There is an x such that . . . ," it is transformed into a proposition again, either general or particular instead of singular, which predicates warmness (or its negation) of several or many subjects of a kind. The predication is identical if it characterizes every referent (x); it is disparate if it fails to characterize some or all of the referents. The predication is formal if the subject necessarily entails (or excludes) the predicate; it is material if the entailment is contingent.

Philosophers have long debated what predicates really are. In the early Middle Ages, they were usually treated as having a being beyond all linguistic and mental entities and thus were viewed as metaphysical. Garland the Computist, the author of an early system of logic, however, viewed predication as mere utterance (*vox*). Peter Abelard, the foremost dialectician of the 12th century, amended this view to include *significatio* as well as *vox*.

Logicians have long distinguished the existential statement "*x* is" from the predicational statement "*x* is *Y*." Franz Brentano, a precursor of Phenomenology prior to World War I, argued that they are both existential, that "*x* is *Y*" means "*xY* is"; *e.g.,* "Some fish have four eyes" means "Four-eyed fish exist." An exactly opposite approach was taken by Alexander Bain, a Scottish philosopher and psychologist, who held that all existential statements have complex subjects from which a predicate can be extracted.

The limitations of predication as a logical form are increasingly evident. The predicate logic is now seen to be but one species of the logic of terms—the others being the logic of classes, the logic of relations, and the logic of identity; and the entire logic of terms, in turn, is distinct from the propositional logic, which deals with whole or unanalyzed statements. In the logic of relations, it is even questionable whether there is any predicate at all, since all of the terms can be regarded as subjects on the same footing (as in "Jane is the sister of Edith is the sister of Rachel"). Moreover, logics that distribute the predicate (with the quantifiers "all," "some," etc.) have also been explored.

Preece, Warren E(versleigh) (b. April 17, 1921, Norwalk, Conn., U.S.), American encyclopaedist, general editor of *Encyclopædia Britannica* in the creation of the 15th edition (1974).

Preece was educated at Dartmouth College (B.A., 1943, Phi Beta Kappa) and, after U.S. Army service during World War II, at Columbia University (M.A., 1947). He worked as a newspaper reporter and copy editor in Connecticut, then taught English for a time before becoming public relations director in the 1956 campaign of U.S. Senator Thomas Dodd (Conn.). *Britannica*'s publisher, William Benton, also of Connecticut, hired him in 1957 as secretary to the encyclopaedia's board of editors. Preece subsequently (from 1964) served as the editor of *Britannica* and made a number of contributions to the development of the 15th edition, notably to what became the *Micropædia* portion of the set. After publication of the new edition, he resigned as editor (1975), though continuing to serve as a member of the board of editors (vice chairman 1975–79). He was coauthor of *The Technological Order* (1962).

Preece, Sir William Henry (b. Feb. 15, 1834, Bryn Helen, Caernarvon, Wales—d. Nov. 6, 1913, Penrhos, Caernarvon), Welsh electrical engineer who was a major figure in the development and introduction of wireless telegraphy and the telephone in Great Britain.

His graduate studies at the Royal Institution of Great Britain, London, under Michael Faraday aroused Preece's interest in applied electricity and telegraphic engineering. For 29 years, from 1870, he was an engineer with the Post Office telegraphic system and contributed many inventions and improvements, including a railroad signaling system that increased railway safety. An early pioneer in wireless telegraphy, he originated his own system in 1892, but his most important contribution in this field was his encouragement of Guglielmo Marconi by obtaining assistance from the Post Office in furthering Marconi's work. Preece also introduced into Great Britain the first telephones, patented by Alexander Graham Bell. Preece was knighted in 1899.

preeclampsia and eclampsia, hypertensive conditions that are induced by pregnancy. Preeclampsia, also called gestational edema-proteinuria-hypertension (GEPH), is an acute toxic condition arising during the second half of the gestation period or in the first week after delivery and generally occurs mainly in young women during a first pregnancy. It is marked by elevated blood pressure (hypertension), protein in the urine (proteinuria), and swelling (edema) that is strikingly noticeable in the hands and face. Eclampsia, a more severe condition with convulsions, follows preeclampsia in about 5 percent of preeclamptic women and poses a serious threat to both mother and child.

The elevated blood pressure that is central to both conditions results from an increased responsiveness to hormones (such as angiotensin) that constrict blood vessels; preeclamptic women thus differ from other pregnant women, whose blood vessels are less responsive to these hormones. Persistent hypertension compromises the blood supply to the placenta, endangering the health of the fetus; it also causes the mother's kidneys to deteriorate, resulting in urinary protein loss. Common symptoms of preeclampsia include headaches, visual disturbances, and stomach pain; however, it may be detected before the onset of symptoms by monitoring blood pressure and weight gain. Preeclampsia can often be controlled by special diets, medication, and limitation of activity. If it occurs late in pregnancy, there is the option of early delivery. Eclampsia can usually be avoided by these measures. If convulsions occur, they are treated with infusions of magnesium sulfate.

preemption, also called SQUATTER'S RIGHTS, in U.S. history, policy by which first settlers, or "squatters," on public lands could purchase the property they had improved. Squatters who settled on and improved unsurveyed land were at risk that when the land was surveyed and put up for auction speculators would capture it. Frontier settlers seldom had much cash, and, because they held no title to their land, they even risked losing their homes and farms to claim jumpers prior to the government auction.

Squatters pressured Congress to allow them to acquire permanent title to their land without bidding at auction. Congress responded by passing a series of temporary preemption laws in the 1830s. Bitterly opposed by Eastern business interests who feared that easy access to land would drain their labour supply, the preemption laws also failed to satisfy the settlers seeking a permanent solution to their problems.

In 1841 Henry Clay devised a compromise by providing squatters the right to buy 160 acres of surveyed public land at a minimum price of $1.25 per acre before the land was sold at auction. Revenues from the preemption sales were to be distributed among the states to finance internal improvements.

The Pre-Emption Act of 1841 remained in effect for 50 years, although its revenue-distribution provision was scrapped in 1842. The law led to a great deal of corruption—nonsettlers acquired great tracts of land illegally—but it also led to the passage of the Homestead Act of 1862 by making preemption an accepted part of U.S. land policy.

preen gland, also called UROPYGIAL, or OIL, GLAND, in birds, an organ located on the back near the base of the tail. Paired or in two united halves, it is found in most birds. Absent in ostrich, emu, cassowary, bustard, frogmouth, and a few other birds, the oil gland is best-developed in aquatic species, notably petrels and pelicans, and in the osprey and oilbird.

The secretions of the preen gland empty to the skin surface through one or more nipple-like pores. Most birds preen by rubbing their bill and head over the preen gland pore and then rubbing the accumulated oil over the feathers of the body and wings and the skin of the legs and feet. The oil is thought to help preserve the integrity of feather structure and, in some species, is also believed to be useful in preserving the horny structure of the bill and the scales of the legs and feet. It has also been speculated that, in at least some species, the oil contains a substance that is a precursor of vitamin D. This precursor substance is thought to be converted to vitamin D by the action of sunlight and then absorbed through the skin. Many ornithologists maintain that the function of the preen gland differs among various species of birds.

prefabrication, the assembly of buildings or their components at a location other than the building site. The method controls construction costs by economizing on time, wages, and materials. Prefabricated units may include doors, stairs, window walls, wall panels, floor panels, roof trusses, room-sized components, and even entire buildings.

The concept and practice of prefabrication in one form or another has been part of human experience for centuries; the modern sense of prefabrication, however, dates from about 1905. Until the invention of the gasoline-powered truck, prefabricated units—as distinct from precut building materials such as stones and logs—were of ultralight construction. Since World War I the prefabrication of more massive building elements has developed in accordance with the fluctuation of building activity in the United States, the Soviet Union, and western Europe.

Prefabrication requires the cooperation of architects, suppliers, and builders regarding the size of basic modular units. In the American building industry, for example, the 4 × 8-foot panel is a standard unit. Building plans are drafted using 8-foot ceilings, and floor plans are described in multiples of four. Suppliers of prefabricated wall units build wall frames in dimensions of 8 feet high by 4, 8, 16, or 24 feet long. Insulation, plumbing, electrical wiring, ventilation systems, doors, and windows are all constructed to fit within the 4 × 8-foot modular unit.

Another prefabricated unit widely used in light construction is the roof truss, which is manufactured and stockpiled according to angle of pitch and horizontal length in 4-foot increments.

On the scale of institutional and office buildings and works of civil engineering, such as bridges and dams, rigid frameworks of steel with spans up to 120 feet (37 m) are prefabricated. The skins of large buildings are often modular units of porcelainized steel. Stairwells are delivered in prefabricated steel units. Raceways and ducts for electrical wiring, plumbing, and ventilation are built into the metal deck panels used in floors and roofs. The Verrazano-Narrows Bridge in New York City (with a span of 4,260 feet [1,298 m]) is made of 60 prefabricated units weighing 400 tons each.

Precast concrete components include slabs, beams, stairways, modular boxes, and even kitchens and bathrooms complete with precast concrete fixtures.

A prefabricated building component that is mass-produced in an assembly line can be made in a shorter time for lower cost than a similar element fabricated by highly paid skilled labourers at a building site. Many contemporary building components also require specialized equipment for their construction that cannot be economically moved from one building site to another. Savings in material costs and assembly time are facilitated by locating the prefabrication operation at a permanent site. Materials that have become highly specialized, with attendant fluctuations in price and availability, can be stockpiled at prefabrication shops or factories. In addition, the standardization of building components makes it possible for construction to take place where the raw material is least expensive.

The major drawback to prefabrication is the dilution of responsibility. A unit that is designed in one area of the country may be prefabricated in another and shipped to yet a third area, which may or may not have adequate criteria for inspecting materials that are not locally produced. This fragmentation of control factors increases the probability of structural failure.

prefect, Latin PRAEFECTUS, plural PRAEFECTI, in ancient Rome, an officer appointed by a superior magistrate to serve as his deputy, or subordinate.

In the early republic, a prefect of the city (*praefectus urbi*) was appointed by the consuls to act in the consuls' absence from Rome. These prefects had judicial and financial responsibilities in the region within 100 miles (160 km) of Rome. The position lost much of its importance temporarily after the mid-4th century BC, when the consuls began to appoint praetors to assume the consuls' responsibilities in their absence. In about 2 BC, however, the office of prefect was given new life by the emperor Augustus. He appointed two praetorian prefects (*praefectus praetorio*), along with a prefect of the fire brigade and a prefect of the grain supply. The praetorian prefects, being responsible for the safety of the emperor, rapidly acquired great power; they virtually were prime ministers. The best known of the Roman prefects, however, came later. He was Papinian (Aemilius Papinianus), appointed by the emperor Septimius Severus (AD 193–211). A jurist of enormous erudition, Papinian was a stern moralist. His works, including *Quaestiones* (37 books), *Responsa* (19 books), *Definitiones* (2 books), and *De adulteriis* (2 books), attained the highest authority and are regarded today as among the principal Roman contributions to the foundation of modern law.

By AD 300 the praetorian prefects directed the civil administration of both the Eastern and the Western empires. They executed judicial powers as delegates of the emperor, organized tax levies, and supervised provincial governors. They also commanded troops and served as quartermasters general to the emperor's court. Under the emperor Constantine I the Great, who succeeded Diocletian in 306 AD, the praetorian prefects were stripped of their military commands, but they retained their judicial and financial functions.

prefect, French PREFET, in France, a high government official, similar to the intendant before the French Revolution. The French prefectoral corps was created in 1800 by Napoleon Bonaparte, who raised it to a position of great prestige and influence. At that time the prefects were the administrators of the *départements* (*q.v.*); they were responsible for public order and good government and for ensuring that the policy of the central government was effectively carried out throughout the country. Napoleon called them *empereurs au petit pied* ("emperors with little feet").

Under succeeding regimes the power of the corps increased, but its prestige declined. Since they were dependent for office on the whim of the central government, the prefects became concerned primarily with police and elections, and one of their principal functions was to ensure the government a safe parliamentary majority. They reached the height of their power under the Second Empire (1852–70). During the first decades of the Third Republic (1870–1940), the position was weakened by the frequent nomination of new men by successive governments. The prefects, however, became increasingly concerned with social and economic problems and, after World War II, while retaining responsibility for public order and good government, they became the dynamic element in the provinces for promoting and coordinating social policies.

In addition to the prefects, each of whom was responsible for a *département,* the prefectoral corps in the 1960s included secretaries-general, who were second in command; subprefects, responsible for the *arrondissements;* and *chefs de cabinet,* the prefects' personal assistants. Under the 1958 constitution of the Fifth Republic, prefects were appointed by the president of the republic with the approval of the Council of Ministers and on the recommendation of the minister of the interior, to whom they were responsible.

The prefect is constitutionally responsible for "coordinating the activities of state officials, the representation of national interests, and the administrative supervision of local authorities." He is the sole legal representative of the central government and the French state in the *département;* when a Cabinet minister delegates his powers, he is required by law to delegate them to the prefect and not directly to his own officials in the field. The prefect, therefore, acts as the agent through which all powers are transmitted from the centre to the periphery of government.

The prefect is the general administrator of the *département,* the chief executive officer of the elected departmental authority (the *counseil général*), the principal police authority, and the supervisor of the *communes* in the *département.* His approval is required for many administrative acts of local authorities. In Paris the prefect of the *département* of the Seine also exercises the municipal powers normally possessed by the mayor of a *commune,* there being no popularly elected mayor of Paris. There is, in addition, a special prefect of police, whose jurisdiction covers the whole Paris territory.

Préfecture de Police, one of the three main police forces of France. Controlled by the Ministry of the Interior, it provides the preventive police force for Paris and the Seine *département;* its uniformed members, known as *gardiens de la paix* ("guardians of the peace"), are responsible for traffic and crowd control and are highly motorized. By contrast, their plain-clothes members, who are known as the directorate of judicial police, investigate all serious crime throughout France. Their work frequently overlaps, not without occasional friction, that of the *juges d'instruction* ("examining magistrates") in the early stages of prosecution for a crime.

prefern, any of a group of extinct plants considered transitional between the first land plants, the psilophytes, of the Silurian and Devonian periods (438 million to 360 million years ago), and the ferns and seed-ferns that were common land plants later in time. The preferns appeared in Middle Devonian times (about 380 million years ago) and lasted into the Early Permian period (about 280 million years ago). The preferns are difficult to classify because they retain certain primitive features of psilophytes and only manifest some of the traits characteristic of true ferns. They had, however, advanced beyond the stage of psilophytes, which had only scalelike leaves or none at all and no distinct roots. The orders usually included in the prefern group are the Protopteridales and Coenopteridales.

The Protopteridales had leaves and reproduced by spores as ferns do but had true wood similar to that of gymnosperms (cone-bearing plants that include pine, spruce, and fir trees), representing an advance for fluid conduction. Members include *Protopteridium,* which, like certain psilophytes, had leafless lower branches, and *Aneurophyton,* which was a fernlike tree at least 6 m (20 feet) tall. The Coenopteridales were a large group of ferns or fernlike plants that displayed a variety of growth forms, such as creeping stems and erect trunks resembling those of trees. Some were vines that lived on other plants. In certain classifications many of the Protopteridales are called progymnosperms, and the Coenopteridales are categorized with the ferns.

Pregl, Fritz (b. Sept. 3, 1869, Laibach, Austria—d. Dec. 13, 1930, Graz), chemist awarded the 1923 Nobel Prize for Chemistry for developing techniques in the microanalysis of organic compounds.

Pregl received his M.D. from the University of Graz (1893), with which he was associated for most of his professional life and where he became director of the Medico-Chemical Institute in 1913. About 1904 he began researches on bile acids and other substances. The difficulty of obtaining these materials in quantities sufficient for use of conventional analytical techniques impelled him to devise analytical methods requiring only minute amounts. By 1912 he was able to make reliable measurements of carbon, hydrogen, nitrogen, and sulfur with only 7–13 milligrams of starting material. His breakthrough eventually enabled scientists to begin work with tenths of milligrams of material. Pregl also developed a sensitive microbalance and micromethods for measuring atomic groups and devised a simple method for determining the functional capacities of kidneys.

pregnancy, the process and series of changes that take place in a woman's organs and tissues as a result of her having a developing infant within her body. The entire process from fertilization to birth normally takes nine months. (For pregnancies other than human, *see* gestation.)

A brief treatment of pregnancy follows. For full treatment, *see* MACROPAEDIA: Reproduction and Reproductive Systems.

The fertilization of an ovum (egg) by a spermatozoon usually occurs in one of the two fallopian tubes. As the fertilized egg, or zygote, moves down the tubes toward the uterus, it undergoes repeated cell divisions. After about five days, it consists of a ball of about 120 cells, differentiated into an inner group of cells that become the embryo and an outer ring of cells (the trophoblast) that becomes part of the placenta. On about the sixth day after fertilization, the trophoblast becomes attached to the uterine wall. The trophoblast invades the uterine lining, forming fingerlike projections that are surrounded by maternal blood vessels. This combination of trophoblastic and maternal tissue is the placenta. It brings the blood supply of the embryo into intimate—but not direct—contact with that of the mother, thereby enabling the exchange of nutrients and wastes between the embryonic and maternal circulations. The embryo itself is linked to the placenta by the umbilical cord, the vessels of which carry blood to and from the placenta. The embryo is surrounded by a fluid-filled amniotic sac, which protectively cushions the developing infant.

By the end of the first month, the embryo has reached a size of about 5 mm (0.2 inch) and most of its major organ systems have begun to form. These systems continue to develop during the second month, and it is during this period that sexual differentiation takes place. The limbs also appear during the second month. By the end of the second month, the major steps in organ development have taken place, and the embryo, though only about 3 cm (1.2 inch) long, is recognizably human in form. From this point forward, it is referred to as a fetus. During the remaining seven months of pregnancy, the fetus completes the maturation of its organ systems and grows dramatically in size.

The most important symptom of pregnancy is the cessation of menstrual periods. Other indications are nausea, tender swollen breasts, and frequent urination. Tests for pregnancy are based on the production by the placenta of the hormone chorionic gonadotropin, which is present in the mother's blood and excreted in her urine. In biological tests, urine is injected into experimental animals such as mice, rabbits, or frogs; if the woman is pregnant, the urine usually contains enough chorionic gonadotrophin to induce characteristic changes in the animals' reproductive organs. In serological tests, use is made of the ability of human chorionic gonadotrophin to stimulate the production of specific antibodies; an immune serum against the hormone is produced in rabbits and used to react with a sample of test urine from the subject. If the mixture remains turbid, the test is positive. Other types of pregnancy tests include the leukocyte alkaline phosphatase test, which is based on the measurable increase in the activity of the enzyme, or organic catalyst, alkaline phosphatase in the white blood cells during pregnancy. Any of these tests may give false positive or negative results, but by the 16th week of pregnancy, a fetal heartbeat can be heard.

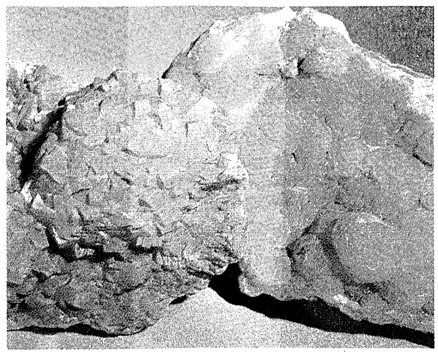
Pregnancy causes marked changes in a woman's body. The uterine wall thins out, and the uterus pushes upward into the abdomen until it presses on the diaphragm. (The uterus may lower slightly several weeks before delivery because the infant's head has dropped into the pelvis.) The breasts grow larger, and the pigmented area around the nipples darkens. The needs of the fetus put an extra burden on the mother's heart, and, by the 19th week, increasing amounts of blood make it necessary for the heart to do 25 to 30 percent more work than before pregnancy. The mother's blood pressure, however, should not rise. Uterine pressure on the bladder causes frequent urination, and the ureters and pelvis of the kidney enlarge and lose tonicity. A pregnant woman usually gains at least 20 pounds, of which 15 pounds are lost at delivery. The remaining weight is stored fluid and will be eliminated as the uterus shrinks to its normal size.

Various abnormalities and diseases may threaten a full-term pregnancy. In ectopic pregnancies, the zygote lodges and develops in any abnormal place, such as in the cervical opening or in the opening of the fallopian tube; it may even adhere to an abdominal organ. These pregnancies are generally ended by surgery to prevent rupture of an affected organ, hemorrhaging, and collapse of the mother.

Toxemias of pregnancy are a group of metabolic disorders that occur during pregnancy or the puerperal period (*i.e.,* immediately following pregnancy). Most common are the acute toxemias, which are characterized by preeclampsia and eclampsia. During preeclampsia the woman has high blood pressure, edema, weight gain, and protein in the urine. In eclampsia the woman has convulsions and loses consciousness. The condition may result in damage to the eyes, brain, kidneys, and other organs and may even cause death. Another toxemia is chronic hypertensive vascular disease, which is considered present if the woman's blood pressure is abnormally elevated before the 24th week of pregnancy and remains so indefinitely after delivery.

Abortion is the termination of a pregnancy before the infant is able to survive outside the uterus and generally occurs before the 20th week. Abortion may be spontaneous (in which case it is called a miscarriage) or the result of medical intervention. Many conditions may cause miscarriages, but at least half of such spontaneous abortions are the result of a defect in the fetus.

prehnite, pale-green to gray, glassy silicate mineral that commonly lines cavities in igneous rocks. It also occurs as stalactite masses. Prehnite is a secondary or hydrothermal mineral that is a basic calcium and aluminum silicate, $Ca_2Al_2Si_3O_{10}(OH)_2$, and is often asso-



Prehnite (left) crystals from Harz Mountains, Germany, and (right) in botryoidal form on a matrix from Paterson, N.J.

By courtesy of the Field Museum of Natural History, Chicago; photograph, John H. Gerard—EB Inc.

ciated with zeolites. Prehnite has been found in Italy, Germany, France, Scotland, and New Jersey in the United States. Clear specimens of fine colour are sometimes cut for gem use and marketed under the name Cape emerald. For detailed physical properties, *see* silicate mineral (table).

Prejevalsky's horse: *see* Przewalski's horse.

prelate, an ecclesiastical dignitary of high rank. In the modern Roman Catholic church, prelates are those who exercise the public power of the church. True prelacy is defined as "preeminence with jurisdiction," and true, or real, prelates are distinguished as (1) greater prelates, those who possess episcopal jurisdiction (such as patriarchs, archbishops, and bishops), and (2) lesser prelates, those who possess a quasi-episcopal or other jurisdiction (such as abbots and prelates "of no diocese" and religious superiors, withdrawn from the ordinary diocesan jurisdiction).

In some Protestant churches the title of prelate was retained after the Reformation. In the Church of England it is restricted to bishops.

Prelog, Vladimir (b. July 23, 1906, Sarajevo, Bosnia, Austria-Hungary [now in Yugoslavia]), Swiss chemist who shared the 1975 Nobel Prize for Chemistry with John W. Cornforth for studies in the stereochemistry of organic molecules and reactions. This work proved to be of fundamental importance to an understanding of biological processes.

Prelog was educated at the Institute Technical School of Chemistry in Prague, receiving his doctorate in 1929. After several years in a commercial laboratory, he began teaching at the University of Zagreb in 1935, first as a lecturer and later as professor of organic chemistry. In 1942 he joined the faculty of the Federal Institute of Technology in Zürich, where he served as head of the laboratory of organic chemistry from 1957 to 1965; he retired from teaching in 1976.

Prelog's research extended to the stereochemistry of alkaloids, antibiotics, enzymes, and other natural compounds. In particular he contributed to the understanding of stereoisomerism; with R.S. Cahn and C.K. Ingold, he developed a generally used system for specifying the chirality of molecules.

prelude, musical composition, usually brief, that is generally played as an introduction to another, larger musical piece. The term is applied generically to any piece preceding a religious or secular ceremony, including in some instances an operatic performance. In the 17th century, organists in particular began to write loosely structured preludes to rigorously conceived fugues. The most notable composer of preludes, J.S. Bach, gave each prelude its own distinct character; some are akin to arias, others to dance forms, toccatas, or inventions.

The preludes of Frédéric Chopin and Claude Debussy are brief, self-contained pieces that vary widely in character but that often explore a particular mood. Chopin wrote études that differ little structurally from some of his preludes, while Debussy's two books of preludes bear descriptive titles reflecting their evocative, sometimes rhapsodic moods, a quality captured perhaps more perfectly in Debussy's brilliant orchestral *Prélude à l'aprés-midi d'un faune* (*Prelude to the Afternoon of a Faun*). Preludes and fugues written in the 20th century include notably those of the Russian composer Dmitry Shostakovich. A variety of modern piano suites (*e.g.,* Opus 25, Arnold Schoenberg's dodecaphonic work) also open with preludes, generally monothematic pieces intended to evoke the spirit and practice of the early 18th century.

Prem Chand, pseudonym of DHANPAT RAI SRIVASTAVA (b. July 31, 1880, Lamati, near Vārānasi, India—d. Oct. 8, 1936, Vārānasi), Indian author of numerous novels and short stories in Hindi and Urdu who pioneered in adapting Indian themes to Western literary styles.

Prem Chand worked as a teacher until 1921, when he joined Gandhi's Noncooperation Movement. As a writer, he first gained renown for his Urdu-language novels and his contributions to Urdu journals. Except in Bengal, the short story had not been an accepted literary form in northern India until Prem Chand's works appeared. Best-known for his works in Hindi, Prem Chand did not achieve complete fluency in that language until his middle years. His first major Hindi novel, *Sēvāsadana* (1918; "House of Service"), dealt with the problems of prostitution and moral corruption among the Indian middle class. Prem Chand's works depict the social evils of arranged marriages, the abuses of the British bureaucracy, and exploitation of the rural peasantry by moneylenders and officials.

Much of Prem Chand's best work is to be found among his 250 or so short stories, collected in Hindi under the title *Mānasarovar* ("The Holy Lake"). Compact in form and style, they draw, as do his novels, on a notably wide range of northern Indian life for their subject matter. Usually they point up a moral or reveal a single psychological truth.

Prem Chand's novels include: *Premashram* (1922; "Love Retreat"), *Rangabhūmi* (1924; "The Arena"), *Ghaban* (1928; "Embezzlement"), *Karmabhūmi* (1931; "Arena of Actions"), and *Godan* (1936; *The Gift of a Cow*).

premature birth and postmature birth, in humans, respectively, any birth that occurs significantly before or after the expected date of delivery.

A premature birth is defined as one that occurs less than 37 weeks after conception. In the United States prematurity occurs in about 7 to 9 percent of pregnancies in white women and about 17 percent in black women. A presumptive reason (usually multiple pregnancy, maternal toxemia or hypertension, abnormal attachment of the placenta, or congenital malformation of the infant) can be found for 40 to 60 percent of premature births. Poor maternal health, hygiene, and nutrition increase the likelihood of prematurity; maternal accidents and acute illness are insignificant as causes. The chief specific causes of death among premature infants are respiratory disturbances, infections, and spontaneous hemorrhages, especially into the brain or lungs. With good care, about 85 percent of all live-born premature infants should survive; those of higher weight have a better chance.

Prematurity is to be distinguished from intrauterine growth retardation, in which weight and development are subnormal for fetal age. An estimated 1.5 to 2 percent of all babies are significantly below a birth weight proper to their fetal age. Deficiency of transplacental nutrition from various causes is frequently responsible. Other causes include fetal infections and some malformations. Generally, babies under 5.5 pounds but carried for more than 37 weeks are considered growth-retarded rather than premature.

A postmature birth is any birth that occurs more than three weeks after the expected date of delivery, at which time placental transfer begins to fail, and the fetus receives decreased amounts of oxygen and nutrients. If birth does not occur naturally or is not induced, the fetus will die. Postmature newborns are often thin, with dry, wrinkled skin and unusually long hair and nails. If the postmature child lives through the first few days after birth, his chances for survival are good.

premenstrual syndrome (PMS), group of physical and emotional symptoms that occur in women before the onset of menstruation and that are characteristically cyclical in nature. These symptoms generally begin from 7 to 14 days before menstruation and end within 24 hours after menstruation has begun.

The medical condition, termed premenstrual syndrome by British physician Katharina Dalton in the 1950s, has only been studied since about the 1930s. In 1985 biologists working in Kenya found that premenstrual female baboons were subject to a similar phenomenon; the premenstrual baboons were observed to withdraw from social contact and to spend a much greater percentage of time up in the trees feeding.

Among the 40 percent of human females believed to suffer from PMS, the types of symptoms and the degree of their severity vary markedly. In about 10 percent of those affected, the syndrome appears in a relatively severe form. Physical symptoms may include headache, cramps, backache, bloating, constipation or diarrhea, and a number of related disorders. Emotional symptoms range from irritability, lethargy, and rapid mood swings to hostility, confusion, aggression, and severe depression.

Though they are the major subject of current research, the causes of PMS are not yet established. The most widely accepted theories centre on hormonal changes (the rapid fluctuation of levels of estrogen and progesterone in the bloodstream), nutritional deficiencies (particularly in regard to the vitamins—notably B vitamins—that affect nerve transmission in the brain), and stress (which has been shown to be a factor in the severity of symptoms). Many researchers suspect that fluctuations of chemical transmitters in the brain are largely responsible.

For purposes of treatment, a chart that records the nature and date of occurrence of an individual's symptoms can aid diagnosis. The major method of treatment for most cases of PMS involves some combination of regular physical exercise, avoidance of stress, and nutritional therapy. Restriction of sodium intake, avoidance of xanthines—found in coffee, tea, chocolate, and cola—and a diet that is high in protein and complex carbohydrates are a few of the dietary measures that can be taken to alleviate or reduce much of the physical discomfort. More severe cases may require drug therapy (including the use of analgesics, diuretics, antidepressants, and sedatives) and psychotherapy to aid stress management.

premier: *see* prime minister.

Premonstratensian, byname WHITE CANON, or NORBERTINE, member of ORDER OF THE CANONS REGULAR OF PRÉMONTRÉ, abbreviation O. PRAEM., a Roman Catholic religious order founded in 1120 by St. Norbert of Xanten, who, with 13 companions, established a monastery at Prémontré, Fr. The order combines the contemplative with the active religious life and in the 12th century provided a link between the strictly contemplative life of the monks of the preceding ages and the more active life of the friars of the 13th century. The Premonstratensians followed the monastic rule of life of St. Augustine, but their supplementary statutes, which were greatly influenced by Cistercian ideals in both the manner of life and the government of the order, made their life one of great austerity. The order was approved by Rome in 1126 and quickly spread over western Europe. Later, after its austerity had been relaxed, reforms were undertaken and a number of more or less independent congregations were created. The order was nearly destroyed by the French Revolution.

Its modern centre of strength is in Belgium, where there are several restored medieval abbeys. The members are engaged in the solemn public celebration of the liturgy and in the apostolate (religious activity) of preaching, pastoral work, mission work, and education. Their habit, or religious dress, is all white.

Přemysl, HOUSE OF, also called PŘEMYSLID DYNASTY, first Czech ruling house, founded, according to tradition, by the plowman Přemysl, who was married to the princess Libuše. The members of the Přemyslid dynasty ruled Bohemia and the lands associated with it from about 800 to 1306. The head of the Přemyslid house was usually designated a prince, or duke (*kníže*), until 1198, when Přemysl Otakar I raised Bohemia to the status of a hereditary kingdom within the Holy Roman Empire.

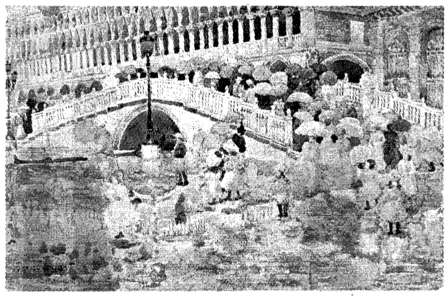
Historical records of the early Přemyslid rulers are scanty. According to legend, Prince Borivoj is said to have been converted to Christianity by Saint Methodius (fl. mid-9th century). Bohemia was consolidated politically in the 10th century, and the best known of its rulers at this time was Borivoj's grandson Vaclav, whose zeal for spreading Christianity in his dominions prompted his murder by his pagan brother Boleslav I (reigned 929–967). Vaclav subsequently came to be venerated as the patron saint of Bohemia. During the rule of Boleslav II (967–999), the Christian church in Bohemia was organized and a bishopric was founded in Prague. Boleslav II's death was followed by a period of fratricidal warfare between his sons that terminated in 1012 when the youngest son, Oldrich, established himself as prince of Bohemia. Oldrich died in 1037 and was succeeded by his son Bretislav I (1037–55). For the next century and a half, disputes and feuds among the members of the Přemyslid family hindered Bohemia's political development, the chief source of discord being the absence of any strict law of succession to the Bohemian throne. At some periods the principle of seniority was observed, while at other times the deceased prince's oldest son attained the throne.

During this period of disarray Bohemia became increasingly dependent on the Holy Roman Empire to the west. The Přemyslid prince Vratislav II (1061–92) obtained from the Holy Roman emperor Henry IV the title of king of Bohemia as a personal (*i.e.,* nonhereditary) privilege, and Prince Vladislav II (1140–73) was awarded the royal crown on the same basis by Emperor Frederick I Barbarossa. In 1197 Přemysl Otakar I became the undisputed overlord of the Přemyslid domains, and in 1198 he was able to secure the royal title for his descendants as well as himself. Under Přemysl Otakar I, medieval Bohemia reached the height of its economic prosperity and political prominence. Přemysl was succeeded by King Vaclav I (1230–53) and the latter's son, Přemysl Otakar II (1253–78), who was one of the greatest rulers of Bohemia. Přemysl Otakar II died in battle in 1278 during one of his expansionist military campaigns and was succeeded by his son Vaclav II. That ruler's diplomatic dexterity and great wealth gained for him the crown of Poland in 1300, but he died prematurely in 1305. His only son, Vaclav III, inherited Bohemia but was assassinated in 1306 while traveling to Poland. Thus ended the long rule of the Přemyslid dynasty in Bohemia. The Bohemian throne subsequently passed to John of Luxembourg, the founder of the Bohemian branch of the Luxembourg dynasty.

Přemysl Otakar (name of Bohemian kings): *see under* Otakar.

Prendergast, Maurice Brazil (b. Oct. 10, 1859, St. John's, Nfd., Can.—d. Feb. 1, 1924, New York City), painter, one of the finest American watercolourists, and one of the first artists in the United States to use the broad areas of colour characteristic of Postimpressionism.

During the 1880s he studied art for two years in Paris, where he was influenced by the work of the French Impressionists and James McNeill Whistler. A painting such as "Umbrellas in the Rain" (1899; Museum of Fine Arts, Boston), painted during his second European



"Umbrellas in the Rain," watercolour by Maurice Prendergast, 1899; in the Museum of Fine Arts, Boston

By courtesy of the Museum of Fine Arts, Boston, Charles Henry Hayden Fund, 1959

trip, reflects his new interest in Postimpressionist currents, especially in the paintings of Édouard Vuillard and Paul Cézanne and the doctrines of Pointillism. Later pictures are composed of floating geometric areas of colour, representing such objects as hats, umbrellas, trees, balloons, and carriage wheels. Many of his works before 1904 were done in watercolour, but after this date he increasingly painted in oils from watercolour sketches. Still mosaic-like in effect, his later works are more abstract in treatment.

Prendergast's works were shown in the controversial Armory Show in New York City (1913), and he exhibited with The Eight (*see* Eight, The).

Prensa, La (Spanish: "The Press"), Argentine daily newspaper that, soon after its founding in Buenos Aires in 1869, broke with the traditional emphasis on propaganda to stress professional, accurate news reporting and independent expressions of editorial opinion.

La Prensa is widely regarded as the finest Spanish-language newspaper in the world. Its unceasing efforts to report the news without bias have been matched by a continuing concern for human welfare. Early in its history, for example, the paper began to sponsor free legal and medical clinics. The paper has faced government harassment from time to time, notably under the regime of Juan Perón through most of the 1940s. The Perón government finally seized control of *La Prensa* in 1951, and it became a propaganda organ of the Peronist Confederación General del Trabajo (General Confederation of Labour). After the overthrow of Perón in 1955, *La Prensa* reappeared as an independent daily in 1956.

Preobrajenska, Olga, Russian in full OLGA YOSIFOVNA PREOBRAZHENSKAYA (b. Jan. 21, 1871, St. Petersburg, Russia—d. Dec. 27, 1962, near Paris), prima ballerina and teacher who, through her studio in Paris, transmitted the elegant, refined style and classic technique of the Imperial Russian Ballet to innumerable 20th-century dancers. A member of the Mariinsky (now Kirov) Theatre for 25 years, she danced in more than 700 performances, winning praise for her precise technique and lyrical interpretations. Her extensive repertoire included leading roles in *Coppélia, La Fille mal gardée, Esmeralda, The Nutcracker, Sleeping Beauty*, and *Les Sylphides*.

She began her training at the Imperial Ballet School in 1879; studied with such teachers as Enrico Cecchetti, Christian Johansson, and Nicholas Legat; and graduated and joined the Mariinsky Theatre in 1889, earning the title prima ballerina in 1900. She toured extensively in the early 1900s, making guest appearances throughout Europe. She taught at the State School in Petrograd (now Leningrad) from 1917 until 1921 and at the Studio Wacker in Paris from 1924 until 1960, where her pupils included Irina Baronova, Tamara Toumanova, Tatiana Riabouchinska (the three "baby ballerinas" of the Ballet Russe de Monte Carlo), Igor Youskevitch, Milorad Miskovitch, and Margot Fonteyn.

preparatory school, school that prepares students for entrance to a higher school. In Europe, where secondary education has been selective, preparatory schools have been those that catered to pupils wishing to enter the academic secondary schools. In North America, where secondary education has been less selective and entry to it less competitive, the term generally refers to private secondary schools that prepare students for universities.

In England, for example, the preparatory (or prep) schools, which began in the 19th century, form an integral part of the private or independent school system. Boys or girls enter the preparatory schools at about the age of 8 and usually leave between the ages of 11 and 13, often to attend one of the private secondary institutions (*see* public school). In Germany this type of elementary private preparatory school (*see Vorschule*) was abolished shortly after World War I. In France the preparatory classes (*classes préparatoires*) attached to the state secondary schools (*see lycée*), were formerly fee-paying; the differences between these and elementary classes in other schools, however, have been abolished so that French elementary education has become identical everywhere.

In the United States a very high proportion of preparatory school graduates enter college or university. The age of enrollment in preparatory school is about 14, and the four- or five-year course is usually geared to meet the requirements of either the college entrance examination board or a particular institution. This kind of secondary private preparatory school is found in only a few other countries, such as Japan.

Preparedness Movement, in U.S. history, a campaign prior to U.S. entry into World War I (April 1917) to increase U.S. military capabilities and to convince the U.S. citizenry of the need for American involvement in the conflict. Almost immediately after the outbreak of hostilities in Europe, a small number of Americans—former president Theodore Roosevelt being among the most prominent—sought to persuade the Wilson administration and the population at large that the nation must prepare itself for war. The fate of occupied Belgium served as an example of what could happen to an unprepared nation. Roosevelt wrote two books on the subject, *America and the World War* (1915) and *Fear God and Take Your Own Part* (1916), that helped popularize the Preparedness Movement.

Joining Roosevelt was Gen. Leonard Wood, who backed the "Plattsburg Idea"—a summer training camp for potential officers at Plattsburg, N.Y., where business and professional men were drilled in military fundamentals. Both Roosevelt and Wood favoured universal conscription, and they publicly criticized Wilson's opposition to a large standing army and his advocacy of unarmed neutrality.

Organizations such as the National Security League, American Defense Society, League to Enforce Peace, and American Rights Committee sponsored preparedness parades and sought to pressure Wilson into strengthening national defenses. Initially, however, Wilson was unmoved by—and even hostile to—the preparedness advocates. Not until German submarine attacks and especially the sinking of the "Lusitania" (May 7, 1915) did the administration begin to favour an increase in armaments. With passage of the National Defense Act (June 3, 1916) and a subsequent naval appropriations measure authorizing an enormous increase in U.S. armed forces, the Preparedness Movement became largely superfluous. It disappeared when mobilization began in earnest following U.S. entry into the war.

prerogative court, in English law, court through which the discretionary powers, privileges, and legal immunities reserved to the sovereign were exercised; such courts were originally formed during the period when the power of the sovereign was greater than that of Parliament. The royal prerogative is essentially the legitimate exercise of the sovereign's authority. Various powers have been considered part of it. The coining of money, the creation of peers, the calling and dissolution of Parliament, and the governing of the Church of England are all prerogatives still attached in form, though not in substance, to the monarch, but the power to legislate, tax, and deal with emergency situations has long belonged to Parliament.

By the time of the Reformation, the prerogative powers of the crown had become considerable. Certain courts had developed out of the king's council to give, in effect, the king's relief in those cases in which the common-law courts had failed to provide adequate remedy or in those areas in which they did not deal. Those courts became permanent specialized institutions, such as Star Chamber (*q.v.*), which dealt with offenses against public order; High Commission (*q.v.*), which was set up to enforce the Reformation settlement; Requests (*q.v.*), a poor-man's court that handled small claims; and Chancery (*q.v.*), which was essentially a court of equity. All of these courts played an important role in carrying out royal authority.

By the early 17th century, the prerogative courts had provoked considerable opposition from the common-law courts, which had lost a good deal of business to them and saw any further extension of their jurisdiction as a threat to the survival of common law. This opposition reached full height at the time when the parliamentary forces were enraged at Charles I's determination to govern without Parliament and at his use of the prerogative courts, particularly Star Chamber and High Commission, to enforce his religious and social policies. Consequently, all the prerogative courts, with the exception of Chancery, which had developed important procedures in the areas of trusts with which the common-law courts refused to deal, were either abolished by the Long Parliament or ceased to exist with the Restoration.

Presanctified, Liturgy of the, a service of worship in Eastern Orthodox and Eastern-rite churches in communion with Rome that is celebrated on Wednesdays and Fridays of Lent and the first three days of Holy Week (the week preceding Easter). Initiated by the Roman pope Gregory I the Great in the late 6th century AD, it was so named because the bread and wine used in the Eucharist (Holy Communion) were consecrated on the preceding Sunday.

presbycusis, gradual impairment of hearing in old age. Ordinarily it is not experienced until after the age of 60. The affected person notices that he has increasing difficulty in hearing high-pitched sounds and in understanding conversation. There is neither medical nor surgical treatment that can restore hearing loss in uncomplicated presbycusis. There may be other conditions present, however, that impair hearing and are remediable. These include accumulated earwax, middle-ear inflammation, and stirrup fixation, in which one of the tiny bones of the middle ear becomes incapable of transmitting sound vibrations.

presbyopia, loss of ability to focus the eye sharply on near objects as a result of the decreasing elasticity of the lens of the eye. The eye's ability to focus on near and far objects—the power of accommodation—depends upon two forces, the elasticity of the lens of the eye and the action of the ciliary muscle, a roughly ring-shaped muscle that encircles the lens and is attached to it by suspensory ligaments. When the ciliary muscle is relaxed, the ring enlarges away from the lens and the suspensory ligaments are tautened, flattening the lens into a shape suitable for viewing distant objects. When the muscle contracts, the ligaments are loosened, and, because of the elasticity of the lens, the surface of the lens—particularly the front surface—becomes more curved, in keeping with viewing near objects. Ordinarily the lens gradually becomes less elastic, so that the power of accommodation is lost progressively with age. The loss is most rapid in the decade of the 40s. Reading and other near viewing is made possible with the help of corrective lenses.

Accommodation may also be lost temporarily as a result of paralysis of the ciliary muscle. With this paralysis, which occasionally occurs from the action of toxins, such as those produced by diphtheria organisms, the muscle cannot contract, and the surface of the lens is prevented from becoming more convex.

presbyter (from Greek *presbyteros*, "elder"), an officer or minister in the early Christian Church intermediate between bishop and deacon or, in modern Presbyterianism, an alternative name for elder. The word presbyter is etymologically the original form of "priest."

The history of presbyterial government in the early church as opposed to episcopacy and pure congregationalism is not known in detail. During the last quarter of the 1st century, a threefold organization is found in the church: (1) a spiritual organization composed of apostles, prophets, and teachers; (2) an administrative organization, consisting of the bishop and the deacons, the former for higher, the latter for inferior services; and (3) a patriarchal organization based upon the natural deference of the younger to the older members of the church. The senior members of the community, by virtue of their age and experience, watched over the conduct and guided the action of the younger and less experienced portion of the church, though they held no official position and were not appointed for any particular work as were the bishops and deacons. In the 2nd century the patriarchal element in the organization was merged in the administrative, and the presbyters became a definite order in the ministry. The time at which the change occurred cannot be definitely fixed.

The next stage of the development of the office is marked by the rise of the single *episcopus*, or bishop, as the head of the individual church. The first trace of this is to be found in the Epistles of Ignatius, which prove that by the year 115 "the three orders" as they were afterward called—bishops, presbyters, and deacons—already existed, not indeed universally, but in a large proportion of the churches. The presbyters occupied an intermediate position between the bishop and the deacons. They constituted "the council of the bishop." It was their duty to maintain order, exercise discipline, and superintend the affairs of the church. At the beginning of the 3rd century, if Tertullian is to be believed, they had no spiritual authority of their own, at any rate as far as the sacraments are concerned. The right to baptize and celebrate the communion was delegated to them by the bishop.

In the next stage the presbyters, like the bishops, were endowed with special sacerdotal powers and functions. With the rise of the diocesan bishops, the position of the presbyters became more important. The charge of the individual church was entrusted to them, and gradually they took the place of the local bishops of earlier days, so that in the 5th and 6th centuries an organization was reached that approximated in general outline to the system of the priesthood, as known in modern times.

Presbyter John (legendary Christian ruler): *see* Prester John.

presbyterian, form of church government developed by Swiss and Rhineland Reformers during the 16th-century Protestant Reformation and used with variations by Reformed and Presbyterian churches throughout the world. John Calvin believed that the system of church government used by him and his associates in Geneva, Strassburg, Zürich, and other places was based upon the Bible and the experience of the church, but he did not claim that it was the only acceptable form. Some of his successors did make such a claim.

According to Calvin's theory of church government, the church is a community or body in which Christ only is head and all members are equal under him. The ministry is given to the entire church and is distributed among many officers. All who hold office do so by election of the people whose representatives they are. The church is to be governed and directed by assemblies of officeholders, pastors, and elders chosen to provide just representation for the church as a whole.

Since the Reformation the various Reformed and Presbyterian churches have made many adaptations of the basic structure but have not departed from it in essentials. In the Presbyterian churches of British-American background, there are usually four categories of church government.

On the congregational level there are the session, the deacons, and the trustees. The session is made up of the elders and the pastor, who is also the moderator, or chairman. The session cares for all the religious or strictly churchly matters. It supervises the calling and election of pastors, receives and dismisses members, determines the order of the services, and exercises church discipline. The deacons, over whom the pastor is also the moderator, care for the poor and any other temporal affairs assigned to them. The trustees, under their own chairman, have charge of the property and fiscal and legal obligations of the congregation. The elders and deacons are ordained to their offices by the pastor. Ordination is for life, but the exercise of the office is often for a term of years. The trustees serve for stated terms and are not ordained.

A presbytery is formed by all ministers, in pastorates or not, of a given area, together with one or more elders appointed by each of the congregations of the area. The presbytery is responsible for ordaining, installing, removing, or transferring ministers. Ordinarily, the people may elect their own pastor, but the presbytery must give its approval and install him in office. Once installed, the pastor may not be dismissed by the people or leave the people without consent of the presbytery. The presbytery also has religious, financial, and legal authority over all the congregations. It serves as a court of appeal for cases coming from the congregational sessions. The moderator is elected annually, and the presbytery meets as often as it wishes.

A synod is made up of several presbyteries. It may be a delegated synod to which only a few representatives from each presbytery are sent, or it may be a synod to which all the members of the presbyteries belong. In either case its jurisdiction in modern times is slight. It is a court of appeal in judicial matters, and it has a certain coordinating role in church program matters among the presbyteries. A synod usually meets annually and its moderator is elected annually.

The General Assembly is an annual meeting of commissioners, ministers, and elders, elected by all the presbyteries (not by the synods) according to their total church membership. This body elects its own officers, the moderator for one year only, the stated clerk for a longer term. It has charge of all the general concerns of the church's faith, order, property, missions, education, and the like. The missionary, benevolent, educational, and publishing work of the denomination are under boards elected by the General Assembly. The assembly also functions as the final court of appeal on all cases that come up to it from the congregational sessions, presbyteries, and synods.

Presbyterian Church (U.S.A.), church formed on June 10, 1983, in the merger of the United Presbyterian Church in the U.S.A. (headquartered in New York City) and the Presbyterian Church in the United States (headquartered in Atlanta, Ga.). The merger ended a North-South split among Presbyterians that had dated from the U.S. Civil War.

The U.S. Presbyterian Church traces its beginnings to the earliest Presbyterian churches in the American colonies. These were established in the 17th century by New England Puritans who preferred the presbyterian system rather than New England Congregationalism. Also in the 17th century, Scots-Irish, English, and other settlers formed Presbyterian churches in Maryland, Delaware, and Pennsylvania. In 1706 some of these churches joined in a loosely organized presbytery, which in 1716 was expanded to a synod of several presbyteries.

The church was a blend of New England Puritan Presbyterians, Scots-Irish Presbyterians, plus Welsh and some other Presbyterians. The Scots-Irish regarded doctrine as the basis of the church and strove for unqualified acceptance of the Westminster Confession. The New England Puritans regarded the Christian life as the basis of the church, accepted creeds as expressions of the faith held by the church, and wished the superior church courts to have only limited and fixed powers. The church suffered a schism from 1741 to 1758 because of the religious revivals of the 18th century. The New England (pro-revival) group, called the New Side, trebled during the schism, while the Scots-Irish (anti-revival), called the Old Side, declined. The two groups reunited in 1758, and the church experienced growth because many of the several hundred thousand Scots-Irish immigrants who came to the Colonies after 1760 became members.

Presbyterians were active participants in the American Revolution, and after the war the church expanded westward. The need for a more definite organization led to the first General Assembly, held in Philadelphia in 1789.

Dissension within the church over a Plan of Union (drawn up in 1801) with the Congregationalists, the slavery question, and theological disputes led to a schism in 1837. Both groups continued to call themselves the Presbyterian Church in the U.S.A., but one group, located primarily in the North, added "New School" and the other added "Old School." Both groups continued to grow, but, during the Civil War, the Old School Presbyterians in the South seceded and formed the Presbyterian Church in the Confederate States of America. After the war the North-South groups of the two churches could not agree to reunite. Unions took place instead of New School and Old School to form in the South the Presbyterian Church in the United States and in the North the Presbyterian Church in the U.S.A.

In the late 19th century and the first part of the 20th century, the churches in both the North and the South continued to grow despite controversies concerning biblical criticism and the activities of a group of conservatives known as fundamentalists. The Presbyterian Church in the U.S.A. was joined by two smaller churches: the major part of the Cumberland Presbyterian Church in 1906 and the Welsh Calvinistic Methodist Church in 1920.

Another, historically separate group developed out of the Presbyterian organizations formed by various Scottish and Scots-Irish immigrants who settled in America in the 18th century. These organizations reflected the divisions within the Scottish church; but, as these issues became less important in America, mergers took place. In 1782 the Reformed Presbyterians and some of the Associate (Seceder) Presbyterians united, and these together with other Secession groups united to form in 1858 the United Presbyterian Church of North America. This church tended to be quite conservative in doctrine and worship practices, but, gradually, changes were made. It was active in the anti-slavery cause and in other reform movements.

In 1958 the United Presbyterian Church of North America merged with the U.S.A. Presbyterians forming the United Presbyterian Church in the U.S.A. This church became active in ecumenical affairs. It adopted a new confession, the Confession of 1967, which with several historic Presbyterian confessions is contained in the church's *Book of Confessions.*

The Southern church, the Presbyterian Church in the United States, traditionally promoted local initiative and restricted the powers of all central agencies. Thus, attempts to unite the Presbyterian Church in the United States with the United Presbyterian Church in the U.S.A. failed in the 1950s, when the Southern church refused centralization. A new movement for union began in the late 1970s, however, and succeeded in 1983.

Presbyterian Church in Ireland, church organized in 1840 by merger of the Secession Church and the Synod of Ulster. In 1854 the Synod of Munster merged into the church.

Presbyterianism in Ireland, except for scattered Puritan groups, began with the plantation of Ulster by King James I in 1610. He hoped to provide a strong Protestant population in Ireland that would support his policies. He therefore provided land that had belonged to the Irish for Scottish and English settlers. Thousands of Scots responded to the offer of land, but their situation in Ireland was often difficult. They were resented by the Irish Catholics, and the English government's policies toward them were inconsistent. At first the Scottish Presbyterians in Ireland were considered part of the established Church of Ireland (Anglican), but changes in policy under King Charles I (reigned 1625-49) forced them out of the established church, and they eventually formed their own organizations. A rebellion against the English by Irish Catholics occurred in 1641, and thousands of Protestants in Ireland were killed. Partial toleration was granted to the Presbyterians in Ireland by the English government under King William III (reigned 1689–1702), but, until 1869, when complete religious toleration was granted, their harsh situation led hundreds of thousands of the Scots-Irish to migrate to North America.

Controversies among Presbyterians in Scotland usually had their counterparts in Ulster. Seceders appeared in 1741 and organized in 1750; Reformed Presbyterians came in 1752 and organized in 1792. The Synod of Ulster was the main Presbyterian body, but it did not include the Presbyterians in Dublin and south and west Ireland, which formed the Synod of Munster. All of these groups, except the Reformed Presbyterians, who continued as a small church, eventually united in the Presbyterian Church in Ireland.

Severe doctrinal controversies occurred among Irish Presbyterians in the 18th and 19th centuries, and during each of them a group that became Unitarian left the church. As a result, the Irish Presbyterians became very conservative in theology. By mid-20th century, however, the Presbyterian Church in Ireland was restudying some of its strict attitudes and was showing interest in national and international problems.

The partition of Ireland in 1921 into Northern Ireland and the Republic of Ireland did not cause the church serious difficulties since most of its members were in Northern Ireland.

Presbyterian Church of England, church organized in 1876 by merger of the United Presbyterian Church and various English and Scottish Presbyterian congregations in England. The United Presbyterian Church had resulted from the merger of some Scottish and English Presbyterian congregations in England in 1847.

In England, Presbyterianism, like Congregationalism, had its roots in the Puritan movement within the Church of England. The Presbyterian Puritans who wanted the episcopally governed Church of England to adopt the presbyterian system of church government made little headway in reaching their goal during the reigns of Queen Elizabeth I and James I in the 16th and 17th centuries. During the English Civil War (1642–51), however, which began during the reign of Charles I (1625–49), the Presbyterian Puritans reached the height of their power.

Beginning in 1640, events moved steadily toward control of England by the Presbyterian–Parliamentary party. Charles was driven to accept a bill removing bishops from all temporal offices and depriving them of their powers of arrest and imprisonment. Eventually, Parliament began preparing to establish the presbyterian system of church government in the Church of England.

The Westminster Assembly, which met from 1643 to 1649, was summoned to advise Parliament in religious matters. At Parliament's request the assembly prepared the Westminster Confession, the Westminster catechisms, a Form of Government, and a Directory of Public Worship. These documents were the results of years of debate by many able scholars. They were accepted by the Parliament in 1648, but the English Church never had an opportunity to consider them.

As the Civil War progressed, Oliver Cromwell, an Independent (Congregationalist), and his army, not Parliament, became supreme in England. The political–religious program of the army alienated the Presbyterian Puritans, some of whom began communicating with the King. In 1648 the army purged Parliament of all Presbyterians (140) and left about 60 Independents in the Commons. This Rump Parliament tried and executed Charles I, set up a military dictatorship under Cromwell, terminated the Presbyterian establishment, and granted freedom to all religious groups while giving special privileges to Congregationalism.

Although the Presbyterian Puritans protested, they had little influence and had lost their popular following. Despite the large place accorded to the laity in the general structure of the Presbyterian system, circumstances had led to the formation of only a ministerial party in England and not to the formation of a Presbyterian Church. Fear of the Independents and reliance upon Parliament and upon strong political figures had been disastrous. Few of the several thousand congregations held by the Presbyterians ever had elders or any lay leadership. Also, the controversy with the episcopal party had come to involve almost exclusively issues of interest only to the clergy.

After Cromwell's death (1658), Parliament was recalled, and Presbyterianism was briefly reestablished. When the monarchy was restored under Charles II (reigned 1660–85), the King reestablished the episcopal form of church government. Most Presbyterian ministers capitulated and accepted episcopal ordination, while about 2,000 ministers resisted and were deposed from their churches. Presbyterianism never regained power in England, although the Westminster Confession and Catechisms became the doctrinal standards of English-speaking Presbyterians.

After William and Mary became the English monarchs (1689), all Protestants in England were granted toleration. Presbyterian congregations existed but had little organization. Many ministers eventually became Congregationalists, Unitarians, or Anglicans, and by the end of the 18th century English Presbyterianism continued only in a few congregations.

Presbyterianism in England was revived by Scots who began settling in England in the 18th century and organized their own congregations. Unions eventually led to the organization of the Presbyterian Church of England (1876), which in 1972 was merged into the United Reformed Church in England and Wales.

Presbyterian Church of Wales, also called CALVINISTIC METHODIST CHURCH, church that developed out of the Methodist revivals in Wales in the 18th century. The early leaders were Howel Harris, a layman who became an itinerant preacher after a religious experience of conversion in 1735, and Daniel Rowlands, an Anglican curate in Cardiganshire who experienced a similar conversion. After the two men met in 1737, they began cooperating in their work and were responsible for starting the religious revival in Wales and for founding Methodist associations. Eventually, however, doctrinal and personal differences between the two men led to the estrangement of Harris from the Welsh Methodists in 1750. He established a community, or "family," at Trefeca, Brecknockshire, but he continued to be an itinerant preacher. He was reconciled with the Welsh Methodists after several years.

Unlike English Methodism, Welsh Methodism became Calvinistic rather than Arminian. The Welsh leaders sided with George Whitefield, an early leader in the English Methodist movement, in his dispute with John Wesley, the founder of Methodism, over the doctrine of free grace. Whitefield, a Calvinist, accepted the doctrine of predestination (*i.e.,* that God predestines some persons to salvation and some to damnation), while Wesley accepted the Arminian doctrine that grace is freely available to all who will accept it. Ultimately, therefore, the Methodist movement in Wales developed into a Presbyterian rather than a Methodist church.

After the early leaders died, leadership of the Methodist movement in Wales passed to Thomas Charles, an ordained Anglican priest who had been influenced by the Methodist revival as a student. He never repudiated his own ordination, but, finally, circumstances led him to ordain nine laymen to the Methodist ministry in 1811. Thus, Methodism in Wales, which until that time had remained within the established Church of England in Wales, became a separate church.

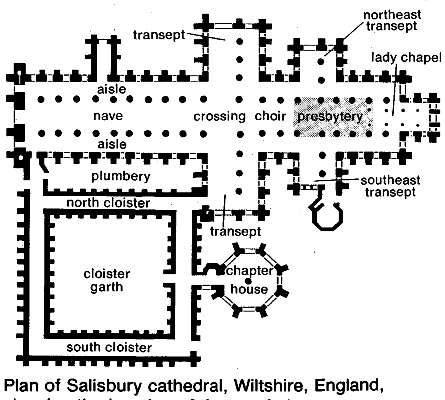
Two synods or associations were formed for the new church, one for South Wales and one for North Wales. In 1823 a Confession of Faith was officially adopted, and in 1864 a General Assembly was formed to unite the two synods. The church government and the doctrine of the church are presbyterian. The majority of the worship services are held in the Welsh language.

Presbyterian churches, one of the major representative groups of classical Protestantism that arose in the 16th-century Reformation. Generally speaking, the modern Presbyterian churches trace their origins to the Calvinist churches of the British Isles, the Continental counterparts of which came to be known by the more inclusive designation Reformed. The term presbyterian denotes a collegiate type of church government by pastors and lay leaders called elders, or presbyters. Strictly speaking, all Presbyterian churches are a part of the Reformed, or Calvinist, tradition, although not all Reformed churches are presbyterian in their form of government.

The Reformed and Presbyterian churches are treated jointly in MACROPAEDIA: Protestantism. The presbyterian form of church government and the histories of respective Presbyterian churches (*e.g.,* Presbyterian Church [U.S.A.]; Scotland, Church of) are treated individually in the MICROPAEDIA. *See also* Calvinism.

presbytery, in church government, ruling body in Presbyterian churches that consists of the ministers and representative elders from congregations within a given district (*see* presbyterian).

presbytery, in Western architecture, that part of a cathedral or other large cruciform church that lies between the chancel, or choir, and the high altar, or sanctuary. As an element



Plan of Salisbury cathedral, Wiltshire, England, showing the location of the presbytery

From M.S. Briggs, *Everyman's Concise Encyclopaedia of Architecture*; E.P. Dutton & Co., Inc., and J.M. Dent & Sons Ltd.

of a cruciform church (*i.e.,* one laid out in the shape of a cross), the presbytery may be located geographically west of the sanctuary and east of the choir. This area, which is sometimes also called the presbyterium, can be occupied only by members of the clergy, those priests who participate in services within the sanctuary. The presbytery is often raised a few steps above or otherwise separated from the chancel, as in Winchester and Salisbury cathedrals in England, but it may also be combined with the chancel, as in the English cathedrals of Lincoln and York.

preschool education, education during the earliest phases of childhood, beginning in infancy and ending upon entry into primary school at about five, six, or seven years of age (the age varying from country to country.)

The institutional arrangements for preschool education vary widely around the world, as do the names applied to the institutions. The terms usually given to centres for the care of infants—those in the first phase of childhood (about three months to three years of age)—are infant school, day care, day nursery, and crèche—the term crèche being used not only in French-speaking countries but also in such places as Scandinavia, the United Kingdom, Czechoslovakia, Poland, the Soviet Union, and Israel. For the second phase of early childhood, other institutional names and arrangements exist, the most common being the "maternal school" (*école maternelle*), or nursery school, and the kindergarten. Typically, the maternal school (for ages three to four or five) precedes kindergarten (for ages four or five to six), but in some countries—Italy, for instance—a child goes from the maternal directly to the primary school. In Germany, in addition to the *Kindergarten,* there is the *Schulkindergarten* (school kindergarten), which is for children of school age who are not considered sufficiently mature and which therefore serves as a kind of preparatory school for primary school. In the United States, kindergarten is considered a part of primary education.

History. The name usually associated with the initiation of early childhood education in modern times is Johann Friedrich Oberlin, an Alsatian Lutheran pastor in Waldersbach, who founded in 1767 the first *salle d'asile* (literally, "hall of refuge"), or infant school, for the care and instruction of very small children while their parents worked in the fields. Other educators began imitating his infant school—in Lippe-Detmold, Berlin, Kaiserswerth, Paris, and elsewhere. In France, the *salles d'asile* changed from private to state-supported institutions in 1833 when they were made part of the national educational system. Later, their name was officially changed to *écoles maternelles.*

Seemingly independently of the Continental infant-school movement, the Scottish reformer Robert Owen in 1816 founded in his model community New Lanark an Institute for the Formation of Character. It served about 100 children of the workers in his cotton mills, mostly from 18 months to 10 years of age; and there were separate infant classes for two- to five-year-olds, who spent half their time in instruction and half in recreation. The New Lanark school led to the establishment of England's first infant school in London in 1818. Set up by the man who had directed Owen's institute, James Buchanan, it cared for children aged one to six years. According to contemporary accounts, Buchanan brought to London the methods that he had evolved at New Lanark:

> He began with simple gymnastic movements, arm exercises, clapping the hands, and counting the movements. *Viva voce* lessons followed, arithmetical tables, etc.... Watt's Divine and Moral Songs and similar hymns soon followed, and the children never tired of singing them to the accompaniment of his flute. He also gave the little people simple object lessons in which they did most of the talking, and learned to observe and describe.

Buchanan's school was imitated by others, notably by Samuel Wilderspin, who wrote some of the earliest and most widely disseminated monographs on infant education.

In Italy a Roman Catholic father, Ferrante Aporti, read a translated work by Wilderspin and, as a result, established Italy's first infant school in Cremona in 1829 and devised an educational plan that aimed at a harmonious combination of moral, intellectual, and physical education. Manual work, at all educational ages, was to give education a certain concreteness and rationality, making it a process of pupil involvement; the very young were to start off becoming accustomed to discipline, friendly cooperation, and piety.

With Friedrich Froebel (*q.v.*), the German founder of the kindergarten, there arose the first systematic theory of early childhood pedagogy: instead of considering early schooling a form of babysitting or social philanthropy or considering it merely a period of preparation for adult roles, Froebel saw early childhood development as a special phase during which the child expresses himself through play. Child's play was a process of discovery and recognition that educated the child to the unity, as well as the diversity, of things in nature. These educational premises guided Froebel's pedagogical institute at Keilhau (founded in 1816), but it was not until 1837 at nearby Bad Blankenburg that he opened his first infant school, which he later called a *Kindergarten,* or "garden for children." There he devised a collection of geometric playthings (or "gifts," as he called them) and various exercises or occupations, such as folding, cutting, and weaving, to make the symbolic forms real or dynamic for the child. Froebel believed that the young child learned best not through formal instruction but through play and imitation, "self-activity." Within 25 years after Froebel's death in 1852, kindergartens were founded in leading cities in Austria, Belgium, Canada, Germany, Great Britain, Hungary, Japan, The Netherlands, Switzerland, and the United States. (*See* kindergarten.)

In 1892 in Italy, the Agazzi sisters, Rosa and Carolina, initiated a blending of Aporti's infant school and Froebel's kindergarten and produced a prototypical Italian maternal school (*scuola materna*). In the school the children were induced to become collaborators in the search for the instruments of their own education—seeking *realia* (objects from real life) as well as Froebelian symbolic objects to examine.

Similarly concerned with nurturing or favourably exploiting the young child's natural impulses—in a safe-guarded, constructive way—was one of the most famous figures in preschool education, Maria Montessori (*q.v.*), who began her studies of educational problems with culturally deprived and mentally deficient children in 1899, when she became director of the Orthophrenic School, in Rome. Because her methods worked with defective children, she felt that they might yield even better results with normal children. Thus, in 1907 she took under her care 60 children, aged three to six, from the slums of the San Lorenzo quarter of Rome and thus inaugurated her first Casa dei Bambini (Children's House). Individual initiative and self-direction characterized the Montessori philosophy, and thus the teacher was to withdraw to the background and merely supervise the use of "didactic materials," a large complex of educational tools that Dr. Montessori herself developed—such as lacing frames, number rods to develop concepts of numbers, map puzzles, and sandpaper letters that children were to trace with their fingers. Also, although usually each child worked alone, group or social activity was not ignored, for there were group gymnastics, games, and religious exercises; and social manners were taught in serving meals, waiting on tables, and the like. The children learned to read, write, and count and to express themselves artistically. (*See* Montessori system.)

Across Europe, in Belgium, meanwhile, another doctor of medicine, Ovide Decroly, was pioneering in the education of the very young, also proceeding from the psychological study of abnormal or exceptional children. In 1907 he opened his École de l'Ermitage (School of the Hermitage) near Brussels. Unlike Montessori's children, however, Decroly's children worked in groups, and, like the Agazzis' children, they worked with real things drawn from everyday life. His educational system was based on three processes: observation, expression (oral, written, manual, or artistic), and association of space and time. He felt the universal needs of the child to be food, protection against danger, endurance for the frustrations of life, work, play, self-evaluation, and self-discipline.

Across the channel in Great Britain were two pioneers in the movement to improve the health and environment of the very young: Grace Owen and Margaret McMillan. Both saw the nursery school as a place for fostering health and physical development (prerequisites to any other kind of development) and as a place that should be an extension of the home. Owen wanted every housing development to have a nursery school, where children of various ages would comprise a group resembling a large family and where play would facilitate socialization. McMillan outlined a plan for a three-year course for training teachers for the nursery schools, maintaining that only trained personnel should work with children from three to six years of age. Training centres at Manchester (under Owen), at Deptford (under McMillan), and at London supplied nursery teachers for the entire British Commonwealth as well as for the early nursery schools in the United States.

The first decade of the 20th century saw the start of what might be called "collective" upbringing. In what was then Palestine the new settlers established kibbutzim, in which were established separate homes for the children in order to free the mothers to work in the commune. As the system has now evolved, all children of a kibbutz from birth to one year remain in an "infant house," cared for by a *meṭapelet* (upbringer) in charge of four or five babies. During the nursing stage mothers feed their babies in the infant house. The "toddler house," containing about eight children one to three or four years old, emphasizes socialization. All children visit home daily for a few hours. In the next stage, kindergarten, the child three or four to seven years old is under the care of a teacher and her three assistants (*meṭapelet*). The aim of this period is readiness for the first grade.

Another variety of collective preschool education is found in the Soviet Union, where crèches and kindergartens (*detskiye sady* and *yasli*) were inaugurated about 1919, partly through the persuasions of N.K. Krupskaya (Lenin's wife), who viewed preschool education as the first step in creating a new Soviet man. Today, children are placed in the crèches (voluntarily) from two months until three years of age; these crèches are under the jurisdiction of the Ministry of Health. The kindergarten, under the jurisdiction of the Ministry of Education, accepts children three to seven years old. All teaching materials used are didactic. The socialization process, respect for authority, and the subordination of individual needs to those of the collective are stressed. Self-discipline and self-reliance are key teaching objectives.

Modern theories. The proliferation of nursery schools and other institutions of preschool education in the 20th century can be traced to a number of developments: (1) a new scientific interest in early childhood, resulting from applications in the fields of psychology, medicine, psychiatry, and education; (2) recognition of the importance of child guidance and parent education; and (3) the efforts of individuals and agencies to improve the educational programs of day nurseries already established for the care of children of working mothers. Because the nursery school movement has sprung from such a variety of social forces, no one type of school may be described as representative of the movement. Nevertheless, it is profitable to consider a few modern views of early childhood education.

One major contribution has been the developmental psychology of Jean Piaget and his followers, who are convinced that children advance through rather regular stages of intellectual development. The first two periods—sensorimotor intelligence (from birth until age two) as well as representative intelligence (from two to seven or eight)—relate to the field of early childhood. In the first stage (sensorimotor) the child learns to use his muscles and senses to deal with external objects and events while his language begins to form. He also begins to deal with and know that things exist even if they are beyond his sight and touch. He also starts to "symbolize" (represent things by word or gesture). In the second stage the child experiences the greatest language growth; words and other symbols become a way to represent both the outside world and inner feelings. At this stage the child's adjustments depend on learning by trial and error, but he also manages things by intuition. He begins to integrate symbolization and elementary types of relationships, such as logical and mathematical relationships (grouping, sizes, quantities, and qualities) and spatial and temporal relationships. Piaget's theory laid the groundwork for recognizing the importance of cognitive learning processes and concept formation in the young child. Piaget also stressed the importance of an environment conducive to learning the necessary skills.

One of the major concerns of nursery schools and kindergartens is language development. Most investigators agree that true speech starts when the child begins to develop meaningful associations with the words he uses (an infant who imitates the word "mama" without understanding its meaning is not engaging in true speech). For a child between two and six, oral speech is a major task, involving both expression and comprehension. By about the age of four he has mastered the fundamentals of the systematic grammar of his language. By the age of six the average child has increased his vocabulary to about 2,500 words or so—depending on the quality of his environment, and particularly the willingness of adults to relate to the child. Many studies show that the very young child in an impersonal institution, such as an orphanage, generally lags in language development behind children of the same age in a normal family setting. One of the many tasks of early childhood education is to provide training in elementary language skills for all children, but especially for those who need compensatory work. To improve their comprehension and speech, there are listening and language games. Educators who find educational games a successful teaching device claim that they stimulate the child's interest in learning.

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

Prescott, city, seat of Yavapai county, west-central Arizona, U.S. It is situated in a mile-high basin among pine-dotted mountains, in an area that is rich in minerals. Gold mining brought the first settlers to the site (1863); farmers and cattlemen followed. Fort Whipple was built and the town was founded in 1864 and named for William H. Prescott, the historian. The town was the capital of Arizona Territory until 1889 (except for the years 1867–77), when the capital was moved to Tucson. A basic cattle-farming and mining economy prevails, and small industries are increasing. Prescott is headquarters of the Prescott National Forest and has resort facilities. Prescott Center College (formerly Prescott College) was opened in 1975 and Yavapai College in 1969. Inc. 1881. Pop. (1987 est.) 22,461.

Prescott, William H(ickling) (b. May 4, 1796, Salem, Mass., U.S.—d. Jan. 28, 1859, Boston), American historian, best known for his *History of the Conquest of Mexico,* 3 vol. (1843), and his *History of the Conquest of Peru,* 2 vol. (1847). He has been called America's first scientific historian.

Life and works. Prescott was from a prosperous, old New England family. He received three years of rigorous instruction in a preparatory school headed by the Jesuit John Gardiner, who infused in him a love of classical learning. In 1811 he entered Harvard, where his academic record was good but undistinguished; he had serious difficulties with mathematics, and in later life the prospect of appraising the mathematical achievements of the aboriginal Mexicans almost prevented him from completing his work. Near the end of his junior year, a crust of bread thrown during a melee in the student commons caused virtual blindness in his left eye; the weakness of his other eye, caused by infection, sometimes prevented him from carrying on any kind of literary work. Throughout his life, Prescott's vision seems to have fluctuated from good to total blindness, and he often resorted to the use of a noctograph, a writing grid with parallel wires that guided a stylus over a chemically treated surface. Substantial portions of all his books and correspondence were composed on this device.

Following his graduation from Harvard in 1814, Prescott's health deteriorated after attacks of what appears to have been an acute type of rheumatism, with swellings in his larger joints and lower legs. He convalesced at his grandfather's home in the Azores and then, encouraged by an apparent recovery, toured Europe. After his return to Boston, he embarked upon serious historical studies, shunning a career in business or law because both occupations demanded more stamina

Prescott, daguerreotype, about 1845

By courtesy of the Metropolitan Museum of Art, New York City, gift of I.N. Phelps Stokes, Edward S. Hawes, Alice Mary Hawes, and Marion Augusta Hawes, 1937

than his delicate health and eyesight could allow. In 1820 he married Susan Amory. With no obvious occupation, he was known as "the gentleman" by his Boston friends. His wife, as well as other readers, provided the eyes that helped Prescott at this time to embark on a literary career.

His first publication was a number of reviews and essays in the *North American Review* in 1821. Some of these were reprinted in *Biographical and Critical Miscellanies* (1845). His "Life of Charles Brockden Brown" (1834) in Jared Sparks's *Library of American Biography* served notice of Prescott's high abilities as a writer. Largely on the advice of his friend the teacher and writer George Ticknor and the later encouragement from the miscellaneous writer Washington Irving, Prescott turned to Spanish themes for his lifework. The appearance in 1838 of his three-volume *History of the Reign of Ferdinand and Isabella the Catholic,* the product of some 10 years of work, was an agreeable surprise to Boston's literary world. This work launched Prescott's career as a historian of 16th-century Spain and its colonies. In another such work, *A History of the Reign of Philip the Second, King of Spain,* 3 vol. (1855–58), Prescott produced graceful, authoritative narratives of Spanish military, diplomatic, and political history that had no equal in their time. Prescott's modern popularity, however, rests with his epic *History of the Conquest of Mexico* and his *History of the Conquest of Peru.*

Working with a superb personal library of perhaps 5,000 volumes and with the help of such overseas associates as Pascual de Gayangos, the Spanish aide who discovered manuscripts and rare books for him, Prescott made rigorous use of original sources. His critical use of historical evidence was such that he might well be called the first American scientific historian.

Assessment. That Prescott's histories continue to be popular with scholars as well as lay readers after more than a century of criticism attests to their vitality and readability. Though further research has revised his view of 16th-century Spanish monarchy, Prescott's basic work is still judged to be generally fair and accurate. It was in narrating the Spanish conquests at that time that Prescott's republicanism penetrates his histories so as to colour his picture of the Spanish state and the aboriginal governments of the Aztecs and the Incas. Moreover, his New England Unitarianism made it difficult for him to appreciate the acceptance of the miraculous or supernatural among peoples of another age or to understand the peculiarities of the conquistadors.

Perhaps the most severe unfavourable criticisms of the *Conquest of Mexico* and the *Conquest of Peru* are based upon Prescott's romantic version of native civilizations, which later findings in archaeology and anthropology have found to be distorted. Prescott's failure to visit the historical settings of his narratives and to examine actual remains of the native cultures he described was partly responsible for this defect in his books. Yet modern scholars have concluded that Prescott's historical narrative, based upon Spanish chronicles, is essentially sound. What Prescott hoped to do with his histories was to instruct and to entertain. His history was narrative and descriptive rather than philosophical or analytical. His colourful prose dealt with conquests, war, diplomacy, and politics—not with cultural, social, or economic themes. In his Spanish histories his concern was almost exclusively with the Spanish courtiers and other aristocrats.

Despite such criticisms, Prescott's achievements as a historian and as a literary artist were remarkable. For example, the persistent demand for the *Conquest of Mexico* has resulted in its publication in 10 languages at least 200 times and that of the *Conquest of Peru* in 11 languages at least 160 times. He was the first English-speaking historian to reach a wide audience outside the Hispanic world with a history expressing the Spanish point of view. Spaniards, in Prescott's histories, were often forerunners of progress. Thus the Moors in Spain and the aboriginal peoples of Mexico and Peru make way for the achievements of Spanish characters. Throughout the conquistador histories, Prescott exposes the reader to vivid landscapes, battles, and processionals as the march of Spanish civilization overwhelms the savage world. Prescott's literary artistry convincingly shows the conquistador Hernán Cortês caught up in a series of crises that, on the eve of final victory, tend to become more and more complex. In the end, however, the "pusillanimity" of the Aztec emperor Montezuma is the advantage that the forthright Cortês has in determining the outcome of events.

Prescott weaves a dramatic fabric that completely envelopes his narrative. Indeed, much of the same story is repeated in both the *Conquest of Mexico* and the *Conquest of Peru* in respect to descriptions of battles, characterizations, use of metaphor, dramatic encounters, and crises, suggesting that Prescott perhaps manipulated his narratives for literary effect. Yet critics generally agree that he accurately follows his sources. His empathy with the Spanish point of view still makes him the greatest Anglo-American historian of the Hispanic world. (W.R.J.)

BIBLIOGRAPHY. Prescott's writings are collected in Wilfred Harold Munro (ed.), *The Works of William H. Prescott*, 22 vol. (1904, reprinted 1968). C. Harvey Gardiner, *William Hickling Prescott: A Biography* (1969), is a critical study of Prescott as a writer and historian based upon exhaustive research. Gardiner and all other writers on Prescott are indebted to George Ticknor, Prescott's lifelong friend and associate, for his *Life of William Hickling Prescott* (1863, reissued 1968).

prescription, in both domestic and international law, the effect of the lapse of time in creating and destroying rights. Prescription is either acquisitive, in that an individual is allowed, after a specified period of time, to acquire title, or extinctive—*i.e.*, barring for a period of time certain court actions (*see* limitation, statute of).

The concept of prescription goes back to the early Roman Empire, when a need arose for a system whereby provincial land, not held by civil title or acquired by usucapio (continuous possession over a period of two years), could still be "owned" after possession over a longer period of time, ranging from 10 to 20 years.

Initially, long-term prescription merely gave the holder a defense against suit for the land. Later it became acquisitive, and all that was required was good faith and title (even if acquired from a nonowner). Prescription continued in the Frankish period, but its form was not settled. In France, in the 16th century, possession over a period of 10–20 years in good faith and with title conferred ownership; 30 years was necessary without either.

These same rules continue in modern France, although with extinctive prescription there are many exceptions to the 30-year rule. In Germany, 10 years and good faith are required. In the United States, the term adverse possession (*q.v.*) is more common than prescription; even if the possessor has taken over land that he knows is not his, title will pass to him if he holds the land continuously for a period of 20 years.

Modern justifications of prescription are based on several considerations: the desire to avoid the difficulties of proof, which long-continued delay in the assertion of rights occasions; and the argument that long-continued use permits the inference of ownership, since right and use usually go together.

International law also has a concept of prescription; it recognizes a nation's claim as valid by reason of long-continued assertion and a government's authority as legitimate by reason of its continuation in power.

The term prescription is also used in some philosophical writing to describe what legal philosophers call custom—that is, long-continued usage or habit as a source of law. Edmund Burke referred to prescription, or custom, as the basis of law in order to refute the claim of supporters of the French Revolution that the source of law is the present generation.

Preseli, district, Dyfed county, southwestern Wales. Created in 1974, it covers an area of 403 square miles (1,044 square km) on the westernmost tip of the South Wales peninsula. About 150 miles (240 km) of convoluted coastline, often comprising smaller peninsulas separated by inlets, makes up the northern, western, and southern borders of the district; to the east, Preseli borders the districts of Ceredigion, Carmarthen, and South Pembrokeshire. Prehistoric earthworks known as Warrior's Dyke have been discovered amidst the high cliffs of St. David's Head, the most westerly point in Wales. The town of St. David's, named for the special saint of Wales born in the 6th century, has been a place of pilgrimage since the Middle Ages, attracting those with hopes of miraculous cures for their ailments to a holy well at St. Non's Chapel.

Haverfordwest, now a market town and the administrative seat of Preseli district, grew up as a walled borough around a castle (*c.* 1120). The town's maritime prosperity declined rapidly after the English Civil War, and during the 19th century Milford Haven (chartered 1793), situated on the northern shore of a deep natural harbour in southern Preseli, grew significantly to become the district's major port. Since 1960, when three major oil refineries were located there, Milford Haven has been one of Europe's leading oil ports. Other major economic activities in Preseli include agriculture (mainly dairy farming) and tourism. Nearly all the district's coastal area lies within the Pembrokeshire Coast National Park. Fishguard and Goodwick, both located at the head of Fishguard Bay in northern Preseli, are popular resort areas, and there is regular ferry service between Fishguard and Northern Ireland. A highway and a railway extend northward from Milford Haven through Haverfordwest and Fishguard, and a civil airport is located at Withybush, outside Haverfordwest. Pop. (1986 est.) 70,600.

Presence, bread of the (Judaism): *see* shewbread.

presentation, in childbirth, the position of the fetus at the time of delivery. The presenting part is the part of the fetus that can be touched by the obstetrician when he probes with his finger through the opening in the cervix, the outermost portion of the uterus, which projects into the vagina. In nearly all deliveries the presenting part is the vertex, the top of the head; in 3 or 4 percent of deliveries, it is the breech (buttocks). Face presentation and transverse (cross) presentation are rare.

In vertex presentations the head of the fetus most commonly faces to the right and slightly to the rear. This position is said to be the most usual one because the fetus is thus best accommodated to the shape of the uterus. In breech presentation the buttocks or the legs are the first to pass through the pelvis. The feet may be alongside the buttocks, or the legs may be extended against the face. Because the head is the last part of the fetus to be delivered in breech birth, there is some danger that the fetus will be asphyxiated; there is also danger that the umbilical cord will be compressed during birth of the head. In face presentation it may be necessary to turn the fetus before delivery if the chin is directed backward. Transverse presentation, which occurs only once in several hundred labours, requires turning of the fetus before vaginal delivery or else delivery by cesarean section.

Presentation of the Lord, also called PRESENTATION OF CHRIST IN THE TEMPLE (festival): *see* Candlemas.

Presentation of the Virgin Mary (festival): *see* Virgin Mary, Presentation of the.

Prešeren, France (b. Dec. 3, 1800, Vrba, Slovenia [now in Yugoslavia]—d. Feb. 8, 1849, Kranj, Slovenia [now in Yugoslavia]), the outstanding Slovene poet of the Romantic movement.

Prešeren studied law in Vienna, where he acquired the familiarity with the mainstream of European thought and literary expression that, through him, reinvigorated Slovene literature. He later held posts in Ljubljana and Kranj as a civil servant and lawyer. His life was one of struggle and disappointment, and in 1835 the sudden death of his close friend Matija Čop and an unhappy love affair brought him to the verge of suicide.

Although Prešeren was not a prolific writer, his work gave new life to Slovene literature, the development of which had been checked by political and social conditions. The themes and prosodic structure of his verse set new standards for Slovene writers, and his lyric poems are among the most sensitive, original, and eloquent works in Slovene. In his *Sonetni venec* (1834; "Garland of Sonnets"), inspired by his unhappy love, as in his later lyrics, he expresses the national consciousness that he sought to stimulate in his compatriots. He also wrote satirical verses (1845) on contemporary literary conditions in Slovenia. The epic poem *Krst pri Savici* (1836; "The Baptism by the Savica") treats the conflict between paganism and the early Slovene converts to Christianity and illustrates Prešeren's patriotism, pessimism, and resignation.

preservative, in foods, any of numerous chemical additives used to prevent or retard spoilage caused by chemical changes, *e.g.*, oxidation or the growth of mold. Along with emulsifying and stabilizing agents, preservatives also help to maintain freshness of appearance and consistency. *See also* emulsifier.

Preservatives are of various types that are suited to certain products and are effective against specific chemical changes. Antimycotics inhibit the growth of molds in such products as fruit juice, cheese, bread, and dried fruit; examples are sodium and calcium propionate and sorbic acid. Antioxidants (*e.g.*, butylated hydroxytoluene, or BHT) retard the development of rancidity produced by oxidation in margarine, shortening, and a variety of foods containing fats and oils. Antibiotics such as the tetracyclines are used to prevent the growth of harmful bacteria in poultry, fish, and canned foods. Humectants, substances that absorb moisture, help to retain the moisture content in such products as shredded coconut.

In addition to retarding spoilage, some preservatives have an aesthetic role—that is, they improve the appearance of the product. An example of one such preservative is sodium nitrate (or its nitrite form), controversial because of its association with the formation of an alleged carcinogen. Nitrate and nitrite are used in the curing of meats to prevent the development of botulism-causing bacteria; they also impart the reddish colour characteristic of ham, bacon, and luncheon meats. Opponents of these particular additives argue that modern sanitation and refrigeration eliminate the need for chemical preservatives. Industry representatives defend their use for cosmetic reasons, pointing out that the natural brownish colour of these meats would be unappetizing.

Preservatives used to maintain moisture and softness in baked goods are known as antistaling agents (*e.g.*, glyceryl monostearate). These substances are thought to act by preventing water loss from starches.

For a discussion of food-preserving methods, *see* food preservation.

president, in government, the officer in whom the chief executive power of a nation is vested. The president of a republic is the chief of state, but his actual power varies from country to country; the presidential office is charged with great powers and responsibilities in the United States and some other countries, but the office is weak and largely ceremonial in the Federal Republic of Germany and in many countries where the prime minister, or premier, functions as the chief executive officer.

In North America, the title of president was first used for the chief magistrate of some of the British colonies there. Such a colonial president was always associated with a colonial council to which he was elected, and the title of president thus carried over to the heads of some of the state governments (*e.g.*, Delaware and Pennsylvania) that were organized after the start of the American Revolution in 1776. The title "President of the United States" was originally applied to the officer who presided over the sessions of the Continental Congress and of the Congress under the Articles of Confederation. The framers of the United States' Constitution adopted the title president to designate the vastly more powerful office in which they vested the authority of the chief executive of the United States.

In the United States, the president's functions, powers, and responsibilities are succinctly defined by the Constitution. His chief duty is to make sure that the laws are faithfully executed, and he performs this duty through an elaborate system of executive agencies that includes cabinet-level departments. The president appoints all the cabinet heads and most other high-ranking officials of the executive branch of the federal government. He also nominates all judges of the federal judiciary, including the members of the Supreme Court, though the Congress (the legislative branch of the federal government) must approve them. The president is the commander-in-chief of the nation's armed forces, in times of peace as well as war. He has at all times unlimited authority to direct the movements of land, sea, and air forces, as well as of nuclear forces. The president has the power to make treaties with foreign governments, though the Senate must approve such treaties. Finally, the president has the power to approve or reject (veto) the laws passed by Congress. Congress can override the president's veto of a bill by summoning a two-thirds majority vote in favour of the measure. Oddly, the president of the United States is not elected by direct suffrage but rather is indirectly elected by the electors within an electoral college (*q.v.*); this institution's voting composition, however, basically reflects the popular vote. The president is elected for a four-year term, and any individual is limited to serving two consecutive terms as president.

The presidential office is commonly used in governments in South and Central America, in Africa, and in various other parts of the world. Sometimes these chief executives function in the democratic tradition as duly elected public officials. Some elected presidents, however, have continued in office beyond their constitutional term under the pretense of emergency. In many other cases, military officers have seized control of a government and afterwards sought to legitimize their rule by assuming the office of president. Still other presidents have been the virtual puppets of the armed forces or of powerful economic interests which put them in office. Most democratically elected presidents in Third World countries have constitutionally defined powers similar to those of the president of the United States. But presidents who have attained their office through force, coercion, or coup d'état often have dictatorial powers.

With rare exceptions, the titular, or ceremonial, head of state of European countries bears the title of president. In contrast to the Americas, western European nations weaken the presidential power by vesting executive authority in cabinets responsible to parliaments. The cabinet's head, and the leader of the majority in parliament, is the prime minister (premier), and this person is the actual chief executive officer of the nation. Some European nations provide for the election of a president by direct suffrage, others by the vote of an electoral college, and still others by a vote of parliament. In the communist governments of eastern Europe and elsewhere, the ceremonial head of state bears the title of president.

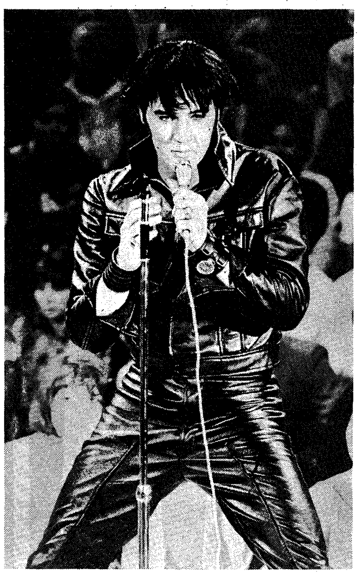
In France, the office of president was endowed with formidable executive powers under the constitution of the Fifth Republic (adopted in 1958). The elected French president appoints the premier, but, if the president must appoint a premier from the ranks of the political opposition, the two officials then divide their executive responsibilities, with the president continuing in charge of foreign relations and national defense.

Presidente Prudente, city, western São Paulo state, Brazil. It lies near the Santo Anastácio River at 1,535 feet (468 m) above sea level. Formerly known as Córrego do Veado, the settlement was given status as a town in 1921 and as a municipality in 1923. The local economy is based largely on the processing of agricultural products, chiefly cotton, coffee, corn (maize), rice, and *feijão* (beans). Lumbering and furniture making are additional activities. The city is linked by rail and road to cities in southern São Paulo state and indirectly to Três Lagoas in Mato Grosso do Sul state. It is also accessible by air. Pop. (1980) 127,623.

Preslav, town, eastern Bulgaria. It lies at the foot of the Preslav Mountains, 11 miles (18 km) southwest of Shumen. Founded by the Proto-Bulgarians in the 8th century and called Yeski Stambolchuk (Eski Stambul), it served as capital of Bulgaria under Simeon the Great in the 10th century. It is now an agricultural centre specializing in wine, fruit, and hogs. Pop. (1986 est.) 10,871.

Presley, Elvis (Aron) (b. Jan. 8, 1935, Tupelo, Miss., U.S.—d. Aug. 16, 1977, Memphis, Tenn.), rock and roll singer whose enormous success changed the shape of American popular culture.

An only child, Presley was raised in Memphis, where he sang Pentecostal church music, listened to "Grand Ole Opry" broadcasts on the radio, and heard black music called the blues. In July 1954 Presley recorded the first of 15 songs for Sam Phillips, a rhythm and blues producer who had been searching for a white singer who sounded like a black man. Five singles by Presley, each a country tune with a rhythm and blues number on the reverse side, enjoyed considerable local sales, and in November 1955 Phillips sold Presley's contract to RCA Victor for $35,000. Presley's in-person performances proved even more popular. His intensely charismatic personal style—the sexy hip shaking that earned him the nickname "Elvis the Pelvis," the ducktail haircut, and the perpetual sneer combined with an aura of vulnerability—excited young fans, especially females, to wild adulation.


Presley, 1968
UPI—EB Inc.

About this time Presley met Colonel Tom Parker, a promoter who managed the rest of his career. In 1956 Presley released "Heartbreak Hotel," the first of 45 records that sold more than a million copies each and included such hits as "Hound Dog," "All Shook Up," "Don't Be Cruel," and "Burning Love." In the same year, he appeared in *Love Me Tender,* the first of 33 motion pictures, and made nationally televised appearances on Tommy and Jimmy Dorsey's "Stage Show" and the "Ed Sullivan Show." Because of protests over the sexual suggestiveness of his gyrations, he was shown on television only from the waist up. Presley's popularity extended to country, pop, and rhythm and blues audiences, and he released 14 consecutive million-selling records before being drafted into the U.S. Army in 1958. Discharged in 1960, he resumed his recording and acting career. His earlier raucous rock and roll style was moderated over the years, and his rebel image was revised into a personification of American upward mobility. In 1968, the year in which he returned to television, he embarked on a Las Vegas-based touring act with a full popular orchestra and a gospellike choir.

Presley's audience, though it had aged, continued to expand, and, with Parker controlling Presley's exposure, the sale of Presley-related merchandise became a lucrative industry that was to outlive the man himself. Presley, meanwhile, suffered a personal decline, battling public pressures on his life, middle-age weight gain, and dependence on drugs. The extent of his problems was not reported until after his sudden death, attributed to natural causes, in Graceland, the ostentatious mansion he had purchased in Memphis. Hundreds of thousands of fans mourned Presley outside the gates of his estate, which continued to be a place of pilgrimage for his admirers. Eight million of his records were sold in the five days following his death, adding to the 500 million sold during his lifetime. His career inspired dozens of Presley imitators, who kept his image alive through nightclub, television, and movie appearances, and was the subject of extensive documentation.

Prešov, Hungarian EPERJES, town, Východoslovenský *kraj* (region), Czechoslovakia, on the Torysa River. First mentioned in documents in 1247, it became a royal free town in 1374 and was one of 24 trading settlements located on a Balkans-to-Baltic trade route. Prešov is now a state historic town; its medieval oval-shaped marketplace, Renaissance burgher houses, and three churches representing Gothic, 16th-century Baroque, and 17th-century Rococo styles survived a great fire in 1887. The ruined Šariš, an important medieval Slovak castle, is 3 miles (5 km) northwest. The town is a cultural centre with theatres, a museum, and a teachers' college. It is an important rail and road junction and has grown rapidly since World War II, with the development of electrical-engineering, textile, and food-processing industries. Pop. (1987 est.) 84,899.

Prespa, Lake, Serbo-Croatian PRESPANSKO JEZERO, Greek LIMNI MEGALI PRESPA ("Big Prespa Lake"), lake on the Yugoslav–Albanian–Greek frontier, at 2,800 ft (853 m) above sea level, with an area of 106 sq mi (274 sq km). Fed by underground streams, it is linked by subterranean channels with Lake Ohrid. Most of the lake is in Yugoslavia. Little developed until after 1945, in the 1970s Prespa became a tourist and fishing centre. South of Lake Prespa, or Limni Megali Prespa, is Limni Mikrá Prespa ("Little Prespa Lake") on the Greek–Albanian border. St. Achilius, a tiny island in Mikrá Prespa, was an early capital of the Bulgarian tsar Samuel (10th century).

Presque Isle, city, Aroostook County, northeastern Maine, U.S., on the Aroostook River and its affluent the Presque Isle Stream, near the New Brunswick border, 163 mi (262 km) north-northeast of Bangor. First settled in 1828 as Fairbanks, it was incorporated as a town in 1859 with a name indicative of "a peninsula (French *presqu'île*) on a stream." It annexed Maysville in 1883. After completion of the Bangor and Aroostook Railroad (1895) it attained importance as a centre for processing and shipping potatoes. The University of Maine at Presque Isle (founded as a state college in 1903) operates the nearby Aroostook Farm-Maine Experiment Station for improving the growing and marketing of potato and grain crops. The former Presque Isle Air Base (closed 1961) is now the site of a vocational-technical institute and an industrial park. The city's potato-based economy is augmented by light manufactures (notably fertilizer and barrels) and hunting and winter sports facilities (skiing at Quaggy Joe Mountain and Mars Hill). In August 1978 Presque Isle was the lift-off point for "Double Eagle II," the first balloon (manned by Max Anderson, Ben Abruzzo, and Larry Newman) to cross the Atlantic Ocean from the United States to France. Inc. city, 1940. Pop. (1980) 11,172.

Press, Frank (b. Dec. 4, 1924, Brooklyn, N.Y., U.S.), American geophysicist known for his investigations of the structure of the Earth's crust and mantle and the mechanics of earthquakes.

After receiving his Ph.D. in geology from Columbia University in 1949, Press taught there for several years and continued his research. In 1955 he accepted a post at the California Institute of Technology as professor of geology, and from 1957 to 1965 he served as director of the institute's seismological laboratory. In 1965 he became professor of geophysics and chairman of the Department of Earth and Planetary Sciences at the Massachusetts Institute of Technology, Cambridge. He served as Pres. Jimmy Carter's science adviser from 1977 to 1981. He returned to the Massachusetts Institute of Technology in 1981.

Press's works include studies of regional and submarine geophysics, planetary interiors, and seismology, including investigations of elastic wave propagation. His participation in the study of the Earth's crust during the International Geophysical Year (July 1957–Dec. 1958) enabled him to make an authoritative estimate that the North American Continent is between 36.8 and 48 km (23 and 30 mi) thick. In that same year on another geophysical expedition, Press played a key role in determining Antarctica to be a genuine continent. Press was elected to the National Academy of Sciences in 1958. He co-authored *Elastic Waves in Layered Media* (1957) and *Earth* (1974).

Press Trust of India (PTI), news agency formed in 1919, when Reuters news agency of Great Britain bought three Indian news services and merged them into the Associated Press of India, using the U.S. Associated Press as a model. Indian newspapers began joining the association in 1948, taking over its management and renaming it Press Trust of India when Reuters terminated its interest in 1953.

A national nonprofit enterprise, PTI, which operates in English, as do most of India's large dailies, became one of the Third World's largest cooperative news agencies. It employed more than 1,000 full-time writers and other specialists in some 50 offices, with correspondents in important world population centres, and had more than 200 subscribers.

In 1976 the government required PTI to merge with India's other three major agencies, the English-language United News of India and the Hindi-language Samachar Vharti and Bharati Samachar, but in 1978, the four agencies were allowed to start operating independently again.

Pressburg (Czechoslovakia): *see* Bratislava.

Pressburg, Treaty of (Dec. 26, 1805), agreement signed by Austria and France at Pressburg (now Bratislava, Czech.) after Napoleon's victories at Ulm and Austerlitz; it imposed severe terms on Austria. Austria gave up the following: all that it had received of Venetian territory at the Treaty of Campo Formio (*see* Campo Formio, Treaty of) to Napoleon's Kingdom of Italy; the Tirol, Vorarlberg, and several smaller territories to Bavaria; and other western lands of the Habsburg monarchy to Württemberg and Baden. Austria agreed to admit the electors of Bavaria and Württemberg, who were allied to Napoleon, to the rank of kings, and to release them, as well as Baden, from all feudal ties with the defunct Holy Roman Empire, thus sharply reducing Austrian influence in Germany. Austria agreed to pay an indemnity of 40,000,000 gold francs. As small compensation, Napoleon allowed Austria to annex Salzburg, Berchtesgaden, and the estates of the Teutonic Order. The French Empire received Piedmont, Parma, and Piacenza, and completely excluded Austria from influence in Italy. The treaty was an integral part of Napoleon's policy of creating a ring of French client states beyond the Rhine, the Alps, and the Pyrenees.

Presse, Die (German: "The Press"), newspaper published near Vienna, Austria's leading daily (though far from the largest) and one of Europe's outstanding journals.

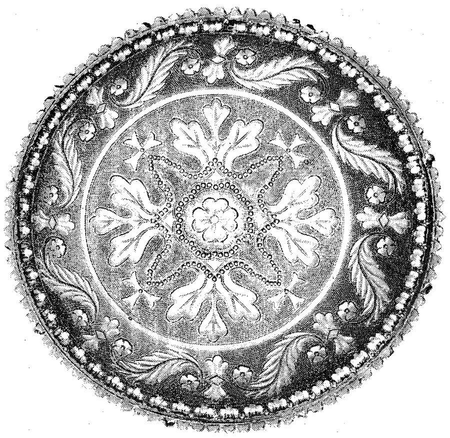
It was founded in 1848 during one of the Austro-Hungarian Empire's intermittent periods of freedom of the press. It emphasized quality and balanced reporting and comment from the start. In 1864 most of its editors and staff left the paper to establish another under the name of *Neue Freie Presse*, dedicated to the same kind of excellent writing and thorough news coverage. The new paper quickly gained recognition and influence.

Neue Freie Presse was merged into a Nazi-propaganda organ in 1939, but after World War II it was reestablished as *Die Presse* and resumed its longtime emphasis on solid national and world news coverage and perceptive editorial and cultural commentary, along with economic and financial news, and features, often using contributions by noted authorities. The modern *Die Presse* is generally liberally oriented, but it is conservative in its support of free enterprise. It is a militant supporter of freedom of the press.

Presse, La (French: "The Press"), French-language daily newspaper published in Montreal. Long the most widely circulated French-language daily newspaper in Canada and in the Western Hemisphere, it remains the largest of standard-size papers, as only the tabloid *Le Journal Montreal* has a larger circulation. The paper was established in 1884.

La Presse is highly regarded as a comprehensive, thorough daily, and in the 1930s and 1940s it had one of the largest circulations among Canadian papers in any language, with a weekday press run in the mid-1940s of more than 219,000, and 252,000 on Saturdays. The Saturday *La Presse* is noted for the quality of its writing and for its coverage of national and international news; this edition includes a colour supplement and many special features.

pressed glass, glassware produced by mechanically pressing molten glass into a plain or engraved mold by means of a plunger. Pressed glass can generally be distinguished from hand-cut glass because of its blunt-edged



Shallow bowl of colourless lacy glass pressed in the oak-leaf pattern, New England, *c.* 1830; in the Corning Museum of Glass, N.Y.

By courtesy of the Corning Museum of Glass, Corning, N.Y.

facets, mold seams (which are often removed by polishing, however), and precise, regular faceting.

Glass was cast in open molds by the Egyptians as early as 5 BC, but it was not until the 19th century that glassmakers learned how to shape glass by pressing. The use of a plunger enabled glassmakers to spread the thick, molten glass quickly throughout the mold before it solidified and thereby made it possible for them to shape the glass into intricate forms with elaborate designs. The first commercial glass-pressing machine was developed in 1825 by John P. Bakewell of the United States. The invention of this device quickly led to the mass production of glassware and greatly reduced its cost. The pressing process became the single most important factor in making glassware affordable for everyday use.

In 1827 Deming Jarves of the Boston and Sandwich Glass Company at Sandwich, Mass., began producing glassware decorated with "lacy" patterns, extremely intricate combinations of dots, circles, diamonds, leaves, and garlands that covered the entire surface of glass articles. These lacy patterns were unique to the new technique of pressing insofar as they could not be produced by the more traditional techniques of cutting and engraving.

Pressed glass was also produced in England; the first pressing machine was installed at Stourbridge by W.H.P. Richardson in 1833. From there pressed-glass technology spread to other parts of England and continental Europe as well. European pressed glass, characterized by a lacy pattern called "snakeskin," was as excessively ornamented as the American variety. Good quality flint glass was used exclusively until the mid-1860s, when a cheaper but more breakable soda-lime glass was introduced. Today glass pressing is used the world over in manufacturing all ordinary glassware.

pressure, in the physical sciences, the perpendicular force per unit area, or the stress at a point within a confined fluid. The pressure exerted on a floor by a 42-pound box the bottom of which has an area of 84 square inches is equal to the force divided by the area over which it is exerted; *i.e.,* it is one-half pound per square inch. The weight of the Earth's atmosphere pushing down on each unit area of the

Earth's surface constitutes atmospheric pressure, which at sea level is about 15 pounds per square inch (about one kilogram per square centimetre).

The pressure exerted by a confined gas results from the average effect of the forces produced on the container walls by the rapid and continual bombardment of the huge number of gas molecules. Absolute pressure of a gas or liquid is the total pressure it exerts, including the effect of atmospheric pressure. An absolute pressure of zero corresponds to empty space or a complete vacuum.

Measurement of pressures by ordinary gauges on Earth, such as a tire-pressure gauge, expresses pressure in excess of atmospheric. Thus, a tire gauge may indicate a pressure of 30 pounds (per square inch), the gauge pressure. The absolute pressure exerted by the air within the tire, including atmospheric pressure, is 45 pounds per square inch. Pressures less than atmospheric are negative gauge pressures that correspond to partial vacuums.

Hydrostatic pressure is the stress, or pressure, exerted equally in all directions at points within a confined fluid (liquid or gas). It is the only stress possible in a fluid at rest.

Lithostatic pressure, the stress exerted on a body of rock by surrounding rock, is a pressure in the Earth's crust somewhat analogous to hydrostatic pressure in fluids. Lithostatic pressure increases with depth below the Earth's surface.

pressure cooker, hermetically sealed pot which produces steam heat to cook food quickly. The pressure cooker first appeared in 1679 as Papin's Digester, named for its inventor, the French-born physicist Denis Papin. The cooker heats water to produce very hot steam which forces the temperature inside the pot as high as 266° F (130° C), significantly higher than the maximum heat possible in an ordinary saucepan. The higher temperature of a pressure cooker penetrates food quickly, reducing cooking time without diminishing vitamin and mineral content.

Pressure cookers are especially useful at high altitudes, where they alleviate the problem of low temperature boiling caused by reduced atmospheric pressure.

Modern innovations in pressure cooker design include safety locks, pressure regulators, portable cookers, and low-pressure fryers.

pressure drum (musical instrument): *see* dùndún pressure drum.

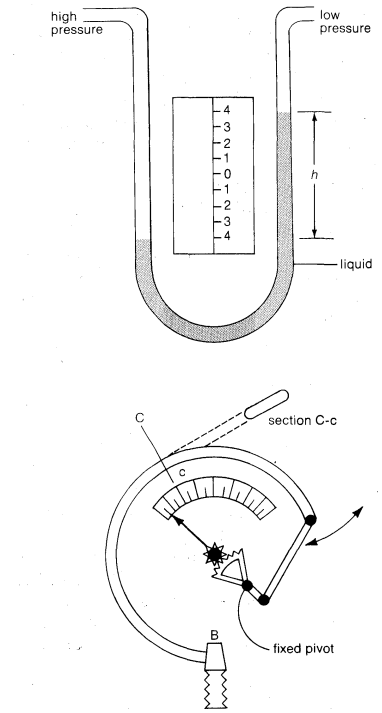
pressure flow (botany): *see* mass flow.

pressure gauge, instrument for measuring the condition of a fluid (liquid or gas) that is specified by the force that the fluid would exert, when at rest, on a unit area, such as pounds per square inch or newtons per square centimetre.

The reading on a gauge, which is the difference between two pressures, is known as the gauge pressure. If the lower of the pressures is the pressure of the atmosphere, the total, or absolute, pressure is the sum of the gauge and atmospheric pressures.

The simplest device for measuring static pressures up to about 90 pounds per square inch (62 newtons per square centimetre) is a U-tube manometer like the one shown at the top in the figure. The differential pressure is the difference in level (head) *h,* multiplied by the density *d* of the liquid and is indicated by the difference in level between the two columns of liquid. The manometer liquids most commonly used are mercury, oil, alcohol, and water.

The Bourdon-tube gauge, invented about 1850, is still one of the most widely used instruments for measuring the pressure of liquids and gases of all kinds, including steam,



Pressure gauges
(Top) Manometer; (bottom) Bourdon tube

water, and air up to pressures of 100,000 pounds per square inch (70,000 newtons per square centimetre). As shown at the bottom in the Figure, a flattened circular tube (cross-section in C-c) is coiled into a circular arc; one end is soldered to the central block **B** and is open to the fluid the pressure of which is to be measured; the other end is sealed and coupled to the pointer spindle. If the pressure inside the tube is greater than the outside pressure, the tube tends to straighten out, thus turning the pointer; the pressure is read on a circular scale.

Metal bellows and diaphragms are also used as pressure-sensing elements. Because of the large deflections for small pressure changes, bellows instruments are particularly suitable for pressures below atmospheric. Two corrugated diaphragms sealed at their edges to form a capsule, which is evacuated, are used in aneroid barometers to measure atmospheric pressure (*see* altimeter).

These instruments employ mechanical linkages and so are primarily useful for measuring static pressures or pressures that change slowly. For rapidly changing pressures, electrical pressure transducers that convert pressure to an electrical signal are more suitable. These include strain gauges; moving contact resistance elements; and inductance, reluctance, capacitative, and piezoelectric devices. Electromechanical transducers, which are used in hydraulic controllers, where speed and power are needed, convert changes in pressure of fluid to electrical signals.

pressure sore: *see* bedsore.

Prestea, town, Western Region, southwestern Ghana, West Africa, on the west bank of the Ankobra River, about 60 mi (100 km) northwest of Cape coast. It is linked by railroad with Tarkwa and with Sekondi-Takoradi, both to the southeast. Prestea is a centre of trade for the surrounding agricultural region, which produces rice, cassava, corn (maize), taro, and timber. Industries produce beverages, soap, matches, salt, textiles, vegetable oils, cocoa products, glass, and wood and wood products. Prestea is one of the mining towns of Ghana where gold is mined and refined on a large scale. Other minerals mined include manganese, iron ore, and bauxite. It is the headquarters of the Prestea Oil Palm Estates. Pop. (1982 est.) 17,832.

Prester John, also called PRESBYTER JOHN, or JOHN THE ELDER, legendary Christian ruler of the East, popularized in medieval chronicles and traditions as a hoped-for ally against the Muslims. Believed to be a Nestorian (*i.e.,* a member of an independent Eastern Christian Church that did not accept the authority of the patriarch of Constantinople) and a king-priest reigning "in the Far East beyond Persia and Armenia," Prester John was the centre of a number of legends that harked back to the writings of "John the Elder" in the New Testament.

The legend arose during the period of the Crusades (late 11th–13th century), when European Christians hoped to regain the Holy Land (Palestine) from the Muslims. In 1071 Jerusalem had been conquered by the Seljuq Turks. Based on a report about Prester John by Bishop Hugh of Gebal in Syria (modern Jubayl, Lebanon) in 1145 to the papal court at Viterbo, Italy, the story was first recorded by Bishop Otto of Freising, Ger., in his *Chronicon* (1145). According to this, John, a wealthy and powerful "priest and king," reputedly a lineal descendant of the Magi who had visited the Christ child, defeated the Muslim kings of Persia in battle, stormed their capital at Ecbatana, and intended to proceed to Jerusalem but was impeded in the last goal because of difficulties in crossing the Tigris River. The battle referred to by Hugh may have been that fought at Qatwan, Persia, in 1141, when the Mongol khan Yeh-lü Ta-shih, the founder of the Karakitai empire in Central Asia, defeated the Seljuq sultan Sanjar. The title of the Karakitai rulers was Gur-khan, or Kor-khan, which may have been changed phonetically in Hebrew to *Yohanan* or, in Syriac, to *Yuḥanan,* thus producing the Latin Johannes, or John. Though the Gur-khans were Mongol Buddhists, many of their leading subjects were Nestorians, and according to a report by the Franciscan missionary Willem van Ruysbroeck in 1235, the daughter of the last Gur-khan and wife of King Küchlüg of the Naiman, a Central Asian people, was a Christian. Küchlüg, whose father's name was Ta-yang Khan (Great King John in Chinese), was defeated by the great Mongol ruler Genghis Khan in 1218. In 1221, Jacques de Vitry, bishop of Acre in Palestine, and Cardinal Pelagius, a Western churchman accompanying crusaders at Damietta in Egypt, reported to Rome information about a Muslim defeat by a certain King David of India, the son or grandson of Prester John. This King David probably was none other than Genghis Khan. Because of rumours, lack of reliable information, or wishful thinking on the part of European Christians, the historical events, personages of the period, and geographical areas involved became interwoven into the legend of Prester John.

A 13th-century chronicler, Alberic de Trois-Fontaines, recorded that in 1165, a letter was sent by Prester John to several European rulers, especially Manuel I Comnenus, the Byzantine emperor, and Frederick I Barbarossa, the Holy Roman emperor. A literary fiction, the letter was in Latin and was translated into various languages, including Hebrew and Old Slavonic. Though addressed to the Byzantine (Greek) emperor, no Greek text of the letter is known; and its anti-Byzantine bias is demonstrated by the Byzantine emperor's being addressed as "governor of the Romans," rather than "emperor." In the letter, the realm of Prester John, "the three Indies," is described as a land of natural riches, marvels, peace, and justice administered by a court of archbishops, priors, and kings. Preferring the simple title presbyter, John declared that he intended to come to Palestine with his armies to battle with the Muslims and regain the Holy Sepulchre, the burial place of Jesus.

The letter notes that John is the guardian of the shrine of St. Thomas, the apostle to India, at Mylapore, India.

In response to an embassy from Prester John, Pope Alexander III sent a reply in 1177 to John, "the illustrious and magnificent king of the Indies and a beloved son of Christ." The fate of this letter is unknown, though its intent probably was to gain support for Alexander in his controversies with Barbarossa. In the 13th and 14th centuries various missionaries and lay travellers, such as Giovanni da Pian del Carpini, Giovanni da Montecorvino, and Marco Polo, all searching for the kingdom of Prester John, established direct contact between the West and the Mongols.

After the mid-14th century, Ethiopia became the centre of the search for the kingdom of Prester John, who was identified with the negus (emperor) of that African Christian nation. The legend, however, locates Prester John in Asia, especially in Nestorian areas.

prestidigitation (popular theatre): *see* conjuring.

Preston, district (borough), county of Lancashire, England, at the lowest bridging point of the Irish Sea estuary, on the River Ribble. Its area is 55 sq mi (142 sq km).

The town grew near the site of a Roman fort at Walton-le-Dale, on a ridge overlooking the river. Its site, on a major north–south routeway, established it as a market centre in the Middle Ages, and the first of 14 charters was granted about 1179. This charter also granted a merchant guild, which has met regularly ever since. By the Tudor period (beginning in the late 15th century), Preston was a great inter-regional market centre with a central position at the focus of the road system. Domestic industry, especially woollen and linen weaving, grew as a response to the town's increasing importance. During the English Civil War, Preston, the Lancashire Royalist headquarters, was besieged and captured, and the fortifications were destroyed. Royalist forces were defeated by the Parliamentary forces of Oliver Cromwell at Preston in 1648. Further stimulus to growth came in 1777, when the first cotton-spinning mill was built in Moor Lane. By 1835 there were 40 factories, mainly spinning, producing 70,000 lb (32,000 kg) of cotton yarn weekly. Improvements in port facilities after 1843 established a trade in Lancashire coal, cotton goods, and raw materials.

Preston, with two large covered markets, is the chief mart for the produce of the Fylde agricultural district. The cattle market holds thrice-weekly sales throughout the year.

Despite decline of the cotton textile industry, the economy has remained strong through diversification. Preston's position on the main London to Scotland railway line and its close proximity to the motorway between Birmingham and Carlisle has made the town attractive to new industries. Increases in engineering and in vehicle and aircraft manufacture more than compensated for jobs lost through mill closures. The town has the largest rayon factory in England.

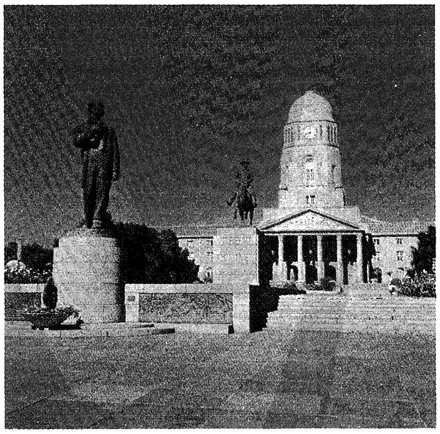
The numerous parish churches include St. John's (1855) on the site of earlier buildings. The Harris Art Gallery, Library and Museum were established by the trustees of E.R. Harris in 1879 and contain several personal book collections. A grammar school was founded in 1550.

Preston, as the principal administrative centre of Lancashire, has a growing service sector. It is one of the focuses (with Leyland and Chorley) of Central Lancashire new town. Pop. (1983 est.) district, 125,200.

Prestwick, burgh, Kyle and Carrick district, Strathclyde region of western Scotland, on the Firth of Clyde, contiguous with the city of Ayr to the south. Prestwick's international airport (opened 1935) is the most important in Scotland, its development being aided by particularly favourable climatic conditions. The town, a golfing and holiday resort with good beaches, also supports coal mining, aircraft construction, and light engineering industries. Pop. (1981) 13,600.

Pretiglian Glacial Stage, also called BRÜGGEN STAGE, major division of Pleistocene time and deposits in the Netherlands (the Pleistocene Epoch began about 2,000,000 years ago and ended about 10,000 years ago). The Pretiglian Stage preceded the Tegelen (Tiglian) Stage. The Pretiglian is the earliest major division of the Pleistocene in the Netherlands.

Pretoria, city, capital of Transvaal and administrative capital of the Republic of South Africa. Pretoria encompasses 229 sq mi (592 sq km) along both sides of the Apies River and extends into the western foothills of the



Monuments to Andries Pretorius (equestrian) and his son Marthinus, Pretoria, S.Af.
Art Resource—EB Inc.

Magaliesberg on the east. Founded in 1855 by Marthinus, son of Andries Pretorius, the Boer statesman (for whom the city was named), it became the capital of the Transvaal in 1860, administrative capital of South Africa in 1910, and a city in 1931. During the South African War, Winston Churchill was imprisoned there (1899) until his escape. The Peace of Vereeniging, ending the war, was signed at Melrose House on May 31, 1902.

Pretoria is well planned and famous for its streets lined with jacaranda trees. Church Street stretches east–west for 12 mi (20 km). The post-World War II boom is evidenced by skyscrapers around Church Square. Landmarks commemorate Boer history (notably the Voortrekker Monument and the Paul Kruger and Louis Botha statues). Its six museums include Paul Kruger's house and the National Cultural History and Open Air Museum.

Pretoria is adorned with large parks, notably the terraced gardens of the Union Buildings, the sunken gardens of Venning Park, five municipal nature reserves, and the National Zoological Gardens. It has Anglican and Roman Catholic cathedrals and is the seat of the universities of Pretoria (founded 1908, university 1930) and South Africa (founded 1873, correspondence school 1946) and technical and teacher-training colleges. At the city's outskirts are the Onderstepoort Veterinary Research Institute and the Council for Scientific and Industrial Research, the nation's largest research organization.

Pretoria is primarily a seat of government, and most people are employed in the service sector. It is also an important rail centre, with an industrial economy based upon the South African Iron and Steel Corporation (Iscor), in operation since 1934. Other activities include engineering, food processing, and diamond mining. Pop. (1980 est.) mun., 528,407.

Pretoria, University of, Afrikaans UNIVERSITEIT VAN PRETORIA, state-supported coeducational institution of higher learning at Pretoria, S.Af. Founded in 1908, the university was at first paired with Transvaal University College in Johannesburg, but in 1910 the two institutions were separated, the Johannesburg section being reincorporated as South African School of Mines and Technology, while the Pretoria section retained the name of Transvaal University College. Originally offering courses in arts, sciences, and law, the college added faculties of agriculture (1917), theology (1918), economics and political science (1919), veterinary science (1920), and music (1923). In 1930 it assumed the name of University of Pretoria, subsequently establishing faculties of education, medicine, dentistry, and engineering. The language of instruction is Afrikaans.

Pretoria Zoo, formally NATIONAL ZOOLOGICAL GARDENS OF SOUTH AFRICA, zoo noted for its wildlife conservation programs. It was opened in 1899 by the State Museum of the South African Republic on a small stretch of land along the Apies River, which flows through Pretoria. In 1913 the zoo became the Transvaal Zoological Gardens, independent of the state museum; in 1916 it adopted its present name, and in 1933 the state took over management of the institution. Over the years the zoo gradually expanded and now occupies both sides of the Apies River, covering a total area of about 32 hectares (80 acres). The zoo's collection of antelope is one of the largest in the world, and more than 20 South African species have been bred under the supervision of its staff. On the 4,047-hectare (10,000-acre) game-breeding centre, opened in 1974 near Lichtenburg, the zoo has successfully bred the endangered scimitar-horned oryx and the banteng. It also operates a 40.5-hectare (100-acre) cheetah breeding area called De Wildt. The Pretoria Zoo was the first to breed the aardwolf, a member of the hyena family.

Pretorius, Andries (Wilhelmus Jacobus) (b. Nov. 27, 1798, near Graaff-Reinet, Cape Colony—d. July 23, 1853, Magaliesberg, Transvaal), outstanding Boer leader in the Great Trek from British-dominated Cape

Pretorius, portrait by an unknown artist
By courtesy of the South African Information Service

Colony who became the dominant military and political figure in Natal and later in the Transvaal.

After taking part in several frontier wars in the Cape Colony, Pretorius went on an exploratory trek in 1837; he left his farm permanently to settle in Natal the following year. When King Dingane's Zulus murdered trek leader Piet Retief and his party and threatened the safety of the settlers in Natal, Pretorius raised a commando force of 500 and defeated 10,000 Zulus at Blood River, killing 3,000 with hardly any loss of his own men. Dingane's brother Mpande then organized a revolt that won the support of Pretorius. Their combined forces defeated Dingane at the Battle of Magono (January 1840), putting Mpande on the Zulu throne. That same year Pretorius succeeded in getting the Boer settlements in the Transvaal to join in a federal union with Natal.

In 1842 the British occupied Durban, in Natal, and, when Pretorius failed to dislodge them, he resigned as commandant general. After the annexation of Natal, he remained on friendly terms with the British authorities. But when the Cape governor, Sir Henry Pottinger, ignored his plea to settle Boer grievances, Pretorius decided to lead a trek once more to the remote Transvaal (1847). The territory known as the Orange River Sovereignty was annexed by the British the following year, provoking Pretorius and the Transvaal Boers to verbal and then armed protest. After taking Bloemfontein, Pretorius and his followers were defeated at Boomplaats (August 1848). Pretorius fled to the Transvaal with a price of £2,000 on his head.

As one of the four commandants general of the Transvaal, Pretorius played a leading role in negotiations with the British (who had removed the price on his head). That conference resulted in the Sand River Convention (Jan. 17, 1852) by which the independence of the Transvaal (the South African Republic) was recognized. With the British in an anti-imperialist mood, Pretorius pressed further for their acceptance of the independence of the Boers in the Orange River Sovereignty, which was finally guaranteed by the Bloemfontein Convention (February 1854), seven months after his death.

Articles are alphabetized word by word, not letter by letter

Pretorius, Marthinus Wessel (b. Sept. 17, 1819, near Graaff-Reinet, Cape Colony—d. May 19, 1901, Potchefstroom, South African Republic), Boer statesman, soldier, eldest son of the Great Trek leader Andries Pretorius, and the first president of the South African Republic. Having also served as president of the Orange Free State, he was the only man to have held both offices. Despite that success, however, his plans to unite the sister republics failed.

Pretorius, a man of little formal education, joined his father in the Great Trek (1838) to Natal, where he fought the Zulus. When his father, whom he had accompanied north to the Transvaal, died in 1853, Marthinus succeeded him as commandant general of the districts of Potchefstroom and Rustenburg and continued his father's efforts toward uniting the trekker Boers. After participating in the founding of the South African Republic (an amalgamation of republics in the Transvaal), Pretorius was elected president in 1857; two years later he was also elected president of the Orange Free State. The independent spirit of the Boers combined with Pretorius' own high-handed methods not only prevented the amalgamation of the two states but also led to civil war and anarchy in the Transvaal. In April 1863 he resigned from the Free State presidency and concentrated on reconciling factions in the Transvaal, where he was elected president of a reorganized South African Republic in May 1864.

As head of the South African Republic, Pretorius worked to improve its administration and, with less success, to solve its financial problems. In external affairs, he gained recognition for the republic abroad and sought to extend its boundaries toward Bechuanaland in the west, beyond the Limpopo River to the north, and toward the sea in the east. Objections by Portugal and Britain caused him to withdraw most of the claims, however. In 1869 he became president again by an overwhelming vote. His popularity waned, however, when he failed to uphold his nation's claim to the diamond fields in the lower Vaal, especially for allowing Natal's governor to arbitrate the dispute without consulting his own Volksraad (parliament). When the award went against the republic in 1871, Pretorius resigned and retired from public life.

After British annexation of the Transvaal (1877), Pretorius rose once more to prominence as a leader of passive resistance. When the Boers finally rebelled (December 1880), he was appointed a member of the ruling triumvirate and became a signatory to the Pretoria Convention (August 1881), which restored independence. The triumvirate dissolved (May 1883) with the election of Paul Kruger as president. Pretorius then retired permanently.

Pretty Polly (foaled 1901), English racehorse (Thoroughbred) who won 22 of 24 races in her four-year career and earned more than $130,000. Pretty Polly was foaled by Admiration and sired by Gallinule. Exceptional from the start of her career, the two-year-old filly won her first race, the British Dominion Plate at Sandown, by 10 lengths according to the official record, but the consensus placed the margin of victory at about 40 lengths. She won her eight other races of the 1903 season and seven races of eight in 1904, including the One Thousand Guineas at Newmarket and the Saint Leger. In 1905 she also won all her races. In her last year of racing, 1906, she won two races. She was not successful at breeding.

pretzel, a brittle, glazed-and-salted cracker of German or Alsatian origin. Made from a rope of dough typically fashioned into the shape of a loose knot, the pretzel is briefly boiled and then glazed with egg, salted, and baked. Pretzels are customarily eaten as a snack with beer.

In many large cities the soft pretzel is a familiar commodity sold hot, often with mustard, from the pushcarts of street vendors. Dry, nut-brown hard pretzels in a variety of configurations, including thick and thin knots, sticks, and nuggets, are commercially packaged in the United States and elsewhere and marketed on a wide scale.

Preuss, Hugo (b. Oct. 28, 1860, Berlin—d. Oct. 9, 1925, Berlin), German political theorist and legal expert who became the principal author of the constitution of the Weimar Republic.

Schooled in the organic-state philosophy of the German political theorist Otto von Gierke, Preuss sustained throughout his own writings the theoretical orientation of his master. A liberal in the politics of Germany under the Kaiser, he belonged to the Progressive People's Party and contributed to such liberal organs as *Nation* and *Die Hilfe* ("Assistance"). As a leading authority on public law, he was commissioned by the new republican government in November 1918 to draft a national constitution. Drawing extensively on both German and foreign concepts and precedents, he contributed a strong preference for administrative centralization; he sought to combine the political and economic principles of both liberalism and Socialism in the constitution. Subsequently, as Weimar minister of the interior (February–June 1919) and then as special government commissioner, he defended his work before the national parliament.

From 1919 he belonged to the German Democratic party. Among his published works, his *Die Entwicklung des deutschen Städtewesens* (1906; "The Development of the Organization and Constitution of German Cities") is probably the most important.

Preussen: *see* Prussia.

preventive detention, the practice of incarcerating accused individuals before trial on the assumption that their release would not be in the best interest of society—specifically, that they would be likely to commit additional crimes if they were released. Preventive detention is also used when the release of the accused is felt to be detrimental to the state's ability to carry out its investigation. In some countries the practice has been attacked as a denial of certain fundamental rights of the accused.

The procedure has been used primarily in civil-law countries, in some of which, particularly France and Belgium, the rights of individuals detained before trial were more carefully protected. In 1970 in France the practice was placed exclusively in the hands of the courts. In Belgium a review of every individual detained in this manner must be held monthly to determine if his release would still constitute a threat to society.

Preventive detention is used to a considerable extent in countries ruled by dictators; it is also found in the Soviet Union, particularly in cases in which the accused individuals are perceived as political or security threats to the government. In these countries, where there is often little concern for the protection of individual rights, preventive detention has been left almost exclusively in the hands of police and prosecuting authorities. Where there is greater concern for individual rights, the courts have been given control; but critics maintain that the practice in any form does not lend itself to vigorous and continuous protection of individual rights.

Court-supervised preventive detention was adopted in 1970 in the United States by the federal government for the District of Columbia over much protest that the measure constituted imprisonment without due process and amounted to the curtailment of rights only because of behaviour that might occur. The procedure has been used sparingly, and its constitutionality has not been fully adjudicated in the courts. *See also* accused, rights of; due process.

preventive medicine, efforts directed toward the prevention of disease, either in the community as a whole—an important part of what is broadly termed public health—or in the individual.

Hippocrates, the Greek physician of the 5th century BC, classified causes of disease into those concerned with seasons, climates, and external conditions, and those more personal causes such as irregular food, exercise, and habits of the individual. Through the Middle Ages the principles of preventive medicine were ignored, in spite of the scourges of leprosy and plague. With the Renaissance came the new learning that revolutionized the whole content of medicine. Practitioners again observed the relation of the seasons, environmental conditions, and personal contact to the incidence of disease.

Concurrent with the growth of medical knowledge there was an empirical movement of practical prevention. For example, in 1388 there was passed the first sanitary act in England, directed to the removal of nuisances; in 1443 came the first plague order recommending quarantine and cleansing; and in 1518 the first rough attempts at notification of epidemic disease and isolation of the patient were made. The study of mortality statistics was initiated in England in the 17th century. The basis of epidemiology was laid in the mid-17th century. In 1700 a treatise on occupational disorders was published in Italy. An English practitioner in the first half of the 18th century wrote on poisons, on plague and methods of its prevention, and on smallpox, measles, and scurvy. Vaccination was introduced in 1798. The early and middle years of the 19th century were notable for discoveries in the transmission of contagious diseases such as typhus, cholera, typhoid fever, and childbed (puerperal) fever. In the same period increasing attention was given to problems of hygiene and nutrition.

The modern era in preventive medicine opened in the mid-19th century with Louis Pasteur's discovery of the role of living microbes as the cause of infections. Toward the close of the century the principle of insect-borne transmission of disease was established. Serological tests were developed, such as the Widal reaction for typhoid fever (1896) and the Wassermann test for syphilis (1906). An understanding of the principles of immunity led to the development of active immunization to specific diseases. Parallel advances in treatment opened other doors for prevention—in diphtheria by antitoxin and in syphilis by arsphenamine. In 1932 the sulfonamide drugs and later the antibiotics including penicillin, streptomycin, chlortetracycline, and chloramphenicol afforded new opportunities of prevention and cure of bacterial diseases.

After 1900 there were many advances in preventive medicine other than those related to infectious diseases. The use of X rays and radioactive substances in the diagnosis and treatment of disease (*e.g.,* tuberculosis and cancer) as well as in fundamental physiological research opened new possibilities. A greater understanding of endocrine functions, with the production of prepared hormone extracts such as insulin, led to preventive measures in certain metabolic diseases. The role of nutrition in health and disease and the isolation of many essential food factors illustrated the importance to health of adequate diet. Other 20th-century advances in preventive medicine included a wider recognition of psychological factors in relation to total health, new surgical techniques, new methods of anesthesia, and genetics research.

Prévert, Jacques(-Henri-Marie) (b. Feb. 4, 1900, Neuilly-sur-Seine, Fr.—d. April 11, 1977, Omonville-la-Petite), French poet who composed ballads of social hope and sentimental love; he also ranked among the foremost of screenwriters, especially during the 1930s and '40s.

Prévert, 1951
Lipnitzki—H. Roger-Viollet

From 1925 to 1929 Prévert was associated with the Surrealists Robert Desnos, Yves Tanguy, Louis Aragon, and André Breton and renewed, in their style, the ancient tradition of oral poetry that led him to a highly popular form of "song poems," which were collected in *Paroles* (1945; "Words"). Many were put to music by Josef Kosma and reached a vast audience of young people who liked Prévert's anticlerical, anarchistic, iconoclastic tones, crackling with humour. He lashed out at stupidity, hypocrisy, and war, and he sang of lovers in the street and the metro and of simple hearts and children. Most popular is his *Tentative de description d'un dîner de têtes à Paris-France* (1931; "Attempt at a Description of a Masked Dinner at Paris, France").

Prévert mastered the art of the small sketch that catches the reader off guard. He used free verse, irregular verse, occasional rhymes, puns, cascades of words intentionally in disarray, enumerations, antithesis, and other devices.

He also wrote for a group of politically militant dramatists with whom he eventually visited the Soviet Union (1933). Prévert wrote many excellent film scripts. His best ones, made for the director Marcel Carné, are *Drôle de drame* (1937; "Odd Drama"), *Les Visiteurs du soir* (1942; "The Visitors of the Evening"), and *Les Enfants du paradis* (1944; "The Children of Paradise"). Collections of his poems include *Histoires* (1946; "Stories"), *Spectacle* (1951), *Grand bal du printemps* (1951; "Grand Ball of Spring"), *Charmes de Londres* (1952; "Charms of London"), *Histoires et d'autres histoires* (1963; "Stories and Other Stories"), and *Choses et autres* (1972; "Things and Other Things").

Préveza, port, chief town, and capital, *nomós* (department) of Préveza, western Greece, on the north side of the entrance to the Amvrakikós Gulf. Linked by highway to Arta and Ioánnina, Préveza exports olives, dairy products, hides, wool, and vegetables. Goods must be transferred by lighter or barge via the Khrisanthis channel (17 feet [5.2 m] deep).

Préveza was founded as Berenicia about 290 BC by Pyrrhus, king of Epirus. In 31 BC Octavian, the future emperor Augustus, defeated Antony in a famous naval battle off the gulf's entrance. The settlement probably was eclipsed when Augustus founded nearby Nicopolis Actia. In 1499 it was occupied by the Venetians, ceded to the Turks by the Treaty of Carlowitz in 1699, and retaken by Venice in 1717. In 1798, a year after it had passed to the French, it was seized by Ali Pasha of Ioánnina. In 1912 it fell to the Greek army and in 1913 was incorporated into the Greek kingdom. Pop. (1981) 13,624.

Previn, André (George), original name ANDREAS LUDWIG PRIWIN (b. April 6, 1929, Berlin, Ger.), German-born American pianist, composer, and conductor, especially sympathetic to French Impressionist music, 19th- and 20th-century Russian music, and 20th-century English music. His film arrangements of Broadway musical scores won him four Academy Awards.

Previn's family fled Nazi persecution and moved to Los Angeles in 1939. While still a teenager he was recognized as a gifted jazz pianist and orchestrator, performing various orchestrating and arranging tasks for Metro-Goldwyn-Mayer in the 1940s and serving under MGM contract from 1952 to 1960. Thereafter he scored the music for films for several studios. Meanwhile he became a noted pianist (both classical and jazz) and started conducting. He was principal conductor of the Houston Symphony from 1967 to 1970, principal conductor of the London Symphony from 1968 to 1979, principal conductor of the Pittsburgh Symphony from 1976 to 1984, and musical director of the Los Angeles Philharmonic from 1985 to 1989. For the Royal Philharmonic Orchestra he was musical director from 1985 to 1986 and principal conductor from 1987.

In addition to his scores for Hollywood, he composed a symphony, concertos, chamber music, and songs. His books include *Music Face to Face* (1971) and *Orchestra* (1979).

Prévost, Françoise (b. *c.* 1680, Paris, Fr.—d. 1741, Paris), French ballerina, the leading dancer of her generation. Her precision, lightness, and grace helped establish the technique of classical ballet; she was also noted for her mime and dramatic ability.

Prévost made her debut at the Paris Académie (now Opéra) in *Atys* and later succeeded Marie Subligny as premiere danseuse. Her performance with Jean Balon in 1708 in *Les Horaces,* an early dance pantomime based on Pierre Corneille's play *Horace,* is said to have moved the audience to tears. After retiring from the Opéra in 1730, she was replaced as leading female dancer by her students Marie Camargo and Marie Sallé.

Prevost, Sir George, 1ST BARONET (b. May 19, 1767, New York, N.Y. [U.S.]—d. Jan. 5, 1816, London, Eng.), soldier in the service of Great Britain, who was governor in chief (1811–15) of Upper and Lower Canada (now Ontario and Quebec). He was known for his conciliatory policies toward French-Canadians.

Prevost attained the rank of major in the British army in 1790. From 1794 to 1796 he saw active service in the West Indies; in 1798, as a brigadier general, he was made military governor of St. Lucia. He dealt successfully with the French there, adopting a policy of conciliation toward them, and also took over as civil governor. He was created a baronet in 1805 for his services in the West Indies.

In 1808 Prevost went to Nova Scotia as lieutenant governor. Four years later he was transferred to Quebec, where he was administrator of Lower Canada, then governor in chief of both Canadas. The previous governor had alienated many of the French-Canadians, but Prevost endeavoured to meet their demands. During the War of 1812, Prevost commanded the British forces in Canada; his military reputation was marred by two incidents: in 1813 he withdrew after a successful attack on Sackets Harbor, N.Y., and in 1814 he was defeated at Plattsburg, N.Y., following another baffling retreat. Prevost was recalled to London in 1815 to face a court-martial, but he died before it was held.

Prévost d'Exiles, Antoine-François, Abbé (b. April 1, 1697, Hesdin, Fr.—d. Nov. 25, 1763, Chantilly), prolific French novelist whose fame rests entirely on one work—*Manon Lescaut* (1731; in full *Histoire du Chevalier des Grieux et de Manon Lescaut;* "Story of the Chevalier of Grieux and of Manon Lescaut").

Originally published as the final installment of a seven-volume novel, *Mémoires et aventures d'un homme de qualité qui s'est retiré du monde* (1728–31; "Memories and Adventures of a Man of Quality Who Has Retired from the World"), Prévost's *Manon Lescaut* is the basis of the operas *Manon,* by Jules Massenet, and *Manon Lescaut,* by Giacomo Puccini. A classic example of the 18th-century novel of feeling, *Manon Lescaut* tells the story of a young man of good family who ruins his life for a courtesan.

From an early age, Prévost displayed many of the weaknesses characteristic of the hero of his most famous work. Two enlistments in the army alternated with two entries into the novitiate of the Society of Jesus, from which he was dismissed in 1721. In that year he took vows as a Benedictine monk and in 1726 was ordained a priest. In 1728 he fled to England. One of his numerous love affairs caused him

Abbé Prévost, detail of a drawing by Georg Friedrich Schmidt, 1745; in the Musée des Beaux-Arts, Tours, Fr.
By courtesy of the Musee des Beaux-Arts, Tours, Fr.; photograph, R. Arsicaud et Fils

to lose his job there as a tutor and to go to Holland in 1730. In 1735 Prévost returned to England to escape his Dutch creditors and was briefly imprisoned in London for forgery. After secretly returning to France, he was reconciled with the Roman Catholic Church (although he may have been a Protestant during his exile).

prévôt, English PROVOST, in French law, an inferior royal judge under the ancien régime, who, during the later Middle Ages, often served as an administrator of the domain. The position appears to date from the 11th century, when the Capetians sought a means to render justice within their realm and to subject their vassals to royal control.

The *prévôts* performed a variety of functions: they collected taxes and fines for the king, served as military commanders for the district, and sat as lower-court judges. For a long time they were the only local judges representing the Capetians; they held their offices as fiefs and collected their revenues and fees as tax farmers. Consequently, they were able to achieve considerable independence of the crown, and abuses followed. By the 13th century they were brought under the control of the *baillis* (*see* bailiff), and after 1493 the *prévôts* were paid by the crown as salaried officials. Their powers were further limited in the 17th century, when the *prévôts* lost all except their judicial powers. In the south of France the *prévôts* were known as *viguiers*.

Prêy Veng, town, southern Kampuchea (Cambodia). Prêy Veng is linked to Phnom Penh, the national capital, by a national highway. The former (prior to 1975) rubber plantations of Phumi Péam Cheăng near the town have the ruins of a Khmer temple. Another important town nearby is 'Neăk Loeăng, where there is a ferry across the Mekong River.

The surrounding region consists mostly of the flat to gently rolling Mekong River flood plains. Rice, corn (maize), and cotton are the chief crops. Pop. (1971 est.) 10,762.

Priam, in Greek mythology, the last king of Troy. He succeeded his father, Laomedon, as king and extended his control over the Hellespont. He married first Arisbe (a daughter of Merops the seer) and then Hecuba, by whom he had many children, including his favourites, Hector and Paris. Homer described Priam as an old man, powerless but kindly, not even blaming Helen, the wife of Paris, for all his personal losses resulting from the Trojan War. In the final year of the conflict, Priam saw 13 sons die: the Greek warrior Achilles killed Polydorus, Lycaon, and Hector within one day. The death of Hector, which signified the end of Troy's hopes, also broke the spirit of the king. Priam's paternal love impelled him to brave the savage anger of Achilles and to ransom the corpse of Hector; Achilles, respecting the old man's feelings and foreseeing his own father's sorrows, returned the corpse. When Troy fell, Neoptolemus, the son of Achilles, butchered the old king on an altar. Both Priam's death and his ransoming of Hector were favourite themes of ancient art. *See also* Hecuba.

priapism, a persistent, painful erection of the penis unaccompanied by sexual excitation or desire.

When normal erection occurs, the sides and the bottom of the penis, the corpora cavernosa and the corpus spongiosum, respectively, become engorged with blood so that the penis enlarges, hardens, and assumes an erect position. The major symptom of priapism is pain and tenderness in the enlarged portions. There may be a short period during the onset when pleasurable sensations are felt, but this quickly gives way to constant pain. In only about 25 percent of the cases can the cause be identified. The causes are generally classified as nervous or mechanical disorders. The nervous disorders may be in the spinal nerves or in the peripheral nerves that lead to the reproductive tract. Syphilitic involvement of the nervous system can cause cases of priapism that may be prolonged for years; most instances of the disorder last only a few hours, days, or weeks.

Not all cases involve the full penis. Sometimes only the corpora cavernosa are engorged. When the corpus spongiosum is also erect, serious urinary difficulties may result. The urethra, which is the duct for urine excretion, runs down the middle of the corpus spongiosum. Constant prolonged restriction of the tube can lead to retention of urine in the bladder. In some cases catheterization (mechanical drainage) can relieve the buildup. If urine retention is not relieved, urine can back up into the kidneys, with serious kidney disease as a result.

Among mechanical causes of priapism are obstructions such as large blood clots or tumours in the penis. In rare cases, chronic priapism may result from exceptionally prolonged and rough copulation. It is caused by a blood clot (thrombosis) in the vein that releases the blood from the penis. It is distressing, lasting for days or weeks, and it generally leaves the affected person permanently impotent. The penis is at first tensely erect and painfully tender. After several days, there is gradual lessening of tension and pain; the organ may remain semi-erect for weeks before it gradually returns to a flaccid state. In this prolonged period the erectile tissue of the penis is replaced by nonfunctioning fibrous scar tissue, so that the sufferer is rendered impotent. This type of priapism may be helped by early treatment with anticoagulant drugs or by drainage with large needles inserted into the erectile tissue.

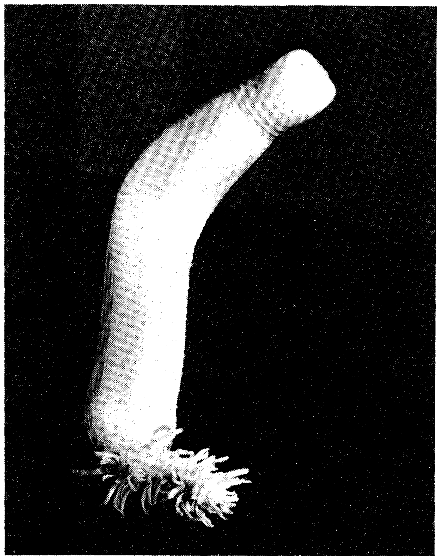
Children have been known to have brief episodes of priapism from full bladders, local irritation, or prolonged masturbation. Disorders such as inflammation of the urethra, calcium stones in the urethra, infections of the prostate gland, or rectal parasites can also cause the condition. More prolonged cases arise from congenital syphilis, leukemia, or sickle cell anemia. Male infants and toddlers are not exempt, but in most cases the sufferer is older.

Ordinarily, treatment is directed toward the cause. Usually only when abscesses or tumours are involved is the penis surgically opened.

priapulid, any of some 15 species of predatory, marine, mud-inhabiting, unsegmented worms of uncertain classification. Sometimes considered a class (Priapulida) of the phylum Aschelminthes, priapulids are perhaps best considered to be a very small phylum with no clear relationship to any other. The largest of the priapulids are 10 to 15 cm (4 to 6 inches) long and inhabit the colder seas, while the smallest, several millimetres long, inhabit warmer seas.

The presoma, or anterior end of the body, with the mouth at the tip, can be retracted into the trunk and is used in locomotion as well as in feeding. The body is covered with a cuticle that is secreted by the hypodermis. Beneath this cuticle lie body-wall muscles that enclose a spacious body cavity. The cuticle hardens into a ridged case (the lorica) during the larval stage. It forms spines on the presoma, especially around the mouth, within the pharynx, and to a lesser degree elsewhere on the body, and it molts as the worm grows to an adult.

The mouth of the priapulid leads into a large muscular pharynx, a short esophagus, a larger intestine (with musculature), and a rectum with the anus at the hind end. There is no circulatory system. The excretory system



Priapulid (*Priapulus caudatus*)
Walter Dawn

consists of flame cells (solenocytes) opening by ducts to the exterior. The nervous system is very simple, consisting of a nerve ring surrounding the mouth, a ventral nerve cord, and peripheral nerves. The reproductive organs are tubular, with posterior openings, and internal fertilization is known to occur in one species.

A number of fossil species that look much like modern forms are known from the Cambrian Period. The evolutionary relationships and therefore the zoological classification rest on the interpretation of the epithelial lining of the body cavity. If it is an epithelium, as some zoologists hold, the priapulids are coelomates; if the nuclei belong instead to the musculature, as others claim, the priapulids are pseudocoelomates, possibly Aschelminthes.

Priapus, in Greek religion, a god of animal and vegetable fertility whose cult was originally located in the Hellespontine regions, centring especially on Lampsacus. He was represented in a caricature of the human form, grotesquely misshapen, with an enormous phallus. The ass was sacrificed in his honour, probably because the ass symbolized lecherousness and was associated with the god's sexual potency. In Greek mythology his father was Dionysus, the wine god; his mother was either a local nymph or Aphrodite, the goddess of love.

In Hellenistic times Priapus' worship spread throughout the ancient world. Sophisticated urban society tended to regard him with ribald amusement, but in the country he was adopted as a god of gardens, his statue serving as a combined scarecrow and guardian deity. He was also the patron of seafarers and fishermen and of others in need of good luck; his presence was thought to avert the evil eye.

Pribićević, Svetozar (b. Oct. 26, 1875, Karlovac, Croatia, Austria-Hungary [now in Yugoslavia]—d. Sept. 15, 1936, Prague), Yugoslav politician, leader of the Serbs within Austria-Hungary before the dissolution of the empire at the end of World War I.

Initially he favoured a centralized Yugoslav nation rather than a federation of the South Slav peoples; as Yugoslav minister of the interior, he jailed Stjepan Radić, head of the Croatian Peasant Party, who urged a pluralistic state. In 1927, however, Pribićević became converted to federalism and espoused the democratic rather than the authoritarian ideal. On Jan. 5, 1929, he and Vladimir Maček (successor to Radić as Croatian Peasant Party chief) urged Alexander I, king of the Serbs, Croats, and Slovenes, to establish a federal system, but the king reacted by proclaiming a dictatorship the next day. Pribićević retained his leadership of the Independent Democratic Party, which he had founded in 1924.

Pribilof Canyon, a long submarine canyon rising from the Bering Abyssal Plain on the floor of the Bering Sea southeast of the Pribilof Islands, Alaska. It runs across the edge of the continental slope and is 265 mi (426 km) long with walls 6,000 ft (1,800 m) high. The canyon is characterized by a V-shaped valley with steep and rocky walls, and its floor is covered by sands and gravels. It is believed to have been formed when large masses of sediments supplied by Alaskan and Siberian rivers slumped down the slope of the continental shelf, and the canyon was cut by streams flowing across the exposed continental shelf. Alluvial fans (broad sedimentary aprons) spread out from its mouth to cover the continental rise; these terminate in the Bering Abyssal Plain.

Pribilof Islands, also called FUR SEAL ISLANDS, islands of Alaska, U.S., including St. Paul (35 sq mi [91 sq km]), St. George (27 sq mi), and two islets lying in the Bering Sea, about 300 mi (500 km) west of the mainland and 180 mi north of the Aleutian Islands. The islands were first visited in 1786 by Gavril Pribylov, a Russian sea captain, who discovered their fur seal rookeries. Control of the islands was transferred from Russia to the United States with the purchase of Alaska (1867).

Northern fur seal bull (*Callorhinus ursinus*) presiding over his harem on St. Paul, Pribilof Islands, Alaska
Stephen J. Krasemann—Peter Arnold, Inc.

Northern fur seals that visit the Pribilofs from April to November have been the focus of an international controversy for many years. The seals use the islands as their breeding ground; the older and stronger bulls gather harems, while the younger "bachelors" congregate separately. If the bachelors are hunted when they are ashore, the herd may be conserved; sealing at sea (pelagic sealing) permits no selectivity, and, moreover, many of the animals killed are lost. In 1870 sealing rights were leased to the Alaska Commercial Company. During the 1880s vessels of several nations engaged in pelagic sealing, which caused the islands' herds to become depleted. In 1886 U.S. vessels began seizing Canadian sealers off the Pribilofs. A tribunal ruled against the U.S. in 1893. After 1910 the U.S. Bureau of Fisheries had direct supervision of the sealing.

In 1911 the United States, Great Britain (for Canada), Japan, and Russia signed the North Pacific Sealing Convention, abolishing pelagic sealing north of latitude 30° N and providing that each nation should share in the skins collected on the Pribilofs. The treaty was ended by Japan's withdrawal in 1941, on its contention that the seals were despoiling Japanese fisheries. In 1957 an interim convention on conservation signed by the United States, Japan, Canada, and the U.S.S.R. created the North Pacific Fur Seal Commission. The herd increased from an estimated 125,000 in 1911 to about 1,500,000 by the second half of the 20th century. About 60,000 skins are harvested yearly.

The indigenous population of the Pribilof Islands is made up of Aleuts, who are closely related to the Eskimo. Formerly treated as wards by the U.S. Fish and Wildlife Service, the Aleuts were granted substantial civil rights by the U.S. Congress in 1966. Pop. (1980) 600.

Příbram, mining city, Příbram *okres* (district), Středočeský *kraj* (region), Czech Socialist Republic, western Czechoslovakia. Located 37 mi (59 km) southwest of Prague, on the Litavka River, it is situated in the hilly and forested Brdy Hřebeny. Silver and gold mining, begun in the 14th century, was the town's major industry until the 1960s, when lead, zinc, and large uranium deposits were found and began to be mined and processed.

Příbram's other major industry is tourism. On the nearby height of Svatá Hora stands the Baroque monastery of Our Lady in Bohemia and its shrine, which has long attracted pilgrims and more recently tourists. The monastery is reached from Příbram by a long covered staircase. In the hills southwest of the city stands the chateau of Vysoká, a favourite retreat, where the Czech composer Antonín Dvořák composed his opera *Rusalka* ("Undine"). Pop. (1985 est.) 39,165.

Price, city, seat (1894) of Carbon County, central Utah, U.S., on the Price River, 65 mi (105 km) southeast of Provo. Settled in 1877 by Mormons, it was named for the river discovered in 1865 by William Price, a bishop of the Mormon Church. Its growth was spurred by the arrival of the Denver and Rio Grande Railroad in 1883. Coal production, livestock, and agriculture (sugar beets and grains) are major economic factors. Price is the seat of the (junior) College of Eastern Utah (1938). This college maintains the Prehistoric Museum (in the city hall) containing a notable dinosaur display, including the *Allosaurus* found in the nearby Cleveland-Lloyd Quarry. The Black Diamond Stampede, a rodeo, is held annually. The main unit of the Manti-LaSal National Forest (headquartered in Price) is to the west. Inc. 1892. Pop. (1982 est.) 9,860.

price, the amount of money that has to be paid to acquire a given product. Insofar as the amount people are prepared to pay for a product represents its value, price is also a measure of value.

It follows from the definition just stated that prices perform an economic function of major significance. So long as they are not artificially controlled, prices provide an economic mechanism by which goods and services are distributed among the large number of people desiring them. They also act as indicators of the strength of demand for different products and enable producers to respond accordingly. This system is known as the price mechanism and is based on the principle that only by allowing prices to move freely will the supply of any given commodity match demand. If supply is excessive, prices will be low and production will be reduced; this will cause prices to rise until there is a balance of demand and supply. In the same way, if supply is inadequate, prices will be high, leading to an increase in production that in turn will lead to a reduction in prices until both supply and demand are in equilibrium.

In fact, this function of prices may be analyzed into three separate functions. First, prices determine what goods are to be produced and in what quantities; second, they determine how the goods are to be produced; and third, they determine who will get the goods. The goods so produced and distributed may be consumer items, services, labour, or other salable commodities. In each case, an increase in demand will lead to the price being bid up, which will induce producers to supply more; a decrease in demand will have the reverse effect. The price system provides a simple scale by which competing demands may be weighed by every consumer or producer.

There is, of course, no such thing as a totally free and unfettered price mechanism in practice. Even in the relatively free market economies of the developed Western world there are all kinds of distortions—arising out of monopolies, government interference, and other conditions—the effect of which reduces the efficiency of price as a determinant of supply and demand. In the centrally planned economies of the Communist world, the price mechanism is supplanted by centralized governmental control for political and social reasons. Attempts to operate an economy without a price mechanism usually result in surpluses of unwanted goods; shortages of desired products; black markets; and slow, erratic, or no economic growth.

Price, George (b. June 9, 1901, Coytesville, N.J., U.S.), American cartoonist whose work, characterized by witty, imaginative drawing and brief, often one-line captions, helped to modernize the magazine cartoon.

As a young man Price did odd jobs in printing offices and freelance illustrations. During the 1920s he was active in advertising art. Much of the humour in his cartoons lay in having a character respond rationally to a wildly improbable situation. His first success, for example, was a series involving the droll responses of a man floating in air.

In 1926 Price became a contributor to *The New Yorker.* Many of his cartoons also appeared in *Collier's* and *The Saturday Evening Post.* Popular collections of his cartoons have appeared, beginning with *Good Humor Man* (1940) and including *Who's in Charge Here?* (1943), *My Dear 500 Friends* (1963), *The People Zoo* (1971), and *Browse At Your Own Risk* (1977).

Price, H(enry) H(abberley) (b. 1899, Neath, Glamorgan, Wales—d. Nov. 26, 1985), British philosopher noted for his study of perception and thinking.

Before his appointment as Wykeham professor of logic at New College, Oxford (1935–

59), where he was educated, Price taught at Magdalen College (1922–24), Liverpool University (1922–23), and Trinity College (1924–35). His earliest book, *Perception* (1932), rejected causal theories of perception, while a later publication, *Thinking and Experience* (1953), revealed the importance of conceptual awareness beyond mere symbolic interpretation. Also writing on religion, parapsychology, and psychic phenomena, he viewed telepathy and clairvoyance as influences on the unconscious mind. Additional works include *Hume's Theory of the External World* (1940), *Belief* (1969), and *Essays in the Philosophy of Religion* (1972).

Price, Leontyne, original name MARY LEONTYNE PRICE (b. Feb. 10, 1927, Laurel, Miss., U.S.), U.S. lyric soprano who sang at leading opera houses of the world.

Both of her grandfathers had been Methodist ministers in black churches in Mississippi, and she sang in her church choir as a girl; but it was not until she graduated from Central State College in Wilberforce, Ohio, that she finally determinined to seek a career as a singer. Financial aid provided by a friend, Elizabeth Chisholm of Laurel, helped her to study for four years at the Juilliard School of Music in New York City, where she worked under the former concert singer Florence Page Kimball, who remained her coach in later years.

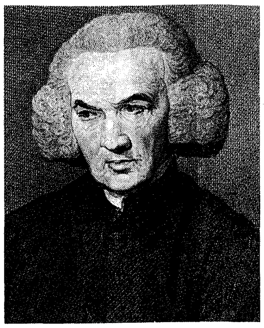
Her singing debut took place in April 1952, in a Broadway revival of Virgil Thomson's *Four Saints in Three Acts;* this led to Ira Gershwin's choosing her to sing Bess in his revival of *Porgy and Bess,* which played in New York City for two years, from 1952 to 1954, and also toured the United States and Europe. The year 1955 saw her triumphant performance of the title role in the National Broadcasting Company's television production of *Tosca,* making her the first black to sing opera on television, and she sang leading roles in other operas on television in the next few years.

Her operatic stage debut did not take place until 1957, at the San Francisco Opera, where she sang each year until 1960. By that time she was one of the most popular lyric sopranos in the country and had also made triumphant appearances in Vienna in 1959 and at Milan's La Scala the next year, where her performance was applauded by an Italian critic who declared that Verdi would have found her the ideal Aïda. Despite this great success, however, her debut at the Metropolitan Opera in New York was deferred until 1961, when she appeared there in the difficult role of Leonora in *Il Trovatore.* After a brilliant performance she became one of the Met's leading sopranos. Later roles there included Cio-Cio-San in *Madame Butterfly,* Donna Anna in *Don Giovanni,* and Liù in *Turandot.* She won several Grammy awards from the American Society of Recording Arts and Sciences.

She was always conscious of her role as a pioneering black in opera and worked hard against racial prejudice, refusing what she considered inappropriate roles and investing her performances with dignity and grandeur.

Price, Richard (b. Feb. 23, 1723, Tynton, Glamorgan, Wales—d. April 19, 1791, Hackney, near London), British moral philosopher, expert on insurance and finance, and ardent supporter of the American and French revolutions. His circle of friends included Benjamin Franklin, William Pitt, Lord Shelburne, and David Hume.

A Dissenter like his father, he ministered to Presbyterians near London. His *Review of the Principal Questions and Difficulties in Morals* (1758) pleaded the cause of ethical intuitionism and Rationalism, foreshadowing both Kant's ethics and 20th-century developments.



Richard Price, engraving by T. Holloway after a painting by Benjamin West

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

Price was admitted to the Royal Society in 1765 for his work on probability, which later formed the foundation of a scientific system for life insurance and old-age pensions (*Observations on Reversionary Payments,* 1771). This same book, coupled with *An Appeal to the Public on the Subject of the National Debt* (1772), led William Pitt to reestablish the sinking fund to extinguish England's national debt.

Enormous sales in America and England followed the publication of his *Observations on the nature of Civil Liberty, the Principles of Government, and the Justice and Policy of the War with America* (1776). Price was given the freedom of the city of London (1776) and was invited by the U.S. Congress (1778) to advise it on finances. Together with George Washington he was made LL.D. by Yale College in 1781. Price eulogized the French Revolution in a celebrated sermon, *Discourse on The Love of Our Country* (1789), to which Edmund Burke's *Reflections on the Revolution in France* was a reply.

Price, Sterling (b. Sept. 20, 1809, Prince Edward County, Va., U.S.—d. Sept. 29, 1867, St. Louis, Mo.), antebellum governor of Missouri, and Confederate general during the U.S. Civil War.

After attending Hampden-Sydney College (1826–27), Price studied law. In 1831 he moved with his family from Virginia to Missouri, where he entered public life. He served in the state legislature from 1836 to 1838 and again from 1840 to 1844, the latter period as speaker of the House.

In 1844 Price won a seat in the U.S. House of Representatives, but he failed to win renomination and resigned on Aug. 26, 1846, to enlist as a colonel in the Missouri infantry. He rose to the rank of brigadier general during the Mexican War and was appointed military governor of Chihuahua.

He returned to Missouri after the war and in 1852 was elected governor. A conditional Union supporter, he did not initially advocate secession as the sectional conflict intensified. But in June 1861, having been given command of the state militia, he organized a small army of 5,000 pro-Confederate troops in southwestern Missouri. A subsequent victory over Union forces at the Battle of Wilson's Creek established Price as a military commander, and in April 1862 he and his troops were officially incorporated into the Confederate Army.

But from the summer of 1862 to the end of the Civil War, Price suffered a series of defeats. The collapse of the Confederacy found him in retreat on the plains of Texas, and he exiled himself to Mexico for a short time. Following the defeat and execution of Emperor Maximilian, however, Price returned to Missouri.

Price, Thomas (b. Jan. 19, 1852, Brymbo, Denbighshire, Wales—d. May 31, 1909, Hawthorn, South Australia, Australia), Australian statesman who as premier of South Australia (1905–09) was the first long-term Labor Party premier of an Australian state.

A stonecutter in England, Price emigrated to South Australia in 1883, continued his trade, and served as secretary of the masons and bricklayers union (1891–93). At one time he worked in Adelaide on the Parliament buildings in which he later served as premier. He entered the House of Assembly in 1893 and soon played an important role in passing labour protection legislation.

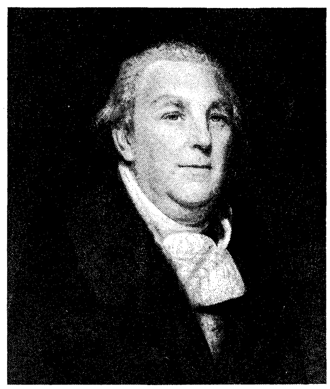
Price became head of the South Australia Labor Party in 1901 and premier of the state in 1905, concurrently serving as commissioner of public works and minister of education. During his administration he unified the public transportation system in Adelaide, created wage boards, liberalized the voting franchise, and initiated the transfer of the Northern Territory to the commonwealth.

Price, Sir Uvedale, 1ST BARONET (b. 1747—d. Sept. 14, 1829, Foxley, Herefordshire, Eng.), British landscape designer and, with the writer-artist William Gilpin and Richard Payne Knight, one of the chief aestheticians of the Picturesque movement in landscaping.

Price was a wealthy country squire, Knight his friend and neighbour; both were enthusiastic amateur landscape designers and critics of the prevailing trend. The Picturesque movement was openly launched in 1794 with Knight's didactic poem "The Landscape," protesting the values of some established practitioners, and Price's "Essay on the Picturesque."

Price was particularly contemptuous of the style popularized by the late Lancelot "Capability" Brown, who eventually came to be regarded as one of the foremost English masters of garden design. Brown's approach was to create a simple, balanced composition, using a small number of natural elements—a grove of trees, a pond, the slight curve of a hill. Price, in contrast, favoured a profusion of detail and praised the "accidents" of nature—a withered tree, a half-submerged branch breaking the glassy surface of a pool. Brown's designs were tranquil and relatively formal; Price's gardens were wild, dramatic, and unkempt. Garden design being referred to at the time as "improvement of grounds," Price was accused by his critics of improvement "by neglect"; Price and Knight together were scornfully called "the wild improvers."

In his "Essay," Price considered the Picturesque in two aspects: first as a category of aesthetic values alongside the Beautiful and the Sublime (which had already been embraced by Brown); and second, as a quality of nature



Sir Uvedale Price, portrait by an unknown artist; in the British Museum

Country Life

per se, one that ought to be looked for in actual practice and preserved or enhanced when found. Price's most extreme pronouncements argued that gardens should imitate landscape paintings and that the purpose of the gardener, like that of the painter, was to improve upon nature.

A lifelong Whig, Price was created a baronet in 1828.

price discrimination, practice of selling a commodity at different prices to different buyers, even though sales costs are the same in all of the transactions. Discrimination among buyers may be based on personal characteristics such as income, race, or age or on geographic location. For price discrimination to succeed, other entrepreneurs must be unable to purchase goods at the lower price and resell them at a higher one. Legislation against price discrimination has usually sought to prevent its use by one seller to drive a competing seller out of business by underselling the competitor in his own market while selling at higher prices in other markets.

One of the most notable examples of price discrimination was practiced in the late 19th century by American railroads, which gave favoured customers lower rates and charged higher rates for short hauls than for long hauls. German industry practiced another type before World War I by maintaining a high domestic price through high tariffs and selling abroad at a loss, thus gaining control of foreign markets.

price index, measure of relative price changes, consisting of a series of numbers arranged so that a comparison between the values for any two periods or places will show the average change in prices between periods or the average difference in prices between places. Price indexes were first developed to measure changes in the cost of living in order to determine the wage increases necessary to maintain a constant standard of living. They continue to be used extensively to estimate changes in prices over time and are also used to measure differences in costs among different areas or countries. *See also* consumer price index; wholesale price index.

Data. The central problem of price-data collection is to gather a sample of prices representative of the various price quotations for each of the commodities under study. Sampling is almost always necessary. The larger and the more complex the universe of prices to be covered by the index, the more complex the sampling pattern will have to be. An index of prices paid by consumers in a large and geographically varied country, for example, ideally should be based on a sample representative of price changes in different cities and localities, in different types of outlets (supermarkets, department stores, neighbourhood shops, etc.), and for different commodities. The number of prices chosen to represent each type of city (or metropolitan area), type of outlet, and category of commodity would ideally be proportionate to its relative importance in the expenditures of the nation. Most price indexes are based on some approximation to such a sampling design.

Once the commodity sample has been chosen, the collection of prices must be planned so that differences between the prices of any two dates will reflect changes in price and price alone. Ideally one would collect the prices of exactly the same items at each date. To this end, commodity prices are sometimes collected in accordance with detailed specifications such as "wheat, no. 2 red winter, bulk, carlots, f.o.b. Chicago, spot market price, average of high and low, per bushel." If all commodities were as standardized as wheat, the making of price indexes would be much simpler than it is. In fact, except for a limited range of goods consisting mainly of primary products, it is very difficult to describe a product completely enough so that different pricing agents can go into stores and price an identical item on the basis of description alone. In view of this difficulty, price-collection agencies sometimes rely upon each respondent, usually a business firm, to report prices in successive periods for the same variant of a product (say, men's shoes); the variant chosen by each respondent may be different, but valid data will be obtained as long as each provides prices for the same variant he originally chose. Because a product may vary in quality from one observation to another, even though it retains the same general specification, the usual procedure is to avoid the computation of average observed prices for each commodity for each date. Instead, each price received from each source is converted to a percentage of the corresponding price reported for the previous period from the same source. These percentages are called "price relatives."

Weighting. The next step is to combine the price relatives in such a way that the movement of the whole group of prices from one period to another is accurately described. Usually, one begins by averaging the price relatives for the same specification (*e.g.,* men's high work shoes, elk upper, Goodyear welt, size range 6 to 11) from different reporters. Sometimes separate averages for each commodity are calculated for each city, and the city averages are combined.

A more difficult problem arises in combining the price relatives for different commodities. They must be given different weights, of course, because not all the commodities for which the prices or price relatives have been obtained are of equal importance. The price of wheat, for example, should be given more weight in an index of wholesale prices than the price of pepper. The difficulty is that the relative importance of commodities changes over time. Some commodities even drop out of use, while new ones appear, and often an item changes so much in composition and design that it is doubtful whether it can properly be considered the same commodity. Under these conditions, the pattern of weights selected can be accurate in only one of the periods for which the index numbers have been calculated. The greater the lapse of time between that period and other periods in the index, the less meaningful the price comparisons become. Price indexes thus can give relatively accurate measures of price change only for periods close together in time.

Adjusting for biases. Another problem of price index number construction that cannot be completely resolved is the problem of quality change. In a dynamic world, the qualities of goods are continually changing (permanent-press clothing, high-definition television, banded tires, self-cleaning ovens, and so forth) to such a degree that it is doubtful whether anyone living in an industrialized economy buys many products that are identical in physical and technical characteristics to those purchased by his grandfather. There is no fully satisfactory way to handle quality changes. One way would be to make price comparisons between two periods solely in terms of goods that are identical in both periods. If one systematically deletes goods that change in quality, the price index will tend to be biased upward if quality is improving on the average and downward if it is deteriorating on the average. A better approach is to attempt to measure the extent to which an observed change in the quoted price represents a change in quality. It is possible, for example, to obtain from manufacturers estimates of the increase or decrease in cost of production entailed in the main changes in automobiles from one model year to the next. The amount added or subtracted from the cost by the changes can then be regarded as a measure of the quality change; any change in the quoted price not accounted for in this way is taken as solely a change in price. The disadvantage of this method is that it cannot take account of improvements that are not associated with an increase in costs.

Whether or not a failure to make sufficient allowance for improvements in the quality of goods causes most price indexes to be biased upward is a matter of dispute. An expert committee appointed to review the price statistics of the U.S. government (the Stigler Committee) declared in 1961 that most economists felt that there were systematic upward biases in the U.S. price indexes on this account. Because the U.S. indexes are usually thought to be relatively good, this view would seem to apply by extension to those of most other countries. The official position of the U.S. Bureau of Labor Statistics has been that errors owing to quality changes have probably tended to offset each other, at least in its index of consumer prices.

Another possible source of error in price indexes is that they may be based on list prices rather than actual transactions prices. List prices probably are changed less frequently than the actual prices at which goods are sold; they may represent only an initial base of negotiation, a seller's asking price rather than an actual price. When prices are collected largely by mail, as is generally the case with indexes of wholesale prices, the respondents may give only their list prices, with the result that the indexes will show greater short-run stability than is warranted. One study has shown that actual prices paid by the purchasing departments of government agencies were lower and were characterized by more frequent and wider fluctuations than were the prices for the same products reported for the price index.

price maintenance, also called RESALE PRICE MAINTENANCE, measures taken by manufacturers or distributors to control the resale prices of their products charged by resellers. The practice is more effective in retail sales than at other levels of marketing. Only a few types of goods have come under such controls, the leading examples being drugs and pharmaceuticals, books, photographic supplies, liquors, miscellaneous household appliances, and various specialty goods.

The initial movement for resale price maintenance in the 1880s reflected the success of brand promotion and the resulting increase in competition among retailers. American manufacturers were granted more specific authority than was the case in other parts of the world; the so-called nonsigners' clause in state fair-trade laws made the contractual prices agreed upon between a manufacturer and contracting dealers binding upon all resellers. (*See* fair-trade law.)

Resale price maintenance as a business practice was weakened during the post-World War II years. It was prohibited in both Canada and Sweden and strongly attacked in France. Of the 44 states in the United States that had fair-trade laws with effective nonsigner provisions during the 1930s, fewer than half still retained those laws 30 years later, and in 1975 fair-trade laws were repealed altogether by an act of Congress. In Great Britain, a governmental committee recommended strongly against collective sanctions and enforcement of resale price maintenance agreements, in sharp contrast to earlier governmental investigations of the subject. In 1956 Great Britain enacted the Restrictive Trade Practices Act, and in 1964 resale price maintenance was made illegal by an act of Parliament, excepting a few products, such as books.

Resale price maintenance by manufacturers was weakened when large-scale retailing, together with the growth of strong dealer organizations, set up conflicting interests within the retailing field. Because marketing channels in highly industrialized countries are complex and overlapping, the establishment and enforcement of a single price or even a minimum price by manufacturers is a complicated and burdensome task in the absence of collective enforcement efforts, limitation of numbers of enterprises, or governmental intervention. Because effective resale price controls attract excessive capital and manpower into distribution activities by eliminating price competition, such a program logically requires some means of restricting the numbers of enterprises.

Although fair-trade laws prevent well-known brands from being used as "bait" to attract customers to buy other brands pushed by distributors, it is generally agreed that resale price maintenance or "fair trade" is not a true solution to problems arising out of trade conflicts or unfair and deceptive selling practices.

Price-Mars, Jean (b. Oct. 15, 1876, Grande Rivière-du-Nord, Haiti—d. 1969, Port-au-Prince), Haitian physician, public official, diplomat, ethnologist, and historian of his country's sociological and intellectual development and of the contribution of Haitians to the culture of the Americas.

Among his ethnological writings is *Ainsi parla l'oncle* (1928; new ed., 1954; "Thus Spoke the Uncle"), a collection of essays intended to "restore to the Haitian people the dignity of their folklore." He also wrote *La République du Haïti et la République Dominicaine* (1953; "The Republic of Haiti and the Dominican Republic"), a history of the relations between the two countries of Hispaniola. He served as Haitian chargé d'affaires in Washington, D.C. (1908–11); national inspector of public education (1912–15); and minister to France (1915–16).

priceite, also called PANDERMITE, an earthy, white borate mineral, hydrated calcium borate ($Ca_4B_{10}O_{19} \cdot 7H_2O$). It has been found as masses and nodules in a hot-spring deposit near Chetco, Ore.; as nodules in shale in Death Valley, Calif.; and as very large masses (weighing up to a ton) underlying gypsum and clay beds at Susurluk, Balıkesir province, Tur. For detailed physical properties, *see* borate mineral (table).

Prichard, city, Mobile county, northern industrial suburb of Mobile, Alabama, U.S. It was named for Cleveland Prichard, who purchased a tract of land (1879) on the east side of the Mobile and Ohio Railroad track and developed it into a vegetable-shipping point for markets in the North and East. Diversified industries include shipbuilding and the manufacture of rayon, chemicals, paper, and lumber products (based on local pine forests). Inc. 1925. Pop. (1988 est.) 40,337.

Prichard, H(arold) A(rthur) (b. Oct. 30, 1871, London, Eng.—d. Dec. 29, 1947, Oxford, Oxfordshire), English philosopher, one of the leading members of the Oxford intuitionist school of moral philosophy, which held that moral values are ultimate and irreducible and can be ascertained only through the use of intuition.

Prichard spent most of his life teaching at the University of Oxford, where he was fellow of Hertford College from 1895 to 1898 and of Trinity College from 1898 to 1924. He was White professor of moral philosophy from 1928 to 1937. His principal works are *Kant's Theory of Knowledge* (1909), *Duty and Interest* (1928), *Moral Obligation* (1949), and *Knowledge and Perception* (1950), the latter two edited by Sir W.D. Ross.

H.A. Prichard
By courtesy of Miss Marjorie M. Prichard

Prichard, James Cowles (b. Feb. 11, 1786, Ross, Herefordshire, Eng.—d. Dec. 23, 1848, London), British physician and ethnologist who was among the first to assign all mankind to a single species. He was also responsible for the conception of moral insanity (psychopathic personality) as a distinct disease.

Prichard received his early education at Bristol and early acquired knowledge of European and Oriental languages. After attending St. Thomas's Hospital, London, he went to Edinburgh, where he took his M.D. in 1808. Later he spent some time at Cambridge and at Oxford, but in 1810 he settled in Bristol. He was appointed physician to St. Peter's Hospital in 1811 and to the Bristol Infirmary in 1814.

His *Researches as to the Physical History of Man* (1813) was expanded into a five-volume work (1836–47). In his classic *Natural History of Man* (1843) he concluded that there was but a single human species. He was also deeply interested in Egyptology, and in 1819 he traced an early connection between the Hindus and the Egyptians and published a hieroglyphic alphabet. His *Eastern Origin of the Celtic Nations* (1831) established the Celtic languages as a branch of Indo-European. Prichard was elected a fellow of the Royal Society in 1827 and at the time of his death was president of the Ethnological Society.

Prichard, Katherine Susannah (b. Dec. 4, 1883, Levuka, Fiji—d. Oct. 2, 1969, Greenmount, near Perth, W.Aus., Australia), Australian novelist and writer of short stories, plays, and verse, best known for *The Pioneers* (1915; filmed 1926).

Her father was editor of the *Fiji Times,* and she grew up mostly in Australia, publishing her first short story when she was only 11 years old. First working as a newspaper journalist in Melbourne and Sydney and then as a free-lance journalist in London before concentrating on her plays and fiction, she returned to Australia in 1916. While visiting London in 1909, Prichard was deeply affected by the hunger marches of the workers. The suffering she witnessed during her second visit caused her to join the Communist Party of Australia in 1920, the year of its formation.

The Marxist influence and her social consciousness was particularly evident in her early plays but remained constant throughout her career. Her skillful use of natural imagery and colloquial language is credited with altering prevailing attitudes towards the Aborigines.

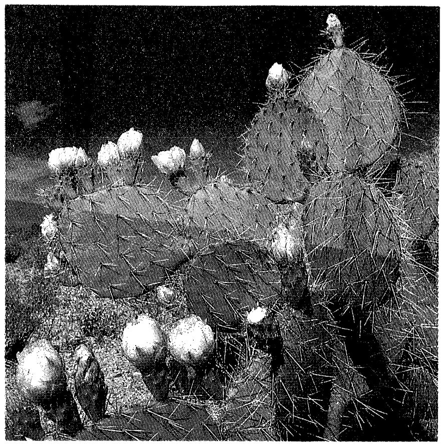
Prichard's varied output, which has been widely translated, includes *The Wild Oats of Han* (1928), a children's book; *Earth Lover* (1930), a book of poems; *Kiss on the Lips* (1932), short stories; *Brumby Innes* and *Bid Me To Love* (1927), plays; and a trilogy of novels, *The Roaring Nineties* (1946), *Golden Miles* (1948), and *Winged Seeds* (1950).

prickleback, any of numerous fishes constituting the family Stichaeidae (order Perciformes). All of the approximately 60 species are marine, and most are restricted to the northern Pacific Ocean; a few species occur in the North Atlantic. Members of the family are characteristically elongate, with a low dorsal fin running the length of the body. In most species the pelvic fins are reduced or absent, a typical feature of the blennies, a group of fishes to which pricklebacks belong. They get their name from the presence of spiny rays that compose the dorsal fin.

prickly ash (plant): *see* angelica tree.

prickly heat, a noncontagious skin eruption of red pimples with intense itching and tingling caused by inflammation around the sweat glands. It is a form of miliaria (*q.v.*).

prickly pear, any member of a genus (*Opuntia*) of flat-stemmed spiny cacti (family Cactaceae), native to the Western Hemisphere. The name refers to the edible fruit of certain species, especially *Opuntia ficus-indica,* also



Engelmann prickly pear (*Opuntia engelmannii*)
Grant Heilman

called Indian fig, an important food for many peoples in tropical and subtropical countries. When *Opuntia* species were first introduced to Australia and southern Africa by early explorers, they prospered; having left behind their natural parasites and competitors they eventually became pests.

The Indian fig is bushy to treelike, growing to a height of 5.5 metres (18 feet); it bears large yellow flowers, 7.5 to 10 centimetres (3 to 4 inches) across, followed by white, yellow, or reddish purple fruits. It is widely grown in warmer areas for the fruit and as a forage crop. The hard seeds are used to produce an oil. Because of their high water content, the stems, especially of spineless varieties, are used as emergency stock feed during drought. Some *Opuntia* species are cultivated as ornamentals, valued for their large flowers. They are easily propagated from stem segments.

prickly poppy, also called ARGEMONY, any of about 30 species of the genus *Argemone,* North American and West Indian plants of the poppy family (Papaveraceae). Most have spiny leaves, yellow or orange sap, and prickly fruits. Some species have become naturalized in arid regions of South America, Asia, and

Prickly poppy (*Argemone hispida*)
F.K. Anderson—EB Inc.

Africa. Prickly poppies are cultivated as garden ornamentals but often become troublesome weeds when growing wild. They were an important source of drugs in pre-Columbian Mexico. Parts of the 30- to 90-centimetre (1- to 3-foot), bristly stemmed plants are still used by herbalists to treat many ailments.

A. hispida, of the Rocky Mountains, is densely prickled. Common garden species grown as annuals in sunny places are *A. grandiflora,* with large, cup-shaped, white or yellow blooms; crested, or thistle, poppy (*A. platyceras*), with 6- to 10-cm (about 2- to 4-inch), white or yellow blooms; and the Mexican poppy (*A. mexicana*), with smaller yellow blooms and light green leaves with white vein markings.

prickly potato (plant): *see* buffalo bur.

pricklywinkle, any of certain snails of the periwinkle (*q.v.*) group.

Pride, Sir Thomas (b. Somerset?—d. Oct. 23, 1658, Worcester House, Surrey, Eng.), Parliamentary soldier during the English Civil War (1642–51), remembered chiefly for his expulsion of the Presbyterians from the House of Commons in 1648. "Pride's Purge," as the incident is called, put the Independents in control of the government.

Pride's early life is obscure. Entering the Parliamentary army as a captain, he became a lieutenant colonel in 1645 and commanded a regiment in the decisive Parliamentary victory at Naseby, Northamptonshire, in June 1645. He then served with Oliver Cromwell against the Royalist rebels in Wales and helped Cromwell rout the invading Scots at Preston, Lancashire, in August 1648. After the army, which was dominated by the Independents, occupied London in December 1648, Pride stood before the entrance to the House of Commons, arresting or expelling about 140 Presbyterian members. In January 1649 Pride became a member of the commission that tried King Charles I, and he signed the warrant for Charles's execution (Jan. 30, 1649). He was knighted by Cromwell in 1656.

pride-of-India: *see* goldenrain tree.

Pridgett, Gertrude: *see* Rainey, Ma.

Pridi Phanomyong, also called PRIDI BANOMYONG, or LUANG PRADIST MANUDHARM (b. May 11, 1900, Ayutthaya, Siam—d. May 2, 1983, Paris), Thai political leader who was one of the instigators of the June 1932 constitutional revolution and was made prime minister in 1946.

After studies at the Royal Law School, Pridi won a government scholarship to study law in France; he gained a doctorate in law from Paris in 1927. While in Paris he was strongly influenced by French socialism, and, with other students, including Phibunsongkhram, he began plotting the overthrow of the Thai absolute monarchy. On return to Thailand the conspirators intensified their efforts, and on June 24, 1932, they carried out a bloodless coup d'état that forced King Prajadhipok to accept a constitution. As the leading ideologue of the ruling People's Party, Pridi helped write the constitution of December 1932, and in 1933 he announced a draft economic policy that envisioned state ownership of all industrial and commercial enterprises as well as payment of monthly salaries to the peasantry. The uproar over this plan forced Pridi into temporary exile abroad. On his return he served as minister of the interior and minister of foreign affairs and founded the University of Moral and Political Science (Thammasat). He served as minister of finance (1938–41) under Phibunsongkhram but resigned in protest against pro-Japanese policies and was appointed regent for the boy king Ananda Mahidol, then at school in Switzerland. As regent, Pridi directed the anti-Japanese underground Free Thai Movement in the later years of the war and engineered the downfall of Phibun's government in 1944. Over the next two years, Pridi was the real power behind successive civilian governments as Thailand, successfully avoiding treatment as an ally of Japan, regained international respectability.

In March 1946 Pridi himself became prime minister, the first to have been popularly elected. Public support for his government was shattered, however, after King Ananda was found dead of gun wounds on June 9, 1946. Pridi was unjustly held responsible, in part because of his earlier radicalism and reputed republican sympathies, and in August he was forced to resign. When the army staged a coup d'état in November 1947, Pridi fled the country; by 1951, after coup attempts on his behalf had failed, he took up residence in China. In 1970 Pridi left China for France, continuing to voice his criticism of the Thai military regimes.

Pridvorov, Yefim Alekseyevich: *see* Bedny, Demyan.

Prie, Jeanne-Agnes Berthelot de Pleneuf, marquise de (marchioness of) (b. 1698, Paris—d. Oct. 7, 1727, Courbépine, Fr.), French adventuress during the reign of Louis XV.

Daughter of an unscrupulous financier, Étienne Berthelot, she was married at age 15 to Louis, marquis de Prie, and went with him to the court of Savoy at Turin, where he was ambassador. She was 21 when she returned to France and was soon the declared mistress of Louis-Henri, duc de Bourbon. During his ministry (1723–1725) she was in several respects the real ruler of France, her most notable triumph being the marriage of Louis XV to Marie Leszczyńska instead of to Mlle de Vermandois. But when, in 1725, she sought to have Bourbon's rival Fleury exiled, her ascendancy came to an end. After Fleury's recall and the banishment of Bourbon to Chantilly, Mme de Prie was exiled to Courbépine, where she committed suicide the next year.

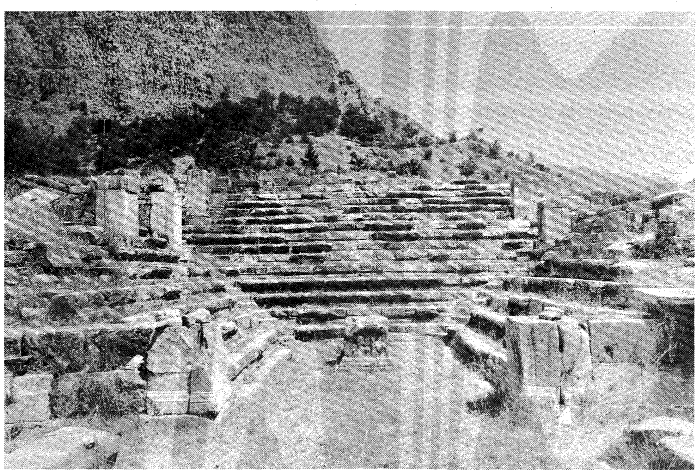
prie-dieu, praying desk for one individual with a knee bench close to the floor and a vertical panel supporting an armrest, below which there is usually a shelf for prayer books and the like. The knee rest and arm support are often upholstered.

First used by the higher clergy during religious services in the early Middle Ages, the prie-dieu became popular in the 19th century partly as a result of the Gothic Revival, partly because of a pietistic passion for family prayers. During this period their secular use was extended by the introduction of prie-dieu (or devotional) chairs, which followed the general shape of the purely religious version but extended the knee rest to form a low seat.

Priene, ancient city of Ionia originally near the mouth of the Maeander (Büyükmenderes) River but now, because of alluvial deposits, about 10 miles inland from the Aegean Sea. The well-preserved remains, which include the Temple of Athena Polias, have provided a principal source of information about Greek city life.

According to the geographer Strabo and the traveller Pausanias, Priene was founded by Ionians and Thebans. Sacked by Ardys of Lydia in the 7th century BC, the city was revived and regained its prosperity under its "sage," Bias, in the 6th century. Captured by the generals of the Persian king Cyrus (*c.* 540), Priene participated in several revolts against the Persians (499–494) and sent 12 ships to join the Ionian rebels at Lade (*c.* 494 BC). The city prospered under the Romans and Byzantines but later declined. It passed into Turkish hands in the 13th century AD. The site is occupied by the modern town of Samsun Kale.

Excavations begun in the 19th century uncovered the Temple of Athena Polias; built by Pythius, probable architect of the Mausoleum of Halicarnassus, the temple is the classic example of the pure Ionian style. Modern excavations at Priene have revealed one of the most beautiful examples of Greek town planning, including a theatre, temples, gymnasium, other public buildings, and private houses.



Council house, Priene, *c.* late 3rd century BC
Hirmer Fotoarchiv, Munchen

priest (from Greek *presbyteros:* "elder"), in some Christian churches, an officer or minister who is intermediate between a bishop and a deacon.

A Christian ministry of the sacerdotal type, a priesthood, developed in the early Christian Church, mainly in connection with celebration of the Eucharist. By the end of the 2nd century, ministers were called priests. Although the priestly office was vested primarily in bishops, the priest shared in the priestly functions and, in the absence of the bishop, could exercise certain of the functions as the delegate of the bishop. With the spread of Christianity and the establishment of parish churches, the parish priest became the principal celebrant of the Eucharist. In this capacity, as well as by hearing confession and granting absolution, the priest eventually assumed the role of the representative of God to the people rather than the peoples' representative to God. The development of eucharistic theology resulted in a further emphasis of the priest's supernatural powers and qualities in a manner that went beyond the Old Testament model of priestly function.

During the 16th-century Protestant Reformation, the Reformers rejected the Roman Catholic doctrine of the sacrifice of the mass and the conception of the priesthood that went with it. The priesthood of all Christians was emphasized. Consequently, ministers were substituted for priests in Protestant churches. The Church of England Reformers retained the title priest in *The Book of Common Prayer,* in order to distinguish priests, who can celebrate Holy Communion, from deacons, who are not entitled to do so. Ministers were generally called clergymen until the 19th century, when the Roman Catholic heritage of the Church of England was emphasized and priest again became the common term.

Priest River, city, Bonner county, northwestern Idaho, U.S., at the junction of the Priest and Pend Oreille rivers. It is a gateway to a spectacular water and forested mountain domain focusing on Priest Lake and Upper Priest Lake (north) and the Kaniksu and Coeur d'Alene national forests in the Idaho panhandle. The area was explored in the 1840s by a Jesuit, Father Pierre Jean De Smet, and both the river and lake were named for the priest. The village was first settled in 1889 and developed after the railroad reached it in 1891. Priest Lake, with a 63-mile (101-kilometre) shoreline and several recreational islands, is known for its giant-size trout (Mackinaw and Dolly Varden). By its shores is the Roosevelt Grove of Ancient Cedars with 800-year-old trees, some more than 150 feet (45 m) high. The annual (February) Pacific Northwest Sled Dog Championship Races are held at Priest River Airport. Pop. (1986 est.) 1,840.

priesthood, the office of a priest, a ritual expert learned in a special knowledge of the techniques of worship and accepted as a religious and spiritual leader.

A brief treatment of priesthood follows. For full treatment, *see* MACROPAEDIA: Sacred Offices and Orders.

In many societies certain forms of social organization (the family, clan, etc.) have a sacral character; hence, a priestly quality often attaches to the head of the group (chieftain, king, head of the household, etc.) by virtue of the sacerdotal functions that he is required to perform. On the other hand, most civilizations also exhibit a definite tendency toward cultic specialization, and it has, therefore, been suggested that the term priest should be limited to the holder of such special office.

Unlike the ancient Roman paterfamilias, who also performed priestly or semipriestly tasks, the full-fledged priest, as a religious functionary and cultic specialist, is distinct from the ordinary people, or "laity," who require priestly services and mediation. Specialization, in its turn, leads to social differentiation and to the establishment of a "clergy"—that is, of a priestly class, or caste. Obviously such specialization arises only in societies able to exempt some individuals from the common toil for subsistence and to provide for their needs in exchange for their ritual contribution to the general welfare. Where such institutionalized division of labour does not exist, as in many so-called primitive societies, suitably gifted or knowledgeable persons will perform priestly duties in addition to their ordinary activities.

Generally speaking, the term priest denotes religious functionaries whose activity is concerned less with the purely mechanical techniques of magic than with the right performance of the ritual acts required by the divine powers and supernatural beings recognized by the group. Because sacrifice is one of the most prominent features of man's ritual relations with the world of gods and spirits, it has come to be associated with priesthood as one of its chief functions; the Brahmans, or priestly caste of Hinduism, for example, derive from those who performed the ritual sacrifice in Vedic times. Medieval Catholicism owed much of its doctrine of the priesthood to the connection of the latter with the Eucharist conceived as a propitiatory sacrifice.

The ancient Inca, Maya, and Aztec distinguished between priests responsible for the cult of the great national gods and such ritual experts as those engaged in divination or curing. Similarly, many African societies differentiated between priests responsible for the worship of the tribal ancestors, on the one hand, and witch doctors and shamans, on the other.

Priesthood, in its fully developed form, generally implies large societies with centralized authority, a fairly elaborate culture, and the existence of an organized cult with fixed rituals and well-formulated doctrines. However, it would be a mistake to assume that every highly developed religion of necessity possesses a priesthood. Islām is perhaps the best example of a religion without priests, religious authority being defined in other than sacerdotal terms. Buddhist doctrine has no room for sacrificial ritual and priestly intervention, although certain sacrificial aspects are implicit in the bodhisattva ideal. Yet in actual practice—especially in Mahāyāna, but to some extent even in Theravāda Buddhism—there is little to distinguish a bhikku, or monk, from a priest. Tibetan Buddhism in particular has produced a type of priesthood whose ritual techniques encompass traditional magic. In Judaism, the decline of the priesthood in ancient times resulted in the assumption of many priestly functions by the rabbi, or teacher. The former hereditary priesthood of the cohen is still recognized symbolically in Orthodox Judaism.

Many primitive societies exhibit patterns of "priesthood of all believers"—*i.e.,* of all members of the group. Thus the Pueblo Indians in the southwestern United States were organized in religious fraternities, and the highly formalized and elaborate rituals necessary to ensure fertility and the general welfare were performed by these groups and not by priestly functionaries. The principle of the priesthood of all believers was also a cardinal doctrine of the churches of the 16th-century Reformation, both Lutheran and Reformed, and of the Protestant Free churches that arose from the Reformation churches. In its Protestant form the doctrine asserts that all men have access to God through Christ, the high priest, and thus do not need a priestly mediator.

Priestley, J(ohn) B(oynton) (b. Sept. 13, 1894, Bradford, Yorkshire, Eng.—d. Aug. 14, 1984, Alveston, near Stratford-upon-Avon, Warwickshire), British novelist, playwright, and essayist, noted for his varied output and his ability for shrewd characterization.

Priestley served in the infantry in World War I (1914–19) and then studied English literature at Trinity College, Cambridge (B.A., 1922). He thereafter worked as a journalist and first established a reputation with the essays collected in *The English Comic Characters* (1925) and *The English Novel* (1927). He achieved enormous popular success with *The Good Companions* (1929), a picaresque novel about a group of traveling performers. This was followed in 1930 by his most solidly crafted novel, *Angel Pavement,* a sombre, realistic depiction of the lives of a group of office workers in London. Among his other more important novels are *Bright Day* (1946) and *Lost Empires* (1965).

J.B. Priestley
Camera Press

Priestley was also a prolific dramatist, and he achieved early successes on the stage with such robust, good-humoured comedies as *Laburnum Grove* (1933) and *When We Are Married* (1938). Influenced by the time theories of John William Dunne, he experimented with expressionistic psychological drama—*e.g., Time and the Conways* and *I Have Been Here Before* (both 1937) and *Johnson over Jordan* (1939). He also used time distortion as the basis for a mystery drama with moral overtones, *An Inspector Calls* (1946). Many of his plays featured skillful characterizations of ordinary people in domestic settings.

An adept radio speaker, he had a wide audience for his patriotic broadcasts during World War II and for his subsequent Sunday evening programs. Priestley's large literary output of more than 120 books was complemented by his status as a commentator and literary spokesman for his countrymen, a role he sustained through his forceful and engaging public personality. Priestley refused both a knighthood and a peerage, but he accepted the Order of Merit in 1977.

A revival of interest in and a reappraisal of Priestley's work occurred in the 1970s. During that decade he produced, among other works, *Found, Lost, Found, or The English Way of Life* (1976).

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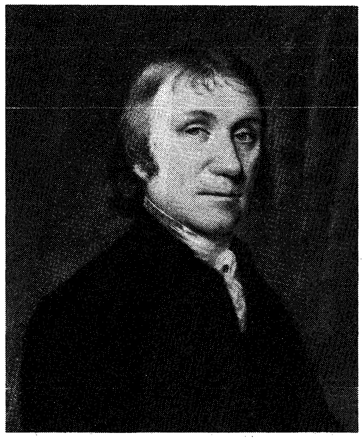
Priestley, Joseph (b. March 13, 1733, Birstall Fieldhead, near Leeds, Yorkshire, Eng.—d. Feb. 6, 1804, Northumberland, Pa., U.S.), English clergyman, political theorist,



Joseph Priestley, portrait in chalk by Ellen Sharples, *c.* 1795; in the National Portrait Gallery, London
By courtesy of the National Portrait Gallery, London

and physical scientist whose work contributed to advances in liberal political and religious thought and in experimental science. He is best remembered as one of the discoverers of the element oxygen.

Education and early career. Priestley was the oldest of six children of a modestly successful cloth dresser. For several years during his childhood Joseph was often sickly, but, perhaps as compensation, he became an avid learner on his own. Although his parents were Calvinists, they were open to other religious views and wanted him to enter the ministry of the Dissenting church, the diverse congregations of which, such as Presbyterian or Independent, did not conform to the Church of England. To prepare himself, he studied "Hebrew, Chaldee, Syriac, and a little Arabic" with a local Dissenting minister.

With improving health, in 1752 he entered a new Dissenting Academy at Daventry, Northamptonshire, one of the educational institutions that, in the 18th century, was established independently by Nonconformists. These academies offered high-quality education and attracted the best teachers and students. His unorthodox opinions developed even more as he added to the required curriculum his own intensive study of history, philosophy, and science, and a daily translation of 10 folio pages of Greek. In 1755 he left Daventry Academy to become assistant minister to the independent Presbyterian congregation in Needham Market, Suffolk, but, as he had become a "furious freethinker," his unorthodox and even heretical opinions gradually lost him the confidence of his orthodox congregation. "After much pain and thought," he renounced the doctrine of the Atonement; moreover, his examination of St. Paul's epistles in the New Testament satisfied him that the Apostle's reasoning "was in many places far from being conclusive." Priestley's intellectual development passed from the Calvinism of his family, through Arianism, with its denial of Christ's divinity, to a rational Unitarianism, with its complete denial of the Trinity. At no stage of this development, however, did he ever waver in the sincerity of his religious convictions or in the genuine piety of his life.

In 1758 Priestley transferred to a more sympathetic congregation in Nantwich, Cheshire, where he opened a day school with 36 students. Becoming interested in science at this time, he provided them with "philosophical instruments," such as an air pump and a static generator for electrical demonstrations. His teaching success led to his appointment in 1761 as a tutor in language and literature at Warrington Academy in Lancashire. Because the universities and learned professions were closed to Dissenters, Priestley developed new courses that were suitable for students preparing for careers in industry and commerce. Textbooks were not available, and these he set himself to write. In 1761 he published the *Rudiments of English Grammar,* a work that was radical in its reliance on description of actual English usage as opposed to prescription on the basis of dead classical languages; it remained in use for 50 years. Ordained a Dissenting minister in 1762 at Warrington, in the same year he married Mary Wilkinson, aged 18, the only daughter of an ironmaster at Bersham in Wales. They had a daughter and three sons.

Priestley enriched the curriculum with his *Theory of Language and Universal Grammar* (1762), *Chart of Biography* (1765), *Essay on a Course of Liberal Education for Civil and Active Life* (1765), and *Lectures on History and General Policy* (1765, 1788). By emphasizing history, science, and the arts rather than the classics of university curricula, he sought to prepare students for a practical life. His educational activities made Warrington Academy the most distinguished school of its kind in England. The degree of LL.D. was conferred on him by Edinburgh University in 1765.

Work in science. Priestley became even more interested in science while attending lectures and demonstrations on practical chemistry given in 1763–65 by the surgeon Matthew Turner. Beginning in 1765, Priestley spent a month of every year in London, where he met the leading men of science, including the American statesman and inventor Benjamin Franklin. On the basis of his electrical experiments, Priestley in 1766 was elected to membership in the Royal Society of London. The next year, with Franklin's encouragement and generous loan of the requisite books, he published *The History and Present State of Electricity,* an original work in which he summarized the knowledge of electricity to his time and described his own experiments. He anticipated the inverse square law of electrical attraction with his observation that when he electrified a hollow sphere there was no charge inside. He also discovered that charcoal conducts electricity and noted the relationship between electricity and chemical change, whereby one could cause the other. This work "drew him into a large field of original experiments" that were not in electricity. As he became more interested in chemistry, he reflected on the similarity between the processes of burning and respiration.

In 1767 Priestley was appointed minister of Mill Hill Chapel, in Leeds, Yorkshire, where he had more leisure for writing and experimenting. Although not primarily theoretical in his approach to science, he was able to perceive what research would be most fruitful. He studied gases, or "airs," as they were then called, a subject that led him to perform many significant experiments. The facts he discovered became central in the theoretical development of chemistry. His work on gases began while he was living next to a brewery in Leeds, where he observed "fixed-air" (carbon dioxide) as it effervesced from vats of fermenting liquor. Before his work, only three gases were known: air, carbon dioxide, and hydrogen. With zeal and enthusiasm he discovered 10 new "airs," four in 1767–73 while at Leeds: nitric oxide (nitrous air), nitrogen dioxide (red nitrous vapour), nitrous oxide (diminished nitrous air, later called "laughing gas"), and hydrogen chloride (marine acid air). His success resulted in large part from his ability to design ingenious laboratory apparatus, particularly an improved pneumatic trough, and his skill in its manipulation. Moreover, by collecting gases above mercury in the trough, instead of in water, he was able to isolate, by trial and error, those that were water-soluble. His description of the gas experiments in the *Philosophical Transactions,* "On Different Kinds of Air" (1772), promptly drew the attention of the French chemist Antoine-Laurent Lavoisier, who provided a theoretical interpretation.

Concurrently with these experiments, Priestley developed rapidly as a political theorist. Representative of 18th-century liberal thought was his *Essay on the First Principles of Government, and on the Nature of Political, Civil, and Religious Liberty* (1769), in which he emphasized individualism; he believed that people should have a voice in their government and power over their own actions. The English economist Jeremy Bentham acknowledged that this influential book inspired his phrase "the greatest happiness of the greatest number." Throughout his life Priestley was an ardent believer in human progress and perfectibility.

In 1772 Priestley's *History and Present State of Discoveries Relating to Vision, Light, and Colours* was an original contribution to optics. It brought an invitation to join Capt. James Cook's second voyage of exploration (1773–75) as an astronomer, but he was obliged to decline when opposition mounted to his Unitarian views. His technique for "impregnating water with fixed-air" (using sulfur acid and chalk), however, was suggested for use on the voyage to make drinking water palatable—and also later made possible the soda-water industry.

In December 1772, William Fitzmaurice-Petty, 2nd earl of Shelburne, later 1st marquis of Lansdowne, appointed Priestley as librarian, literary companion, and tutor to his two young sons, on generous terms, with the freedom to preach and write as he wished. He settled at the Shelburne estate at Calne, Wiltshire, in July 1773. The following November he was awarded the Copley Medal by the Royal Society for his experiments on gases, on which he continued to report in a series of volumes entitled *Experiments and Observations on Different Kinds of Air,* 6 vol. (1774–86).

Discovery of oxygen. Priestley's most famous discovery occurred on Aug. 1, 1774, when he obtained a colourless gas by heating red mercuric oxide (he called it *mercurius calcinatus per se*). Finding that a candle would burn in it "with a remarkably vigorous flame," he called it "dephlogisticated air" because he believed, accepting prevailing theory, that ordinary air became saturated with phlogiston when it could no longer support combustion or life. (Phlogiston was thought to be a material that was transferred during burning and respiration; a unifying idea in 18th-century chemistry, it avoided quantitative considerations but was the reverse of the oxidative interpretation of combustion and respiration established by Lavoisier in 1789.) Priestley was not yet sure, however, that he had discovered a "new species of air." (Oxygen was also discovered by the Swedish chemist and apothecary Carl Wilhelm Scheele, probably by 1773.) The following October Priestley accompanied Shelburne on a journey through Belgium, Holland, Germany, and France, where in Paris he informed Lavoisier how he obtained his new "air." The meeting of the two scientists was highly significant for the future of chemistry: Lavoisier required no more than the barest intimation of the success of Priestley's experiments to appreciate their significance. He immediately repeated them and in 1775–80 conducted intensive investigations from which he correctly deduced the elementary nature of oxygen, recognized it as the active "principle" of the atmosphere, interpreted its role in combustion and respiration, and gave it its name (1789). Priestley, however, did not accept all of Lavoisier's views and continued in particular to uphold the phlogiston theory until, in his old age, he was its last champion.

Other significant scientific discoveries. Continuing his studies of the atmosphere, Priestley discovered ammonia (alkaline air), sulfur dioxide (vitriolic acid air), silicon tetrafluoride (fluor acid air), nitrogen (also discovered by Daniel Rutherford in 1772), and a gas later identified as carbon monoxide. Of striking significance was his observation that light was important for plant growth and that green plants gave off "dephlogisticated air" (really oxygen). These observations became fundamental to the systematic work on photosynthesis by the Dutch physician Jan Ingenhousz (begun in 1779) and by the Swiss clergyman-naturalist Jean Senebier during the next two decades. Drawing then on his earlier knowledge of electricity, Priestley decomposed ammonia by sparking with electric sparks and noticed the formation of dew when mixtures of hydrogen and oxygen are exploded.

In 1779, for reasons not entirely clear, Priestley left Shelburne's employ and settled in the industrial town of Birmingham as minister of the New Meeting congregation. He received a small annuity from Shelburne, and friends raised a subscription to defray the expenses of his experiments. The years at Birmingham were the happiest and busiest of his life. He wrote books on religion and theology and published sermons, tracts, and catechisms. In his *History of the Corruptions of Christianity* (1782), he rejected most of the fundamental doctrines of Christianity, including the Trinity, predestination, and the divine verbal inspiration of the Bible and traced them to their historical sources of error. This work aroused another storm of protest. By the time of the French Revolution he had acquired a reputation as the antagonist of all establishments, both political and religious.

Priestley regularly took part in meetings of Birmingham's Lunar Society, which met monthly at the full moon. Flourishing independently of the Royal Society of London, this organization in 1766–91 actively promoted science and its applications to industry and crafts. There, Priestley was the honoured colleague of the naturalist Erasmus Darwin, the pottery manufacturer Josiah Wedgwood, and the inventor of the steam engine, James Watt. Concluding his scientific work, he observed that "calces" (oxides) are changed to the metallic state (reduced) when heated in hydrogen, but he did not notice that water is also produced, and he gave a phlogistic interpretation.

During these years, Priestley was widely known as the defender of the principles of the French Revolution and an ardent advocate of civil and religious liberty. He angered the anti-revolutionary populace by publicly disagreeing with the *Reflections on the Revolution in France* (1790), written by the British statesman Edmund Burke, who opposed the Revolution. On July 14, 1791, on the second anniversary of the fall of the Bastille prison in Paris, an outbreak of mob violence occurred in Birmingham, in the course of which Priestley's house, library, and laboratory were destroyed. He was driven from Birmingham, never to return.

For the next two years Priestley resided at Hackney, near London, where he taught at the New College (Hackney College); but the progress of the French Revolution, the execution of Louis XVI in 1793, and the declaration of war against France the same year excited further rancour against him. His three sons had emigrated to the United States in August 1793; Priestley and his wife followed in April 1794, taking up residence in Northumberland, Pa. He was welcomed by various learned societies, including the American Philosophical Society, and offered the chair of chemistry at the University of Pennsylvania, but he refused to accept any public office.

During his years in America, Priestley continued his literary and religious activities, but he was hampered in his scientific work by the difficulties of communicating with his friends in England. He published in the United States a four-volume *History of the Christian Church to the Present Times.* He was a friend and correspondent of two leaders of the American Revolution, John Adams and Thomas Jefferson, both of whom held views on religion similar to his own. His *Doctrines of Heathen Philosophy compared with those of Revelation* appeared after his death. It had been written at the suggestion of Jefferson, who felt, however, that "it did not do justice to the undertaking," adding that Priestley "felt himself pressed by the hand of death." He died at Northumberland in 1804. (S.R.)

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Where the same name may denote a person, place, or thing, the articles will be found in that order

Priests' Charter, German PFEFFENBRIEF (October 1370), treaty that unified the legal system in all the Swiss cantons, particularly highlighting two features: safety on the highways for traders and nonintervention by foreign priests. Bruno Brun, a provost wanting to escape punishment, was the catalyst for an amendment in the Zürich constitution, which ruled against the foreign clergy exercising jurisdiction while in Switzerland. The Priests' Charter contained the first mention of "Confederation" (*Eidgenossenschaft*) and provided for a majority instead of a unanimous voting system.

Prieur, Pierre-Louis, byname PRIEUR DE LA MARNE (b. Aug. 1, 1756, Sommesous, Fr.—d. May 31, 1827, Brussels), French political figure, a member of the Committee of Public Safety, which ruled Revolutionary France during the period of the Jacobin dictatorship (1793–94). He vigorously enforced the Committee's policies in the anti-Republican coastal towns west of Paris.

Prieur was a lawyer at Châlons at the time of his election to the bourgeois Third Estate of the States General (later, the National Assembly) of 1789. Since he was one of the few delegates to advocate radical democratic reforms, his sobriquet was altered to Crieur de la Marne (Crier of the Marne). Prieur sat with the Montagnards (deputies from the Club of the Jacobins) in the National Convention, which first met in September 1792; and on March 26, 1793, he became a member of the Committee of General Defense. On July 10 he was elected to the predominantly Jacobin Committee of Public Safety.

Beginning in October, Prieur de la Marne was dispatched on missions to the coastal towns in and around Brittany, where he vigorously suppressed counterrevolutionary activity. He set up a tribunal that ordered the execution of about 2,900 insurgents in the Vendée. Because he was seldom in Paris, Prieur had little part in the political crisis that led to the collapse of the Jacobin regime in July 1794. After participating in the abortive Jacobin uprising of 1 Prairial (May 20, 1795), he practiced law and held bureaucratic posts in Paris until he entered Napoleon's government of the Hundred Days (March–June 1815). In 1816 the newly restored monarch Louis XVIII exiled him.

Prieur-Duvernois, Claude-Antoine, byname PRIEUR DE LA CÔTE-D'OR (b. Dec. 2, 1763, Auxonne, Fr.—d. Aug. 11, 1832, Dijon), French military engineer, a member of the Committee of Public Safety, which ruled Revolutionary France during the period of the Jacobin dictatorship (1793–94). He organized the manufacture and requisitioning of the weapons and munitions needed by the French for war with the European powers.

When the Revolution broke out in 1789, Prieur was a lieutenant of engineers in the army. He became a captain in April 1791 and was elected to the revolutionary Legislative Assembly (October 1791–September 1792) and its successor, the National Convention. While on a mission for the National Convention to Caen, he was arrested by counterrevolutionaries on June 9, 1793, and imprisoned for nearly two months.

On Aug. 14, 1793, Prieur and his friend Lazare Carnot (also a military engineer) were elected to the Committee of Public Safety. While Carnot took charge of military operations, Prieur assumed control of all matters relating to armament. He sought the advice of many of France's finest scientists and engineers and directed the nationalization of war industries. Prieur thereby played a major role in the extensive economic planning carried out by the Jacobin regime. He remained a conservative bourgeois democrat, however, viewing economic controls as a temporary expedient and opposing social welfare measures favoured by the Parisian lower classes.

Although he supported Carnot in his conflict with Louis de Saint-Just and Robespierre (the committee's leading members) over the conduct of the war, Prieur had no part in the conspiracy that brought about Robespierre's downfall on 9 Thermidor (July 27, 1794). During the ensuing Thermidorian reaction against the Jacobin regime, he resigned from the Committee of Public Safety (October 1794). Prieur was largely responsible for the adoption by the government of a uniform standard of weights and measures in March 1795. He set up a wallpaper factory in Paris, and in 1811 Napoleon's government granted him a pension.

Prignano, Bartolomeo (pope): *see* Urban VI.

Prigogine, Ilya, (b. Jan. 25, 1917, Moscow), Russian-born Belgian physical chemist who received the Nobel Prize for Chemistry in 1977 for contributions to nonequilibrium thermodynamics, especially the theory of dissipative structures. His theoretical work extended the work of Lars Onsager by developing thermodynamic methods of understanding irreversible processes as well as the classical reversible reactions that were supposed to result in states of equilibrium.

Prigogine was taken to Belgium as a child. He received his Ph.D. in 1942 at the Free University in Brussels, where he accepted the position of professor in 1947. In 1962 he became director of the International Institute of Physics and Chemistry, Solvay, Belg. He also served as director of the Center for Statistical Mechanics and Thermodynamics at the University of Texas, Austin, from 1967.

prijaji (Javanese social class): *see* priyayi.

Prikaspiyskaya Nizmennost (U.S.S.R.): *see* Caspian Depression.

Prilep, Turkish PERLEPE, town in Macedonia, Yugoslavia, south of Skopje on the Titov Veles–Bitola railway line. Prilep was an important centre during the Middle Ages. St. Nikola's Church (1299) has valuable frescoes; the monastery of Archangel Michael and the Church of St. Dimitri both date from the 14th century, and the castle was built in the 14th century by a national hero, Marko Kraljević. The fertile Prilep Basin, or Pelagonija lowland, is a centre for fruit and tobacco growing and leatherworking. Silica bricks and insulating materials are made from local diatomaceous earth. Pop. (1981 prelim.) mun., 99,941.

Priluki, city, Chernigov *oblast* (administrative region), Ukrainian Soviet Socialist Republic, on the Uday River. It is one of the oldest cities in the Ukraine, being first documented in 1092. It was destroyed by the Mongols in the 13th century. Today it has a wide industrial base as a centre of the oil industry based on local deposits (those of the Dnepr-Donets depression), with engineering, textiles, clothing, and food industries as well. Teacher-training and medical schools are located in the city. Pop. (1983 est.) 69,000.

Prim (y Prats), Juan (b. Dec. 6, 1814, Reus, Spain—d. Dec. 30, 1870, Madrid), Spanish military leader and political figure who played an important role in the Revolution of 1868 that resulted in the dethronement of Isabella II, the Bourbon Spanish queen.

Prim rose to military fame in the struggle to win the throne for Isabella II against her uncle, Don Carlos (First Carlist War, 1833–39). After victory, however, Prim opposed the government of the young queen's regent Baldomero Espartero. Professing liberal principles, Prim was elected in 1843 to the Cortes (parliament) and shortly afterward took part in a successful insurrection against Espartero; he was then named military governor of Madrid and later of Barcelona. Prim soon conspired against the government of Ramón María Narváez, leader of the Moderate Party. Captured and condemned, he was later pardoned.

After serving as governor of Puerto Rico (from 1847), Prim was given command of the Spanish commission attached to the Turkish Army fighting the Russians in the Crimea

(1853). In 1857 he was the only member of the Progressive Party elected to the Cortes. Prim distinguished himself in the war between Spain and Morocco (1859–60) and in 1861 was appointed to command the joint English, French, and Spanish expedition to Mexico.

Upon his return to Spain, Prim resumed his political career and, as one of the leaders of the Progressive Party, opposed Isabella II. Driven into exile by an abortive attempt at rebellion in 1866, he reentered the country in triumph in the 1868 revolution that deposed the queen. Prim thereupon became the most powerful figure in the new government and proceeded to search for a suitable monarch for the nation. The consideration, supported by Prim, of Prussia's candidate, Prince Leopold of Hohenzollern-Sigmaringen, served as the casus belli of the Franco-Prussian War (1870–71). When Leopold stepped down, Prim obtained the election of Amadeus of Savoy. On Dec. 27, 1870, just prior to Amadeus' arrival in Spain, Prim was fatally wounded by assassins, and he died three days later. His death deprived Amadeus of a staunch supporter, contributing to the instability of a reign that ended two years later.

Primadizzi (Italian painter): *see* Primaticcio, Francesco.

primaquine, synthetic antimalarial drug introduced into medicine in the 1950s. Primaquine is one of an important series of chemically related antimalarial agents, the quinoline derivatives. It is administered orally as primaquine phosphate.

Primaquine inhibits the development of the malarial parasites *Plasmodium vivax* and *P. falciparum* in both blood and tissue, thus producing complete cures and preventing relapses. Some abdominal discomfort may occur as a side effect.

primary education: *see* elementary education.

primary election, in the United States, an election to select the candidates who will run for public office. Primaries may be closed (partisan), so that only declared party members may vote; or they may be open (nonpartisan), so that voters choose which party's primary they wish to vote in without declaring any party affiliation. Closed primaries may be direct or indirect. A direct primary functions as a preliminary election whereby voters decide on their party's ticket; some form of direct primary is now used in all U.S. states. In an indirect primary, voters elect delegates who choose the party's candidates at a nominating convention.

The presidential primaries held in many states are indirect primaries. In most presidential primaries, the delegates elected are bound and pledged (Republicans by some state rules, Democrats by national party rules) to vote in a way that reflects the preferences of the voters. Delegates may be bound for only one ballot or until released by the candidate. In some states, the presidential preference vote is advisory and does not bind the delegates. The delegates can be bound to presidential candidates on a winner-take-all basis, as in many Republican state primaries, or by proportional representation, as in the Democratic primaries, in which any candidate receiving a minimum percentage of the votes is entitled to at least one delegate. Allocating delegates by proportional representation makes it difficult for a candidate to build a delegate landslide out of a series of narrow primary victories.

The formal, legally regulated primary system is peculiar to the United States. The earliest method for nominating candidates was the caucus (*q.v.*), adopted in colonial times for local offices and continued into the 19th century for state and national offices. Nominating conventions, instituted as a means of checking the abuses of the caucus system, also became subject to abuses that led first to their regulation and ultimately to their elimination for most offices except president and vice-president. After 1890, mandatory regulations transformed the primary into an election that is conducted by public officers at public expense.

Although direct primaries were used as early as 1842 (by the Democratic Party in Crawford county, Pa.), the system came into general use only in the 20th century, beginning with Wisconsin in 1903. The movement spread so rapidly that by 1917 all but four states had adopted the direct primary for some or all statewide nominations. Except in several Southern states, where primaries are still optional, primaries are now required for all state and local offices in the United States. Attention from the news media has increased the importance of presidential primaries to the point where success, especially in the early primaries, gives a candidate a great advantage in publicity and private campaign funding, whereas failure can end a campaign.

Names can be placed on the primary ballot by a simple declaration of candidacy, by nomination at an official or unofficial pre-primary convention, or by the most popular system, a signed petition of a required number of voters. Endorsement of an official party candidate at pre-primary conventions usually results in the candidate's being listed first on the ballot. Usually primaries include only those parties that have polled a fixed minimum at the last election.

The merits of open versus closed primaries are widely debated. Proponents of open primaries argue that voters should be able to choose which primary they will vote in at each election. Open primaries allow independents unwilling to declare a party affiliation to vote and prevent voter intimidation. Party organizations prefer closed primaries because they promote party unity and keep those with no allegiance to the party from influencing its choice, as happens in crossover voting, when members of rival parties vote for the weakest candidate in the opposition's primary. Several states compromise by allowing both registered party members and independents to vote in primaries.

The closest parallel to the U.S. primary has been the "preselection" ballot of the Australian Labour Party, in which candidates in each locality have been selected by party members in that locality from those offering themselves for the preselection vote.

primary mineral, in an igneous rock, any mineral that formed during the original solidification (crystallization) of the rock. Primary minerals include both the essential minerals used to assign a classification name to the rock and the accessory minerals present in lesser abundance. In contrast to primary minerals are secondary minerals, which form at a later time through processes such as weathering and hydrothermal alteration. Primary minerals form in a sequence or in sequential groups as dictated by the chemistry and physical conditions under which the magma solidifies. Accessory minerals form at various times during the crystallization, but their inclusion within essential minerals indicates that they often form at an early time.

primary school, in many countries, an elementary school. It is the preferred term in such countries as Great Britain and France (French *école primaire*) and in most publications of the United Nations Educational, Scientific, and Cultural Organization. In the United States it is not a synonym but denotes only the first years of elementary education—specifically, kindergarten and grades 1 through 3.

primate, in Christianity, an ecclesiastical title for a bishop in some churches who has precedence over a number of other bishops. In the early church, it was one of several titles, including metropolitan, exarch, and patriarch, used to designate a chief bishop who had certain rights of superintendence over an entire district or area. Through gradual development it became primarily an honorary office.

In the modern Roman Catholic church, primates are those metropolitan archbishops whose sees, by reason of antiquity or prominence, are the primary sees of a region or nation. Apart from the special case of the pope, who has among his titles that of primate of Italy, primates generally do not possess any jurisdiction outside their own dioceses, but only a limited and honorary right to precedence.

In the Church of England, the archbishop of York is primate of England, whereas the archbishop of Canterbury is primate of the entire Anglican Communion.

primate, in zoology, a member of the mammalian order Primates, which comprises two suborders: the prosimians (lemurs, lorises, and tarsiers) and the anthropoids (monkeys, apes, and man). According to fossil records, primates originated in the Late Cretaceous (97.5 to 66.4 million years ago) as forest-dwelling creatures. Evidence that modern man is a descendant of these early primates was first provided by Charles Darwin in his *Origin of Species,* published in 1859.

A brief treatment of primates follows. For full treatment, *see* MACROPAEDIA: Mammals.

The anatomical and behavioral features that distinguish primates from members of other mammalian orders include a lack of strong specialization in structure; prehensile hands and feet, usually with opposable thumbs and great toes; flattened nails instead of claws on the digits; acute vision with some degree of binocular vision; relatively large brain exhibiting a degree of cortical folding; and prolonged postnatal dependency. No primate exhibits all these features, and indeed the diversity of primate forms has produced disagreement as to their proper classification.

Taxonomically the primate order can be arranged in 11 families: The prosimians include the lemurs (Lemuridae), the aye-aye (a single species comprising the Daubentoniidae), galagos and lorises (Lorisidae), tarsiers (Tarsiidae), and a little-known group of arboreal creatures including the avahi, sifaka, and indri (Indriidae). The anthropoids include marmosets and tamarins (Callitrichidae), South American monkeys other than marmosets (Cebidae), African and Asian monkeys (Cercopithecidae), siamangs and gibbons (Hylobatidae, the lesser apes), orangutans, gorillas, chimpanzees (Pongidae, the great apes), and man and his direct ancestors (Hominidae). The tree shrews (Tupaiidae) are included among the prosimians by some authorities but by others among the insectivores.

A wide range of size, weight, and habitat is found among members of the primate order. The smallest primates are weighed in tens of grams, while the gorilla (*Gorilla gorilla*) typically weighs 140 to 180 kg (300 to 400 pounds). Nonhuman primates are found throughout the tropical areas of India, Africa, Asia, and South America. A few species also live in temperate latitudes, but lack of winter food supply limits their adaptability to these climates.

The combination of an unspecialized physical structure and highly specialized behaviour has made the primates a very successful order. An unspecialized structure helps primates flourish in changing environments, while their well-developed brains allow them to adapt their behaviour to suit their specific needs. Most primates have binocular vision and forward-facing eyes, two characteristics that are necessary for depth perception. Although their vision is highly developed, primates have shortened muzzles and a correspondingly reduced sense of smell. These modifications are a reflection of the predominantly arboreal life that has long characterized primates. Except for two species, all primates have five digits on each hand and foot. All have prehensile (grasping) hands, and all except man have prehensile feet. Although the opposable (freely moving) thumb is present in most primates, it is particularly developed in man, making him capable of delicate manipulation.

One of the striking features of the primate order, wherein it differs from other mammalian orders, is that its existing members fall into a graded series, or scale of organization, which suggests an actual evolutionary trend leading from the most primitive (tree shrews) to the most advanced (humans).

A trend in primate evolution has been toward a more elaborate brain. In higher primates the neocortex functions to receive, analyze, and synthesize information from the senses. The brain of anthropoids is larger, relative to body weight, than that of prosimians and is characterized by a complicated pattern of folds and fissures on the surface. Another evolutionary trend in primates involves the development of offspring both before and after birth. Gestation periods are relatively long, allowing for the development of the more complex brain. The more sophisticated species also exhibit longer infant and juvenile stages, which are probably related to the time required for their more advanced mental development and their integration into complex social systems. The reproductive cycle of copulation, gestation, birth, and lactation occupies the higher female primates for a year or more. The female does not usually come into estrus again until the offspring of the previous pregnancy is weaned. Primate infants are generally born fully furred and with their eyes open. Except in the case of man, chimpanzee, and gorilla, the newborns are able to cling to the mother's fur and need no support. Physical dependency ends when the young are weaned, but it is followed by an extended period of psychological maternal dependency lasting from 2½ years in lemurs to 14 years or so in man.

Primates exhibit four different forms of locomotion: vertical clinging and leaping; quadrupedalism, which involves use of both the forelimbs and the hind limbs in walking, climbing, and swinging; brachiation, in which the primary form of movement is swinging by the forelimbs; and bipedalism, the upright striding of man. All primates are able to sit upright, many can stand upright, and some can even walk upright for short periods, but only man is capable of the upright striding gait.

Primates are omnivorous, and their teeth are multipurpose, allowing them to cut, tear, and grind. Although nonhuman primates will occasionally eat the flesh of other mammals, their diet consists primarily of leaves, fruit, bark, nuts and other vegetable matter, birds, eggs, rodents, insects, and frogs.

For centuries man has recognized the superior intelligence of monkeys and has valued them as pets. Because the biology of all primates is very similar, nonhuman species have become increasingly important to man in medical research and space science. More than a quarter of a million wild monkeys are used in laboratories every year. Although most primates are still plentiful in the wild, certain species, including the orangutan and gorilla, are in danger of extinction from hunting, poaching, or loss of habitat.

Primaticcio, Francesco, also called BOLOGNA, LE PRIMATICE, or PRIMADIZZI (b. April 30, 1504, Bologna, Emilia [Italy]—d. 1570, Paris, Fr.), Italian Mannerist painter, architect, and leader of the first school of Fontainebleau.

Primaticcio studied with Giulio Romano and assisted him in his work on the decorations of the Palazzo del Tè in Mantua. When the French king Francis I invited Romano to assist in the redecoration of the Fontainebleau Palace in 1531, Romano sent Primaticcio in his place, and, once there, Primaticcio became one of the principal artists in France.

In his initial work at Fontainebleau, Primaticcio employed a decorative style that combined stucco work and mural painting. He returned to Rome for a couple of years to purchase artworks for Francis I, and on his return he decorated the Cabinet du Roi with a series of paintings, now lost, that flouted rational perspective in painting and stressed the primacy of the human figure. Primaticcio's stylistic use of exaggerated musculature and active, elongated figures in these works was to exert great influence on French painting for the remainder of the 16th century.

In 1543 Primaticcio completed a number of decorations for the bedchamber of the Duchesse d'Étampes; all of these works survive. During this period he also completed work on the Galerie d'Ulysse (1541–70) and the Salle de Bal (or Galerie Henri II). The former was completely destroyed under Louis XV, and the latter has been heavily restored. Primaticcio increased his use of foreshortening and illusionistic treatment of subjects in his later work. His design for the ceiling of the chapel of the Hotel de Guise in Paris (1557) was to be the artist's last major work. For the last decade of his life, Primaticcio collaborated with the sculptor Germain Pilon on the tomb of Henry II in the abbey church of St. Denis near Paris. In his decorations Primaticcio was one of the first artists in France to replace religious themes with those of classical mythology. He subdued the violence of Italian Mannerism, investing it with a quiet and characteristic French elegance.

primavera (species *Cybistax donnelsmithii,* or *Donnel-Smithii*), timber tree of Central America with brilliant yellow flowers, or its firm light wood, often called white mahogany. Although the tree is unrelated to true mahogany, the wood resembles it in being easy to work, lustrous, and free of tendency to warp. When first cut, it is a pale yellow; upon exposure to air and light it darkens to a yellowish rose with streaks of red, orange, and brown. Primavera is used, either in thin lumber or veneer form, for special effects in paneling and cabinetmaking.

prime, any of those positive integers greater than 1, each divisible only by itself and 1—*i.e.,* 2, 3, 5, 7, 11, 13, 17, 19, 23, . . .

Every positive integer greater than 1 can be expressed as the product of only a single set of prime numbers. Primes have been recognized since at least 300 BC, when they were studied by the Greek mathematicians Euclid and Eratosthenes, yet even today there remain certain open questions regarding them. *See* number theory.

prime minister, also called PREMIER, the head of the executive branch of government in countries with a parliamentary system. The prime minister serves under the chief of state (even if the chief of state has only titular or ceremonial powers), except in those rare cases in which the chief of state assumes the functions of prime minister. Although the origin of the title lies in 17th-century France, where the Cardinal de Richelieu was acknowledged in 1624 as *principal* or *premier ministre,* it was in England that the office of the prime minister definitively evolved as that of the chief executive of the government in a parliamentary context.

Great Britain. Prior to the 18th century, powerful and important individuals may have occupied preeminent positions in any one ministry, but the chief executive power was usually apportioned between the monarch and the various members of the Cabinet. But the place vacated by George I when, from 1717, he ceased to attend Cabinet meetings had to be filled by a single individual, and this presiding officer developed into a prime minister. Sir Robert Walpole is usually regarded as the first prime minister, and during his long term of office (1721–42) he developed many attributes of premiership. He was master of his Cabinet; he insisted that his colleagues subscribe to the principles of his party; he dismissed his opponents; he dispensed the royal patronage; and, with reservations, he may be described as commanding a majority in the House of Commons. However, on the fall of Walpole in 1742 the further development of the office was checked. It was William Pitt the Younger who consolidated the work of Walpole and who by his long tenure of power (1783–1801, 1804–06) accustomed the nation to the office. Pitt established the prime minister as the person who would supervise and coordinate the work of the various departments and who would possess the chief confidence of the king. Under Pitt's successors in the 19th century the office of prime minister attained the functions and character it retains to this day in Britain and many other parliamentary democracies.

In Britain the prime minister is still appointed by the sovereign, but the latter's participation in the selection process may now be said to be merely nominal. Since it is desirable that the office be filled by the individual most able to pass legislation in Parliament, the prime minister is now normally the acknowledged head of the party commanding a majority in the House of Commons.

The prime minister wields significant powers of patronage and has the exclusive right to appoint hundreds of ministerial and diplomatic posts, as well as the right to bestow certain Anglican church offices and numerous honours and decorations on individuals of his choice. The prime minister ultimately determines government policy, and all measures decided upon at meetings of the Cabinet must be approved by him. Finally, it is the prime minister who advises the sovereign to dissolve Parliament in preparation for a general election, a step necessary if his legislative programs are decisively defeated in the House of Commons. An official residence, 10 Downing Street, is assigned to the prime minister, and he also has the use of Chequers, a country mansion in Buckinghamshire.

Commonwealth countries. The British prime minister has become the model for prime ministers in the member states of the Commonwealth, and the evolution of the office in these nations has proceeded along lines similar to those in Great Britain. Thus in Canada it emerged along with the gradual development of responsible government; though Sir Allan Napier McNab (1854–56) is often regarded as the first prime minister, the office was not clearly established until after federation, when John Alexander Macdonald held it from 1867 to 1873. In Australia the office of prime minister was fully developed by the time of federation in 1900, and in 1901 Edmund Barton became the first prime minister of the new Commonwealth of Australia. In India, elections held in 1937 under the Government of India Act (1935) resulted in the establishment of cabinet government under prime ministers in the 11 provinces, and when in 1947 full autonomy was granted, Jawaharlal Nehru became the first prime minister of India and Liaquat Ali Khan that of Pakistan. Similar developments occurred in other parts of the Commonwealth as they attained self-government.

Continental Europe. Imported into countries in the rest of the world with different traditions of executive leadership, the office of prime minister, or premier, has undergone various modifications. It is in the surviving constitutional monarchies, like those in Scandinavia and the Low Countries, that the British norm is most closely approximated. France has varied the powers of the premier (*président du conseil des ministres*) under its various constitutions.

The office of premier first assumed primary importance in France beginning with the Third Republic (1870–1940). Under that system a president filled the role of constitutional monarch, and the premier was supposed to discharge the functions of his British counterpart. In fact, with a few notable exceptions such as Georges Clemenceau, these French premiers were weak executives, and their terms of office were unstable and short-lived (there were more than 50 in the 70 years of the Republic).

The Fourth Republic (1946–58), though it slightly strengthened the premier's role, did nothing to increase the stability of the governments, which were usually coalitions. The Fifth Republic (from 1958) greatly strengthened the presidency, weakening Parliament and placing the premier in a subordinate position. The premier became responsible for the day-to-day administration of the government, but many of his executive and policy-making powers passed to the president. This arrangement worked smoothly enough when the president and the premier belonged to the same party. But when the president was of one party and he was forced to choose as his premier a member of the political opposition by virtue of the latter's voting majority in Parliament (as happened following the legislative elections of 1986), a power-sharing arrangement had to be worked out between the two chief executives.

In Italy Conte Camillo di Cavour became the first premier (*primo*, or *primo ministro*), but he had been preceded in Piedmont by the Marchese D'Azeglio, the first premier under the Piedmontese constitution of 1848. In fact, however, the political fragmentation of the country and the fluidity of party groupings in Parliament made premiers more dependent on royal favour than on any other single factor and their terms of office were always brief. Between 1860 and the coming of Fascism in 1922, Italy had 38 premiers. The new constitution of 1947, however, ushered in a system which made possible more stable ministries and proportionally stronger premiers.

Germany gives its prime minister the title of chancellor (*kanzler*). Under the Empire (1871–1918), even though the chancellor was endowed with explicitly superior powers vis-à-vis the other ministers, he was always dependent on the kaiser. In the Weimar Republic (1919–33) he was a greatly weakened figure; Cabinet decisions were by majority vote and he had to allocate portfolios at the direction of the parties which made up his coalition. The constitution of the German Federal Republic in 1949 explicitly guarded against such weakness, and this together with the strong personality of the first chancellor, Konrad Adenauer (1949–63), gave the office a vigorous start. Under Adenauer's successors in the office, the chancellor has continued to function as a strong chief executive responsible for the conduct of both foreign and domestic affairs.

Japan. In Japan, a situation similar to that of present-day Germany prevails. There, by the constitution, the prime minister (*sōri daijin*) "exercises control and supervision" over the whole of the executive branch, and his counter-signature is required for all laws and Cabinet orders. Thus Cabinet ministers are basically mere extensions of his authority. The emperor selects the prime minister from among the members of the lower house of the Diet (Kokkai) upon the recommendation of that body. Since World War II the person chosen has been the leader of the majority party.

Primerica Corporation, formerly called (1901–87) AMERICAN CAN COMPANY, diversified American corporation that is involved in such financial services as health and life insurance, mortgage banking, and mutual fund management, as well as in specialty retailing operations including the direct-mail selling of consumer goods and sales outlets for audio and video recordings and equipment. Throughout most of its history the company was noted for its production of metal cans for food and beverages, as well as other metal, paper, and plastic packaging and such consumer products as disposable cups, containers, towels, and tissues. Headquarters are in Greenwich, Conn.

The American Can Company was founded in 1901 through the consolidation of several producers of metal cans that primarily supplied the food-canning industry. That year American Can monopolized 90 percent of the nation's can-making capacity; by 1913 the percentage had dropped to about 30 percent, and an antitrust suit brought by the U.S. government to dismember the firm failed in the courts (1916). Another antitrust decision in 1950 did restrict the company's selling and leasing procedures.

American Can was notable for its pioneering research in tin-plating, container sterilization, and the use of aluminum in cans. In 1981 the company began to move out of manufacturing and transformed itself into a financial services conglomerate. This process concluded in 1986 with the sale of its remaining packaging operations to Triangle Industries, Inc., which also acquired the name American Can Company. The former American Can Company assumed the name Primerica Corporation in 1987.

primitive culture, in the lexicon of early anthropologists, any of numerous societies usually characterized by lack of a written language, relative isolation, small population, relatively simple social institutions and technology, and a generally slow rate of sociocultural change. History and myth in such cultures are passed on through an oral tradition and may be the province of a person or group especially trained for the purpose.

Increasingly in the 20th century, the use of the term primitive in connection with human societies and the institutions and products thereof has been regarded as a vestige of the colonial spirit in which the discipline of anthropology was born. The term primitive, it has been charged, along with the loose equivalents savage, preliterate, and others, implies that the cultures so characterized are at an earlier stage of development than "higher," or literate, civilizations. Contemporary anthropologists generally prefer to avoid this assumption, which they regard as simplistic. In addition, early writers frequently used these terms with the implication that such peoples were mentally and morally inferior. The term nonliterate has been adopted by some scholars in an attempt to avoid negative value connotations. The limitations inherent in one culture's description of another, however, render all such designations problematic. The criteria for an objective anthropological vocabulary remain a matter of considerable debate.

The subject matter traditionally encompassed under the term primitive culture is treated in a number of articles in the MACROPAEDIA. For an overview of the concept of human culture, *see* Culture, The Concept and Components of. For a cross-cultural discussion of kinship systems, the basic means of social organization in most nonindustrial societies, *see* Family and Kinship. For a treatment of the religious systems, institutions, and practices associated with nonliterate cultures worldwide, *see* Religious and Spiritual Belief, Systems of; Rites and Ceremonies, Sacred; Sacred Offices and Orders. For a discussion of nonindustrial technology, *see* Agriculture, The History of; Technology, History and Concepts of; Tools. For an account of economic systems characteristic of nonliterate societies, *see* Economic Systems. Particular nonliterate peoples and cultures and their arts (visual arts, performing arts, and oral traditions) are treated in a variety of MACROPAEDIA articles. For peoples of Africa, *see* Africa; African Arts. For peoples of North and South America, *see* American Indians. For peoples of the Arctic region, *see* Arctic, The. For peoples of Asia, *see* Asia; Central Asian Arts; East Asian Arts; South Asian Arts; Southeastern Asian Arts. For peoples of Australia, *see* Australia; Oceanic Arts. For peoples of the Pacific island groups, *see* Pacific Islands; Oceanic Arts.

primitive weevil, any member of the almost 2,000 species of the beetle family Brenthidae (order Coleoptera). These insects occur throughout the world but are most prevalent in the tropics. The female uses her long, straight snout to bore holes in trees for her eggs. The male's snout is short, broad, and flat. Most species are between 7 and 30 mm ($\frac{1}{3}$ to $1\frac{1}{3}$ inches) in length and are dark in colour with orange markings on the wing covers (elytra). The adults live under tree bark, feeding on fungi, sap, and other insects. The larvae bore through wood and may cause considerable damage to living trees.

primitivist art: *see* naïve art.

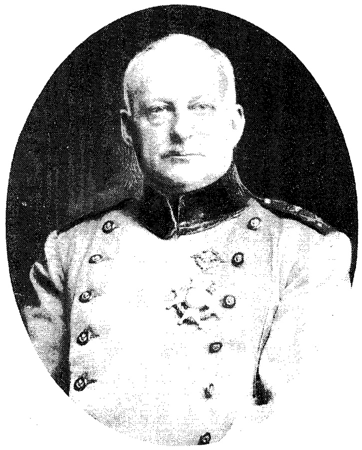
Primo de Rivera, José Antonio, MARQUÉS DE ESTELLA (b. April 24, 1903, Madrid—d. Nov. 20, 1936, Alicante, Spain), eldest son of the dictator General Miguel Primo de Rivera and the founder of the Spanish fascist party, the Falange (*q.v.*).

After a university education and military service, Primo de Rivera began a career as a lawyer in 1925. In October 1933 he launched the Falange Española as a movement committed to overthrowing the government if the political parties of the left should manage to impose their policies on the country. He expounded his fiery if rather nebulous Fascist views in his periodicals *F.E.* (1934) and *Arriba* (1935), and when these publications were suppressed he addressed meetings across the country and made speeches in the Cortes, to which he had been elected in 1933. In 1935 the parties of the left formed the Popular Front, which came to power after the elections of February 1936. Shortly after losing his seat in the Cortes at that time, Primo de Rivera was arrested. While in prison he was reelected for Cuenca, but his candidature was annulled by the Popular Front government, which then proceeded to dissolve his party. With the outbreak of the Spanish Civil War, he was held in prison, given a summary trial, and executed by the Republican authorities.

General Francisco Franco's party treated him as a martyr and merged the Falange Party with other groups to form the Nationalist movement. Primo de Rivera's articles and speeches formed the doctrine of Franco's Nationalist movement in the years after the Civil War. Rivera's *Obras completas* ("Complete Works") was published in 1944.

Primo de Rivera (y Orbaneja), Miguel, MARQUÉS DE ESTELLA (b. Jan. 8, 1870, Cádiz, Spain—d. March 16, 1930, Paris), general and statesman who as dictator of Spain from September 1923 to January 1930 founded an authoritarian and nationalistic regime that attempted to unify the nation around the motto "Country, Religion, Monarchy." Though it enjoyed success in certain areas, his repressive government failed to create an acceptable political system and succumbed to the widespread discontent it had engendered.

Born into a military family, Primo de Rivera was graduated from the General Military Academy in Toledo in 1888 and served as an



Miguel Primo de Rivera
By courtesy of the Biblioteca Nacional, Madrid

officer in Morocco, Cuba, and the Philippines. In 1915 he was named military governor of Cádiz and four years later captain general of Valencia. In the same capacity in Barcelona in 1922, he acted firmly in suppressing disorder. He saw the unrest and upheaval there and in the nation at large as products of a parliamentary system that he termed corrupt and inefficient. When he was brought to power by the coup d'état of September 1923, he accordingly dissolved the Cortes (parliament) and suspended constitutional guarantees.

The most popular achievement of Primo de Rivera's regime was the successful termination of the Moroccan War (1927). He also had some success in settling labour difficulties and in public works undertakings. His government failed to win the support of the middle classes, however, and also suppressed liberties in Catalonia. Further, its reliance on the landlord class prevented the implementation of fundamental agrarian reforms. Primo de Rivera attempted to create a strong party faithful to Spanish traditions; his Unión Patriótica, however, failed to fulfill this hope.

The regime survived three attempts to overthrow it by force in 1926, but discontent with the government, which was becoming increasingly intolerant of opposition, continued to grow. By 1929 public finance was in a troubled state, and dissatisfaction had spread to many segments of society. When his chief source of power, the army, refused to support him, Primo de Rivera was forced to resign, and, broken in health, he died shortly thereafter.

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primogeniture and ultimogeniture, preference in inheritance that is given by law, custom, or usage to the eldest son and his issue (primogeniture) or to the youngest son (ultimogeniture). In exceptional cases, primogeniture may prescribe such preferential inheritance to the line of the eldest daughter. The motivation for such a practice has usually been to keep the estate of the deceased, or some part of it, whole and intact. In the West, laws forbidding the partitioning of land and decreeing its devolution upon the youngest or eldest son served as a means of preserving not only the size of the real estate so affected but also the power and prestige of the aristocracy, which traditionally rested on land ownership.

Strict primogeniture among nonliterate peoples is rare; the eldest son usually assumes the responsibility of trusteeship of the property and of adjudicating attendant disputes. Sometimes the practice, in modified form, governs succession to power and office rather than to possessions. Among some agricultural peoples of increasing population and limited land, however, one of the two practices as employed in the West prevents the partitioning of an already scarce commodity. Some observers have reasoned that the designation of a sole heir generates territorial expansion by forcing the unwilled sons to fend for themselves: among the Maori and some peoples of Polynesia, this meant trekking off to colonize a new, uninhabited area.

Primogeniture probably implies, as a choice over ultimogeniture, the importance of hierarchical considerations by maintaining respect for the most advanced in age. If, on the other hand, ultimogeniture (also called junior right and mimorat) is the method of maintaining the integrity of the inheritance, the elder brothers may be compensated with privileges of authority, travel, and some form of pecuniary or material advantage; and it may be reasoned that the youngest son, having stayed the longest in the house of his father, having more years to live, and being the least likely to have established himself in the world, should be the one to whom the land falls.

Consult the INDEX *first*

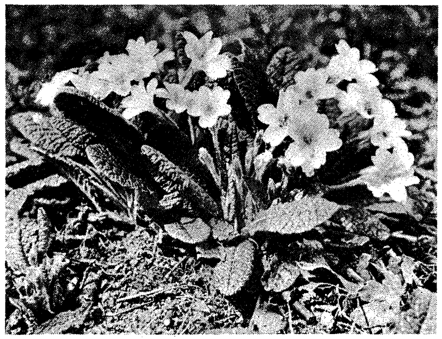
Primorsky Kray, also spelled PRIMORSKIJ KRAJ, English MARITIME TERRITORY, administrative division, Russian Soviet Federated Socialist Republic, between the Sea of Japan (east) and northeastern (formerly Manchuria) China (west). Covering an area of 64,054 sq mi (165,900 sq km), it is the smallest and most southerly of the Soviet Far Eastern territories. The *kray* was formed in 1938 from part of the former Far Eastern Territory, which had supplanted (1926) the Soviet Far Eastern Republic.

The rugged Sikhote-Alin mountains, running northeast–southwest, parallel the coast, with elevations up to 6,086 ft (1,855 m). The chief river is the northward-flowing Ussuri (a branch of the Amur), which there forms the U.S.S.R.–China boundary. The coastal plain is narrow, with few harbours and short, swiftly-flowing streams. In the south is Peter the Great Bay (Zaliv Petra Velikogo), one of the world's great sheltered harbours. On a peninsula along Zolotoy Rog (Golden Horn) Bay, an inlet of the gulf, is the territory's capital, Vladivostok, one of Soviet Asia's principal ports and the Pacific terminus of the Trans-Siberian Railroad.

The *kray*'s climate is influenced by the Pacific monsoon, with cold winters and almost constant northerly winds. Summer, with its onshore southeast winds, is wet and warm. In the fertile lowlands of the Ussuri and Lake Khanka (shared with China) in the south, soybeans, kaoliang (a form of millet), and rice flourish and truck and dairy farming are also important. Coal mining supports diversified manufactures in the cities. Surface coal deposits are at Rettikhovka and Novoshakhtinsky. Tin, lead, zinc, and fluorspar are also worked. A tungsten mine at Vostok, in the north, was opened in the 1970s. Fishing and whaling bases are on the coast, while the Sikhote-Alin is a source of timber and small fur-bearing animals.

In 1979 the population was chiefly Russian (85 percent), with Ukrainians (9 percent) and smaller numbers of Udegeys, Orochis, and Namays. Main cities, aside from Vladivostok, are Ussuriysk, the port of Nakhodka, Artyom, and Partizansk (*qq.v.*). The population was more than 75 percent urbanized in 1982. Pop. (1983 est.) 2,079,000.

primrose, any flowering plant of the genus *Primula*, of the family Primulaceae, with more than 500 species, chiefly occurring in the



Primrose (*Primula vulgaris*)
A.J. Huxley

Northern Hemisphere in cool or mountainous regions. The plants are low-growing, usually perennial herbs; a few are biennials. Most species grow 25 to 50 centimetres (10 to 20 inches) tall, but some are as short as 5 cm and others as tall as 120 cm. Many species are cultivated for their attractive flowers.

The stalk is short or absent. The stalked leaves may be long and narrow, tufted, or roundish and are crowded together. On the lower side the midrib is often prominent. The stalked flowers are solitary or borne in loose umbels (*i.e.,* the flower stalks arise from one point, and the flowers are in a flat or ball-like cluster). The five petals of the flowers are joined to form a five-lobed corolla that may be red, pink, purple, blue, white, or yellow.

The fairy primrose (*P. malacoides*) and the Chinese primrose (*P. sinensis*) are generally grown in greenhouses. The polyanthus hybrids (*P. veris, P. elatior,* and *P. vulgaris*) are popular garden primroses.

Primrose, Archibald Philip: *see* Rosebery, Archibald Philip Primrose, 5th earl of.

Primulaceae, the primrose family, of the order Primulales, containing 28 genera of herbaceous flowering plants. Although worldwide in distribution, most species grow in temperate and colder regions of the Northern Hemisphere, and many are Arctic or Alpine. These annual or perennial herbs have simple leaves, often with a toothed margin; their flowers have both stamens and pistil, and the fruits are capsules.

Primulales, primrose order of flowering plants, belonging to the class called dicotyledon (*q.v.*; characterized by two seed leaves). It is comprised of 3 families, 64 genera, and about 2,000 species of plants distributed on every continent.

A brief treatment of Primulales follows. For full treatment, *see* MACROPAEDIA: Angiosperms.

Leaves of the Primulales are simple (*i.e.,* they have a single blade), and flower parts occur in fives; other attributes separate the order into families and genera.

Of the three families, two—Theophrastaceae and Myrsinaceae—are mainly tropical. They consist mostly of trees and shrubs with evergreen leaves, small flowers, and fleshy fruits. The third family, Primulaceae, occurs chiefly in north temperate and Arctic regions. It consists primarily of herbaceous annuals and perennials with large flowers and capsules (dry fruits) that split to release their seeds.

The Primulaceae, with 28 genera and about 1,000 species, is noted for many horticulturally valuable plants. The primroses (*Primula*), which are familiar garden plants, account for nearly one-half of the species, with major centres of distribution in China and the Himalayas. More than 100 species and hybrids are on horticultural and botanical lists as suited for cultivation. Other familiar plants of this family include *Cyclamen,* creeping Jenny (*Lysimachia nummularia*), and the shooting star (*Dodecatheon*).

The Theophrastaceae is represented in Hawaii and the American tropics. Only a few of its 60 species are in cultivation as ornamentals in temperate regions. Flowers of this family have, in addition to five stamens, a cycle of five expanded staminodes (sterile stamens), alternating with petals. Seeds are large and yellow. The small tree *Jaquinia barbasco* (Theophrastaceae) of the West Indies is widely grown in the tropics for its foliage, fragrant white flowers, and orange fruits. It yields a poison used to stupefy fish.

The Myrsinaceae, most abundant in the tropics and the Southern Hemisphere, has extensions of distributions into Mexico and Florida, and to Japan in the Pacific regions. In nature, the family may often be identified by glands, or resin ducts, that appear as tiny, translucent spots in its evergreen leaves. Staminodes, if present, are not expanded, and seeds are small and dark coloured. Only a small fraction of its 1,000 species are in cultivation. Abundant, long-lasting, bright berries make *Ardisia crenata,* the coralberry, a favourite greenhouse plant. *A. primulifolia* is the only herb of this family. *Maesa indica,* a small tree of the Old World, produces an edible, creamy-white fruit. The cape myrtle (*Myrsine africana*), an ornamental shrub distributed from the Azores to Taiwan, is grown for its red, berrylike drupes. It is used locally as a tapeworm remedy.

All species of Primulales produce abundant seed. In addition, some species commonly reproduce by vegetative propagation. For example, runners of a weedy pimpernel (*Anagallis arvensis*) and rhizomes of *Lysimachia thyrsiflora,* both members of the primrose family, produce roots at nodes. These horizontal stems separate to establish separate plants.

Some genera develop flowers singly, but, in most members of this order, inflorescences of various configurations are produced. A calyx and corolla, of five joined sepals and petals, respectively, and similar numbers of stamens and carpels (constituting the pistil) are almost universal in the Primulales.

Primus, Pearl (b. Nov. 29, 1919, Trinidad), American dancer, choreographer, anthropologist, and teacher.

Primus' family moved to New York City when she was three years of age. She studied biology at Hunter College in New York City and later joined the New Dance Group, with whom she made her dance debut in 1943. In 1944 she gave a solo recital, which led to several Broadway engagements. Primus formed her own company in 1944.

Primus' first major choreographic work was *African Ceremonial* (1944), demonstrating her early interest in her black heritage. Primus traveled to Africa on a Rosenwald Fellowship in 1948, the first of many such research trips (which eventually led to her Ph.D. in African and Caribbean studies). Primus' dances reflected these travels, notably *Congolese Wedding* (1974) for Alvin Ailey's company. Although most of her other dances are based on primitive West Indian forms, she choreographed several pieces about American life, including *Strange Fruit* (1945), which examines a Southern lynching; *The Negro Speaks of Rivers* (1944), based on a poem by Langston Hughes; and *Michael, Row Your Boat Ashore* (1979), about the Birmingham church bombings.

Primus became the director of the Art Center of Black African Culture in Nigeria and a teacher at Hunter College.

prince, feminine PRINCESS, a European title of rank, usually denoting a person exercising complete or almost complete sovereignty or a member of a royal family, but in some cases used to designate lower ranking nobles.

France. Although lordly vassals might conventionally be referred to as "princes," the title prince was not official in France until the 15th century, when members of the royal house came to be distinguished as "princes of the blood" (*princes du sang*) with specified rights of precedence; in 1711 they were granted precedence absolutely.

In a few cases the king accorded or acknowledged the title without defining the status of a principality in relation to a duchy, a countship, or a marquisate. Such princely titles were often borne by the eldest sons of dukes.

Germany. From the 10th to the 12th century a new class of *Fürsten,* or princes, arose in Germany, consisting of the holders of well-defined territorial lordships in immediate dependence on the German king and on the Holy Roman Empire; an Estate of Princes of the Realm (*Reichsfürstenstand*) came into being from the 1180s and comprised dukes, counts palatine, margraves, landgraves, archbishops, bishops, certain abbots, and the masters of the military-religious orders. New admissions to this Estate required not only the sovereigns' bestowal of the title *Fürst* (lower than that of duke or landgrave) but also the consent of the existing princes. In the *Reichstag,* or Diet, the *Kurfürsten,* or electoral princes (more commonly, electors; *q.v.*), eventually set themselves apart from the others, whose number grew considerably until the dissolution of the Holy Roman Empire. Only 10 princes were not mediatized by 1815—including Liechtenstein, which even survived World Wars I and II. The title *Fürst* as bestowed by the Prussian monarchy in the 19th–20th century was simply honorific.

The German language uses the term *Fürst* for a prince with sovereign or quasi-sovereign rights or for the head of a princely family, but it may use *Prinz* for a junior member of a sovereign or princely house. Examples are *Kronprinz,* crown prince; *Kurprinz,* electoral prince, heir to an electorate; *Erbprinz,* hereditary prince, heir to a principality; Prinz von Preussen, heir presumptive to Prussia; Prinz von Battenberg, for descendants of the grand ducal house of Hesse through a morganatic marriage.

Spain and Portugal. In Spain, counts of Barcelona had been regarded as princes of Catalonia in the sense that they were the greatest feudatories of that country; and, when Count Ramón Berenguer IV became king-consort of Aragon in 1137, he styled himself príncipe de Aragon instead of king. The sons of Spanish kings, meanwhile, had the style of infante; but the title of príncipe de Asturias was created, in 1388, for the eldest son of John I of Castile, namely the future Henry III of Castile. On the union of the Castilian and Aragonese crowns, this title became that of the heir apparent to the whole Spanish monarchy; it long remained the only Spanish princely title. In 1795, however, the title príncipe de la Paz was created for Manuel de Godoy, with higher rank than his duchy of La Alcudia; but it was abolished in 1808. Baldomero Espartero received the title príncipe de Vergara in 1872 for his lifetime only. Outside Spain, on the other hand, the Spanish kings bestowed princely titles with extreme liberality.

In Portugal the heir apparent to the throne had the title of prince royal from the reign of King Edward (1433–38).

Italy. In southern Italy the Lombard dukes of Benevento became practically sovereign princes after the Frankish annexation of the northern kingdom of Lombardy (774); and successive partitions of their territory, from 847, created three principalities, Benevento, Salerno, and Capua. In the 11th century the latter two fell to the Normans, while Benevento became an exclave of the Papal States. Subsequently, princely titles became very numerous in southern Italy: the Spanish kings conceded at least 120 for Sicily and about as many for Naples. For Italy as a whole the aggregate was increased by Roman principalities created by the papacy and by principalities of the Holy Roman Empire in the north.

Great Britain. In Great Britain the word prince could always be used in a generally descriptive way for a sovereign, duke, or other peer; but as a title of rank it was not used until 1301, when Edward I invested his son, the future Edward II, as Prince of Wales. From Edward III's time the king's eldest son and heir was usually so invested.

Not until the accession of the German George I (1714), however, did it become settled practice for all the sovereign's descendants in the male line (*i.e.,* his children and the children of his sons) to be styled "prince" or "princess" and "royal highness"; great-grandchildren in the male line were "prince" or "princess" and "highness." In 1917 George V limited the title of prince or princess to the sovereign's children and the children of the sovereign's sons; the only extension was for the eldest living son of the eldest son of the Prince of Wales. The granting or withholding of a princely title remained, however, a matter of the sovereign's will: Elizabeth II's consort, Philip, Duke of Edinburgh, was expressly created a prince of Great Britain and Northern Ireland in 1957.

Prince, princess
foreign-language equivalents

	masculine	feminine
Czech	kníže	kněža
	prins	princezna
Danish	fyrste	fyrstinde
	prins	prinsesse
Dutch	vorst	vorstin
	prins	prinses
French	prince	princesse
German	Fürst	Fürstin
	Prinz	Prinzessin
Hungarian	herceg	hercegnö
Italian	principe	principessa
Japanese	kōshaku	kōshaku-fujin
Latin	princeps	principissa
Norwegian	fyrste	fyrstinne
	prins	prinsesse
Polish	książę	księżna
Portuguese	príncipe	princesa
Romanian	prinț	prințesă
Russian	knyaz	knyaginya
Serbo-Croatian	kraljević	kraljevna
	princ	princeza
Spanish	príncipe	princesa
Swedish	furste	furstinna
	prins	prinsessa

Russia and Poland. In Russia and in Poland the title prince was accorded to descendants of sovereign or formerly sovereign dynasties, whether Russian, Tatar, Lithuanian, or Polish. (For grand princes *see* grand duke.) Apart from this use, the title was granted as a high rank of nobility by the Russians from Peter the Great's time (1682–1725). In Poland, where 10 princely houses claimed descent from ancient dynasties, there were four more created by the Holy Roman Empire and one created by the Holy See, as well as one created in 1808 by the Russians, but only two created for ordinary nobles by the Polish crown (Poniatowski in 1764, Poninski in 1773).

Prince, F(rank) T(empleton) (b. Sept. 13, 1912, Kimberley, Cape Province, S.Af.), British poet whose sensitive, compassionate poetry is written with precision and craftsmanship.

Prince was educated at Christian Brothers College, Kimberley; Balliol College, Oxford; and Princeton University. He was appointed reader in English literature at the University of Southampton, England (1946), becoming professor of English (1957–74). He was professor of English at the University of the West Indies, Mona, Jam. (1975–78), and taught in the United States thereafter.

His native South Africa offered Prince the themes for his earlier poems, but the tradition of European civilization (specifically Renaissance Italy) exerted a deeper influence on his writing. *Soldiers Bathing and Other Poems* (1954) is perhaps his best-known work. Acutely self-critical, Prince rejected much of his poetry; of his published work he was satisfied only with *The Doors of Stone: Poems, 1938–1962* (1963), a collection of fewer than 50 poems. Prince's literary criticism includes *In Defence of English* (1959), *William Shakespeare: The Poems* (1963), and *The Italian Element in Milton's Verse* (1954). He published *Memoirs of Oxford* in verse in 1970, *Drypoints of the Hasidim* (1975), *Afterword on Rupert Brooke* (1976), and *Collected Poems* (1979).

Prince, Harold (Smith), byname HAL PRINCE (b. Jan. 30, 1928, New York, N.Y., U.S.), American theatrical producer and director who won Antoinette Perry (Tony) awards for the production or direction (or both) of a wealth of Broadway musicals.

The son of a New York stockbroker, Prince majored in English at the University of Pennsylvania (B.A., 1948) and began his theatrical career as an apprentice and stage manager for the noted producer and director George Abbott. In 1953 he began producing musicals (initially in partnership with Robert E. Griffith) and was amazingly successful in his first outing, with *The Pajama Game* (1954); he thereafter produced or coproduced more than 30 musicals, including *Damn Yankees* (1955), *West Side Story* (1957), *Fiorello!* (1959), *A Funny Thing Happened on the Way to the Forum* (1962), *Fiddler on the Roof* (1964), *Cabaret* (1966), *Zorba* (1968), *Company* (1970), *Follies* (1971), *A Little Night Music* (1973), *Pacific Overtures* (1976), *Sweeney Todd* (1979), *Evita* (1980), and *The Phantom of the Opera* (1988).

From 1963 (with *She Loves Me*), when he began directing many musical productions—and often producing or coproducing them too—Prince came to be recognized as one of the most creative and innovative figures on Broadway. He received directorial Tony awards for *Cabaret, Company, Follies, Candide, Sweeney Todd, Evita,* and *The Phantom of the Opera.*

Prince Albert, city, central Saskatchewan, Canada, on the North Saskatchewan River, 25 miles (40 km) west of its confluence with the South Branch and 88 miles (142 km) northeast of Saskatoon. It was founded in 1866 by the Reverend James Nesbit as a Presbyterian mission station, near the site of a fur-trading post established in 1776. Named for Queen Victoria's consort, it developed as a lumbering centre in the early 1900s. Prince Albert now serves as a distribution point for northern Saskatchewan. Its industries include oil refining, woodworking, pulp and paper milling, tanning, and food packaging. The city is also a resort and gateway to Prince Albert National Park, and its Lund Wildlife Exhibit contains numerous specimens of Canadian wildlife displayed in natural surroundings. It is the site of a federal penitentiary, a provincial school for the retarded, and Natonum Community College. Sturgeon Lake and other Indian reservations are nearby. Inc. town, 1885; city, 1904. Pop. (1986) city, 33,686; metropolitan area, 40,841.

Prince Albert National Park, park, in central Saskatchewan, Canada, having its main entrance 25 miles (40 km) northwest of the city of Prince Albert. Established in 1927, the park covers an area of 1,496 square miles (3,875 square km) and is largely a woodland and lake area, interlaced with streams and nature trails. The park lies north of the great agricultural prairies between the watershed areas of the Churchill and North Saskatchewan rivers, but most of its large lakes (Kingsmere, Waskesiu, Crean) drain northward toward the Churchill. Normally the lakes form connected waterways and offer facilities for extended canoe and boat trips. It is a sanctuary for birds (notably white pelicans and jet-black cormorants), moose, elk, caribou, and bears and other furbearing animals. A museum at Waskesiu, the park headquarters, near the eastern boundary, houses a collection of wildlife species.

Prince Edward Island, one of the four Atlantic Provinces of Canada. It lies in the southern sector of the Gulf of Saint Lawrence and is separated from Nova Scotia and New Brunswick by the Northumberland Strait. With an area of 2,185 square miles (5,660 square km), it is Canada's smallest province. Its capital is Charlottetown.

A brief treatment of Prince Edward Island follows. For full treatment, *see* MACROPAEDIA: Canada.

Before the European explorations, the island was traditionally the summer resort of the Micmac Indians of the mainland. They used the island for fishing, hunting, and some planting. The Micmacs called the island Abegweit, meaning "Cradled on the Waves." There is a Micmac reservation on a small island off the north shore. Historians credit the European discovery of the island to Jacques Cartier, the French navigator, in June 1534. It was claimed for France by Samuel de Champlain, who called it the Île Saint-Jean. In 1720 the island was colonized by 300 French settlers, sponsored by a commercial company of the Count de Saint-Pierre. The island was ceded to Great Britain in 1763. In 1799 the island was renamed in honour of Edward, Duke of Kent, who was then commander of the British forces in North America. The island was divided into lots of about 20,000 acres (8,000 hectares), which in 1767 were awarded to grantees to encourage settlement. The system was less than satisfactory, but it endured until it was replaced by the Land Purchase Act of 1875. Prince Edward Island is known as the "Cradle of Confederation" because the Charlottetown Conference, held there in 1864, led to the conference that initiated Canada's federation. Prince Edward Island did not become a province until 1873.

Prince Edward Island has numerous streams, bays, and tidal estuaries. On the south and east sides, the bays provide good natural harbours. Most of the island is within 5 miles (8 km) of the sea or a tidal inlet, and no locality is more than 10 miles (16 km) from salt water. Because there has been little industrial development, the island's water pollution problem is not as extensive as in some other parts of Canada. Some water resources, however, are being polluted by processing plants, pesticides, erosion, and sedimentation. Prince Edward Island has a mild climate and fertile soil, and more than one-half of the island is used for agriculture. Dairying is a major industry. Tobacco is grown in the eastern part of the island, and fur-bearing animals are raised in the western part. Fishing for lobster, cod, haddock, tuna, clams, and scallops is important. Harvesting of Irish moss (a seaweed) is popular.

Many of the residents are descendants of early settlers from the British Isles. More than one-third of the population is of Scottish descent, and nearly as many are of Irish descent. Several thousand are descended from the 30 Acadian families recorded in the census of 1765.

Prince Edward Island is a low-wage area with limited opportunities for employment and thus loses much of its young population to other provinces. During the late 1960s the provincial government began to institute a series of economic reforms to enable residents to create viable economic enterprises for themselves. These included full exploitation of agriculture; development of tourist facilities; better use of forest assets; improvement of fisheries; expansion of manufacturing; public investment in housing, health, and welfare service; and the extension of educational facilities. Federal authorities subsequently designated the province a Special Rural Development Area under the Fund for Rural Economic Development Act, and in 1969 the federal and provincial governments entered into a 15-year agreement (unique in North America) to advance the programs.

Most travel between the province and the mainland is by automobile, a fact that has led to proposals to build a causeway over the Northumberland Strait. Ferry services operate between the island and the provinces. Regular airline flights connect Charlottetown with Toronto, Montreal, and major cities in the United States. In 1989 the Canadian National Railway closed its rail services on the island.

The provincial government consists of the Legislative Assembly, with two representatives elected by universal adult suffrage from each of the province's 16 districts. The executive branch consists of the premier, who is the head of the majority party in the assembly and who selects therefrom the members of the Executive Council, which he heads. The lieutenant governor represents the British monarch and is appointed by Canada's governor-general. Judges are appointed by the federal government.

Primary and secondary education is free and compulsory through the 12th grade and may include technical or vocational training. Higher education is provided by Holland College (an institute of applied science and technology) and the University of Prince Edward Island, which in 1968 replaced Prince of Wales College and St. Dunstan's University, respectively; both are located in Charlottetown.

The cultural centre of Prince Edward Island is the Charlottetown Confederation Centre of the Arts, a complex that includes a large auditorium, art gallery and museum, children's theatre, public library, and various studios. The centre's art gallery has a rich collection, including works of Robert Harris, the province's best-known artist. An annual summer festival performs a musical version of the novel *Anne of Green Gables* (1908), written by the province's best-known author, Lucy Maud Montgomery (1874–1942). Handicrafts are encouraged by government agency and by the Women's Institutes. Pop. (1989 est.) 130,000.

Prince Edward Island, one of the two Prince Edward Islands in the southern Indian Ocean, 1,200 miles (1,900 km) southeast of Cape Town and 12 miles (19 km) north-northeast of Marion Island. It has an area of 18 square miles (47 square km). South Africa proclaimed its sovereignty over the island in 1947, actually annexing it in 1948. Prince Edward Island is volcanic in origin. It has steep escarpments on its northwest and southwest coasts, rising to 2,370 feet (722 m) in the centre of the island. The climate is cool and stormy; dominant westerly winds bring heavy rain (on an average of 300 days a year) and snow. The mean annual temperature is 40° F (4.4° C); yearly rainfall averages 100 inches (2,500 mm). Plants include the Kerguelen cabbage, peculiar to that part of the world. The island is uninhabited except for occasional biologic research teams.

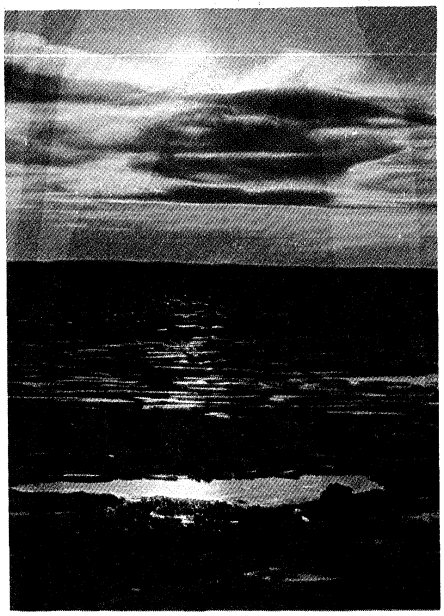
Prince Edward Island National Park, park in Canada, comprising a coastal strip along Prince Edward Island's north shore, 20 miles (32 km) northwest of Charlottetown. Established in 1937, the park extends along the Gulf of St. Lawrence for nearly 25 miles (40 km) and covers an area of 7 square miles (18 square km). It includes Rustico Island, natural habitat of the great blue heron and other birds. Its white sand-dune beaches are hemmed in by red sandstone cliffs. There is both fresh-water and offshore fishing. Green Gables, a farmhouse near Cavendish, was made famous in Lucy Maud Montgomery's novel *Anne of Green Gables* (1908).

Prince George, city, central British Columbia, Canada, at the confluence of the Nechako and Fraser rivers, 487 miles (784 km) north of Vancouver. It originated in 1807 when Simon Fraser established a North West Company fur-trading post, Fort George, on the site. The settlement grew with the coming of the Grand Trunk Pacific Railway (1913). It is now the focus of the province's central and northern transportation systems and regional administration headquarters. Its economy is linked with the development of the forest industries, minerals, oil and natural gas, and hydropower of the interior regions. Prince George College was opened in 1962. Inc. city, 1915. Pop. (1986) 67,621.

Prince of Wales Island, island, largest of those in the Torres Strait connecting the Coral Sea with the Arafura Sea, 10 miles (16 km) northwest of Cape York Peninsula, Queensland, Australia. It has an area of about 70 square miles (180 square km). Rugged and wooded, the island rises to 761 feet (232 m). It has little arable land and no permanent sources of fresh water; there are no suitable landings for ships. Pearl shell was exported, but the decline in world demand for pearl shell since the 1950s has led many islanders to migrate to Queensland. Pop. (1971) 90.

Prince of Wales Museum of Western India, in Bombay, museum begun in 1905 and housed in a domed building in the Indo-Saracenic style. The collections include Tibetan art, Chinese porcelain, Mughal and Rājput miniatures, and the Jehangir Art Gallery, completed in 1952. The jewelry and glass collections are also noteworthy. The natural history section of the museum started with the collection of the Bombay Natural History Society. The history section contains dioramas, and there is a collection of exhibits from the Marāthā period (17th–18th century).

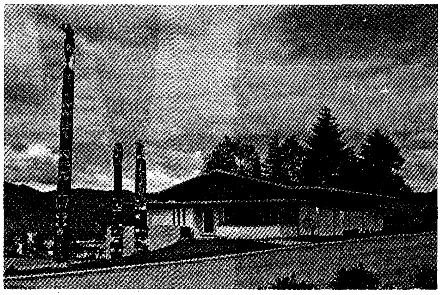
Prince of Wales Strait, arm of the Arctic Ocean, extending northeastward for 170 miles



Banks Island in the Prince of Wales Strait at sunset
Joe Rychetnik—Photo Researchers/EB Inc

(275 km) from Amundsen Gulf to Viscount Melville Sound, separating Banks and Victoria islands, Northwest Territories, Canada. It forms part of the Northwest Passage route through the Canadian Arctic archipelago between the Atlantic and the Pacific oceans. It was discovered in 1850 by Robert McClure, the Irish explorer, who came within sight of the Viscount Melville Sound before heavy ice forced him to turn back, and was named after Albert Edward, then the Prince of Wales.

Prince Rupert, city, on Kaien Island in Chatham Sound, western British Columbia, Canada, near the mouth of the Skeena River on the Pacific coast, 934 miles (1,503 km) northwest of Vancouver. Named in 1906 for Prince Rupert, first governor of the Hudson's Bay Company, it began as a tent town and developed after 1914 as the terminus of



Totem poles outside the Museum of Northern British Columbia, Prince Rupert
By courtesy of the Prince Rupert Tourist Bureau; photograph, Jack Wrathall

the Grand Trunk Pacific Railway (later the Canadian National Railway). In the 1970s it became the western terminus of the Yellowhead Highway from Edmonton, Alta. Its ice-free harbour serves the northern provincial lumbering, mining, and agricultural areas, and the Alaska Marine Ferries and the British Columbia Ferry System. Salmon and halibut fishing and processing are important. The city has vast cold-storage plants and pulp mills. An airport is on nearby Digby Island. During World War II, Prince Rupert served as a marshaling and supply base for Allied forces in the Aleutians and the mid-Pacific. The Museum of Northern British Columbia in the city has a notable collection of Haida Indian carvings. Inc. city, 1910. Pop. (1986) 15,755.

Prince Rupert's Land (Canada): *see* Rupert's Land.

Prince William Sound, irregular inlet of the Gulf of Alaska, U.S., east of the Kenai Peninsula. It spans about 90 to 100 miles (145 to 160 km). Hinchinbrook and Montague islands are at its oceanward entrance. The area lies within the Chugach National Forest, and there has been considerable fishing, mining, and forestry. Shipping is centred at the port of Valdez, the southern terminal for the trans-Alaskan pipeline, and at Cordova. The sound was named by the British navigator Captain George Vancouver in 1778 to honour the third son of King George III.

Prince William Sound was the site of a massive oil spill in 1989, when an Exxon Corporation tanker, the *Exxon Valdez,* ran aground on Bligh Reef at 12:04 AM on March 24. Because of delayed efforts to contain the spill and because of naturally strong winds and waves, about 10.9 million gallons of North Slope crude oil poured into the sound and eventually polluted thousands of miles of indented shoreline, as well as adjacent waters, as far south as the southern end of Shelikof Strait between Kodiak Island and the Alaskan Peninsula.

princeps (Latin: "first one," or "leader"), the unofficial title used by the Roman emperors from Augustus (reigned 27 BC–AD 14) to Diocletian (reigned AD 284–305). Thus this period in Roman history is known as the principate (*principatus*), whereas the government of the empire under Diocletian and his successors is known as the dominate, from *dominus* ("lord," "master").

The title princeps originated under the Roman Republic, when it was held by the leading member of the Senate (*princeps senatus*). Thus, Augustus' use of the title lent plausibility to his claim to be the restorer of republican institutions vitiated during the civil wars of the 1st century BC. In fact, he had replaced the oligarchy of the republic with his own autocratic rule. Under his successors *principatus* soon did come to mean autocracy. This usage gave rise to the medieval title "prince."

Princes Islands (Turkey): *see* Kızıl Adalar.

princess: *see* prince.

Princess Charlotte Bay, inlet of the Coral Sea, indenting northeastern Queensland, Australia. Located on the east shore and at the base of the Cape York Peninsula, it is bounded on the east by Cape Melville and on the west by Claremont Point and measures 38 miles (61 km) by 15 miles (24 km). It receives the Normanby, North Kennedy, and Morehead rivers. Mangrove forests fringe its shore. The Flinders Islands lie just to the east. The bay was sighted in 1815 and named after Princess Charlotte, the daughter of George IV, by Lieutenant Charles Jeffreys of the British Royal Navy.

princess style, in dress design, style of women's clothing characterized by garments that are closely fitted to the waistline, which is unbroken by a seam. The princess style first was introduced in 1848 but was little worn until the 1860s.

Woman (right) wearing a princess dress, coloured engraving by Adèle-Anaïs Toudouze from *Le Follet,* 1866; in the Victoria and Albert Museum, London
By courtesy of the Victoria and Albert Museum, London

At that time, the princess gown was made of fitted sections of material, worn over a crinoline and flared out at the hem. The princess style continued to be worn through the 20th century with greater or lesser popularity according to the fashion.

Princeton, town ("borough") and township, Mercer county, western New Jersey, U.S., on the Millstone River, 11 miles (18 km) northeast of Trenton. The borough (area 2 square miles [5 square km]) was incorporated in 1813; it is surrounded by the township (17 square miles [44 square km]), which was incorporated in 1838.

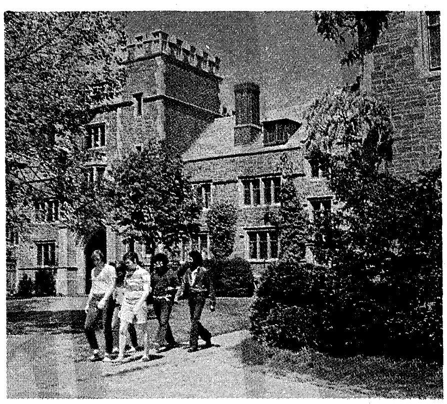
The site, near the plantation established (1681) by Captain Henry Greenland, was settled in 1696 by Quakers. First known as

Stony Brook after the Long Island home of one of the settlers, it was renamed in 1724 to honour William III, Prince of Orange-Nassau. Its location on the Philadelphia–New York City stagecoach route and the relocation there of the College of New Jersey (now Princeton University) from Newark (founded 1746 in Elizabeth) enhanced its development as a cultural and legislative centre. Nassau Hall (1756), principal structure of the college, changed hands three times during the American Revolutionary Battle of Princeton, and the engagement ended within its walls, with George Washington's troops defeating a British detachment (Jan. 3, 1777). The New Jersey state legislature convened in Princeton the following summer, and the Continental Congress was assembled there from June to November 1783.

In addition to the university, other educational institutions include the Institute for Advanced Study (1930), where Albert Einstein spent his final years, Princeton Theological Seminary (1812), Westminster Choir College (1926), and Columbus Boychoir School (founded 1937 in Columbus, Ohio; moved to Princeton in 1950). The Educational Testing Service, developers of achievement tests for schools, has headquarters in Princeton. More than 50 national and international corporations maintain research installations in the borough.

Morven (1701), the Stockton family home, used as headquarters by the British general Lord Cornwallis, is the official residence for New Jersey governors. Firestone Library, on the Princeton campus, has many original manuscripts, including some by William Faulkner and F. Scott Fitzgerald. Bainbridge House, birthplace of William Bainbridge, commander of the USS *Constitution,* is now the home of the Princeton Historical Society. The Princeton Cemetery contains the graves of Aaron Burr, President Grover Cleveland, and some members of the Colonial Assembly and the Continental Congress. Palmer Square, the midtown business district, is a noted example of urban redevelopment emphasizing colonial architecture. At nearby Rocky Hill is Rockingham State Historic Site, the house used by George Washington as his headquarters when the Continental Congress convened in Princeton and where he wrote his "Farewell Address to the Armies." Pop. (1988 est.) borough, 12,587, township, 14,536.

Princeton University, coeducational, privately endowed institution of higher learning at Princeton, N.J. It was founded as the College of New Jersey in 1746, making it the fourth-oldest university in the United States. It was in Princeton's Nassau Hall in 1783 that George Washington received the formal thanks of the Continental Congress for his conduct of the War of Independence. Two U.S. presidents—James Madison and Woodrow Wilson—graduated from Princeton, and Wilson served as president of the university from 1902 to 1910. The school's name was changed to Princeton University in 1896. Another famous graduate of Princeton is the novelist F. Scott Fitzgerald, who did much to popularize its image as a bastion of upper-class male snobbism. Since 1969, the university has admitted women.



Students near Blair Tower on the campus of Princeton University

Eric Carle—Shostal/EB Inc.

In addition to a college and graduate school, Princeton has a school of engineering and applied science and a school of architecture and urban planning. Princeton's Woodrow Wilson School of Public and International Affairs continues a long Princeton tradition of furnishing government officials.

Consult the INDEX *first*

Princip, Gavrilo (b. July 25 [July 13, Old Style], 1894, Obljaj, Bosnia [now in Yugoslavia]—d. April 28, 1918, Theresienstadt, Austria), South Slav nationalist who assassinated Archduke Francis Ferdinand, heir to the Austro-Hungarian throne, and his consort, Sophie, Duchess von Hohenberg (*née* Chotek), at Sarajevo, Bosnia, on June 28, 1914. Princip's act gave Austria-Hungary the excuse that it had sought for opening hostilities against Serbia and thus precipitated World War I. In Yugoslavia—the South Slav state that he had envisioned—Princip is regarded as a national hero.

Born into a Bosnian Serb peasant family, Princip was trained in terrorism by the Serbian secret society known as the Black Hand (true name Ujedinjenje ili Smrt, "Union or Death"). Wanting to destroy Austro-Hungarian rule in the Balkans and to unite the South Slav peoples into a federal nation, he believed that the first step must be the assassination of a member of the Habsburg imperial family or a high official of the government.

Having learned that Francis Ferdinand, as inspector general of the imperial army, would pay an official visit to Sarajevo in June 1914, Princip, his associate Nedjelko Čabrinović, and four other revolutionaries awaited the archduke's procession on June 28. Čabrinović threw a bomb that bounced off the archduke's car and exploded beneath the next vehicle. A short time later, while driving to a hospital to visit an officer wounded by the bomb, Francis Ferdinand and Sophie were shot to death by Princip, who said he had aimed not at the duchess but at General Oskar Potiorek, military governor of Bosnia. Austria-Hungary held Serbia responsible and declared war July 28.

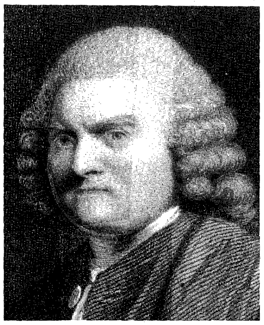
After a trial in Sarajevo, Princip was sentenced (Oct. 28, 1914) to 20 years' imprisonment, the maximum penalty allowed for a person under the age of 20 on the day of his crime. Probably tubercular before his imprisonment, Princip underwent amputation of an arm because of tuberculosis of the bone and died in a hospital near his prison.

Príncipe (island, West Africa): *see* São Tomé and Príncipe.

Pringle, Sir John, 1st Baronet (b. April 10, 1707, Stitchel, Roxburgh, Scot.—d. Jan. 18, 1782, London, Eng.), British physician, an early exponent of the importance of ordinary putrefactive processes in the production of disease. His application of this principle to the administration of hospitals and army camps has earned him distinction as the founder of modern military medicine.

A pupil of the Dutch physician Hermann Boerhaave and the German anatomist Bernard Albinus at the University of Leiden (M.D., 1730), Pringle served as professor of moral philosophy at the University of Edinburgh (1734–44). In 1742 he became physician to the Earl of Stair, who was commander of the British army on the European continent, and served as physician general to the British forces in the Low Countries during part of the War of the Austrian Succession (1740–48). In London he became physician to the Duke of Cumberland (1749) and to George III (1774). He was created a baronet in 1766.

Pringle's chief published work was *Observations on the Diseases of the Army* (1752). Medical procedures outlined in the book addressed problems of hospital ventilation and camp sanitation by advancing rules for proper drainage, adequate latrines, and the avoidance of marshes. He recognized the various forms of dysentery as one disease, equated hospital and jail fevers (typhus), and coined the term influenza. His suggestion that military hospitals be treated as sanctuaries mutually protected by belligerents eventually led to the establishment of the Red Cross (1864).

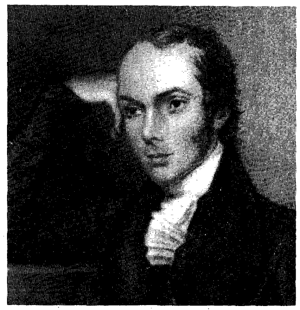


Sir John Pringle, detail of an engraving by W.H. Mote after a portrait by Sir Joshua Reynolds

The Mansell Collection

Pringle, Thomas (b. Jan. 5, 1789, Blaiklaw, Roxburghshire, Scot.—d. Dec. 5, 1834, London, Eng.), Scottish-South African poet, often called the father of South African poetry.

Pringle was educated at the University of Edinburgh and befriended by Sir Walter Scott. He immigrated to South Africa in 1820. He published a newspaper and a magazine in Cape Town, but his reform views caused their suppression. He returned to London in 1826 and spent the rest of his life in the anti-slavery movement. His two verse collections, *Ephemerides* (1828) and *African Sketches* (1834), contained many notable poems dealing with the people, wildlife, and landscape of Africa. *Narrative of a Residence in South Africa* (1835) was his autobiography.



Thomas Pringle, engraving by William Finden

By courtesy of the trustees of the National Library of Scotland

Pringsheim, Nathanael (b. Nov. 30, 1823, Wziesko, Silesia—d. Oct. 6, 1894, Berlin, Ger.), botanist whose contributions to the study of algae made him one of the founders of the science of algology.

Pringsheim studied at various universities, including the University of Berlin, from which he received the Ph.D. in 1848. He then taught briefly at the universities of Jena and Berlin but preferred to spend his time doing research in his private laboratory in Berlin.

Pringsheim's most important work concerned reproduction in the algae. In 1855 he confirmed the occurrence of sexuality in this group of plants when he observed fertilization in the freshwater alga *Vaucheria.* His observations and conclusions were published in the first issue of the botanical journal *Jahrbücher für wissenschaftliche Botanik* ("Annals of Scientific Botany"), which he founded in 1858 and edited until his death. In 1860 he demonstrated a similarity between the life history of freshwater algae and that of mosses. Nine years later he discovered what he considered to be the most primitive form of sexual reproduction in plants, the conjugation of zoospores in the colonial flagellated alga *Pandorina.*

Pringsheim's observation of the formation of plant cells provided support for the belief, opposed by the German botanist Matthias Jakob Schleiden, that cells arise only by division of pre-existing cells. In 1868 Pringsheim and the botanist Julius von Sachs were the first scientists to describe the specialized bodies in the cell cytoplasm called plastids. Pringsheim also was the first to demonstrate a case of apospory, sometimes called apomixy (the production of a sexual generation from an asexual generation without the intervention of spores), in the Thallophyta (*e.g.,* algae, fungi). By 1875 his attention had turned completely to plant physiology, and four years later he published a paper on the effects of light on chlorophyll, the green colouring matter of plants. Because Pringsheim was known as a morphologist, however, many of his views on physiology were not accepted or validated by other botanists.

prinia, any bird of the large genus *Prinia,* belonging to the Old World warbler family, Sylviidae. Prinias are sometimes called long-tail warblers or wren-warblers, from their long, graduated tails, which are carried, wrenlike,

Tawny-flanked prinia (*Prinia subflava*)
R.M. Bloomfield—Ardea Photographics

cocked up. Prinias, 10 to 15 centimetres (4 to 6 inches) long, are more strongly marked than most sylviids. They make beautifully woven purselike nests, which are suspended from twigs or attached to tall grass stalks; often the nest is sewn to the foliage.

Abundant in most of sub-Saharan Africa and from Bangladesh to Indochina, in rank growth and garden shrubbery, is the tawny flanked prinia (*P. subflava*). Also well known is the black-chested prinia (*P. flavicans*) of southern Africa. The ashy prinia (*P. socialis*) is one of the most common birds found in India.

Prinsep, James (b. Aug. 20, 1799, County of Essex, Eng.—d. April 22, 1840, London), antiquary and colonial administrator in India, the first European scholar to decipher the edicts of the ancient Indian emperor Aśoka.

Prinsep was appointed to the Calcutta mint in 1819 but left to become assay master (1820–30) at the Benares (Vārānasi) mint. He returned to the Calcutta mint as assay master in 1832, leaving in 1838 for England because of ill health.

As secretary of the Asiatic Society of Bengal (from 1832), he had access to and developed the study of the largest collection of Indian coins then existing.

Trained as an architect, Prinsep assumed responsibility for architectural projects, chiefly at Benares. He introduced a uniform coinage and reformed the Indian system of weights and measures while at Calcutta, where Prinsep's Ghat, an archway on the bank of the Hooghly, was erected to his memory.

Compilations of his writings have been published, chiefly *Essays on Indian Antiquities, Historic, Numismatic, and Palaeographic,* edited by E. Thomas, 2 vol. (1858).

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

printed circuit, electrical device in which the wiring and certain components consist of a thin coat of electrically conductive material applied in a pattern on an insulating substrate by any of several graphic art procedures. After World War II, printed circuits replaced conventional wiring in much electronic equipment, such as radio and television sets, computers and control equipment, and airborne and guided-missile electronic systems. They greatly reduced the size and weight of the equipment while improving reliability and uniformity over the hand-soldered circuits formerly used.

Of the many techniques of manufacture, most involve photoetching or stencil etching. The insulating board is coated with copper and a protective film is deposited, photographically or by silk-screening, in the pattern desired for the circuit. The unprotected copper is then etched away either in an acid bath (for photographically deposited film) or by stencil-etching methods (for silk-screen film). The remaining conductive copper is left intact in the pattern of the circuit.

The development of far smaller and more compact integrated circuits (*see* integrated circuitry) made printed circuits obsolete in the early 1970s.

printing, process for reproducing text and illustrations, traditionally by applying ink to paper under pressure but in modern times including a variety of other methods.

A brief treatment of printing follows. For full treatment, *see* MACROPAEDIA: Printing, Typography, and Photoengraving.

The earliest printing was probably done from painstakingly engraved woodblocks. Printed texts of this type are known from Japan and China from the 8th and 9th centuries. Movable type, consisting of individual elements from which texts could be composed and then printed, was devised in China in the 11th century, but the complexity of the Chinese ideographic language discouraged the further development of the technique.

Printing from carved woodblocks (xylography) appeared in Europe in the 14th century. Various experimenters worked with movable wooden type and with metallographic printing, which involved successively impressing metal type dies into a clay or soft metal matrix to produce a printing plate. Johannes Gutenberg is generally credited with bringing together in about 1450 the two ideas that constituted the invention of modern printing: the use of dies to make individual pieces of type that could be assembled as required and then reused, and the use of a press by which sharp impressions could be made many times over, on both sides of a sheet of paper if desired. Over the next 500 years a great many improvements were made in the mechanics of printing, but the fundamental process remained essentially the same.

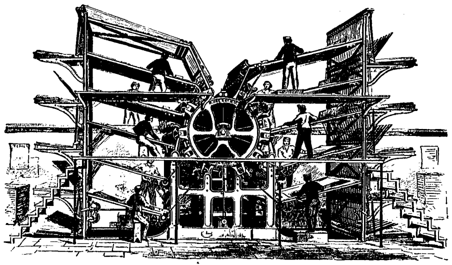
In modern commercial printing, three basic techniques are used—letterpress, rotogravure, and offset (*qq.v.*).

The letterpress system, the same in principle as that of Gutenberg, relies on mechanical pressure to transfer a raised inked image to the surface to be printed. The earliest machines consisted of a bed on which the type was placed and a means of applying pressure to the paper placed on the inked type. There are three main designs of letterpress machines: the platen press used for small-scale printing; the sheetfed flatbed machine in which the printing surface, resting on the bed, moves backward and forward in contact with the paper gripped on the impression cylinder; and the webfed rotary press that prints on a continuous roll of paper and is usually equipped to deliver a folded product such as a newspaper. The printing surface for letterpress rotary presses is the curved stereotype plate made by a molding process from the original metal type. Letterpress flatbed and rotary presses may be designed to print one or more colours or to print both sides of the paper. Such machines were responsible for the enormous growth of popular newspapers in Europe and North America in the 19th century.

In contrast to printing from a raised-relief-image area, the rotogravure method is an intaglio process that relies on the transfer of ink from recessed cells of varying depths. The cells are created in a coated copperplate cylinder by photographically producing resistant areas in the coating, consisting of pigmented gelatin, that permit differential etching of the cylinder with ferric chloride. Alternatively, the cells may be produced by the use of an electromechanical engraving machine or, more recently, by the engraving of a plastic-coated cylinder by laser beam. Rotogravure presses are generally fed from a roll of paper and usually include a folder that delivers the product as a series of pages in the required numerical sequence. The cylinder surface is sprayed with ink of low viscosity that contains a spirit solvent; the cylinder surface is then wiped clean by an oscillating steel blade, the "doctor," leaving the ink in the cells of the cylinder that is then transferred under pressure to the paper. The printed paper then passes through or over a dryer, where the volatile solvent is driven off, and thence passes into the folder. Multiunit rotogravure presses can produce magazines, complete or in sections, in one, two, or four colours at high speed. Rotogravure has the advantage of being able to transfer a greater density of pigment per unit area than other printing processes. Rotogravure is used mainly for long-run magazine production and by the packaging industry.

In the offset system the printing and nonprinting areas of the plate differ not in height but in wettability by the ink. The plate is prepared by first coating it with a thin layer of a light-sensitive material; a photographic negative of the text is then placed on it, and the plate is illuminated through the film, thereby rendering the exposed areas insoluble in water and receptive to ink. The unexposed areas are washed free of the light-sensitive substance and left wetted with water and thus repellent to the ink. The essential components of an offset press are the printing plate, which is clamped around the plate cylinder; the wetting and inking systems; the offset or blanket cylinder; and the impression cylinder.

The inked image is first transferred from the plate onto the rubber blanket on the offset cylinder and from there to the sheet of paper,



Hoe's ten-cylinder type-revolving newspaper press, 1855

By courtesy of Wood-Hoe, Division of Wood Industries, Inc.

which is gripped on the impression cylinder. Offset presses that are designed to print upon rolls of paper are known as web offset presses. Such presses usually print both sides of the paper, and it is commonly arranged that the web passes between the two blanket or offset cylinders, thus printing both sides simultaneously and eliminating the need for impression cylinders. Both sheet and web presses may be designed to print one or more colours. Because offset platemaking costs are lower and press speeds higher, offset replaced letterpress as the most widely used printing process.

For many years the text to be printed was cast in metal, using Monotype (*q.v.*) to set single characters or Linotype (*q.v.*) to set text line by line. More recently, typesetting has moved away from hot metal to computerized typesetting (*q.v.*), utilizing very high speed optical methods. Before type matter can be used for printing, it must be made up into pages with any illustrations incorporated. For offset and rotogravure, which require an image on film this may be done by computer in a process known as an electronic page makeup system.

For illustrations, the representation of a full tone range is achieved in letterpress and offset by photographing the artwork through a halftone screen, which breaks up the image into dots of different sizes that will transfer different amounts of ink. In rotogravure the effect is achieved by varying the volume of the cells etched into the cylinder. Full-colour illustrations are produced by analyzing the subject into its yellow, red, blue, and black components; separate plates or cylinders are made for each colour that, when superimposed in register in the printing operation, render a full-colour reproduction of the original.

printing telegraph: *see* teletypewriter.

printmaking, an art form consisting of the production of images, usually on paper but occasionally on fabric, parchment, plastic, or other support, by various techniques of multiplication, under the direct supervision of or by the hand of the artist. Such fine prints, as they are known collectively, are considered original works of art, even though they can exist in multiples.

A brief treatment of printmaking follows. For full treatment, *see* MACROPAEDIA: Printmaking.

Printmakers conceive their images not as drawings or paintings but rather as they will appear as a result of the printmaking technique. Images are drawn or carved, for example, in mirror reverse on the plate, block, or stone. Original prints are thereby distinguished from drawings or paintings translated by commercial processes of reproduction to multiples. The artist-printmaker is involved at each stage of the printmaking process, from the conception of the work to the technical process of preparing the plate, block, or stone to the actual printing and then to any finishing work. Each printmaking process has its own distinctive characteristic, and the artist-printmaker selects that technique most appropriate to the effect that he wishes to create. Prints may vary slightly, and in large editions sometimes the earlier prints are finer in quality as the printing medium may subsequently wear or deteriorate. Likewise the inking, wetness, and quality of paper, the wiping of the plate, and other variables can result in small distinctions between prints.

Editions today are usually limited to a predetermined number of prints, decided upon by the artist and publisher. Each print is usually identified by its own number and by the number of the edition, frequently shown separated by an oblique line (4/50 means the fourth impression of an edition limited to 50). The artist may sign each print. Once the edition has been finished, the artist usually cancels the plate, block, or stone (by striking or marking across it) or destroys it completely. Some plates from earlier periods, especially the 17th and 18th centuries, have been "restruck" in later times, and it can be difficult to be sure whether the print in question is an original made by the artist or under his supervision or is a later restrike from an original plate.

There are three major techniques of printmaking, but within each technique a large number of variations exist. The major techniques are relief printing, where the background is cut away, leaving a raised image; intaglio printing, where the image is incised directly into the plate; and surface printing such as lithography, where the image is painted or drawn onto a stone, and stencil printing, where the design is cut out and printed by spraying paint or ink through the stencil.

The usual materials of relief printing are wood and linoleum, though metal, cardboard, and others are used. The relief process lends itself to bolder designs in which large areas of light and dark predominate. To print, the wood or lino is inked, leaving the background clean, and paper is placed over it and pressed or rubbed.

The best known forms of intaglio printing are engraving and etching. A metal plate is used, and the image is either engraved into the metal with a special tool called a burin, or the plate is covered with acid-resistant material called ground, usually waxy in texture, and the design is drawn with a sharp metal needle onto the ground; the plate is then immersed in acid, which eats into the metal where it is exposed by the drawn lines and creates an etched image. Drypoint, mezzotint, and aquatint are other intaglio techniques. The plate is printed by inking, wiping, and then passing it through a roller press with the plate face up and covered with dampened paper.

Lithography is the best known surface process. The design is drawn on a stone in greasy crayon, and the stone is then wetted with water. Ink is rolled onto the stone and adheres only to the greasy drawing. The inked image is then transferred to paper. Of the stencil processes, silk screen is the best known and is frequently used to produce colour prints.

The history of printmaking parallels the history of art and is one of the oldest art forms. Though he had several predecessors, the first important engraver was a 15th-century German, Martin Schongauer. In the 16th century Albrecht Dürer created prints of the highest quality, and in the 17th century the etchings of Rembrandt were especially fine.

Japanese printmaking originated in the 17th century with the Ukiyo-e school of woodcuts. Prints were made until the middle of the 19th century and had a profound influence on the history of Western art and design. The best known artists were Hokusai, the most famous woodcutter, and Hiroshige, the last great printmaker before the decline of that school. In the 20th century, however, a revival of the Japanese woodcut (*hanga*) produced such masters as Onchi Kōshirō and Munakata Shikō.

Important 18th-century Western artists who made prints include William Hogarth, Francisco Goya, and Giambattista Piranesi. Among the works of 19th-century printmakers those of Honoré Daumier and of many of the French Impressionists are notable.

Twentieth-century printmaking was stimulated by the development of photographic reproduction processes that rendered reproductive printmaking—which had grown popular to illustrate mass magazines, newspapers, and advertising posters—obsolete, returning the techniques to the creative artists. Experimentation in new styles and new directions proliferated, with France retaining the lead but soon challenged by Germany, England, and the United States. Printmaking in the late 20th century presented a great diversity of styles and techniques, ranging from near-photographic realism to a totally abstract approach to the subject.

Printz, Johan Björnsson (b. July 20, 1592, Bottnaryd, Swed.—d. May 3, 1663, Gunillaberg Manor, Swed.), Swedish military officer and colonial governor of New Sweden on the Delaware River.

Printz, the son of a Lutheran pastor, received his early education in Sweden before he departed in 1618 for theological studies at German universities. He was pressed into military service in Germany in about 1620, and during the Thirty Years' War, he became a mercenary for Archduke Leopold of Austria, Duke Christian of Brunswick, and King Christian IV of Denmark. Printz entered the Swedish army in 1625; 13 years later he had risen to the rank of lieutenant colonel. In 1639 he surrendered Chemnitz to a Saxon army but was exonerated of any wrongdoing by a military court-martial in Sweden.

In April 1642 Printz was appointed director (governor) of the colony of New Sweden, and the following February he arrived with two ships at Ft. Christina, the site of present Wilmington, Del. Shortly after his arrival, he ordered the construction of Ft. Elfsborg at Varens Kill, and he built his own large residence at New Gothenborg (Tinicium Island). Printz, who was an energetic and conscientious governor, established harmony with the local Indians, arranged amicable relations with English North American settlers, initiated trade connections with the Dutch in New Netherlands, and constructed or directed several commercial enterprises within New Sweden.

He also was an autocratic administrator, and his growing quarrels with the settlers led several of them to petition to take their grievances directly to the Swedish government. Printz had the ringleader of the dissident colonists executed, but tensions continued to grow. In September 1653 the governor relinquished his rule to his deputy and son-in-law, John Papegoja, and returned to Sweden. He spent his last years there as governor of his home district.

Prío Socarrás, Carlos (b. July 14, 1903, Bahia Honda, Cuba—d. April 5, 1977, Miami Beach, Fla., U.S.), president of Cuba (1948–52).

Prío became politically active while a law student at the University of Havana, spending two years in prison for his anti-government activities. He took part in the coup that deposed Gerardo Machado's dictatorship in 1933 and helped organize the Partido Revolucionario Cubano. He went into exile in the United States when this party was outlawed, returned to Cuba in 1939, and was elected to the National Assembly. In 1940 he became leader of his party and was elected senator in that year and again in 1944. He served as prime minister from 1945 to 1947 and labour minister from 1947 to 1948. In the latter position he opposed the Communists, ending their control of the unions. Elected president in 1948, Prío continued the centrist policies of his predecessor, Ramón Grau, and pursued programs of agrarian reform and establishment of low-cost housing, a national bank, civil service, and labour courts. In spite of vigorous efforts to increase foreign trade and restore public order, Prío was unable to solve Cuba's economic problems. In the face of growing labour unrest, he did little to combat corruption and gang violence. In 1949 he tried to organize a bloc of Latin American countries committed to democratic government in order to combat internal and external anti-democratic elements. Prío was deposed by Fulgencio Batista in 1952 and went into exile in the United States until 1959, when he returned to Cuba to support Fidel Castro. He returned to Miami in 1961, becoming a spokesman for the Cuban community in exile. His death was apparently a suicide.

prion, also called WHALEBIRD, any member of several species of small Antarctic seabirds of the genus *Pachyptila,* in the family Procellariidae (order Procellariiformes). All are blue-gray above and whitish below. Among the broad-billed species, the bill, unique among petrels, is flattened, with the upper mandible fringed with strainers (lamellae) not unlike those in the mouths of ducks. The thin floor of the mouth is distensible, forming a small pelican-like pouch. In feeding, the bird "hydroplanes," skittering across the water with its wings out and propelling itself with its feet as it dips its bill into the water for small marine invertebrates, such as squid and crustaceans.

The smallest of the four species is the fairy prion (*P. turtur*), about 20 centimetres (8 inches) long; the largest is the broad-billed prion (*P. forsteri*) at about 27 cm (10½ in.). Most of the prions breed in burrows on Antarctic and sub-Antarctic islands. The broad-billed prion is more northerly in distribution, breeding on islands located between 35° and 60° S. A related bird, the short-tailed shearwater (*Puffinus tenuirostris*), is known in Alaska as the whalebird (*see* shearwater).

prion, an infectious agent of small size and unique composition; it appears to be composed solely of proteins, and lacks genetic material in the form of nucleic acids. Prions are the tiniest infectious agents known, with the rod-shaped individuals being beyond the resolving power of all but the most powerful electron microscope. They have been identified as the cause of several serious neurological diseases known as slow infections. These disorders generally have prolonged incubation times of several years and a gradual onset of symptoms; they almost invariably end in death for the afflicted individual. Among the diseases either conclusively or tentatively identified as being caused by prions are scrapie (a neurological disorder of sheep), Creutzfeldt-Jakob disease, and kuru (both occurring in humans). Prions may also be the causal agent in Alzheimer's disease (presenile dementia).

The apparent absence of nucleic acids in prions presents scientists with a puzzling phenomenon, since nucleic acids are the basic reproductive material in all other life forms. Further research, it is hoped, will help to elucidate the specific method and materials used in the reproduction of prions.

Prionopidae (bird family): *see* helmet-shrike.

Pripet Marshes, Russian PRIPET POLESYE (Pripet Woodlands), Polish POLESIE, vast, waterlogged region of the Soviet Union, the largest swamp of the European continent. The Pripet Marshes occupy the south of the Belorussian Soviet Socialist Republic and the northern *oblasti* (regions) of the Ukrainian S.S.R. They lie in the thickly forested basins of the Pripyat and Dnepr rivers, bounded on the north by the Belorussian Ridge (Belorusskaya Gryada) and on the south by the Volya, Podolsk (Podolskaya), and Dnepr uplands. The distinctive natural traits of the Pripet Marshes are a wide development of saturated sandy lowlands, intersected by a dense network of rivers with weakly cut riverbeds and wide floodlands; and a prevalence of pine forests amid the wide expanse of low-lying bogs and marsh-ridden lands.

The region experiences a warm temperate climate. The average annual precipitation reaches 22–26 in. (550–650 mm) and exceeds evaporation, giving sufficient—and in some places quite abundant—moisture. In conjunction with an abundance of subsoil waters and their close proximity to the surface, a virtually unique soil saturation and associated bogging down of the surface are thus produced.

Numerous tributaries of the Pripyat (including the Stokhod, Styr, Goryn, Ubort, Yaselda, and Ptich) and the Dnepr (Sozh, Teterev, and Irpen) course down into the swamps from the surrounding highlands, carrying in large amounts of water. In the spring, when snowmelt occurs, the region's rivers overflow their low-lying banks and intensify the saturation of the land. Huge marshes are developed along the course of the Pripyat itself, while the middle of the river is marked by the soggy expanses of the Pinsk Marshes. The numerous lakes that dot the landscape are in various stages of choking up into additional bogs.

About one-third of the region is forested, consisting of pine, birch, alder, oak, aspen, white spruce, and hornbeam. The region has thus supported—where conditions permit—a diversified lumbering industry. Elk, lynx, wolf, fox, wild boar, roe, beaver, badger, and weasel are to be seen and are sometimes hunted. A host of birds, including black grouse, orioles, hazel grouse, woodpeckers, owls, blue tits, and wild duck, inhabit the forests and marshlands. These, too, are hunted. Human intervention is most evident, however, in the sections of the region that are being developed and transformed into agricultural lands, where rye, barley, wheat, flax, hemp, potatoes, a variety of vegetables, and fodder grasses are cultivated.

Land reclamation projects were first initiated in 1872 by a state-sponsored "western expedition for the drainage of swamps" led by the Russian scholar I.I. Zhilinsky. A vast amount of land reclamation has taken place during the 20th century. A complex series of measures for achieving this formidable goal was underway during the 1970s and early 1980s. They included the regulation of water drainage and the construction of reservoirs on the rivers, the regulation of river channels, afforestation of sandy uplands, and the clearing of undesirable vegetative cover.

Pripyat River, also spelled PRIPIAT, or PRIP'AT', also called PRIPET, PRIPETS, or STRUMEN, river in the Ukrainian and Belorussian Soviet Socialist republics, a tributary of the Dnepr River. It is 480 mi (775 km) long and drains an area of 44,150 sq mi (114,300 sq km). It rises near the Polish border south of Brest and flows eastward through a flat, forested, and swampy basin known as the Pripet Marshes to Mozyr; there it turns southeastward to join the Dnepr in the Kiev Reservoir. Navigation on the Pripyat is possible to Pinsk, where the Dnepr-Bug Canal leads to the Bug. Much swamp in the river basin has been reclaimed for agriculture, but the population density remains low.

Priscian, Latin in full PRISCIANUS CAESARIENSIS (fl. *c.* AD 500, b. Caesaria, Mauretania), the best known of all the Latin grammarians, author of the *Institutiones grammaticae*, which had a profound influence on the teaching of Latin and indeed of grammar generally in Europe.

Though born in Mauretania (in modern Algeria), Priscian taught in Constantinople. His minor works include *De nomine, pronomine et verbo* ("On Noun, Pronoun, and Verb"), for the teaching of grammar in schools; a treatise on weights and measures; a treatise on the metres of Terence; *Praeexercitamina*, an adaptation for Latin readers of some Greek rhetorical exercises; a panegyric in verse on the emperor Anastasius I; and a verse translation of Dionysius' *Periegesis*. Priscian's *Institutiones grammaticae* ("Grammatical Foundations") is a systematic exposition of Latin grammar. As far as possible Priscian took the works of Apollonius Dyscolus on Greek grammar as his guide. He drew illustrative citations from many Latin authors and in this way was able to preserve numerous fragments that would otherwise have been lost.

Priscian's work was extensively quoted in the 7th, 8th, and 9th centuries. Subsequently it became the standard work for the teaching of grammar in the medieval schools; and it provided the background for the rise of speculative grammar (the logic of language) in the 13th and 14th centuries. There are about 1,000 manuscript copies extant. Of these, the greater part contain only books i–xvi (called *Priscianus major*); a few contain books xvii and xviii (*Priscianus minor*) and some of the minor works; and a few contain all 18 books of the *Institutiones*.

Apart from fragments, the oldest manuscripts are of the 9th century. The first printed edition was produced in 1470, at Venice.

Priscillian (b. *c.* 340, Spain—d. 385, Trier, Belgica, Gaul), early Christian bishop who was the first heretic to receive capital punishment; a rigorous ascetic, he founded Priscillianism, an unorthodox doctrine that persisted into the 6th century.

Around the Spanish towns of Mérida and Córdoba, Priscillian began around the year 375 to teach a doctrine that was similar to both Gnosticism (*q.v.*) and Manichaeism (*q.v.*) in its dualistic belief that matter was evil and the spirit good. Among his many unorthodox doctrines, Priscillian taught that angels and human souls emanated from the Godhead, that bodies were created by the devil, and that human souls were joined to bodies as a punishment for sins. These beliefs led to a denial of the true humanity of Christ.

Priscillian led his followers in a quasi-secret society that aimed for higher perfection through ascetic practices and outlawed all sensual pleasure, marriage, and the consumption of wine and meat. The spread of Priscillianism throughout western and southern Spain and in southern Gaul disturbed the Spanish Church, which, led by bishops Hyginus of Mérida and Ithacius of Ossonoba, soon opposed the new movement.

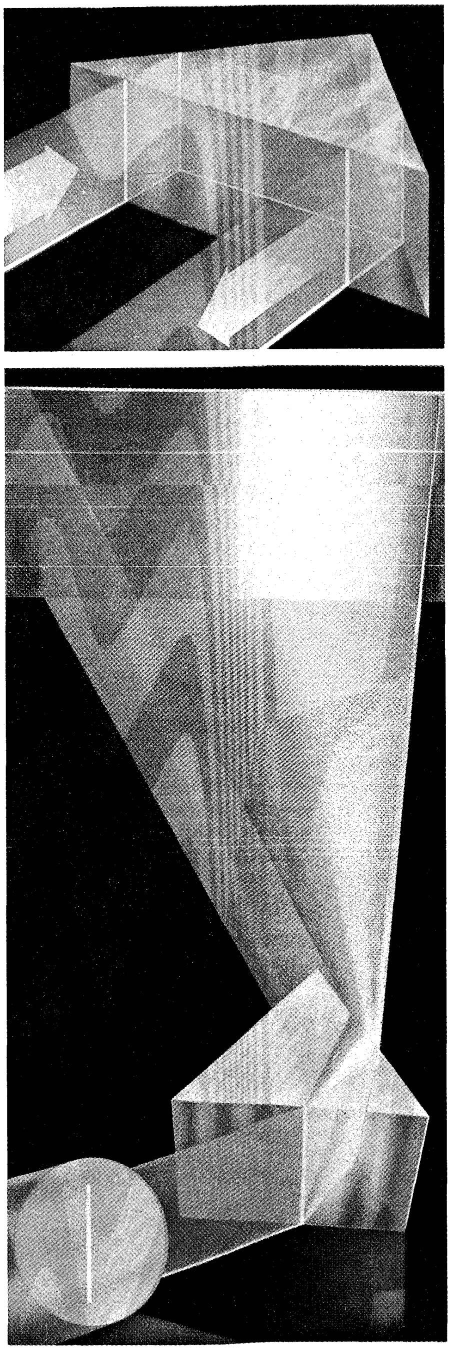
In 380 the Council of Saragossa, Spain, condemned ideas attributed to Priscillian, who, nonetheless, was elected bishop of Ávila, Spain. The Roman emperor Gratian was persuaded by Priscillian's enemies to exile him and his key disciples to Italy. Although they were not received by Pope St. Damasus I, they managed to be absolved by civil authorities, who ultimately enabled them to force Ithacius out of Spain. Ithacius went to the imperial court at Trier, where he persuaded the Roman emperor Magnus Maximus to have Priscillian tried. Priscillian was condemned in 384 by a synod at Bordeaux. Priscillian appealed to Maximus, who ordered him to Trier, where he was judged guilty of sorcery and immorality and was executed.

The fall of Maximus in 388 led to a reaction in favour of Priscillianism. In 400 and 447 councils at Toledo, Spain, condemned some of Priscillian's doctrines, which in 407–08 were outlawed by the Roman emperor Flavius Honorius. In 563 the Council of Braga renewed the condemnation, and thereafter Priscillianism as an organized cult disappeared.

The question of Priscillian's orthodoxy has been much discussed. In 1889, 11 treatises ascribed to Priscillian were published, revealing his unorthodox doctrine of the Trinity in which the Son differs from the Father only in name. A. D'Alès' *Priscillien et l'Espagne chrétienne à la fin du IV^e siècle* ("Priscillian and Christian Spain at the End of the 4th Century") appeared in 1936.

Priscus, Helvidius: *see* Helvidius Priscus.

prism, in optics, piece of glass or other transparent material cut with precise angles and plane faces, useful for analyzing and reflecting light. An ordinary triangular prism can separate white light into its constituent colours, called a spectrum (*see* illustration, bottom). Each colour, or wavelength, making up the white light is bent, or refracted, a different amount; the shorter wavelengths (those toward the violet end of the spectrum) are bent the most, and the longer wavelengths (those toward the red end of the spectrum) are bent the least. Prisms of this kind are used in certain spectroscopes, instruments for analyzing light and for determining the identity and structure of materials that emit or absorb light.



Functions of a prism
(Top) The reversal of light by a prism; (bottom) the dispersion of white light into its component colours by a prism

Prisms can reverse the direction of light by internal reflection (*see* illustration, top), and for this purpose they are useful in binoculars (*q.v.*).

Prisms are made in many different forms and shapes, depending on the application. The Porro prism, for example, consists of two prisms arranged both to invert and to reverse an image and are used in many optical viewing instruments, such as periscopes, binoculars, and monoculars. The Nicol prism consists of two specially cut calcite prisms bonded together with an adhesive known as Canada balsam. This prism transmits waves vibrating in one direction only and thus produces a plane-polarized beam from ordinary light.

prison, an institution for the confinement of persons convicted of major crimes or felonies. In the 19th and 20th centuries, imprisonment replaced corporal punishment, execution, and banishment as the chief means of punishing serious offenders.

A brief treatment of prisons follows. For full treatment, *see* MACROPAEDIA: Crime and Punishment.

Development of the prison system. Jails were widely used in 12th-century England as places for the confinement of accused persons until their cases could be tried by the king's court. In 1166 Henry II commanded that every county should establish an institution for this purpose. Imprisonment gradually came to be accepted not only as a device for holding persons awaiting trial but also as a means of punishing convicted criminals. During the 16th century a number of houses of correction were established in England and on the continent for the reform of minor offenders. In these institutions there was little segregation by age, sex, or other condition. The main emphasis was on strict discipline and hard labour. In England an act of 1711 fixed the maximum term of confinement at three years.

Among the best known of the houses of correction, the immediate forerunners of the prison, were London's Bridewell and the Ghent House of Correction, which were established in 1553 and 1775, respectively. Similar institutions were constructed in the American Colonies soon after their settlement.

Although reformation of offenders was intended in the houses of correction, the unsanitary conditions and lack of provisions for the welfare of the inmates soon produced widespread agitation for further changes in methods of handling criminals.

Solitary confinement of criminals became an ideal among the rationalist reformers of the 18th century, who believed that solitude would help the offender to become penitent and that penitence would result in reformation. Facilities conducive to such treatment, however, were slow to appear.

In the nascent United States, fines and imprisonment became the major forms of punishment for nearly all offenses, felonies as well as misdemeanours. Around 1794, Walnut Street Jail in Philadelphia was converted to become the first state penitentiary; prisoners were segregated by sex and the severity of their offenses, and hard labour was stressed as a reformative measure.

Solitary confinement received far greater emphasis when Eastern State Penitentiary, was opened on Cherry Hill in Philadelphia in 1829. Each prisoner of this institution remained in his cell or its adjoining yard, working alone at trades such as weaving, carpentry, or shoemaking, and saw no one except the officers of the institution and an occasional visitor from outside. This method of prison management, known as the "separate system," became a model for penal institutions constructed in several other states and in various parts of the world. Through much of the 19th century the separate system remained the dominant philosophy of prison management in much of Europe.

Meanwhile, strenuous opposition to the prolonged isolation of prisoners developed very early, especially in the United States. Even before Eastern State Penitentiary was placed in operation, its critics had been successful in formulating a competing philosophy of prison management, known as the "silent system." The main distinguishing feature of the silent system was that prisoners were allowed to work together in the daytime. Silence was strictly enforced at all times, however, and at night the prisoners were confined in individual cells. Vigorous competition between supporters of the silent system and of the separate system prevailed until about 1850, but by that time the silent system had been victorious in most U.S. states. During this period new developments in Europe and elsewhere were beginning to produce fundamental revisions in both U.S. systems.

The mark system was developed about 1840 by Capt. Alexander Maconochie at Norfolk Island, an English penal colony located east of Australia. Instead of serving fixed sentences, prisoners there were required to earn marks or credits proportional to the seriousness of their offenses. Credits were accumulated through good conduct, hard work, and study, and could be denied or subtracted for indolence or misbehaviour. When a prisoner obtained the required number of credits he became eligible for release. The mark system symbolized the decline of the "let the punishment fit the crime" theory of correction and presaged the use of indeterminate sentences, individualized treatment, and parole. Above all it emphasized training and performance, rather than solitude, as the chief mechanisms of reformation.

Further refinements in the mark system were developed in the mid-1800s by Sir Walter Crofton, director of Irish prisons. Irish inmates progressed through three stages of confinement before they were returned to civilian life. The first portion of the sentence was served in isolation. Then the prisoners were allowed to associate with other inmates in various kinds of work projects. Finally, for six months or more before release, the prisoners were transferred to "intermediate prisons," where inmates were supervised by unarmed guards and given sufficient freedom and responsibility to permit them to demonstrate their fitness for release. Release was also conditional upon the continued good conduct of the offender, who could be returned to prison if necessary.

Reformatory movement. Many features of the Irish system were adopted by reformatories constructed in the United States in the late 19th century for the treatment of youthful and first offenders. Among the leaders of the reformatory movement was Zebulon Brockway, first superintendent of New York's Elmira Reformatory, opened in 1876. Brockway and his associates advocated classification and segregation of various types of prisoners, individualized treatment emphasizing vocational training and industrial employment, indeterminate sentences and rewards for good behaviour, and parole or conditional release. The reformatory philosophy gradually permeated the entire U.S. prison system. By the turn of the century isolation and solitary confinement were used primarily as disciplinary actions against recalcitrant prisoners instead of being justified as effecting penitence and reformation.

The Irish system and the U.S. innovations had great impact upon European correctional practices. England's famous Borstal System, for example, was established in 1908 by Evelyn Ruggles-Brise, director of English prisons, after he had studied several U.S. reformatories.

Modern trends. Correctional programs in nearly all parts of the world show a significant trend toward specialization, diversification, and experimentation. Considerable effort, for example, is aimed at the rehabilitation of prisoners and at minimizing their numbers. Minor offenders are sometimes allowed to pay fines in installments, or to serve jail sentences at night or on weekends. The expanding use of probation and parole as rehabilitative procedures also tends to hold down the numbers of inmates in institutions. Another important trend is the substitution of individualized treatment for the earlier doctrine of equal punishments for equal crimes.

The third major trend in prison administration involves an attempt to reduce the social barrier between inmates of the correctional institution and the civilian community. There is also increasing interest in the possibility that the society formed by the prisoners can be utilized for therapeutic purposes. A further significant trend in correction is the professionalization of correctional occupations.

Prison organization. Most prisons operate under a military-style system of authority and communication. Each officer in the staff hierarchy has specified duties and responsibilities and is linked to officers of higher and lower rank through a chain of command and a predetermined channel of communication. Despite its clear logic, however, this system of authority and communication may have some serious weaknesses. One problem is that many policy decisions are made by administrators who are far removed from the scene of direct and daily contact with the prisoners, where the worthiness of alternative programs and policies can perhaps best be observed. The prison's administrative organization may also tend to create some questions concerning the accuracy and completeness of reports as they move up and down the ranks. For many officers in the lower ranks, allegiance to administrative policies may be less important than participation in the unofficial exchange of rumours and messages within the prison community. Alienation and disinterest among lower officers encourage departures from administrative policies, criticisms of higher authorities, and fraternization and collusion with the inmates. Where such collusion occurs, the effect of prison experience is to give inmates practice in methods of deceit and nonconformity.

The problems related to administrative policy are not alone responsible for the difficulties encountered in the rehabilitation of prisoners. Prisoners, too, have a code of conduct, and in many instances it calls for behaviour that is directly opposed to the official rules and regulations. But deviations from the code are as much the rule as the exception. The result is that neither the administrative system nor the society of prisoners can long retain dominance in the prison community. Although the integrity of the two systems may be maintained on the surface, symbiotic relationships between officers and inmates develop in such a way that the behaviour of each in almost any given instance is determined by intersecting influences that cannot be realistically accredited to either system.

Group therapy and other devices for increasing by the inmates participation in the routine affairs of prison management are designed to reduce the barrier between the society of prisoners and the dictates of administrative policy. The same general objective is sought by increased use of smaller institutions, reductions in the degree of custodial supervision, prisoner furloughs and home visits, employment of prisoners in the civilian community, and intensive parole supervision after the offender has been released from prison.

Perhaps even more important is the attempt to reduce the discrepancy between public precept and institutional practice through the use of advisory councils and other forms of participation by citizens in prison administration.

prisoner of war (POW or PW), any person captured or interned by a belligerent power during war. In the strictest sense it is applied only to members of regularly organized armed forces, but by broader definition it has also included guerrillas, civilians who take up arms against an enemy openly, or noncombatants associated with a military force.

In the early history of warfare there was no recognition of a status of prisoner of war, for the defeated enemy was promptly destroyed on the battlefield. The women, children, and elders of the defeated tribe or nation were frequently disposed of in similar fashion, although occasionally they were enslaved by the victor. The captive, whether or not an active belligerent, was completely at the mercy of his captor, and if the prisoner survived the battlefield, his existence was dependent upon such factors as the availability of food and his usefulness to his captor. Slaughtering of prisoners was sometimes practiced to terrify the enemy or to satisfy sadistic impulses of the conqueror. If permitted to live, the prisoner was considered by his captor to be merely a piece of movable property, a chattel. During religious wars, it was generally considered a virtue to put nonbelievers to death, but in the time of the campaigns of Julius Caesar a captive could, under certain circumstances, become a freedman within the Roman empire.

As warfare changed, so did the treatment afforded captives and members of defeated nations or tribes. Enslavement of enemy soldiers in Europe declined during the Middle Ages, but ransoming was widely practiced and continued even as late as the 17th century. Civilians in the defeated community were only infrequently taken prisoner, for as captives they were sometimes a burden upon the victor. Further, as they were not combatants it was considered neither just nor necessary to take them prisoner. The development of the use of the mercenary soldier also tended to create a slightly more tolerant climate for a prisoner, for the victor in one battle knew that he might be the vanquished in the next.

In the 16th and early 17th centuries some European political and legal philosophers expressed their thoughts about the laws of war generally and, in an incidental fashion, the amelioration of the effects of capture upon war prisoners. The most famous of these, Hugo Grotius, stated in his *De jure belli ac pacis* (1625; *On the Law of War and Peace,* 1682) that victors had the right to enslave their enemies, but he advocated exchange and ransom instead. The idea was generally taking hold that in war no destruction of life or property beyond that necessary to decide the conflict was sanctioned. The Treaty of Westphalia (1648), which released prisoners without ransom, is generally taken as marking the end of the era of widespread enslavement of prisoners of war.

In the 18th century a new attitude of morality in the law of nations, or international law, had a profound effect upon the problem of prisoners of war. The French political philosopher Montesquieu in his *L'Esprit des lois* (1748; *The Spirit of Laws,* 1750), wrote that the only right in war that the captor had over a prisoner was to prevent him from doing harm. The captive was no longer to be treated as a piece of property to be disposed of at the whim of the victor but was merely to be removed from the fight. Other writers, such as Jean-Jacques Rousseau and Emerich de Vattel, expanded on the same theme and developed what might be called the quarantine theory for the disposition of prisoners. From this point on the treatment of prisoners generally improved.

By the middle of the 19th century it was clear that a definite body of principles for the treatment of war prisoners was being generally recognized in the Western world. But observance of the principles in the American Civil War and in the Franco-German War left much to be desired, and numerous attempts were made in the latter half of the century to improve the lot of wounded soldiers and of prisoners, whether wounded or not. In 1874 a conference at Brussels prepared a declaration relative to prisoners of war, but it was not ratified. In 1899 and again in 1907 international conferences at The Hague drew up rules of conduct that gained some recognition in international law. During World War I, however, when POW's were numbered in the millions, there were many charges on both sides that the rules were not being faithfully observed. Soon after the war the nations of the world gathered at Geneva to devise the Convention of 1929, which before the outbreak of World War II was ratified by France, Germany, Great Britain, the United States, and many other nations, but not by Japan or the Soviet Union.

During World War II millions of persons were taken prisoner under widely varying circumstances and experienced treatment that ranged from excellent to barbaric. In the latter category was the notorious Bataan death march of U.S. prisoners taken by the Japanese early in 1942 in the Philippines. On the other side of the world, in Europe and northern Africa, treatment of prisoners was generally more nearly in accord with the Geneva Convention, though there were some shocking instances of mistreatment, especially by the Nazis. In all theatres, efforts were made through the international Red Cross committee to deliver food parcels and medical supplies to prisoners from their families and friends. After the war, international war crimes trials were held in Germany and Japan, based on the concept that acts committed in violation of the fundamental principles of the laws of war were punishable as war crimes.

Soon after the end of World War II the Geneva Convention of 1929 was revised and set forth in the Geneva Convention of 1949. It continued the concept expressed earlier that prisoners were to be removed from the combat zone and be humanely treated without loss of citizenship or of legal identity. The convention of 1949 broadened the term prisoner of war to include not only members of the regular armed forces who have fallen into the power of the enemy but also the militia, the volunteers, the irregulars and members of resistance movements if they form a part of the armed forces, and persons who accompany the armed forces without actually being members, such as war correspondents, civilian supply contractors, and members of labour service units. The protections given prisoners of war under the Geneva Convention remain with them throughout their captivity and cannot be taken from them by the captor or given up by the prisoners themselves. During the conflict prisoners might be repatriated or delivered to a neutral nation for custody. At the end of hostilities all prisoners are to be released and repatriated without delay, except those held for trial or serving sentences imposed by judicial processes. *See also* Geneva conventions.

Priština, city, capital and administrative centre of the Kosovo autonomous region of the republic of Serbia, Yugoslavia. It is linked to Skopje by road and rail and, via Kraljevo, to Belgrade, and it has an airport. Near Priština, lead, silver, and zinc are mined in the Kopaonik mountains.

Priština was the capital of the Serbian state before the Turks defeated the Balkan Christian armies in 1389 at the Battle of Kosovo, fought on the Kosovo Polje (plain) north of Priština. The city retains an Oriental appearance, though much new building has occurred since 1945. The Museum of Kosovo-Metohija has an archaeology collection, a Serbian medieval-art department, and an ethnography section. Priština is the site of a university (1970); the Priština Fakultet (college) is a cultural centre for the Albanians of Kosovo. There are Albanian-language newspapers and radio programs.

Southeast of the town is the Gračanica Monastery, built in 1321 by King Milutin, a fine work of Serbian architecture containing valuable frescoes. A market town, it has a diversified industrial base: woodworking, textiles, food processing, metal goods, and pharmaceuticals. Pop. (1981) mun., 210,040.

Pritchett, V.S., byname of SIR VICTOR SAWDON PRITCHETT (b. Dec. 16, 1900, Ipswich, Suffolk, Eng.), British novelist, short-story writer, and critic known for his ironic style and his lively portraits of middle-class life.

Pritchett was educated at local schools in London and became a full-time journalist in 1922, traveling widely on assignments in the following years. He published several novels in the 1930s, along with short stories and critical essays. He was a literary critic for the *New Statesman* (1928–65) and occasionally wrote travel articles for the *Christian Science Monitor*. Both of these occupations proved fruitful; his journalism sharpened his powers of observation, and Pritchett eventually became as well known for his perceptive essays and reviews as for his penetrating and finely crafted short stories. His novels are generally considered to be less successful. His short stories have been published in several volumes, including *You Make Your Own Life* (1938), *Collected Stories* (1956), *Blind Love and Other Stories* (1969), and *More Collected Stories* (1983). Spain, London, and New York City have been the subjects of four of his travel books, and his memoir, *Midnight Oil,* was published in 1971. Collections of his critical essays include *The Myth Makers* (1979) and *A Man of Letters* (1985).

Pritchett was made a Commander of the Order of the British Empire in 1968 and knighted in 1975.

Prithvi Nārāyaṇ Shah (b. 1720—d. 1775), member of the ruling Shah family of Gurkha (Gorkha) principality, Nepal, who conquered the three Malla kingdoms of Kāthmāndu, Pātan, and Bhādgaon in 1769 and consolidated them to found the modern state of Nepal. He also established the capital of Nepal at Kāthmāndu.

In 1742 Prithvi Nārāyaṇ became king of Gurkha. An ambitious ruler, he was able to quickly enlarge his territory by conquering the quarrelsome and disunited principalities around Gurkha. Prithvi Nārāyaṇ's initial attempts to establish hegemony over the three Malla kingdoms were abortive, however; the Raja of Kāthmāndu enlisted the aid of the East India Company in 1767 and was able to repulse Prithvi Nārāyaṇ's encroachments. Two years later, however, after the company's forces had been recalled, Kāthmāndu was taken. This allowed Prithvi Nārāyaṇ to consolidate his territories into a new "Kingdom of Nepal," which he made into a unified, strong, and independent state. He then annexed Tarai, Kumāon, Garhwāl, Simla, and Sikkim in northern India, as well as large portions of the Tibet plateau and of the valleys of the Inner Himalayas. By conquering Makwānpur, however, he brought down upon himself the combined military forces of the East India Company and the Nawab of Bengal, who together succeeded in retaking that area. Nepal at that time extended from the Punjab to Sikkim and was almost twice as large in land area as it is today.

Prithvi Nārāyaṇ sealed his border and maintained peaceful but distant relations with the British, refusing to trade with them. He died before he could effectively organize the administration of his new country. Upon his death, Prithvi Nārāyaṇ was succeeded by his son, Pratāp Singh Shah.

Pritzker FAMILY, American family prominent in business and philanthropy during the later 20th century.

The family's fortunes began with Abram Nicholas Pritzker (b. Jan. 6, 1896, Chicago—d. Feb. 8, 1986, Chicago), who was the son of a Russian Jewish immigrant who had come to Chicago in 1881 from Kiev. Abram graduated from Harvard University with a law degree in 1920 and then went to work in the law firm his father had established. He and his brother, Jack Nicholas Pritzker (b. Jan. 6, 1904, Chicago—d. Oct. 30, 1979, Chicago), left the firm in 1936 to try their hand at commerce, particularly real estate. In 1957 they bought the Hyatt House hotel in Los Angeles and built this investment over the years into a chain of more than 150 Hyatt hotels in the United States and abroad. A.N. Pritzker also became a philanthropist on a large scale, helping establish the Pritzker School of Medicine at the University of Chicago and giving several million dollars annually to other causes.

Pritzker's business empire continued to expand under the direction of his two surviving sons, Jay Arthur (b. Aug. 26, 1922, Chicago) and Robert Alan (b. June 30, 1926, Chicago), to whom he relinquished control of the family businesses in 1981. By the mid-1980s the Pritzker family owned approximately 260 companies and subsidiaries, including the Hyatt Corporation, Braniff Airlines, and *McCall's* magazine, but their largest business interest was the Marmon Group, a collection of dozens of companies turning out an array of manufactured goods ranging from brake drums to railway boxcars. Jay and Robert specialized in buying financially troubled companies and rejuvenating them into profitmaking enterprises. At the time of Abram Nicholas' death in 1986, the Pritzker family's holdings were estimated at $1,500,000,000.

privacy, rights of, in U.S. law, an amalgam of principles embodied in the federal Constitution or recognized by courts or lawmaking bodies concerning what Supreme Court Justice Louis Brandeis described in 1890 as "the right to be left alone." The right of privacy is a legal concept in both the law of torts and U.S. constitutional law. The tort concept is of 19th-century origin. Subject to limitations of public policy, it asserts a right of persons to recover damages or obtain injunctive relief for unjustifiable invasions of privacy prompted by motives of gain, curiosity, or malice. In torts law, privacy is a right not to be disturbed emotionally by conduct designed to subject the victim to great tensions by baring his intimate life and affairs to public view or by humiliating and annoying invasions of his solitude. Less broad protections of privacy are afforded public officials and other prominent persons considered to be "public figures," as defined by law.

In U.S. constitutional law a right of privacy is commonly regarded as created by provisions of the Constitution, particularly the First, Fourth, and Fifth amendments. The Fourth Amendment prohibits unreasonable searches and seizures; the First and Fifth include privacy protections in that they focus not on what the government may do but rather on the individual's freedom to be autonomous.

The rights of privacy were initially interpreted to include only protection against tangible intrusions resulting in measurable injury. After publication of an influential article by Justice Brandeis and Samuel Warren, "The Right to Privacy," in the Harvard Law Review in 1890, however, the federal courts began to explore various constitutional principles that today are regarded as constituent elements of a constitutional right to privacy. For example, in 1923 the Supreme Court struck down a Nebraska law prohibiting schools from teaching any language other than English, saying the law interfered with the rights of personal autonomy. In 1965 the Supreme Court held that the federal Constitution included an implied right of privacy. In that case, *Griswold* v. *Connecticut*, the court invalidated a law prohibiting the use of contraceptives, even by married persons. Justice William O. Douglas, writing for the court, stated that there is a "zone of privacy" within a "penumbra" created by fundamental constitutional guarantees, including the First, Fourth, and Fifth amendments.

The "right to be left alone" also has been extended to provide the individual with at least some control over information about himself, including files kept by schools, employers, credit bureaus, and government agencies. Under the U.S. Privacy Act of 1974, individuals are guaranteed access to many government files pertaining to themselves, and the agencies of government that maintain such files are prohibited from disclosing personal information except under court order and certain other limited circumstances. Modern technology, giving rise to electronic eavesdropping (*q.v.*), and the practices of industrial espionage (*q.v.*) have complicated the problem of maintaining a right of privacy in both tort and constitutional law.

private, in most armies, the lowest grade of enlisted personnel. In the armies of the United States, Germany, and France, a private ranks below a private first class, who in turn ranks below a corporal. In the army of the People's Republic of China, private second class ranks below private first class. The grade equivalent to private in other branches of the armed services in the United States varies; in the U.S. Navy it is seaman, in the U.S. Air Force, airman.

private international law, the law governing the resolutions of problems that result from the fact that there exists in the world a multiplicity of different sets of courts and of different systems of private law. *See* conflict of laws.

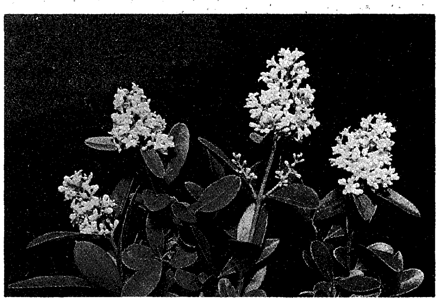
privateer, privately owned armed vessel commissioned by a belligerent state to attack enemy ships, usually vessels of commerce. Privateering was carried on by all nations from the earliest times until the 19th century. Crews were not paid by the commissioning government but were entitled to cruise for their own profit, with crew members receiving portions of the value of any cargo or shipping that they could wrest from the original owners. Frequently, it was impossible to restrain the activities of privateers within the legitimate bounds laid down in their commissions. Thus, it often became difficult to distinguish between privateers, pirates, corsairs, or buccaneers, many of whom sailed without genuine commissions.

In the late 16th century, English privateers such as Sir John Hawkins and Sir Francis Drake were encouraged or restrained, according to prevailing political conditions. With the growth of a regular navy, however, the British Admiralty began to discourage privateering because it was more popular among sailors than was serving in the Navy. At this same period, Dutch Sea Beggars and French Huguenot privateers were active. Throughout the 17th century, English buccaneers in the West Indies, such as Sir Henry Morgan, sometimes sailed as genuine privateers. From 1690, French privateers from Dunkerque (Dunkirk) and Saint-Malo were particularly active against English commerce. During the American Revolution the American colonists found it difficult to form a new navy because more than 1,000 privateers were already licensed. Privateering continued through the 18th century and into the War of 1812: the U.S. brig *Yankee* alone seized or destroyed $5,000,000 worth of English property. Meanwhile, the prospects of French privateering had been ruined by the efficiency of frigates and convoy escorts.

In 1856, by the Declaration of Paris, Great Britain and the other major European countries (except Spain) declared privateering illegal. The U.S. government refused to accede, holding that the small size of its navy made reliance on privateering necessary in time of war. The rise of the American navy at the end of the 19th century and the realization that privateering belonged to an earlier form of warfare prompted the United States to recognize the necessity of finally abolishing it. Spain agreed to the ban in 1908.

At the Hague Peace Conference of 1907 it was then stipulated, and has since become part of international law, that armed merchant ships must be listed as warships, though there have been various interpretations of the word armed. The ambiguous status of the privateer has thus ceased to exist—the state now assumes full responsibility for all converted ships engaged in military operations.

privet, any of about 40 to 50 species of shrubs and small trees belonging to the genus *Ligustrum* of the family Oleaceae that are widely used for hedges, screens, and ornamental plantings. Privets—native to Europe, Asia,



Common privet (*Ligustrum vulgare*)
A to Z Botanical Collection—EB Inc.

Australia, and the Mediterranean region—are evergreen or deciduous plants with opposite, usually oval, smooth-margined leaves; creamy-white, often odorous, terminal clusters of flowers; and one- to four-seeded black berries.

The hardy common privet (*L. vulgare*), native to northeastern Europe and Great Britain and naturalized in northeastern North America, is widely used as a hedge plant. It reaches about 4½ metres (15 feet). Glossy privet (*L. lucidum*), from eastern Asia, is a 9-m tree in areas with mild winters. It has 25-centimetre (10-inch) flower clusters in summer. Japanese privet (*L. japonicum*), about 4.7 m tall, has very glossy leaves. It also requires mild winters, as does the smaller leaved California privet (*L. ovalifolium*) from Japan, commonly grown as a hedge plant. All four species have variegated forms.

privileged communication, in law, communication between persons who have a special duty of fidelity and secrecy toward each other. Communications between attorney and client are privileged and need not be divulged when made in connection with prospective litigation. The right of privileged communication exists between husbands and wives in that they are not required to testify against each other. In many jurisdictions the privilege exists between physicians (particularly psychiatrists) and patients, as the courts have begun to recognize that the basis of a doctor–patient relationship is trust, which would be negated were the doctor forced to reveal patients' communications in court. Although many members of the clergy insist on the same rights and refuse to testify in court, they have at times been held in contempt of court for refusing to reveal alleged confidences. In general, however, judges have been hesitant to resort to such measures. Reporters have claimed the right to privileged communication and have refused to reveal the sources of their information. In 1972, however, the U.S. Supreme Court rejected a news reporter's claim of confidentiality in *Branzburg* v. *Hayes*.

Privy Council, historically, the British sovereign's private council. Once powerful, the Privy Council has long ceased to be an active body, having lost most of its judicial and political functions since the middle of the 17th century. This atrophy set in largely because the sovereign ceased to have responsibility for political decisions; and, on occasions when the monarch was concerned with an issue, informal meetings were held with the politically more powerful Cabinet. In modern times, meetings of the Privy Council are held for the making of formal decisions.

The Privy Council is descended from the *curia regis,* which was made up of the king's tenants-in-chief, household officials, and anyone else the king chose. This group performed all the functions of government in either small groups, which became the king's council, or large groups, which grew into the great council and Parliament.

By the time of Henry VII, the king's council had become the instrument of the crown; it was made up of the Privy Council, the courts of Chancery, Star Chamber, and High Commission, and their local subsidiaries.

The council system worked well as long as the king was capable of choosing the right men and providing leadership. The Stuarts were unable to do this, and jealousy and anger at the council's political activities grew among parliamentarians and common lawyers. In the midst of the religious and constitutional controversies of the mid-17th century, the council system was swept away, but the Privy Council was never formally abolished. It was revived under Charles II, but from that time on, the crown turned more and more to the Cabinet. An attempt to return the Privy Council to power was made in the Act of Settlement of 1701 (Hanoverian Succession), but it proved futile.

From the time of the accession of George I the Privy Council became a purely formal body meeting on purely formal occasions to transact formal business. By 1960 there were more than 300 members, mostly dignitaries who held or had held high political, judicial, or ecclesiastical office, along with an occasional eminent person in science or letters.

There is, however, a Privy Council office, with the lord president of the council as responsible minister. It is concerned with the making of orders in council and with a wide variety of functions derived mainly from the power of the sovereign in council to issue royal charters, chiefly to municipal corporations and to charitable bodies engaged in education, research, and the encouragement of literature, science, and the arts. The council bears the main responsibility for research through the department of scientific and industrial research. Usually it functions through committees, the most noteworthy of which, the Judicial Committee of the Privy Council (*q.v.*), is set up by statute and hears appeals from ecclesiastical courts, prize courts, and courts from the colonies as well as some independent members of the Commonwealth.

Prix de l'Arc de Triomphe, one of the world's foremost horse races, originated in 1920, and run over a 2,400-metre (about 1½-mile) course at Longchamp, Paris. The race is an international event for horses at least three years old and attracts entries from several nations of Europe and other parts of the world. It is usually run in October. *See* Sporting Record: *Horse racing.*

Prix du Jockey Club, one of the major French horse races, an event for three-year-old colts and fillies that originated in 1836. It is run over a 2,400-metre (about 1½-mile) course at Chantilly, near Paris, and is sometimes termed the French Derby because of its similarity to the older English race of that name. It is run in June. *See* Sporting Record: *Horse racing.*

priyayi, also spelled PRIJAJI, in traditional Javanese society, a class that comprised the elite in contrast to the masses, or "little people" (*wong cilik*). Until the 18th century the *priyayi,* under the royal families, were the rulers of the Javanese states. Like the knights in medieval Europe and the samurai of Japan, the *priyayi* were loyal to their lord and had a sense of honour and a readiness to die in battle. Their culture was marked by an elaborate code of etiquette. After the Dutch gained control of the Javanese kingdom of Mataram (18th century) and introduced indirect rule, the *priyayi* were used as administrators. Gradually they became professional civil servants. For this reason, the *priyayi* as a class were often regarded as Javanese civil servants. The *priyayi* were the first Indonesians to be exposed to Western (Dutch) education. Not surprisingly, the leaders of the Indonesian nationalist movements before World War II were predominantly from the *priyayi.* The Budi Utomo, the first proto-nationalist organization in Java, was also founded by the members of this class.

prize cases (1863), in U.S. history, legal dispute in which the Supreme Court upheld President Lincoln's seizure of ships that ran the naval blockade prior to the congressional declaration of war in July 1861.

On April 19 and 27, 1861, Lincoln issued proclamations authorizing a blockade of Confederate ports. Congress did not recognize a state of war until July 13. During that interval of almost three months, the Union Navy captured a number of merchant vessels, and those seizures were challenged in court on the basis that Lincoln had exceeded his constitutional authority.

When the prize cases reached the Supreme Court in 1863, the justices ruled by a five to four majority that the President had acted constitutionally. While only Congress could declare war, the chief executive did have a lawful responsibility to take measures to resist insurrection. The Court thus sanctioned Lincoln's exercise of emergency powers prior to the congressional authorization of those powers.

prize court, a municipal (national) court in which the legality of captures of goods and vessels at sea and related questions are determined.

During time of war private enemy ships and neutral merchantmen carrying contraband are subject to seizure. Title to such vessels and their cargoes does not immediately pass to the captor state but, under international law, must be adjudicated by the captor state's prize court, which may condemn them as lawful prizes. Enemy warships, enemy public ships (such as prison ships), and neutral ships participating in hostilities, on the other hand, are subject to capture. Title in them passes immediately to the captor state and is not subject to condemnation by a prize court.

Although prize courts are municipal courts, and their character and organization are thus determined by national tradition and law, they apply customary and conventional international law. There is a practice of long standing for belligerents, at the outbreak of war, to enact prize law through statutory legislation; such enactments are presumed to be declaratory of international law but are, in any event, binding on the courts.

In the 20th century, unrestricted sea warfare involving the destruction of merchant shipping has reduced the role of prize courts. The United States has held no prize courts since 1899 for the additional reason of its more liberal policy of requisitioning foreign vessels with compensation rather than appropriating them as prizes. *See also* angary; contraband.

Prizren, town of the Kosovo autonomous region in the republic of Serbia, Yugoslavia, in the foothills of the Šar Mountains.

As the capital of Serbia in the 14th century, Prizren was a large cultural and trading centre and minted its own coinage. The town is very picturesque, with churches, mosques, numerous old houses, and ancient Turkish baths. The church of Bogorodica Ljeviška (1306–07), turned into a mosque by the Turks, was restored in 1950 to reveal large and beautiful frescoes. The Sinan Paša Mosque (1615) is built of marble taken from the 14th-century St. Archangel Monastery. Major industries are textiles and man-made fibres, woodworking, footwear, and food processing. Prizren remains a centre for handicrafts, particularly filigree. Pop. (1981) mun., 134,526.

Prizren, League of: *see* Albanian League.

probabilism, in casuistry, a principle of action grounded on the premise that, when one does not know whether an action would be sinful or permissible, he may rely on a "probable opinion" for its permissibility even though a more probable opinion calls it sinful. An opinion is considered probable either if sound, logical arguments can be cited in its favour (intrinsic probability) or if recognized authorities give it support (extrinsic probability).

Formulated in 1577 by Bartolomé de Medina, a Dominican of Salamanca, probabilism was developed by the Jesuits. The Jansenists, who held that in doubtful cases of conscience one should follow the safer view—against permissibility (tutiorism, rigorism)—attacked the benignity of the Jesuit confessors as leading to laxity of morals. Excesses of probabilism were condemned by Pope Alexander VII (1666, 1667) and more forcefully by Pope Innocent XI (1679).

Probabiliorism, which enjoins following the more probable opinion, was predominant in the 18th century before the formulation of equiprobabilism (either of two equally probable opinions may be followed) by the moral theologian Alfonso Maria de' Liguori, a doctor of the church.

In a broader context, Carneades, one of the heads of the Platonic Academy (flourished 2nd century BC), was attacked by his fellow Greeks for advocating an intellectual Skepticism that, they argued, rendered man incapable of any action whatsoever. Carneades replied that "probability" ("approvability") was a sufficient practical guide for day-to-day living.

probability theory, a branch of mathematics concerned with the analysis of random phenomena. The outcome of a random event cannot be determined before it occurs, but it may be any one of several possible outcomes. The actual outcome is considered to be determined by chance.

A brief treatment of probability follows. For full treatment, *see* MACROPAEDIA: Probability Theory.

The entire set of possible outcomes of a random event is called the sample space, and each outcome in this space is assigned a probability, a number indicating the likelihood that the particular outcome will arise in a single instance. The probabilities are nonnegative and their sum is 1. An example of a random experiment is the tossing of a coin. The sample space consists of the two outcomes, head and tail, which usually are considered to be equally likely, so that each is assigned the same probability, $1/2$.

Games of chance were the first random experiments to be analyzed. The 17th-century French mathematicians Blaise Pascal and Pierre de Fermat, in response to the requests of prominent gamblers, initiated the mathematical study of particular games. A typical problem was that of the Gambler's Ruin. Two players, Peter and Paul, toss a coin. For each head, Paul pays Peter $1; and for each tail, Peter pays Paul $1. If Peter initially has a dollars and Paul b dollars, what is the probability that Peter will be ruined? The probability is equal to $b / (a + b)$, the proportion of the total capital initially in Paul's possession. Other questions associated with this game are, How long can one expect the game to last before one player is ruined? What is changed if the coin shows a bias in favour of head or tail? The early theorists also examined games based on cards, dice, and roulette wheels.

As science grew in the 18th and 19th centuries, analogies appeared between certain biological, physical, and social phenomena and games of chance. For example, the sexes of newborn infants follow sequences similar to those of coin tosses. As a result, probability became a fundamental tool in modern genetics.

Molecules, particles, and quanta of heat and light behave in a random manner and can be treated mathematically as outcomes of games of chance. For example, a smokestack emits many small particles; as they emerge from the stack, they are carried parallel to the ground in the direction of the wind. They also move up and down in a manner analogous to that of the fortune of a gambler in a coin-tossing game. Thus the height of the particle above the ground after a specified time is governed by the laws of the game. The physicist is less interested in the motion of a single particle than in the behaviour of the collection of particles. Estimation of the proportion of particles falling below a specified height at a given time can be answered by reference to the mathematical solution of the corresponding problems for the game of chance.

Probability also forms the rational basis of the institution of insurance. An insurance company may be compared to a bettor who places a series of bets on the health, life, or welfare of specified individuals or properties. Using past records, the insurer employs probability theory to derive the requirements for staying ahead in the game.

Two of the primary results of the mathematical theory of probability are the law of large numbers and the central limit theorem. If a random experiment is repeated many times under identical conditions, and the outcomes are recorded, the law of large numbers implies that the proportion of performances in which some specified outcome occurs is roughly equal to the underlying probability of that outcome. The important consequence of this is that the probabilities can be estimated by observing relative frequencies of the outcomes in a long series of performances.

The central limit theorem implies information about the probable deviation of the observed relative frequency of a particular outcome from the underlying probability of the outcome. It states that this deviation is governed by a universal probability law that is described mathematically in terms of the so-called normal curve.

probate, the judicial proceedings in Anglo-American law by which it is determined whether or not a paper purporting to be the last will of a deceased person is the legally valid last will. What appears to be a valid will may not be so: it may have been forged, not executed in the way required by law, signed by the testator while mentally incompetent or under duress, or subsequently revoked. If the document is held to be genuine and valid, it is admitted to probate; otherwise its admission is refused. Until it has been so admitted, it cannot be used for any legal purposes; in particular, the person nominated as executor cannot function, and the court must appoint an administrator of the estate.

The idea that the genuineness and validity of a will should be investigated and determined in special proceedings was developed in England by the ecclesiastical courts, which in the Middle Ages had acquired jurisdiction over succession to personal property. No such idea had been worked out by the secular courts, which had jurisdiction over the descent of real property. In America, secular courts were set up to deal with probate matters, and in the 19th century their jurisdiction was extended to cover the problem of the validity of a will with respect to real property. The same step was taken in England in 1897, after jurisdiction had been transferred in 1857 from the ecclesiastical to the secular courts.

Under the rules in the English courts, probate can be granted simply upon the presentation of a document presenting the outward appearance of a will properly executed. Such probate "in the common form" was revocable, however, if within 30 years doubts were raised as to the validity of the document, or if an interested party had entered a caveat (asked to have his objections heard) before the probate had been granted. In these cases, the person interested in having the document admitted to probate had to prove it "in the solemn form." Probate in the solemn form is a regular judicial proceeding in which the facts needed to establish the validity of the document must be proved, ordinarily through testimony by witnesses.

The English pattern is also that of the other common-law parts of the Commonwealth and, basically, also that of the United States. Under the pattern prevailing in most states in the United States, the document purporting to be a will is admitted to probate in a special court, usually called the probate court. Proceedings require little proof but occasionally allow the adjudication of a limited range of objections. Any interested party, however, may have the probate revoked if he prevails in a will contest; this must be raised, usually in a court higher than the probate court, within a short period fixed by statute. In most states the courts acting in probate matters also supervise the administration and distribution of a deceased's estate by an executor, or administrator; in addition, they have jurisdiction over the guardianship of infants and the conservation of the estates of mentally incompetent persons.

probation, correctional method under which the sentences of selected offenders may be conditionally suspended upon the promise of good behaviour and agreement to accept supervision and abide by specified requirements. Probation is distinct from parole, which involves conditional release from confinement after part of a sentence has already been served.

The probation process for an adult begins with a pre-sentence investigation of the offender after guilt has been established. Statutes commonly exclude from consideration persons convicted of serious offenses, such as armed robbery or murder, or persons previously convicted of other offenses.

When probation is ordered by the court, the offender is placed under the supervision of a probation officer, or a person appointed by the court, with the conditions of probation specified in the court order. Typically, these require that the probationer conduct himself properly, maintain his local residence, report regularly to his probation officer, support his family, pay restitution, avoid criminal associations and disreputable places, and abstain from drinking. Though these conditions may effect the rehabilitation of an individual, they have been criticized by some as requiring the guilty to tread a narrower path than the average citizen.

Early discharge by the court in recognition of good conduct is a common practice. If the probationer violates the terms of his probation or commits a further offense during the period, he may be brought back before the court for revision or revocation of the original order of probation. Studies made in several countries show that 70 to 80 percent of all probationers successfully fulfill the terms of probation and are discharged. Limited evidence suggests that the proportion of former probationers convicted of subsequent offenses is small, probably fewer than 3 in 10.

probe rocket: *see* sounding rocket.

probenecid, drug used to inhibit the transport of organic acids in the renal tubules of the kidneys. It was used in medicine originally to prolong the action of the antibiotic penicillin by preventing its loss in the urine.

In large doses probenecid enhances the excretion of uric acid, an effect desirable in persons suffering from chronic gout. Continued administration in gouty arthritis reduces swelling in enlarged joints and restores their mobility.

problem novel, work of fiction in which a prevailing social problem, such as the double sexual standard or race or class prejudice, is dramatized through its effect on the characters of a novel. The type emerged in the mid-19th-century era of reform. An early example is Mrs. Gaskell's *Ruth* (1853), which portrays a humane alternative to the Victorian "fallen woman's" usual progress to social ostracism and prostitution. If the work is strongly weighted to convert the reader to the author's stand on a social question, as is the case with Harriet Beecher Stowe's antislavery novel *Uncle Tom's Cabin* (1852), it is more properly called a propaganda novel. Usually a problem novel limits itself to exposure of a problem. A personal solution may be arrived at by the novel's characters, but the author does not insist that it can be applied universally or that it is the only one. Most problem novels derive their chief interest from their novelty or timeliness. For example, in 1947 Laura Z. Hobson's *Gentleman's Agreement*, revealing the unwritten code of anti-Semitism upheld in U.S. middle-class circles, created a stir among a public freshly shocked by the Holocaust in World War II. The problem novel continues to be popular as a form of serious and provocative fiction whose chief merits are usually extraliterary.

problem play, type of drama that developed in the 19th century to deal with controversial social issues in a realistic manner, to expose social ills, and to stimulate thought and discussion on the part of the audience. The genre had its beginnings in the work of the French dramatists Alexandre Dumas *fils* and Émile Augier, who adapted the then-popular formula of Eugène Scribe's "well-made play" (*q.v.*) to serious subjects, creating somewhat simplistic, didactic thesis plays on subjects such as prostitution, business ethics, illegitimacy, and female emancipation. The problem play reached its maturity in the works of the Norwegian playwright Henrik Ibsen, whose works had artistic merit as well as topical relevance. His first experiment in the genre was *Love's Comedy* (published 1862), a critical study of contemporary marriage. He went on to expose the hypocrisy, greed, and hidden corruption of his society in a number of masterly plays: *A Doll's House* portrays a woman's escape from her childish, subservient role as a bourgeois wife; *Ghosts* attacks the convention that even loveless and unhappy marriages are sacred; *The Wild Duck* shows the consequences of an egotistical idealism; *An Enemy of the People* reveals the expedient morality of respectable provincial townspeople.

Ibsen's influence helped encourage the writing of problem plays throughout Europe. Other Scandinavian playwrights, among them August Strindberg, discussed sexual roles and the emancipation of women from both liberal and conservative viewpoints. Eugène Brieux attacked the French judicial system in *La Robe rouge*. In England, George Bernard Shaw brought the problem play to its intellectual peak, both with his plays and with their long and witty prefaces.

Probolinggo, also spelled PRABALINGGA, or PEROBOLINGGO, *kotamadya* (city) and *kabupaten* (regency), Jawa Timur *propinsi* (East Java province), Java, Indonesia, on the southern side of Selat (strait) Madura. There is a good harbour for small ships, and the fishing industry is important. Cottage industries include pottery and the manufacture of sarongs. The surrounding regency grows rice, corn (maize), sugar, rubber, coffee, and mangoes, the last renowned for their excellence. The city is on road and rail routes. The regency's population is heavily Madurese, and the city has many Chinese. Pop. (1980) city, 100,296; regency, 866,318.

proboscidean, a member of the mammalian order Proboscidea, which contains the largest living land mammals, the elephants, and their extinct relatives. The group includes nearly 300 species divided among three suborders, the wholly extinct Deinotherioidea and Mastodontoidea and the Elephantoidea, in which are classed the Asian elephant (*Elephas maximus*) and the African elephant (*Loxodonta africana*), the only species still extant.

A brief treatment of proboscids follows. For full treatment, *see* MACROPAEDIA: Mammals.

The major features of the order are the elongated snout, ivory tusks, column-like legs, and large, heavyset bodies. The snout, composed of the upper lip, nostrils, and palate, forms a long, boneless proboscis usually called a trunk. In more recent forms this trunk is both long and strong; it can be used for manipulating small pieces of food or for pulling over living trees. Elephants drink by sucking up water with the trunk and then squirting it into the mouth. They may walk across rivers underwater with just the tip of the trunk protruding so that they can breathe.

In living proboscideans the tusks are formed from the second upper incisors. They may reach 3.5 metres (11.5 feet) in length. In some extinct forms there were also lower tusks, and some groups (such as the deinotherioids) lost the upper tusks completely; *Deinotherium* evolved downward-pointing tusks on the end of the mandible. Canine teeth are typically absent or greatly reduced throughout the Proboscidea. The molars in living forms are high-crowned teeth with a grinding surface composed of transverse ridges of enamel; these teeth are replaced from behind as they wear down.

The African elephant (*Loxodonta*) is the larger of the two extant species. Bulls may weigh 5,400 kilograms (6 tons) and stand 3.3 m tall at the shoulder; cows are somewhat shorter. The largest on record was a bull standing 4 m tall with an estimated weight of 9,000 kg. The tusks appear on both sexes. In *Loxodonta* the trunk has a corrugated surface and ends in two fingerlike projections, and the ears are huge, frequently 1 m across.

In contrast, the Asian or Indian elephant (*Elephas*) has relatively small ears, a smooth trunk with a single projection at the tip, and only the bulls grow tusks; in the Ceylonese race, even 90 percent of the bulls are tuskless. The Indian elephant has shorter legs than its African counterpart, and its eyes are noticeably smaller. The ridging on the upper surface of the molars is finer and more complex in the Asian species. The top of the head is quite domed in *Elephas*, whereas it is flattened and the forehead more convex in *Loxodonta*.

Proboscideans first appeared in the Paleocene Epoch (54,000,000 to 65,000,000 years ago). Their ancestors are unknown but presumed to have been small, about the size of pigs. Various members of the order have inhabited Europe, Asia, Africa, and North and South America. The genus *Cuvieronius* may have lived in South America as recently as AD 200–400, and mastodons are thought to have survived into historical times in North America. The mammoths (*Mammuthus*), of the suborder Elephantoidea, survived until about 10,000 years ago; hunting by man was probably among the causes of their extinction. The largest stood over 4.2 m at the shoulder. The woolly mammoth (*M. primigenius*), among the most specialized members of the family Elephantidae, inhabited the cold subarctic areas of the Northern Hemisphere. It was about the same height as the Asian elephant, but its body was shorter and the hindquarters sloped strongly downward. In adaptation to the cold it had very small ears, a short tail, short dense hair with a longer, bristly outer coat, and a layer of subcutaneous fat covering the body.

Elephants are quite social and usually live in herds. Among Asian elephants, 10 to 15 females and their young form the core of the herd and travel under the guidance of an old cow. The overall herd leader is a dominant male. Other males may serve the herd as scouts. Female members of a herd are usually related by blood and may remain together for many years, as elephants in the wild have an average life span of perhaps 60 years. Young males move to the periphery of the herd after about 6 or 7 years. One or more individuals stand guard while the rest of the herd is bathing or feeding. If a herd member is injured, others surround it and help it to stay upright and to move away from danger. Orphaned calves are adopted by other females in the herd.

Elephants are totally herbivorous, eating grasses, leaves, and the bark of trees. Asian elephants are very fond of wild rice and the wood apple (*Feronia elephantorum*), and the African species enjoys the fruit of certain palm trees. During droughts *Loxodonta* obtains some water from the spongy tissues of the baobab tree.

There is little courtship before mating among proboscideans. The gestation period may last from 20 to 22 months. The herd surrounds and protects the mother during parturition. Within two hours of birth the calf is able to stand and suckle; it uses the mouth to nurse, not the trunk. The calf weighs about 90 kg (200 lb) and is 1 m tall at birth; it is born with a sparse coat of brown and yellow hair. Ordinarily there is a four-year interval between calves.

Elephants have long been valued for the ivory of their tusks, and many populations are in danger of extermination due to the demand for this material. They have also been used as work animals, especially in India and the surrounding areas. Because they do not breed well in captivity, elephant drives are often held to capture young animals; previously trained elephants are used to subdue and help train the newly captured individuals.

proboscis monkey (*Nasalis larvatus*), long-tailed arboreal monkey, family Cercopithecidae, found in the swampy mangrove forests of Borneo. The proboscis monkey is red-brown with pale underparts. The nose is long and

Proboscis monkey (*Nasalis larvatus*)
Tierbilder Okapia, Frankfurt am Main

pendulous in the male, smaller in the female, and upturned in the young. The male is about 56–72 cm (22–28 inches) long without the 66–75-centimetre (26–29-inch) tail and weighs 12–24 kg (26–53 pounds); the female is smaller and much lighter. The proboscis monkey is a diurnal vegetarian that lives in groups of about 20. The young have blue faces and are born singly, apparently at any time of year; gestation is an estimated 166 days. The proboscis monkey is declining in population, despite government protection, because of the destruction of its habitat.

proboscis worm: *see* ribbonworm.

Probus, Marcus Aurelius (d. 282), Roman emperor from AD 276 to 282.

The son of a Balkan military officer, he served with distinction in the army and apparently was eastern praetorian prefect when his troops proclaimed him emperor in opposition to Florian, who was soon killed by his own men. Probus' reign was spent in continual frontier warfare against hostile tribes on the Rhine and Danube, complicated by insurrections in Britain, Gaul, and the East. His policy of allowing outside tribes to settle within the empire proved dangerous.

Fourth-century writers attest to his intense interest in agriculture. He encouraged the planting of vineyards in Gaul, Spain, and Britain and was evidently killed by troops who resented his strict discipline and their being detailed to agricultural reclamation work in the Balkans.

procaine hydrochloride, synthetic organic compound used in medicine as a local anesthetic; introduced in 1905 under the trade name Novocaine, it became the first and best-known substitute for cocaine in local anesthesia. Generally used in a 1 to 10 percent saline solution, procaine hydrochloride is administered by injection for infiltration (area flooding as in dental anesthesia), nerve-block, spinal, and caudal anesthesia. Unlike cocaine, procaine is not toxic, addicting, or irritating. It has been displaced somewhat by the chemically related drugs lidocaine and mepivacaine, which produce prompter, more intense, and longer lasting anesthesia.

procaryote, any cell or organism that lacks internal membranes. Bacteria and blue-green algae are characteristically procaryotic. They lack a nuclear membrane, well-defined chromosomes, and most of the components of eucaryotic cells (that is, cells of all living organisms above the level of bacteria). There is evidence that the cell membrane of procaryotes folds inward and carries out many of the functions associated with the components of eucaryotic cells. *Compare* eucaryote.

procedural law, also called ADJECTIVE LAW, the law governing the machinery of the courts and the methods by which both the state and the individual (the latter including societies, whether incorporated or not) enforce their rights in the several courts. It prescribes the means of enforcing rights or providing redress of wrongs and comprises rules relative to jurisdiction, pleading and practice, evidence, appeal, execution of judgments, representation of counsel, costs, conveyancing and registration, etc. Procedural law is commonly contrasted with substantive law, which constitutes the great body of law and defines and regulates legal rights and duties. (*See also* evidence.)

A brief treatment of procedural law follows. For full treatment, *see* MACROPAEDIA: Procedural Law.

Procedural law is a set of established forms for conducting a trial and regulating the events that precede and follow it. Its primary concern is the just and efficient enforcement of the substantive law: for instance, whereas the substantive law of the criminal code outlines what an offense is and how it will be punished, criminal procedure specifies how the rights of the accused will be protected.

Typically, common-law proceedings begin with the determination of "jurisdiction," the selection of a court on the basis of its specialization in an area of law related to the issue at hand, its authority over the defendant, or the location (venue) most suitable for the participants. The parties entitled to institute a legal suit generally include only those who can lay proper claim to the rights at issue or who stand to benefit from the outcome of the trial (known as the real party)—though, when a segment of the public is involved, a representative party may be selected to represent the entire group in trial procedures called class actions. Others who may enter a trial are anyone presented as an amicus curiae ("friend of the court") who testifies in support of one of the contending sides, and anyone joined to the suit as being interested in the litigation.

Because trials often extend over long periods of time, actions such as attachments and temporary injunctions are sometimes taken before court proceedings actually begin, in order to ensure that the rights or properties under dispute cannot be infringed upon or disposed of while the trial is waiting to be heard or is in progress. In the first stage of a trial, called pleading, contending sides meet to set forth their claims, usually written in concise, formal documents that facilitate definition and limitation of the issues and determination of their validity. In English and U.S. procedural law, the second stage of the trial consists of presentation of the case to a jury, while in the European system documentary evidence only is presented to a group of judges.

During the trial, the plaintiff and defendant present their cases and summon witnesses to testify, who may in turn be cross-examined by the opponent. The judge regulates the proceedings, determines the admissibility of evidence when objections are raised, and lastly submits instructions to the jury concerning the laws pertaining to the issues. The jury then deliberates and presents a verdict.

If no request for retrial is granted, the final stage of the procedure is either enforcement or appeal; according to res judicata and collateral estoppel regulations, defendants cannot be tried again for the same cause or for a different cause based on an identical set of facts. Monetary awards and the permission or restraint of action decided by the court are subject to immediate enforcement, and failure to comply may result in additional penalties for contempt of court. The losing party in a suit generally must compensate the opponent for legal expenses in addition to the amount of the penalty or compensation specified by the court. Appeals received by higher courts in the Anglo-American system are examined solely to determine whether or not the trial was properly conducted in the lower courts.

procellariiform, also called TUBINARES, order of seabirds (Procellariiformes) including the albatrosses (family Diomedeidae), shearwaters, fulmars, prions, and large petrels (Procellariidae), storm petrels (Hydrobatidae), and diving petrels (Pelecanoididae).

A brief treatment of procellariiforms follows. For full treatment, *see* MACROPAEDIA: Birds.

The significant characteristics of procellariiforms are large tubular nostrils on the upper bill (the unique and unifying trait of the order), webbed feet, and a vestigial or missing hind toe. The birds produce, in the stomach, large amounts of musky-smelling oil that is excreted defensively and probably used when preening to waterproof the feathers.

The natural habitat of procellariiforms is the Southern Hemisphere, but some are known to migrate north across the Equator to spend winters in the northern summer seas, returning home in the southern spring. Many procellariiforms feed upon krill, a shrimplike animal that is a favourite food of the Antarctic fulmar and several varieties of petrel.

Tubinares, or tube-nosed birds, are best adapted for flying at sea. On land they are clumsy and subject to predators because their legs are placed far back on their bodies and provide inadequate balance. Some species require a long runway to take flight, but in the air they become marvels of balance and grace. Albatrosses, for example, stay aloft using long glides that are only occasionally punctuated by wingbeats. Smaller birds, including petrels and shearwaters, use more frequent flapping and shorter glides.

Shearwaters, storm petrels, and diving petrels make short dives to feed on small fish and crustaceans found close to the water's surface. Albatrosses, fulmars, and giant petrels are not primarily diving feeders; they consume food that is found on the water's surface including squid, fish, and ship garbage.

Some islands are heavily populated with breeding procellariiforms. Mature adults return to established breeding sites and deposit a single white egg, which incubates from 40 to 80 days. The parents always nest in the same spot and remain faithful to it and each other. Breeding bird pairs stage an elaborate greeting ceremony, clacking their bills and screaming excitedly. The newly hatched chick requires parental warmth for the first week or so, after which its rapidly growing down protects it while the parents forage for food, sometimes flying hundreds of miles to find it. The fledgling eventually flies out to sea along the traditional migration route, alone and unguided. These fledglings have been known to fly as far as 6,200 miles (10,000 km) in a little more than two weeks.

Procellariiforms are not brightly coloured, usually being black, white, brown, or gray. They often have striking feather patterns of dark and light. Most varieties have long wings, short necks, and short tails and legs. The bill is short to medium in length with single or double nostrils, depending upon the species.

The human exploitation of procellariiforms for feathers, food, and oil has resulted in the complete or partial extinction of some species. Rats, pigs, and cats also prey on them. The relatively low present demand for feathers used to make hats and the establishment of many bird sanctuaries and strict hunting regulations have removed the immediate sources of danger to these species.

process philosophy, a 20th-century school of Western philosophy that emphasizes the elements of becoming, change, and novelty in experienced reality; it opposes the traditional Western philosophical stress on being, permanence, and uniformity. Reality—including both the natural world and the human sphere—is essentially historical in this view, emerging from (and bearing) a past and advancing into a novel future. Hence, it cannot be grasped by the static spatial concepts of the old views, which ignore the temporal and novel aspects of the universe given in man's experience. Foremost among the many modern thinkers who have contributed to process philosophy have been Henri Bergson and Alfred North Whitehead.

procession, in Christianity, organized body of people advancing in formal or ceremonial manner as an element of Christian ritual or as a less official expression of popular piety. Public processions seem to have come into vogue soon after the recognition of Christianity as the religion of the Roman Empire by Constantine in the 4th century.

Of the vast number of processions that developed during the Middle Ages, some of the more important still have a place in the ritual of the Roman Catholic Church. They include ordinary processions, held on certain yearly festivals throughout the universal church and on other days according to the customs of the local churches, and extraordinary processions, held for special occasions (*e.g.,* to pray for rain or good weather, in time of storm, famine, plague, war, and other disasters). Other processions characteristic of certain localities, though not regulated so strictly by the church and considered nonliturgical, play an important part in the religious life of the people; in the United States, for example, May processions are sometimes conducted in honour of the Virgin Mary.

The Major Rogation procession (April 25), a penitential observance with the object of obtaining God's blessing on crops that have been planted, seems to have been adopted from one of the festivals in the pagan calendar of Rome. The Minor Rogations, observed on the three days before the Feast of the Ascension, date from the 5th century. The procession on Candlemas (February 2), which includes the blessing and carrying of candles, might well be another instance of the church's subrogating a pagan procession. Another procession with a long history is that celebrated on Palm Sunday, commemorating the triumphant entrance of Christ into Jerusalem.

Processions have been a part of the Roman Catholic eucharistic liturgy (mass) at the entrance rite and at the offertory rite, when the bread and wine to be used in the liturgy are brought up to the altar. Although these processions were discontinued at the end of the Middle Ages, strong efforts have been made by liturgists in the 20th century to reintroduce them to promote participation by the people. Processions associated with the adoration of the eucharistic Host, which are all of late origin, include those at the beginning and closing of the Forty Hours' devotion, on the Feast of Corpus Christi, and on Holy Thursday.

In the Eastern Orthodox Church, two noteworthy processions connected with the celebration of the Eucharist are the "little entrance" before the reading of the Gospel and the "great entrance" before the eucharistic prayer, when the offerings of bread and wine are carried in a more elaborate procession. The separation of the people from the sanctuary by a solid wall known as the iconostasis has tended to concentrate their devotion on these processions.

Following the Protestant Reformation, processions associated with the eucharistic Host and those honouring the Virgin Mary and the saints were abolished. Processions vanished from the Reformed churches in response to John Calvin's demand for simplicity in worship. The Lutheran Church in some localities has retained the ancient rogation processions during the week before Whitsunday and, in some cases, during the month of May. In the Anglican churches, the funeral procession, processional litanies, and the solemn entrance of the clergy and choir are still retained.

processionary caterpillar, larval stage characteristic of the small insect family Thaumetopoeidae (order Lepidoptera), sometimes classified as part of the prominent moth family

Processionary caterpillars (*Thaumetopoea pityocampa*)
Ingmar Holmasen

(Notodontidae). These hairy caterpillars live in communal webs and march in columns to their food source. During the movement each larva lays down a silken thread. The large adults have dull-coloured wings and lack a proboscis (feeding organ). Females of both species possess an abdominal hair tuft, which is used to cover the egg masses.

Prochorus Cydones: *see* Cydones, Prochorus.

Procida, Island of, Italian ISOLA DI PROCIDA, Latin PROCHYTA, island near the northwest entrance to the Bay of Naples, Napoli *provincia,* Campania *regione,* southern Italy. It lies between Ischia Island and Cape Miseno on the mainland. It has an area of 1.45 square miles (3.75 square km), and the highest point is 250 feet (76 m) above sea level. Of volcanic origin, it is made up, with the adjacent Vivara Island, of four extinct craters. Parts of the margins of all four have been destroyed by the sea to form crescent-shaped bays on the east side of the island. The only town, Procida, is on the northeast; its castle is now a prison. The soil of the island is very fertile and supports grapes and citrus fruit; fishing is also carried on. Pop. (1987 est.) mun., 10,585.

Proclamation of ———: *see under* substantive word or date (*e.g.,* 1763, Proclamation of).

Proclus (b. *c.* 410, Constantinople [now Istanbul]—d. 485, Athens), the last major Greek philosopher. He was influential in helping Neoplatonic ideas to spread throughout the Byzantine, Islāmic, and Roman worlds.

Proclus was reared at Xanthus in Lycia, and he studied philosophy under Olympiodorus the Elder at Alexandria. At Athens he studied under the Greek philosophers Plutarch and Syrianus, whom he followed as *diadochos* (Greek: "successor"), or head of the Academy founded by Plato *c.* 387 BC. Remaining there until his death, he helped refine and systematize the Neoplatonic views of the 3rd-century Greek philosopher Iamblichus, whose school stressed elaborate metaphysical speculation.

Like Iamblichus, Proclus opposed Christianity and passionately defended paganism. As a Neoplatonic Idealist, he emphasized that thoughts comprise reality, while concrete "things" are mere appearances. Ultimate reality, the "One," is both God and the Good and unifies his ethical and theological systems. His attitudes significantly influenced subsequent Christian theology, in both East and West, through their adaptation by Pseudo-Dionysius the Areopagite, a 5th-century writer whose forgeries were long thought to be works by a 1st-century convert of the Apostle Paul, Dionysius the Areopagite.

The most important Arabic philosophical work to transmit Proclus' ideas was the *Liber de causis* ("Book of Causes"), which passed as a work of Aristotle in medieval times despite its dependence upon Proclus' own *Institutio theologica* (*Elements of Theology*). Latin translations of this, his most important work, and many of his other writings in Greek were made in the 13th century by the scholar William of Moerbeke and became the principal sources for medieval knowledge of Platonic philosophy. The *Elements* is a concise exposition of Neoplatonic metaphysics in 211 propositions. His *Elements of Physics* distilled the essence of Aristotle's views, and his *In Platonis theologiam* (*Platonic Theology*) explicated Plato's metaphysics. His commentaries on Plato, extant in their entirety, include those on *The Republic, Parmenides, Timaeus,* and *Alcibiades I.*

Although more highly regarded as a systematizer and commentator than as an original thinker, Proclus was also the author of numerous nonphilosophical writings, including astronomical, mathematical, and grammatical works. He wrote seven hymns and two epigrams, one of which he composed for the common tomb of himself and his master, Syrianus. The *Life of Proclus,* a favourable biography by his successor, Marinus, at Athens, was reprinted in English translation by Laurence J. Rosan, *The Philosophy of Proclus* (1949).

proconsul, Latin PRO CONSULE, or PROCONSUL, in the ancient Roman Republic, a consul whose powers had been extended for a definite period after his regular term of one year. From the mid-4th century BC the Romans recognized the necessity, during lengthy wars, of extending the terms of certain magistrates; such extension was termed *prorogatio.* Initially prorogation was voted by the people, but soon the Senate assumed this power. As Rome acquired more overseas territories, prorogation became more common: provincial governors were almost always prorogued magistrates or proconsuls. By the middle republic proconsular powers were sometimes conferred upon private citizens, for example, on Pompey in 77, 66, and 65 BC. Under the empire (after 27 BC), governors of senatorial provinces were called proconsuls. In modern times the title has been used informally of certain powerful colonial officials (*e.g.,* the consul general of British-occupied Egypt).

Procopius (b. probably between 490 and 507, Caesarea, Palestine [now in Israel]), Byzantine historian whose works are an indispensable source for his period and contain much geographical information.

From 527 to 531 he was adviser (*consilarius*) to the military commander Belisarius on his first Persian campaign. In 533 and 534 he took part in an expedition against the Vandals and was in Africa until 536, when he joined Belisarius in Sicily. He was in Italy on the Gothic campaign until 540, after which he apparently returned to Constantinople, since he describes the great plague of 542 in the capital. Nothing is known with certainty of his subsequent life. He may have been prefect of Constantinople in 562.

Procopius' writings fall into three divisions: the *Polemon* (*De bellis; Wars*), in eight books;

Peri Ktismaton (*De aedificiis; Buildings*), in six books; and the *Anecdota* (*Historia arcana; Secret History*), published posthumously.

The *Wars* consist of: (1) the Persian Wars (two books), on the long struggle of the emperors Justin I and Justinian I against the Persian kings Kavadh and Khosrow I down to 549; (2) the Vandal War (two books), describing the conquest of the Vandal kingdom in Africa and subsequent events from 532 to 548; (3) the Gothic War (three books), describing the war against the Ostrogoths in Sicily and Italy from 536 to 551. The eighth book contains a further summary of events down to 553.

The *Buildings* contains an account of the chief public works undertaken during the reign of Justinian down to 560. If not written at the command of Justinian (as some have supposed), it is evidently grounded on official information and is a valuable source of information.

The *Secret History* purports to be a supplement to the *Wars*, containing explanations and additions that the author could not insert into the latter work for fear of Justinian and Theodora. It is a vehement invective against these sovereigns, with attacks on Belisarius and his wife, Antonina, and on other noted officials. Owing to the ferocity of the attacks upon Justinian, the authenticity of the *Secret History* was questioned, but Procopius' authorship is now generally recognized. In point of style, the *Secret History* is inferior to the *Wars* and has the air of being unfinished, or at least unrevised.

Procopius the Great: *see* Prokop the Bald.

Procrustes, also called POLYPEMON, or DAMASTES, in Greek legend, a robber dwelling in the neighbourhood of Eleusis; he was slain by the Attic hero Theseus. He had an iron bed (or, according to some accounts, two beds) on which he compelled his victims to lie, stretching or cutting off their legs to make them fit the bed's length. The "bed of Procrustes," or "Procrustean bed," has become proverbial for inflexibility.

Procter, William Cooper (b. Aug. 25, 1862, Glendale, near Cincinnati, Ohio, U.S.—d. May 2, 1934, Cincinnati), American manufacturer who established the nation's first profit-sharing plan for employees.

The soap-making firm of Procter & Gamble was founded in Cincinnati by Procter's grandfather, William Procter, a candlemaker, who joined with James Gamble, an Irish soapmaker, in 1837. The company expanded steadily with the successful marketing of Ivory Soap, introduced in 1879, and with other products subsequently introduced during the presidency (1890–1907) of his father, William Alexander Procter.

William Cooper Procter started to work at the company in 1883 and became general manager in 1890, after working in every department of the plant. He was president of the company from 1907 until 1930, during which time sales rose from $20,000,000 to more than $200,000,000. From 1930 until his death four years later, he served as chairman of the board. During his career with Procter & Gamble, the company built plants in five states, Canada, and England; operated its own cottonseed oil mills; and offered new product lines like Crisco shortening and Camay and Oxydol soaps.

Under his management, the company pioneered in labour relations. At his suggestion, in 1887, Procter & Gamble was the first American company to give a half-holiday on Saturdays. That same year he originated a profit-sharing plan.

In 1920, Procter changed the company's retailing practices so that he could guarantee his employees 48 weeks of work every calendar year, year-round. His other innovations included a disability pension plan, a life insurance plan, and employee representation on the board of directors.

Procter was head of the Cincinnati Red Cross chapter for 20 years. His philanthropic activities included giving large donations to the Cincinnati children's hospital and to Princeton University.

Procter & Gamble Company, major American manufacturer of soaps, cleansers, and other household products. Headquarters are in Cincinnati, Ohio.

The company was formed in 1837 when William Procter, a British candlemaker, and James Gamble, an Irish soapmaker, merged their businesses in Cincinnati. The chief ingredient for both products was animal fat, which was readily available in the hog-butchering centre of Cincinnati. The company supplied soap and candles to the Union Army during the Civil War and sold even more of these products to the public when the war was over. Among its early products were Ivory soap; Crisco shortening, introduced in 1911; and Tide, the first laundry detergent, which Proctor & Gamble introduced just after World War II. In 1932 Procter & Gamble introduced the radio audience to "The Puddle Family," the first soap opera, so called because of the sponsor. Over succeeding years the company acquired additional concerns including coffee, tea, and baking-mix companies.

The modern Procter & Gamble markets products in several major areas: laundry and cleaning products, including soaps, detergents, and cleansers; personal care products, including toothpastes, deodorants, shampoos, and paper products; food products, including shortenings, cake mixes, and coffee; and such miscellaneous products as cellulose pulp, chemicals, and animal feed ingredients.

The greatest percentage of Procter & Gamble's sales comes from detergents, fabric softeners, and cleansers, and the second largest from personal care products. The company has long been one of the leading U.S. national advertisers, as well as one of the leading issuers of free samples and discount coupons.

proctitis, acute inflammatory infection of the anus and rectum, chiefly occurring in male homosexuals. Proctitis is a sexually transmitted disease that is usually acquired by the direct inoculation of pathogenic microorganisms into the rectum during anal intercourse. The most common cause of proctitis is gonorrhea, but it may also be caused by chlamydia infections, herpes, or syphilis. The usual symptoms include anorectal pain, a purulent or bloody discharge, constipation, and inflammation of the rectal lining. Herpes infections also typically produce fever and rectal ulcers. Therapy is directed at the specific microbial cause, but diagnosis and treatment are often complicated by the presence of multiple sexually transmitted infections in the same individual. When the infection extends beyond the rectum to the sigmoid colon, it is termed proctocolitis; this disorder usually involves the additional symptoms of diarrhea, abdominal cramping, and fever.

proctor, in English law, formerly a practitioner in ecclesiastical and admiralty courts, who performed duties similar to those of solicitors in ordinary courts. After the Judicature Act of 1873, the title of proctor in this sense became obsolete, the term solicitor being extended to include proctors. *See also* solicitor.

The word is still used sometimes in the United States to denote any practitioner in probate and admiralty courts; in England the queen's proctor, who represents the British crown in divorce cases, still exists.

proctoscope, lighted tube that is used by physicians for the visual inspection of the rectum and lower colon. The instrument consists of a 25-centimetre (10-inch)-long metal or plastic tube with a strong, dependable light. Modern proctoscopes often use optic fibres to deliver light at the inserted end, whereas older instruments used an external light source located near the examiner's eye. The proctoscope allows the entire surface of the rectal lining to be examined for evidence of disease. It is passed into the anal canal using gentle pressure and is gradually advanced as far as is comfortable for the patient being examined. Proctoscopy or proctosigmoidoscopy (in which the lower or sigmoid colon is also observed) is a standard part of the physical examination of older persons. The rigid instrument has been somewhat replaced by flexible instruments using optic fibres to transmit both light from the outside and images of the intestine. These flexible instruments allow more extensive observation with less patient discomfort.

procuracy, Russian PROKURATURA, in Soviet and Soviet-modeled legal systems, government office concerned with ensuring administrative legality. The Soviet constitution invests the procurator general (Russian: *generalny prokuror*) with the responsibility of supervising the observance of the law by all government ministries and institutions subordinate to them, as well as by individual officials and citizens. The procurator general is appointed by the Supreme Soviet for a term of seven years. He appoints subordinate procurators at all administrative levels from union republic to district and town.

The procurator is not the president of a court or a tribunal but rather is a watchdog of legality who is charged with ensuring the strict observance of the constitution and laws by all government officials and citizens. His organization is composed of a department for general supervision; a bureau of investigation for the supervision of preliminary inquiries in criminal matters; a department for the supervision of investigations carried out by the state security service (KGB); departments to supervise criminal and civil proceedings in the courts; a department to supervise prisons, prison camps, and compulsory labour centres; and departments for administration, statistics, and research.

procurator, plural PROCURATORS, or PROCURATORES, government financial agent in ancient Rome. From the reign of the emperor Augustus (27 BC–AD 14), procurators were regularly appointed to official posts in the imperial administration of the provinces or in the departments of the imperial government concerning such matters as the grain supply, the mint, and the mines. Procurators of provinces supervised imperial finances in their respective jurisdictions. In imperial provinces the procurator served under a legate; in senatorial provinces he exercised more authority within the administration of the governor and his quaestor.

Procurators were also appointed to govern, with small troop detachments, certain lesser provinces. These procurators exercised both financial and judicial authority, even in capital cases, but were usually subject to the general authority of the governor of a major province in the region. In the 4th century AD the office was renamed *rationalis.*

Procyon, also called ALPHA CANIS MINORIS, brightest star in the northern constellation Canis Minor (Lesser Dog) and one of the brightest in the entire sky, with an apparent visual magnitude of 0.34. Procyon lies about 11 light-years from the Earth and is a visual binary, a bright yellow-white subgiant with a faint, white dwarf companion of about the 11th magnitude. The name apparently derives from Greek words for "before the dog," in reference to the constellation.

procyonid, any member of the mammalian family Procyonidae (order Carnivora), including the raccoon and allied species. They are hunted for their fur and flesh, and sometimes kept as pets. Except for the lesser panda of East Asia, the living forms inhabit North and Central America. Procyonids are closely related to bears (Ursidae) and dogs (Canidae). They are small animals with long, often bushy and dark-banded tails. They are omnivorous. There are seven or eight living, and several extinct, genera.

For more information on procyonid species and groups, *see* cacomistle; coati; kinkajou; olingo; panda; raccoon.

prodigy, an extraordinary person, particularly a child, who shows spontaneous early signs of genius or exceptional ability along certain lines. Among these are the arithmetical prodigies, the chess prodigies, and the lightning calculators who have a remarkable memory for figures and vivid visual or auditory imagery but who often do not excel in other ways. Best known are the musical prodigies—Mozart, Schubert, and Mendelssohn, all of whom began to compose before the age of 12; Johann Hummel, Chopin, and Yehudi Menuhin, who gave public concerts by 11 years of age; and Brahms, Dvořák, and Richard Strauss, all of whom drew musical attention early. Far less common is precocious ability in acting, writing, drawing, and painting. Prodigies should be distinguished from those whose superior achievements result from overtraining rather than talent. They must also be distinguished from so-called idiot savants, whose achievement is confined to a very limited area and who show little understanding of their ability because of average or subnormal intelligence.

Prodigies are both born and made—born with retentive memories and a quality of mind that enables them to relate and organize experiences; and made in the sense that they receive opportunities and rewards of special practice, instruction, or training. Some, however, achieve a superior level of performance without help, or even in spite of adversity—Blaise Pascal, for example, though his father deprived him of mathematical books at the age of 11, secretly constructed a geometry of his own. Few mental prodigies reported in history have met early expectations. Musical prodigies, however, seldom fade into oblivion.

Prodromus, Theodore, also called PTOCHOPRODROMUS (Greek: "Poor Prodromus") (d. *c.* 1166), Byzantine writer, well known for his prose and poetry, some of which is in the vernacular.

He wrote many occasional pieces for a widespread circle of patrons at the imperial court. Some of the work attributed to him is unpublished and some of it may be wrongly attributed to him. Even so, there does emerge from these writings the figure of an author in reduced circumstances, with a marked propensity for begging, who was in close touch with the court circles during the reigns of John II (1118–43) and Manuel I (1143–80). He was given a prebend by Manuel I, and he ended his life as a monk. Behind panegyric and conventional treatment his writings, often produced on the occasion of some public event, provide the historian with vital information on many aspects of contemporary history. There is a strongly satirical vein in his works, which range from epigrams and dialogues to letters and occasional pieces in both prose and verse. He had a biting sense of humour, and his comments are shrewd and pithy.

producer gas, mixture of flammable gases (principally carbon monoxide and hydrogen) and nonflammable gases (mainly nitrogen and carbon dioxide) made by the partial combustion of carbonaceous substances, usually coal, in an atmosphere of air and steam. Producer gas has lower heating value than other gaseous fuels, but it can be manufactured with relatively simple equipment; it is used mainly as a fuel in large industrial furnaces.

producer goods, also called INTERMEDIATE GOODS, in economics, goods manufactured and used in further manufacturing, processing, or resale. Producer goods either become part of the final product or lose their distinct identity in the manufacturing stream. The prices of producer goods are not included in the summation of a country's gross national product (GNP), because their inclusion would involve double counting of costs and lead to an exaggerated estimate of GNP. Only the price of final consumer goods is included in the GNP. The contribution of producer goods to the GNP may be determined through the value-added method. This method calculates the amount of value added to the final consumer good by each stage of the production process. When the values added at all stages of production have been established, they are summed to estimate the total value of the final product.

production function, in economics, equation that expresses the relationship between the quantities of productive factors (such as labour and capital) used and the amount of product obtained. It states the amount of product that can be obtained from every combination of factors, assuming that the most efficient available methods of production are used.

The production function can thus answer a variety of questions. It can, for example, measure the marginal productivity of a particular factor of production (*i.e.,* the change in output from one additional unit of that factor). It can also be used to determine the cheapest combination of productive factors that can be used to produce a given output.

production management, also called OPERATIONS MANAGEMENT, the planning and control of industrial production processes to ensure that they move smoothly at the required level. Techniques of production management are employed in service industries as well as in manufacturing industries.

A brief treatment of production management follows. For full treatment, *see* MACROPAEDIA: Industrial Engineering and Production Management.

The responsibilities of production management are often referred to as the "five M's": men, machines, methods, materials, and money. The management of men, machines, and methods involves maintaining a flexible production process with a work force that can readily adapt to new equipment and schedules. Responsibilities for materials include the management of both physical (raw) materials and information materials (paperwork). Money management, including such areas as inventory, plant capacity, and customer service, is a major responsibility and can determine the competitiveness of an entire operation. The production cycle requires that various departments interact. Sales, financial, engineering, and planning departments exchange information—such as sales forcasts, production schedules, inventory levels, and budgets—until, finally, detailed production orders are dispatched by the production-control division.

Control is a chief function of production management. The manager must ensure that operations produce at planned output levels while meeting cost and quality objectives. The production plan must be monitored regularly, and adjustments must be made to meet fluctuating market demands.

Inventory control oversees raw materials, component parts, work in process, finished goods, packing and packaging materials, and general supplies and determines when to replenish inventory and by what amount. The control of labour involves using industrial-engineering tools, such as time-study measurements, to design efficient work methods. Workers must be hired, trained, and assigned in synchronization with changing production processes and schedules. Production managers often use techniques developed in the fields of industrial engineering, operations research, and systems engineering.

productivity, in economics, a measure of productive efficiency calculated as the ratio of what is produced to what is required to produce it. The inputs taken as the denominator of the ratio are usually the traditional factors of production—land, labour, and capital—taken singly or in the aggregate.

A brief treatment of productivity follows. For full treatment, *see* MACROPAEDIA: Economic Growth and Planning.

In practice, productivity calculations are seldom made for land or capital for reasons both practical and theoretical. For example, the productivity of a given capital input, say a machine, depends on the valuation given the machine. Such a valuation, however, is extremely difficult to determine, even in relation to another machine of observably different capacity. Cost is not a guide, for a radical technological improvement may have yielded greater capacity for the same cost; yet capacity alone is not sufficient, for account should be taken of cost, along with various other factors.

Labour, on the other hand, is in most cases easily quantified, as by a simple counting of workers engaged on a particular product. More fundamentally, the experience of industrial nations has been that the effects of increasing productivity show themselves chiefly in the use of labour. Technological improvements have tended to displace labour rather than the other factors of production.

Productivity may be viewed as a measure of efficiency alone at a given moment in economic time, or it may be seen as an indicator of economic development, that is, as an index of growth. The latter possibility flows from the fact that, over the course of development from a primitive extractive economy to a technologically sophisticated one, productivity increases. The pattern of increase typically exhibits a long-term stability, interrupted from time to time by sudden leaps that are taken to represent major technological changes. Thus, productivity in Great Britain, Europe, and the United States made great advances following the development of steam power, the railroad, the gasoline motor, the open-hearth furnace, electric power, and so on.

A long-term increase in productivity is associated with similar long-term increases in real wages; it is also the case that where real wages rise in the absence of a corresponding increase in productivity, prices rise. A high level of wages in a given industry may lead to the substitution of capital for labour. This last effect is sometimes given as the explanation for the rapid mechanization of industry in the United States in the 19th century, when labour was relatively scarce and thus expensive. By the same token, in densely populated, underdeveloped countries the cheapness of labour discourages investment in productivity-enhancing capital goods.

productivity, biological: *see* biological productivity.

Proell, Annemarie (skier): *see* Moser-Proell, Annemarie.

proenzyme: *see* zymogen.

Proetus, in Greek mythology, a king of Argos, grandson of Danaus. He quarreled with his brother Acrisius and divided the kingdom with him, Proetus taking Tiryns, which he fortified. Proetus' daughters were driven mad either because they insulted the goddess Hera or because they would not accept the new rites of Dionysus. They imagined themselves cows, until the seer Melampus cured them on condition that he be given a third of the kingdom and his brother, Bias, another third. *See also* Bellerophon.

Professional Golfers' Association of America (PGA), organization formed in the United States in 1916 at the instigation of Rodman Wanamaker, a Philadelphia businessman, with the stated purpose of promoting interest in professional golf, elevating the standards of the game, and advancing the welfare of its members. By the late 1980s the PGA had a membership of about 8,500 playing and teaching professionals. Its annual PGA national championship tournament was one of the world's major golf events. In addition, it shared in the conduct of an international team match with Great Britain for the Ryder Cup and cosponsored an annual yearlong series of tournaments, called the tour, held throughout the United States. Other activities included maintenance of a PGA Hall of Fame and a training program for would-be touring professionals. Differences between the touring professionals and the teaching professionals were resolved in 1982 by the addition of a second tour. The PGA headquarters are in Lake Park, Fla. Similar organizations exist in other countries (the Canadian PGA was founded in 1911). The women's equivalent of the PGA is the Ladies Professional Golf Association (LPGA), founded in 1950. It provides organized professional tournament golf for women and holds the LPGA Championship tournament.

For American PGA and LPGA championship tournament winners, *see* Sporting Record: *Golf.*

profit, in business usage, the excess of total revenue over total cost during a specific period of time. In economics, profit is the excess over the returns to capital, land, and labour (interest, rent, and wages). To the economist, much of what is classified in business usage as profit consists of the implicit wages of manager-owners, the implicit rent on land owned by the firm, and the implicit interest on the capital invested by the firm's owners. In conditions of competitive equilibrium, "pure" profit would not exist, because the competitive market would cause the rates of return to capital, land, and labour to rise until they exhausted the total value of the product. Should profits emerge in any field of production, the resulting increase in output would cause price declines that would eventually squeeze out profits.

The real world is never one of complete competitive equilibrium, though, and the theory recognizes that profits arise for several reasons. First, the innovator who introduces a new technique can produce at a cost below the market price and thus earn entrepreneurial profits. Secondly, changes in consumer tastes may cause revenues of some firms to increase, giving rise to what are often called windfall profits. The third type of profit is monopoly profit, which occurs when a firm restricts output so as to prevent prices from falling to the level of costs. The first two types of profit result from relaxing the usual theoretical assumptions of unchanging consumer tastes and states of technology. The third type accompanies the violation of perfect competition itself.

profit sharing, system by which employees are paid a share of the profits of the business enterprise in which they are employed, in accordance with a scheme defined in advance. Such payments, which may vary according to salary or wage, are distinct from and additional to regular earnings. Profit-sharing plans were probably first developed in France before the middle of the 19th century as a means of increasing worker incentive and eliminating the antagonism between workers and owners. The scheme was adopted later in a number of other countries and currently exists to varying degrees throughout much of western Europe, the United States, and parts of Latin America.

Profit shares may be distributed on a current or deferred basis or by some combination of the two. Under current distribution, profits are paid out to employees immediately in the form of cash or company stock. Profit sharing in the form of ownership shares in the firm has in a few cases also involved participation by employees in the firm's management. In deferred-payment plans, profit shares may be paid into a trust fund from which employees can draw annuities in later years. Some employers find deferred profit sharing a favourable substitute for pension plans because the employer contribution is not fixed but varies with profits.

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progeria, human disorder with many characteristics of premature aging. Affected persons have parchment-like skin, become bald or gray-haired early in life, and tend to develop diseases related to aging decades before they occur in normal individuals. Initially, progeria was studied as a model of normal aging, but because not all organs are affected, this is no longer thought to be appropriate. There is, for example, no evidence of senility or of aging in the central nervous system. Two major types of progeria occur: the extremely rare Hutchinson–Gilford syndrome, which has its onset in early childhood, and Werner's syndrome, which is unrelated and occurs later in life. A third disease, progeria with microphthalmia (the Hallerman–Streiff–François syndrome), in which dwarfism is a prominent feature, is also sometimes included.

Signs of infant progeria, the Hutchinson–Gilford syndrome, appear at about age one, after an evidently normal infancy. Affected individuals seldom exceed the size of a normal 5-year-old, although they have the physical appearance of 60-year-old adults by the time they are 10. Many of the superficial aspects of aging, such as baldness, thinning of the skin, prominence of blood vessels of the scalp, and vascular diseases, occur. Sex organs remain small and underdeveloped. A few individuals with progeria are mentally retarded, but most have normal intelligence and may even be precocious. By age 10, extensive arteriosclerosis and heart disease have developed, and most patients die before they reach 30; the median age of death is 13. A hereditary basis has been suspected, but there is no evidence to support the suspicion, and the cause remains a mystery.

Werner's syndrome, sometimes called progeria of the adult, appears in young adulthood or, less commonly, in late adolescence. The aging changes are somewhat less pronounced, so that affected persons look about 30 years older than their chronological age. There is no dwarfism, as growth has been completed by the time the disease appears, but affected persons tend to be slightly shorter than average. Patients with Werner's syndrome are sexually mature, but secondary sex characteristics are poorly developed. Superficial signs of aging are premature balding or graying of hair, loss of teeth and hearing, cataracts, acute arthritic episodes, skin ulcers, and osteoporosis (loss of bony tissue). There is an increased tendency to develop heart disease, diabetes mellitus, and cancer, and the average lifespan is 47 years. This type of progeria is hereditary and is transmitted as a recessive trait, but its underlying cause is unknown.

progesterone, hormone secreted by the female reproductive system that functions mainly to regulate the condition of the inner lining (endometrium) of the uterus. Progesterone is produced by the ovaries, placenta, and adrenal glands; in the ovaries the site of production is the corpus luteum tissue, which begins to form prior to an egg's release and continues to grow into the empty follicular space once the egg has left the follicle (a capsule of tissue around the egg). The released egg, if it is fertilized by the male sperm cell, becomes implanted in the uterus, and a placenta forms. The placenta then produces progesterone during the period of pregnancy. If the egg is not fertilized, progesterone is secreted by the ovaries until a few days before menstruation, at which time the level of progesterone drops sufficiently to stop the growth of the uterine wall and to cause it to start to break down, and menstruation ensues.

Progesterone prepares the wall of the uterus so that the lining is able to accept a fertilized egg and so that the egg can be implanted and develop. It also inhibits muscular contractions of the uterus that would probably cause the wall to reject the adhering egg.

Progesterone is known to have effects on other female organs. In the ovaries, progesterone and estrogens are thought responsible for the release of an egg during ovulation. It is believed that if the egg is fertilized, these hormones are influential in the prevention of further egg release until the pregnancy has terminated. This dual action ordinarily prevents the release and fertilization of more than one egg at one time, although two or more eggs are occasionally released. Many oral contraceptives are composed of a synthetic chemical similar to progesterone that inhibits egg growth and release in the ovaries and thereby prevents fertilization. In the fallopian tubes progesterone is thought to stop the muscular contractions in the tube once the egg has been transported. During pregnancy, progesterone also stimulates development of the glands in the breasts that are responsible for milk production.

program, computer: *see* computer program.

program music, instrumental music that carries some extramusical meaning, some "program" of literary idea, legend, scenic description, or personal drama. It is contrasted with so-called absolute, or abstract, music, in which artistic interest is supposedly confined to abstract constructions in sound. It has been stated that the concept of program music does not represent a genre in itself but rather is present in varying degrees in different works of music. Only in the so-called Romantic era, from Beethoven to Richard Strauss, is the program an essential concept, and even there it leaves its mark on much music commonly considered "pure" or "absolute."

In a sense, it is impossible to speak of purely abstract music; any work of art must have some "content," some series of images, states of mind, or moods that the artist is trying to project or communicate—if only the sense of pure abstractness. For example, a siciliana (a composition using an Italian dance rhythm) bears in its rhythm associations of tranquillity for many listeners. Most music works on such a symbolic and evocative but not directly descriptive level. Thus, Beethoven considered his *Symphony No. 6* (*Pastoral*) "more an expression of feeling than painting." A few examples of literal "tone painting" aside (such as the bird calls in the second movement), the *Pastoral* depicts the emotions one might feel in the surroundings of nature or perhaps some other human situation.

There is a descriptive element in the music of many cultures, from the stylized sounds of falling rain and snow in Japanese samisen music to the vividly evoked plagues in Handel's oratorio *Israel in Egypt* (1739) and the bird calls, battle sounds, and so forth appearing in European music (instrumental and vocal) for several centuries. But the development of music with a pervasive program, like the term program music itself, is a uniquely 19th-century phenomenon, beginning precisely with Beethoven, for he unified the movements of a symphony or sonata into a psychological whole. Not only the *Pastoral* but the *Symphony No. 3* (*Eroica*) and many later works exhibit this feature, in which contrasting states of mind are brought into immediate contact, and, occasionally, the process of transition between them is explored.

This interest in the unification of contrary tendencies found expression in two characteristically 19th-century forms: the suite of short pieces (as Robert Schumann's *Carnaval*) and the symphonic poem, starting with expanded overtures such as Beethoven's *Leonore No. 3* and Felix Mendelssohn's *Hebrides*. These works are often unified by a basic theme (cyclic technique; *q.v.*), but just as frequently they exhibit a looseness of form that stands in vivid contrast to the structural rigour of Bach, Haydn, and Mozart.

The development of program music quickly reached maturity with the works of Carl Maria von Weber (*Konzertstück,* 1821) and Hector Berlioz (*Symphonie fantastique,* 1830), both of whom distributed at concerts a printed synopsis of the "plots" behind their works. Schumann, on the other hand, left unstated the connection between movements of his *Kreisleriana;* yet his music differs from Weber's not so much in its lack of programmatic intent as in its lack of written program. The lines are blurred more thoroughly in the music of Franz Liszt, possibly the best known composer of program music, whose specifically programmatic works—such as the *Faust Symphony* or the symphonic poems on the lives of the poet Torquato Tasso and the Cossack Ivan Mazeppa—are not often performed. In his works without written program, notably the *Piano Sonata in B Minor* and his two piano concerti, similar types of moods are expressed in a style resembling that of the symphonic poems.

The era after Liszt saw the quick demise of program music, even though there are important exceptions. Detailed programs to some orchestral works of Richard Strauss, for example, exercise considerable control over the music. Strauss's imitation of bleating sheep in *Don Quixote* (1897) is a celebrated example; because it is an episode conjured up by the story, it may be missed unless a plot summary is provided. This cannot be said of earlier programmatic works (including Strauss's own *Don Juan* and *Till Eulenspiegel*), in which the music is internally sufficient to a listener who may not know the program.

Other composers of the time began to have doubts about the value of a written program; Anton Bruckner and Gustav Mahler, for example, withdrew their own published descriptions of their symphonies. Although certain works since 1900 reflect a programmatic attitude—*e.g.,* Arnold Schoenberg's *Verklärte Nacht* (*Transfigured Night*; first performed in 1903) and many Soviet works, such as Dmitry Shostakovich's *Symphony No. 7* (*Leningrad;* 1941)—the movement of the 20th century has generally been away from the depictive. *See also* symphonic poem.

programmed learning, educational technique characterized by self-paced, self-administered instruction presented in logical sequence and with much repetition of concepts. Programmed learning received its major impetus from the work done in the mid-1950s by the U.S. behavioral psychologist B.F. Skinner and is based on the theory that learning in many areas is best accomplished by small, incremental steps with immediate reinforcement, or reward, for the learner. This technique can be applied through texts, so-called teaching machines, and computer-assisted-instruction. No matter what the medium, two basic types of programming are used: linear, or straight-line programming, and branching programming.

Linear programming immediately reinforces student responses that approach the learning goal. Responses that do not lead toward the goal go unreinforced. Each bit of learning is presented in a "frame," and a student who has made a correct response proceeds to the next frame. All students work through the same sequence, and a low rate of error is necessary to ensure continued positive reinforcement of correct responses.

Branching, or intrinsic, programming, was initially developed in conjunction with the use of an electronic training device for military personnel. This technique provides the student a piece of information, presents a situation requiring a multiple choice or recognition response, and on the basis of that choice instructs the student to proceed to another frame, where he or she learns if the choice was correct, and if not, why not. A student who responded incorrectly will either be returned to the original frame, or routed through a subprogram designed to remedy the deficiency indicated by the wrong choice. A student who selects correctly advances to the next frame in the program. This process is repeated at each step throughout the program, and a student may be exposed to differing amounts of material depending upon errors made.

Text materials often rely on a cardboard mask that the student uses to cover the correct response until a choice is made. There are successful programmed learning texts for primary-grade pupils, but most such texts have been designed for upper-grade and college-level subjects such as statistics, economics, and foreign languages.

programming language, computer: *see* computer programming language.

Progreso, city and port on the Gulf of Mexico, northern Yucatán state, eastern Mexico. Although vessels must anchor offshore, where a breakwater stretches approximately 1 mi (2 km) into deeper water, and are not protected from wind, it is the major port on the peninsula and Yucatán's second largest city. The port was built to export the henequen, or sisal hemp, produced inland, but it also handles fine woods, chicle, honey, salt, copra, and hides. Progreso's white sand beaches and clear, calm waters make it a popular resort. It is linked to Mérida, the state capital, to the south, by highway and railroad. Pop. (1970) 17,518.

Progress, Alliance for: *see* Alliance for Progress.

Progressive Bloc, Russian PROGRESSIVNYI BLOK, coalition of moderate conservatives and liberals in the fourth Russian Duma (elected legislative body) that tried to pressure the imperial government into adopting a series of reforms aimed at inspiring public confidence in the government and at improving the management of Russia's effort in World War I. The bloc was formed in August 1915 under the leadership of Pavel N. Milyukov. On September 7 its members issued a program that called upon Emperor Nicholas II to appoint ministers who enjoyed the nation's confidence and who would cooperate with the legislature. It urged that the government curtail its practices that discriminated against national and religious minority groups and that it cooperate with private organizations that had formed to promote the war effort. It also called for an amnesty for political prisoners, for the strict adherence to rule by law, and for less interference in civilian affairs by military authorities.

The bloc, which included about half of the Duma membership, received support from several political factions in the State Council (the upper house of the legislature) as well as from some ministers and organizations representing local governments. But the Emperor responded on Sept. 16, 1915, by suspending the session of the Duma (which had begun on August 1).

Throughout 1916 the bloc became increasingly dissatisfied with the administration; in November 1916 Milyukov delivered a scathing criticism of it to the Duma. When the February Revolution broke out, members of the bloc (with two left-wing Duma members) formed the Provisional Committee of the Duma (March 12, 1917), which appointed the first Provisional Government, which in turn assumed official power in Russia on March 15, 1917.

Progressive Conservative Party of Canada, byname CONSERVATIVE PARTY, French PARTI PROGRESSISTE-CONSERVATEUR DU CANADA, one of the major Canadian political parties. Its origin may be traced to the informal groups of government supporters, or Tories, that operated in Canada's nascent party system in the century prior to that country's confederation as the Dominion of Canada in 1867. Until 1854 the opposing groups of Tories and Reformers were factional and unstable. In that year, however, a government of Reformers fell as a result of internal division, and disciplined new parties were formed that have dominated Canadian politics ever since. The old Tories and other conservatives, including a majority of conservative French-Canadians, joined with a group of moderate liberals to form the Liberal-Conservative Party under the leadership of John Macdonald; except for a period during and after World War I, the party kept this name until 1942, when it was renamed Progressive Conservative.

The Liberal-Conservatives were dominant in the Canadian Parliament until 1864, when a coalition was formed with the Liberals that lasted until 1867. Macdonald's attempt to continue coalition government after that date foundered in 1873, when the party was heavily defeated at the polls. Macdonald, however, continued to lead the party and swept back into power in 1878 after adopting a protectionist tariff policy; he continued in office until 1891, when his death left the party without an effective leader. In 1896 the party lost office and remained out of power until 1911, when it was aided by an "unholy" alliance with the Quebec Nationalists. During World War I a large number of Liberals gave their support to the Conservative administration (1917), the party temporarily adopting the title Unionist. In 1921, as the National Liberal and Conservative Party, it went down to a severe defeat, and thereafter it held power only twice (for three months in 1926 and from 1930 to 1935) until John G. Diefenbaker was able to form a minority government in June 1957. A 1958 election gave the party a large majority, and it remained in power until 1963. Diefenbaker was succeeded as leader in 1967 by Robert L. Stanfield, who was defeated in the election of 1968. Except for a nine-month period of government under Joe Clark in 1979–80, the party remained out of power on the federal level. In 1983 Clark was replaced by Brian Mulroney as party leader, and in 1984 a general election returned the government to the Conservatives.

Neither the Conservatives nor the Liberals can be characterized as parties of the right or left within the Canadian political spectrum. The Conservative Party contains various shades of opinion, and its policies are generally determined by political expediency, local issues, and practical need rather than by ideology. In general, however, the Conservatives favour orthodoxy in finance and less governmental involvement in social affairs.

Progressive Democrats, conservative Irish political party formed in December 1985. It was founded principally by Desmond O'Malley, who had held two ministries in Fianna Fáil governments but eventually broke with party leader Charles James Haughey over various issues, including Northern Ireland. O'Malley created the party with fellow Fianna Fáil dissidents, together with some former supporters of the Fine Gael and the Labour Party. In its first electoral test, in February 1987, the party secured almost 12 percent of the popular vote and 14 seats in the Dáil (the lower house of parliament), running on a program of fiscal restraint, privatization, a secular state, and acceptance of the reality of a divided Ireland. The party seemed to siphon off more support from adherents of the conservative Fine Gael than from Fianna Fáil.

progressive education, movement that took form in Europe and the United States during the late 19th century as a reaction to the alleged narrowness and formalism of traditional education. One of its main objectives was to educate the "whole child"—that is, to attend to physical and emotional, as well as intellectual, growth. The school was conceived of as a laboratory in which the child was to take an active part—learning through doing. The theory was that a child learns best by actually performing tasks associated with learning. Creative and manual arts gained importance in the curriculum, and children were encouraged toward experimentation and independent thinking. The classroom, in the view of Progressivism's most influential theorist, the American philosopher John Dewey, was to be a democracy in microcosm.

The sources of the progressive education movement lay partly in European pedagogical reforms from the 17th through the 19th century, ultimately stemming partly from Jean-Jacques Rousseau's *Émile* (1762), a treatise on education, in the form of a novel, that has been called the charter of childhood. In the late 18th and early 19th centuries, Rousseau's theories were given practical application in a number of experimental schools. In Germany, Johann Bernhard Basedow established the Philanthropinum at Dessau (1774), and Friedrich Froebel founded the first kindergarten at Keilhau (1837). In Switzerland, Johann Pestalozzi dedicated himself, in a succession of schools, to the education of poor and orphaned children. Horace Mann and his associates worked to further the cause of universal, nonsectarian education in the United States.

Throughout the late 19th century, a proliferation of experimental schools in England extended from Cecil Reddie's Abbotsholme (1889) to A.S. Neill's Summerhill, founded in 1921. On the European continent some pioneers of progressive educational methods were Maria Montessori in Italy; Ovide Decroly in Belgium; Adolphe Ferrière in Geneva; and Elizabeth Rotten in Germany. The progressive educational ideas and practices developed in the United States, especially by John Dewey, were joined with the European tradition after 1900. In 1896 Dewey founded the Laboratory Schools at the University of Chicago to test the validity of his pedagogical theories.

From its earliest days progressive education elicited sharp and sustained opposition from a variety of critics. Humanists and idealists criticized its naturalistic orientation, its Rousseaueaan emphasis on interesting and freeing the child, and its cavalier treatment of the study of classic literature and classical languages.

Progressive Federal Party, Afrikaans PROGRESSIEWE FEDERALE PARTY (PFP), former South African political party established in 1977 in the merger of the Progressive Reform Party (founded 1975) and defectors from the United Party (founded 1934; *see* New Republic Party). In 1989 the Progressive Federal Party merged with two smaller parties to form the liberal Democratic Party (*q.v.*).

The history of the Progressive Federal Party may be traced to 1959, when liberal defectors from the United Party (the major opposition to the ruling National Party) formed the Progressive Party. From 1961 to 1974, Helen Suzman was the party's sole representative in Parliament, fighting alone against apartheid and the extension of South Africa's racial and security laws. In 1974, however, the Progressive Party won seven seats and, in the following year on July 25, 1975, merged with the Reform Party (itself formed in February of that year by other defectors from the United Party); the result was the Progressive Reform Party, which, with further recruits from the United Party, became the Progessive Federal Party on Sept. 5, 1977. In 1981 the party won 26 seats in Parliament. The number had dropped to 19 by the time of the merger of 1989.

The party sought a new constitution for South Africa, with equal rights for all South Africans, regardless of race or creed; it looked for "proportional representation without majority domination."

Progressive National Baptist Convention, Inc., association of black Baptist churches, organized in 1961 at Cincinnati, Ohio, U.S. It developed from a group of black Baptists who left the National Baptist Convention, U.S.A., Inc., because they disagreed with the procedure for electing officers of the convention. The first annual convention of the new church was held in 1962.

Progressive Party (Japan): *see* Kaishintō.

Progressive Party (U.S., 1912): *see* Bull Moose Party.

Progressive Party (1924), in the United States, a short-lived independent political party assembled for the 1924 presidential election by forces dissatisfied with the conservative attitudes and programs of the Democrats and Republicans. The Progressive Party included liberals, agrarians, Republican progressives, socialists, and labour representatives. It chose as its presidential candidate Senator Robert M. La Follette of Wisconsin, who in 1911 had organized what became an independent party formally called the Progressive but generally known as the Bull Moose Party (*q.v.*). The 1924 Progressives pledged a "housecleaning" of executive departments, public control of natural resources, public ownership of railways, and tax reduction. The party polled only some 17 percent of the popular vote and did not influence the election, in which President Calvin Coolidge and the Republicans won a majority. The Progressive Party dissolved when La Follette died the following year.

Progressive Party (1948), in the United States, a dissident political faction founded in 1947 by Henry A. Wallace, who had broken with the Democratic administration of President Harry S. Truman. Unlike the Progressive organizations of 1912 and 1924, Wallace's party campaigned on changes in foreign policy rather than domestic issues. It particularly advocated a more conciliatory policy toward the Soviet Union. The party won more than 1,000,000 popular votes in the 1948 election but was never again influential.

progressive tax, tax levied at a rate that increases as the quantity subject to taxation increases. Devised to collect a greater proportion of tax revenue from wealthy people, progressive taxes reflect the "ability-to-pay" principle. Progression may be introduced through exemptions from tax liability of an initial amount of the tax base, or through progressively greater rates for larger and larger bases. Progressive taxes are a stabilizing force in periods of inflation or recession because the amount of tax revenue changes more than proportionately with the increase or decrease in income.

In an inflationary economy, with prices and incomes rising, the actual dollar value of tax credits and allowances remain unchanged. As individual income increases, however, the taxpayer is moved into a higher tax bracket, so that a greater percentage of the income goes toward taxes. During inflationary periods, taxpayers at the lower end of the income scale suffer most under this system.

At the same time, the government's tax revenues rise. Working from the basic premise that tax revenues should roughly equal government expenditures, the taxing body must then decide how to spend the increased revenue. This phenomenon greatly strengthens the role of government in the overall economy. By either reducing tax rates or increasing spending, the government can stimulate or restrain private demand.

These side effects of inflation on a progressive tax system—shifting the tax burden to the "less able" and increasing the power of the government to control the economy—are contrary to the purpose of the progressive income tax. Tax theorists and economists are divided on how best to deal with this problem. The solution that has been advocated most often is indexation, and several countries adjust their tax rates annually in times of inflation, usually in line with the consumer price index.

Those in favour of indexation argue that the increases in effective income tax rates and the resulting growth of the government sector are unintentional and uncontrollable by-products of an inflationary economy. Indexing would help to insure the individual against one of the chief drawbacks of inflation and return a certain amount of economic initiative to the private sector. The argument against indexing is twofold. First, indexing would eliminate the desirable stabilizing effects of progressive taxation during periods of inflation. Second, indexing has not been designed to work effectively in periods of recession.

prohibition, legal prevention of the manufacture, sale, or transportation of alcoholic beverages with the aim of obtaining partial or total abstinence through legal means. Some attempts at prohibition were made in Aztec society, ancient China, feudal Japan, the Polynesian islands, Iceland, Finland, Norway, Sweden, Russia, Canada, and India, but only a few countries—most notably, certain Muslim countries—have maintained national prohibition. Most countries that have experimented with the ban have soon lifted it. Finland, for instance, adopted prohibition in 1919 and repealed it in 1931, and the United States adopted it in 1919 and repealed it in 1933.

In northern European countries liquor control has reflected concern for the prevention of alcoholism. The Finnish prohibition outlawed the sale of spirits in an attempt to redirect the population toward greater consumption of beer (with lower alcoholic content). Sweden experimented with a system of liquor-ration books with the aim of limiting the individual's use of liquor.

Various cultures differ considerably in their attitudes toward drinking as well as their systems of control. Among the Japanese, for example, drunkenness is not strongly condemned, and the drunkard is simply prevented from harming himself or others. Other cultures may show high acceptance of drinking as a social custom with a norm directing moderate use. With regard to control, efforts have been directed toward the drinker, as in Sweden, or toward the seller, as in the United States.

In the United States an early wave of movements for state and local prohibition arose out of the intensive religious revivalism of the 1820s and '30s, which stimulated movements toward perfectionism in human beings, including temperance and the abolition of slavery. The precedent for seeking temperance through law was set by a Massachusetts law, passed in 1838 and repealed two years later, which prohibited sales of spirits in less than 15-gallon quantities. The first state prohibition law was passed in Maine in 1846 and ushered in a wave of such state legislation before the Civil War.

The drive for national prohibition emerged out of a renewed attack on the sale of liquor in many states after 1906. The underlying forces at work to support national prohibition included antipathy to the growth of cities (the presumed scene of most drinking), evangelical Protestant middle-class anti-alien and anti-Roman Catholic sentiment, and rural domination of the state legislatures, without which ratification of the Eighteenth Amendment would have been impossible. Other forces included the corruption existing in the saloons and the industrial employers' increased concern for preventing accidents and increasing the efficiency of workers.

The Anti-Saloon League, founded in 1893, led the state prohibition drives of 1906–13. During World War I a temporary Wartime Prohibition Act was passed to save grain for use as food. By January 1920 prohibition was already in effect in 33 states covering 63 percent of the total population. In 1917 the resolution for submission of the Prohibition Amendment to the states received the necessary two-thirds vote in Congress; the amendment was ratified on Jan. 29, 1919, and went into effect on Jan. 29, 1920. On Oct. 28, 1919, the National Prohibition Act, popularly known as the Volstead Act (after its promoter, Congressman Andrew J. Volstead), was enacted, providing enforcement guidelines.

Federal government support of enforcement of Prohibition varied considerably during the 1920s. Illegal manufacture and sales of liquor went on in the United States on a large scale. In general, Prohibition was enforced wherever the population was sympathetic to it. In the large cities, where sentiment was strongly opposed to Prohibition, enforcement was much weaker than in rural areas and small towns. Increased price of liquor and beer, however, meant that the working classes probably bore the restrictions of urban Prohibition to a far greater degree than the middle-class or upper class segments of the population.

Prohibition brought into being a new kind of criminal—the bootlegger. The career of Al Capone was a dramatic instance of the development of bootlegging on a large scale. His annual earnings were estimated at $60,000,000. The rise of the bootlegging gangs led to a succession of gang wars and murders. A notorious incident was the St. Valentine's Day Massacre in Chicago in 1929, when the Capone gang shot to death seven members of the rival "Bugs" Moran gang. Historians of the underworld, however, suggest that by the late 1920s bootlegging was on the verge of semimonopoly control and that the end of gang wars was approaching.

The temperance movement itself changed during the 1920s; the fundamentalist and nativist groups assumed greater leadership, tending to drive away less hostile and urban forces.

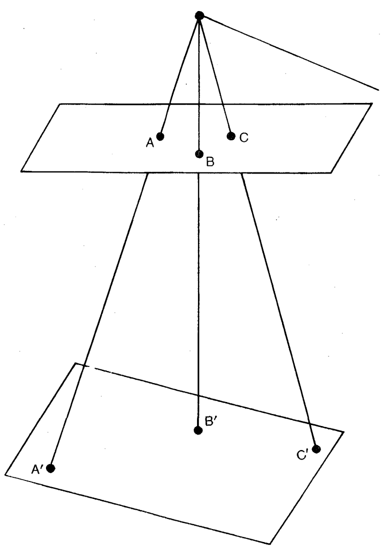
Major supporters of Prohibition gradually became disenchanted with it, citing the increase in criminal liquor production and sale, the development of the speakeasy, and increased restriction on individual freedom as its results. In 1932 the Democratic Party adopted a platform calling for repeal, and the Democratic victory in the presidential election of 1932 sounded the death knell of the Eighteenth Amendment.

In February 1933 Congress adopted a resolution proposing the Twenty-first Amendment to the Constitution to repeal the Eighteenth. On Dec. 5, 1933, Utah became the 36th state to ratify the amendment, and repeal was achieved. After repeal a few states continued statewide prohibition, but by 1966 all had abandoned it. In general, liquor control in the United States came to be determined more and more at local levels.

Prohibition Party, oldest minor U.S. political party still in existence. It was founded in 1869 to campaign for legislation to prohibit the manufacture and sale of intoxicating liquors, and from time to time has nominated candidates for state and local office in nearly every state of the Union. Rural and small-town voters affiliated with Protestant evangelical churches provided most of the party's support. The Prohibition Party reached the peak of its national strength in the elections of 1888 and 1892, in each of which its candidate for president polled 2.2 percent of the popular vote. Since 1900 its strength has been effective mainly on the local and county levels.

projection, in cartography, systematic representation on a flat surface of features of a curved surface, as that of the Earth. Such a representation presents an obvious problem but one that did not disturb ancient or medieval cartographers. Only when the voyages of exploration stimulated production of maps showing entire oceans, hemispheres, and the whole Earth did the question of projection come to the fore. Mercator produced the simplest and, for its purposes, the best solution by in effect converting the spherical Earth into a cylinder with the open ends at the poles; this cylinder was then opened to form a plane surface. East-west and north-south directions could be represented with fidelity, and the distortions in size became gross only near the polar regions (rendering Greenland, for example, disproportionately large). The Mercator projection is still widely used, especially when north-south dimensions are of chief importance. Many other projections are used, for example, the conic projection, drawn from a point directly above the North or South Pole. All projections involve some degree of distortion, and those showing the entire Earth involve a large degree.

projection, in geometry, a correspondence between the points of a figure and a surface (or line). In plane projections, a series of points on one plane may be projected onto a second plane by choosing any focal point, or origin, and constructing lines from that origin that pass through the points on the first plane and impinge upon the second (*see* illustration). This type of mapping is called a central projection. The figures made to correspond by the projection are said to be in perspective, and the image is called a projection of the original figure. If the rays are parallel instead, the projection is likewise called "parallel"; if, in addition, the rays are perpendicular to the plane upon which the original figure is projected, the projection is called "orthogonal." If the two planes are parallel, then the configurations of points will be identical; otherwise this will not be true.



Central projection of one plane on another

A second common type of projection is called stereographic projection. It refers to the projection of points from a sphere to a plane. This may be accomplished most simply by choosing a plane through the centre of the sphere and projecting the points on its surface along normals, or perpendicular lines, to that plane. In general, however, projection is possible regardless of the attitude of the plane. Mathematically, it is said that the points on the sphere are mapped onto the plane; if a one-to-one correspondence of points exists, then the map is called conformal.

Projective geometry (*q.v.*) is the discipline concerned with projections and the properties of projective configurations.

projection printer: *see* enlarger, photographic.

projection screen, surface on which the image from an optical projector is shown. Many materials are suitable for screens, the principal requirement being a high degree of reflectivity. The three most common types of screen are the mat white, the glass bead, and the lenticular. Mat white is a nonglossy white surface, which may be produced by a flat white paint coating, that provides uniform brightness of a projected image over a wide viewing angle. It is therefore well adapted for projection in a large theatre or auditorium. The glass-bead and lenticular screens, on the contrary, are highly directional—that is, they reflect maximum brightness back toward the light source (projector) and less brightness toward the sides (as the viewing angle increases). They are therefore especially suitable for screenings in small rooms—*e.g.*, for home movies. The glass-beaded screen is made up of many tiny beads on a canvas backing, the lenticular screen of tiny, uniformly spaced, cylindrical lenses.

In the back-projection system, the image is transmitted through a translucent screen to spectators on the other side.

projective geometry, branch of mathematics that deals with the relationships between geometric figures and the images, or mappings, of them that result from projection. Common examples of projections are the shadows cast by opaque objects, motion pictures, and maps of the Earth's surface.

A brief treatment of projective geometry follows. For full treatment, *see* MACROPAEDIA: Geometry: *Projective geometry*.

One of the stimuli for the development of projective geometry was the need to understand perspective in drawing and painting, in which a three-dimensional scene or object is rendered as if projected onto the plane of the picture. Rigorous study of the discipline was initiated by the French engineer Jean-Victor Poncelet in about 1820. Modern projective geometers emphasize the mathematical properties of objects that are preserved in the images, despite the distortion of lengths, angles, and shapes that generally occurs. Such properties include the straightness of lines and the incidence of points and lines; that is, if a point lies on a line in the object, the image of the point lies on the image of the line.

The mathematical requirement of a projection is that every point in the object and the corresponding point in the image must lie on a straight line, the projection ray, that passes through the centre of projection. In descriptive geometry, the centre of projection is assumed to be infinitely distant from the object, so that all the projection rays are parallel; further, the rays are perpendicular to the projection plane, so that the projection is called orthogonal. In the pinhole camera, or camera obscura, the centre of projection is the pinhole; because the pinhole lies between the object and the image, the image is inverted.

projective test, in psychology, examination that commonly employs ambiguous stimuli, notably inkblots (Rorschach Test) and enigmatic pictures (Thematic Apperception Test) to evoke responses that may reveal facets of the subject's personality by projection of internal attitudes, traits, and behaviour patterns upon the external stimuli. Projective tests are also used, less frequently, to study learning processes. Additional projective methods involve requiring subjects to make wooden block structures, complete sentences, paint with the fingers, or provide handwriting samples, and also the various association tests in which the stimuli are usually spoken words.

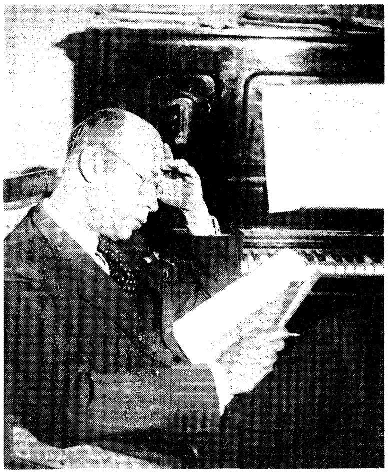
projector, device for transferring photographic and other images in an enlarged form onto a viewing screen. All types of projectors employ a light source and a lens system. A simple still-photo or slide projector for exhibiting transparencies has two sets of lenses, one between the light source and the transparency, to concentrate the light, and one in front of the transparency, to focus the picture on the screen and enlarge the image. Another type of still projector has the light source positioned in front of the picture so that the image is formed by light reflected from the picture; this produces a dimmer image but is necessary for the exhibition of opaque pictures—*i.e.*, printed photographs and illustrations from books and magazines.

A motion-picture projector is a more complex device, though it still employs the basic combination of light source and lens systems. A shutter operates to flash each successive frame on the screen (usually at a rate of about 16 per second), while electrically driven reels pass the sprocket-wound film through the lens system. To effect reel changes smoothly in public movie houses, two synchronized projectors are used, one beginning a new reel as the other completes an old one.

Prokhorov, Aleksandr Mikhaylovich (b. July 11, 1916, Atherton, Queensland, Australia), Soviet physicist who received, jointly with Nikolay Gennadiyevich Basov of the Soviet Union and Charles H. Townes of the United States the Nobel Prize for Physics in 1964 for fundamental research in quantum electronics that led to the development of the maser and laser. Prokhorov joined the P.N. Lebedev Physical Institute, Moscow, as a senior associate in 1946. He and Basov jointly suggested the maser principle of amplifying and emitting parallel electromagnetic waves that are all in phase and all of the same wavelength. In 1954 Prokhorov became head of the institute's Oscillation Laboratory and later professor at Moscow M.V. Lomonosov State University. He received the Lenin Prize in 1959 and later two Orders of Lenin and various medals. In 1971 he was elected corresponding member of the American Academy of Arts and Sciences. Prokhorov has written a number of fundamental works on the construction of infrared and visible light lasers and on non-linear optics.

Prokofiev, Sergey (Sergeyevich) (b. April 23 [April 11, old style], 1891, Sontsovka, Ukraine, Russian Empire—d. March 5, 1953, Moscow), 20th-century Russian (and Soviet) composer who wrote in a wide range of musical genres, including symphonies, concerti, film music, operas, ballets, and program pieces.

Pre-Revolutionary period. Prokofiev (Prokofjev in the transliteration system of the Akademiya Nauk of the Soviet Union) was



Prokofiev
Sovfoto

born into a family of agriculturalists. Village life, with its peasant songs, left a permanent imprint on him. His mother, a good pianist, became the highly gifted child's first mentor in music and arranged trips to the opera in Moscow. A high evaluation was put upon the boy's talent by a Moscow composer and teacher, Sergey Taneyev, on whose recommendation the Russian composer Reinhold Glier twice went to Sontsovka in the summer months to become young Sergey's first teacher in theory and composition and to prepare him for entrance into the conservatory at St. Petersburg (later Petrograd, now Leningrad). The years Prokofiev spent there—1904 to 1914—were a period of swift creative growth. His teachers were struck by the originality of his musical thinking. When he graduated he was awarded the Anton Rubinstein Prize in piano for a brilliant performance of his own first large-scale work—the *Piano Concerto No. 1 in D Flat Major,* Opus 10.

The conservatory gave Prokofiev a firm foundation in the academic fundamentals of music, but he avidly sought musical innovation. His enthusiasms were supported by progressive circles advocating musical renewal. Prokofiev's first public appearance as a pianist took place before such a group in St. Petersburg in 1908. A little later he met with friendly sympathy in a similar circle in Moscow, which helped him make his first appearances as a composer, at the Moscow summer symphony seasons of 1911 and 1912.

Prokofiev's talent developed rapidly as he applied many new musical ideas. He studied the compositions of Igor Stravinsky, particularly the early ballets, but maintained a critical attitude toward his countryman's brilliant innovations. Contacts with the then new currents in theatre, poetry, and painting also played an important role in Prokofiev's development. He was attracted by the work of modernist Russian poets; by the painting of the Russian followers of Cézanne and Picasso; and by the theatrical ideas of Vsevolod Meyerhold, whose experimental productions were directed against an obsolescent naturalism. In 1914 Prokofiev became acquainted with the great ballet impressario Sergey Diaghilev, who became one of his most influential advisers for the next decade and a half.

After the death of his father in 1910, Prokofiev lived under more straitened material conditions, though his mother provided for his continuing studies. On the eve of World War I, he visited London and Paris to acquaint himself with the newest in art. The tense pre-storm atmosphere that pervaded Russia sharpened in him a feeling of skepticism, of disbelief in romantic ideals, but did not shake his essentially healthy outlook on life. Exempt from war mobilization as the only son of a widow, Prokofiev continued to perfect his musicianship on the organ and appeared in concerts in the capital and elsewhere. The pre-Revolutionary period of Prokofiev's work was marked by intense exploration. The harmonic thought and design of his work grew more and more complicated. Prokofiev wrote the ballet *Ala and Lolli* (1914), on themes of ancient Slav mythology, for Diaghilev, who rejected it. Thereupon, Prokofiev reworked the music into the *Scythian Suite,* Opus 20, for orchestra. Its premiere in 1916 caused a scandal but was the culmination of his career in Petrograd. The ballet *The Tale of the Buffoon Who Outjested Seven Buffoons* (1915; *The Buffoon,* 1915–20), also commissioned by Diaghilev, was based on a folktale; it served as a stimulus for Prokofiev's searching experiments in the renewal of Russian music. Despite Diaghilev's assertion of the priority of ballet over opera, which he considered a dying genre, Prokofiev was active in the field of opera. Following the immature *Maddalena,* which he wrote in 1911–13, he composed in 1915–16 *The Gambler,* a brilliant and dynamic adaptation of the story by Dostoyevsky. Continuing the operatic tradition of Mussorgsky, Prokofiev skillfully combined subtle lyricism, satiric malice, narrative precision, and dramatic impact. During this period, Prokofiev achieved great recognition for his first two piano concerti—the first the one-movement *Concerto in D Flat Major* (1911), and the second the dramatic four-movement *Concerto in G Minor* (1913).

The year 1917—the year of two Russian revolutions—was astonishingly productive for Prokofiev. When the Tsar was overthrown in February 1917 he was in the streets of Petrograd, expressing the joy of victory. As if inspired by feelings of social renewal, he wrote within one year an immense quantity of new music: two sonatas, the *Violin Concerto No. 1 in D Major,* the *Classical Symphony,* and the choral work *Seven, They Are Seven;* he began the magnificent *Piano Concerto No. 3 in C Major,* Opus 26; and he planned a new opera—*The Love for Three Oranges,* after a comedy tale by the Italian dramatist Carlo Gozzi. In the summer of 1917 Prokofiev was included in the Council of Workers in the Arts, which led Russia's left wing of artistic activity; but for almost nine months he was stranded in the Caucasus, cut off from Petrograd by the civil war. Only in the spring of 1918 did he succeed in returning there. In the difficult circumstances of these years, however, he concluded that music had no place and decided to leave Russia temporarily to undertake a concert tour abroad. Prokofiev travelled, with official sanction, over the difficult route through Siberia, where civil strife was raging.

Foreign period. The next decade and a half are commonly called the foreign period of Prokofiev's work. For a number of reasons, chiefly the continued blockade of the Soviet Union, he could not return at once to his homeland. Nevertheless, he did not lose touch with Russia. The first five years of Prokofiev's life abroad are usually characterized as the "years of wandering." On the way from Vladivostok to San Francisco, in the summer of 1918, he gave several concerts in Tokyo and Yokohama. In New York City the sensational piano recitals of the "Bolshevik Pianist" evoked both delight and denunciation. The composer had entrée to the Chicago Opera Association, where he was given a commission for a comic opera. The conductor and the producer of the opera, both Italian, gladly backed the idea of an opera on the Gozzi plot. Accordingly, *The Love for Three Oranges* was completed in 1919, though it was not produced until 1921. Within a few years the opera was also produced with immense success on the stages of the Soviet Union as well as in western Europe.

In America, Prokofiev met a young singer of Spanish extraction, Lina Llubera, who eventually became his first wife and the mother of two of his sons, Svyatoslav and Oleg. Not meeting with continuing support in the United States, the composer set out in the spring of 1920 for Paris for meetings with Diaghilev and the conductor Serge Koussevitzky. They soon secured for him wide recognition in the most important western European musical centres. The production of *The Buffoon* by Diaghilev's ballet troupe in Paris and London in 1921 and the Paris premiere of the *Scythian Suite* in 1921 and that of *Seven, They Are Seven* in 1924 evoked enormous interest, consolidating his reputation as a brilliant innovator. The successful performance of the *Third Piano Concerto* (1921), completed in France, also marked one of the peaks of Prokofiev's dynamic national style.

Prokofiev spent more than a year and a half in 1922–23 in southern Germany, in the town of Ettal in the Bavarian Alps. Resting after fatiguing premieres and reviewing the course of his creative path, he also prepared many of his compositions for the printer. The attention of the composer at this period turned to the basic conception of the opera *The Flaming Angel,* after a story by the contemporary Russian author Valery Bryusov. The opera, which required many years of work (1919–27), did not find a producer within Prokofiev's lifetime.

Meanwhile, Prokofiev, finding himself not interested in the musical activity in Germany, settled in Paris in the autumn of 1923. There he was in close touch with progressive French musical figures, such as the composers Francis Poulenc and Arthur Honegger, while continuing his own intensive creative activity. Vexed by criticisms of his melodically lucid *First Violin Concerto,* which had its premiere in Paris in 1923, he addressed himself to a search for a more avant-garde style. These tendencies appeared in such compositions of the early 1920s as the epic *Symphony No. 2 in D Minor,* commissioned by Koussevitzky. Its intense dramatic quality and its striking sense of proportion are also found in the *Symphony No. 3 in C Minor* (1928), based on thematic material from the opera *The Flaming Angel,* reworked by the composer. In close collaboration with Diaghilev, Prokofiev created new one-act ballets, *Le Pas d'acier* (performed in 1927) and *The Prodigal Son* (performed in 1929). *Le Pas d'acier* had a sensational success in Paris and London, thanks to its original staging and bold evocation of images of Soviet Russia at the beginning of the 1920s—with its economic disolcation and the beginnings of industrialization. *The Prodigal Son* had a lofty biblical theme and music that was exquisitely lyrical. It reflects a striving toward emotional relaxation and toward clarification of style that are also seen in the *String Quartet No. 1 in B Minor,* Opus 50, in the *Sonata for Two Violins in C Major,* Opus 56 (1932), and in the ballet *On the Dnieper.*

In 1927 Prokofiev toured the Soviet Union and was rapturously received by the Soviet public as a world-renowned Russian musician-revolutionary. While there, he strengthened his old associations with the innovative theatrical producer Vsevolod Meyerhold, who helped him in a basic revision of the opera *The Gambler,* produced in 1929 in Brussels.

During the 1920s and early '30s, Prokofiev toured with immense success as a pianist in the great musical centres of western Europe and the United States. His U.S. tours in 1925, 1930, and 1933 were attended with tumultuous success and brought him new commissions, such as the *Symphony No. 4 in C Major* (1930), incorporating musical material of *The Prodigal Son,* for the 50th anniversary of the Boston Symphony, and the *First String Quartet,* commissioned for the Library of Congress. His new piano concerti—*No. 4* (1931), for the left hand, and *No. 5 in G Major* (1932)—demonstrated anew his bent for impulsiveness and virtuoso brilliance.

Soviet period. Although he enjoyed material well-being, success with the public, and contact with outstanding figures of Western culture, Prokofiev increasingly missed his homeland. Visits to the Soviet Union in 1927, 1929, and 1932 led him to the decision to conclude his foreign obligations and return to Moscow once and for all. From 1933 to 1935 the composer gradually accustomed himself to the new conditions and became one of the leading figures of Soviet culture. In the two decades constituting the Soviet period of Prokofiev's work—1933 to 1953—the realistic and epical traits of his art became more clearly defined. The synthesis of traditional tonal and melodic means with the stylistic innovations of 20th-century music was more fully worked out.

In the years preceding World War II, Prokofiev created a number of classical masterpieces. These included his *Violin Concerto No. 2 in G Minor* (1935), the ballet *Romeo and Juliet* (1935–36), and the music for Sergey Eisenstein's film *Alexander Nevsky* (1938). His work in theatre and the cinema gave rise to a number of charming programmatic suites, such as the *Lieutenant Kije* suite (1934), the *Egyptian Nights* suite (1934), and the symphonic children's tale *Peter and the Wolf* (1936). Turning to opera, he cast in the form of a contemporary drama of folk life his *Semyon Kotko,* depicting events of the civil war in the Ukraine (1939). The basis of the brilliantly modernized opéra bouffe *Betrothal in a Monastery* (composed in 1940, produced in 1946) was the play *The Duenna,* by the 18th-century British dramatist Richard Brinsley Sheridan. Testing his powers in other genres, he composed the monumental *Cantata for the 20th Anniversary of the October Revolution* (1937), on texts by V.I. Lenin, and the epic cantata *The Toast* (1939).

On his last trip abroad, Prokofiev visited Hollywood, where he studied the technical problems of the sound film; the experience thus gained he applied brilliantly in the striking national music for Eisenstein's film *Alexander Nevsky,* depicting the heroic Russian struggle against the Teutonic Knights of the 13th century. The cantata *Alexander Nevsky* was based on the music of the film. One of the summits of Prokofiev's art was the production of his ballet *Romeo and Juliet* in Leningrad, with Galina Ulanova in the leading role. Throughout the 1930s Prokofiev took part in the organizational work of the Composers' Union, made appearances as conductor and as pianist, and traveled much throughout the country.

On the eve of World War II, a change occurred in his personal life: leaving his first family, he linked his destiny with that of the poet Mira Mendelssohn, who became his second wife. The war sharpened Prokofiev's national and patriotic feelings. Regardless of the difficulties of the war years, he composed with remarkable assiduity, even when the evacuation of Moscow in 1941 made it necessary for him and his wife to move from one place to another until they were able to return in 1944.

From the first days of the war, the composer's attention was centred on a very large-scale operatic project: an opera based on Leo Tolstoy's novel *War and Peace.* He was fascinated by the parallels between 1812, when Russia crushed Napoleon's invasion, and the then-current situation. The first version of the opera was completed by the summer of 1942, but subsequently the work was fundamentally revised, a task that occupied more than 10 years of intensive work. Those who heard it were struck both by the immense scale of the opera (13 scenes, more than 60 characters) and by its unique blend of epic narrative with lyrical scenes depicting the personal destinies of the major characters. An increasing predilection for national-epical imagery is manifested in the heroic majesty of the *Symphony No. 5 in B Flat Major* (1944) and in the music (composed 1942–45) for Eisenstein's two-part film *Ivan the Terrible* (Part I, 1944; Part II, 1948). Living in the Caucasus, in central Asia, and in the Urals, the composer was everywhere interested in the folklore, an interest that was reflected in the *String Quartet No. 2 in F Major,* on Kabardinian and Balkarian themes (1941), and in the comic opera *Khan Buzai,* on themes of Kazakh folktales. Documents of those troubled days are three piano sonatas, *No. 6* (1940), *No. 7* (1942), and *No. 8* (1944), which are striking in the dramatic conflict of their images and in their irrepressible dynamism.

Overwork was fatal to the composer's health. During the last years of his life, Prokofiev seldom left his villa in a suburb of Moscow. His propensity for innovation, however, is still evident in such important works as the *Symphony No. 6 in E Flat Minor* (1945–47), which is laden with reminiscence of the tragedies of the war just past; the *Sinfonia Concerto for Cello and Orchestra in E Minor* (1950–52), composed with consultation from the conductor and cellist Mstislav Rostropovich; and the *Violin Sonata in F Minor* (1938–46), dedicated to the violinist David Oistrakh, which is in Russian folk imagery. Just as in earlier years, the composer devoted the greatest part of his energy to musical theatre: cases in point were the opera *The Story of a Real Man* (1947–48), the ballet *The Stone Flower* (1948–50), and the oratorio *On Guard for Peace* (1950). The lyrical *Symphony No. 7 in C Sharp Minor* (1951–52) was the composer's swan song.

In 1953 Prokofiev died suddenly of cerebral hemorrhage. On his worktable there remained a pile of unfinished compositions, including sketches for a 6th concerto for two pianos, a 10th and an 11th piano sonata, a Kazakh comic opera, and a solo violoncello sonata. The subsequent years saw a rapid growth of his popularity in the Soviet Union and abroad. In 1957 he was posthumously awarded the Soviet Union's highest honour, the Lenin Prize, for the *Seventh Symphony.* (I.V.N./Ed.)

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Prokop THE BALD, also called PROKOP, or PROCOPIUS, THE GREAT, Czech PROKOP HOLÝ, or VELIKÝ (b. *c.* 1380—d. May 30, 1434, Lipany, Hung.), Bohemian warrior-priest who was the foremost leader of the Hussite Reformation forces in the later period of the Hussite wars.

Initially Prokop was a conservative (Utraquist) priest, but then he joined the heretical religious movement that had sprung from the teachings of the martyred Bohemian Reformer Jan Hus (d. 1415). Prokop effectively defended Hussite Bohemia against Romanist crusaders (1426, 1427, 1431) and himself invaded Silesia, Saxony, Thuringia, and Hungary. In 1433 he attended the Council of Basel, which unsuccessfully attempted to reconcile the Bohemian heretics with Rome. The following year he embraced the more antifeudal, peasant-worker (Taborite) branch of the Hussite movement. When in 1434 a united Utraquist and Romanist force from the old part of Prague seized control of the more radical "new town," he sought, with the aid of the Taborite commander Prokop the Lesser, to regain it but was killed at the ensuing Battle of Lipany.

Prokopovich, Feofan (b. June 18, 1681, Kiev, Ukraine, Russian Empire—d. Sept. 19, 1736, St. Petersburg [now Leningrad]), Russian Orthodox theologian and archbishop of Pskov, who by his administration, oratory, and writings collaborated with Tsar Peter I the Great (1672–1725) in westernizing Russian culture and centralizing its political structure. He also directed the reformation of the Russian Orthodox church in accordance with a Lutheran model and effected a political integration of church and state that was to last two centuries.

After an Orthodox education, Prokopovich, through the Latinizing influence of the Poles in Kiev, became a Roman Catholic and in 1698 entered the Greek College of San Anastasio in Rome. Declining the opportunity to enter the Society of Jesus (Jesuits), he returned to Kiev in 1701, reverted to his Orthodox faith, and later became abbot of the Kiev monastery and rector of its celebrated ecclesiastical academy, where he taught theology, literature, and rhetoric. After publicizing laudatory statements on the cultural-political reform of Peter the Great, he was called to the court at St. Petersburg in 1716 and was made a counselor to the tsar on church and educational affairs. As principal theorist in the restructuring of the Russian church as a political arm of the state, Prokopovich cooperated in replacing the patriarchate with a Holy Synod, or supreme ecclesiastical council, by drawing up in 1720 the *Spiritual Regulations,* a new constitution for Orthodoxy. Appointed synodal first vice president, he was responsible for the legislative reform of the entire Russian church, subordinating it to the secular and spiritual authority of Tsar Peter, and for effecting a church-state relationship, sometimes termed a Protestantized caesaropapism, that was to continue until the Russian Revolution of 1917. Such a theory was derived by combining concepts from the 17th-century English political philosopher Thomas Hobbes with Byzantine theocratic thought.

As a theologian, Prokopovich promoted the autonomy of doctrinal theology from moral and ascetical teaching. Basing his theology mainly on liberal Protestant sources, he formed a body of doctrine markedly Lutheran in orientation, particularly in its insistence on Sacred Scripture as the sole source of Christian revelation and in its account of grace, free will, and justification. His design of the theological curriculum for St. Petersburg's ecclesiastical academy was patterned after the Lutheran faculty of Halle, Ger., and became the centre for the propagation of his Orthodox reform.

By his principal work, a systematic Latin exposition of the entire corpus of doctrinal theology—including tracts *De Deo* ("On God"), *De Trinitate* ("On the Trinity"), *De Creatione et Providentia* ("On Creation and Divine Providence")—and on theological anthropology, Prokopovich's teachings prevailed until about 1836, when a reaction toward traditional Orthodox beliefs set in. During the reign of Peter's second successor, the empress Anna Ivanovna (1730–40), Prokopovich himself assumed a more conservative outlook than his earlier view of the papacy as Antichrist. His funeral eulogy for Tsar Peter reflected his devotion to his monarch and is considered a classic example of Russian oratory. To advance Peter's cultural revolution, Prokopovich assisted in organizing the Russian Academy of Sciences and composed several didactic poems and plays acclaiming the new Russia.

Prokopyevsk, also spelled PROKOPJEVSK, or PROKOPEVSK, city, Kemerovo *oblast* (province), central Russian Soviet Federated Socialist Republic, on the Aba River. A small village of 18th-century origin, it expanded rapidly in the 1920s to become the largest coal-mining centre of the Kuznetsk Basin, although it is gradually declining. There is a large coal-enriching plant, and coal miners' lamps are made at Prokopyevsk, which is the site of a coal-research institute. Other industries produce flour and machinery for mills and grain elevators. Pop. (1989 prelim.) 274,000.

prolactin, also called LUTEOTROPIC HORMONE (LTH), or LUTEOTROPIN, a protein hormone produced by the pituitary gland of mammals that acts with other hormones to initiate secretion of milk by the mammary glands. It also acts to maintain the corpus luteum of the ovary, which is the source of the female sex hormone progesterone. Its function in males is not known. In humans prolactin is similar to human growth hormone.

prolamin, any of certain seed proteins known as globulins that are insoluble in water but soluble in water-ethanol mixtures. Prolamins contain large amounts of the amino acids proline and glutamine (from which the name prolamin is derived) but only small amounts of arginine, lysine, and histidine. Gliadin from wheat contains 14 percent by weight of proline, 45 percent of glutamine, and very little lysine. Hordein is the prolamin from barley; zein is that from corn.

The term glutelin is used for seed globulins that are insoluble in water but soluble in acidified or alkaline solutions. Both prolamins and glutelins are mixtures of several similar proteins.

prolapse, in human physiology, a downward protrusion of an internal organ out of its normal cavity. The term is usually applied to protrusion of the rectum or of the uterus outside the body. In either case, the prolapse follows progressive weakening of the muscles, ligaments, and other supporting tissues around the organ.

Rectal prolapse, in which the membrane that lines the rectum pushes out through the anus, occurs frequently in elderly people following a history of constipation and straining during bowel movements. Prolapse of the uterus into the vagina usually is a delayed reaction to childbirth injuries that created a weakness that is increased by gravitational forces. Sudden increases in intra-abdominal pressure, such as may be produced by coughing, sneezing, or bowel movements, then force the rectal or uterine tissue out through the adjacent opening.

Rectal prolapse is often transient at first but may eventually become chronic with continued straining, requiring surgical repair. Although mild uterine prolapse can be relieved by temporary artificial supports and exercises to strengthen the muscles of the pelvic floor, severe prolapse that causes vaginal discomfort and impedes walking often must be treated by hysterectomy.

proletariat, the lowest or one of the lowest economic and social classes in a society.

In ancient Rome the proletariat consisted of the poor landless freemen. It included artisans and small tradesmen who had been gradually impoverished by the extension of slavery. The proletariat (literally meaning "producers of offspring") was the lowest rank among Roman citizens; the first recognition of its status was traditionally ascribed to the Roman king Servius Tullius (fl. 6th century BC). In some periods of Roman history it played an important role, not as as an independent force but as a mass following, in the political struggles between the Roman patricians and the wealthy plebeians. Because it had little opportunity for productive work, which was performed in the main by slaves, its existence was largely parasitic on the Roman economy. On occasions it was quieted by doles of bread from the state and diverted by spectacles—"bread and circuses."

In the theory of Karl Marx, the term proletariat designated the class of wage workers who were engaged in industrial production and whose chief source of income was derived from the sale of their labour power. As an economic category it was distinguished in Marxian literature from the poor, the working classes, and the *Lumpenproletariat.* Because of its subordinate position in a capitalist society and the effects of periodic depressions on wages and employment, the proletariat as described by Marxists was usually living in poverty. But it was not therefore identified with the poor, for some members of the proletariat, the highly skilled or labour aristocracy, were recognized as not poor, and some members of the entrepreneurial class were not wealthy. Despite synonymous use in agitational literature, the term proletariat was distinguished from the working class as a generic term. The former referred to those engaged in industrial production, whereas the latter referred to all who must work for their living and who received wages or salary, including agricultural labourers, white-collar workers, and hired help occupied in the distribution services. The *Lumpenproletariat* consisted of marginal and unemployable workers of debased or irregular habits and also included paupers, beggars, and criminals.

proletariat, dictatorship of the: *see* dictatorship of the proletariat.

Proletkult, abbreviation of PROLETARSKAYA KULTURA (Russian: "Proletarian Culture"), organization established in the Soviet Union in 1917 to provide the foundations for a truly proletarian art—*i.e.,* one that would be created *by* proletarians *for* proletarians and would be free of all vestiges of bourgeois culture. Its leading theoretician was Aleksandr Bogdanov. Subsidized by the state, but independent of Communist Party control, the Proletkult established workshops all over the country where workers were taught to read and encouraged to write plays, novels, and poems. Although the workshops produced a few poets, their styles and techniques were invariably imitative of writers of the past. Lenin soon realized the inadvisability of trying to force a new culture and withdrew his support. By 1923 Proletkult was abolished.

proline, an amino acid obtained by hydrolysis of proteins. Its molecule contains a secondary amino group (>NH) rather than the primary amino group ($-NH_2$) characteristic of most amino acids. Unlike other amino acids, proline, first isolated from casein (1901), is readily soluble in alcohol. Collagen, the principal protein of connective tissue, yields about 15 percent proline. It is one of several so-called nonessential amino acids; *i.e.,* animals can synthesize it from glutamic acid and do not require dietary sources.

prologue and epilogue, prefatory and supplementary pieces to a literary work, especially a verse drama. The ancient Greek *prologos* was of wider significance than the modern prologue, effectually taking the place of an explanatory first act. A character, often a deity, appeared on the empty stage to explain events prior to the action of the drama, which consisted mainly of a catastrophe. On the Latin stage, the prologue was generally more elaborately written, as in the case of Plautus' *Rudens,* which contains some of his finest poetry.

In England the mystery and miracle plays began with a homily. Thomas Sackville used a dumb show as a prologue to the first English tragedy, *Gorboduc* (performed 1561); Shakespeare began *2 Henry IV* with the character of Rumour to set the scene, and *Henry V* with a chorus. The Plautine prologue was revived by Molière in France during the 17th century.

The epilogue, at its best, was a witty piece intended to send the audience home in good humour. Its form in the English theatre was established by Ben Jonson in *Cynthia's Revels* (*c.* 1600). Jonson's epilogues typically asserted the merits of his play and defended it from anticipated criticism.

The heyday of the prologue and epilogue in the English theatre was the Restoration period. From 1660 to the decline of the drama in the reign of Queen Anne, scarcely a play was produced in London without a prologue and epilogue. Playwrights asked their friends to write these poems for them. Poems supplied by writers of established reputation conferred prestige on the works of novices.

Though epilogues were rarely written after the 18th century, prologues have been used effectively in such 20th-century plays as Hugo von Hofmannsthal's *Jedermann* (1911; *Everyman,* 1912), Thornton Wilder's *Our Town* (1938), Tennessee Williams' *Glass Menagerie,* and Jean Anouilh's *Antigone* (both 1944).

Prome (Burma): *see* Pyè.

promenade, place for strolling, where persons walk (or, in the past, ride) at leisure for exercise, display, or pleasure. Vehicular traffic may or may not be restricted. Promenades are located in resort towns and in parks and are public avenues landscaped in a pleasing manner or commanding a view.

The Royal Crescent at Bath, Avon, Eng., is an 18th-century example of a promenade, and the Boardwalk in Atlantic City, N.J., is a modern example. Large cities not devoted to a leisured life, or class, rarely include a walk that is exclusively a promenade because the pace of contemporary life set by the automobile, and the chance of being attacked by someone in the shrubbery, detract from its original purpose as a place for strolling.

promethazine, also called 10-(2-DIMETHYLAMINOPROPYL)PHENOTHIAZINE, synthetic drug used to counteract the histamine reaction, as in allergies. Promethazine, introduced into medicine in the 1940s, is used in the form of its hydrochloride. It is administered orally in tablets and syrups and intramuscularly in an aqueous solution. Promethazine is effective in controlling the symptoms of hay fever, acute skin reactions (such as hives), and contact dermatitis (as from poison ivy). It also has been used in anti-emetic preparations (for the control of nausea such as occurs in motion sickness). The commonest side effect of promethazine is drowsiness.

Prometheus, in Greek religion, one of the Titans, the supreme trickster, and a god of fire. His intellectual side was emphasized by the apparent meaning of his name, Forethinker. In common belief he developed into a master craftsman, and in this connection he was associated with fire and the creation of man.

The Greek poet Hesiod related two principal legends concerning Prometheus. The first is that Zeus, the chief god, who had been tricked by Prometheus into accepting the bones and fat of sacrifice instead of the meat, hid fire from man. Prometheus, however, stole it and returned it to Earth once again. As the price of fire, and as punishment for mankind in general, Zeus created the woman Pandora and sent her down to Epimetheus (Hindsight), who, though warned by Prometheus, married her. Pandora took the great lid off the jar she carried, and evils, hard work, and disease flew out to wander among mankind. Hope alone remained within.

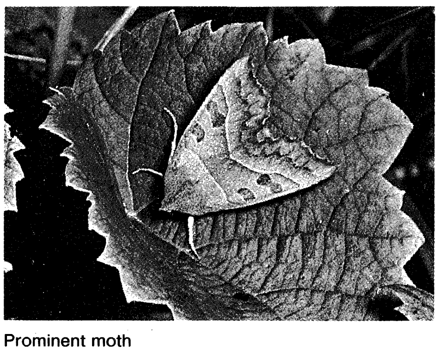
Hesiod relates in his other tale that, as vengeance on Prometheus, Zeus had him chained and sent an eagle to eat his immortal liver, which constantly replenished itself; Prometheus was incorporated into *Prometheus Bound* by Aeschylus, who made him not only the bringer of fire and civilization to men but also their preserver, giving man all the arts and sciences as well as the means of survival.

promethium (Pm), chemical element, only rare-earth metal of transition Group IIIb of the periodic table not detected in nature. Conclusive chemical proof of the existence of promethium, the last of the rare-earth elements to be discovered, was obtained (1947) by J.A. Marinsky, L.E. Glendenin, and C.D. Coryell, who isolated the radioactive isotope promethium-147 (2.7-year half-life) from uranium fission products at the research site at Oak Ridge, Tenn. Identification was firmly established by spectroscopy. Earlier investigators thought that they had found the element with atomic number 61 in naturally occurring rare earths and had prematurely called it illinium and florentium. Promethium-147 is effectively separated from the other rare-earth fission products by an ion-exchange method. Its soft beta radiation is converted to electricity in miniature batteries formed by sandwiching promethium between wafers of a semiconductor such as silicon; these batteries operate in extreme temperatures for five years. Promethium has also been prepared by slow neutron bombardment of the isotope neodymium-146; the resultant isotope, neodymium-147, decays by electron emission to promethium-147. The metal itself was first prepared (1963) by reduction of the fluoride, PmF_3, with lithium.

All of the isotopes of promethium are unstable; the longest lived is promethium-145 (18-year half-life). Because of the short half-lives of its isotopes, any promethium that might result from spontaneous fission of uranium in uranium ores would occur in infinitesimal concentrations. The physical and chemical properties of promethium are those of a typical rare earth. It is trivalent in its compounds and solutions, most of which are pink or rose.

atomic number	61
stablest isotope	(145)
melting point	1,080° C
boiling point	2,460° C
specific gravity	—
valence	3
electronic config.	2-8-18-23-8-2 or (Xe)$4f^5 5d^0 6s^2$

prominent moth, typical member of the widely distributed family Notodontidae (order Lepidoptera) characterized by projecting wing tufts in the adult and dorsal humps in the larva. These nocturnal moths have stout, hairy bodies and somewhat narrow forewings. Most species are dull gray, yellow, or brown and are difficult to see on bark or twigs.



Prominent moth
Ken Brate—Photo Researchers

Larvae feed on foliage. When disturbed, some raise both ends of their bodies, vibrate their prolegs to frighten the enemy, and squirt a fluid to a distance of several inches. The bright coloration of the larva warns predators of its bad taste. Pupation occurs underground.

promissory note, short-term credit instrument consisting of a written promise by one person (maker) to pay a specified amount of money to another on demand or at a given future date. Promissory notes are often negotiable and may be secured by the pledge of collateral.

Promissory notes were in use in Europe during the Renaissance. The instrument has changed substantially during the 20th century, both in form and use; clauses have been added, including those that authorize the sale of collateral, permit extensions of time, and permit acceleration of payment in event of default.

promoter, in chemistry, substance added to a solid catalyst to improve its performance in a chemical reaction. By itself the promoter has little or no catalytic effect. Some promoters interact with active components of catalysts and thereby alter their chemical effect on the catalyzed substance. The interaction may cause changes in the electronic or crystal structures of the active solid component. Commonly used promoters are metallic ions incorporated into metals and metallic oxide catalysts, reducing and oxidizing gases or liquids, and acids and bases added during the reaction or to the catalysts before being used.

Promoters Revolution (June 24, 1932), also called REVOLUTION OF 1932, in the history of Thailand, a bloodless coup that overthrew the Thai king, put an end to absolute monarchy in Thailand, and initiated the so-called Constitutional Era. The coup was headed by a group of men often referred to as the "promoters." They included members of the Thai elite, noted intellectuals, some European-educated, and disaffected army officers; among the key "promoters" were Pridi Phanamyong and Phya Phahon Phonphayuhasena.

As the traditional pattern of life in Thailand changed drastically under the impact of Western ideas, opposition to the institution of monarchy had grown among officials and the intelligentsia. The revolution brought about first a Temporary Constitution, which stripped the king of his powers and then vested them nominally in the people but actually in the small group of Promoters, calling itself the People's Party. In effect, the Temporary Constitution was a party dictatorship cloaked under constitutional forms.

The Permanent Constitution, which came into effect in December 1932, partially restored some measure of prestige and dignity to the crown, although the king's actual power was nominal. Royal princes were excluded from membership in the State Council and the Assembly, a partially elected, partially appointed body with legislative power as well as the power of constitutional interpretation. In effect, however, the constitution was a facade used to justify the coup. A number of liberal Western-type reforms were espoused, but more direct means of control were preferred to constitutional representative government; a majority of the Siamese people did not understand this concept or remained indifferent to it.

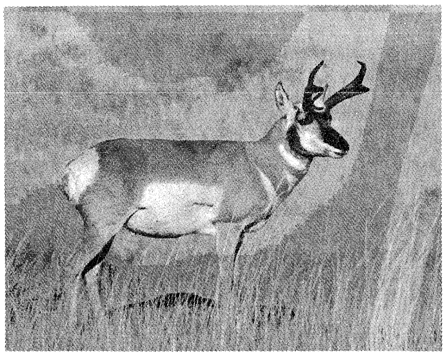
After the 1932 coup Thailand had a long succession of constitutions and governments. None of the constitutions, however, effectively limited political power or provided a means by which political contests could be decided.

prompt neutron, in nuclear fission reactions, nuclear particle without an electric charge that is emitted instantaneously by a nucleus undergoing fission—in contrast to a delayed neutron, which is emitted by an excited nucleus among the fission products at an appreciable time interval (milliseconds to minutes) after fission has occurred. Most neutrons released in fission reactions are prompt; for example, only about 0.7 percent of the neutrons emitted in uranium-235 fission are delayed.

pronephros, most primitive of the three vertebrate kidneys, active in the adults of some primitive fish (lampreys and hagfish), the embryos of more advanced fish, and the larvae of amphibians. It is a paired organ consisting of a series of nephrons that filter urine from both the pericardial cavity fluids via openings called nephrostomes and the bloodstream from the glomerulus. Cells of the nephron tubule may secrete nitrogenous wastes into the urine and reabsorb water and nutrients. Urine passes from the nephrons into one of two long tubes, the Wolffian ducts, which run along either side of the body cavity and empty into a bladderlike urogenital sinus.

In more advanced vertebrates the pronephros is the first kidney to develop in the embryo. Frequently nonfunctional, it is soon replaced (after 3½ weeks in humans) by the mesonephros, which lacks nephrostomes and draws fluid from the glomerulus only.

pronghorn (*Antilocapra americana*), North American hoofed mammal, the sole living member of the family Antilocapridae (order Artiodactyla), also known as prongbuck and as pronghorned, or American, antelope.



Pronghorn (*Antilocapra americana*)
Leonard Lee Rue III

It stands about 80–100 centimetres (2½–3¼ feet) at the shoulder. It is reddish brown with a short, dark-brown mane, white underparts, two white bands on the throat, and a large circular white patch on the rump. The hairs of the rump can be erected to produce a flash of white, apparently a warning signal, that can be seen by man for 3–4 kilometres (2–2½ miles). Both sexes bear erect horns that branch into two prongs, the longer curving backward and the shorter projecting forward.

The pronghorn, valued as a game animal, inhabits open plains and semideserts, living alone or in small bands in summer and forming large herds in winter. The male gathers a harem in late summer, and the female bears one or two young after about eight months' gestation. A swift, nimble animal, the pronghorn can attain a speed of 70 km per hour and leaps 6 metres (20 feet) at a bound. It was once found from Alberta to northern Mexico but is now reduced in both numbers and range; some subspecies are endangered. It has, however, responded well to conservation practices, and controlled hunting occurs through most of its range.

pronoia system, Byzantine form of feudalism based on government assignment of revenue-yielding property to prominent individuals in return for services, usually military; instituted during the reign of the Byzantine emperor Constantine IX Monomachus (1042–55).

In the beginning, a *pronoia* (grant of land) was bestowed for the life of the holder and could not be transferred by alienation or inheritance. The grants varied from large areas including several villages to small estates sufficient to fill a single family's needs. The holder was absolute master over the peasants living on his land, collecting taxes from them and meting out justice to them.

In the 11th century the *pronoia* became the basis of the military system, obliging its holder to provide military service and troops in proportion to the value of his grant. Under the Comnenus dynasty (1081–1185), monastic lands were seized in order to be redistributed as *pronoia*s, thereby increasing the number of landholders supplying troops for the army.

By the late 13th century, the *pronoia* could be passed on to heirs, and the obligation for military service was transferred as well. Under the Palaeologian dynasty (1261–1453), the feudal nobility refused to fulfill their military obligations but retained their grants of land.

Prontosil (trade name) also called SULFAMIDOCHRYSOIDINE, first of a long series of sulfonamide drugs. It was introduced into medicine in the 1930s for the treatment of bacterial infections. The introduction of Prontosil, a trade-name drug, marked a turning point in chemotherapy because it was the first synthetic drug found to cure general bacterial infections in man.

Prontosil resulted from research, directed by the German chemist and pathologist Gerhard Domagk, on the antibacterial action of azo dyes. A red azo dye of low toxicity, Prontosil was shown by Domagk to prevent death in mice infected with streptococci. This dye was also effective in controlling staphylococcic infections in rabbits, but it was ineffective against pneumococcic and other experimental infections. These studies by Domagk excited interest in chemotherapy in France, England, and the U.S. Within a relatively short period of time, it was demonstrated that Prontosil was effective in combatting experimental infections not only in animals but also against streptococcic diseases in man, including meningitis and puerperal sepsis.

Later, it was found that the Prontosil molecule is disrupted in the tissues to form *para*-aminobenzenesulfonamide (designated sulfanilamide).

Like other sulfonamides, Prontosil was administered orally. It has been replaced in clinical use by newer sulfonamides, including sulfanilamide, sulfathiazole, and others.

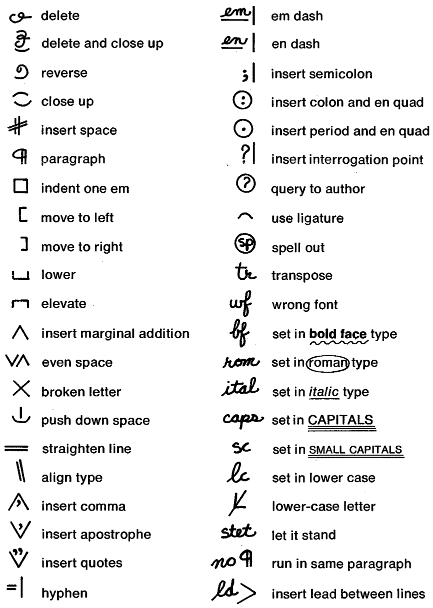
proof, in logic, an argument that establishes the validity of a proposition. Although proofs may be based on inductive logic, in general the term proof connotes a rigorous deduction. In formal axiomatic systems of logic and mathematics, a proof is a finite sequence of well-formed formulas (generated in accordance with accepted formation rules) in which: (1) each formula is either an axiom or is derived from some previous formula or formulas by a valid inference; and (2) the last formula is that which is to be proved. For proof by cases, *see* dilemma.

proof, in liquor distilling, a measure of the absolute alcohol content of a distilled liquor, which is a mixture of alcohol and water. The measurement is made by determining the specific gravity of the liquor; that is, the weight per unit volume of the liquid compared to that of water. The measurement of the alcohol content is expressed in terms that vary from country to country: specific gravity, percentage by volume of alcohol, percentage by weight of alcohol, percentage by volume of proof spirit, or by gradations on an arbitrary scale. The measurement is done at an index temperature, as specific gravity varies with temperature.

In Great Britain, the Customs and Excise Act of 1952, declared proof spirits (100 proof) to be those in which the weight of the spirits is $^{12}/_{13}$ the weight of an equal volume of distilled water at 51° F (11° C). Thus, proof spirits are 48.24 percent alcohol by weight or 57.06 percent by volume. Other spirits are designated over or under proof, with the percentage of variance noted. In the United States, a proof spirit (100 proof) is one containing 50 percent alcohol by volume.

proof spirit, alcoholic liquor or mixture of alcohol and water that contains a standard percentage of alcohol. *See* distilled liquor.

proofreading, reading and marking corrections on a proof or other copy of the text of articles and books before publication. Proofreading dates from the early days of printing. A contract of 1499 held the author finally responsible for correction of proofs. In modern practice, proofs are made first from a galley, a long tray holding a column of type, and hence are called galley proofs; the term is sometimes also used for the first copy produced in photocomposition and other forms of typesetting that do not involve metal type.



Commonly used proofreading marks

Galley proofs, and the later proofs of the type arranged into page form, usually bear queries (regarding possible errors of fact) arising through the proofreader's skill, which involves more than assuring an exact correspondence between the copy given to the printer and its printed form. Lawsuits between printers and authors, errata sheets, authors' apologies and complaints at not seeing proof in printed books, all were common through the 15th, 16th, 17th, and 18th centuries; and even in modern publication they are not unknown.

The marks illustrated are those most commonly used in proofreading. Many are also used in editing copy before the proof stage.

propaganda, dissemination of information—facts, arguments, rumours, half-truths, or lies—to influence public opinion.

A brief treatment of propaganda follows. For a full treatment, *see* MACROPAEDIA: Propaganda.

As a systematic effort to persuade, propaganda is an act of advocacy in mass communication, involving the making of deliberately one-sided statements to a mass audience. The one-sided presentations common to propaganda are used to spread and nourish particular images by emphasizing only the good points of one position and the bad points of another. Although the fact of propaganda activity is old, the term is comparatively modern, deriving from the name of the organization set up in 1622 by the Roman Catholic Church to carry on missionary work, the Sacred Congregation for the Propagation of the Faith (*propaganda fide*).

In the effort to manipulate people's beliefs and attitudes, propaganda uses a wide variety of symbols ranging from words and graphic art to banners, monumental sculpture, clothing, insignia, and postage-stamp designs. Contemporary propagandists use opinion surveys and other researching techniques to determine how most effectively to employ symbols in order to influence people's attitudes. In the 20th century, pictures and the written media, which were formerly the principal instruments for propaganda, were supplemented by radio, motion pictures, and television, which could convey vivid propagandistic symbols to a mass audience.

Archaeological evidence indicates that ancient civilizations used impressive statues, temples, palaces, and sumptuous clothing to convince their subjects of the power and greatness of a particular king, noble, or priesthood. The ancient Greeks were perhaps the first people to develop a systematic and deliberate analysis of propaganda in their cultivation of rhetoric and public argumentation as a means of swaying the minds of assembled groups of listeners. Propaganda of a sort has been used by virtually all of the world's great religions as they sought to make converts, and indeed, the spread of all complex political systems and religions has probably been due to a combination of earnest conviction and the deliberate use of propaganda. The Industrial Revolution brought a new type of propaganda, that aimed at affecting the beliefs and buying preferences of consumers through the use of mass-marketing and advertising campaigns. Enormous masses of data on consumer attitudes and psychology are now routinely compiled by large corporations and trade organizations in order that they may better understand and manipulate consumers' wants; and these techniques have also been adapted for use by politicians interested in gaining or keeping public support for themselves and for their political programs.

A somewhat more ominous modern development of propaganda has occurred in such 20th-century totalitarian states as Nazi Germany and the Soviet Union under Stalin, where the dissemination of information and popular culture were strictly controlled by the state. Under these regimes, virtually all of the mass media were converted into blatantly propagandistic vehicles striving to uphold the power and authority of the state and to induce the population to wholeheartedly accept the state's ideology and declared goals.

propagandistic art, art that is employed to create, manipulate, or maintain desired attitudes, beliefs, or actions among a population. Propagandistic art is usually instigated by governments to further their own ends; it is sometimes distinguished from commercial and public-service publicity and from patriotic art arising from the spontaneous emotion of an individual. "Propagandistic" is not necessarily a kind of art but rather a use of art. Context can focus, slant, or select for propagandistic purposes.

Propagandistic art is as old as history and was used extensively by the ancient imperial governments of Egypt, Mesopotamia, Persia, and China. In the West the Hellenistic kingdoms and the Roman Empire devoted considerable energy to the production of propaganda in the form of statues, monuments, building programs, and theatrical displays.

During most of the Middle Ages the church lavished its resources on visual arts intended to serve didactic and propagandistic purposes. This practice increased to an unprecedented extent during the Renaissance, and the expense of Pope Leo X's building program was one of the causes of unrest leading to the Protestant Reformation in the 16th century. To correct such excesses and to increase the effectiveness of the propaganda of the Roman Catholic Church, the Council of Trent finally codified an extensive list of guidelines to be followed in the commissioning and production of art.

With the rise of nation-states in western Europe during the late Middle Ages, secular governments commissioned ever greater amounts of propagandistic art. Such governments were monarchies, however, and propagandistic art served the dual purposes of displaying the government's power and wealth and personally flattering the monarch. During the 17th-century reign of Louis XIV of France, an astonishing proportion of the national wealth was devoted to his praise.

The 20th century brought major changes in propagandistic art. The bulk of propaganda was carried out through such ephemeral but relatively inexpensive media as the press, radio, television, and motion pictures, while the use of more permanent works of fine art became increasingly rare. An outstanding example of fine art used for propagandistic purposes is the work of the Mexican muralists José Clemente Orozco, Diego Rivera, and David Alfaro Siqueiros, whose public works praised the reforms of the Mexican Revolution and extolled the culture and integrity of the Aztec Indians at the expense of their Spanish conquerors. Later, Adolf Hitler, with the academic architect Albert Speer, planned a monumental building program to celebrate Germany's conquests under National Socialism and to advertise the alleged superiority of the Aryan race.

Works of art commissioned during the Great Depression of the 1930s by the Works Progress (later Projects) Administration in the United States sought to foster national pride and productivity. The Soviet Union officially encourages art that glorifies the state and teaches ideological lessons.

propagation, in botany, plant reproduction, either sexual or asexual; in horticulture, the term applies particularly to reproduction by artificial means. Sexual propagation includes fertilization processes that are crucial to the scientifically controlled development of hybrid or homozygous plant strains. Asexual propagation allows for rapid, genetically consistent plant reproduction.

Methods of asexual propagation include bulb division, layering, cutting, and grafting. Bulbs and other underground rootlike structures, such as tubers and corms, may be divided as they mature. The sections are then placed in a moist medium to root. In layering, the stem of a large plant is notched and wrapped in moist sphagnum moss or bent to the ground and covered with moist soil; when roots appear, growing out of the moss, the stem is cut below the roots and potted. Auxins (growth hormones) are often added to the wounds or soil to stimulate rooting. Stem cuttings are rooted in water or a moist potting medium such as sand, peat moss, or vermiculite. When cutting or layering are not feasible, a bud or twig of one plant is grafted onto the fully developed root system of another.

Propagation of the Faith, Society for the, organ of the papacy for the collection and distribution of money to support Roman Catholic missions throughout the world. The society was organized in Lyon on May 3, 1822, at a meeting of laymen called to raise money for the missions in Louisiana. This group joined with and adopted the fund-raising methods of Pauline Jaricot, who had been collecting for missions since 1818 and who was later designated by Pope Leo XIII as the official founder of the society. In 1922 the headquarters of the society was moved from France, where it had been under the control of a French council of laymen, to Rome, where Pope Pius XI reorganized it and made it the chief fund-raising and distribution agency for all Roman Catholic missions.

propane, colourless, easily liquefied, gaseous hydrocarbon (compound of carbon and hydrogen), a member of the paraffin series. It is separated in large quantities from natural gas, light crude oil, and oil-refinery gases. Its chemical formula is C_3H_8.

Propane is an important raw material for the petrochemical industry. The decomposition of propane in hot tubes to form ethylene also yields propylene, another important product, from which such chemicals as acetone and propylene glycol are derived.

Propane has a boiling point of $-42.1°$ F ($-43.8°$ C) and thus is readily liquefied under elevated pressures; it therefore is transported and handled as a liquid in cylinders and tanks. In this form, alone or mixed with liquid butane, it has great importance as a fuel for domestic and industrial uses and for internal-combustion engines.

propanol: *see* propyl alcohol.

propellant, any gas, liquid, or solid the expansion of which can be used to impart motion to another substance or object. In aerosol dispensers, compressed gases such as nitrous oxide, carbon dioxide, and many halogenated hydrocarbons are used as propellants. The propellant may remain in gaseous form (nitrous oxide or carbon dioxide), or it may liquefy under pressure. Food products, such as whipped cream, are propelled by nitrous oxide or carbon dioxide; nonfood products, such as cosmetics, insecticides, paints, and pharmaceuticals formerly were dispensed with the aid of fluorinated hydrocarbons. Because of the threat believed to be posed to the Earth's ozone layer by halogenated propellants, they have been banned in many countries except for essential uses such as some drugs, pesticides, lubricants, and cleaners for electrical or electronic equipment. (*See also* aerosol container.)

Solid and liquid propellants are substances such as gunpowder and other explosives that undergo rapid chemical reaction, producing gaseous products. Black powder (gunpowder) was used as a propellant in rockets until the 20th century. During World War I, Robert H. Goddard developed double-base powder (40 percent nitroglycerin, 60 percent nitrocellulose) as a solid propellant for rockets, later switching to a liquid propellant of liquid oxygen and gasoline. German V-2 rockets during World War II were propelled by a mixture of liquid oxygen and alcohol, other German missiles by nitric acid and a hydrocarbon. The most common rocket propellants in modern use are concentrated hydrogen peroxide or a combination of liquid oxygen and liquid hydrogen. Other rocket propellants include combinations of hydrazine and nitric acid or of kerosene and liquid oxygen, or solid synthetic rubber propellants known as Thiokols.

propeller, device with a central hub and radiating blades placed so that each forms part of a helical (spiral) surface. By its rotation in water or air, a propeller produces thrust and gives forward motion to a ship or aircraft. In Great Britain the propeller of an airplane or the rotor of a helicopter is commonly called an airscrew.

A propeller's thrust is proportional to the product of the mass of water or air it is acting on and the accelerating rate. For the most efficient propulsion, the mass should be large and the acceleration small.

proper motion, in astronomy, the apparent motion of a star across the celestial sphere at right angles to the observer's line of sight; any radial motion (toward or away from the Sun) is not included. Proper motion is generally measured in seconds of arc per year; the largest known is that of Barnard's star in the constellation Ophiuchus, about 10″ yearly. The English astronomer Edmond Halley, in 1718, was the first to detect proper motions—those of Aldebaran, Arcturus, and Sirius. The symbol for proper motion is the Greek letter μ (mu).

Consult the INDEX *first*

Propertius, Sextus (b. 55–43 BC, Assisi, Umbria, Italy—d. after 16 BC, Rome), greatest elegiac poet of ancient Rome. The first of his four books of elegies, published in 29 BC, is called *Cynthia* after its heroine (his mistress, whose real name was Hostia); it gained him entry into the literary circle centring on Maecenas.

Very few details of the life of Sextus Propertius are known. His father died when he was still a boy, but he was given a good education by his mother. Part of the family estate was confiscated (*c.* 40 BC) to satisfy the resettlement needs of the veteran troops of Octavian, later the emperor Augustus, after the civil wars. Propertius' income was thus severely diminished, though he was never really poor. With his mother, he left Umbria for Rome, and there (*c.* 34 BC) he assumed the dress of manhood. Some of his friends were poets (including Ovid and Bassus), and he had no interest in politics, the law, or army life. His first love affair was with an older woman, Lycinna, but this was only a passing fancy when set beside his subsequent serious attachment to the famous "Cynthia" of his poems.

The first of Propertius' four books of elegies (the second of which is divided by some editors into two) was published in 29 BC, the year in which he first met "Cynthia," its heroine. It was known as the *Cynthia* and also as the *Monobiblos* because it was for a long time afterward sold separately from his other three books. Complete editions of all four books were also available. *Cynthia* seems to have had an immediate success, for the influential literary patron Maecenas invited Propertius to his house, where he doubtless met the other prominent literary figures who formed Maecenas' circle. These included the poets Virgil (whom Propertius admired) and Horace (whom he never mentions). The influence of both, especially that of Horace in Book III, is manifest in his work.

Cynthia's real name, according to the 2nd-century writer Apuleius, was Hostia. It is often said that she was a courtesan, but elegy 16 in Book I seems to suggest that she belonged to a distinguished family. It is likely that she was married, though Propertius only mentions her other lovers, never her husband. From the poems she emerges as beautiful, passionate, and uninhibited. She was intensely jealous of Propertius' own infidelities and is painted as a woman terrible in her fury, irresistible in her gentler moods. Propertius makes it clear that, even when seeking pleasures apart from his mistress, he still loved her deeply, returning to her full of remorse, and happy when she reasserted her dominion over him.

After many violent scenes, it appears that Propertius finally broke off his tempestuous affair with her in 24 BC, though inferring dates from the poems' internal evidence cannot be undertaken with real confidence, as this kind of personal poetry often interweaves fact with fancy. He was to look back on his liaison with her as a period of disgrace and humiliation. This may be more than a mere literary pose, although after Cynthia's death (she does not seem to have lived for long after their break) he regretted the brusqueness of their separation and was ashamed that he had not even attended her funeral. In a most beautiful and moving elegy (IV:7), he conjures up her ghost and with it re-creates the whole glamour and shabbiness of the affair. While he makes no attempt to brush over the disagreeable side of her nature, he also makes it clear that he loves her beyond the grave.

Propertius' poetic powers matured with experience. The poetry of Book II is far more ambitious in scope than that of Book I and shows a richer orchestration. His reputation grew, and the emperor Augustus himself seems to have taken notice of him, for, in Books III and IV, the poet laments the premature death of Marcellus, Augustus' nephew and heir apparent (III:18), and he composed a magnificent funeral elegy (IV:11) in praise of Cornelia, Augustus' stepdaughter—the "Queen of Elegies" as it is sometimes called.

As his poetic powers developed, so also did Propertius' character and interests. In his earliest elegies, love is not only his main theme but is almost his religion and philosophy. It is still the principal theme of Book II, but he now seems a little embarrassed by the popular success of Book I and is anxious not to be thought of simply as a gifted scoundrel who is constantly in love and can write of nothing else. In Book II he considers writing an epic, is preoccupied with the thought of death, and attacks (in the manner of later satirists, such as Juvenal) the coarse materialism of his time. He still loves to go to parties and feels perfectly at ease in the big city with its crowded streets, its temples, theatres, and porticoes, and its disreputable quarters. In a way, he is a conservative snob, in general sympathy with Roman imperialism and Augustan rule; but he is open to the beauties of nature and is genuinely interested in works of art; though he disapproves of ostentatious luxury, he also appreciates contemporary fashions.

Some of his contemporaries accused him of leading a life of idleness and complained that he contributed nothing to society. But Propertius felt it his duty to support the right of the artist to lead his own life, and he demanded that poetry, and art in general, should not be regarded simply as a civilized way of passing the time. In elegy 3 of Book III he gives deep meaning to the process of artistic creation and emphasizes the importance of the creative artist.

In Books III and IV Propertius demonstrates his command over various literary forms, including the diatribe and the hymn. Many of his poems show the influence of such Alexandrian poets as Callimachus and Philetas. Propertius acknowledges this debt, and his claim to be the "Roman Callimachus," treating Italian themes in the baroque Alexandrian manner, is perhaps best shown in a series of elegies in Book IV that deal with aspects of Roman mythology and history and were to inspire Ovid to write his *Fasti,* a calendar of the Roman religious year. These poems are a compromise between the elegy and the epic. Book IV also contains some grotesque, realistic pieces, two unusual funeral elegies, and a poetic letter.

Two of the lasting merits of Propertius seem to have impressed the ancients themselves. The first they called *blanditia,* a vague but expressive word by which they meant softness of outline, warmth of colouring, a fine and almost voluptuous feeling for beauty of every kind, and a pleading and melancholy tenderness; this is most obvious in his descriptive passages and in his portrayal of emotion. His second and even more remarkable quality is poetic *facundia,* or command of striking and appropriate language. Not only is his vocabulary extensive but his employment of it is extraordinarily bold and unconventional: poetic and colloquial latinity alternate abruptly, and in his quest for the striking expression he frequently seems to strain the language to the breaking point.

Propertius' handling of the elegiac couplet, and particularly of the pentameter, deserves especial recognition. It is vigorous, varied, and picturesque. In the matter of the rhythms, caesuras, and elisions that it allows, the metrical treatment is more severe than that of Catullus, but noticeably freer than that of Ovid, to whose stricter usage, however, Propertius increasingly tended (particularly in his preference for a disyllabic word at the end of the pentameter). An elaborate symmetry is observable in the construction of many of his elegies, and this has tempted critics to divide a number of them into strophes.

As Propertius had borrowed from his predecessors, so his successors, Ovid above all, borrowed from him; and graffiti on the walls of Pompeii attest his popularity in the 1st century AD. In the Middle Ages he was virtually forgotten, and since the Renaissance he has been studied by professional scholars more than he has been enjoyed by the general public. To the modern reader acquainted with the psychological discoveries of the 20th century, the self-revelations of his passionate, fitful, brooding spirit are of peculiar interest.

Almost nothing is known about Propertius' life after his love affair with Cynthia was over. It is possible that he married her successor in his affections (perhaps in order to qualify for the financial benefits offered to married men by the *leges Juliae* of 18 BC) and had a child, for an inscription in Assisi and two passages in the letters of the younger Pliny (AD 61/62–*c.* 113) indicate that Propertius had a descendant called Gaius Passennus Paulus Propertius, who was also a poet. During his later years he lived in an elegant residential area in Rome on the Esquiline Hill. The date of his death is not certain, though he was still alive in 16 BC, for two events of that year are mentioned in his fourth book, which was perhaps edited posthumously.

Sextus Propertius is generally thought of as a difficult poet, partly because of the uncertainty of many manuscript readings, partly because of the often obscure mythological allusions in which his work abounds. But such allusions are not there for ornament; they are a kind of emotional shorthand by which Propertius expresses his deep insight into human nature. The mellifluous Greek names, moreover, are skillfully woven into the rich verbal pattern that, along with his sincerity, is one of his outstanding characteristics. (G.Lu.)

MAJOR WORKS. Four Books of Elegies: Book I, known in antiquity as the *Cynthia Monobiblos* (*c.* 33–*c.* 28 BC); Book II (*c.* 28–*c.* 25 BC); Book III (*c.* 24–*c.* 22 BC); and Book IV (*c.* 21–*c.* 16 BC). Special mention may be made of Elegy 1, Book I, which introduces Cynthia; of Elegy 28 (both parts), Book II, a prayer for her recovery from illness; of Elegy 10, Book III, on Cynthia's birthday; of Elegy 24, Book III, on their final parting after a quarrel; and of Elegy 7, Book III, on Cynthia's death.

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property, an object of legal rights; possessions or wealth collectively, frequently with strong connotations of individual ownership. In law the term refers to the complex of jural relationships between and among persons with respect to things. The things may be tangible, such as land or goods, or intangible, such as stocks and bonds, a patent (*q.v.*), or a copyright (*q.v.*).

A brief treatment of property follows. For full treatment, *see* MACROPAEDIA: Property Law.

Every known legal system has rules that deal with the relations among persons with respect to (at least) tangible things. The extraordinary diversity of the property systems of non-Western societies, however, suggests that any concept of property other than the descriptive one is dependent on the culture in which it is found. Since property law deals with the allocation, use, and transfer of wealth and objects of wealth, it must reflect the economy, family structure, and politics of the society in which it is found.

Very few, if any, non-Western societies generalize about property in the way Western legal systems do. What distinguishes the Western property system from the systems of most, if not all, other societies is that its category of private property is a default category. Western legal systems regard individual ownership as the norm, derogations from which must be explained. The legal concept of property in the West is characterized by a tendency to agglomerate in a single legal person, preferably the one who is currently in possession of the thing in question, the exclusive right to possess, privilege to use, and power to convey the thing.

In classical Roman law (roughly AD 1–250), the sum of rights, privileges, and powers a legal person could have in a thing was called *dominium,* or *proprietas* (ownership). The classical Roman jurists do not state that their system tends to ascribe *proprietas* to the current possessor of the thing, but that it did is clear enough. Once the Roman system had identified the *proprietarius* (the owner), it was loath to let him convey anything less than all the rights, privileges, and powers that he had in the thing.

The medieval English legal system similarly showed the tendency at critical points to agglomerate property rights in a single individual. A notion of property in land emerged at the end of the 12th century in England from a mass of partly discretionary, partly customary, feudal rights and obligations. What began as essentially an appellate jurisdiction, offered by the king in his court to ensure that a feudal lord did right by his men, ended with the free tenant being the owner of the land, in a quite modern sense, with the lord's rights limited to receipt of money payments.

The fundamental tendency in Western property law to agglomerate property rights in a single individual is probably not the product of the influence of a particular philosophical idea or the dominance of one social group over another or even of a balancing of social interests. As the need arose for a category to describe the sum of the rights, privileges, and powers that an individual could have with respect to a thing, the Romans, followed by the English, chose a noun derived from an adjective that means "own." The category at once described the concept and also the tendency. As time went on, the tendency took on an independent life. Western law excluded from the category "property" certain rights, privileges, and powers with respect to a thing because they existed in someone other than the property holder. In modern legal systems, though not in the Roman, property came to represent one of the rights of the individual against the state, perhaps originally because property had come to rest in the freeholder (*see* freehold) and not in his lord, and the king was the lord of all.

In Western law today, most tangible things may be the object of property, although certain kinds of natural resources, such as wild animals, water, and minerals, may be the object of special rules, particularly as to how they are to be acquired. Because Western law gives great emphasis to the concept of possession, it has had considerable difficulty in making intangible things the object of property. Some Western legal systems still deny the possibility of property in intangibles. In all Western legal systems, however, the great increase of wealth in the form of intangibles (stocks, bonds, bank accounts) has meant that property or property-like treatment must be given to such intangibles. Certain government-created rights such as patents and copyrights have traditionally been treated as property. Others, such as the right to receive social-insurance payments, have not normally been so treated, although there appears to be some tendency to treat these rights as property also. (This is the "new property" of recent writing.)

The use of property, particularly property in land, is extensively regulated throughout the West. Neighbours injured by adjoining land uses may sue in nuisance in the Anglo-American countries. Similar actions exist in the civil-law countries. Throughout the West landowners may agree to allow others to use their land in ways that would otherwise be actionable, and such agreements may be made to bind those to whom the land is conveyed. Anglo-American law tends to divide these grants of use rights into categories that reflect their common-law origins: easements (such as rights of way), profits (such as the right to take minerals or timber), real covenants (such as a promise to pay a homeowners' association fee), equitable servitudes (such as a promise to use the property for residential purposes only). The civil law does not have as many categories, the category of "servitudes" tending to cover for them all, and is a bit more restrictive. Most of the same practical results, however, can be achieved in civil-law countries as in Anglo-American.

Throughout the West public regulation of land use has increased dramatically in the 20th century. Most familiar is zoning, the division of a given area into districts with limitations on the types of land use (such as residential, commercial, or industrial). Extensive regulation of types of building (such as height or density) and of materials and methods of construction (building codes) is also very common. When public authorities cannot achieve their purposes through regulation, they may "expropriate" the land. This occurs, for example, when land is acquired by government for construction of a highway or by a utility company for creation of a reservoir. Such expropriation may not be a voluntary exchange between the parties, but compensation for property value is commonly provided.

Throughout the West property may be acquired by various "original modes" of acquisition. For instance, "occupancy" is a means of original acquisition when the thing possessed belonged to no one formerly. A thing can also be acquired if someone possesses it for a certain period of time as if he were the owner. This is called "acquisitive prescription" in civil-law countries, "adverse possession" in Anglo-American countries. The privileges conferred by public authorities, such as rights to mineral resources in the public domain or to exclusive use of an invention, can be viewed as types of original acquisitions.

A far more common means of acquiring property is by transfer from the previous owner or owners ("derivative acquisition"). Most forms of such transfer are voluntary on the part of the previous owner. "Sale," the voluntary exchange of property for money, is the most common of these. A "donation," or gift, is another voluntary form. Succession to property upon death of the previous owner is a central concept in nearly all property systems and falls into the category of derivative acquisition. In the West succession may by dictated by a will made by the deceased or by the laws of intestacy, statutes that determine the distribution of property in the event the deceased left no will. Other instances of derivative acquisition are involuntary. A bankrupt person, for example, may have property sold by judicial sale to pay his debts.

property, real and personal (law): *see* real and personal property.

property tax, a levy imposed upon real property—basically land and buildings—and, in some countries, upon business and farm equipment and inventories, and on personal property such as automobiles, jewelry, furniture, tools, and even intangibles such as bonds, mortgages, and shares of stock. In most countries, property taxes are used by local or state, rather than national, governments and supply to them a significant proportion of total tax revenues.

A brief treatment of property taxes follows. For full treatment, *see* MACROPAEDIA: Taxation.

The taxes of the ancient world were originally land taxes based on area rather than on value. Later, gross output came to serve as the base, and gradually other forms of wealth, such as farmhouses, animals, and implements, were included. The property tax is ultimately a tax upon persons; property serves only as the basis of assessment. The administration of property tax involves the discovery or identification of the property to be taxed, its valuation, the application of the appropriate tax rate, and its collection. Problems arise in determining what property actually exists in a physical sense and the value of the property. Inequities in evaluating different kinds of property or property bearing different kinds of improvements are continuing problems of administration, especially for local governments that may lack expertise in such matters.

In general the property tax seems to be either roughly proportional to income or slightly regressive. While property taxes may burden persons with low incomes more than strictly proportionally, their total redistributive effect from higher to lower income groups is substantial when account is taken of the degree to which property taxes pay for schools and other services used by low-income groups. There is also widespread horizontal inequity in property taxes because of unequal assessment upon owners. The tax falls more heavily on some kinds of businesses (*e.g.,* railroads and other utilities) and some types of consumption (*e.g.,* housing) than on others.

Property taxation has several economic effects. A community with high tax rates on buildings will be at a disadvantage in the competition for construction capital unless it can offer compensatory advantages. The tax on buildings and property other than land can distort resource allocation, by discouraging improvements that would bring land to its highest use. Lower tax rates on the fringes of urban areas encourage suburbanization. High taxes on structures favour horizontal over vertical growth of metropolitan areas. Property taxes continue in use because they are easily administered and very difficult to evade, and because the tax base—land—is a permanent and fixed resource.

prophet, a divinely inspired revealer, interpreter, or spokesman. In Western culture, the classic period of Israelite prophecy has tended to predominate in analyses of the phenomenon, but the figure of the prophet is to be found in numerous manifestations throughout history and worldwide.

A brief treatment of prophets and prophecy follows. For full treatment, *see* MACROPAEDIA: Doctrines and Dogmas, Religious.

The prophet differs from other religious functionaries and representatives of religious authority in that he claims no personal part in his utterance. He speaks not his own mind but a revelation "from without." He may be "inspired" with his message (as in the case of Jeremiah), or he may be "possessed" by a spiritual power—a god, a spirit, the Holy Ghost—which uses him as an instrument and speaks through him (as in Aeschylus' description of Cassandra in the *Agamemnon* and of the prophet of Apollo in the *Eumenides*). Plato defined the prophet as one who speaks in ecstasy, and in the Hellenistic period Philo of Alexandria similarly stated that the prophet "speaks nothing of his own" but resembles the lyre on which someone else plays.

The prophetic or charismatic (from Greek *charisma*, "divine gift") state may occur spontaneously, or it may be induced by a variety of techniques: by meditation, by mystico-magical formulas and gestures (the *mantras* and *mudras* of esoteric Buddhism, for example), by music (II Kings 3:15, "And when the minstrel played, the power of the Lord came upon him"), by drumming, dancing, or the ingestion of intoxicants or narcotics. Prophets very often resist the call (Amos and Jeremiah among the Hebrew prophets; many prospective shamans) until overcome by the superior power that wants to use them as its instrument.

In contrast to the diviner, who uses or manipulates objective techniques and signs to address what are primarily private needs and anxieties, the prophet, impelled by the spirit, may articulate a message of more general and fundamental import, enunciating principles and norms that are critical of the present, in either a destructive or a reforming sense. He may address his group (tribe, nation) as a whole or may found a new society that will realize his message. The prophetic personality thus frequently becomes a religious founder, reformer, or sectarian leader (Zoroaster, Muḥammad, and others). The "ideal-typical" prophet (in Max Weber's sense) is, however, less concerned with founding a new religion or introducing revolutionary reforms than with criticizing his society from the inside, as it were, and in the light of what he believes to be the divinely established norms underlying its existence. If he is a revolutionary, he very frequently does not know it.

The semantic spectrum of the term prophetic has consequently become rather wide. According to whether the emphasis is on possession and ecstasy, inspired utterance, prediction of the future, visionary experience, ethical fervour, passionate social criticism, sense of absolute commitment, millenarian and apocalyptic expectation, etc., the most diverse phenomena and personalities have been called prophetic: Montanists, Pentecostals, Zoroaster, Muḥammad, Joachim of Fiore, Savonarola, Thomas Müntzer, Jakob Böhme, George Fox, Joseph Smith, and many others. The moral seriousness of the ancient Chinese sages and their profound regard for the law of heaven has suggested comparisons with Hebrew prophecy, and the Egyptian text known as the "Peasant's Complaint" has been claimed as a witness for a prophetic movement in ancient Egypt. Even Marxism has at times been qualified as prophetic, both because of its passionate protest against social injustice and because of the eschatological structure of its doctrine.

Disregarding this wide and at times merely figurative use of "prophetic," there may be recognized a distinct prophetic type of religion. Its main characteristics are a dynamic conception of a deity, an emphasis on the will (both of God and of man) as a constitutive factor of the religious reality, a basic dualism, a profound awareness of the seriousness of sin (as distinct from breaking a taboo), a radical ethical outlook based on unequivocal choice between good and evil, a positive attitude toward society and toward this world in general, and a relationship to the time process that could crystallize in eschatological and messianic hopes.

Prophet, Companions of the: *see* Companions of the Prophet.

Prophet, The, byname of TENSKWATAWA (b. *c.* March 1768, Old Chillicothe, Ohio—d. 1834, Argentine, Kan., U.S.), North American Shawnee Indian religious revivalist, who worked with his brother Tecumseh for an Indian confederacy to resist U.S. encroachment in the Northwest.

The Prophet's declaration in 1805 that he had a message from the "Master of Life," followed by his accurate prediction of a solar eclipse in 1806, caused a great stir among the Indians. In advocating a return to distinctively Indian ways of life, he rejected white men's innovations, such as the use of alcohol and of textile clothing rather than animal skins and furs, the concept of individual ownership of property, and intermarriage with whites. He retained his hold over his followers by presenting himself as one who had contact with the supernatural through incantations and dreams. Witch burning was a feature of his program. In November 1811, while Tecumseh was away, he allowed the Shawnees to be drawn into military action with Gen. William Henry Harrison; the defeat on the Tippecanoe River (November 7) thoroughly discredited The Prophet and destroyed the Indian confederacy.

Prophet Dance, North American Plateau Indian ritual of the early 19th century during which the participants danced in order to hasten the return of the dead and the renewal of the world, particularly the world as it was before European contact. The Prophet Dance was a precursor of the famous Ghost Dance movement of the 1870s and 1890s.

Prophets, The (biblical division): *see* Nevi'im.

Prophets, The Lives of the, pseudepigraphal collection (not in any scriptural canon) of folk stories and legends about the major and minor biblical prophets and a number of other prophetic figures from the Old Testament books of I Kings, II Chronicles, and Nehemiah. The work demonstrates the popularity of religious and philosophical biography in the Mediterranean and Near Eastern areas during the Hellenistic period (3d century BC to 3d century AD) of Judaism.

Originally written in the 1st century AD in Hebrew, the *Lives* is extant only in a Greek translation and in Syriac, Latin, and Ethiopic translations made from the Greek. The original author (or authors) was a Jew, but the versions that have been preserved all show signs of Christian editing, especially of the messianic and iconographical material.

Each section uses legendary and biblical sources to summarize the life of a particular prophet. *The Lives of the Prophets* includes such typical Hellenistic religious motifs as miracles and divine epiphanies. Many of the stories are related to, if not dependent upon, other apocryphal works—*e.g.,* the life of Isaiah resembles the *Martyrdom of Isaiah*, the life of Jeremiah recalls the account of the Ark of the Covenant in the Second Book of the Maccabees, and the life of Habakkuk is related to Bel and the Dragon in Additions to Daniel.

Prophet's Mosque, courtyard of the Prophet Muḥammad in Medina, Arabian Peninsula, which was the model for later Islāmic architecture. The home of Muḥammad and his family was a simple structure, made of raw brick, that opened on an enclosed courtyard where people gathered to hear him. In 634 Muḥammad decreed that prayer be directed toward Mecca; against the wall facing Mecca, the *qiblah* wall, he built a roofed shelter supported by pillars made of palm trunks. Against the opposite wall of the courtyard stood a roofed gallery to shelter his companions, the antecedent of the roofed oratories in later mosques.

In 628 a *minbar*, or pulpit, was added so that the Prophet was raised above the crowd; besides leading prayer, Muḥammad declared his new law and decided disputes from the *minbar*. Later mosques also combined political, judicial, and religious functions. In 706 Caliph al-Walīd I destroyed the original brick buildings and created a new mosque on the site. The new mosque, containing the tomb of Muḥammad, is one of the three holiest places of Islām.

Propontis (Turkey): *see* Marmara, Sea of.

proportional counter, type of ionization chamber capable of differentiating between various kinds of charged particles and energies (*see* ionization chamber).

proportional representation, electoral device that seeks to create a representative body that reflects the distribution of opinion in the electorate. Where majority or plurality systems effectively reward strong parties and penalize weak ones by assigning authority to represent the whole constituency to a candidate who may have received half or less of the votes, proportional representation ensures minority groups a measure of representation proportionate to their numbers.

To its advocates the case for proportional representation is fundamentally the same as that for representative government: an election is like a census of opinion as to how the nation should be governed, and only if an assembly represents the full diversity of opinion within a nation can its decisions be regarded as the decisions of the nation itself. The system is also suggested as a means of redressing the possible anomaly arising under majority or plurality systems whereby parties may win more seats with fewer popular votes than their opponents.

Proportional representation is opposed on grounds of both principle and expediency. Its opponents hold that in an election a nation is making a decision, a choice, and that the function of the electoral system is to achieve a consensus rather than a census of opinions. Further, to make it possible for small parties to be represented is to encourage the formation of splinter parties, the mutual bargaining of which may lead to weak government.

The key to proportional representation is the creation of constituencies with multiple representatives. The principle was formulated systematically in the middle of the 19th century by C.C.G. Andrae in Denmark and Thomas Hare and John Stuart Mill in Great Britain. Since then, several methods for applying it have been devised; the best known are the single-transferrable-vote method and the list system.

Under the single-transferrable-vote method, voters rank candidates on the ballot in order of preference. A quota is calculated using the so-called Droop formula (named after its deviser, the Belgian H.R. Droop): the total number of valid votes cast is divided by the number of seats to be filled plus one, and one is added to the quotient. Thus, for example, if 200,000 votes are cast and nine seats are to be filled, the quota equals 200,000 divided by ten, plus one, or 20,001. The first preference votes are counted, and any candidate who obtains the quota is declared elected. Votes received by successful candidates in excess of the quota are transferred to other candidates according to the voters' second preferences. Any surplus among subsequently elected candidates is similarly transferred, and so on, if necessary. If any seats are still vacant, the candidate with the fewest votes is eliminated, and all his ballots transferred to the voters' second preferences, and so on, until all seats are filled by candidates obtaining a quota. In this way the results reflect fairly accurately the preferences of the electors and, therefore, their support for both individuals and parties.

Under the list system, the elector votes not for a single candidate but for a list of candidates; each list, normally, is put up by a different party. Each party gets a share of the seats proportional to its share of the votes. There are various alternative rules to achieve this; the two principal ones are the largest-remainder rule and the highest-average rule (the latter being often referred to as the d'Hondt rule, from its deviser, the Belgian Victor d'Hondt). Under the largest-remainder rule a quota is set, and each party is assigned one seat for each time that it can meet the quota. These votes are deducted from each party's total, and when no party has enough votes remaining to meet the quota, remaining seats are assigned on the basis of whatever votes are left. Under the highest-average rule, seats are assigned one at a time to the party with the highest total. After each seat is assigned, the winning party's total is adjusted: the original total vote is divided by the number of seats it has won plus one. The seats that a party wins are assigned to its candidates in the order in which they are named in the list. The principle of the list system is carried to its logical conclusion when a whole country is used as a constituency.

The two systems of proportional representation discussed above, and variations of them, were adopted in the Weimar Republic in Germany (1919–33), the Fourth Republic in France (1946–58), and in Belgium, Denmark, Norway, Sweden, Greece, Italy, Finland, Ireland, Luxembourg, Switzerland, and The Netherlands. Proportional representation is thought to be superfluous where a two-party system operates effectively.

propositional calculus, also called SENTENTIAL CALCULUS, in logic, symbolic system of treating compound and complex propositions and their logical relationships. As opposed to the predicate calculus, the propositional calculus employs simple, unanalyzed propositions rather than terms or noun expressions as its atomic units; and, as opposed to the functional calculus, it treats only propositions that do not contain variables. Simple (atomic) propositions are denoted by letters, and compound (molecular) propositions are formed using the standard symbols: $\cdot$ for "and," $\vee$ for "or," $\supset$ for "if . . . then," and $\sim$ for "not."

As a formal system the propositional calculus is concerned with determining which formulas (compound proposition forms) are provable from the axioms. Valid inferences among propositions are reflected by the provable formulas, because (for any A and B) $A \supset B$ is provable if and only if B is always a logical consequence of A. The propositional calculus is consistent in that there exists no formula in it such that both A and $\sim A$ are provable. It is also complete in the sense that the addition of any unprovable formula as a new axiom would introduce a contradiction. Further, there exists an effective procedure for deciding whether a given formula is provable in the system. *See also* predicate calculus; thought, laws of.

propositional function, in logic, a statement expressed in a form that would take on a value of true or false were it not for the appearance within it of a variable x (or of several variables), which leaves the statement undetermined as long as no definite values are specified for the variables. Denoted as a mathematical function, $A(x)$ or $A(x_1, x_2, \cdot \cdot \cdot, x_n)$, the propositional function is an abstraction from propositional forms (or predicates). For example, "x is small," "x ist klein," and "x is not large" are all propositional forms. The substitution of some noun (or value) for x yields a specific proposition that is either true or false, but "x is small" itself has no truth-value. Abstracting from these three propositional forms yields a propositional function $A(x)$, which has, for example, the value true when x takes the value mouse and has the value false when x is elephant.

Propositional functions permit the treatment in symbolic logic of propositions the truth of which is contingent upon variable components.

proprietary colony, in British-American colonial history, a type of settlement dominating the period 1660–90, in which favourites of the British Crown were awarded huge tracts of land in the New World to supervise and develop. Before this time most of the colonies had been financed and settled under the jurisdiction of joint stock companies. After the Restoration (1660), Charles II used proprietaries as a device to meet pent-up demands for territorial expansion as well as to repay political and economic debts incurred in the struggle for the throne. Vast tracts of land in New York, New Jersey, Pennsylvania, and North and South Carolina were distributed in this way.

Although proprietorships were feudal in origin, American proprietors were forced to yield power and privileges to their colonists. By the turn of the century most British officials, fearing the proprietaries' independence from parliamentary authority, favoured an end to the granting of new proprietary colonies despite their success. One important result of the proprietary movement was the diversification of settlers, who were attracted from several different countries rather than from England alone, thus helping to bring a more cosmopolitan character to the new country.

proprioception, the perception by an animal of stimuli relating to its own position, posture, equilibrium, or internal condition.

The coordination of limb movements requires continuous awareness of the position of each limb. The receptors in the skeletal (striated) muscles and on the surfaces of tendons of vertebrate animals provide constant information on the positions of limbs and the action of muscles. Comparable organs of arthropods (*e.g.,* insects, crustaceans) include stretch receptors located on the outsides of muscles and chordotonal organs (special nerves that measure tension changes) within the joints. Awareness of limb position and movements is also gained through the stimulation of sensitive hairs at the joints.

The awareness of equilibrium changes usually involves the perception of gravity. The organ for such perception most frequently found in invertebrates is the statocyst, a fluid-filled chamber lined with sensitive hairs and containing one or more tiny, sandy or stonelike grains (statoliths). The statoliths may be free moving, as in most mollusks, or loosely fixed to the sense hairs, as in some crustaceans. Statocysts are also found in many cnidarians and worms. Comparable organs in vertebrates are the saccule and utricle of the ear, the grains being called otoliths. In either case, a change in the animal's position or orientation is conveyed to the sense hairs by the pressure of the statoliths.

A third type of proprioceptor, found in all vertebrates and some invertebrates (*e.g.,* cephalopods, crustaceans), informs the animal of body rotations. The crustacean organ uses the inertia of fluid in a cavity, into which slender sensory hairs project. Rotation of the animal causes the stimulation of the hairs because of the inertial lag of the fluid.

Vertebrates are able to sense rotation by the inertial lag of fluid in the semicircular canals of the ear, acting on sensory hairs. The three canals form loops lying in planes at right angles to each other; by integrating signals from the canals, the central nervous system can detect rotation in planes other than those of the canals.

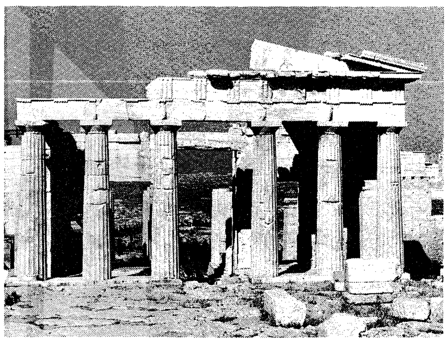
proptosis (eye disorder): *see* exophthalmos.

propyl alcohol, also called PROPANOL, either of two isomeric alcohols used as solvents and as intermediates in chemical manufacturing. Normal (*n*-)propyl alcohol (molecular formula $CH_3CH_2CH_2OH$), or 1-propanol, is a by-product of the synthesis of methyl alcohol from carbon monoxide and hydrogen. It occurs in fusel oil. It easily forms esters and ethers, some of commercial importance. It is used especially in the preparation of lacquers.

Isopropyl alcohol $(CH_3)_2CHOH$, or 2-propanol, is manufactured from propylene by treatment with sulfuric acid, followed by hydrolysis and distillation. Isopropyl alcohol is easily oxidized to acetone, of which it is a major industrial source. Besides being used as rubbing alcohol, a solvent, and a chemical intermediate, isopropyl alcohol serves as a de-icing and anti-stall agent in liquid fuels.

Both propyl alcohol isomers are colourless, flammable, fragrant liquids miscible with water in all proportions and somewhat toxic.

propylaeum, in ancient Greek architecture, porch or gatehouse at the entrance of a sacred enclosure, usually consisting of at least a porch supported by columns both without



East facade of the Propylaea, the Acropolis, Athens, designed by Mnesicles, 5th century BC
Alison Frantz

and within the actual gate. The most famous propylaeum is the one designed by Mnesicles as the great entrance hall of the Athenian Acropolis (begun in 437 BC).

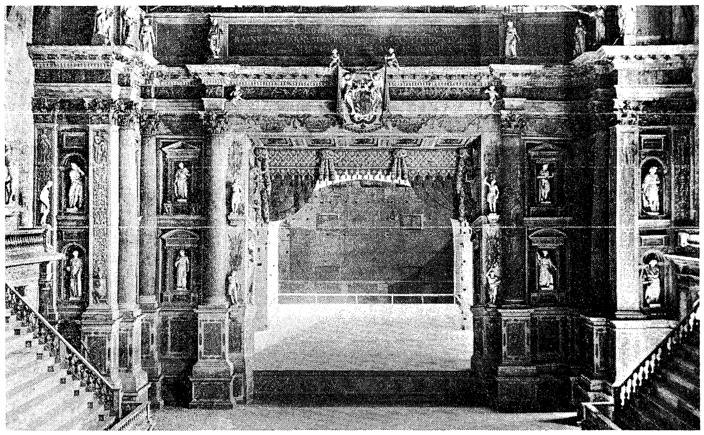
The name propylaea is also applied to various monumental gateways, Neoclassical and Romantic in style, built in the late 18th and 19th centuries. They include the Propyläen of Munich (1862) and Berlin's Brandenburg Gate (1784).

propylene, also called PROPENE, a colourless, flammable, gaseous hydrocarbon, C_3H_6, obtained from petroleum; large quantities of propylene are used in the manufacture of resins, fibres, and elastomers (*see* polyolefin), and numerous other chemical products. *See* glycol; propyl alcohol.

prosbul (from Greek *pros boulē*, "in front of the court"), a legal procedure introduced into Judaism by Hillel the Elder in the 1st century BC to permit private loans to persons in need without fear on the lender's part that the debt would be legally abrogated at the end of the sabbatical year (every seventh year). The court assumed the obligation of collecting the debt, thus technically removing the personal element specified in the law: "every creditor shall release what he has lent to his neighbor; he shall not exact it of his neighbor, his brother, because the Lord's release has been proclaimed" (Deut. 15:2). Though the procedure was criticized as an evident circumvention of the Law, it was retained to benefit those in urgent need of financial help. Because precise calculation of sabbatical years is uncertain, they have been designated as those years of the Jewish religious calendar that are divisible by seven. The sabbatical years 5740 AM and 5747, for example, correspond respectively to 1979–80 and 1986–87.

proscenium, in theatre, the frame or arch separating the stage from the auditorium, through which the action of a play is viewed. In the ancient Greek theatre, the proscenium (Greek *proskēnion*) originally referred to a row of colonnades, supporting a raised acting platform (*logeion*), and afterward to the entire acting area. A proscenium in the modern sense was first installed in a permanent theatre in 1618–19 at the Teatro Farnese built in Parma, Italy. It had been introduced as a temporary structure at the Italian court about 50 years earlier. Although this arch did contain a stage curtain, its main purpose was to provide atmosphere and a sense of spectacle, and scene changes were still carried out in view of the audience. It was not until the 18th century that the stage curtain was commonly used as a means of hiding scene changes.

The proscenium opening was of particular importance to the realistic playwrights of the 19th century, such as Henrik Ibsen, for whom it was a "picture frame" or an imaginary fourth wall through which the audience experienced the illusion of spying on characters behaving exactly as if they were unobserved. The illusion was further enhanced by controlled lighting, which made it possible to darken the auditorium where the audience was seated and create the illusion for the spectator that he was not in a theatre.



Proscenium of the Teatro Farnese (1618), a court theatre at Parma, Italy, designed by Giovanni Battista Aleotti
Fotocelere, Turin

The proscenium theatre declined in popularity in the 20th century, when the movement toward fuller communication between actor and audience led to the revival of other, more intimate forms of theatre, such as the projecting stage and theatre-in-the-round.

proscription, Latin PROSCRIPTIO, plural PROSCRIPTIONES, in ancient Rome, a posted notice listing Roman citizens who had been declared outlaws. Rewards were offered to anyone killing or betraying the proscribed, and severe penalties were inflicted on anyone harbouring them. Their properties were confiscated, and their sons and grandsons were forever barred from public office and from the Senate.

The process was first used by the dictator Sulla in 82 BC, when some 4,700 of his alleged enemies (including those of the house of Marius) were proscribed and their lands turned over to Sulla's veterans. Children and grandchildren of these proscribed were restored to their rights in 49 by Julius Caesar, who tactfully avoided the proscription process that Romans had come to view as a horror. The next extensive use of proscription occurred during the Triumvirate of Mark Antony, Octavian, and Lepidus (43 BC), who used it to rid themselves of their opponents (some 300 senators and 2,000 equites, including Cicero) and to acquire lands for their legions and funds for themselves. Some of the proscribed escaped capture, however, and a few were later restored to their privileges.

prose poem, brief composition that may contain all the attributes of lyric poetry but that is set on a page as prose. The form was introduced into French literature by Jacques Bertrand (Aloysius), with his *Gaspard de la nuit* (1842; "Gaspard of the Night"). His poetry attracted little interest at the time, but his influence on the Symbolists, at the end of the century, was acknowledged by Baudelaire in his *Petits Poèmes en prose* (1869, later titled *Le Spleen de Paris*). It was this work that gave the form its name, and the *Divagations* (1897) of Stéphane Mallarmé and *Illuminations* (1886) of Arthur Rimbaud firmly established prose poetry in France. Other turn-of-the-century poets who wrote prose poetry were Paul Valéry, Paul Fort, and Paul Claudel.

Prose poems were written in the early 19th century by the German poets Hölderlin and Novalis, and at the end of the century by Rainer Maria Rilke. The 20th century saw a renewed interest in the form in such works as Pierre Reverdy's *Poèmes en prose* (1915) and in the works of the French poet Saint-John Perse.

prosecutor, government official charged with bringing defendants in criminal cases to justice in the name of the state. Although responsibilities vary from one jurisdiction to another, many prosecutors are in charge of all phases of a criminal proceeding, from investigation by the police through trial and beyond to all levels of appeal. Many also defend the state in civil actions.

In some countries, such as France and the Soviet Union, public prosecution is carried out by a single office that has representatives in courts all over the country (*see* ministère public). In Japan, too, the office of public prosecutor runs parallel to a unitary court system. In the United States, however, states and counties have their own prosecutors. Only on the federal level is the system unitary, a district attorney being appointed by the U.S. attorney general's office for each federal district (*see* attorney general).

In some countries, including France, Japan, and Germany, the prosecutors are part of a career civil service. They are appointed and dismissed by the ministry of justice and generally subject to its control. In Japan, however, they may be dismissed only for reasons of health or after disciplinary proceedings.

In the Soviet Union the procurator general is elected by the Supreme Soviet for a term of seven years; the regional and local procurators, elected by the regional soviets, serve for five. Although in theory the prosecuting body is an independent state agency, in practice it comes under considerable central control, particularly in political cases.

In most U.S. state and local jurisdictions, prosecutors are elected to office. On the federal level, district attorneys are, in effect, members of the executive branch of the government; they are usually replaced when a new administration comes into office. Prosecutors, whether elected or appointed, are often subject to political pressures. Efforts have been made in Japan and Germany to insulate the office from such pressures.

In some countries the prosecutor takes charge of the investigation once a crime has been committed. In both the United States and the Soviet Union the prosecutor is largely responsible for the police investigation, in which he must assure that the guaranteed rights of the accused are protected. In Great Britain, where much of the prosecution is still theoretically private, most cases are prosecuted by the police; the office of public prosecution is responsible for only the most serious ones.

In the United States the prosecutor presents evidence at a hearing before a grand jury (*q.v.*), which may or may not return an indictment for trial. In most civil-law countries, however, a special investigating magistrate is in charge of the preliminary hearing. In general, the prosecutor participates little in this stage of the process, sometimes offering his assessment of the case at the end of the proceeding. In the Soviet Union, however, a representative from the procurator's office runs the preliminary hearing; the procurator general oversees the investigation and can order it to continue if he feels more evidence can be found. At the same time he can overturn any investigation he feels is unfounded.

In countries where the judge handles the questioning of witnesses, the prosecutor is limited to presenting evidence and giving a final summation. In the United States and Great Britain the prosecutor plays an active role in questioning witnesses. In most countries, when a decision is appealed to a higher court, the prosecutor presents briefs and pleads the state's case.

Proserpina, also spelled PROSERPINE (goddess): *see* Persephone.

Proskurov (Ukrainian S.S.R.): *see* Khmelnitsky.

prosobranch, any snail of the subclass Prosobranchia, class Gastropoda. Most of these primitive snails are marine; a few live on land or in fresh water. Many prosobranchs breathe by means of gills, which are located in front of the heart; some have a special respiratory structure on the mantle or, in land species, a simple pulmonary cavity. The auricle of the heart is in front of the ventricle. Larval torsion results in a figure-eight arrangement of the viscera and nerve cord that persists throughout life. Most species have a lid (operculum) on the foot that closes the shell when the animal retracts. The sexes are separate.

For further information on members of the prosobranch group, *see* abalone; conch; cone shell; cowrie; ear shell; freshwater snail; helmet shell; land snail; limpet; mitre shell; murex; olive shell; periwinkle; slipper shell; top shell; triton shell; turban shell; volute; wentletrap; whelk; worm shell.

prosodic feature (phonetics): *see* suprasegmental.

prosody, the rhythmic aspect of language; in literary criticism, the term chiefly denotes the metrical structure of poetry and the study of such structure.

A brief treatment of prosody follows. For full treatment, *see* MACROPAEDIA: Literature, The Art of. Though prosody is an element in all languages, its treatment here and in the MACROPAEDIA is centred on English, since that is the only common language of all readers of this encyclopaedia.

"Traditional" prosody is that which dominated English poetry between the 16th and 19th century, though it had first been more or less established in the poetry of Geoffrey Chaucer (*c.* 1340–1400). It is based on lines measured by syllable stress and is sometimes called accentual-syllabic verse. Each line of verse consists of basic units called "feet," with either two or three syllables in a foot. These syllables are "weak" or "strong" according to the way they are pronounced. The word forget, for example, has an unstressed syllable (weak) followed by a stressed syllable (strong). The four principal feet found in English poetry are the iambic (bĕhóld); the trochaic (tígĕr); the dactylic (déspĕrăte); and the anapestic (ŭn dĕrstánd). If a line comprises only one foot it is called monometer; if two, dimeter; if three, trimeter; if four, tetrameter; if five, pentameter; if six, hexameter; and so on, though the count in English verse seldom goes above six. Lines organized into complete groups are called stanzas, which are then identified by the number of lines (couplet, tercet, quatrain, sestet, octave, and so on) and by the metre the lines follow: thus, iambic pentameter; trochaic dimeter; dactylic tetrameter; and so on. The complete group of stanzas confirms the verse form of the poem (such as sonnet, ode, lyric poem).

Old English and Middle English poetry, on the other hand, were written in a strong-stress metre. That is, the lines of verse are not measured by "feet" but by a constant number of strong stresses. The number of unstressed syllables in each line is variable. The lines of verse divide sharply at a medial pause called a caesura, on each side of which are two stressed syllables.

There was a return to this sort of prosodic structure in the later 19th century, influenced by the innovative writing of Walt Whitman and Gerard Manley Hopkins. It has been developed in the 20th century by such poets as Ezra Pound, T.S. Eliot, and W.H. Auden (though these three were also masters of "traditional" prosody).

Romance language verse is largely based on a syllabic metre; that is, the line is determined by a fixed count of syllables. Stress and pause, on the other hand, are variable. Experimentation in English verse with this kind of structure has generated a prosody more interesting to the eye than to the ear.

The prosody of Greek and Latin poetry was determined by quantitative metres. This was possible because the rules governing length of vowels ("quantity") were established by precise grammatical conventions. No such rules obtain in English. Moreover, Greek and Latin are both inflected languages; that is, words change their form to indicate distinctions in mood, case, tense, and number. Thus complicated metrical patterns and long, slow-paced lines developed because the languages were hospitable to an alternation of long vowels (a characteristic of the root vowels) and short vowels (a characteristic of the inflected syllables). English had lost most of its inflected forms by the 15th century. German, which has retained them, is more at ease in adopting and adapting the ancient classical metres.

It should be noted that the terminology of "traditional" English prosody was established by Renaissance theorists who sought to impose the rules of classical prosody on vernacular English forms. They merely succeeded in redefining, in classical terms, the elements of an already existing syllable-stress metre.

Non-metrical prosody is a feature of modern poetry, although many critics deny that it is possible to write poetry without employing some kind of metre. Visual prosidies have been fostered by poets of the Imagist movement and by such experimenters as e.e. cummings, who revived the practice of some Metaphysical poets in "shaping" the verse by typographical arrangement.

Prosody entails several important elements other than metre. Rhyme scheme, too, is one of a variety of effects including alliteration and assonance that influences the total "sound meaning" of a poem. Very often, prosodical study is trying to discover the subtleties of a poem's rhythm, its "flow," a quality rooted in such elements as accent, metre, tempo, but not synonymous with them.

Prosody also takes into account a consideration of the historical period to which a poem belongs; the poetic genre; and the poet's individual style. Finally, the term prosody encompasses the theories that have been developed through the ages about the value of structure: from the "decorum" of the classical age, which identified certain metres as suitable only for particular subjects; to Renaissance formulations of "laws" by which modern verse was restricted to classical measures; to the 18th-century exhaustion of Alexander Pope's idea that the movement of sound and metre should represent the actions they carry; to G.M. Hopkins' controversial theories of "sprung rhythm" based on natural stress of words. Since the publication in 1906–10 of George Saintsbury's great *History of English Prosody,* the subject has been a respected part of literary study, though much dispute continues to surround prosodic theories.

Prospect Island (Kiribati): *see* Teraina Atoll.

prospecting, search for economically exploitable mineral deposits. Up to the 20th century, prospecting was done by men roaming likely areas on foot and recognizing gold, iron, lead, or other valuable ores by sight. Certain types of mineral deposits are associated with certain types of rock and land forms; copper, lead, and zinc, for example, generally appear in igneous rock formed by cooling of masses of molten minerals at or near the Earth's surface. Geologists can sometimes infer the extent of deposits by mapping outcroppings; drilling is then used to confirm the estimates.

In the 20th century, more sophisticated techniques developed as the result of the maturing of the physical sciences and the need to seek minerals beneath the surface. Some valuable minerals, such as iron and copper, are magnetic: first the compass and later the more sensitive magnetometer have been used to detect them. The gravimeter, an instrument that can detect minute changes in the Earth's gravitational field, can be used to detect certain minerals that have densities different from those of the surrounding formations. Some sulfide mineral deposits have undergone partial oxidation, and the resulting nonuniformity in chemical composition creates an electric potential that causes currents to flow in the surrounding ground; voltmeters can be used to detect them. Another electrical method involves implanting electrodes in the ground and tracing the current between them by means of a galvanometer; the current will seek out conductors in the ground.

Seismic methods utilize information gained from the transmission of natural (earthquake) and artificial shock waves by different underground bodies. In systematic seismic exploration, a hole is drilled and an explosive charge set off in it; seismic waves, travelling to the boundaries between different rock layers and reflected from these layers, can be timed, and the types of rock deduced.

Ores of uranium and thorium give off radiation that can be detected by suitable instruments such as the Geiger counter. Geochemical methods of prospecting involve chemical analysis for traces of metals in soils, vegetation, and stream water or silt. Methods of prospecting for oil and natural gas are similar to those used for minerals.

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

Prosper OF AQUITAINE, SAINT, Latin PROSPER TIRO (b. *c.* 390, Lemovices, Aquitania—d. *c.* 463, probably Rome; feast day July 7), early Christian polemicist famous for his defense of Augustine of Hippo and his doctrine on grace, predestination, and free will which became a norm for the teachings of the Roman Catholic Church. Prosper's chief opponents were the Semi-Pelagians, who believed in the power of man's innate will to seek God, but at the same time accepted Augustine's concept of the universality of original sin as a corruptive force that cannot be overcome without God's grace.

Before 428, Prosper moved to Marseille, where he lived as a monk. Reacting to the rise of Semi-Pelagianism, he wrote (428) an appeal for help to Augustine, who replied with *De praedestinatione sanctorum* ("Concerning the Predestination of the Saints") and *De dono perseverantiae* ("Concerning the Gift of Perseverence"). In response to continuing Semi-Pelagian attacks, Prosper single-handedly rose to Augustine's defense. In his writings he opposed one of the most revered monks of the era, Abbot John Cassian of Saint-Victor, as well as Vincent of Lérins. He also wrote a reply to the general attack on Augustine, *Ad objectiones Gallorum calumniantium* ("To the Objections of the Gallic Calumniators").

After Augustine's death (430) in Hippo, Prosper went to Rome in 431 to enlist the aid of Pope Celestine I, who wrote a letter praising Augustine. Prosper then returned to France, but by 435 he had established himself at Rome as secretary to Pope Leo I the Great.

Before his death he composed a collection of Augustinian propositions called *Liber sententiarum Sancti Augustini* ("The Book of the Sentences of St. Augustine"), which was used in the decrees of the second Council of Orange in 529 refuting Semi-Pelagianism. L. Valentin's *Saint Prosper d'Aquitaine* appeared in 1900.

Prospero, first of four X-3 satellites orbited by Great Britain. It was launched with a British Black Arrow missile on Oct. 28, 1971, from the rocket-testing facility at Woomera, Australia. Prospero weighed 145 pounds (66 kilograms) and was primarily designed to test the efficiency of various technical innovations, such as a new system of telemetry and solar cell assemblies. It also carried detectors to measure the density of high-speed micrometeoroid particles of space dust in the Earth's upper atmosphere.

Prosser, Gabriel: *see* Gabriel.

Prossnitz (Czechoslovakia): *see* Prostějov.

prostaglandin, any of a group of physiologically active substances having diverse hormone-like effects in animals. In terms of chemical structure, prostaglandins are 20-carbon fatty acid derivatives containing a 5-carbon ring. They were discovered in human semen in 1935 by the Swedish physiologist Ulf von Euler, who named them thinking that they were secreted by the prostate gland. They are now known to be of widespread occurrence in animal tissues, where they are formed from polyunsaturated fatty acids and are rapidly metabolized. Prostaglandins are very potent: some affect human blood pressure at concentrations as low as 0.1 microgram per kilogram of body weight. They also are diverse in their effects. Depending on their type, prostaglandins can stimulate smooth-muscle contraction; lower and, in some animals, raise blood pressure; decrease and increase the clotting ability of blood; enhance ion transport across some membranes; stimulate inflammation; and inhibit lipolysis (the breakdown of fat) in adipose tissue. A given prostaglandin may have different and even opposite effects in different tissues. Prostaglandins are receiving much attention, partly because of their potential therapeutic value, which includes control of cardiovascular disease and virus infections; they may be useful as contraceptives and in producing abortions in humans and livestock. Substances that inhibit prostaglandin synthesis may be useful in controlling pain, asthma attacks, and anaphylactic shock, and in reducing the clotting ability of blood.

prostate gland, chestnut-shaped reproductive organ located directly beneath the bladder in the male, which adds secretions to the sperm during the ejaculation (*q.v.*) of semen. The gland surrounds the urethra, the duct that serves for the passage of both urine and semen; rounded at the top, the gland narrows to form a blunt point at the bottom, or apex. The diameter in the broadest area is about 4 centimetres (1.6 inches). The two ejaculatory ducts, which carry sperm and the fluid secreted by the seminal vesicles, converge and narrow in the centre of the prostate and unite with the urethra; the urethra then continues to the lower segment of the prostate and exits near the apex.

The prostate gland is a conglomerate of 30 to 50 tubular or saclike glands that secrete fluids into the urethra and ejaculatory ducts. The secretory ducts and glands are lined with a moist, folded mucous membrane. The folds permit the tissue to expand while storing fluids. Beneath this layer is connective tissue composed of a thick network of elastic fibres and blood vessels. The tissue that surrounds the secretory ducts and glands is known as interstitial tissue; this contains muscle, elastic fibres, and collagen fibres that give the prostate gland support and firmness. The capsule enclosing the prostate is also of interstitial tissue.

In man, the prostate contributes 15–30 percent of the seminal plasma (or semen) secreted by the male. The fluid from the prostate is clear and slightly acidic. It is composed of several protein-splitting enzymes; fibrolysin, an enzyme that reduces blood and tissue fibres; citric acid and acid phosphatase, which help to increase the acidity; and other constituents, including ions and compounds of sodium, zinc, calcium, and potassium.

Normally the prostate reaches its mature size at puberty, between the ages of 10 and 14. Around the age of 50, the size of the prostate and the amount of its secretions commonly decrease. Increase in size after midlife, often making urination difficult, may occur as a result of inflammation or malignancy. Males who do not secrete adequate amounts of the male hormone androgen may maintain normal function of the prostate with injections of androgen. *See also* bulbourethral gland; seminal vesicle.

For a depiction of the prostate gland in human anatomy, shown in relation to other parts of the body, *see* the colour Trans-Vision in the PROPAEDIA: Part Four, Section 421.

prostatic disorder, any of the abnormalities and diseases that afflict the prostate gland in the male reproductive system. The prostate gland is dependent on the hormonal secretions of the testes for growth and development. When production of the male hormone (androgen) decreases, the prostate begins to degenerate. Boys who are castrated before reaching puberty do not develop an adult-sized or functioning prostate. When a normal man ages, changes gradually occur in the prostate. Between the fourth and sixth decades there is atrophy of the smooth muscles and an increase in fibrous scar tissue, collagen fibres (protein strands), and numbers of lymph cells. When a man passes the age of 60 years, the organ is largely replaced by fibrous tissue.

In men over the age of 60 years, enlargement (hyperplasia) of the prostate is relatively common. In the vast majority of cases it causes no symptomatic difficulties, though infection may occur, as may rupturing of blood vessels. Enlargement may cause compression of the urethra with progressive obstruction of the flow of urine, incomplete emptying, or inability to void; there may also be a constant dribbling of urine. The bladder is never totally emptied, however, and the remaining urine becomes stagnant and infection sets in. The stagnant urine may cause the precipitation of stones in the bladder; the bladder muscle thickens to overcome this obstruction. If urine begins to back up in the kidney, progressive damage may ensue, which can lead to kidney failure and subsequent uremia (the toxic effects of kidney failure).

Cancer of the prostate is one of the commonest cancers. It may manifest itself in three forms: (1) cancer producing symptoms leading directly to the prostate; (2) hidden cancer that causes no prostatic symptoms but spreads to certain other parts of the body; and (3) latent cancer, where a slow-growing mass is found, usually at autopsy. Latent tumours are found in 25 percent of the male population over the age of 40 years. The cancerous prostate is usually hard and dry and shows small islands of yellow cancer cells distributed throughout the tissue. The cancer may spread from the prostate to the floor of the bladder and to all of the reproductive ducts leading into the prostate. The pelvic and spinal lymph nodes are involved early, as well as the bones of the pelvis. Cancer may spread to the liver, lungs, or bone by way of the blood system; about 70 percent of the cases show bone involvement. Infections of the prostate are common and are usually caused by bacteria that inhabit the stool. Gonorrhea, a venereal disease, may also affect the prostate. Treatment is usually administration of antibiotics.

Prostějov, German PROSSNITZ, town, Jihomoravský *kraj* (South Moravia region), Czechoslovakia, just southwest of Olomouc, in the farming region of the Haná Plain. Founded in the 12th century, the town became a centre for publishing Czech and Hebrew books after 1500. The town hall has a Renaissance portal (1521) and contains a museum featuring a clock collection. The annual Haná Harvest Festival takes place in the amphitheatre and gardens of a castle at Náměšť na Hané, a few miles to the north. Industrial products include farm machinery, paper, and clothing. Pop. (1983 est.) 50,891.

prosthesis, artificial substitute for a missing part of the body. The artificial parts that are most commonly thought of as prostheses are those that replace lost arms and legs, but bone, artery, and heart valve replacements are common (*see* artificial organs), and artificial eyes and teeth are also correctly termed prostheses. The term is sometimes extended to cover such things as eyeglasses and hearing aids, which improve the functioning of a part. The medical specialty that deals with prostheses is called prosthetics. The origin of prosthetics as a science is attributed to the 16th-century French surgeon Ambroise Paré. Later workers developed upper-extremity replacements, including metal hands made either in one piece or with movable parts. The solid metal hand of the 16th and 17th centuries later gave way in great measure to a single hook or a leather-covered, nonfunctioning hand attached to the forearm by a leather or wooden shell. Improvement in the design of prostheses and increased acceptance of their use have accompanied major wars. New lightweight materials and better mechanical joints were introduced after World Wars I and II.

One type of below-knee prosthesis is made from plastic and fits the below-knee stump with total contact. It is held on either by means of a strap that passes above the kneecap or by means of rigid metal knee hinges attached to a leather thigh corset. Weight bearing is accomplished by pressure of the prosthesis against the tendon that extends from the kneecap to the lower legbone. In addition, a foot piece is commonly used that consists of a solid foot and ankle with layers of rubber in the heel to give a cushioning effect.

There are two main types of above-knee prostheses: (1) the prosthesis held on by means of a belt around the pelvis or suspended from the shoulder by straps and (2) the prosthesis kept in contact with the leg stump by suction, the belt and shoulder straps being eliminated.

The more complicated prosthesis used in cases of amputation through the hip joint or half of the pelvis usually consists of a plastic socket, in which the person virtually sits; a mechanical hip joint of metal; and a leather, plastic, or wooden thigh piece with the mechanical knee, shin portion, and foot as described above.

A great advance in fabrication of functional upper-extremity prostheses followed World War II. Arm prostheses came to be made of plastic, frequently reinforced with glass fibres.

The below-elbow prosthesis consists of a single plastic shell and a metal wrist joint to which is attached a terminal device, either a hook or a hand. The person wears a shoulder harness made of webbing, from which a steel cable extends to the terminal device. When the person shrugs the shoulder, thus tightening the cable, the terminal device opens and closes. In certain cases the biceps muscle may be attached to the prosthesis by a surgical operation known as cineplasty. This procedure makes it possible to dispense with the shoulder harness and allows finer control of the terminal device. The above-elbow prosthesis has, in addition to the forearm shell, an upper-arm plastic shell and a mechanical, locking elbow joint. This complicates its use, inasmuch as there must be one cable control for the terminal device and another control to lock and unlock the elbow. The most complicated upper-extremity prosthesis, that used in cases of amputation through the shoulder, includes a plastic shoulder cap extending over the chest and back. Usually no shoulder rotation is possible, but the mechanical elbow and terminal device function as in other arm prostheses.

A metal hook that opens and closes as two fingers is the most commonly used terminal device and the most efficient. After World War II the APRL hand (from U.S. Army Prosthetic Research Laboratory) was developed. This is a metal mechanical hand covered by a rubber glove of a colour similar to that of the patient's remaining hand. Many attempts have been made to use electrical energy as the source of hook or hand control. This is done primarily by building into the arm prosthesis electrodes that are activated by the patient's own muscle contractions. The electric current generated by these muscle contractions is then amplified by means of electrical components and batteries to control the terminal device. Such an arrangement is referred to as a myoelectrical control system.

prosthodontics, also called PROSTHODONTIA, dental specialty concerned with restoration and maintenance of oral function, appearance, and comfort by use of prostheses. The oral prostheses replacing teeth may be removable dentures or partial dentures or permanently fixed tooth prostheses, connected to remaining teeth or implanted in the alveolar bone. Other prostheses include crowns and caps that replace the outer portions of teeth and protect the remaining structure. Prosthodontics also provides oral prostheses to correct deformities, such as cleft palate, and to replace alveolar bone in order to provide underlying support for dentures.

Maxillofacial prosthodontics, a subspecialty of prosthodontics, is concerned with the correction of deformities of the face and head and restoration of normal function by means of prostheses. Deformities may be congenital, acquired (through trauma or surgical treatment, as of cancer), or developmental (stemming from some other disorder). Prostheses are also used as an interim measure to correct defects until surgical reconstruction can be undertaken.

prostitution, the practice of engaging in relatively indiscriminate sexual activity, in general with individuals other than a spouse or friend, in exchange for immediate payment in money or other valuables.

The definition of prostitution is based on culturally determined values that differ in various societies and circumstances. Prostitutes may be of either sex and may hire their bodies for heterosexual or homosexual activity, but the majority of prostitution has been among females, with males as clients. Through the ages prostitutes have been shunned and reviled by society in general, and punishments have included stoning, whipping, branding, imprisonment, and death. Their clients, on the other hand, have rarely been touched by the law, and in fact in many societies the frequenting of prostitutes may rouse some public indignation but is also considered to be a sign of virility.

Among some peoples prostitution has been required of young girls as a puberty rite or as a means of acquiring a dowry, and some religions have required prostitution of a certain class of priestesses. The ancient Greeks and Romans required that prostitutes wear distinctive dress and pay severe taxes.

Hebrew law did not forbid prostitution but confined the practice to foreign women. Among the ordinances laid down by Moses to regulate public health were several dealing with the transmission of venereal disease.

In Europe during the Middle Ages there were some attempts by church leaders to rehabilitate penitent prostitutes and fund their dowries. In a society governed, however, by the cult of courtly love, where women even of the highest rank were chattel bound into marriages to fulfill political and financial arrangements, prostitution flourished. It was not merely tolerated but was protected, licensed, and regulated by law, and it constituted a large source of public revenue. Public brothels on a large scale were established in large cities throughout Europe: at Toulouse the profits were shared between the city and the university; in England the bordellos were originally licensed by the bishops of Winchester and subsequently by Parliament.

Stricter controls were imposed with the outbreak of an epidemic of venereal disease in the 16th century and with the advent of new ideas of sexual morality brought in with the Reformation. Brothels were closed throughout Europe, and when disease continued to claim victims, regulations became even more stringent. Some cities passed laws requiring periodic medical inspection, but to little avail.

International cooperation to stamp out the traffic in women for the purpose of prostitution was begun in 1899. In 1921 the League of Nations established the Committee on the Traffic in Women and Children, and in 1949 the United Nations General Assembly adopted a convention for the suppression of prostitution.

In the United States prostitution flourished in almost every city and was virtually uncontrolled until the passage of the Mann Act (1910), which prohibited interstate transportation of women for immoral purposes. By 1915 nearly all states had passed laws banning brothels and regulating the profits of prostitution.

In most large Western cities prostitution is tolerated: law enforcement agencies are more concerned with regulating the crimes associated with prostitution. A British parliamentary act of 1959 prohibits open solicitation by prostitutes but permits them to operate in their own homes and provides rehabilitative training to all who wish to change trades. Regulations in Scandinavian countries emphasize hygienic aspects, require frequent medical examination, and provide free mandatory hospitalization for anyone found to be infected with venereal disease.

Soviet and Chinese officials maintain that prostitution no longer exists in their countries. Throughout Asia the trade continues to flourish openly. Until the mid-20th century it was almost the only occupation open to women responsible for their own support. In most Eastern countries prostitution is an urban problem, but in India a majority of prostitutes are in rural areas.

Female prostitutes are very often economically disadvantaged and are usually unmarried and lack skills to support themselves. Many are drawn at an early age into the subculture of prostitution and associated crime. They frequently are associated with a male procuror, or pimp, or with a house of prostitution, or brothel, managed by a supervisor, or madam. In exchange for residence, appointments, and protection, the prostitute must share a large portion of her earnings with her pimp or madam. Health hazards to female prostitutes include venereal diseases, acquired through indiscriminate sexual contact, and, in some subcultures, drug abuse.

Male prostitution has received less public attention in most cultures. Heterosexual male prostitution—males hired by or for females—is very rare. Homosexual male prostitution, however, has become increasingly common, in large cities in particular, in the 20th century.

protactinium (Pa), radioactive chemical element of the actinide series, in Group IIIb of the periodic table, rarer than radium; its atomic number is 91. It occurs in all uranium ores to the extent of 0.34 part per million of uranium and was first isolated (1934) in metallic form by Aristid V. Grosse. The first isotope, protactinium-234, was discovered (1913) by Kasimir Fajans and O.H. Göhring and named brevium, afterward uranium X_2, because it was a short-lived member of the uranium radioactive decay series. The long-lived isotope protactinium-231 was discovered (1917) independently by Otto Hahn and Lise Meitner in pitchblende, by Fajans, and by Frederick Soddy, John Cranston, and Sir Alexander Fleck. This isotope decays to actinium-227 with a half-life of 32,500 years.

All of the more than a dozen isotopes are radioactive; synthetic protactinium-233 is of special interest because it is the progenitor of the fissile uranium isotope uranium-233 in the production of nuclear fuel from thorium. Protactinium in most of its compounds exhibits an oxidation state of +5 (thus resembling tantalum) but also can be obtained in the +4 state. Its compounds readily hydrolyze in water, forming colloids, but dissolve by forming complex ions (as with the fluoride ion in hydrofluoric acid).

atomic number	91
stablest isotope	231
valence	4,5
electronic config.	2-8-18-32-20-9-2 or (Rn)$5f^26d^17s^2$

protactinium-231–thorium-230 dating, method of age determination that makes use of the quantities of certain protactinium and thorium isotopes in a marine sediment. Protactinium and thorium have very similar chemical properties and appear to be precipitated at the same rates in marine sediments. The isotopes protactinium-231 and thorium-230 are both radioactive and decay with half-lives of 32,500 years and 80,000 years, respectively. The ratio of the two radioactive isotopes constitutes a better radioactive geochronometer than either of them separately, because they do not need to have a uniform sedimentation rate through time but need only be precipitated in the same proportion. It is likely that this condition will hold even though the rate of sedimentation may vary. Sediments as old as 175,000 years may be dated by this method.

protagonist, in ancient Greek drama, the first or leading actor. The poet Thespis is credited with having invented tragedy when he introduced this first actor into Greek drama, which formerly consisted only of choric dancing and recitation. The protagonist stood opposite the chorus and engaged in an interchange of questions and answers. According to Aristotle in his *Poetics,* Aeschylus brought in a second actor, or deuteragonist, and presented the first dialogue between two characters. Aeschylus' younger rival, Sophocles, then added a third actor, the tritagonist, and was able to write more complex, more natural dialogue. That there were only three actors did not limit the number of characters to three because one actor would play more than one character.

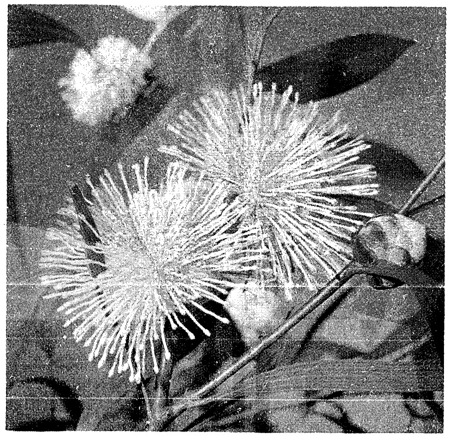
In the early days of Greek drama, the poets themselves chose and often trained their own actors. By 449 BC, however, the leading actors for each play were chosen by the chief magistrates of Athens, the archons. These leading actors, the protagonists, were then in charge of selecting their own supporting actors, the deuteragonists and tritagonists. The protagonists also competed for acting prizes that were independent of the contests for the best tragedies. The term protagonist has since come to be used for the principal character in a novel, story, or drama.

Protagoras (b. *c.* 485 BC, Abdera, Greece—d. *c.* 410), Greek thinker and teacher who was the first and most famous of the Greek Sophists.

He spent most of his life at Athens, where he exercised considerable influence over contemporary thought on moral and political questions. Plato named one of his dialogues after him. Protagoras taught as a Sophist for more than 40 years, claiming to teach men "virtue" in the conduct of their daily lives. He is best known for his dictum "Man is the measure of all things," probably an expression of the relativity to the individual of all perceptions and, according to some, of all judgments as well. He acquired great wealth and reputation from his teaching, prompting his appointment as lawgiver for the Athenian colony of Thurii in Italy. Though he adopted conventional moral ideas, Protagoras expressed his agnostic attitude toward belief in the gods in *Concerning the Gods.* He was accused of impiety, his books were publicly burned, and he was exiled from Athens *c.* 415 BC for the rest of his life.

protamine, simple alkaline protein usually occurring in combination with a nucleic acid as a nucleoprotein. In the 1870s Johann Friedrich Miescher discovered a protamine, salmine, in the sperm of salmon. Other typical protamines include sturine, from sturgeon, and clupeine, from herring sperm. The drug protamine sulfate, prepared from the sperm of various fishes, is used as an antidote to overdoses of the anticoagulant heparin.

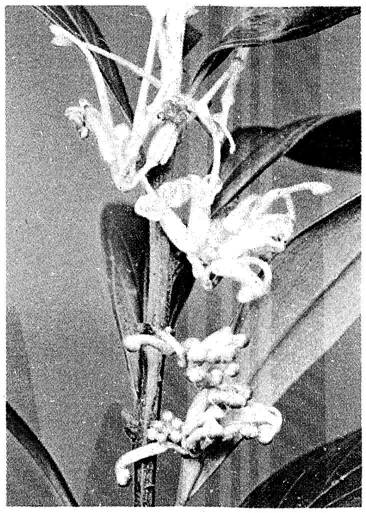
Proteales, order of dicotyledonous flowering plants comprising the family Proteaceae,



Hakea laurina
F. Collet—Photo Researchers

with 62 genera of shrubs and trees confined mainly to the Southern Hemisphere, mostly in Australia (750 species) and South Africa and Madagascar (350 species). They also occur in Malaysia, southeastern Asia, some Pacific islands, and Central and South America.

The plants are characterized by flowers that are usually individually small but that are combined into dense, often showy inflorescences (clusters). They have a four-parted perianth (whorl of petallike parts) with the four stamens (male pollen-producing structures) located on the tips of the perianth segments, sometimes with only the anther (pollen sac) exposed. The simple or much-divided leaves are typically spirally arranged and are often covered thickly with hairs or have a thick cuticle, adaptations that help retard water loss. The plants typically grow in regions that have a long dry season each year.



Grevillea oleides
W.H. Hodge

The chief genera are *Grevillea* (190 species), *Protea* (130 species), *Hakea* (100 species), *Helicia* (90 species), *Leucodendron* (70 species), and *Persoonia* (60 species).

In warm regions several species are cultivated as ornamentals, including the silver-tree (*Leucodendron argenteum*), the leaves of which are covered with fine silky hairs; the Australian honeysuckles (*Banksia* species); the fire bushes or fire trees (*Embothrium* species); and the hakeas (*Hakea* species). The silky oak (*Grevillea robusta*), native to Australia, is widely grown in warm climates. The Queensland or Macadamia nut (*Macadamia integrifolia*) is grown for its edible seeds.

protection, equal (law): *see* equal protection.

protectionism, policy of protecting domestic industries against foreign competition by means of tariffs, subsidies, or import quotas. Protectionist policies have been implemented by many countries despite the fact that the world economy generally benefits from free trade.

Protective tariffs are often used to stimulate industries in a country beset by recession or depression. Protectionism is especially helpful to infant industries in developing nations and as a means of fostering self-sufficiency in defense industries. Import quotas, which set a maximum level of certain goods that can be imported into a country, are used for the same reasons as protective tariffs but usually with greater effect. While goods may continue to be imported despite protective tariffs, no goods can be imported above an import quota.

A spurning of protectionism in favor of free trade by Great Britain in the early 1800s led to the repeal of the statutory protective tariffs known as the Corn Laws in 1846. By the early 20th century, however, Britain was encountering increased industrial competition, and during the Great Depression of the 1930s, protectionism was adopted again. Britain remained highly protectionist until 1973, when it joined the European Economic Community (EEC). The United States has tended to be a protectionist country, with protective tariffs reaching their high points in the 1820s, when nearly 70 percent of import values were collected in customs duties, and in 1934, when a similar rate was collected under the Smoot-Hawley Act of 1930.

The proliferation of high protective tariffs around the world led 23 nations to sign reciprocal trade agreements, in the form of the General Agreement on Tariffs and Trade (GATT), in 1947; by 1975, 70 nations had adhered to GATT guidelines. Reciprocity only limits protectionism, however, and the call for protective legislation is still heard whenever an industry suffers from foreign competition.

Protector, the: *see* Somerset, Edward Seymour, 1st duke of.

protectorate, in international relations, the relationship between two states one of which exercises some decisive control over the other. The degree of control may vary from a situation in which the protecting state guarantees and protects the safety of the other, such as the status afforded to the Kingdom of Bhutan by India, to one that is a masked form of annexation, in the manner of the German protectorate established in Czechoslovakia in March 1939.

The use of the term protectorate to describe such a relationship is a recent one, dating from the 19th century. Nevertheless, the relationship is an ancient one. In dealing with dependent nations Rome used terms that veiled subjection; the kingdoms of Numidia, Macedonia, Syria, and Pergamum were examples of protected states, their rulers being termed *inservientes* (subjects). In medieval Europe the relation existed, but the relationship of subordination of one state to another was invariably expressed in terms of feudal law. One state was deemed the vassal of another, and the ruler of one did homage to the other. In the 16th century the rise of European national states led to increasing use of the system of protectorates as a prelude to annexation, particularly by France. This use was also developed during the 19th century as a means of colonial expansion or as a means of maintaining the balance of power. Thus, by the Treaty of Paris (1815) the Ionian Islands became a protectorate of Great Britain in order to prevent Austria from gaining complete control of the Adriatic. Later in the century, a curious situation arose with the disintegration of the Ottoman Empire. Provinces that owed allegiance to Turkey began to revolt against Turkish rule and, as a stage in their struggle for independence, were sometimes placed under the protection of a foreign power. Thus, Moldavia and Walachia, which became protectorates of Russia in 1829, were placed under international protection in 1856 and in 1878 united to form the independent state of Romania.

In modern times, the majority of protectorates have been established by treaty by the terms of which the weaker state surrenders the management of all its more important international relations—although some protectorates have been imposed by force (*e.g.,* the unilateral declaration by Great Britain concerning Egypt in 1914). The treaty defines the position of the protected state in the international community, with special reference to its treaty-making powers and its right to diplomatic and consular representation. There is a conflict of opinion whether or not the protected state thus loses its sovereignty. Many writers have supported the view that there is no such loss, but it is now generally accepted that the relationship of protectorate must be recognized by third powers. The right of the protecting state to interfere in all matters of external affairs constitutes a definite loss of sovereignty, and since in orthodox theory sovereignty is one and indivisible, such a situation must imply a loss of sovereignty on the part of the weaker state. It is equally clear that, on the assumption of the status of protectorate, the weaker state ceased to qualify for membership in the United Nations.

protein, complex molecule composed of amino acids and necessary for the chemical processes that occur in living organisms.

A brief treatment of proteins follows. For full treatment, *see* MACROPAEDIA: Biochemical Components of Organisms.

Proteins are sometimes referred to as macromolecular peptides because they are very large molecules and because the amino acids of which they are composed are joined by peptide bonds. (A peptide bond is a link between the amino, NH_2, group of one amino acid and the carboxyl, COOH, group of another.) Although amino acids may have other formulas, those in protein invariably have the general formula $RCH(NH_2)COOH$, where C is carbon, H is hydrogen, N is nitrogen, O is oxygen, and R is a group, varying in composition and structure, called a side chain. Amino acids are joined together to form long chains. Most of the common proteins contain more than 100 amino acids.

The vast majority of the proteins found in living organisms are composed of only 20 different kinds of amino acids, repeated many times and strung together in a particular order. Each type of protein has its own unique sequence of amino acids; this sequence, known as its primary structure, actually determines the shape and function of the protein.

Interactions among the amino acids cause the protein chain to assume a characteristic secondary structure and, under some circumstances, a tertiary structure. The secondary structure is a function of the angles formed by the peptide bonds that link together the amino acids. These bond angles are held in position by the development of hydrogen bonds between the nitrogen atom of one amino-acid unit and the oxygen atom of another. Commonly, these hydrogen bonds cause the chain to assume a helical secondary structure—*i.e.,* the backbone of the chain resembles a rope spirally wound along an imaginary tube.

The tertiary structure refers to the looping and folding of the protein chain back upon itself. Such a structure characterizes the globular proteins (*i.e.,* those with a more or less spherical shape). Tertiary structure is determined largely by the side chains of the amino acids. Some side chains are so large that they disrupt the regular helical secondary structure of the chain, causing it to have kinks and bends. Furthermore, side chains that carry opposite electrical charges attract one another and form ionic bonds; those with like electrical charges repel one another. Hydrophobic side chains—*i.e.,* those that are insoluble in water—cluster together at the centre of the folded protein, avoiding exposure to the aqueous environment. Hydrophilic side chains, which readily form hydrogen bonds with water molecules, are left on the outside of the protein structure. A type of covalent bond known as a disulfide bridge frequently forms between the sulfur-containing side chains of two cysteine amino acids. Disulfide bridges stabilize looping sections of the protein chain.

Some proteins, such as hemoglobin, are composed of more than one protein subunit (polypeptide chain). The spatial conformation of these chains is known as the quaternary structure. Quaternary structure is maintained by the same kinds of forces that determine tertiary structure.

Proteins may be classified according to several methods. For example, they are sometimes classified as either simple or conjugated. Simple proteins are those that consist only of amino acids. Conjugated proteins contain not only amino acids but also nonamino-acid prosthetic groups. A prosthetic group may be a carbohydrate, lipid, nucleic acid, metal, pigment, or some other nonprotein molecule or ion. Many of these substances are vitamins or metals (trace elements) needed in small amounts in the diet. Hemoglobin is a well-known example of a conjugated protein. A hemoglobin molecule contains four prosthetic groups, each consisting of the metal iron and the pigment porphyrin. These prosthetic groups enable hemoglobin to carry oxygen through the bloodstream.

Proteins are also classified according to their function. Under this scheme, they can be divided into two main categories: structural proteins and biologically active proteins. A drawback to this system is that some proteins serve both as structural elements and as biologically active compounds. Most structural proteins are fibrous—*i.e.,* they are composed of elongated, threadlike chains. Major structural proteins in animals include collagen, which is the protein of bones, tendons, ligaments, and skin; and keratin, the protein of hair, nails, hoofs, and feathers. Biologically active proteins are mostly globular, their functional activity being directly related to their complex three-dimensional shape. Major kinds of biologically active proteins include enzymes, which catalyze chemical reactions in living systems; protein hormones, which serve as chemical messengers between different parts of the body; transport proteins, which carry substances from one part of the body to another; and immunoglobulins (or antibodies), which protect the body from microorganisms and other foreign substances.

The sequence of amino acids in all proteins is genetically determined by the sequence of nucleotides in cellular DNA. When a particular protein is needed, the DNA code for that protein is transcribed into a sequence of complementary nucleotides along a segment of RNA. This RNA segment then serves as a template for subsequent protein synthesis. Each group of three nucleotides specifies a particular amino acid; the amino acids are assembled into the sequence coded by the RNA. Some diseases, such as sickle-cell anemia, result from a change that takes place in a single amino acid in a protein.

protein-bound iodine test, also called PBI TEST, laboratory test that assesses thyroid function by measuring the concentration of thyroid hormones circulating in the bloodstream. These hormones, which contain iodine, are normally transported in the bloodstream by carrier proteins. In the PBI test these carrier proteins are precipitated from the blood, and the quantity of bound iodine is measured. Under certain abnormal circumstances, protein-bound iodine may be partly derived from iodinated substances other than the thyroid hormones. The butanol-extraction iodine test, which roughly parallels the PBI test, serves to separate the thyroid hormones from other types of iodinated components. *See also* thyroid function test.

protein concentrate, a human or animal dietary supplement that has a very high protein content and is extracted or prepared from vegetable or animal matter. The most common of such substances are leaf protein concentrate (LPC) and fish protein concentrate (FPC).

LPC is prepared by grinding young leaves to a pulp, pressing the paste, then isolating a liquid fraction containing protein by filter or centrifuge. Herbaceous plants and legumes, such as clover and lucerne, produce higher yields of protein concentrate than perennial grasses. The protein quality of some LPCs has been found to approach that of the soybean, the most protein rich of the oilseeds; all LPCs require supplements, however, because they are deficient in two of the nutritionally essential amino acids, lysine and methionine.

FPC, processed directly from fish, is most commonly incorporated in cereal or wheat-based foods as a source of lysine. FPC flour is made by grinding the fish and adding to it an isopropanol solvent, which effects a separation of liquids and solids; the solid material is then extracted by centrifuge, and the process may be repeated several times. After the final centrifuging, the solid material is dried and ground.

protein malnutrition: *see* kwashiorkor.

proteinase: *see* proteolytic enzyme.

proteinosis, alveolar (medicine): *see* alveolar proteinosis.

proteinuria, also called ALBUMINURIA, presence of protein in the urine, usually in the form of albumin. Protein is not normally found in the urine of healthy persons, although it is sometimes found in young people and pregnant women who have urinated from an upright position; this condition, known as orthostatic proteinuria, is harmless. Light proteinuria is associated with diseases such as kidney infections and congestive heart failure; heavy proteinuria (excretion of more than 4 grams of protein per day) is an indication of serious kidney disease.

proteolytic enzyme, also called PROTEINASE, any of a group of enzymes that break the long chainlike molecules of proteins into shorter fragments (peptides) and eventually into their components, amino acids. Proteolytic enzymes are present in bacteria and plants but are most abundant in animals. In the stomach, protein materials are attacked initially by the gastric enzyme pepsin. When the protein material is passed to the small intestine, proteins, only partially digested in the stomach, are further attacked by proteolytic enzymes secreted by the pancreas.

These enzymes are liberated in the small intestine from inactive precursors produced by the acinar cells in the pancreas. The precursors are called trypsinogen, chymotrypsinogen, proelastase, and procarboxypeptidase. When the pancreatic enzymes become activated in the intestine, they convert proteins into free amino acids, which are easily absorbed by the cells of the intestinal wall.

Trypsinogen is transformed to trypsin by an enzyme (enterokinase) secreted from the walls of the small intestine. Trypsin then activates the precursors of chymotrypsin, elastase, and carboxypeptidase.

The pancreas produces a protein that inhibits trypsin. It is thought that in this manner the pancreas protects itself from autodigestion.

Fragments of proteins not fully hydrolyzed by the proteolytic enzymes are usually digested by enzymes in the mucous membrane lining the intestinal wall.

proteomyxid (subclass Proteomyxidia), any of various microorganisms (class Actinopodea), most of which are parasites in freshwater and saltwater algae or in other plants. Their pseudopodia (cytoplasmic extensions) often fuse. Proteomyxida that have radiating pseudopodia (*e.g., Vampyrella*) resemble heliozoans, another protozoan group. Their life cycle, which is not completely known for many species, may include flagellated and amoeboid (*i.e.,* with pseudopodia) phases. Proteomyxida open the cell wall of algae, insert pseudopodia, and digest the cell.

Proterozoic Eon, the younger of the two divisions of Precambrian time, extending from 2.5 billion to 570 million years ago. It is often divided into the Early Proterozoic Era (2.5 to 1.6 billion years ago), the Middle Proterozoic Era (1.6 billion to 900 million years ago), and the Late Proterozoic Era (900 to 570 million years ago). Proterozoic rocks have been identified on all the continents and often constitute important sources of metallic ores, notably of iron, gold, copper, uranium, and nickel. It is thought that the many small protocontinents that had formed during early Precambrian time coalesced into one or several large landmasses by the initial segment of the Proterozoic. Rocks of the Proterozoic contain many definite traces of primitive life-forms—*e.g.,* the fossil remains of such microorganisms as bacteria and blue-green algae. *See* Precambrian time.

Protesilaus, Greek mythological hero in the Trojan War, leader of the force from Phylace and other Thessalian cities west of the Pegasaean Gulf. Though aware that an oracle had foretold death for the first of the invading Greeks to land at Troy, he was the first ashore and the first to fall. His bride, Laodameia, was so grief stricken that the gods granted her request that Protesilaus be allowed to return from the dead for three hours. At the expiration of the time she accompanied him to the underworld, either by taking her own life or by immolating herself in the flames in which her father burned the waxen image of Protesilaus that she had been cherishing.

Protestant Episcopal Church, also called EPISCOPAL CHURCH, autonomous church in the United States. It was part of the Anglican Communion, formally organized in Philadelphia in 1789 as the successor to the Church of England in the American Colonies. In points of doctrine, worship, and ministerial order, the church descended from and has remained associated with the Church of England.

The history of the church began with the first permanent English settlement at Jamestown, Va., in 1607. As more settlers arrived in America, the church spread and was the established church in several colonies. It was limited in its work, however, because no bishop was sent to the colonies, and only bishops could ordain priests and confirm church members. When the American War of Independence began in 1775, there were about 300 Church of England congregations in the 13 colonies. The church suffered persecution and a decline in membership during the Revolution, since all of the clergymen had taken an oath of allegiance to the crown at the time of their ordination, and many of them were Loyalists who were forced to flee to Canada or England.

Some, however, supported the Revolution. William White, chaplain of the Continental Congress, proposed that congregations form themselves into an American church that would continue the spiritual legacy of the Church of England but would otherwise separate from it. Conventions of clergy and laity were held in the early 1780s to claim church property formerly claimed by the Church of England and to plan for a new church. Interstate conventions in 1784 and 1785 began drafting a constitution and prayer book. In 1787 English bishops consecrated White as bishop of Pennsylvania and Samuel Provoost as bishop of New York. Earlier, in 1784, Samuel Seabury of Connecticut had been consecrated by Scottish bishops.

In the 19th century the church expanded westward through the work of the Domestic and Foreign Missionary Society (organized in 1820). Foreign missions were begun in Greece in 1829 and subsequently expanded to other countries.

The Oxford Movement in the Church of England, which emphasized the Roman Catholic heritage of the church (High Church), became influential in the Protestant Episcopal Church in the 1840s. Though it enriched the worship services and spiritual discipline of the church, it caused considerable controversy, because many Episcopalians preferred to emphasize the Protestant heritage (Low Church). In later years the promotion of liberal theology, biblical criticism, the Social Gospel, and the ecumenical movement lessened the tensions between the High and Low Church attitudes.

During the American Civil War, Episcopalians fought for both the South and the North. Unlike several other Protestant churches, however, the Episcopal Church avoided schism.

The church inherited its doctrinal statements from the Church of England, but it does not apply these statements as rigid confessions. It accepts the Apostles' and Nicene creeds and its prayer book as statements of its doctrinal positions. The Thirty-nine Articles of the Church of England, slightly adapted for American circumstances, are part of the prayer book and of official doctrine, but formal acceptance of them is not required of the clergy or laity.

In the organization of the church, each self-supporting congregation (parish) elects its lay governing board (vestry) for temporal affairs and its rector as spiritual leader. Congregations that are not self-supporting (missions) are directed by the bishop of the area. In a given area the parishes and missions make up a diocese, headed by a bishop. All clergy and laity representing all congregations meet annually in convention to conduct the business of the diocese. The convention elects the bishop to serve until death or retirement.

The dioceses and mission districts belong to the General Convention, which meets triennially. All bishops are members of the House of Bishops, and the House of Delegates is made up of equal numbers of clergy and laity. The Executive Council, the administrative agency of the General Convention, is headed by the Presiding Bishop (elected by the House of Bishops), who also presides over the House of Bishops. Headquarters are in New York City.

Protestant ethic, the value attached to hard work, thrift, and efficiency in one's worldly calling, which, especially in the Calvinist view, were deemed signs of an individual's election, or eternal salvation.

The German sociologist Max Weber in *The Protestant Ethic and the Spirit of Capitalism* (1904–05) held that the Protestant ethic was an important factor in the economic success of Protestant groups in the early stages of European capitalism, for, because worldly success came to be interpreted as a sign of election, it was vigorously pursued. Calvinism's antipathy to the worship of the flesh, its emphasis on the religious duty to make fruitful use of the God-given resources that each individual had at his disposal, and its orderliness and systemization of ways of life were also regarded by Weber as economically significant aspects of the ethic.

Weber's thesis has been subject to criticism by various writers. Although the English historian R.H. Tawney (*q.v.*) accepted Weber's thesis, he expanded it in his *Religion and the Rise of Capitalism* (1926) by arguing that political and social pressures and the spirit of individualism with its ethic of self-help and frugality were more significant factors in the development of capitalism than Calvinist theology. In general, Weber's monocausal explanation for the rise of capitalism has been abandoned in favour of multicausal explanations.

Protestant Orthodoxy, also called PROTESTANT SCHOLASTICISM, phase of orthodoxy that both Lutheran and Reformed theology went through after the 16th-century Reformation.

In the Lutheran church the period of orthodoxy began around 1560 with the theological effort to reunite the factions that had developed after Martin Luther's death. The "golden age" of orthodoxy ended about 1700, but it remained a potent force in Europe until about 1800.

The central aspects of orthodox Lutheran theology included the primacy of God's Word; the forgiveness of sins exclusively by divine grace for Christ's sake through faith as the core of the biblical message; and the vital roles of baptism, absolution, the Eucharist, and the sacred ministry. Other key aspects were reverence for the inherited expressions of the mind of the historic church, especially in the doctrine of Christ, and a strong defense of the Lutheran position in comparison with Roman Catholicism, Reformed Protestantism, and Socinianism, a form of Unitarianism.

The era of Reformed orthodoxy began shortly after the death of John Calvin (1564) and ended about 1700. Reformed theologians originally called themselves orthodox in contrast to Roman Catholics and to Lutherans, whom they regarded as only imperfectly reformed. The term soon came to designate a special type of rigid Calvinism, which, in its severe form, stood in conscious opposition to Arminianism and Socinianism, as well as to Roman Catholicism and Lutheranism.

The architects of Reformed orthodoxy were Theodore Beza, Calvin's successor at Geneva, and Hieronymus Zanchius (also known as Girolamo Zanchi), professor at Neustadt an der Haardt, Ger. Beza worked to preserve the theology contained in Calvin's *Institutes of the Christian Religion.* According to Beza the capstone of this system was the doctrine of an absolute decree by which God predestined some persons to everlasting life and others to hell. Unlike Calvin, Beza was moved by philosophical as well as biblical considerations. Zanchius gave Reformed orthodoxy its classic formulation of the doctrine of the perseverance of the elect.

Additional features generally characteristic of Reformed orthodoxy were a doctrine of the sacraments that stressed their symbolic nature; an ethical approach to repentance; a presbyterian form of church government; stress on church discipline and practical Christianity; and, in comparison with Lutheranism, a more literal approach to the Bible and a greater separation of the divine and human natures in Christ.

The strongholds of Reformed orthodoxy were in Switzerland and the Netherlands. Presbyterianism in Great Britain and early American Puritanism were generally orthodox. The French Reformed community formally accepted the canons of Dort (1619), a Reformed orthodox confession, but amid the political confusion of the period a vocal humanistic opposition developed. German Reformed theology, like Anglicanism, was never orthodox in the strict sense. The German Heidelberg Catechism taught a rather mild Calvinism.

Protestant Orthodoxy, in both its Lutheran and Reformed types, was changed by Pietism, science, and philosophy in the 18th century.

Protestant Union, also called EVANGELICAL UNION, or UNION OF AUHAUSEN, German PROTESTANTISCHE UNION, EVANGELISCHE UNION, or UNION VON AUHAUSEN, military alliance (1608–21) among the Protestant states of Germany for mutual protection against the growing power of the Roman Catholic states of Counter-Reformation Europe. In 1608, when Maximilian I, duke of Bavaria and champion of the Roman Catholic cause, seized control of the Lutheran city of Donauwörth, the Protestant princes met in Auhausen, near Nördlingen, and on May 14 formed a military union under the nominal leadership of Frederick IV of the Palatinate. The Protestant Union's real leader, however, was Christian I, prince of the minor northern German state of Anhalt. The Union's members included the Palatinate, Anhalt, Neuberg, Württemberg, Baden, Ansbach, Bayreuth, Hesse-Kassel, Brandenburg, Ulm, Strassburg, and Nürnberg. The formation of the Union provoked the counter-alliance of the Catholic League (1609) under Maximilian.

From its beginnings, the Union was beset with internal strife between its Lutheran and Calvinist members and between the cities and the territorial magnates. The powerful Protestant elector of Saxony refused to join, and the membership remained relatively small. When, in 1620, the forces of the League were poised for attack against Frederick V of the Palatinate, who had accepted the Bohemian crown, the Union's members, guaranteed of their prerogatives by Maximilian, refused to go to Frederick's aid. After Frederick was deposed by Roman Catholic armies in November 1620, the Union's members met in protest at Heidelberg but soon disbanded, never again to reconvene.

Protestantism, one of the three major branches of Christianity, originating in the 16th-century Reformation, characterized by its doctrines of justification by grace through faith, the priesthood of all believers, and the authority of the Holy Scriptures.

A brief treatment of Protestantism follows. For full treatment, *see* MACROPAEDIA: Protestantism.

The historical origin of the word Protestant is in the second imperial Diet of Speyer (1529), which reversed by a majority vote the decision of the first Diet of Speyer (1526) to allow each prince of the Holy Roman Empire to determine the religion of his territory. The minority, consisting of 6 princes and 14 cities, issued a formal *Protestation,* the primary purpose of which was to protest that "in matters which concern God's honour and salvation and the eternal life of our souls, everyone must stand and give account before God for himself." A secondary purpose was to protest against the ban on the expansion of evangelical religion.

The supporters of the Reformation doctrines gradually came to be called Protestants both by their opponents and by themselves, since it was a convenient name to cover the many varieties of Reformed Christianity. It spread from the continent of Europe to England, where, since 1689, the coronation service has contained an oath to defend the "Protestant Reformed Religion by law established." The non-Anglican Reformed churches in Great Britain have accepted the name as a true description of themselves since the 17th century, and this is also the case in the United States and the other English-speaking countries. No communion incorporated the word Protestant into its title, however, until this was done by the Protestant Episcopal Church of America. The 19th-century Oxford Movement persuaded an increasingly large number of clergy and laity of the Church of England to repudiate the word Protestant as a description of their church. The term is officially used on both sides of the Atlantic Ocean by a number of societies propagating the view that the principles of the Reformation are being neglected.

The basic doctrines of Protestantism at the Reformation, in addition to those of the creeds, were the supremacy of Holy Scripture in matters of faith and order, the justification by grace alone through faith alone, and the priesthood of all believers. There has been variation in sacramental doctrine among Protestants, but the limitation of the number to the two "sacraments of the Gospel," baptism and Holy Communion, has been almost universal. In the 18th century the Enlightenment produced liberal Protestantism, which cast doubt on some doctrines in the creeds and stressed reason, religious experience, and the principle of private judgment in a way that would have been repugnant to the original Reformers. But this form of Protestantism was a spent force by the end of World War I. Through the efforts of such thinkers as Søren Kierkegaard and Karl Barth, Protestant theology and devotion have regained their objectivity with, at the same time, a deeper appreciation of the values of pre-Reformation Christianity. Though the doctrine of the verbal inerrancy of Scripture is maintained by several Protestant groups, the supremacy of the biblical revelation usually has been reasserted without it.

See also Reformation.

Proteus, in Greek mythology, the prophetic old man of the sea and shepherd of the sea's flocks (*e.g.,* seals). He was subject to the sea god Poseidon, and his dwelling place was either the island of Pharos, near the mouth of the Nile River, or the island of Carpathus, between Crete and Rhodes. He knew all things—past, present, and future—but disliked telling what he knew. Those who wished to consult him had first to surprise and bind him during his noonday slumber. Even when caught he would try to escape by assuming all sorts of shapes. But if his captor held him fast, the god at last returned to his proper shape, gave the wished-for answer, and plunged into the sea. From his power of assuming whatever shape he pleased, Proteus came to be regarded by some as a symbol of the original matter from which the world was created.

Protevangelium of James, pseudepigraphal (noncanonical and unauthentic) work written about the mid-2nd century AD to enhance the role of Mary, the mother of Jesus, in Christian tradition. The story of Mary's childhood as given in the *Protevangelium* has no parallel in the New Testament, and reference to a nine-year stay in the Temple of Jerusalem contradicts Jewish customs. Mary's birth to aged parents is termed miraculous, and after the birth of Jesus a midwife is said to have confirmed that Mary was still a virgin. The *Protevangelium* modified the nativity narratives of Matthew and Luke. Though the writer called himself James, his true identity is still uncertain. The work was possibly composed in Egypt and was widely popular from antiquity on through the Renaissance. There are more than 30 extant Greek manuscripts and others in Coptic, Syriac, and Armenian.

prothallium, the small, green, heart-shaped structure (gametophyte) of a fern that produces both male and female sex cells (gametes). The prothallium forms from a spore. After fertilization, a young sporophyte plant develops; it consists of a primary root, primary leaf, the rudiment of a new stem, and an organ, called a foot, that absorbs food from the gametophyte.

The single prothallial cell of some fern and conifer microspores (small reproductive bodies) represents the vegetative body of the male gametophyte.

prothoracotropin: *see* thoracotropic hormone.

prothrombin, a carbohydrate-protein compound (glycoprotein) occurring in blood plasma and an essential component of the blood-clotting mechanism. Prothrombin is transformed into thrombin by a factor known as thromboplastin or prothrombinase; thrombin then acts to transform fibrinogen, also present in plasma, into fibrin, which, in combination with platelet cells from the blood, forms a clot. Under normal circumstances, prothrombin is changed into thrombin only when injury occurs to the tissues or circulatory system or both; hence, fibrin and blood clots are not formed except in response to bleeding.

The disease hemophilia, in which bleeding will not stop once initiated, is caused by a hereditary lack of one of the factors necessary to convert prothrombin to thrombin. Hypoprothrombinemia, a deficiency in prothrombin, is characterized by a tendency to prolonged bleeding. It is usually associated with a lack of vitamin K, which is necessary for the synthesis of prothrombin in the liver cells. In adults the condition occurs most commonly in cases of obstructive jaundice, in which the flow of bile to the bowel is interrupted, bile being necessary for the intestinal absorption of vitamin K. It can also result from a general impairment in liver and intestinal-cell function or follow exposure to dicumarol and related therapeutic anticoagulants. In the newborn a lack of prothrombin leads to the condition known as hemorrhagic disease of the newborn, characterized by spontaneous internal and external hemorrhage, particularly from the umbilicus or mucous membranes; although this abnormal bleeding tends to run a short, self-limited course, it can sometimes have a fatal outcome. If suspected, it can be prevented by the administration of vitamin K to the mother during labour.

Protić, Stojan (b. Jan. 28, 1857, Kruševac, Serbia [now in Yugoslavia]—d. Oct. 28, 1923, Belgrade), Serbian statesman and editor who was the first prime minister of the Kingdom of Serbs, Croats, and Slovenes (1918–19, 1920), later called Yugoslavia.

Having studied history and philology in Belgrade, Protić briefly worked in government service before devoting himself to journalism and becoming editor of *Samouprava* ("Autonomy"), the daily newspaper of the Serbian Radical Party. Although he served a short prison term for a press offense, he became editor of another paper, *Odjek* ("Echo"), in 1884 and strongly advocated changing Serbia's constitution. Elected to Parliament in 1887, he became secretary of the commission that drafted a more democratic constitution adopted in 1889. Consistently reelected to Parliament (1888–97), Protić also founded and edited the monthly journal *Delo* ("Deed") in 1894. After an attempt in July 1899 on the life of the former king Milan (reigned 1868–89), repressive measures were undertaken against the Serbian Radical Party; and Protić was found guilty of conspiracy and sentenced to 20 years' hard labour in fetters. Reprieved in 1900, he was reelected to Parliament in 1901. After 1903 he joined Nikola Pašić and Lazar Pacu as a leader of the Radical Party and represented it in the government as home secretary four times and as minister of finance twice between 1903 and 1918. In June 1914, when Austria-Hungary delivered the ultimatum to Serbia that started World War I, Protić drafted Serbia's reply, acting for Prime Minister Pašić, who was then away from the capital, and for Pacu, the senior minister, then in Belgrade.

Called upon after the war to be prime minister of the Kingdom of Serbs, Croats, and Slovenes, Protić selected a Cabinet including representatives from all sections of the new state. He resigned on Aug. 16, 1919, but again served as prime minister from February to May 1920. Later, as minister in charge of the constituent assembly (1920–21), he argued for moderate decentralization and on that basis broke with the centralist Pašić and the majority of Radicals. To promote his views, which were not incorporated into the constitution of 1921, he founded the newspaper *Radikal* and unsuccessfully ran for Parliament as an Independent Radical in 1923.

protist (kingdom Protista), any member of a kingdom of eukaryotic, almost exclusively unicellular organisms, comprising the algae, protozoans, and lower fungi.

A brief treatment of protists follows. For full treatment, *see* MACROPAEDIA: Protists.

The concept of the protists was developed to accommodate intermediate organisms, primarily the single-celled-animal-like forms and plantlike forms (protozoans and algae, respectively). The term was first suggested in 1866 by the German zoologist Ernst Haeckel. Protists are predominantly unicellular, although coenocytic, colonial, and single-tissue forms exist. They exhibit all forms of nutrition as well as sexual and asexual reproduction. They are frequently motile, primarily using flagella, cilia, or pseudopodia.

Many protists have affinities with both plants and animals, which created problems of placing them somewhat arbitrarily into one or the other of the traditional kingdoms. Furthermore, many previously established relationships were called into question around the mid-20th century with the advent of biochemical and genetic testing. It is postulated that some groups are not as closely related to one another as once thought. As a result, the arrangement or classification of protists, while of working convenience, is regarded as not entirely satisfactory because of the taxonomic variations that arise from individual interpretations.

protium, isotope of hydrogen (*q.v.*) with atomic weight of approximately 1; its nucleus consists of only one proton. Ordinary hydrogen is made up almost entirely of protium.

Proto-Chimú (early South American civilization): *see* Moche.

Proto-Corinthian style, Greek pottery style that flourished at Corinth during the Oriental period (*c.* 725–*c.* 600 BC). Proto-Corinthian pottery, most of which is miniature in size, was the first to be decorated in the black-figure painting technique: figure silhouettes drawn in black and filled in with incised details. The principal motifs, which mirror Middle

Eastern styles, are animals in procession and human figures, sometimes in mythical scenes. The small aryballos (scent or oil bottle) is an especially common shape.

Proto-Geometric style, visual art style of ancient Greece that signaled the reawakening of technical proficiency and conscious creative spirit, especially in pottery making. With the collapse of the Minoan-Mycenaean civilization about the 12th century BC, the arts sustained by the palace bureaucracies disappeared, together with literacy. Invasions and wars kept a once-flourishing civilization practically in caves, the only creative production being some rough, shoddily executed pottery. About 1050 BC, judging from the improvement in pottery, life seems to have become more settled, enabling pottery makers to become artists again.

The vocabulary of the Proto-Geometric style is limited to circles, arcs, triangles, and wavy lines, all derived from Minoan-Mycenaean representations of aquatic and plant life. The design elements are conscientiously rendered, with compasses and multiple brushes, and are carefully placed in horizontal bands on significant parts of the vase, mainly at the shoulder or belly. The lower portion of the vase, which was now better made and well proportioned, was usually either left plain or painted in a solid glossy black pigment inherited from Bronze Age artists. Other than vases, surviving artworks include only some simple, bronze,

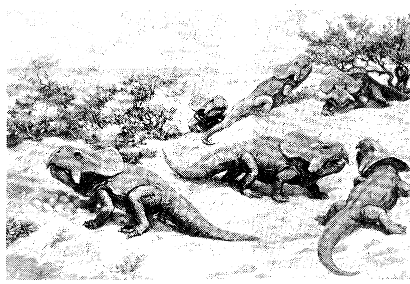
Proto-Geometric amphora from Athens, early 10th century BC; in the Kerameikos Museum, Athens
Hirmer Fotoarchiv, Munich

safety-pin-like clasps called fibulae and some primitive clay figures showing clear Minoan influence; but the evidence of the vases shows a new art developing out of a ruined civilization, a new ability to discipline hand and eye that evolved into the Geometric style.

Proto-Sinaitic inscriptions: *see* Sinaitic inscriptions.

protobiont (biology): *see* eobiont.

Protoceratops, extinct genus of primitive dinosaurs found as fossils in Gobi (desert) deposits of the Cretaceous Period (144 to 66.4 million years ago). *Protoceratops,* a predecessor of the more familiar horned dinosaurs, is one of the most primitive members of the last major group of dinosaurs to evolve. It may have evolved from a small biped but moved about on all four limbs; the hind limbs were more strongly developed than the forelimbs, giving the back an arched appearance. Although small for a ceratopsian dinosaur, *Protoceratops* was still a relatively large animal. Adult individuals were about 2 m (7 feet) long and must have weighed about 180 kg (400 pounds). The skull was very long, about one-fifth the total body length. Bones in the skull had grown backward into a perforated frill that probably served as a surface for the attachment of chewing muscles, for the attachment of muscles that controlled head movements, and for shielding the vulnerable neck region from attack by predators. The jaws were beaklike, and teeth were present in the upper and lower jaws. An area on top of the



Protoceratops, from a mural by Charles R. Knight
By courtesy of the Field Museum of Natural History, Chicago

snout of fossil specimens may mark the position of a hornlike structure. The tail was well developed, with long vertebral spines, suggesting to some theorists that *Protoceratops* may have been at least partially aquatic in habit.

The remains of more than 80 individuals have been found in all stages of growth; the remains include newly hatched young and whole and broken eggs, some with the remains of embryos in them. The eggs, about 15 cm (6 inches) long and ellipsoidal in shape, appear to have been laid in circular clusters. Because of the unusually complete series of remains known, it is possible to work out the rates and manner of growth of *Protoceratops* and to study the range of variation evident in the genus.

protochordate, any member of either of two invertebrate subphyla of the phylum Chordata: the Tunicata (sea squirts, salps, etc.) and the Cephalochordata (amphioxus). Like the remaining subphylum of the chordates, the Vertebrata, the protochordates have a hollow dorsal nerve cord, gill slits, and a stiff supporting rod, the notochord, the forerunner of the backbone. The protochordates differ chiefly from the vertebrates in not having a backbone. Recent protochordates are thought to have evolved from the same ancestral stock as that which gave rise to the vertebrates.

Two main theories have gained general acceptance as to how the vertebrates may have evolved. One theory proposes that the ancestral form was sessile (attached), perhaps like a pterobranch (*q.v.*) but with an unspecialized larva. This larva adapted to an independent pelagic life and became sexually mature. Subsequently, the sessile stage was lost, and the vertebrates evolved from this free-swimming animal. The other, more recent theory postulates that the chordates evolved from a small fossil group called the mitrates.

For more information on protochordate groups, *see* amphioxus; appendicularian; salp; sea squirt; tunicate.

Protococcus (algae): *see* Pleurococcus.

protocol sentence, in the philosophy of Logical Positivism, a statement that describes immediate experience or perception and as such is held to be the ultimate ground for knowledge. Such a statement is also called an atomic statement, observation statement, judgment of perception, or basic statement; in particular, the term protocol sentence is associated with the work of Rudolf Carnap, a 20th-century German-American philosopher of science and of language.

A protocol sentence, which reports the sensations of a particular observer at a particular time, may range in complexity from "blue patch now" to "A blue sphere is on the table." It is thought to be irrefutable and therefore the ultimate justification for other more complex statements, particularly for statements of science. If a scientific statement is equivalent in meaning to some set of protocol sentences, it is considered true; thus, science is firmly grounded in observation and experience.

This view was challenged by philosophers who argue that all statements presuppose some nonobservational framework (such as the ability to recognize a colour as blue). Therefore, they assert, protocol sentences are not basic and can always be replaced by a set of more fundamental sentences. The attempt to ground knowledge in protocol sentences is then faced with the possibility of an infinite regress to ever more basic sentences. Further, if the protocol sentences are truly reports of the sensations of a particular observer, then they are not intersubjectively testable; being not necessarily true for *all* observing subjects, they are not scientific. Thus, according to this criticism, if every scientific statement were equivalent to a set of protocol sentences, then each would be equivalent to a set of nonscientific statements—*i.e.,* to a set of purely subjective statements.

Protocols of the Learned Elders of Zion, fraudulent document that served as a pretext and rationale for anti-Semitism in the early 20th century. The document purports to be a report of a series of 24 (in other versions, 27) meetings held at Basel, Switz., in 1897, at the time of the first Zionist congress. There Jews and Freemasons were said to have made plans to disrupt Christian civilization and erect a world state under their joint rule. Liberalism and socialism were to be the means of subverting Christendom; if subversion failed, all the capitals of Europe were to be sabotaged.

The *Protocols* were printed in Russia in abbreviated form in 1903 in the newspaper *Znamia* ("Banner") and subsequently (1905) as an addendum to a religious tract by Serge Nilus, a tsarist civil servant. They were translated into German, French, English, and other European languages and soon came to be a classic of anti-Semitic literature. In the United States Henry Ford's private newspaper, *Dearborn Independent,* often cited them as evidence of a Jewish threat.

The spurious character of the *Protocols* was first revealed in 1921 by Philip Graves of *The Times* (London), who demonstrated their obvious resemblance to a satire by the French lawyer Maurice Joly on Napoleon III published in 1864 and entitled *Dialogue aux Enfers entre Machiavel et Montesquieu* ("Dialogue in Hell between Machiavelli and Montesquieu"). Subsequent investigation, particularly by the Russian historian Vladimir Burtsev, revealed that the *Protocols* were forgeries compounded by officials of the Russian secret police out of the satire of Joly, a fantastic novel (*Biarritz*) by Hermann Goedsche (1868), and other sources.

protoenstatite, a variety of the silicate mineral enstatite (*q.v.*). Protoenstatite is stable only at high temperatures.

protogalaxy, in cosmology, vast cloud of gas that by contraction and condensation becomes a galaxy of stars. In evolutionary ("big-bang") models of creation, protogalaxies appear early in the expansion phase of the universe; in the steady-state model they are slowly but continually forming from newly created matter.

Protogenes (fl. late 4th century BC; b. Caunus, Caria [now in Turkey]), Greek painter, contemporary and rival of Apelles, noted for the care and time he devoted to each of his paintings. He lived most of his life at Rhodes. Little else is known of him, and none of his paintings survives. The "Ialysus" and the "Resting Satyr" were among the most renowned of his works.

The "Ialysus" was a painting of the hero-guardian of a Rhodian town of the same name. According to ancient accounts, Protogenes spent from 7 to 10 years on this painting.

After remaining in Rhodes for at least 200 years, the "Ialysus" was carried off to Rome. There it was placed in the Temple of Peace, where later it was destroyed by fire.

Protogenes worked on the painting of the "Resting Satyr" in his Rhodian garden during the siege of the city by Demetrius Poliorcetes in 305–304 BC. According to legend, Demetrius was so moved by the artist's dedication that he took special precautions to protect him and his work. Protogenes has also been mentioned for his portraits and as the author of two books on painting.

protomonad (order Kinetoplastida), any of an order of protozoan zooflagellates characterized as free-living or parasitic colourless organisms, typically with one or two flagella and usually without a secreted pellicle (or envelope). Solitary and colonial free-living forms usually feed by pseudopodia (protoplasmic extensions) or by a simple mouth; parasitic forms absorb food through the cell wall. Reproduction is by a lengthwise splitting, although multiple division and budding occur, and sexual reproduction has been reported.

Protomonads, such as the solitary *Monas* or the colonial *Anthophysis,* are oval and amoeboid with one to three flagella; they inhabit foul water and feces and also may be found in human and animal intestines. The choanoflagellates, which sometimes are placed in a separate order, have a food-catching collar surrounding a single flagellum. The *Bodo* group includes forms with two to four flagella. The *Trypanosoma* species are elongated blood parasites found in man and many animals. The members of the vertebrate parasite genus *Leishmania* also cause disease.

proton, a stable subatomic particle that has a unit-positive charge and a mass of $1.6726231 \times 10^{-27}$ kg, which is 1,836 times the mass of an electron.

A brief treatment of protons follows. For full treatment, *see* MACROPAEDIA: Atoms: Their Structure, Properties, and Component Particles.

While studying streams of gas atoms and molecules from which electrons had been stripped (ionized), Wilhelm Wien (1898) and J.J. Thomson (1910) identified a positive particle equal in mass to the hydrogen atom. Ernest Rutherford showed (1919) that nitrogen under alpha particle bombardment ejects what appear to be hydrogen nuclei. By 1920 he accepted the hydrogen nucleus as an elementary particle, naming it proton.

Protons, together with electrically neutral particles called neutrons, make up all atomic nuclei except for the hydrogen nucleus (which consists of a single proton). Every nucleus of a given chemical element has the same number of protons. This number relates to the atomic number of an element, which determines the position of the element in the periodic table (*see* periodic law). Because the number of protons in a nucleus equals the number of electrons orbiting the nucleus, under most conditions, the atom is electrically neutral.

Protons are classified as baryons, particles that are made up of three smaller units of matter known as quarks (*see* quark). The proton has an antimatter counterpart, the antiproton, which has the identical mass but a negative electric charge.

Protons from ionized hydrogen are given high velocities in particle accelerators and are commonly used as projectiles to produce and study nuclear reactions. Protons are the chief constituent of primary cosmic rays and are among the products of some types of artificial nuclear reactions.

proton-proton cycle, also called PROTON-PROTON REACTION, chain of thermonuclear reactions that is the chief source of the energy radiated by the Sun and other cool main-sequence stars. Another sequence of thermonuclear reactions, called the carbon cycle, provides much of the energy released by hotter stars.

In a proton-proton cycle, four hydrogen nuclei (protons) are combined to form one helium nucleus; 0.7 percent of the original mass is lost mainly by conversion into heat energy, but some energy escapes in the form of neutrinos (ν). First, two hydrogen nuclei (^1H) combine to form a hydrogen-2 nucleus (^2H, deuterium) with the emission of a positive electron (e^+, positron) and a neutrino (ν). The hydrogen-2 nucleus then rapidly captures another proton to form a helium-3 nucleus (^3He), while emitting a gamma ray (γ). In symbols:

$$^1H + {}^1H \rightarrow {}^2H + e^+ + \nu$$
$$^2H + {}^1H \rightarrow {}^3He + \gamma.$$

From this point the reaction chain may follow any of several paths, but it always results in one helium-4 nucleus, with the emission of two neutrinos in total. The energy of the neutrinos emitted is different for the different paths. In the most direct continuation, two helium-3 nuclei (produced as indicated above) form one helium-4 nucleus (^4He, alpha particle) with the release of two protons,

$$^3He + {}^3He \rightarrow {}^4He + {}^1H + {}^1H.$$

The path that produces the most energetic neutrinos uses a helium-4 nucleus as a catalyst and cycles through beryllium and boron isotopes at intermediate states. In symbols:

$$^3He + {}^4He \rightarrow {}^7Be + \gamma$$
$$^7Be + {}^1H \rightarrow {}^8B + \gamma$$
$$^8B \rightarrow {}^8Be + e^+ + \nu,\ {}^8Be \rightarrow 2\,{}^4He.$$

The latter path occurs only at relatively high temperatures and is of interest because such energetic neutrinos have been detected in a large-scale experiment in a deep mine. The detection rate in this solar-neutrino experiment is smaller than theoretically predicted; the cause for the discrepancy is as yet undetermined. *Compare* carbon cycle.

proton theory of acids and bases (chemistry): *see* Brønsted-Lowry theory.

protonosphere, region in the Earth's upper atmosphere where atomic hydrogen and protons (ionic hydrogen) are the dominant constituents; it can be considered the outermost extension of the ionosphere. In the lowest part of the Earth's atmosphere, called the homosphere (100 km [about 65 miles]), turbulence causes a continuous mixing of the atmospheric constituents, whereas in the heterosphere, above 100 km, the various constituents tend to separate out.

In the heterosphere, the concentrations of the heavier constituents, such as nitrogen or oxygen, decrease more rapidly with increasing altitude than do the concentrations of lighter gases, such as hydrogen or helium; and eventually the atmosphere is dominated by the lighter gases. Under mean daytime conditions, helium and its ion become dominant around 1,000 km (620 miles) and hydrogen and protons above 2,500 km (1,555 miles). The density in the protonosphere continues to decrease with altitude, finally merging with the interplanetary medium about 100,000 km (62,100 miles) above the surface of the Earth.

Solar ultraviolet radiation, which dissociates molecules of water vapour, methane, and hydrogen, is the primary source of atomic hydrogen. Because these constituents exist as well on Venus, Mars, Jupiter, Saturn, Uranus, and Neptune, it is suspected that these planets also possess a corresponding protonosphere.

protoplanet, in astronomical theory, a hypothetical eddy in a whirling cloud of gas or dust that becomes a planet by condensation during formation of a solar system. As the central body, or protostar, of the system contracts and heats up, the increasing pressure of its radiation is believed to drive off much of the thinner material of the protoplanets, particularly those closer to the nascent star.

protoplasm, the cytoplasm and nucleus of a cell. The term was first defined in 1835 as the ground substance of living material and, hence, responsible for all living processes. Advocates of the protoplasm concept implied that cells were either fragments or containers of protoplasm. The weakness of the concept was its inability to account for the origin of formed structures within the cell, especially the nucleus. Today the term is used to mean simply the cytoplasm and nucleus. The word protoplasm is somewhat unpopular in modern biology, although the term protoplasmic streaming is commonly used to describe the movement of the cytoplasm.

Protopopov, Aleksandr Dmitriyevich (b. Dec. 30 [Dec. 18, Old Style], 1866, Moscow, Russia—d. Jan. 1, 1918 [Dec. 19, 1917], Moscow), Russian statesman who was imperial Russia's last minister of the interior (1916–17).

A landowner and industrialist, Protopopov was elected a delegate from Simbirsk province to the third Duma (Russian legislature) in 1907 and joined the left wing of the conservative Octobrist Party. Elected again to the fourth Duma (1912), he became one of its deputy speakers, and, after the onset of World War I, he lent his support to the Progressive Bloc, a coalition of political groups formed in 1915 to promote the war effort and national unity. The following year he led a "good-will" parliamentary delegation to Great Britain, France, and Italy. On the homeward journey he held talks in Stockholm with a German agent on the prospects of concluding a separate Russo-German peace. Despite public disapproval of this action, he was well received upon his return by Tsar Nicholas II as well as by Tsarina Alexandra and her close adviser Rasputin; soon afterward, he was appointed minister of the interior in the Cabinet of Boris Vladimirovich Sturmer (Oct. 1, 1916).

Although his colleagues in the Duma had considered Protopopov a moderate liberal deserving their respect, they condemned him as a renegade when he joined the government. Lacking in administrative experience, he minimized the threat of revolution in Russia. He also failed to relieve the serious food shortages in Petrograd and other cities. When he ordered the police to take severe measures to prevent the outbreak of riots, he succeeded only in contributing further to the mounting discontent that erupted in March (February, Old Style) 1917, in a series of strikes and riots that overthrew the imperial regime, including Protopopov. Imprisoned in the Peter-Paul Fortress after the February Revolution, he was later shot by order of the communist Cheka (political police).

Protopopov, Oleg Alekseyevich; and Belousova, Ludmila Yevgeniyevna (respectively, b. July 16, 1932, Leningrad, Russian S.F.S.R.; b. Nov. 22, 1935, Ulyanovsk, Russian S.F.S.R.), Soviet-born figure skaters, first to win the pairs championship in the Olympic Winter Games twice (1964, at Innsbruck, Austria, and 1968, at Grenoble, Fr.). They also won the world pairs title four consecutive years (1965–68). In these competitions they consistently received the highest marks for artistic as well as technical excellence.

Protopopov and Belousova met in 1954 (when he completed his service in the Soviet navy), began to skate together, and soon were married. They first entered major competition in 1958. In 1979 the pair defected, requesting political asylum in Switzerland, and joined the American ice show *Ice Capades.*

Protostomia, group of animals—including the arthropods (*e.g.,* insects, crabs), mollusks (clams, snails), and annelid worms—classified together on the basis of embryological development. The mouth of the Protostomia (*proto,* "first"; *stoma,* "mouth") develops from the first opening into the embryonic gut (blastopore). The coelom (body cavity) forms from a split in the embryonic mesoderm (middle tissue). Larval (immature) forms, if present, are called trochophores. The Protostomia constitute one of two divisions of the coelomates (animals with a body cavity, or coelom). *Compare* Deuterostomia.

protozoan (subkingdom Protozoa), any of a group of small, usually microscopic, unicellular, eukaryotic organisms of the kingdom Protista. Protozoans are found worldwide in most soils, freshwater, and oceans. Although some scientists consider protozoans to form a group only in that they exhibit certain common characteristics, most scientists now classify them as a subphylum of Protista. The taxonomic relationships of protozoans to one another and to other protists continues to change as genetic and biochemical testing establishes new relationships and as previous classifications based primarily on morphological and physiological features are revised.

A brief treatment of protozoans follows. For full treatment, *see* MACROPAEDIA: Protozoa.

The smallest known protozoans are tiny blood parasites less than 2 microns long; the largest may be 16 mm (0.6 inch) in length and visible to the naked eye. Although protozoan shapes vary, all protozoans share such eukaryotic features as lipid-protein membranes and membrane-bound vacuoles and organelles. When oxygen is used at any stage in metabolism, mitochondria and associated ribosomes are present. All protozoans have at least one nucleus, and many are multinucleate. Some membrane-bound food vacuoles aid in the breakdown of food, and contractile vacuoles maintain the osmotic balance in the cell. Though mostly solitary, protozoans sometimes form colonies that are held together by a matrix.

Some protozoans move with the aid of flagella—long, whiplike structures that move either back and forth or spirally. Some move with cilia, which resemble flagella in their infrastructure but are much smaller and more numerous; they are distributed in characteristic locations along the cell body, such as around the mouth (cytosome) or in measured rows called kineties. Cilia move in wavelike patterns that propel the protozoan forward, much like oars. There are many theories to explain how amoebas move, and this movement is largely dependent on the type of pseudopodium displayed by the species; but movement generally means the flow of cytoplasm outward from the cell as contractile pressures are exerted on the cytoplasm.

Most protozoans use aerobic respiration—*i.e.,* the oxidation of glucose and water to carbon dioxide and water. Although rare, anaerobic processes do take place in certain protozoans, especially parasites.

Some protozoans demonstrate purely heterotrophic, or animal-like, nutrition; other protozoans are autotrophs, depending principally or completely on photosynthesis for the manufacture of their foodstuffs. Chlorophyll and other pigments are available to autotrophs for photosynthesis. Other protozoans demonstrate both characteristics (mixotrophy), and they can alter their metabolism to accommodate changes in environment and available nutrients.

The most common form of reproduction in protozoans is binary fission, which involves nuclear division, the duplication of organelles, and an approximately equal division of the body. Budding involves the unequal division of the cytoplasm, resulting in organisms of vastly different size. In schizogony, the nucleus undergoes a series of divisions followed by a rapid squeezing off of uninuclear buds. Plasmotomy occurs when a multinucleate organism separates into two or more organisms without undergoing nuclear division first. Protozoans also reproduce sexually.

protozoology, the study of protozoans. The science had its beginnings in the latter half of the 17th century when Antonie van Leeuwenhoek of the Netherlands first observed protozoans by means of his invention, the microscope.

Protozoans are common, and they are of particular interest to man because they cause such diseases as malaria, amoebic dysentery, and African trypanosomiasis (sleeping sickness). Certain protozoans known as foraminifera, which have an extensive fossil record, are useful to geologists in locating petroleum deposits. Protozoans also serve as experimental organisms in many studies of cell and molecular biology.

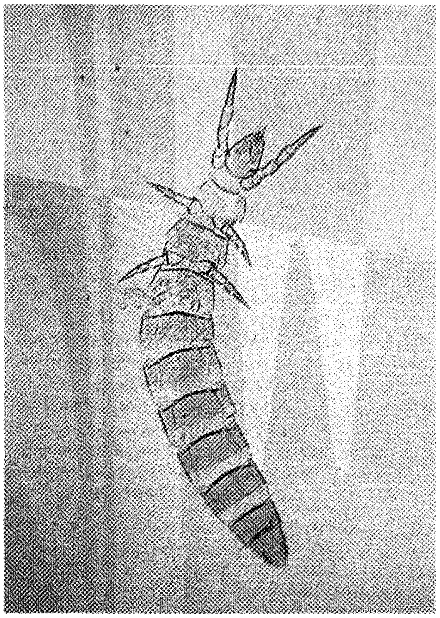
protractor, any of a group of instruments used to construct and measure plane angles. The simplest protractor comprises a semicircular disk graduated in degrees—from 0° to 180°. It is an ancient device that was already in use during the 13th century. At that time, European instrument makers constructed an astronomical observing device called the *torquetum* that was equipped with a semicircular protractor.

A more complex form of protractor, designed for plotting the position of a ship on navigational charts, was invented in 1801 by Joseph Huddart, a U.S. naval captain. This instrument, called a three-arm protractor, or station pointer, is composed of a circular scale connected to three arms. The centre arm is fixed, while the outer two are rotatable, capable of being set at any angle relative to the centre one.

A related instrument used by marine navigators is the course protractor. It provides an effective tool with which to measure the angular distance between magnetic north and the course plotted on a navigational chart.

protruded disk (medicine): *see* herniated disk.

proturan (class or order Protura), member of a group of minute (0.5 to 2 mm [0.02 to 0.08 inch]), pale, wingless, blind, primitive insects (about 150 species) that live in damp humus and soil and feed on decaying organic matter. Proturans, frequently known as telsontails, include some of the most primitive hexapods (*i.e.,* animals with six legs). They are worldwide in distribution, although the group was unknown before 1907.



Proturan
William E. Ferguson

Unlike winged insects, proturans lack antennae and possess 12 abdominal segments (instead of the typical 11), 3 of which are added postembryonically in successive nymphal molts, or sheddings of skin (anamorphosis). The front legs, carried like antennae, serve a sensory function. The cone-shaped head has anterior sucking mouthparts. There is a pair of ventral styli on each of the first three abdominal segments. Some authorities consider the proturans distinct from true insects.

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Proud, Joseph (b. March 22, 1745, Beaconsfield, Buckinghamshire, Eng.—d. Aug. 3, 1826, Handsworth, near Birmingham, Warwickshire), English Swedenborgian minister and hymn writer who possessed considerable gifts as a preacher.

The son of a General Baptist minister, Proud served Baptist churches at Knipton, Fleet, and Norwich before in 1788 openly adopting the views of Emanuel Swedenborg. As a minister of the (Swedenborgian) New Church, he gathered large congregations in Birmingham, Manchester, and London. His first volume of 300 hymns appeared in 1790 and was several times reprinted. A small book of hymns for children was published in 1810. Many of his compositions continue to be used in Swedenborgian worship.

Proudhon, Pierre-Joseph (b. Jan. 15, 1809, Besançon, Fr.—d. Jan. 19, 1865, Paris), French libertarian socialist and journalist whose doctrines became the basis for later radical and anarchist theory.

Proudhon, detail of an oil painting by Gustave Courbet, *c.* 1865; in the Musée du Petit Palais, Paris
Giraudon—Art Resource/EB Inc.

Early life and education. Proudhon was born into poverty as the son of a feckless cooper and tavern keeper, and at the age of nine he worked as a cowherd in the Jura Mountains. Proudhon's country childhood and peasant ancestry influenced his ideas to the end of his life, and his vision of the ideal society almost to the end remained that of a world in which peasant farmers and small craftsmen like his father could live in freedom, peace, and dignified poverty, for luxury repelled him, and he never sought it for himself or others.

Proudhon at an early age showed the signs of intellectual brilliance, and he won a scholarship to the college at Besançon. Despite the humiliation of being a child in sabots (wooden shoes) among the sons of merchants, he developed a taste for learning and retained it even when his family's financial disasters forced him to become an apprentice printer and later a compositor. While he learned his craft, he taught himself Latin, Greek, and Hebrew, and in the printing shop he not only conversed with various local liberals and Socialists but also met and fell under the influence of a fellow citizen of Besançon, the utopian Socialist Charles Fourier.

With other young printers, Proudhon later attempted to establish his own press, but bad management destroyed the venture, and it may well have been compounded by his own growing interest in writing, which led him to develop a French prose difficult to translate but admired by writers as varied as Flaubert, Sainte-Beuve, and Baudelaire. Eventually, in 1838, a scholarship awarded by the Besançon Academy enabled him to study in Paris. Now, with leisure to formulate his ideas, he wrote his first significant book, *Qu'est-ce que la propriété?* (1840; *What Is Property?*, 1876). This created a sensation, for Proudhon not only declared, "I am an anarchist"; he also stated, "Property is theft!"

This slogan, which gained much notoriety, was an example of Proudhon's inclination to attract attention and mask the true nature of his thought by inventing striking phrases. He did not attack property in the generally accepted sense but only the kind of property by which one man exploits the labour of another. Property in another sense—in the right of the farmer to *possess* the land he works and the craftsman his workshop and tools—he regarded as essential for the preservation of liberty, and his principal criticism of Communism, whether of the utopian or the Marxist variety, was that it destroyed freedom by taking away from the individual control over his means of production.

In the somewhat reactionary atmosphere of the July monarchy in the 1840s, Proudhon narrowly missed prosecution for his statements in *What Is Property?*; and he was brought into court when, in 1842, he published a more inflammatory sequel, *Avertissement aux propriétaires* (*Warning to Proprietors*, 1876). In this first of his trials, Proudhon escaped conviction because the jury conscientiously found that they could not clearly understand his arguments and therefore could not condemn them.

In 1843 he went to Lyon to work as managing clerk in a water transport firm. There he encountered a weavers' secret society, the Mutualists, who had evolved a protoanarchist doctrine that taught that the factories of the dawning industrial age could be operated by associations of workers and that these workers, by economic action rather than by violent revolution, could transform society. Such views were at variance with the Jacobin revolutionary tradition in France, with its stress on political centralism. Nevertheless, Proudhon accepted their views and later paid tribute to his Lyonnais working-class mentors by adopting the name of Mutualism for his own form of anarchism.

As well as encountering the obscure working-class theoreticians of Lyon, Proudhon also met the feminist Socialist Flora Tristan and, on his visits to Paris, made the acquaintance of Karl Marx, Mikhail Bakunin, and the Russian Socialist and writer Aleksandr Herzen. In 1846 he took issue with Marx over the organization of the Socialist movement, objecting to Marx's authoritarian and centralist ideas. Shortly afterward, when Proudhon published his *Système des contradictions économiques, ou Philosophie de la misère* (1846; *System of Economic Contradictions: or, The Philosophy of Poverty,* 1888), Marx attacked him bitterly in a book-length polemic *La misère de la philosophie* (1847; *The Poverty of Philosophy,* 1910). It was the beginning of a historic rift between libertarian and authoritarian Socialists and between anarchists and Marxists which, after Proudhon's death, was to rend Socialism's First International apart in the feud between Marx and Proudhon's disciple Bakunin and which has lasted to this day.

Early in 1848 Proudhon abandoned his post in Lyon and went to Paris, where in February he started the paper *Le Représentant du peuple.* During the revolutionary year of 1848 and the first months of 1849 he edited a total of four papers; the earliest were more or less regular anarchist periodicals and all of them were destroyed in turn by government censorship. Proudhon himself took a minor part in the Revolution of 1848, which he regarded as devoid of any sound theoretical basis. Though he was elected to the Constituent Assembly of the Second Republic in June 1848, he confined himself mainly to criticizing the authoritarian tendencies that were emerging in the revolution and that led up to the dictatorship of Napoleon III. Proudhon also attempted unsuccessfully to establish a People's Bank based on mutual credit and labour checks, which paid the worker according to the time expended on his product. He was eventually imprisoned in 1849 for criticizing Louis-Napoleon, who had become president of the republic prior to declaring himself Emperor Napoleon III, and Proudhon was not released until 1852.

His conditions of imprisonment were—by 20th-century standards—light. His friends could visit him, and he was allowed to go out occasionally in Paris. He married and begat his first child while he was imprisoned. From his cell he also edited the last issues of his last paper (with the financial assistance of Herzen) and wrote two of his most important books, the never translated *Confessions d'un révolutionnaire* (1849) and *Idée générale de la révolution au XIXe siècle* (1851; *The General Idea of the Revolution in the Nineteenth Century,* 1923). The latter—in its portrait of a federal world society with frontiers abolished, national states eliminated, and authority decentralized among communes or locality associations, and with free contracts replacing laws—presents perhaps more completely than any other of Proudhon's works the vision of his ideal society.

After Proudhon's release from prison in 1852 he was constantly harassed by the imperial police; he found it impossible to publish his writings and supported himself by preparing anonymous guides for investors and other similar hack works. When, in 1858, he persuaded a publisher to bring out his three-volume masterpiece *De la justice dans la Révolution et dans l'église,* in which he opposed a humanist theory of justice to the church's transcendental assumptions, his book was seized. Having fled to Belgium, he was sentenced in absentia to further imprisonment. He remained in exile until 1862, developing his criticisms of nationalism and his ideas of world federation (embodied in *Du Principe fédératif,* 1863).

On his return to Paris, Proudhon began to gain influence among the workers; Paris craftsmen who had adopted his Mutualist ideas were among the founders of the First International just before his death in 1865. His last work, completed on his death bed, *De la capacité politique des classes ouvrières* (1865), developed the theory that the liberation of the workers must be their own task, through economic action.

Assessment. Proudhon was not the first to enunciate the doctrine that is now called anarchism; before he claimed it, it had already been sketched out by, among others, the English philosopher William Godwin in prose and his follower Percy Bysshe Shelley in verse. There is no evidence, however, that Proudhon ever studied the works of either Godwin or Shelley, and his characteristic doctrines of anarchism (society without government), Mutualism (workers' association for the purpose of credit banking), and federalism (the denial of centralized political organization) seem to have resulted from an original reinterpretation of French revolutionary thought modified by personal experience.

Proudhon was a solitary thinker who refused to admit that he had created a system and abhorred the idea of founding a party. There was thus something ironical about the breadth of influence that his ideas later developed. They were important in the First International and later became the basis of anarchist theory as developed by Bakunin (who once remarked that "Proudhon was the master of us all") and the anarchist writer Peter Kropotkin. His concepts were influential among such varied groups as the Russian populists, the radical Italian nationalists of the 1860s, the Spanish federalists of the 1870s, and the syndicalist movement that developed in France and later became powerful in Italy and Spain. Until the beginning of the 1920s, Proudhon remained the most important single influence on French working-class radicalism, while in a more diffuse manner his ideas of decentralization and his criticisms of government had revived in the later 20th century, even though at times their origin was not recognized. (G.W.)

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Proust, Joseph-Louis (b. Sept. 26, 1754, Angers, Fr.—d. July 5, 1826, Angers), French chemist who proved (1808) that the relative quantities of any given pure chemical compound's constituent elements remain invariant, regardless of the compound's source, and

Joseph-Louis Proust, medallion by Pierre-Jean David
H. Roger-Viollet

thus provided crucial evidence in support of John Dalton's "law of definite proportions," which holds that elements in any compound are present in fixed proportion by weight.

Chief apothecary at the Salpêtrière Hospital, Paris, he became director of the Royal Laboratory at Madrid (1799–1806), where he determined quantitatively the elemental constitution of a great variety of chemical substances. His proof of the principle of the constant composition of chemical compounds resolved in his favour a long-standing dispute with the French chemist Claude-Louis Berthollet.

Proust, Marcel (b. July 10, 1871, Anteuil, Fr.—d. Nov. 18, 1922, Paris), French novelist, author of *À la recherche du temps perdu* (*Remembrance of Things Past*), a novel based on Proust's life told psychologically and allegorically and often in the form of a "stream of consciousness."

Life and works. Marcel was the son of Adrien Proust, an eminent physician of provincial French Catholic descent, and his wife, Jeanne, *née* Weil, of a wealthy Jewish family. After a first attack in 1880, he suffered from asthma throughout his life. His childhood holidays were spent at Illiers and Auteuil (which together became the Combray of his novel) or at seaside resorts in Normandy with his maternal grandmother. At the Lycée Condorcet (1882–89) he wrote for class magazines, fell in love with a little girl named Marie de Benardaky in the Champs-Élysées, made friends whose mothers were society hostesses, and was influenced by his philosophy master Alphonse Darlu. He enjoyed the discipline and comradeship of military service

Marcel Proust, oil painting by Jacques-Émile Blanche; in a private collection

at Orléans (1889–90) and studied at the École des Sciences Politiques, taking *licences* in law (1893) and in literature (1895). During these student days his thought was influenced by the philosophers Henri Bergson (his cousin by marriage) and Paul Desjardins and by the historian Albert Sorel. Meanwhile, via the bourgeois salons of Madames Straus, Arman de Caillavet, Aubernon, and Madeleine Lemaire, he became an observant habitué of the most exclusive drawing rooms of the nobility. In 1896 he published *Les Plaisirs et les jours,* a collection of short stories at once precious and profound, most of which had appeared during 1892–93 in the magazines *Le Banquet* and *La Revue Blanche.* From 1895 to 1899 he wrote *Jean Santeuil,* an autobiographical novel that, though unfinished and ill-constructed, showed awakening genius and foreshadowed *À la recherche.* A gradual disengagement from social life coincided with growing ill health and with his active involvement in the Dreyfus affair of 1897–99, when French politics and society were split by the movement to liberate the Jewish army officer Alfred Dreyfus, unjustly imprisoned on Devil's Island as a spy. Proust helped to organize petitions and assisted Dreyfus' lawyer Labori, courageously defying the risk of social ostracism. (Although Proust was not, in fact, ostracized, the experience helped to crystallize his disillusionment with aristocratic society, which became visible in his novel.) Proust's discovery of John Ruskin's art criticism in 1899 caused him to abandon *Jean Santeuil* and to seek a new revelation in the beauty of nature and in Gothic architecture, considered as symbols of man confronted with eternity: "Suddenly," he wrote, "the universe regained in my eyes an immeasurable value." On this quest he visited Venice (with his mother in May 1900) and the churches of France and translated Ruskin's *Bible of Amiens* and *Sesame and Lilies,* with prefaces in which the note of his mature prose is first heard.

The death of his father in 1903 and of his mother in 1905 left him grief stricken and alone but financially independent and free to attempt his great novel. At least one early version was written in 1905–06. Another, begun in 1907, was laid aside in October 1908. This had itself been interrupted by a series of brilliant parodies—of Balzac, Flaubert, Renan, Saint-Simon, and others of Proust's favourite French authors—called "L'Affaire Lemoine" (published in *Le Figaro*), through which he endeavoured to purge his style of extraneous influences. Then, realizing the need to establish the philosophical basis that his novel had hitherto lacked, he wrote *Contre Sainte-Beuve,* attacking the French critic's view of literature as a pastime of the cultivated intelligence and putting forward his own, in which the artist's task is to release from the buried world of unconscious memory the ever-living reality to which habit makes us blind. In January 1909 occurred the real-life incident of an involuntary revival of a childhood memory through the taste of tea and a rusk biscuit (which in his novel became madeleine cake); in May the characters of his novel invaded his essay; and, in July of this crucial year, he began *À la recherche du temps perdu.* He thought of marrying "a very young and delightful girl" whom he met at Cabourg, a seaside resort in Normandy that became the Balbec of his novel, where he spent summer holidays from 1907 to 1914; but, instead, he retired from the world to write his novel, finishing the first draft in September 1912. The first volume, *Du côté de chez Swann,* was refused by the best-selling publishers Fasquelle and Ollendorff and even by the intellectual *La Nouvelle Revue Française,* under the direction of the novelist André Gide, but was finally issued at the author's expense in November 1913 by the progressive young publisher Bernard Grasset and met with some success. Proust then planned only two further volumes, the premature appearance of which was fortunately thwarted by his anguish at the flight and death of his secretary Alfred Agostinelli and by the outbreak of World War I.

During the war he revised the remainder of his novel, enriching and deepening its feeling, texture, and construction, increasing the realistic and satirical elements, and tripling its length. In this majestic process he transformed a work that in its earlier state was still below the level of his highest powers into one of the profoundest and most perfect achievements of the human imagination. In March 1914, instigated by the repentant Gide, *La Nouvelle Revue Française* offered to take over his novel, but Proust now rejected them. Further negotiations in May–September 1916 were successful, and in June 1919 *À l'ombre des jeunes filles en fleurs* appeared simultaneously with a reprint of *Swann* and with *Pastiches et mélanges,* a miscellaneous volume containing "L'Affaire Lemoine" and the Ruskin prefaces. In December 1919, through Léon Daudet's recommendation, *À l'ombre* received the Prix Goncourt, and Proust suddenly became world famous. Three more installments appeared in his lifetime, with the benefit of his final revision, comprising *Le Côté de Guermantes* and *Sodome et Gomorrhe.* He died in Paris of pneumonia, succumbing to a weakness of the lungs that many had mistaken for a form of hypochondria and struggling to the last with the revision of *La Prisonnière.* The last three parts of *À la recherche* were published posthumously, in an advanced but not final stage of revision: *La Prisonnière, Albertine disparue* (originally called *La Fugitive,* though the new title may well have had Proust's authority), and *Le Temps retrouvé.*

Proust's enormous correspondence (3,000 letters have appeared in print; many more await publication), remarkable for its communication of his living presence, as well as for its elegance and nobility of style and thought, is also highly significant as the raw material from which a great artist built his universe. For *À la recherche du temps perdu* is the story of Proust's own life, told as an allegorical search for truth.

At first, the only childhood memory available to the middle-aged narrator is the evening of a visit from the family friend, Swann, when the child forced his mother to give him the goodnight kiss that she had refused. But, through the accidental tasting of tea and a madeleine cake, the narrator retrieves from his unconscious memory the landscape and people of his boyhood holidays in the village of Combray. In an ominous digression on love and jealousy, the reader learns of the unhappy passion of Swann (a Jewish dilettante received in high society) for the courtesan Odette, whom he had met in the bourgeois salon of the Verdurins during the years before the narrator's birth. As an adolescent the narrator falls in love with Gilberte (the daughter of Swann and Odette) in the Champs-Élysées. During a seaside holiday at Balbec, he meets the handsome young nobleman Saint-Loup, Saint-Loup's strange uncle the Baron de Charlus, and a band of young girls led by Albertine. He falls in love with the Duchesse de Guermantes but, after an autumnal visit to Saint-Loup's garrison-town Doncières, is cured when he meets her in society. As he travels through the Guermantes's world, its apparent poetry and intelligence is dispersed and its real vanity and sterility revealed. Charlus is discovered to be homosexual, pursuing the elderly tailor Jupien and the young violinist Morel, and the vices of Sodom and Gomorrah henceforth proliferate through the novel. On a second visit to Balbec the narrator suspects Albertine of loving women, carries her back to Paris, and keeps her captive. He witnesses the tragic betrayal of Charlus by the Verdurins and Morel; his own jealous passion is only intensified by the flight and death of Albertine. When he attains oblivion of his love, time is lost; beauty and meaning have faded from all he ever pursued and won; and he renounces the book he has always hoped to write. A long absence in a sanatorium is interrupted by a wartime visit to Paris, bombarded like Pompeii or Sodom from the skies. Charlus, disintegrated by his vice, is seen in Jupien's infernal brothel, and Saint-Loup, married to Gilberte and turned homosexual, dies heroically in battle. After the war, at the Princesse de Guermantes's afternoon reception, the narrator becomes aware, through a series of incidents of unconscious memory, that all the beauty he has experienced in the past is eternally alive. Time is regained, and he sets to work, racing against death, to write the very novel the reader has just experienced.

Proust's novel has a circular construction and must be considered in the light of the revelation with which it ends. The author reinstates the extratemporal values of time regained, his subject being salvation. Other patterns of redemption are shown in counterpoint to the main theme: the narrator's parents are saved by their natural goodness, great artists (the novelist Bergotte, the painter Elstir, the composer Vinteuil) through the vision of their art, Swann through suffering in love, and even Charlus through the Lear-like grandeur of his fall. Proust's novel is, ultimately, both optimistic and set in the context of human religious experience. "I realized that the materials of my work consisted of my own past," says the narrator at the moment of time regained. An important quality in the understanding of *À la recherche* lies in its meaning for Proust himself as the allegorical story of his own life, from which its events, places, and characters are taken. In his quest for time lost, he invented nothing but altered everything, selecting, fusing, and transmuting the facts so that their underlying unity and universal significance should be revealed, working inward to himself and outward to every aspect of the human condition. *À la recherche* is comparable in this respect not only with other major novels but also with such creative and symbolic autobiographies as Johann Wolfgang von Goethe's *Dichtung und Wahrheit* and the Vicomte de Chateaubriand's *Mémoires d'outretombe,* both of which influenced Proust.

Proust projected his own sexual inversion upon his characters, treating this, as well as snobbism, vanity, and cruelty, as a major symbol of original sin. His insight into women and the love of men for women (which he himself experienced for the many female originals of his heroines) remained unimpaired, and he is among the greatest novelists in the fields of both heterosexual and homosexual love.

(G.D.P./Ed.)

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proustite, a sulfosalt mineral, silver arsenic sulfide (Ag_3AsS_3), that is an important source of silver. Sometimes called ruby silver because of its scarlet-vermilion colour, it occurs in the upper portions of most silver veins, where it is less common than pyrargyrite. Large, magnificent crystals, of hexagonal symmetry, have been found at Chañarcillo, Chile; other notable localities are Lorrain, Ont., and Freiberg and Marienberg, Ger. It is mined as a silver ore in Mexico and is found in small amounts in the silver mines of the western United States. For detailed physical properties, *see* sulfosalt (table).

Prout, William (b. Jan. 15, 1785, Horton, Gloucestershire, Eng.—d. April 9, 1850, London), English chemist and biochemist noted for his discoveries concerning digestion, metabolic chemistry, and atomic weights.

The son of a tenant farmer, Prout graduated from Edinburgh University in 1811 with a medical degree. Thereafter he practiced as a successful physician, specializing in the treatment of urinary and digestive ailments. Prout's other career, as an experimentalist and theorist, was many-sided. Between 1815 and 1827 he published a number of papers that helped establish the barely explored areas of metabolic and physiological chemistry. He discovered that the gastric juices of animals contain significant amounts of hydrochloric acid. He was one of the first to extract pure urea from urine; he discovered uric acid in excrement; and he published a large and authoritative textbook on urinary and digestive pathology in 1840. Prout's classification of food components into water, fats, carbohydrates, and proteins was quickly adopted by his fellow biochemists.

In 1815 Prout advanced the idea that the atomic weights of elements are whole-number multiples of the atomic weight of hydrogen (Prout's hypothesis). This theory proved highly fruitful for later investigations of atomic weights, atomic theory, and the classification of the elements. Prout's theory concerning the relative densities and weights of gases was in agreement with Avogadro's law (1811), which was not generally accepted until the 1850s.

Prouvé, Jean (b. April 8, 1901, Nancy, Fr.—d. March 23, 1984, Nancy), French engineer and builder known particularly for his contributions to the art and technology of prefabricated metal construction.

Trained as a metalworker, Prouvé owned and operated from 1922 to 1954 a workshop for the manufacture of wrought-iron objects. He emphasized advanced metalworking techniques and was particularly concerned with the design and production of architectural components and furniture. His significant early buildings using metal panels as curtain walls include a clubhouse at Buc Airport (1937–39) and the Maison du Peuple at Clichy, Fr. (1938–39). Prouvé's commitment to the idea of prefabricated building components is exemplified by his Headquarters of the Federation of Building Industries, Paris (1947–51), and by several experimental houses and a school. His exceptional grasp of building technology resulted in such striking designs as the Meridian Room of the Paris Observatory (1951), the Exhibition Hall at Nanterre, Fr. (1956–58), and the Church of the Sacré-Coeur de Bonnecousse (1959–60), at Mazamet, Fr. Prouvé pioneered new structural techniques that would permit the efficient and inexpensive construction of buildings with prefabricated components while retaining architectural quality and individuality.

Prouvé taught at the School of Arts and Crafts (Conservatoire National des Arts et Métiers) from 1958 to 1971. He was elected a member of the Academy of Architecture in Paris in 1972.

Provençal language: *see* Occitan language.

Provençal literature, the body of writings in the Occitan, or Provençal, language of Provence and neighbouring regions in southeastern France. Provençal literature flourished from the 11th to the 14th century, when its poetry reached rare heights of virtuosity and variety in its celebration of courtly, or chivalric, love.

The oldest extant piece of Provençal verse probably belongs to the 10th century. A more important fragment is the beginning of an anonymous adaptation in Occitans of Boethius' treatise *On the Consolation of Philosophy.* The earliest work of any importance in Provencal literature is the poetry of William IX, duke of Aquitaine (Guilhem VII of Poitiers), who was active at the close of the 11th century. His extant poems consist of 11 strophic pieces (in stanza form with repeated lines) that were meant to be sung. Several were love songs, and the most important expressed the writer's regret for the frivolity of his past and apprehension at bidding farewell to his country and his son. The contrast between Boethius' poem and the stanzas of William IX indicates that by the 11th century, Provençal poetry was developing in various directions.

The origins of the earliest Provençal poets were indicated by contemporary Latin chroniclers, who mentioned *ioculares,* men of a class not highly regarded, whose profession consisted in amusing their audience by jugglers' tricks, by exhibiting performing animals, or by recitation and song. These performers were called *joglars* in Provençal and *jongleurs* in French. From among them rose the troubadours, who originally may have been *joglars* skilled in poetry. But by the end of the 11th century a clear distinction had been drawn between the lower sort of *joglars* and the more refined troubadours, who composed their works in the elegant and refined literary language of the aristocracy and the court. Indeed, the troubadours comprised not only the more accomplished poets of the upper ranks of society but also some of the great nobles who wrote poetry themselves.

The lyric love poems of the troubadours became the crowning glory of medieval Provençal literature. The troubadours' love songs reflected social conditions in the Midi (southern France) under feudalism. The daughters of territorial lords were married for political reasons and welcomed the attentions of courtiers, who addressed songs of love to them. As the poets were usually far beneath the ladies in social status, they wrote in a most guarded style. This profession of "courtly," or "chivalrous," love became a matter of convention, but the sentiments of respect, passion, and devotion thus addressed to noble ladies in the songs of the troubadours were to have a lasting influence on both European literature and social mores.

William IX had been the first of the troubadours. In the first part of the 12th century, Cercamon, a Gascon, composed pastorals, and his pupil Marcabrun wrote about 40 pieces, several of which were concerned with contemporary history. Jaufré Rudel of Blaye, a nostalgic singer of the *amor de lonh* ("distant love"), is scarcely less famous. Slightly later in the same century Bernard de Ventadour composed songs of elegant simplicity, some of which may be taken as perfect specimens of Provençal poetry. His contemporary Bertran de Born is famous for the part he is said to have played both with his sword and his *sirventes* (a form of Provençal lay) in the struggle between Henry II of England and his rebel sons. Other troubadours include Arnaut Daniel, a master of complicated versification and difficult form; Guiraut de Bornelh, an acknowledged master of *trobar clus,* or "close" style, though he also composed songs of charming simplicity; Arnaut de Mareuil, noteworthy for his exquisite delicacy of sentiment; the somewhat eccentric Peire Vidal of Toulouse; the chivalrous Raimbaut de Vaqueyras; Folquet de Marseille, a monk who became bishop of Toulouse; the truculent monk of Montaudon; and the satirical Peire Cardenal.

The decline and fall of Provençal literature was due mainly to political causes. When in the first decades of the 13th century the Albigensian Crusade had ruined a large number of nobles of the Midi and reduced them to poverty, the profession of troubadour ceased to be lucrative, and many troubadours went to the north of Spain and Italy, where Provençal poetry was esteemed. Following their example, other poets began to compose in Provençal, but from the middle of the 13th century these poets began to abandon the foreign tongue and took to the local dialects. About the same time in the Midi itself, poetry had died out save in a few places, and in the 14th century works were mainly for instruction and edification: the poetry of the troubadours was dead.

Aside from the troubadours' love poetry, medieval Provençal literature has some prominent specimens in other literary genres. Among these are the chansons de geste (poems in stanzas of indefinite length, with a single rhyme), the most notable of which is the *Girart de Roussillon,* a poem of 10,000 lines which related the struggles of Charles Martel with his vassal Gerard of Roussillon. Several Provençal romances of adventure have also survived: *Jaufré, Blandin de Cornoalha,* and *Guillem de la Barra.* Connected with the romance of adventure was the *novel* (in Provençal, plural, *novas*), which was originally an account of a recent event. Some of them could be ranked with the most graceful works in Provençal literature. Two were by the Catalan author Ramon Vidal de Besalú: the *Castia-gilos* was an elegant treatment of a story of the husband who disguises himself as his wife's lover, and the other was a recital of a question of the law of love. Mention may also be made of *Novas del Papagai* by Arnaut de Carcassès, in which the principal character is an eloquent parrot, who assists his master's amorous enterprises. *Novas* came to be extended to the proportions of a long romance, and *Flamenca* was a poem of more than 8,000 lines in which a lady by ingenious devices eludes the vigilance of her jealous husband: no book in medieval literature had more quickness of intellect or was more instructive about the manners and usages of polite society in the 13th century.

Provençal didactic and religious poetry includes several biographies of saints. Dramatic literature in Occitan consisted of short mysteries and miracle plays belonging to the 15th or 16th century. Aside from a few treatises on grammar and the poetic arts, relatively few notable works of prose literature were produced in Occitan in the medieval period.

By the late 15th century Provençal literature had waned without fading entirely, and in the following three centuries there was a succession of works in Provençal, chiefly of a didactic and edifying character, which served to keep alive some kind of literary tradition. After the French Revolution, scholars of Provençal literature occupied themselves by studying the brilliant literary traditions of the Middle Ages. This revival of interest in Provençal literature culminated in 1854 with the founding of a literary association known as the Felibrige. This group of poets and orthographers was dedicated to reviving the literary use of Occitans and to the purification of that language. By writing in their native dialect, the members of the Felibrige showed a desire to stir the Provençal nation to renewed awareness of its glory. The group's founder was Joseph Roumanille, but its most prominent and talented member was the poet Frédéric Mistral, whose finest works (the long narrative poems *Mirèio* [1859] and *Calendau* [1867], among others) towered above those of his fellows. Mistral received the Nobel Prize for Literature in 1904. (A.By./Ed.)

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Provence, historic and cultural region encompassing the southeastern French *départements* of Bouches-du-Rhône, Vaucluse, Alpes-de-Haute-Provence, and Var. It is roughly coextensive with the former province of Provence and with the present-day planning region of Provence-Alpes-Cote d'Azur (*q.v.*).

The *gouvernement* of Provence in 1789

With the establishment of Greek colonies (among them Massilia [modern Marseille]) in the area by the beginning of the 6th century BC, Provence was first oriented toward the civilization of the Mediterranean. In 125 BC the Massiliots appealed to the Romans for help against a coalition of neighbouring Celts and Ligurians. The Romans defeated the coalition but remained in occupation of the region. Thus by the end of the 2nd century BC, Provence formed part of Gallia Transalpina, the first Roman *provincia* beyond the Alps, from which the area took its name. By the 4th century AD, Arles, an important meeting place for merchants, was the seat of the prefecture of all Gaul, and Marseille was the main centre of Greek studies in the west.

With the breakdown of the Roman Empire in the late 5th century, Provence was successively invaded by the Visigoths, Burgundians, and Ostrogoths. The region came under the rule of the Franks in about 536 and was subsequently ruled by their Merovingian dynasty, though it was not integrated with the rest of France.

The great Carolingian rulers made Frankish rule effective in Provence, but, after the collapse of Carolingian rule, Provence formed part of a series of kingdoms set up between France and Germany: the first kingdom of Provence from 855 to 863; the second kingdom of Provence from 879 to about 934; and Burgundy–Provence, the Kingdom of Arles, which was nominally attached to the Holy Roman Empire in 1032. By the end of the 10th century, a local dynasty (which had led the region's defense against invasions by the Muslims) dominated the area and had acquired the title of count of Provence. With the end of this dynasty in 1113, the house of Barcelona gained the title, and Provence was ruled by the Spanish from Catalonia for more than a century.

In the 12th century, Provençal cities flourished from trade with the Levant and set up autonomous governments called consulates. At the same time, the civilization of the province—in which a language close to Latin was spoken and of which troubadour poetry and examples of early Romanesque architecture were among the outstanding cultural achievements—was at its height.

The Albigensian Crusade of the early 13th century, in which the Roman Catholic church suppressed the Cathari sect of southern France, introduced into Provence the influence of the papacy and northern France (although Provence, not being a stronghold of the Cathari, escaped devastation). The popes acquired Comtat Venaissin (in northern Provence, along the Rhône River) in the early 13th century and took up residence in Avignon from 1309 to 1377. Northern French influence in Provence dates from 1246, when Provence passed to the Angevin ruler Charles of Anjou, brother of King Louis IX. The province was at first subordinated to the Italian interests of these Angevin counts of Provence, who were also kings of Naples, but their reign saw the development of many of the region's characteristic political institutions, notably its Estates (assembly), which had the power to approve taxes and to help govern the province in times of disorder in the late 14th century.

In 1481 Provence was willed to the king of France, and its union to the crown was effected on the condition that Provence keep its administrative autonomy. From the 16th to the 18th century, however, control by the king grew. In 1673 the *généralité* of Aix was established as the seat of an intendant (royal governor), while the Estates of Provence were not convened between 1639 and 1787, until just prior to the French Revolution.

With the Revolution, the province completely lost its own political institutions and in 1790 was divided into the *départements* of Bouches-du-Rhône, Var, and Basses-Alpes (now Alpes-de-Haute-Provence). (The *département* of Vaucluse was added after the annexation of Comtat Venaissin in 1791 and that of Alpes-Maritimes with the annexation of the countship of Nice in 1860.)

The region comprises the Mediterranean coastline of southeastern France and its immediate (mostly hilly or mountainous) hinterland. Provence is mostly Roman Catholic, though there are sizable Protestant enclaves around Marseille and in Vaucluse around Lourmarin and Merindol. Repatriated émigrês from North Africa have greatly increased the number of Jews in Provence. Occitan continues to be spoken in the Comtat Venaissin.

Provence, Louis-Stanislas-Xavier, comte de (count of): *see* Louis XVIII *under* Louis (France).

Provence-Alpes-Côte d'Azur, formerly PROVENCE-CÔTE D'AZUR, *région de programme* ("planning region"), encompassing the southeastern French *départements* of Alpes-Maritimes, Hautes-Alpes, Alpes-de-Haute-Provence, Var, Bouches-du-Rhône, and Vaucluse and roughly coextensive with the historic region of Provence (*q.v.*). The capital is Marseille, and the other principal cities are Nice, Toulon, Cannes, and Aix-en-Provence. The region has an area of 12,124 square miles (31,400 square km) and is bounded by the *départements* of Savoie to the north, Isère and Drôme to the northwest, and Gard to the west. Bouches-du-Rhône, Var, and Alpes-Maritimes face the Mediterranean Sea to the south; Italy borders Alpes-Maritimes, Alpes-de-Haute-Provence, and Hautes-Alpes to the east. The southern flank of the Alps dominates the region and rises abruptly from the eastern coast, which is the Côte d'Azur. The plains of Comtat, Crau, and Camargue lie to the west and are drained by the lower Rhône River. A Mediterranean climate prevails along the coast. Annual precipitation approaches the national average but varies sharply from year to year.

The population is heavily concentrated along the coast and lower Rhône River. The coastal *départements* of Alpes-Maritimes and Bouches-du-Rhône have grown at the expense of the inland *départements* of Alpes-de-Haute-Provence and Hautes-Alpes, whose population has declined since 1800. The overall population has grown since 1946, with repatriates from North Africa accounting for much of the increase. Many retirees have been attracted to the Riviera region of Alpes-Maritimes, with the result that the population of the *département* is aging. More than 80 percent of the population is urban, though the percentage is much lower in the inland *départements.*

Dry farming predominates in Var and Vaucluse, producing grapes, wheat, and olives. The canal of Provence, initiated in the 1960s, taps the Verdon River and is used for irrigation. The petroleum refineries of Berre-l'Étang and La Mède outside Marseille support a major petrochemical complex; airplanes are built in nearby Marignane. The basin of Gardanne in Bouches-du-Rhône produces lignite. Tourism is a major industry and centres on the Côte d'Azur (particularly the Riviera) and the Alps. Pop. (1987 est.) 4,115,400.

Provence Alps, French ALPES DE PROVENCE, western spurs of the Maritime Alps (*q.v.*) in southeastern France, lying between the Dauphiné Alps (north), the Lower Rhône River (west), and the Mediterranean Sea (south). The coastal massifs of Maures and Estérel are considered part of the range. The mountains are dissected by valleys of the Durance, Var, Argens, and Verdon rivers. The Gorges du Verdon (Grand Canyon of the Verdon) near the resort of Castellane is a popular scenic attraction. The hills surrounding the perfume-making town of Grasse are covered with lavender.

proverb, succinct and pithy saying in general use, expressing commonly held ideas and beliefs. Proverbs are part of every spoken language and are related to such other forms of folk literature as riddles and fables that have originated in oral tradition. Comparisons of proverbs found in various parts of the world show that the same kernel of wisdom may be gleaned under different cultural conditions and languages. The biblical proverb "An eye for an eye, a tooth for a tooth," for example, has an equivalent among the Nandi of East Africa: "A goat's hide buys a goat's hide, and a gourd, a gourd." Both form part of codes of behaviour and exemplify the proverb's use for the transmission of tribal wisdom and rules of conduct. Often, the same proverb may be found in many variants. In Europe this may result from the international currency of Latin proverbs in the Middle Ages. The proverb known in English as "A bird in the hand is worth two in the bush" originated in medieval Latin, and variants of it are found in Romanian, Italian, Portuguese, Spanish, German, and Icelandic. Many biblical proverbs have parallels in ancient Greece. "A soft answer turneth away wrath" was known to Aeschylus as well as to Solomon, and "Physician, heal thyself" (Luke 4:23) was also known to the Greeks.

Certain stylistic similarities have been found in proverbs from the same part of the world. Middle Eastern proverbs, for instance, make frequent use of hyperbole and colourful pictorial forms of expression. Typical is the proverbial Egyptian description of a lucky man: "Fling him in the Nile and he will come up with a fish in his mouth." Classical Latin proverbs are typically pithy and terse (*e.g., Praemonitus, praemunitis;* "forewarned is forearmed"). Many languages use rhyme, alliteration, and wordplay in their proverbs, as in the Scots "Many a mickle makes a muckle" ("Many small things make one big thing"). Folk proverbs are commonly illustrated with homely imagery—household objects, farm animals and pets, and the events of daily life.

Proverbs come from many sources, most of them anonymous and all of them difficult to trace. Their first appearance in literary form is often an adaptation of an oral saying. Abraham Lincoln is said to have invented the saying about not swapping horses in the middle of the river, but he may only have used a proverb already current. Popular usage sometimes creates new proverbs from old ones; *e.g.,* the biblical proverb, "The love of money is the root of all evil" has become "Money is the root of all evil." Many still-current proverbs refer to obsolete customs. The common "If the cap fits, wear it," for instance, refers to the medieval fool's cap. Proverbs sometimes embody superstitions ("Marry in May, repent alway"), weather lore ("Rain before seven, fine before eleven"), or medical advice ("Early to bed, early to rise,/ Makes a man healthy, wealthy, and wise").

Most literate societies have valued their proverbs and collected them for posterity. There are ancient Egyptian collections dating from as early as 2500 BC. Sumerian inscriptions give grammatical rules in proverbial form. Proverbs were used in ancient China for ethical instruction, and the Vedic writings of India used them to expound philosophical ideas. The biblical book of Proverbs, traditionally associated with Solomon, actually includes sayings from earlier compilations.

One of the earliest English proverb collections is the so-called *Proverbs of Alfred* (*c.* 1150–80), containing religious and moral precepts. The use of proverbs in monasteries to teach novices Latin, in schools of rhetoric, and in sermons, homilies, and didactic works made them widely known and led to their preservation in manuscripts.

The use of proverbs in literature and oratory was at its height in England in the 16th and 17th centuries. John Heywood wrote a dialogue in proverbs (1546; later enlarged) and Michael Drayton a sonnet; and in the 16th century a speech in proverbs was made in the House of Commons.

In North America the best-known use of proverbs is probably in *Poor Richard's*, an almanac published annually between 1732 and 1757 by Benjamin Franklin. Many of Poor Richard's sayings were traditional European proverbs reworked by Franklin and given an American context when appropriate.

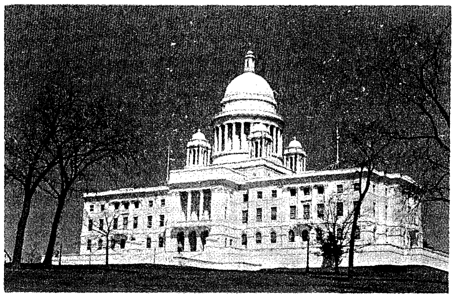
The study of folklore in the 20th century has brought renewed interest in the proverb as a reflection of folk culture.

Proverbs, The, also called THE BOOK OF PROVERBS, an Old Testament book of "wisdom" writing found in the third section of the Jewish canon, known as the Ketuvim, or Writings. The book's superscription, "The proverbs of Solomon. . . ," is not to say that it as a whole or even individual proverbs should be credited to King Solomon, for scholarly examination discloses that it contains seven collections of wisdom materials (mostly short sayings) from a wide variety of periods, all after Solomon's time.

The earliest collection (25:1–29:27), titled "proverbs of Solomon which the men of Hezekiah king of Judah copied," came into being about 700 BC; the latest (1:1–9:18) dates from the 4th century BC. There also is an untitled acrostic poem about the virtuous wife (31:10–31).

The third collection (22:17–24:22) has attracted much attention because of its close affinity to the Egyptian "Wisdom of Amenemope," variously dated between the 10th and 6th centuries BC. This likeness suggests that Israel's wisdom movement, whatever its origins, was influenced by the wisdom literature of other ancient Middle Eastern cultures.

Providence, city, capital of Rhode Island, U.S., and seat of Providence county. It lies at the head of Narragansett Bay on the Providence River. A seaport and an industrial and commercial centre, it is the focus of a metropolitan area that includes Pawtucket, East Providence, Central Falls, Cranston, and Woonsocket. It was founded in 1636 by Roger Williams, who had been banished from Plymouth Colony for his unorthodox religious beliefs. Williams and five dissenter companions, after canoeing along the Moshassuck River to what is now College Hill, found a freshwater spring. From the Narraganset Indian chieftains Canonicus and Miantonomi he purchased the surrounding land, which he named for "God's merciful providence." The settlement's growth, halted by King Philip's (Indian) War (1675–76), was given impetus in 1680, when Pardon Tillinghast built a wharf that became a base for the thriving Triangular Trade in molasses, slaves, and rum between Africa, the West Indies, and the American Colonies.



The State House, Providence, R.I.

By courtesy of the Rhode Island Department of Economic Development, Providence

Providence played an important role in the American Revolutionary War; it had its own "Tea Party," at which tea was burned in protest against taxation. Forts were built in the town, and American and French troops were quartered in what is now University Hall (built 1770; restored 1940) at Brown University. The Old State House (1762) was the scene of the signing of the Rhode Island Independence Act (May 4, 1776) two months in advance of the country's own Declaration of Independence. In the post-Revolutionary period, Providence's sea trade quickly recovered; and, by the late 19th century, it was supplemented by industrial activity, which today includes the manufacture of machinery and machine tools, textiles, jewelry, and rubber goods. Providence remains a busy seaport and is a distributing point for oil, coal, gas, cement, and lumber.

Providence was incorporated as a city in 1831 and became sole capital of Rhode Island in 1900, an honour it had shared with Newport until that time. The city contains much of historic interest. The Old State House is a national historic landmark. The names of many streets (*e.g.,* Benefit, Benevolent, Hope, Friendship, Dubloon, India, Packet, and Ship) are reminders of the community's early search for religious toleration and of its maritime commerce. Other colonial landmarks include: the First Baptist Church (1775), the oldest Baptist church in the United States; the Market House (1773); and the John Brown House (1786), now the home of the Rhode Island

Historical Society. The First Unitarian Church (1815–16) has a large bell cast by Paul Revere.

Educational institutions include Brown University (founded in 1764 in Warren as Rhode Island College, moved to Providence in 1770, and renamed in 1804 for Nicholas Brown, its principal benefactor); Johnson and Wales College (1914); the Rhode Island School of Design (1877); Rhode Island College (established in 1854 as Rhode Island Normal School); and Providence College (1917, Roman Catholic). The Providence Athenaeum (1838) houses a collection of old books and paintings. The State House (1895–1900), built of white Georgia marble, has a dome measuring 50 feet (15 m) in diameter. The city has two cathedrals, SS. Peter and Paul (1878–86, Roman Catholic) and St. John (1810, Episcopal).

Severe damage was caused by a hurricane and tidal wave in 1938, and, as a protection, the Fox Point Hurricane Barrier was completed in 1966. Pop. (1987 est.) city, 158,978; metropolitan area (CMSA), 1,117,700.

province, Latin PROVINCIA, plural PROVINCIAE, in Roman antiquity, a territorial subdivision of the Roman Empire—specifically, the sphere of action and authority of a Roman magistrate who held the *imperium,* or executive power. The name was at first applied to territories both in Italy and wherever else a Roman official exercised authority in the name of the Roman state. Later the name implied Roman possessions outside Italy from which tribute was required.

Under the republic (*c.* 509–31 BC), when each province was formed, the Senate drew up a special charter, or *lex provinciae* (provincial law), based on the report of the general who had conquered the province. This charter defined the province's territorial limits and the number of towns that it included, as well as the rights and duties of the provincials, especially the kind and amount of tribute that they had to pay. The Senate also appointed a Roman magistrate to rule each province, together with a quaestor and up to three *legati* (lieutenants). Assisted by his staff, the governor exercised complete control over his province. The virtual autonomy of provincial governors in republican times often tempted them to widespread extortion and other abuses against provincials. Provincial administrative reforms at the beginnings of the empire, however, provided for a division of powers, and procurators were appointed to look after provincial finances. Upon assuming the government of a province, the governor would issue an edict to supplement the *lex provinciae;* during his tenure he was not bound by the edicts of his predecessors. Governors were either consuls or praetors, and these were called proconsuls and propraetors when their powers were extended for more than a year. The Senate decided which provinces would be governed by consuls and which by praetors. The praetors and consuls would then draw lots to determine their particular provinces.

Under the empire (from 27 BC), provinces were divided into two classes: senatorial provinces were governed by former consuls and former praetors, both called proconsuls, whose term was annual; imperial provinces were governed by representatives of the emperor (called propraetorian legates), who served indefinitely.

Roman provincial government allowed for considerable local autonomy. Roman officials were few and, particularly in the eastern provinces, relied heavily upon locally recognized leaders if they were friendly to Rome. Augustus, who reigned from 27 BC to AD 14, initiated for the first time a general policy regarding governing practices to provide efficient and just administration.

Provincetown, urban town (township), Barnstable county, eastern Massachusetts, U.S., at the northern tip of Cape Cod. It is located among sand dunes within a fishhook-shaped harbour that was visited by the explorers Bartholomew Gosnold in 1602 and Henry Hudson in 1609. The Pilgrims landed there on Nov. 20, 1620 (before they founded Plymouth). It was on board the *Mayflower* in Provincetown harbor that the Mayflower Compact, establishing general lines for the colony's government, was signed and where the first European child in New England (Peregrine White) was born. The Pilgrim Memorial Monument (252 feet [78 m] high and built 1907–10) and Provincetown Historical Museum (both on Town Hill) commemorate these events. Traders and fishermen settled the site prior to 1700; the community, known as the Precinct of Cape Cod or Province Lands, was part of Truro until it was separately incorporated in 1727 as Provincetown. Exposed to repeated seaborne attacks, it was abandoned during the French and Indian Wars and the American Revolution. Its harbour was used by the British as a naval base during the Revolution and during the War of 1812.

Provincetown, Cape Cod, Mass.
V. Bucher—Photo Researchers/EB Inc.

As an active whaling and fishing port in the 19th century, Provincetown attracted large numbers of Portuguese fishermen, whose descendants still maintain a fleet there. Salt making (by evaporating seawater) was long an important activity. Bounded by the Cape Cod National Seashore, Provincetown is a popular summer resort and noted artists' colony. A longtime resident was Eugene O'Neill, whose first produced play, *Bound East for Cardiff,* was staged there in 1916 by the Provincetown Players. Ferry and air services connect the town to Boston, 55 miles (89 km) to the northwest across Cape Cod and Massachusetts bays. Pop. (1986 est.) 3,500.

Provincetown Players, theatrical organization that began performing in 1915 in Provincetown, Mass., U.S., founded by a non-theatre group of writers and artists whose common aim was the production of new and experimental plays. Among the original Provincetowners who staged the first plays in members' homes were Mary Heaton Vorse, George Cram Cook, Susan Glaspell, Hutchins Hapgood, Wilbur Steele, and Robert Edmond Jones.

In 1916 the group produced in New York City Eugene O'Neill's *Bound East for Cardiff* and *Thirst,* thus launching the career of one of America's distinguished playwrights. That winter the Provincetown Players took up residence in New York City's Greenwich Village and for years thereafter discovered and developed the work of such noted writers, designers, and actors as Floyd Dell, Edna St. Vincent Millay (*Aria da Capo*), Donald Oenslager, Kenneth Macgowan, Jasper Deeter, and Paul Green, whose *In Abraham's Bosom* was awarded the Pulitzer Prize in 1927.

From its inception to its demise in 1929, the Provincetown Players flourished as a non-commercial theatre; it stimulated the work of many theatrical talents that otherwise might have remained obscure.

Provincias Unidas de Centro-América: *see* United Provinces of Central America.

Provins, town, Seine-et-Marne *département,* Île-de-France *région,* north-central France. It lies east-southeast of Paris. The older part of the city, the Ville-Haute (Upper Town), stands on a hill and is partly surrounded by medieval walls (12th and 13th-century). The Upper Town is dominated by a 12th-century keep known as the Tour de César, built on the site of a Roman fort. The 12th-century Grange-aux-Dîmes (tithe barn) houses a small museum of medieval sculpture. The Ville-Basse (Lower Town), founded in the 9th century by monks fleeing from the Normans, lies in the valley below.

In the 13th century Provins was one of the most important towns in France, with a population of 80,000 inhabitants. A prosperous wool centre, its fairs were famous all over Europe. At the end of the 13th century, its privileges were abrogated, and it began to decline. The cultivation of the red rose, imported by a crusader, flourished at Provins; and when Edmund "Crouchback," younger son of Henry III of England, was suzerain of the town in the 13th century, he made the flower the badge of the house of Lancaster. It became famous in the Wars of the Roses, the 15th-century English dynastic struggle, as opposed to the white rose of the house of York. Kaolin is mined in the vicinity. Pop. (1982) 12,005.

Provo, city, seat (1852) of Utah county, north-central Utah, U.S. It lies along the Provo River between Utah Lake and the Wasatch Mountains, at an elevation of 4,549 feet (1,387 m). Settled (1849) by a Mormon colonizing mission sent by Brigham Young, its name was changed (1850) from Fort Utah (established as a defense against Ute Indian attacks) to honour Étienne Provost, a French-Canadian trapper. Construction of railroads in the 1870s from Salt Lake City (45 miles [72 km] north-northwest) and Scofield spurred the city's industrial development as a centre for mining (silver, lead, copper, and gold) and manufacturing (steel, canning, electronics, and textiles). At Geneva, on the city's northwestern flank, is a large integrated steel plant. The founding in 1875 of Brigham Young Academy (which became a university in 1903) also contributed to Provo's growth. Utah Technical College at Provo opened in 1941. The adjacent Uinta National Forest is headquartered in the city. Nearby are the Timpanogos Cave National Monument (*q.v.*), a state fish hatchery and bird refuge, and Provo Peak (11,054 feet [3,369 m]). Inc. 1851. Pop. (1987 est.) city, 78,164; Provo-Orem metropolitan area (MSA), 241,800.

provolone, cow's-milk cheese from southern Italy. Provolone, like mozzarella, is a plastic curd cheese; the curd is mixed with heated whey and kneaded to a smooth, semisoft consistency, often molded into fanciful shapes such as pigs, fruits, or sausages. The brown, oily rind of provolone is wrapped in cords, which impress grooves in the rind, and hung to ripen. They are often seen on display in Italian food shops. The creamy yellow interior of provolone is smooth and pliable.

The cheese comes in two types: the mild and delicately flavoured *dolce* and the longer-aged, sharper *piccante.* Provolone is also commonly smoked to impart a light, distinctive aroma and flavour.

Prudentius, in full AURELIUS CLEMENS PRUDENTIUS (b. AD 348, Caesaraugusta, Spain—d. after 405), Christian Latin poet whose *Psychomachia* ("The Contest of the Soul"), the first completely allegorical poem in European literature, was immensely influential in the Middle Ages.

Prudentius practiced law, held two provincial governorships, and was awarded a high position by the Roman emperor Theodosius. Tiring of court life, he devoted the rest of his time, from about 392, to writing poems on Christian themes. He published a collection of his poems with an autobiographical preface in 405.

The *Cathemerinon* ("Book in Accordance with the Hours") comprises 12 lyric poems on various times of the day and on church festivals. The symbolism of light and darkness occasionally develops into sustained allegory. The *Peristephanon* ("Crowns of Martyrdom") contains 14 lyric poems on Spanish and Roman martyrs. Three long didactic poems give a polemical exposition of Christian doctrine in a form agreeable to those steeped in the old classical literary tradition. The *Apotheosis* is directed against disclaimers of the Trinity and the divinity of Christ. The *Hamartigenia* ("The Origin of Sin") attacks the Gnostic dualism of Marcion and his followers. The *Psychomachia* describes the struggle of faith, supported by the cardinal virtues, against idolatry and the corresponding vices. The two *Contra Symmachum* ("Books Against Symmachus") were written in reply to that pagan senator's requests that the altar of Victory be restored to the Senate house. The *Dittochaeon* ("The Double Testament"), 49 quatrains intended as captions for the murals of a basilica in Rome, is of interest mainly to art historians.

Prudentius gave classical literary form to Christian doctrines. His poetry's content was derived from early Christian authors, such as Tertullian and St. Ambrose, and from the Bible and the Acts of the Martyrs. Familiar to moderns is the beautiful Christmas plainsong hymn *Divinum Mysterium* ("Of the Father's Love Begotten") and the hymn for Epiphany, "Earth Has Many a Noble City," both from the *Cathemerinon*.

Prudhoe Bay, small inlet of the Beaufort Sea and Arctic Ocean, indenting the north coast of Alaska, U.S., and lying 200 miles (320 km) east-southeast of Point Barrow. The bay has been the centre of drilling activities since the discovery of vast petroleum deposits on Alaska's North Slope in 1968. The trans-Alaskan oil pipeline, which links the area to Valdez, an ice-free port on Prince William Sound (Pacific Ocean) 800 miles (1,300 km) to the south, has led to the rapid growth of the settlement of Prudhoe Bay.

Prudhomme, René-François-Armand: *see* Sully Prudhomme.

Prud'hon, Pierre-Paul (b. April 4, 1758, Cluny, Fr.—d. Feb. 16, 1823, Paris), French draftsman and painter whose work bridges the Neoclassical spirit of the late 18th century and the personal expression of 19th-century Romanticism.

After training at Dijon, Fr., Prud'hon went to Rome (1784), where he became acquainted with the Neoclassical sculptor Antonio Canova and admired the work of Leonardo da Vinci and Correggio. The latter particularly inspired him to introduce a softer, more sensual effect into French painting, which was then dominated by the austere sculptural style of Jacques-Louis David.

At first Prud'hon survived by drawing for engravers and painting portraits. Brought to the attention of Napoleon, he was employed intermittently as court portraitist and decorator. One of his best-known works, the "Portrait of the Empress Joséphine" (1805), was influenced by Canova and Correggio and possesses his characteristic seductive mildness and the vaguely romantic, mysterious quality that he invested in his portraits of women.

Prud'hon achieved fame and honour with an allegorical work, "Crime Pursued by Vengeance and Justice" (1808). The elegance, fancy, and grace of his work, reminiscent of the times of Louis XV and XVI, prompted David to compare him disparagingly with the Rococo master François Boucher. Because of

"Crime Pursued by Vengeance and Justice," oil on canvas by Prud'hon, 1808; in the Musée-Hôtel Sandelin, Saint-Omer, Fr.
Giraudon—Art Resource/EB Inc.

his imperfect understanding of the aging of pigment, Prud'hon's paintings have darkened badly. His drawings, however, retain their exceptional qualities. Shock resulting from the suicide of his mistress, Constance Mayer, in 1821 is believed to have hastened his death.

prune, dried plum. *See* plum.

pruning, in horticulture, the removal or reduction of parts of a plant, tree, or vine that are not requisite to growth or production, are no longer visually pleasing, or are injurious to the health or development of the plant. Pruning is common practice in orchard and vineyard management for the improvement of flowering and fruiting. In home gardening (*e.g.,* rose culture), pruning enhances plant shape and flowering potential; new growth emerges from the bud or buds immediately below the pruning cut. The once-common practice of cutting off a branch so that its base is flush with the limb is now recognized as inadvisable. Instead, the pruning cut should be made just above the collar, or swelling—essentially a protective callus—that surrounds the base of the branch. Ragged bark at the edge of the wound should be carefully trimmed. The application of pruning paint, or dressing, also a once-common practice, is unnecessary, but thin coasts may be applied for cosmetic reasons. Incorrect pruning can cause flower and fruit loss and leave the plant weak and vulnerable to disease or insect damage.

Tree injuries caused by ice, strong winds, lightning, fire, or disease require major repair by a tree surgeon. If left uncorrected, such damage can result in the death of the tree. Common tree surgery procedures include the removal of broken, dead, or diseased branches; cutting back limbs that interfere with traffic, impede power and telephone lines, obstruct views, or mar the shape of a tree; thinning to permit air circulation and secure more light; removal of branches that rub against others to prevent wounding and possible future decay; judicious cutting to compensate for root loss and promote formation of blossoms; and heading back to revitalize an aged tree. The origin of modern tree surgery is attributed to John Davey of Kent, Ohio, who established a landscaping business there in 1880.

Prunus, genus of more than 400 species of flowering shrubs and trees, in the rose family (Rosaceae). The genus *Prunus* has great economic importance as it includes the cultivated almond, peach, plum, cherry, and apricot (*qq.v.*). Some authorities separate peaches, almonds, and flowering almonds in the genus *Amygdalus.*

Prus, Bolesław, pseudonym of ALEKSANDER GŁOWACKI (b. Aug. 20, 1847, Hrubieszów, Pol.—d. May 19, 1912, Warsaw), Polish journalist, short-story writer, and novelist, one of the leading figures of the Positivist period in Polish literature following the revolt of 1863.

Though born to a gentry family, Prus had experienced proletarian conditions and was a lifelong believer in social equality. Throughout much of his life he contributed articles called "chronicles" to daily papers and periodicals; these reveal the talent for detailed observation and lively presentation that was to make his novels and short stories so effective.

Among the best known of his tales are *Z legend dawnego Egiptu* ("A Legend of Old Egypt"), *Kamizelka* ("The Waistcoat"), and *Katarynka* ("The Barrel-Organ"). His novels include *Lalka* (1890; "The Doll"), which gives a complex picture of bourgeois life in Warsaw toward the end of the 19th century; and *Faraon* (1897; "The Pharaoh"), an ambitious evocation of ancient Egypt.

Prusa: *see* Bursa.

Prussia, German PREUSSEN, Polish PRUSY, in European history, any of certain areas of eastern and central Europe, respectively (1) the land of the Prussians on the southeastern coast of the Baltic Sea, which came under Polish and German rule in the Middle Ages; (2) the kingdom ruled from 1701 by the German Hohenzollern dynasty, including Prussia and Brandenburg, with Berlin as its capital, which seized much of northern Germany and western Poland in the 18th and 19th centuries and united Germany under its leadership in 1871; and (3) the *Land* (state) created after the fall of the Hohenzollerns in 1918, which included most of their former kingdom and which was abolished by the Allies in 1947 as part of the political reorganization of Germany after its defeat in World War II.

The original Prussians, mainly hunters and cattle breeders, spoke a language belonging to the Baltic group of the Indo-European language family. These early Prussians were related to the Latvians and Lithuanians and lived in tribes in the then heavily forested region between the lower Vistula and Niemen rivers. Their social organization was loose (although some elements of stratified society can be traced), and they were pagans. Early attempts to convert the Prussians to Christianity—notably those made by Saint Adalbert and Saint Bruno of Querfurt at the turn of the 11th century—were unsuccessful. In the 13th century, however, the Prussians were conquered and Christianized by the German-speaking knights of the Teutonic Order, which had been awarded Prussian lands by the Polish duke Conrad of Mazovia for help against Prussian incursions. The Prussian countryside was subdued, castles were built for German nobility, and many German peasants were settled there to farm the land. By the middle of the 14th century, the majority of the inhabitants of Prussia were German-speaking, though the Old Prussian language did not die out until the 17th century; by the 17th century the indigenous population was thoroughly assimilated.

The latter part of the 14th century was characterized in eastern Europe by a strong reaction among Slavs and Balts against the Germans. Poland and Lithuania formed their first dynastic union in 1386 and, in the 15th century, defeated the Teutonic Knights in a series of wars. By the Second Treaty of Toruń (1466) the Polish crown acquired direct sovereignty over the Teutonic Order's former possessions to the west of the lower Vistula River, together with the Kulmerland (or Chełmno district) and Ermland (Warmia) to the east; and that part of Prussia east of the Vistula River (*i.e.*, East Prussia) was left to the order only on condition that the grand, or high, master should hold it as fief of the Polish crown. The lands along the Vistula, under Polish sovereignty, became known as Royal Prussia; thus a wedge of predominantly Polish-speaking territory came to be consolidated between German-speaking East Prussia and the German Reich to the west.

Ducal Prussia and the Kingdom of Prussia, to 1786. The Teutonic Order's last grand master in Prussia, Albert of Hohenzollern, became a Lutheran and, in 1525, secularized his fief, which he transformed into a duchy for himself. Thenceforward until 1701 this territory (*i.e.*, East Prussia) was known as Ducal Prussia. When Albert's son and successor, Albert Frederick, died sonless in 1618, the duchy passed to his eldest daughter's husband, the Hohenzollern elector of Brandenburg, John Sigismund.

The union of Ducal Prussia with Brandenburg (*q.v.*) was fundamental to the rise of the Hohenzollern monarchy to the rank of a great power in Europe. John Sigismund's grandson Frederick William of Brandenburg, the Great Elector (reigned 1640–88), by military intervention in the Swedish-Polish War of 1655–60 and by diplomacy obtained the ending of Poland's suzerainty over Ducal Prussia at the Peace of Oliva (1660). This made the Hohenzollerns sovereign over Ducal Prussia, whereas Brandenburg and their other German territories were still nominally parts of the Reich under the theoretical suzerainty of the Holy Roman emperor. Frederick William was also able to set up a centralized administration in Prussia and to wrest control of the duchy's financial resources from the nobility.

The most significant achievement of the Great Elector's son Frederick (reigned 1688–1713) was to secure the royal dignity for himself as Frederick I, king in Prussia, crowning himself at Königsberg on Jan. 18, 1701. Thereafter, the other Hohenzollern possessions, though theoretically remaining within the German Reich and under the ultimate overlordship of the Holy Roman emperor, soon came to be treated in practice rather as belonging to the Prussian kingdom than as distinct from it.

Frederick I's son Frederick William I began his reign in 1713 shortly before the conclusion of the Treaty of Utrecht, which assigned to him not only the so-called Upper Quarter of Geldern on the Meuse River but also the principality of Neuchâtel and Valengin on the border of France and Switzerland. Through participation in the Great Northern War, he further acquired much of western Pomerania (1720).

It was Frederick William I who endowed the Prussian state with its military and bureaucratic character. He raised the army to 80,000 men (equivalent to 4 percent of the population) and geared the whole organization of the state to the military machine. One half of his army consisted of hired foreigners; the other half was recruited from the king's own subjects on the basis of the "canton system." This system made all young men of the lower classes—mostly peasants—liable for military service. While the upper bourgeoisie was exempt from this military service, the nobles were under a moral obligation, which the king repeatedly emphasized, to serve in the officers' corps.

This close coordination of military, financial, and economic affairs was moreover complemented by Frederick William I's reorganization of the administrative system, and he came to control the whole life of the state. His autocratic temperament and his fanatical addiction to work found expression in complete absolutism. To his son and successor, Frederick II, he left the best-trained army in Europe, a financial reserve of 8,000,000 thalers, productive domains, provinces developed through large-scale colonization (particularly East Prussia), and a hardworking, thrifty, conscientious bureaucracy.

Frederick II the Great (reigned 1740–86) put the newly realized strength of the Prussian state at the service of an ambitious but risky foreign policy. Hailed by Voltaire as "the philosopher king" personifying the Enlightenment and its ideal of peace, Frederick astonished Europe within seven months of his accession to the throne by invading Silesia (December 1740). This bold stroke precipitated the War of the Austrian Succession, and the Austro-Prussian struggle for Silesia continued, with uneasy intermissions, until the end of the Seven Years' War in 1763. Silesia, a rich province with many flourishing towns and an advanced economy, was an important acquisition for Prussia. Frederick's wars not only established his personal reputation as a military genius but also won recognition for Prussia as one of the Great Powers.

Besides Silesia, Frederick also acquired East Frisia on the North Sea coast, and later, at the First Partition of Poland in 1772, he obtained West Prussia, that is, Polish Royal Prussia, thus forming a territorial link between East (Ducal) Prussia and the rest of his domains to the west.

Frederick made no substantial changes in the administrative system as organized by his father, but he did effect improvements in the judicial and educational systems and in the promotion of the arts and sciences. The freedom of conscience that Frederick instituted was the product not merely of his own skeptical indifference to religious questions but also of a deliberate intention to bring the various churches together for the benefit of the state and to allow more scope to the large Roman Catholic minority of his subjects in relation both to the Protestant majority and to the Evangelical establishment.

The French Revolutionary and Napoleonic period. Frederick William II (reigned 1786–97) was not nearly so considerable a ruler as his uncle, whom he succeeded. He purchased the margravates of Ansbach and Bayreuth in southern Germany and obtained a far larger territory in the east through the Second and Third Partitions of Poland, but he had no success against the armies of Revolutionary France. By the Peace of Basel (1795), he consented to France's eventual annexation of the German lands west of the Rhine. Moreover, Frederick William's management of the Prussian economy was less prudent than his predecessor's and finally brought the state's finances into disorder. His son, Frederick William III (reigned 1797–1840), pursued at first a foreign policy of caution and neutrality with respect to France and Napoleon, and, when at last he went to war in 1806, it was too late to avert catastrophe. Napoleon's overwhelming defeat of the Prussians in the battles of Jena and Auerstädt was followed by the rapid collapse of the state. By the Treaty of Tilsit (1807) the king had to cede all his possessions west of the Elbe River and all that had been gained under the Second and Third Partitions of Poland, together with the southern part of what had been gained under the First, so that the monarchy was reduced to Brandenburg, Silesia, the Pomeranian provinces, northern West Prussia (without Danzig), and East Prussia. Furthermore, the state was required to pay an exorbitant contribution to Napoleon's finances and to accept a French occupation of much of its territory.

The backwardness of Prussia was revealed by the disaster of 1806. Administrative, social, and military reforms were clearly overdue, and the king's chief minister, Karl Stein (*q.v.*), seized the opportunity to introduce them. His basic idea was to evoke a positive consciousness of solidarity with the state by allowing the citizens to take a more active part in public affairs. This idea underlay the emancipation of the serfs (begun in 1807), the measures for local self-government, and the reshaping of the central government. Even after Stein was dismissed from office at Napoleon's behest in November 1808, the work of reform continued under Karl von Hardenberg, Prussia's chancellor of state, or prime minister, from 1810.

The Napoleonic domination of Europe, meanwhile, was provoking a great upsurge of national sentiment, which was felt in Prussia no less strongly than in the other German states and was eventually to manifest itself in the War of Liberation (1813–14). The transformation of the Prussian army from a largely mercenary force into a genuinely national organ was begun by Gerhard von Scharnhorst, who thus prepared it for the part that it was to play.

At the same time, the Romantic movement in the intellectual and artistic fields further stimulated patriotism and the cult of liberty, to the service of which it even brought its interpretation of history. The foundation, in 1809, of the Friedrich Wilhelm University in Berlin, with Wilhelm von Humboldt as its chief promoter, affirmed Prussia's spirit in the aftermath of defeat.

Karl von Hardenberg adroitly steered Prussia through the difficult year 1812, when Prussia and Austria, in enforced alliance with France, had to participate in Napoleon's attack on Russia. Napoleon's retreat from Moscow was the signal for a rising against the French. The Prussian army, with G.L. von Blücher and A. Neidhardt von Gneisenau as its leaders, took a major part in the Battle of Leipzig, in the campaign of 1814 in France, and in the Waterloo campaign of 1815.

The Congress of Vienna (1814–15) did not restore Ostfriesland, Lingen, Hildesheim, Ansbach, or Bayreuth to Prussia, and the latter recovered nothing of its gains under the Third Partition of Poland and regained only Danzig and a few other towns under the Second. But the rest of what Prussia had possessed in 1803 was restored practically entirely by the Congress, with considerable additions of new territory. This new territory comprised (1) areas taken from the kingdom of Saxony, which were merged with older Prussian territories on the west bank of the lower Elbe to form the Prussian province of Saxony; (2) areas west and east of the Rhine River, which were merged with older Prussian territories to form the Prussian Rhine province and the province of Westphalia; and (3) the formerly Swedish part of Vorpommern, with Rügen Island, which was merged with the rest of the Pomeranian territory to form the province of Pomerania, or Pommern. Moreover, by the Peace of Paris (1815), France ceded Saarlouis and Saarbrücken to Prussia, which incorporated them in the Rhine province. Thus, after 1815, Prussia stretched uninterrupted from the Niemen River in the east to the Elbe River in the west, and west of the Elbe it possessed large (if discontinuous) territories in western Germany.

With its major territorial axis shifted from eastern Europe to western and central Germany, Prussia was henceforth the only great power with a predominantly German-speaking population. It was thus Austria's potential rival for hegemony in the German Confederation (*Deutscher Bund*), which the Congress also created.

The kingdom from 1815 to 1918. The reforming impulse flagged after 1815. Frederick William III promised in May 1815 to introduce a constitution but failed to carry out his promise, and the army lost much of its new spirit. On the other hand, the Prussian educational system remained the best in Europe, the University of Berlin in particular enjoying an unrivaled reputation. The major parts of the kingdom's western provinces, however, had never been Prussian before and, being mainly Roman Catholic, were alien to Prussia in outlook. This often produced a fierce conflict between church and state. The Prussian bureaucracy established a high standard of efficiency and honesty that was at this time unique in Europe. In 1818 a simplified tariff, with moderate customs dues, was introduced for the entire kingdom; and this tariff became the basis for the Zollverein (Customs Union) established in 1834, which by 1852 included all the German states except Austria and Hamburg.

Frederick William IV (reigned 1840–61), a romantic, aspired to revive in Prussia his imaginary conception of the Middle Ages. He called off the conflict with the Roman Catholic church, and in 1844 he actually attended the celebrations that marked the completion, after many centuries, of the Cologne Cathedral—the first king of Prussia to enter a Roman Catholic building. Though opposed to modern constitutionalism, he aspired to create Estates of the Realm on a medieval pattern. He sponsored a national Diet and then abandoned it.

In March 1848 revolution broke out in Germany, inspired by the February revolution in France. Though the Prussian army was victorious over the insurrection, the king lost his nerve. He withdrew the army from Berlin on March 19 and for a brief period put himself at the head of the revolution. A liberal government was set up, and a Constituent Assembly was summoned; but the liberal moves were abortive, the army reoccupied Berlin, and in December the Assembly was dissolved. Finally the king imposed a constitution by decree in February 1850. This constitution remained unchanged until 1918. Prussia received a parliament with two chambers. The First, or Upper, Chamber, officially named the Herrenhaus (House of Lords) in 1854, was composed of representatives of the great landed proprietors and of the large towns, and of members nominated by the king, some for life and some with hereditary right. The Second, or Lower, Chamber was elected by all taxpayers, divided into three classes according to the taxes paid. The king retained the unrestricted choice of ministers, but it was difficult for them to govern against the express wish of the chambers. The constitution appeared inadequate by contemporary liberal standards; but its retention in the years of reaction after 1850 gave Prussia a higher standing than Austria in liberal eyes.

During the revolution of 1848 Frederick William IV had aspired to lead the movement for German unification and had even been tempted to accept the German imperial crown, which was offered to him by a delegation from the Frankfurt Assembly on April 3, 1849. He was dissuaded with difficulty by his conservative advisers; but he did thereafter try to establish the so-called Erfurt Union, a union of the German states without Austria. In 1850 Austria challenged this union. Frederick William IV and his conservative ministers shrank from war, and Prussia was obliged to abandon its ambitions by the Punctation of Olmütz (Nov. 29, 1850).

Frederick William IV became insane in 1857. His brother took over as regent in 1858 and became king as William I on Frederick William IV's death in 1861. William I appointed a liberal ministry under Karl Anton, prince of Hohenzollern-Sigmaringen, a Roman Catholic, and for nearly four years Prussia experienced the so-called New Era, during which it was hoped that Prussia would win the leadership of Germany by the force of moral example. But dispute soon arose between the king and the chambers over budgets and taxes for the army. Otto von Bismarck, who was appointed minister-president in September 1862, devised an ingenious theory. The constitution provided that the budget should be agreed between the two chambers and the king. Bismarck argued that, since the Lower Chamber had failed to agree with the Upper and with the king, there was "a gap in the constitution"; and he claimed that it was the king's duty to spend money without a budget until agreement was reached. The government got its money. During the crisis of 1863–64 over the Schleswig-Holstein question, the Lower Chamber persisted in rejecting the military budget, but this did not prevent Prussia's going to war against Denmark. It was Prussia's Seven Weeks' War against Austria in 1866 that ended the constitutional crisis: Bismarck apologized for the illegal expenditure of money; and in September the two chambers passed an Act of Indemnity.

The Danish War of 1864 led to an Austro-Prussian condominium over Schleswig-Holstein. The Seven Weeks' War was followed by the annexation not only of Schleswig-Holstein but also of Hanover, Electoral Hesse, Nassau, and Frankfurt am Main to Prussia, which now extended without interruption across the northern two-thirds of Germany and contained two-thirds of Germany's population.

The Franco-German War of 1870–71 established Prussia's position as the leading state in the imperial German Reich. William I of Prussia became German emperor on Jan. 18 1871; the Prussian army virtually absorbed the other German armed forces, except the Bavarian army, which remained autonomous in peacetime. Bismarck combined the offices of imperial chancellor and Prussian minister-president, and Prussia's history merged largely into that of the German empire. (*See* Germany.)

Germany's defeat at the end of World War I and the overthrow of the empire and the Prussian monarchy also ended Prussia's supremacy. Prussia—which lost part of Silesia, Posen, West Prussia, Danzig, Memel, northern Schleswig, some small areas on the Belgian frontier, and the Saar district as a result of the Treaty of Versailles or the ensuing plebiscites—became a *Land* under the Weimar Republic, with more restricted powers than before and with little influence on the government of the Reich. After the rise to power of Adolf Hitler in 1933, the Prussian constitution was set aside and the legislature abolished, though Prussia remained a unit for administrative purposes.

In 1945, after defeat in World War II, Germany came under the four-power control of the victorious allies—Great Britain, the United States, the Soviet Union, and France. Northern East Prussia was annexed by the Soviet Union; the rest of the *Land* east of the Oder-Neisse line was transferred to Poland; and the remainder was divided between the Soviet, British, and French zones of occupation. One of the few acts of the Allied Control Council was formally to abolish Prussia (March 1, 1947).

Prussian blue, any of several deep-blue pigments that are composed of complex iron cyanides and hence called iron blues. The most common of these pigments are Prussian, Chinese, Milori, and toning blue. Prussian blue has a reddish tint and is used almost exclusively in paints, enamels, and lacquers; Chinese blue is very dark, with a greenish tint, and is favoured for use in printing inks; Milori blue has a reddish tint; toning blue is dull, with a strong red tone, and is largely used in carbon paper. All these pigments are chemically similar, differences in shade arising from variations in particle size and details of the manufacturing process.

Prussian blue was first synthesized about 1704 by the reaction of iron(II) salts with potassium ferrocyanide; the initial product, an insoluble white compound called Berlin white, was then oxidized to the blue pigment. Modern commercial methods are similar but use the cheaper sodium ferrocyanide; the oxidation is carried out with sodium chlorate, sodium chromate, or other reagents. The iron blues often are mixed with yellow pigments, such as lead chromate or zinc chromate, to produce greens. Turnbull's blue, formed by the reaction of ferricyanides and iron(II) salts, has the same chemical composition as the iron blues ($MFe_2[CN]_6$, in which M represents an ion such as sodium, potassium, or ammonium).

Prussian Civil Code, byname of German ALLGEMEINES LANDRECHT ("General State Law"), the law of the Prussian states, begun during the reign of Frederick the Great (1740–86) but not promulgated until 1794 under his successor, Frederick William II. It was to be enforced wherever it did not conflict with local customs. The code was adopted by other German states in the 19th century and remained in force until it was replaced by the civil code of the German empire effected in 1900 (*see* German Civil Code).

The Prussian Civil Code was a product of the 18th-century Enlightenment. More than just a civil code, it contained many elements of constitutional and administrative law. It attempted to be totally comprehensive, its 17,000 paragraphs aiming at a final solution for every legal situation so as to avoid interpretation by judges.

The code rose out of the administrative and judicial reforms of Frederick the Great, who felt that even in an absolute monarchy there should be prompt and impartial administration of justice to protect the subject against the arbitrary will of the prince. Yet, instead of bridging the gulf between the social classes, distinctions were carefully preserved in the interests of the state. To the nobility, from which came the army officers and the higher bureaucracy, was reserved the exclusive ownership of manorial estates. The business class was to devote itself to trade and industry—activities forbidden to the nobility. The peasantry paid the bulk of the direct taxes and supplied the army's foot soldiers; they were, therefore, to be protected against encroachments from the lords of the manor.

Freedom of conscience and religion was granted, but it was the state that determined which religions were to be permitted. Censorship was rigidly imposed, only academics being free from it. Political dissenters were subject to severe penalties.

The criminal law included in the code was fairly liberal. Its aim was to prevent crime rather than punish it, and for that reason torture was abolished, and the death penalty was dropped for many crimes. The overriding interest was considered to be the security and welfare of the community.

Prussian language, Old: *see* Old Prussian language.

Prut River, also spelled PRUTH, Romanian PRUTUL, a tributary of the Danube River, now forming the eastern boundary of Romania with the Soviet Union. Prior to 1940 and the taking of Bessarabia by the Soviet Union, the Prut was almost entirely in Romania. It rises on the northeastern slopes of the Eastern Carpathians in the southwestern Ukrainian S.S.R. It flows 530 miles (850 km) north, then east past Kolomyya and Chernovky, and finally south-southeast. The Prut receives water from several tributaries off the Eastern Carpathians and the Moldavian Basin. It empties into the Danube east of Galați, Romania.

Prynne, William (b. 1600, Swainswick, Somerset, Eng.—d. Oct. 24, 1669, London), English Puritan pamphleteer whose persecution by the government of King Charles I (ruled 1625–49) intensified the antagonisms between the King and Parliament in the years preceding the English Civil War (1642–51).

Prynne

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

Although he was trained as a lawyer, Prynne began to publish Puritan tracts in 1627. Soon he was attacking the ceremonialism of the Anglican Church and the frivolous pastimes of his age. In his famous book *Histrio Mastix: The Players Scourge, or, Actors tragoedie* (1633), he tried to prove that stage plays provoked public immorality. Many believed his vigorous denunciation of actresses was directed at Charles I's theatrically inclined wife, and the powerful Anglican William Laud (archbishop of Canterbury 1633–45) had him committed to prison in February 1633; a year later Prynne was sentenced to life imprisonment and his ears were partially cut off. Nevertheless, from his cell he issued anonymous pamphlets attacking Laud and other Anglican prelates, resulting in further punishments: the stumps of his ears were shorn (1637) and his cheeks were branded with the letters S.L., meaning "seditious libeller"—though he preferred "Stigmata Laudis" ("the marks of Laud").

Freed from prison by the Long Parliament in November 1640, Prynne devoted himself to bringing about the conviction and execution (January 1645) of Archbishop Laud. Then, as the Parliamentarians fragmented into Presbyterian (moderate Puritan) and Independent (radical Puritan) camps, Prynne wrote pamphlets attacking both factions and calling for a national Puritan church controlled by the King. This attack led to his expulsion from Parliament by the Independents in 1648, and from June 1650 to February 1653 he was imprisoned for refusing to pay taxes to the Commonwealth government, which he deemed unconstitutional and morally lax. As a member of the Convention Parliament of 1660, he supported the restoration of King Charles II to the throne; Charles rewarded him with the office of Keeper of the Records in the Tower of London in 1661. Prynne spent the last nine years of his life writing histories that contain valuable compilations of official documents. His career is recounted in William Lamont's *Marginal Prynne* (1963).

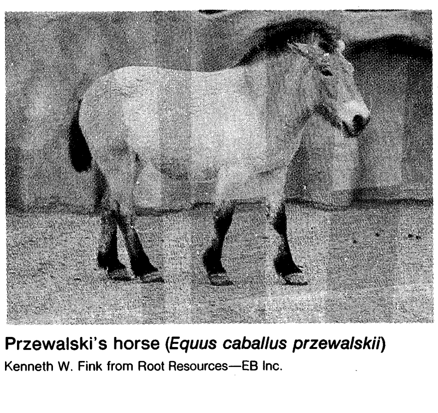
prytaneum, Greek PRYTANEION, town hall of a Greek city-state, normally housing the chief magistrate and the common altar or hearth of the community. Ambassadors, distinguished foreigners, and citizens who had done signal service were entertained there. Prytanea are attested at Sigeum in the Troad from the 6th century BC and at various dates in such places as Cyzicus, Erythrae, Priene, Ephesus, Epidamnus, Rhodes, and Olympia. In Athens one sign of the unification (synoecism) of Attica by Theseus was the creation of a single prytaneum, which became the seat of the chief archon. Although the prytaneum was dedicated to Hestia, Greek goddess of the hearth, and within the building a perpetual fire burned, it was not otherwise sacred. Prytanea were built according to many widely varied ground plans. According to some contemporary sources, when colonizers went to establish a new Greek colony, they took with them a brand from the prytaneum at Athens, from which the fire in the new colony's prytaneum was kindled.

Przemyśl, *województwo* (province), southeastern Poland, established 1975, comprising an area of 1,713 sq mi (4,437 sq km). It is bordered by the Soviet Union on the east and by the provinces of Krosno on the south, Rzeszów on the west, and Zamość on the north. Situated in the Carpathian highlands (south) and the Sandomierz Basin (north), the region flourished during the 15th and 16th centuries as a defense area against Tatar and Hungarian attacks on Poland. Przemyśl came under Austrian rule in 1772 and was returned to Poland in 1918. During World War II, the area that now comprises Przemyśl province was overrun by Russian and German troops. The economy of the province includes agriculture (wheat, oats, and rye); food processing; textile manufacturing; the production of chemicals, porcelain, and glass; lumber milling; and the manufacture of farm machinery. Natural-gas wells are located in the central and north central parts of the province. Pipelines transport natural gas to Polish cities further inland. The San River flows through the middle of the province and has numerous health spas located on its banks. In the northeastern part of the province, there is a sulfur hot-springs spa and the Smolinka sulfur mine. The provincial capital is Przemyśl (*q.v.*) city. Pop. (1982 est.) 381,700.

Przemyśl, city, capital of Przemyśl *województwo* (province), southeastern Poland, near the border of the Soviet Union on the San River. Located on Góra Zamkowa (Castle Mountain) at the juncture of the Carpathian Mountains and the Sandomierz Basin, the modern city serves as a marketing centre for the district, relying upon metal, timber, and textile industries.

The town was founded on a trade route from Ruthenia to Poland in 1340. It received town status and trading privileges in 1389 and developed into a cultural and trade centre for the area. During the 15th and 16th centuries, it flourished as a defense point against Tatar and Hungarian attacks. It passed to Austria in 1772 and was returned to Poland in 1918. During the early years of World War II (1939–40), the city was split by the German–Soviet frontier. Extensive damage resulted, but Przemyśl still retains many fine historic buildings, including the regional and diocesan museums. Pop. (1982 est.) 62,200.

Przewalski's horse, Przewalski's also spelled PRZHEVALSKY'S, PREJEVALSKY'S, or PREYEVALSKY'S (*Equus caballus przewalskii*), last wild horse subspecies surviving in the 20th century. It was discovered in western Mongolia in the late 1870s by the Russian explorer, N.M. Przhevalsky. Several expeditions since 1968 have failed to find this horse, which probably crossed with half-wild domesticated horses and lost its distinct features. Specimens have been kept in zoos. They are yellowish or light red (sometimes called dun) in colour, with a dark mane and tail and, usually, a dorsal stripe. The mane is short and erect with no forelock. The low withers blend into a narrow back, and the croup is short and steep. About 12 to 14 hands (48 to 56 inches, or 122 to 142 centimetres) tall, Przewalski's horse resembles a coarse domestic pony.



Przewalski's horse (*Equus caballus przewalskii*)

Kenneth W. Fink from Root Resources—EB Inc.

Przhevalsk, also spelled PRŽEVAL'SK, formerly KARAKOL, city and administrative centre of Issyk-Kul *oblast* (region), Kirgiz Soviet Socialist Republic, at the northern foot of the Terskey-Alatau Mountains at an altitude of 5,807 ft (1,770 m) on the Karakol River. Known as Karakol before 1889 and again from 1921 to 1939, it was founded in 1869 as a Russian military and administrative outpost; it was renamed for the Russian explorer Nikolay Mikhaylovich Przhevalsky, who died in the town in 1888. It has a number of food and other light industries, a teacher-training institute, a theatre, and a museum. There are various health resorts and sanatoriums in the vicinity. Pop. (1983 est.) 56,000.

Przhevalsky, Nikolay Mikhaylovich (b. April 6 [March 31, old style], 1839, Smolensk, Russia—d. Nov. 1 [Oct. 20, O.S.], 1888, Karakol), Russian traveller who, by the extent of his explorations, route surveys, and plant and animal collections, added vastly to geographical knowledge of east central Asia.

Przhevalsky

Novosti Press Agency

About 1869 he went to Irkutsk in central Siberia and in 1870 set out from the region around Lake Baikal, travelled through to Urga (now Ulaanbaatar), Mongolia, and crossed the Gobi to reach Kalgan (Chang-chia-k'ou), China, 100 miles (160 kilometres) from Peking. His second journey began in 1876 at Kuldja in westernmost Sinkiang Province, China, and took him southeastward across the peaks of the Tien Shan and the drifting sands of the Takla Makan to the foot of the A-erh-chin Shan-mo range. His third journey brought him within 170 miles of his goal, Lhasa, Tibet, but he was forbidden to enter the area. On his fourth and last trip, begun at Urga in 1883, he crossed the Gobi into Russian Turkistan and visited one of the largest mountain lakes in the world, Issyk-Kul. He died on the shores of the lake, at Karakol, which was later renamed Przhevalsk after him. His natural history discoveries include the wild camel and the wild horse, known as Przewalski's horse (*q.v.*). His accounts of his first two journeys were both published in English translations: *Mongolia, the Tangut Country, and the Solitudes of Northern Tibet* (1876) and *From Kulja, Across the Tian Shan to Lop nor* (1879).

Przybyszewski, Stanisław (b. May 7, 1868, Łojów, Kingdom of Poland, Russian Empire—d. Nov. 23, 1927, Jaronty, Pol.), Polish essayist, playwright, and poet.

Having completed his secondary education at a German *Hochschule* at Toruń, he went in 1889 to Berlin to study first architecture and then psychiatry. There he became closely associated with the Berlin German-Scandinavian artistic circle, which included August Strindberg. The Norwegian painter Edvard Munch introduced Przybyszewski to a Norwegian pianist, Dagny Juel, whom he married in 1893. Five years later they settled in Kraków, where he took over the editorship of *Życie* ("Life") and became a leader of the Polish Modernists. Przybyszewski's poetry displays a passionate, sensual mysticism, while his prose works describe unusual psychological types and the ambivalence of eroticism. His unconventional philosophical writings and plays enjoyed a meteoric but ephemeral success. His autobiography, *Moi współcześni,* 2 vol. (1926–30; "My Contemporaries"), is an interesting, if not very reliable, account of the central European cultural scene at the turn of the century.

Przysucha, Jacob Isaac ben Asher, also called JACOB ISAAC OF PRZYSUCHA, Przysucha also spelled PSHISHKHAH, byname HA-YEHUDI ("the Jew"), or HA-YEHUDI HA-KADOSH ("the Holy Jew") (b. 1776, Przedborz, Kingdom of Poland—d. 1814, Przysucha), Jewish Ḥasidic leader who sought to turn Polish Ḥasidism away from its reliance on miracle workers. He advocated a new approach that combined study of the Torah with ardent prayer.

Przysucha was the descendant of a rabbinic family. He became learned in the Torah and was also known for his intense spirituality. For a time he was a disciple of Jacob Isaac Horowitz of Lublin, who was known as "the Seer." Przysucha gradually established a new form of Ḥasidism, Pshishkhah Ḥasidism, based on his belief that the wholehearted observance of one's duty as a Jew was of greater value than the performance of miracles, which he felt appealed to the ignorant and materialistic. Because Przysucha and his followers believed that prayer should be offered only when one felt close to God, they did not pray at fixed times, as required by religious law. This brought them into conflict with Ḥasids led by the Seer, and a breach developed between the two groups and between Przysucha and his former master.

Psaila, Carmelo (Maltese poet): *see* Karm, Dun.

psalm tone, melodic recitation formula used in the singing of the psalms and canticles of the Bible, followed by the "Gloria Patri" ("Glory Be to the Father") during the chanting of the liturgical hours, or divine office. In the Gregorian chant repertory there are eight psalm tones. Because each psalm verse is divided into two halves, the psalm tones have a binary, or two-part, form. The first part consists of the *initium,* or intonation, of a melodic fragment; *tenor,* or recitation note; *flexa,* or downward inflection, used only if the first half of the verse is long; and *mediatio,* or middle cadence (resting point). The second part comprises the *tenor,* sung until the *terminatio,* or final cadence.

Each psalm is preceded and followed by an antiphon, a nonbiblical verse, the melody for which is composed in one of the eight ecclesiastical modes. The eight psalm tones are related to the ecclesiastical modes, having the same *tenor* and final note (except psalm tone 3, the final of which is ordinarily B instead of E, the final of mode 3). The psalm tone chosen corresponds to the number of the mode of the antiphon melody (*e.g.,* psalm tone 4 and mode 4).

Differentiae (various endings) are used to make a smooth transition between the end of a psalm tone and the beginning of an antiphon. The *differentia* that makes the smoothest connection is chosen. Examples are in the *Liber usualis,* the liturgical book containing frequently used Gregorian chants. *See also* Ambrosian chant; psalmody.

psalmody, singing of psalms in worship. In biblical times professional singers chanted psalms during Jewish religious services. Occasionally, the congregation interpolated a short refrain between the chanted verses. The alternation of soloist and chorus was called responsorial psalmody (*see* responsory). Another method, antiphonal psalmody, was the alternation by two half choirs in the singing of psalm lines or half lines (*see* antiphon). Psalms were also sung without either refrain or alternating singers (direct psalmody). These methods of psalmody were adopted by the early Christian Church in the East and West. Early Christian psalmody was the germ from which evolved both the classical Gregorian chant and also the Byzantine, Ambrosian, and other Christian chants (*see also* psalm tone).

In 16th-century Reformation churches congregational singing was reintroduced. Until about 1700 all except Lutherans excluded hymns having nonbiblical texts. Metrical, strophic (stanzaic) translations of the psalms were set to composed or borrowed melodies for congregational singing (metrical psalmody). The most noted collection of metrical psalms is the Genevan psalter of 1562, prepared at the direction of John Calvin, with melodies collected by Loys Bourgeois and translations by Clément Marot and Theodore Beza. It was translated into Dutch in 1566, largely replacing the previous Dutch psalter that had been published in 1540. English psalters, influenced by the French, appeared in 1562, 1564, 1621, 1671, and 1696. A 1612 psalter for "English Separatists" was taken to America by the Pilgrims of 1620, and the *Bay Psalm Book* was published there in 1640—the first book printed in the New World.

Psalms, book of the Old Testament composed of sacred songs, or of sacred poems meant to be sung. In the Hebrew Bible, Psalms begins the third and last section of the biblical canon, known as the Writings (Hebrew *Ketuvim*).

In the original Hebrew text the book as a whole was not named, although the titles of many individual psalms contained the word *mizmor,* meaning a poem sung to the accompaniment of a stringed instrument. The Greek translation of this term, *psalmos,* is the basis for the collective title *Psalmoi* found in most manuscripts, from which the English name *Psalms* is derived. A variant translation found in a 5th-century manuscript of the Septuagint is *Psaltērion,* whence the English name *Psalter,* which is often used as an alternative name for the Book of Psalms or for a separate collection of psalms intended for liturgical use. Rabbinic literature uses the title *Tehillim* ("Songs of Praise"), a curious hybrid of a feminine noun and a masculine plural ending.

In its present form, the book of Psalms consists of 150 poems divided into five books (1–41, 42–72, 73–89, 90–106, 107–150), the first four of which are marked off by concluding doxologies. Psalm 150 serves as a doxology for the entire collection. This specific numbering follows the Hebrew Bible; slight variations, such as conjoined or subdivided psalms, occur in other versions. The fivefold division is perhaps meant to be an imitation of the Pentateuch (the first five books of the Old Testament), suggesting that the book reached its present form through liturgical use.

The psalms themselves range in mood and expression of faith from joyous celebration to solemn hymn and bitter protest. They are sometimes classified according to form or type; the major forms include the hymn (*e.g.,* 104, 135), the lament (*e.g.,* 13, 80), the song of confidence (*e.g.,* 46, 121), and the song of thanksgiving (*e.g.,* 9, 136). They may also be classified according to subject matter. Thus a number of psalms have been called "royal" psalms (2, 18, 20, 21, 28, 44, 45, 61, 63, 72, 89, 101, 110, 132) because they feature the king, portraying him as both the representative of Yahweh to the community and the representative of the community to Yahweh. Psalms are also classified according to their use; the "Zion" hymns (46, 48, 76, 84, 87, 122), for example, were part of a ritual reenactment of the great deeds of Yahweh in maintaining Zion as the inviolable centre of his divine presence.

The dating of individual psalms poses an extremely difficult problem, as does the question of their authorship. They were evidently written over a number of centuries, from the early monarchy to post-Exilic times, reflecting the varying stages of Israel's history and the varying moods of Israel's faith. They were an integral part of the ritualized activities that the Hebrew community developed for marking important public and personal situations. Although many of the psalms had their setting in the ritual life of the Temple of Solomon before the Babylonian Exile (6th century BC), the Psalter became the hymnbook of the Second Temple of Jerusalem, and the order of worship in the Temple probably played an important role in shaping and ordering the book.

The psalms also had a profound effect on the development of Christian worship. Luke believed the psalms to be a source of guidance. Obeying Paul's call to "sing psalms and hymns and spiritual songs," the early Church chanted or sang psalms as part of the liturgy. After the Reformation, psalms were set to traditional melodies for congregational singing.

psaltery (from Greek *psaltērion:* "harp"), musical instrument having plucked strings of

Angel playing a psaltery, detail from "Angel Musicians," panel by Hans Memling; in the Koninklijk Museum voor Schone Kunsten, Antwerp

By courtesy of the Koninklijk Museum voor Schone Kunsten, Antwerp gut, horsehair, or metal stretched across a flat soundboard, often trapezoidal but also rectangular, triangular, or wing-shaped. The strings are open, none being stopped to produce different notes. The instrument, probably of Near Eastern origin in late classical times, reached Europe in the 12th century as a variety of the trapezoidal Arabic psaltery, or *qānūn*. It was popular in Europe until about the 15th century and developed there into several shapes, including the characteristic "boar's head"—*i.e.,* with two incurving sides. It was plucked with the fingers or two quill plectra. Even after its decline, it continued to be played on occasion in fashionable society. It also gave rise to the harpsichord, which is a large psaltery with a keyboard mechanism for plucking the strings. Psalteries still played in European folk music include the Finnish *kantele* and its Baltic relatives, among them the Estonian *kannel,* which is bowed rather than plucked, and the Russian *gusli.*

The medieval *qānūn* also diffused eastward across India to Indonesia and China. Still prominent in the music of Arabic-speaking countries, it is played with finger plectra and is normally triple strung.

Psalteries are members of the zither family, instruments having strings extended across an armless, neckless frame or holder; non-Western psalteries are thus sometimes referred to as zithers. The dulcimer is a psaltery having strings that are struck with hammers rather than plucked.

psamma: *see* beach grass.

Psammetichus (kings of Egypt): *see under* Psamtik.

Psamtik, also spelled PSAMATIK, Greek PSAMMETICHUS, name of kings of Egypt grouped below chronologically and indicated by the symbol •.

• **Psamtik I** (d. 610 BC), governor, later king (reigned 664–610 BC) of Egypt, who expelled the Assyrians from Egypt and reunited the country, founding its 26th dynasty.

According to the Greek historian Herodotus, he was one of 12 co-rulers and secured the aid of Greek mercenaries in order to become sole ruler. After an abortive rebellion by his vassals against the Assyrian ruler of Egypt in 663, Psamtik was unexpectedly restored as governor of Athribis, a city of the Nile Delta, by the Assyrian king. Later, rejecting his vassal status, he negotiated an alliance with Gyges, the king of Lydia in Asia Minor, which enabled him to subdue the other Assyrian princes and vassals in the Delta (658–651). He established his capital at Sais, his native city, in the western Delta, and proceeded to reform Egypt's government. To remove the last vestiges of the rule of the kings of Cush—the African kingdom south of Egypt, which had persisted after the Assyrian raid of 663—he negotiated the adoption of his daughter by the priestess of the Theban god Amon, thus securing control over the considerable wealth of the temples. Thebes remained under its own governor, an appointee of the Cushites, but Psamtik installed a new official as governor of the South and also created the post of administrator of Middle Egypt. In addition, he placed military garrisons along the Nile throughout Upper and Middle Egypt.

Psamtik I, detail of a relief from the south end of the Suez Canal; in the British Museum

Reproduced by courtesy of the trustees of the British Museum

To counteract the power of the resident military class, Psamtik organized a Greek mercenary corps as part of his army. As a check against feudal tendencies, he also encouraged a policy of large property donations to temples by the wealthy nobility. Partly as a response to the recent foreign domination, he encouraged a revival of Old Kingdom ideals in religion and art in Egypt.

Psamtik probably remained neutral following the death of Gyges, his Lydian ally, in 653. With the spectacular rise of Babylon, however, he sent reinforcements to the beleaguered Assyrians in 614. Having successfully regained Egypt's independence and fostered its prosperity, he left a strong kingdom to his son.

• **Psamtik II,** also spelled PSAMATIK (d. 589 BC), king (reigned 595–589 BC) of the 26th dynasty of Egypt, who conducted an important expedition against the kingdom of Cush, Egypt's southern neighbour.

Psamtik II, portrait head found in Nile Delta; in the British Museum

Reproduced by courtesy of the trustees of the British Museum

The Greek historian Herodotus, writing in the 5th century BC, refers briefly to an Ethiopian war of Psamtik, an expedition that contemporary records prove to have been of great importance. Perhaps suspecting a Cushite threat to Egypt, Psamtik sent a large force against it. The army consisted of native Egyptians led by Ahmose, who later became pharaoh, and mercenaries (Greeks, Phoenicians, and Jews) led by another general. A contemporary stela from Thebes dates the venture to the third year of his reign and refers to a great defeat that was inflicted on a Cushite force. The expedition advanced at least as far south as the Third Cataract of the Nile; Greek participants in the expedition left graffiti on the colossuses at Abu Simbel, the temple of Ramses II, claiming to have advanced beyond Kerkis (perhaps modern Korkos) near the Fifth Cataract of the Nile, which stood well within the Cushite Kingdom.

Psamtik initiated destruction of the memorials of the 25th (Cushite) dynasty in Egypt by hacking out their names and the emblems of royalty from their statues and reliefs. Toward Palestine he apparently remained neutral. He paid a peaceful visit to Phoenicia in 591, after the Cushite campaign.

• **Psamtik III** (fl. 6th century BC), last king (reigned 526–525 BC), of the 26th dynasty of Egypt, who failed to block the Persian invasion of 525 and was later executed for treason.

The 5th-century-BC Greek historian Herodotus, the primary source for knowledge of the reign, states that in 525 BC, after only six months on the throne, Psamtik confronted a Persian invasion led by King Cambyses II. After the enemy had crossed Sinai with the aid of the Arabs, a bitter battle was fought at Pelusium, a city on Egypt's eastern frontier. The Egyptians with their mercenaries were compelled to withdraw to Memphis, the traditional capital, near Cairo. Cambyses besieged the city and captured it, seizing Psamtik. The former king was initially well treated but he was later executed for conspiracy against the Persians.

Psappho (poet): *see* Sappho.

Psaronius, genus of fossil ferns that resembled modern tree ferns. It is included in the division (or class) Pterophyta. The plants had long doubly divided fronds arranged in a complex pattern of helices crowning the trunk. The trunk was peculiar in that it had a central stem surrounded for almost its entire length by a compact layer of roots; it tapered strongly from a wide basal stump to a bare stem high up the column, almost 7½ metres (25 feet) tall.

PSDI (political party): *see* Italian Democratic Socialist Party.

Psellus, Michael (Constantine) (b. 1018, Constantinople—d. *c.* 1078), Byzantine philosopher, theologian, and statesman whose advocacy of Platonic philosophy as ideally integrable with Christian doctrine initiated a renewal of Byzantine classical learning that later influenced the Italian Renaissance.

Psellus served in the Byzantine state secretariat under the emperors Michael V (1041–42) and Constantine IX (1042–54). The latter in 1045 chose him to head the philosophy faculty in the newly founded imperial university.

In 1054, after the ecclesiastical upheaval following the definitive separation of the Greek and Roman churches, Psellus withdrew from academic work into monastic seclusion, adding Michael to his baptismal name. Recalled by the empress Theodora (1055–56) to serve as her prime minister, he continued in the office during the reign of his former student, the emperor Michael VII Ducas (1071–78). Having urged the Emperor to reject any overtures towards reunion with Rome, Psellus was forced into final exile when the Byzantine Macedonian dynasty's internal struggle between aristocratic and military families resulted in Michael's deposition and the accession of the emperor Nicephorus III Botaneiates (1078–81).

Criticized by some historians for his overweening ambition and political duplicity, Psellus made lasting contributions to Byzantine culture, including the reform of the university curriculum to emphasize the Greek classics, especially the Homeric literature that, with Platonist thought, he interpreted as precursory to Christian revelation. Manifesting encyclopaedic knowledge, Psellus composed treatises and poetry, all characterized by forceful and sometimes virulent expression, on themes in theology, philosophy, grammar, law, medicine, mathematics, and the natural sciences. Foremost among his writings are a tract, "Commentary on Plato's Teachings on the Origin of the Soul," and the *Chronographia,* which recounts the events from the accession of the emperor Basil II in 976 to that of Nicephorus III. Notable also among Psellus' literary remains are his correspondence, consisting of more than 500 letters, and his funeral eulogy for Michael Cerularius, patriarch of Constantinople and principal force behind the Schism of 1054.

Psellus' most enduring legacy, however, was his reversal of emphasis from Aristotelian thought (as promoted by the 9th-century patriarch Photius) to the Platonic tradition. With this change, Byzantine thought returned to the idealism of early Greek Christianity as exemplified by the 4th-century Cappadocian school of Gregory of Nazianzus and Gregory of Nyssa.

pseudepigrapha, in biblical literature, a work affecting biblical style and usually spuriously attributing authorship to some biblical character. Pseudepigrapha are not included in any canon. *See* apocrypha.

Pseudo-Demetrius: *see* Dmitry, False.

Pseudo-Dionysius THE AREOPAGITE (fl. *c.* 500), probably a Syrian monk who, known only by his pseudonym, wrote a series of Greek treatises and letters for the purpose of uniting Neoplatonic philosophy with Christian theology and mystical experience. These writings established a definite Neoplatonic trend in a large segment of medieval Christian doctrine and spirituality—especially in the Western Latin Church—that has determined facets of its religious and devotional character to the present time. Historical research has been unable to identify the author, who, having assumed the name of the New Testament convert of St. Paul (Acts 17:34), could have been one of several Christian writers familiar with the Neoplatonic system of the 5th-century Athenian Proclus. In the 9th century Dionysius was confused with St. Denis of France; but this was disproved in the 12th century by Peter Abelard.

The treatises "On the Divine Names," "On Mystical Theology," "On the Celestial Hierarchy," and "On the Ecclesiastical Hierarchy" comprise the bulk of the Dionysian corpus of writings, supplemented with 10 letters affecting a 1st-century primitive Christian atmosphere. Their doctrinal content forms a complete theology, covering the Trinity and angelic world, the incarnation and redemption, and the last things, and provides a symbolic and mystical explanation of all that is. The system is essentially dialectical, or "crisis" (from the Greek word meaning "crossroads, decision"), theology—*i.e.,* the simultaneous affirmation and denial of paradox in any statement or concept relative to God. God's transcendence above all rational comprehension and categorical knowledge ultimately reduces any expression of the divinity to polar pairs of contraries: grace and judgment, freedom and necessity, being and nonbeing, time and eternity. The incarnation of the Word, or Son of God, in Christ, consequently, was the expression in the universe of the inexpressible, whereby the One enters into the world of multiplicity. Still, the human intellect can apply to God positive, analogous terms or names such as The Good, Unity, Trinity, Beauty, Love, Being, Life, Wisdom, or Intelligence, assuming that these are limited forms of communicating the incommunicable.

The "Divine Names" and "Mystical Theology" treat the nature and effects of contemplative prayer—the disciplined abandonment of senses and intelligible forms to prepare for the immediate experience of "light from the divine darkness" and ecstatic union—in a manner and scope that make them indispensable to the history of Christian theology and piety. His treatises on the hierarchies, wherein he theorized that all that exists—the form of Christian society, the stages of prayer, and the angelic world—is structured as triads that are the images of the eternal Trinity, introduced a new meaning for the term hierarchy.

The 9th-century Irish philosopher-humanist John Scotus Erigena made a Latin translation of his writings, and the 12th- and 13th-century Scholastics Hugh of Saint-Victor (Paris), Albertus Magnus, and Thomas Aquinas wrote commentaries on them. The 14th- and 15th-century Rhineland and Flemish mystics, and the 16th-century Spanish mystics all were influenced by Dionysian thought. Writers of the Greek and Eastern churches, already sympathetic toward Platonic thought, simply absorbed the Dionysian corpus in their theologies as one element among others of this intellectual school. Such syntheses were effected by Gregory of Nazianzus and other 4th-century Cappadocian theologians, the 7th-century résumé of Maximus the Confessor, and the works of the 14th-century mystic Gregory Palamas.

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Pseudo-Longinus: *see* Longinus.

pseudobulbar palsy, disease of both pyramidal tracts above the level of the bulb, or lower brain stem, that simulates bulbar palsy (*see also* amyotrophic lateral sclerosis). It results in bilateral hemiplegia (paralysis of the muscles of the lower face, arm, and leg) as well as difficulty in speaking, chewing, and swallowing caused by weakness or paralysis of muscles of the jaw, palate, pharynx, vocal cords, and tongue. Spasmodic laughing and crying are frequent.

pseudocopulation, the action of a male insect, such as a bee, wasp, or fly, that tries to mate with a flower whose parts resemble those of a female insect of the same species as the male. Masses of pollen become attached to the male insect during this process and are transferred to the next flower visited by the insect, thus pollinating it.

The term pseudocopulation also refers to the close positioning of a male animal and a female of the same species, as in frogs, to facilitate contact between eggs and sperm at the time of discharge. True copulation, or sexual union between individuals, does not occur in this process.

pseudocyesis: *see* false pregnancy.

pseudohemophilia B: *see* von Willebrand's disease.

pseudohermaphroditism, in human beings, a condition in which the individual has a single chromosomal and gonadal sex but combines features of both sexes in the external genitalia, causing doubt as to the true sex. Female pseudohermaphroditism refers to an individual with ovaries but with secondary sexual characteristics or external genitalia resembling those of a male. Usually at puberty the female secondary sex characteristics develop. If the condition is identified at birth, the child may be raised as a female with a minimum of social readjustment. Administration of certain corticosteroids prevents further development of the condition, and surgery may be used to correct any residual genital defects.

Male pseudohermaphroditism refers to individuals whose gonads are testes but whose secondary sexual characteristics or external genitalia resemble those of a female. In this disorder the fetal target organs are unable, for unknown reasons, to react to testosterone produced by the fetal testes. The most common type is testicular feminization, wherein the external genitals are entirely feminine, and at puberty female secondary sex characteristics appear, yet the gonads are testes, and the sex-chromosome pattern is male. The disorder is sometimes recognized at puberty when menstruation fails to begin. In testicular feminization, because there is little or no response to male hormones and because the external genitalia are female, the child is raised as a female. Other forms of male pseudohermaphroditism can be altered to become "complete" male, and such children may be raised as males.

pseudohypoparathyroidism: *see* Albright's syndrome.

pseudolaryngeal speech, mechanical or esophageal speech that is taught by therapists to persons who have had the larynx, or voice box, surgically removed (laryngectomy). The operation is necessary when cancer (neoplasm) tumours are present on or near the larynx. After surgery, patients learn to swallow air into the esophagus and belch it out in a controlled manner. The tissues of the gullet act on the ejected air resulting in sound that is altered by oral–nasal structures to produce recognizable speech sounds. Former laryngectomy patients often work with newly diagnosed laryngeal cancer patients before and after surgery to demonstrate that it is possible to learn how to speak again. As a result of this technique, many former laryngeal cancer patients have been able to return to their former occupations and professions.

pseudomonad, any bacterium of the family Pseudomonadaceae, a large and varied group comprising about four genera and several hundred species. The individual cells are rod-shaped, often curved, averaging about 1 μm (micrometre; $1\ \mu m = 10^{-6}$ metre) in diameter and several micrometres in length. The cells of most species are separate and not joined in filaments; many are motile, propelled by one or more flagella (whiplike appendages), usually located terminally. The cells of some aquatic species are attached to surfaces by long strands or stalks (holdfasts).

Most species of the family are found in soil or water; some cause diseases in plants, and a few cause serious diseases in man and other mammals.

The most significant species are in the genera *Pseudomonas* and *Xanthomonas. Pseudomonas aeruginosa,* very common and widespread, is an opportunistic pathogen for man, causing antibiotic-resistive infections in persons of weakened resistance. It has been implicated in hospital-acquired infections of surgical wounds and severely burned tissue and in fatal infections of cancer patients treated with immunosuppressive drugs. Whereas *P. mallei,* the cause of glanders, or farcy, of horses and donkeys, is occasionally pathogenic for man, *P. pseudomallei* causes melioidosis, an uncommon but highly fatal tropical lung disease of man and other mammals.

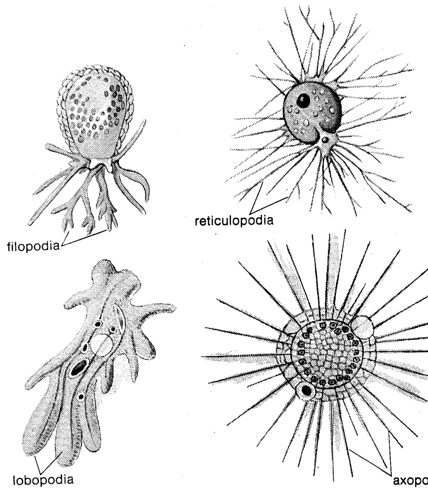
A few pseudomonads cause plant diseases: *P. syringae* in lilacs, citrus, beans, and cherries; and *P. solanacearum* in potato, tomato, tobacco, and other plants.

Xanthomonas is distinct among bacteria for its unique yellowish cell pigments. Its species cause bacterial spot of peach (*X. pruni*) and tomato (*X. vescicatoria*), canker of grapevine (*X. ampelina*), and a number of vascular diseases of cole crops (*X. campestris*).

pseudomorph, mineral formed by chemical or structural change of another substance, though retaining its original external shape. Although pseudomorphs give the appearance of being crystalline, they are commonly granular and waxy internally and have no regular cleavage; those that are crystalline have optical properties different from those required by their outward form.

Pseudomorphs are formed by substitution, deposition, or alteration. In the formation of a pseudomorph by substitution, the original substance has been gradually removed and simultaneously replaced by another. A common example of this is petrified wood, in which all the cellulose fibres have been replaced by silica, even those in the bark. Pseudomorphs can be formed by deposition of one mineral on the surface of crystals of another (*see also* epitaxy). Alteration pseudomorphs may be formed in several ways: from a change in internal crystal structure without a change in chemical composition (these pseudomorphs are called paramorphs; *e.g.,* aragonite becomes calcite, and brookite becomes rutile); by the loss of an ingredient from the original compound (*e.g.,* cuprite loses oxygen to form copper); by the addition of an ingredient to the original compound (*e.g.,* anhydrite adds water to form gypsum, and cuprite adds carbon dioxide and water to form malachite); and by an exchange of constituents (*e.g.,* feldspar loses potassium silicate and gains water to become kaolinite).

pseudopodium, also called PSEUDOPOD, temporary or semipermanent extension of the cytoplasm, used in locomotion and feeding by all sarcodine protozoans (*i.e.,* those with pseudopodia; *see* sarcodine) and some flagellate protozoans. Pseudopodia are formed by some cells of higher animals (*e.g.,* white blood corpuscles) and by amoebas. During amoeboid feeding, pseudopodia either flow around and engulf prey or trap it in a fine, sticky mesh.



Types of pseudopodia

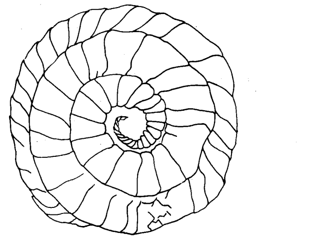
From (top, centre left) R.P. Hall, *Protozoa* (1964), Holt, Rinehart and Winston, Inc.; (centre right, bottom) R.R. Kudo, *Protozoology* (1966), Charles C. Thomas, Publisher, Springfield, Ill.

Protozoans have four types of pseudopodia. Lobopodia, characteristic of *Amoeba,* are blunt and fingerlike; filopodia are slender and tapering, occasionally forming simple, branched networks; reticulopodia, found in the foraminiferans, are branching filaments that fuse to form food traps; and axopodia, characteristic of the actinopods, are long and sticky (like reticulopodia) but radiate singly and have a stiff, internal rod composed of numerous microtubules. Lobopodia and filopodia are formed as the result of a pressure system; reticulopodia and axopodia depend on a two-way flow of cytoplasm.

pseudopregnancy: *see* false pregnancy.

pseudorabies, also called AUJESZKY'S DISEASE, or MAD ITCH, viral disease mainly of cattle and swine. Infected swine lose their appetites and may have convulsive fits. Survivors of the initial attack scratch and are restless. A cow shows infection by rubbing against posts and by licking and biting the affected areas. The itching becomes so intense that the animal lunges and runs about in a rabieslike frenzy.

Pseudoschwagerina, extinct genus of fusulinid foraminiferans (single-celled animals with hard shells preservable as fossils) found as fossils in Early Permian marine rocks (286 to 258 million years ago). The shell is spherical with localized thickening as a sort of lip. In thin section, the shell structure consists of widely spaced inner walls and distinctive wall deposits. *Pseudoschwagerina* is a guide, or index, fossil for the Wolfcampian Stage, a division of Permian rocks.


Pseudoschwagerina uddeni

From C. Dunbar and K. Waage, *Historical Geology* (copyright 1969); by permission of John Wiley & Sons, Inc.

pseudoscorpion: *see* false scorpion.

pseudotuberculosis, any of various diseases not caused by the tubercle bacillus but marked by the formation of tubercle-like nodules. Pseudotuberculous disorders of humans, now seldom called pseudotuberculosis, include actinomycosis, glanders, and nocardiosis (*q.v.*); pseudotuberculous thyroiditis is now designated granulomatous thyroiditis (*see* thyroiditis). In veterinary medicine, "pseudotuberculosis" denotes caseous lymphadenitis, a disease of sheep and goats caused by *Corynebacterium pseudotuberculosis,* and *Yersinia pseudotuberculosis* infection, occurring in many mammals and birds.

pseudotuberculous thyroiditis, also called SUBACUTE, GIANT-CELL, or DE QUERVAIN'S THYROIDITIS: *see* granulomatous thyroiditis.

pseudoxanthoma elasticum, also called GRÖNBLAD-STRANDBERG SYNDROME, inherited disease in which the premature breakdown of exposed skin occurs. It is characterized by eruptions of yellow plaques and thickening and grooving of the skin on the face, neck, and sometimes the armpits, abdomen, and groin. The skin loses its elasticity and hangs loosely from underlying structures. Affected persons show signs of poor circulation in the extremities; leg muscles tire easily, and spontaneous bleeding into the tissues or from any opening is common. The heart muscles have many small calcified deposits. Angioid streaks (streaks resembling blood vessels) of the retina are found in at least 80 percent of the cases. Through the ophthalmoscope the angioid streaks can be seen as brown or brownish black bands that resemble the normal retinal vessels but are generally much wider. These streaks are produced by breaks in the elastin-rich internal membrane of the choroid, which permits the choroidal pigment to be seen. Deterioration of vision may occur because of bleeding or degenerative changes. Pseudoxanthoma elasticum is inherited as an autosomal recessive disorder.

Pshishkhah, Jacob Isaac ben Asher: *see* Przysucha, Jacob Isaac ben Asher.

PSI (Italian political party): *see* Italian Socialist Party.

psi particle (particle physics): *see* J/psi particle.

Psichari, Ernest (b. Sept. 27, 1883, Paris, Fr.—d. Aug. 22, 1914, Rossignol, Belg.), French writer and soldier whose works combine militaristic sentiments with a semimystical religious devotion.

The grandson of the historian of ideas Ernest Renan and the son of a Greek philologist, Ioánnes Psicharís (Jean Psichari), Psichari grew up in an atmosphere of liberal intellectualism. After a period of acute emotional and mental stress, he started on the long journey toward an acceptance of religious faith, encouraged by the French Catholic intellectuals Maurice Barrès, Charles Péguy, and Jacques Maritain. As a common soldier in Africa (1906–12), he first found the satisfaction of a rigid moral commitment. *L'Appel des armes* (1913; "The Call to Arms"), a military novel, which became a guide for nationalist youth before World War I, recorded his experiences. He became a Roman Catholic in 1913 and prepared himself for the priesthood, but the outbreak of World War I intervened, and he was killed at the front in an early engagement.

His autobiographical novel, *Le Voyage du centurion* (1916; "The Voyage of the Centurion"), dealing with his conversion while in Africa, retraces his pilgrimage from skepticism to an ardent faith and a total abandonment to God.

psilocin and psilocybin, hallucinogenic principles contained in certain mushrooms (notably two Mexican species, *Psilocybe mexicana* and *Stropharia cubensis*). Hallucinogenic mushrooms used in religious ceremonies by the Indians of Mexico were considered sacred and were called "god's flesh" by the Aztecs. In the 1950s the active principles psilocin and psilocybin were isolated from the Mexican mushrooms. They are not used in modern medicine.

Chemically, psilocin and psilocybin are indole hallucinogens that block the action of serotonin (the indole amine transmitter of nerve impulses) in brain tissue. Psilocybin differs from psilocin in having a phosphate group attached to the molecule at the oxygen atom.

Psilocin and psilocybin produce experiences similar to those produced by mescaline and LSD. They act within 20 to 30 minutes, and the duration of action is about four hours.

psilomelane, barium and manganese oxide [$BaMnMn_8O_{16}(OH)_4$], an important ore mineral of manganese. A secondary mineral formed under surface conditions, it is often a dark gray to black alteration product of manganous carbonate or silicate minerals. It may form large residual deposits and occurs abundantly in lake or swamp bedded deposits and clays; it is also abundant as a replacement in calcareous or dolomitic rocks. It has been found in Germany, France, Belgium, Scotland, Sweden, India, and the United States. For detailed physical properties, *see* oxide mineral (table).

The name psilomelane (from the Greek words for "naked [bald, or smooth]" and "black") refers to the mineral's typical black, smooth-surfaced, botryoidal (grape-bunch-shaped) or stalactitic masses.

Psilotophyta, a division of spore-bearing vascular plants with only two living genera, commonly known as whisk ferns (order Psilotales).

A brief treatment of psilotophytes follows. For full treatment, *see* MACROPAEDIA: Ferns and Other Lower Vascular Plants.

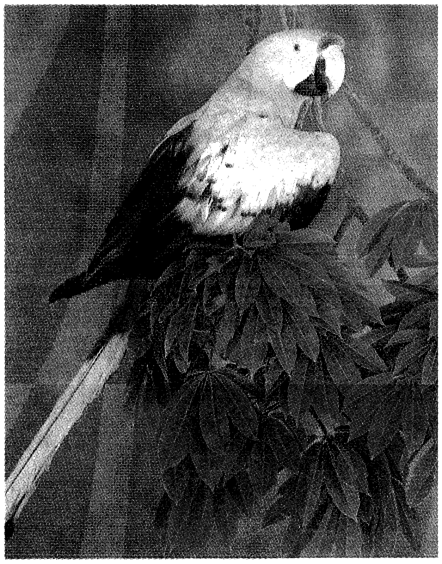
Psilotophytes have an upright stem and an underground stem (rhizome), both with dichotomous branching. They have no true roots. Their leaflike structures are small and scaly or flattened, unlike the true leaves of ferns and seed plants. The shrublike *Psilotum,* one of the two living genera, is commonly found in tropical regions; *Tmesipteris,* a hanging epiphyte, is distributed throughout the South Pacific and Oceania.

Psilotophytes go through sporophytic (asexual) and gametophytic (sexual) phases during their life cycle. Gametophytes germinate from spores and live underground or on tree trunks. The male organs (antheridia) and the female organs (archegonia) are both located on the surface of the gametophyte, and fertilization occurs when a sperm travels down to an egg inside the archegonium. The embryo sporophyte develops a rhizome and stem, which ultimately grow into a mature sporophyte. Upon reaching maturity, the sporophyte releases its spores, and the cycle is repeated.

psittaciform, order of birds (Psittaciformes) consisting of a single family, Psittacidae, that includes lories, lovebirds, macaws, parakeets, parrots, keas, cockatoos, cockatiels, lorikeets, parrotlets, budgerigars, rosellas, conures, and amazons.

A brief treatment of psittaciforms follows. For full treatment, *see* MACROPAEDIA: Birds.

The geographic range of the order is quite large, with species inhabiting most of the tropical and south temperate regions of the world. Twenty-eight genera are found in South and Central America, six in Africa and Madagascar, and nine in the Orient. The Australasian



Scarlet macaw (*Ara macao*)
K. Wothe—Bruce Coleman Ltd.

region, including Australia, New Guinea, New Zealand, and many South Pacific islands, supports the most species, with a total of 44 genera. Until the early 1900s, eastern North America had a native parrot, the Carolina parakeet (*Conuropsis carolinensis*), but this species was exterminated by man through overhunting. The last captive specimen died in the same year (1914) and the same zoo (Cincinnati) as the last passenger pigeon, but the species may have survived in the wild until 1938.

Ranging in size from 3 to 40 inches (8 to 100 cm), these short-necked, plump-bodied birds are easily recognized by their large, hooked bills and zygodactylous feet (two toes pointing forward and two backward). Their strong bills can chisel open the toughest of nuts, and their thick fleshy tongues aid in manipulating foodstuffs during this process. When climbing and handling food, parrots use the powerful bill as a gripping appendage. Most parrots have pointed wings and short tails that are either rounded or squared off. Though they are quick in the air, they tire easily and generally only fly from tree to tree. The macaws (*Ara*) can be recognized by their pointed wings and long tails. A few species, notably the cockatoos (family *Cacatuinae*) have crested heads.

Parrots are generally brightly coloured, most frequently green marked with red, orange, blue, and other bright hues. Some are solid green or brown, and there are blue, gray, and bright red parrots, among others. In the majority of species, both sexes have identical plumage.

Parrots generally inhabit forested tropical areas, although some, such as the grass parakeets (*Neophema*) and the budgerigar (*Melopsittacus undulatus*), live in grasslands with scattered trees. The kea (*Nestor notabilis*) of New Zealand nests at high elevations but flies to the forest lowlands to feed.

Psittaciforms subsist mostly on plant matter. Depending on their size, they eat grass seeds, berries, fruits, or nuts. The larger forms will also dig up roots and tubers and eat any insects they uncover in the process. Some dietary specializations are found in the group; for example, the black cockatoos (*Calyptorhynchus*) eat wood-boring beetles that they gather by gnawing through the bark of trees. Unlike most nectar-feeding birds, which suck up the juices through tubular tongues, brush-tongued parrots lick the nectar from crushed flowers. The kea is more omnivorous than most parrots. It has earned the enmity of sheep farmers from its recently developed passion for sheep liver; although it rarely attacks healthy sheep, it will kill injured sheep to obtain their livers.

Most species of parrots are gregarious and some highly so; nomadic grassland species may move in groups of up to hundreds of thousands. The agricultural development of central Australia, especially the concomitant availability of water, has allowed the population increase of several species, including budgerigars and corellas (*Cacatua sanguinea*).

Some parrots are solitary nesters, and other species are colonial; but all are monogamous. Behaviour during courtship and for pair-bond maintenance includes mutual preening, mutual feeding, vocalizations, and bill caressing. Nesting in tree hollows, sometimes lined with leaves or bark, is the norm for the order, but various exceptions occur. The orange-fronted parakeet (*Aratinga canicularis*) makes a hollow in a termite mound, while the kea and the flightless owl parrot (*Strigops habroptilus*) are examples of parrot species that nest in rock crevices. The ground parrot (*Pezoporus wallicus*) simply deposits its eggs in a slight depression in the ground.

The white, spherical eggs laid by psittaciformes hatch after 16 to 30 days of incubation, those of the larger species requiring the most time. Small parrots may lay up to nine eggs and breed two or three times a year, but the larger species usually lay two eggs once during the year. The helpless and nearly naked young remain in the nest for some time, and both parents feed them by regurgitation.

Parrots have been associated with humans throughout history. The first written reference to a parrot is credited to Ctesius, a Greek historian of the 5th century BC. Over the centuries, parrots have been popular both for public zoos and private collections. The larger parrots are quite long-lived, and life spans of more than 50 years have been verified.

In the wild, most parrots are given to loud, screeching vocalizations, although some of the smaller ones also emit rather pleasant, twittering sounds. But the most renowned feature of these birds is their ability as mimics. Certain species, especially the African gray parrot (*Psittacus erithacus*) and some amazon parrots (*Amazona*), may develop extensive vocabularies, although there is no evidence that they understand themselves. The smaller forms, such as budgerigars and lovebirds (*Agapornis*), are less talented mimics. Budgerigars (also called "budgies," or shell parakeets) are enormously popular household pets.

Psittacosaurus, genus of small dinosaurs found as fossils in Early Cretaceous deposits (144 to 97.5 million years ago) of Mongolia and China. *Psittacosaurus,* which was ancestral to or related to the horned dinosaurs, was primitive and at least occasionally bipedal. The hind limbs and pelvis were well developed and characteristic of the ornithischian dinosaurs (those with a birdlike pelvis). Although the forelimbs were not as large or massive as the hind limbs, it is probable that *Psittacosaurus* was able to assume a quadrupedal pose, perhaps for feeding. It was about 2 m (6 feet) long. The skull was high and narrow. The anterior region was very much like a parrot's beak, and the upper jaw curved over the lower. Teeth, absent from the anterior portions of the jaw, were present in the cheek region.

psittacosis, also called ORNITHOSIS, or PARROT FEVER, infectious disease of worldwide distribution caused by a bacterial parasite (*Chlamydia psittaci*) and transmitted to humans from various birds. The infection has been found in about 70 different species of birds, but parrots and parakeets (Psittacidae, from which the disease is named), pigeons, turkeys, ducks, and geese have been the principal sources of human infection.

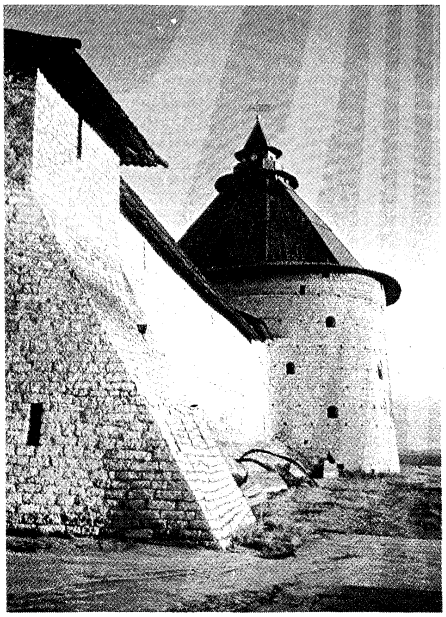
The association between the human disease and sick parrots was first recognized in Europe in 1879, but a thorough study of the disease was not made until 1929–30, when severe outbreaks, attributed to contact with imported parrots, occurred in 12 countries of Europe and America. During the investigations conducted in Germany, England, and the United States, the causative agent was revealed. Strict regulations followed concerning importation of psittacine birds, which undoubtedly reduced the incidence of the disease but did not prevent the intermittent appearance of cases. The infection was later found in domestic stocks of parakeets and pigeons and subsequently in other species. Infected turkeys, ducks, or geese have caused many cases among poultry handlers or workers in processing plants.

Psittacosis usually causes only mild symptoms of illness in birds, but in humans it can be a fatal infection if untreated. Humans usually contract the disease by inhaling dust particles contaminated with the excrement of infected birds. The bacterial parasite thus gains access to the body and multiplies in the blood and tissues. In humans psittacosis causes high fever and pneumonia, with such other symptoms as chills, weakness, head and body aches, and (in some cases) an elevated respiratory rate. The disease's duration is two to three weeks, and convalescence often is protracted. Before modern antibiotic drugs were available, the case fatality rate was approximately 20 percent, but penicillin and the tetracycline drugs reduced this figure almost to zero.

Pskov, *oblast* (province), northwestern Russian S.F.S.R. It occupies an area of 21,350 square miles (55,300 square km) in the lowland basins of the Lovat, Shelon, and Velikaya (Great) rivers, with intervening low, morainic uplands. Much of the surface is covered by peat bog, grass marsh, and lakes—notably Peipus (*q.v.*) in the northwest—while most of the remainder has mixed forest of spruce, pine, oak, and birch on infertile soils. The average temperatures are 18° F (−8° C) in January and 63° F in July. Extensive natural pastures support dairying and cattle raising. Flax is the main crop and the basis for the local linen industry. Fodder crops, potatoes, rye, and oats are also grown. Apart from Pskov city, the *oblast* headquarters, the other cities are small and are concerned chiefly with processing local agricultural products. About two-thirds of the population is urban. Pop. (1989) 846,000.

Pskov, city and administrative centre of Pskov *oblast* (province), northwestern Russian S.F.S.R. It lies along the Velikaya (Great) River at its confluence with the small Pskova River, at a point 9 miles (14 km) above the

Velikaya's outfall into Lake Pskov. Pskov is one of the oldest Russian towns, being first mentioned in a chronicle of the year 903



Section of the kremlin wall, Pskov city, Russian S.F.S.R.
R. Ziegler—Pictorial Parade/EB Inc.

as Pleskov. The town became important in the European Middle Ages as a centre for trade between the interior of Russia and the Hanseatic seaports of the Baltic. A kremlin (citadel) called the Krom was established on a promontory in the town beside the Velikaya. Pskov was under the protection of the city of Novgorod in the 11th and 12th centuries. In the latter century monasteries were established on the left bank of the Velikaya, in the suburb known as Zavelichye. In 1240 the Teutonic Knights captured Pskov, but, after their defeat in 1242 on the ice of Lake Peipus by Alexander Nevsky, the 13th century saw Pskov attain a population of 60,000. In 1348 Pskov achieved full independence as a republic, but in 1510 it was annexed by Moscow and in 1571 was sacked by Ivan IV the Terrible. The city survived sieges by Stephen Báthory of Poland in 1581 and by Gustavus II Adolphus of Sweden in 1615. The 18th century saw the beginning of a long period of decline of the city that was only reversed in the 20th century. In World War II Pskov suffered much damage, but many historic buildings survived. Notable is the 17th-century Cathedral of the Trinity in the kremlin. Modern Pskov is an important railway junction and has large machine-building and flax-processing industries. Pop. (1989 prelim.) 204,000.

Pskov school, school of late medieval Russian icon and mural painting that grew up in the Russian city of Pskov in the late 12th century and reached its highest development, especially in icon painting, in the 14th through the early 16th centuries. Pskov and the larger city of Novgorod both remained free of Mongol rule in the two centuries following the invasions of Russia in the mid-13th century and thus preserved and transformed the Byzantine artistic tradition that was the basis of Russian art. Pskov evolved a vital and highly accomplished school of its own.

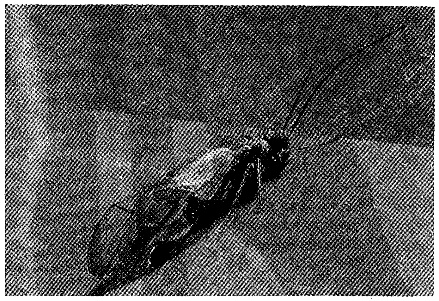
The earliest evidence of an independent style at Pskov is the fresco decoration of the Mirozhsk monastery, executed by Greek and local painters in 1156. Although painted in a static, formal, archaic manner close in style to Byzantine prototypes, these frescoes show a particularly sombre and intense emotionalism that goes beyond even the typical Russian emphasis on emotional expression. In addition there are integral elements of the later, more developed Pskovian icon style: a classical monumentality, a skillful use of intense colour, and a strong rhythmic quality of composition, all of which distinguish it from Novgorod's more prosaic, anecdotal art.

In the course of the 13th and early 14th centuries, especially after the introduction of the iconostasis—a screen standing before the sanctuary on which a large group of icons could be hung—icon painting assumed predominance over fresco. Pskov perfected an extremely forceful style of icon painting that to the end of its development combined a remarkably skillful expression with a somewhat archaic, even naive, manner of presentation. Pskov's isolation from Greek influence is especially reflected in the persistent inclusion of local peasant types and decorative motifs from folk art. At the same time, the Pskov school adopted the conventions of small, elongated, graceful figures and delicate detail that by the 14th century had become characteristic of Russian art, subjecting these outward forms to an intensification of the peculiar local qualities already discernible in the early frescoes. The early monumentalism led to a simplified, explicitly rhythmic composition in large colour masses dominated by fiery orange-red and a deep "Pskovian" olive green. This composition, which was particularly suited to the dark church interiors of this far-northern city, exaggerated the generally contemplative character of Russian icon painting into a sombre, almost oppressive poignancy.

"Nokola from Kozh," icon painted on panel by an unknown artist of the Pskov school, beginning of the 14th century; in the State Tretyakov Gallery, Moscow
Novosti Press Agency

In 1510 Moscow, having conquered much of central Russia, annexed Pskov as part of the growing national state; thereafter the Pskov school gradually lost its independent significance. *See also* Novgorod school; Moscow school.

psocid, any member of the insect order Psocoptera (also called Corrodentia), of about 1,100 species. The psocid is soft-bodied and usually less than 5 mm (0.2 inch) long. Its slender antennae are at least as long as its body, and wing venation is simple (there are no crossveins). Mouthparts are adapted for chewing, with the upper jaw usually elongated and chisellike. Psocids eat fungi (including molds), cereals, pollen, and organic debris.



Barklouse (Psocoptera)
William E. Ferguson

The best-known species, the booklouse, is a pale and wingless insect usually found indoors among old books and papers, on dusty shelves, or in cereals.

The majority of psocids, usually called barklice, generally have four membranous wings that are held rooflike over the body when at rest. They are found on tree bark and foliage, under stones, or in ground litter.

psoriasis, a chronic, recurrent skin disorder, characterized by reddish, slightly elevated plaques or papules (solid elevations) covered with silvery-white scales. In most cases, the lesions tend to be symmetrically distributed on the elbows and knees, scalp, chest, and buttocks. The lesions may remain small and solitary or coalesce into large plaques that often form geometrical patterns with a central area of normal skin. The nails, frequently involved, become thickened, irregularly laminated, and brittle.

The cause of psoriasis is not known, but the lesions are thought to result from abnormalities in both the nonvascular horny outer layer of the skin and its deeper vascular layer. Psoriasis occurs in both sexes with equal frequency, being most prevalent between the ages of 10 and 30. A tendency to psoriasis is inherited. It is most often seen in northern climates, affecting from 1 to 2 percent of the white population.

The onset of psoriasis is usually gradual but occasionally explosive. Precipitating factors may include injury to the skin, acute infection, and psychological upsets. Ordinarily, the lesions become less severe and sometimes disappear during the summer, possibly owing to the effect of sunlight. The severe complications of psoriasis are extensive sloughing of the outer layer of the skin, with resulting inflammation, and psoriatic arthritis. Generally, however, individuals with psoriasis are in relatively good health.

There is no permanent cure for psoriasis, but the skin symptoms can be treated with locally applied corticosteroids, methotrexate, coal-tar ointment, or ultraviolet light with varying degrees of success.

psorosis, disease of *Citrus* plant species caused by several related viruses. Symptoms vary greatly and include formation in some young leaves of elongated, white to yellow-green flecks, spots, rings, or large translucent areas. Certain symptoms tend to fade as the leaves mature. Rings bordered by sunken grooves may form on the fruit. On trees 6 to 12 or more years old, the outer bark in localized areas commonly becomes scaly, or small irregular pustules and gumlike deposits develop, with the wood being stained underneath. Variously sized cavities or narrow grooves may develop in the large limbs and trunk. If psorosis is severe, growth is dwarfed, trees lack vigour, and yields may be reduced one-third or more. The psorosis viruses are transmitted by bud grafts, rarely through natural root grafts. The disease may be controlled by removing seriously affected trees, planting psorosis-free stock, and using only scions and buds from virus-free trees.

PSP test (medicine): *see* phenolsulfonphthalein test.

Psyche (Greek: "Soul"), in classical mythology, princess of outstanding beauty who aroused Venus' jealousy and Cupid's love. The fullest version of the tale is that told by the Latin author Apuleius in his *Metamorphoses* (*The Golden Ass*).

Psyche, depicted with wings, classical sculpture; in the Louvre, Paris
Alinari—Art Resource/EB Inc.

According to Apuleius, the jealous Venus commanded her son Cupid (the god of love) to inspire Psyche with love for the most despicable of men. Instead, Cupid placed Psyche in a remote palace where he could visit her secretly and, by his warning, only in total darkness. One night Psyche lit a lamp and found that the figure at her side was the god of love himself. When a drop of oil from the lamp awakened him, he reproached Psyche and fled. Wandering the earth in search of him, Psyche fell into the hands of Venus, who imposed upon her difficult tasks. Finally, touched by Psyche's repentance, Cupid rescued her, and, at his instigation, Jupiter made her immortal and gave her in marriage to Cupid.

The sources of the tale are a number of folk motifs; the handling by Apuleius, however, conveys an allegory of the progress of the Soul guided by Love, which adhered to Psyche in Renaissance literature and art. In Greek folklore the soul was pictured as a butterfly, which is another meaning of the word *psychē*.

psyche (furniture): *see* cheval glass.

psychedelic drug, also called PSYCHOTOMIMETIC DRUG, or HALLUCINOGEN, any of the so-called mind-expanding drugs that are able to induce states of altered perception and thought, frequently with heightened awareness of sensory input but with diminished control over what is being experienced, such as recognizing the boundaries that separate one object from another or the individual from the environment. These experiences are neither true hallucinations nor actual schizophrenic or psychotic episodes, however. One of the most common of these drugs is LSD (lysergic acid diethylamide). This drug may induce sympathomimetic effects, such as increased heart rate, but has not been shown to cause death directly. Chronic exposure, however, may lead to psychoses or difficulties with memory or abstract thinking. Such drugs have been proposed as treatment aids for psychotherapy, alcoholism, and mental disturbances, although their effectiveness has not been proved.

Psychiana, religious movement that emphasized spiritual healing, prosperity, and physical and material happiness, founded in 1929 by Frank B. Robinson (1886–1948), a pharmacist of Moscow, Idaho. The son of an English Baptist minister, Robinson studied in a Canadian Bible school but later rejected organized religion. He was subsequently influenced by the New Thought movement and experienced religious conversion. This convinced him that he must share his new religious insights with others.

In his series of *Psychiana Lessons* and books, including *Your God-Power* (1943), Robinson emphasized the availability of the power of God to all. He was called the "mail-order prophet" because he advertised his movement in newspapers and periodicals, over the radio, and by direct mail. About one million copies of his publications were purchased as a result of his persuasive advertising campaign.

Robinson incorporated the Psychiana movement and called himself the archbishop of Psychiana. Eventually he had a staff of about 100 people in Moscow, Idaho, that helped him run his organization. He rejected, however, the formation of local groups. After Robinson's death in 1948, his son headed the organization for a time, but the movement had been so dominated by the elder Robinson that it lost vitality and eventually died out.

psychiatry, the branch of medicine that is concerned with the diagnosis, treatment, and prevention of mental disorders.

A brief treatment of psychiatry follows. For full treatment, *see* MACROPAEDIA: Mental Disorders and Their Treatment.

The term *psychiatry* is derived from two Greek words meaning "mind healing." Until the 18th century, mental illness or disorder was most often seen as demonic possession, but it gradually came to be considered as a sickness requiring treatment. Many judge that modern psychiatry was born with the efforts of Philippe Pinel in France and J. Connolly in England, who both advocated a more humane approach to mental illness. By the 19th century, research, classification, and treatment of disorders had gained momentum. Psychotherapy evolved from its origins in spiritual healing. The psychoanalytic theory of Sigmund Freud and his followers dominated the field for many years and did not receive a serious theoretical challenge until behaviour therapy and therapies deriving from humanistic psychology were developed in the mid-20th century. Insight therapies such as psychoanalysis, which pursue greater awareness of the patient's internal conflicts, continue to be dominant in psychiatric practice.

The trained psychiatrist, who has completed medical school and a psychiatric residency, commonly employs medical treatments in addition to psychotherapy. Lobotomy, or leucotomy, whereby nerve fibres running to the front of the brain are severed, is today used only in severe cases and has generally lost favour as a treatment. Shock therapy (also called electroshock, or electroconvulsive, therapy) continues to be used for severe depressions and certain forms of psychosis. The medical technique that is by far the most widely used is drug therapy. The advent in the 1950s of psychotropic (mind-altering) drugs revolutionized treatment of the mental patient. Like the other medical techniques, drug therapy has sometimes been abused in pursuit of patient "management"; used properly, however, it can enhance a patient's outlook for recovery and return to the community.

The contemporary psychiatrist frequently functions as a member of a mental-health team that includes clinical psychologists and social workers. As the therapeutic roles of these three professionals are not necessarily clearly delineated, an uneasy balance in orientation and division of skills may exist.

psychoanalysis, a highly influential method of treating mental disorders, shaped by psychoanalytic theory, which emphasizes unconscious mental processes and is sometimes described as "depth psychology."

The psychoanalytic movement originated in the clinical observations and formulations of the Austrian psychiatrist Sigmund Freud, who coined the term. During the 1890s, Freud was associated with another Viennese, Josef Breuer, in studies of neurotic patients under hypnosis. Freud and Breuer observed that, when the sources of patients' ideas and impulses were brought into consciousness during the hypnotic state, the patients showed improvement.

Observing that most of his patients talked freely without being under hypnosis, Freud evolved the technique of free association of ideas. The patient was encouraged to say anything that came to mind, without regard to its assumed relevancy or propriety. Noting that patients sometimes had difficulty in making free associations, Freud concluded that certain painful experiences were repressed, or held back from conscious awareness. Freud noted that in the majority of the patients seen during his early practice the events most frequently repressed were concerned with disturbing sexual experiences. Thus he hypothesized that anxiety was a consequence of the repressed energy (libido) attached to sexuality; the repressed energy found expression in various symptoms that served as psychological defense mechanisms. Freud and his followers later extended the concept of anxiety to include feelings of fear, guilt, and shame consequent to fantasies of aggression and hostility and to fear of loneliness caused by separation from a person on whom the sufferer is dependent.

Freud's free-association technique provided him with a tool for studying the meanings of dreams, slips of the tongue, forgetfulness, and other mistakes and errors in everyday life. From these investigations he was led to a new conception of the structure of personality: the id, ego, and superego. The id is the unconscious reservoir of drives and impulses derived from the genetic background and concerned with the preservation and propagation of life. The ego, according to Freud, operates in conscious and preconscious levels of awareness. It is the portion of the personality concerned with the tasks of reality: perception, cognition, and executive actions. In the superego lie the individual's environmentally derived ideals and values and the mores of his family and society; the superego serves as a censor on the ego functions.

In the Freudian framework, conflicts among the three structures of the personality are repressed and lead to the arousal of anxiety. The person is protected from experiencing anxiety directly by the development of defense mechanisms, which are learned through family and cultural influences. These mechanisms become pathological when they inhibit pursuit of the satisfactions of living in a society. The existence of these patterns of adaptation or mechanisms of defense are quantitatively but not qualitatively different in the psychotic and neurotic states.

Freud held that the patient's emotional attachment to the analyst represented a transference of the patient's relationship to parents or important parental figures. Freud held that those strong feelings, unconsciously projected to the analyst, influenced the patient's capacity to make free associations. By objectively treating these responses and the resistances they evoked and by bringing the patient to analyze the origin of those feelings, Freud concluded that the analysis of the transference and the patient's resistance to its analysis were the keystones of psychoanalytic therapy.

Early schisms over such issues as the basic role that Freud ascribed to biological instinctual processes caused onetime associates Carl Jung, Otto Rank, and Alfred Adler (*qq.v.*) to establish their own psychological theories. Most later controversies, however, were over details of Freudian theory or technique and did not lead to a complete departure from the parent system. Other influential theorists have included Erik Erikson, Karen Horney, Erich Fromm, and Harry Stack Sullivan. At one time psychiatrists held a monopoly on psychoanalytic practice, but soon non-medical therapists also were admitted.

Later developments included work on the technique and theory of psychoanalysis of children. Freud's tripartite division of the mind into id, ego, and superego became progressively more elaborate, and problems of anxiety and female sexuality received increasing attention. Psychoanalysis also found many extraclinical applications in other areas of social thought, particularly anthropology and sociology, and in literature and the arts.

psychobiology, also called BIOPSYCHOLOGY, school of psychiatry founded by a Swiss-born U.S. psychiatrist, Adolf Meyer. Meyer's holistic approach is based on a concept of man as a psychologically integrated biological unit. Meyer emphasized that the understanding of human behaviour requires the utilization of knowledge from biology, psychology, and sociology. In his view, mental disorders are the result of unrealistic expectations and faulty habits, complicated by organic and hereditary factors.

psychodrama, group psychotherapeutic technique in which patients more or less spontaneously dramatize their personal problems before an audience of fellow patients and therapists, some of whom may also participate in the dramatic production. A stage setting is generally used, and the chief therapist functions as director, encouraging participants to project as much as possible into their roles and occasionally modifying the parts of the players. The subject of the drama is usually some emotionally charged situation common to the group or from the patient-protagonist's life, enabling participants to gain some emotional release and control over anxiety provoked in similar situations as well as to learn new ways of responding in the future. Sometimes the therapist-director will have an auxiliary character switch roles with the protagonist, so that the patient may observe and react to himself as others see him. The dramatization is followed by discussion between players and audience.

The technique was introduced in the 1920s by the Viennese psychiatrist J.L. Moreno, who had observed that an actress subject to violent fits of temper in private life behaved more moderately when given violent stage roles. Although the situations in psychodrama are simulated, they can generate real emotion and new insight and help to establish more effective behaviour patterns. Psychodrama also involves a wider range of activity than such methods as psychoanalytic free association and encourages a flexible, active approach to life's problems.

A less structured form of psychodrama known as role playing is used both as a psychotherapeutic technique and in human relations and personnel training. Participants act out the roles of others or take new roles for themselves. The aim is to develop skills in dealing with such practical social situations as speechmaking, interviewing, or applying for a job. By practicing their own roles and those of others, participants may improve their ability to see situations from other points of view and take more objective views of themselves.

psychogalvanic reflex (PGR), also called GALVANIC SKIN RESPONSE (GSR), a change in the electrical properties of the body (probably of the skin) following noxious stimulation, stimulation that produces emotional reaction, and, to some extent, stimulation that attracts the subject's attention and leads to an aroused alertness. Though most of the work on this phenomenon has involved human subjects, it has been demonstrated in other mammals. The PGR can be demonstrated in several ways but usually with what are essentially modifications and improvements of the method described by the French physician C.S. Féré in 1888.

In these, the response appears as an increase in the electrical conductance of the skin (a decrease in resistance) across the palms of the hands or soles of the feet. In the experimental arrangements, the subject forms one arm of a type of balanced electrical circuit. When his resistance to the passage of a weak electrical current decreases, the circuit is thrown out of balance, as indicated by the deflection of a galvanometer. The amount of change in his resistance can be calculated. The response appears about two seconds after stimulation, as by a pinprick or threat of injury; it rises to a maximum after two to ten seconds and subsides at about the same rate.

The PGR is mediated by the sympathetic division of the autonomic nervous system. It is a part of the general arousal or activation pattern of physiological responses that mobilizes and fits the person for effective reaction in an emergency. In addition, parts of the brain's premotor cerebral cortex appear to have a role in producing the PGR, and in 1936 it was suggested that it is an accessory to the activity of the postural mechanisms, for which it could play a preparatory function. The consensus is that the PGR is associated with activation of the sweat glands by the postganglionic sympathetic fibres but that the perspiration actually secreted does not produce the characteristic decrease in skin resistance by acting as an electrolytic conductor.

A more sensitive indicator of minimal emotional arousal than are other physiological responses, the PGR has figured extensively in studies of emotion and emotional learning. It can help to uncover complexes of emotional sensitivities when used with word association tests or interviews; by observing when the response occurs, the skilled worker can deduce which stimuli evoke emotional disturbance. The PGR is essentially involuntary, although people can be taught to control it somewhat via biofeedback training. As a detector of emotion, the response often has served as one of the indicators in the lie detector, along with blood pressure, pulse, and respiration. If a neutral stimulus, such as a light or tone, is paired with mild pain, the neutral stimulus acquires the power to evoke the PGR. With such conditioning, the response can become a useful indicator for studying human learning.

psychogenetics: *see* behaviour genetics.

psychokinesis, also called TELEKINESIS, in parapsychology, the action of mind on matter, in which objects are caused to move or change as a result of mental concentration upon them. The physical nature of psychokinetic (PK) effects contrasts with the cognitive quality of extrasensory perception (ESP), the other major grouping of parapsychological phenomena. Levitation is said to result from powers of psychokinesis; such displays are common, though fraudulent, in theatrical magic. In PK tests, the subject attempts by thinking or willing to influence thrown dice, causing a certain die face to turn up or causing the die to land in a certain area. Experimental results, as with other parapsychological phenomena, have been inconclusive.

psycholinguistics, the study of psychological aspects of language. Experiments investigating such topics as short-term and long-term memory, perceptual strategies, and speech perception based on linguistic models are part of this discipline. Most work in psycholinguistics has been done on the learning of language by children. Language is extremely complex, yet children learn it quickly and with ease; thus, the study of child language is important for psychologists interested in cognition and learning and for linguists concerned with the insights it can shed about the structure of language. In the 1960s and early 1970s much research in child language used the transformational–generative model proposed by the U.S. linguist Noam Chomsky; the goal of that research has been to discover how children come to know the grammatical processes that underlie the speech they hear. The transformational model has also been adapted for another field of psycholinguistics, the processing and comprehension of speech; early experiments in this area suggested, for example, that passive sentences took longer to process than their active counterparts because an extra grammatical rule was necessary to produce the passive sentence. Many of the results of this work were controversial and inconclusive, and psycholinguistics has been turning increasingly to other functionally related and socially oriented models of language structure.

psychological anthropology: *see* culture-and-personality studies.

psychological development, the processes of human psychophysiological growth and decline from birth through death, and the subject matter of the discipline known as developmental psychology (*q.v.*). Child psychology was the traditional focus of research, but since the mid-20th century much as been learned about adulthood through middle age and old age.

Childhood. The developmental years of a child's life are commonly divided into the neonatal period, from birth to one month of age; infancy, from birth to one year; early childhood, or the preschool years, from one to six; mid-childhood, 6 to 10; preadolescence, 10 to 12; and adolescence, 12 to 21.

Sigmund Freud thought that the personality is reasonably well established by the end of the preschool years (currently it is thought to be even younger), and that subsequent growth and change is only minor elaboration on an already determined personality structure. Freud's delineation of psychosexual stages was highly influential. He postulated three pregenital developmental stages, the oral, the anal, and the phallic, which describe the child's primary source of motivation. These occur during the first five years of life, are each organized around a specific body zone, and are narcissistic in character. After the latency stage (from 8 to about 12), the narcissism is redirected toward genuine interactions with others. The ultimate or genital development phase occurs as the adolescent moves into adulthood. Freud postulated that a fixation in one or another phase may cause emotional disturbance.

Postfreudian theories have deemphasized but not eliminated the psychosexual focus in trying to describe how a child grows from utter helplessness to eventual autonomy and self-reliance. Erik Erikson revamped Freud's psychosexual developmental stages in terms of psychosocial conflicts; chronologically, the issues concern trust (of mother), autonomy, initiative, industry (achievement), and identity.

Among modern researchers, Jean Piaget (*q.v.*) proposed the view that cognitive development proceeds by a succession of four main stages. The sensorimotor stage is the period of a child's mental development in roughly the first two years of life, when he is chiefly occupied with learning to coordinate his sense perceptions and physical movements. By the age of two years the child is able to integrate sensory information from the various modalities as relating to the same source; to behave as though the external world is a permanent place, independent of his or her perceptions; and to exhibit experimental or goal-directed behaviour that may be creatively and spontaneously adapted for new purposes. The preoperational stage is the period from about two to seven, when the child is capable of learning concepts of class, size, number, and material but can deal with only one problem at a time. The concrete-operational stage occurs roughly between the ages of 7 to 11 and is characterized by a person's ability to engage in formal reasoning on an abstract level. The fourth and final stage, the formal-operational, or propositional, stage, begins when a person is no longer dependent upon working with concrete realities and present tangibles but can perform logical operations on abstract and symbolic material. He can systematically formulate hypotheses or propositions, test them, and make rational evaluations. Among the developmental tasks that typically occur during (but are not limited to) the second decade of life are adjustments in the areas of sexual role and relations, occupational orientation, the development of a mature set of values and responsible self-direction, and the lessening of one's emotional dependence on parents.

Adulthood. Adult psychology as a field of study did not receive much interest or study until the mid-20th century, when Erik Erikson outlined his eight psychological stages of life and devoted three of them to the post-adolescence period: young adulthood, manifested by intimacy versus isolation; adulthood, generativity versus stagnation; and maturity, ego integrity versus despair.

Some psychologists have delineated several periods and transitions that occur from early to middle adulthood and that involve various crises of reassessment of one's life and decisions regarding new commitments and goals. During the middle 30s people develop a sense of time limitation and face a period of acceptance. Older behaviour patterns or beliefs may be given up in favour of new ones.

Middle age. Middle age is a period of adjustment between the potentialities of the past and the limitations of the future. An emotional rebellion has been observed in many persons, sometimes referred to as a mid-life crisis, engendered by the recognition that less time remains to be lived than has been lived already. The apprehension of loss (of youth, family, friends) may be associated with depression that often accompanies the early part of the mid-life crisis.

During middle age dramatic shifts in female hormone production lead to the onset of menopause and its somatic effects. In men, physiological changes may include vasomotor and metabolic disturbances, and loss of libido (sexual drive) and potency. Often women whose children have grown or have left home experience the "empty-nest syndrome"—feeling unwanted or unneeded. During late middle age individuals become aware that ill health and death are both potentialities and eventualities and thus may consciously or unconsciously alter the patterns of their lives. Individuals accept the limits of their accomplishments and either take satisfaction in them or despair and become anxious over unobtained objectives.

Old age. During old age individuals often become more dependent on their children or other younger people, both emotionally and physically. In old age the need for affection and physical sharing may partially replace sexual drive. The sexual lives of older people may nevertheless be quite adequate.

Physiological changes. The physical changes during the aging process proceed at different rates in different people. Beginning with middle age comes a slowing of psychomotor behaviour. Reaction time begins to slow, as does breathing capacity and the ability to remember and to process information. The nervous system suffers a loss and reduced functioning of neurons. Studies of workers and on-the-job performance indicate that speed and accuracy improve until a worker reaches the age of between 35 and 45; at that time, accuracy and speed maintain a constant level briefly and then begin a slow decline.

psychological novel, work of fiction in which the thoughts, feelings, and motivations of the characters are of equal or greater interest than is the external action of the narrative. In a psychological novel the emotional reactions and internal states of the characters are influenced by and in turn trigger external events in a meaningful symbiosis. This emphasis on the inner life of characters is a fundamental element of a vast body of fiction: William Shakespeare's *Hamlet* is perhaps the prime early example of it in dramatic form. Although an overtly psychological approach is found among the earliest English novels, such as Samuel Richardson's *Pamela* (1740), which is told from the heroine's point of view, and Laurence Sterne's introspective first-person narrative *Tristram Shandy* (1759–67), the psychological novel reached its full potential only in the 20th century. Its development coincided with the growth of psychology and the discoveries of Sigmund Freud, but it was not necessarily a result of this. The penetrating insight into psychological complexities and unconscious motivations characteristic of the works of Fyodor Dostoyevsky and Leo Tolstoy, the detailed recording of external events' impingement on individual consciousness as practiced by Henry James, the associative memories of Marcel Proust, the stream-of-consciousness technique of James Joyce and William Faulkner, and the continuous flow of experience of Virginia Woolf were each arrived at independently.

In the psychological novel plot is subordinate to and dependent upon the probing delineation of character. Events may not be presented in chronological order but rather as they occur in the character's thought associations, memories, fantasies, reveries, contemplations, and dreams. For instance, the action of Joyce's *Ulysses* (1922) takes place in Dublin in a 24-hour period, but the events of the day evoke associations that take the reader back and forth through the characters' past and present lives. In the complex and ambiguous works of Franz Kafka, the subjective world is externalized, and events that appear to be happening in reality are governed by the subjective logic of dreams.

psychological testing, also called PSYCHOMETRICS, the systematic use of tests to quantify psychophysical behaviour, abilities, and problems and to make predictions about psychological performance.

A test is any means of generating a response to which the subject's behaviour in other contexts can be related. Tests fall into three general categories. Aptitude tests are used to predict future behaviour. An intelligence quotient (IQ) test is a good example of this type. By measuring an individual's IQ, the test-giver hopes to predict the subject's future ability to learn and reason. A second category is the achievement test, which assesses the subject's present level of academic or intellectual accomplishment. School exams, which measure the information that the individual has already assimilated, fall into this category. Tests of personality form the third general category. These are often used by mental health clinics and psychiatric hospitals to help diagnose mental disorders.

Problems in psychological testing. Psychological measurements present problems that measurements of the physical world do not. Whereas a scale, for example, measures weight, an objectively verifiable property, psychological traits and intelligence cannot be directly measured but must be inferred from behavioral manifestations. Inference is a component of all psychological testing.

The primary criterion of the worth of a given test is its validity, that is, the degree of success with which it measures the specific attribute that is ostensibly being tested. A test's empirical, or predictive, validity is measured by weighing its findings against the subject's behaviour as measured in other contexts. The empirical validity of a scholastic aptitude test, for example, would be judged by weighing its scores against the student's school grades. A test may also be evaluated by its content validity, or the extent to which its content corresponds to its purpose. This is most applicable to school exams.

The validity of a test of personality is the most difficult to evaluate. Any assumed trait that is believed to underlie behaviour is called a construct. If low scorers and high scorers on a test measuring a particular trait are found to behave differently in similar situations, then the test exhibits construct validity.

A test is also judged on its reliability. It is considered reliable to the extent that a given subject will obtain similar scores on the same test from day to day. Reliability can be affected by the scorer; an essay test, for example, which requires the scorer to make a complex judgment, is more prone to scorer unreliability than is a multiple-choice test. A test's reliability may also be affected by the time at which it is given, or by content that is unrepresentative of the field covered.

Methods and categories of testing. A distinction may be made between a test, in which a subject is told to do his best, and an inventory, in which the subject is told to give typical reactions, such as in word association or picture association.

A free-response test, as typified by the essay test, allows the individual leeway in responding to the test questions. One type of free-response test is the projective test, in which a subject's responses to ambiguous stimuli are interpreted. Thus, the subject projects his feelings onto the testing stimulus. A limited-response test, like a multiple-choice test, is considered fully objective, for there is only one set of correct answers. Tests that demand short or one-word answers to fill in the blank in a sentence combine elements of free-response and limited-response tests.

Most tests require purely verbal (written or oral) responses, but performance tests (for instance, early childhood tests that measure motor coordination) demand some other activity from the subject. Speed and power (ability regardless of time) are two factors in devising tests; most tests require a compromise. Some intelligence tests, such as the Stanford-Binet, are administered individually, because psychologists feel that the rapport established encourages the individual to do his best.

Many psychological tests make use of psychometric scaling methods that locate stimuli on a linear (straight-line) scale. The scale can represent, for example, attitudes, judgments of quality, preferences, and levels of attributes or traits. Such scales may be used for measuring the subject's own attributes, as well as having him rate those of others. In another kind of test, psychologists observe subjects in unscripted dramas, called sociodrama and psychodrama, as a means of judging personality traits.

Standardized tests. A standardized test enables the comparison of a subject's response with the norm. When the raw scores (correct answers) of everyone who has taken the test are arranged in order, each individual can be assigned a numerical value called a centile, or a percentile, telling how much better or worse he performed than the others tested. For instance, a student who scores above the 60th centile in an achievement test has performed better than 60 percent of the other people who took the test.

An individual's IQ is computed by another method, based on his mental age and his chronological age. The once widely used Stanford-Binet test for measuring intelligence has been largely replaced by several more flexible tests created by David Wechsler.

Various tests have been devised to isolate and measure factors of intelligence (such as verbal or numerical ability). The British psychologist Charles E. Spearman provided evidence for one general factor of intelligence (*g*) underlying all mental operations. Joy Paul Guilford, by contrast, generated a model postulating 120 different factors of intellect. An individual's scores on several such tests can be plotted graphically as a profile, which may then, for example, be used for comparison with the profiles of different persons or with a group profile for such purposes as vocational guidance or personnel selection.

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psychological warfare, also called PSYWAR, the use of propaganda against an enemy, supported by such military, economic, or political measures as may be required. Such propaganda is generally intended to demoralize the enemy, to break his will to fight or resist, and sometimes to render him favourably disposed to one's position.

Although often looked upon as a modern invention, psychological warfare is of ancient origin. Cyrus the Great employed it against Babylon, Xerxes against the Greeks, and Philip II of Macedon against Athens. The conquests of Genghis Khan were aided by expertly planted rumours about large numbers of ferocious Mongol horsemen in his army. Centuries later, in the American Revolution, Thomas Paine's "Common Sense" was but one of many pamphlets and leaflets used to strengthen the British-American colonists' will to fight. With modern scientific advances in communications, however, such as high-speed printing and radio, together with important developments in the fields of public-opinion analysis and the prediction of mass behaviour, psychological warfare has become a more systematic and widespread technique in strategy and tactics, and a larger ingredient of warfare as a whole.

Most modern armies have specialized units trained and equipped for psychological warfare. Such units were a major part of the German and Allied forces during World War II and the U.S. armed forces in the Korean and Vietnam wars. The British and the Malayan government forces made extensive use of air-dropped leaflets—promising immunity to those who surrendered—to combat the guerrilla revolt in Malaya in the early 1950s. The twisting of personality and the manipulation of beliefs in prisoners of war by brainwashing and related techniques can also be regarded as a form of psychological warfare.

Professionally managed psychological warfare is usually accompanied by the intelligence functions of propaganda analysis and audience information. Propaganda analysis consists of the examination of the nature and effectiveness of one's own and the competing propagandas, together with the study of the general flow of mass communications through the audiences addressed. Audience information provides concrete details about the target groups to which propaganda is directed.

Psychological warfare is sometimes divided by its practitioners into levels reflecting the areas in and the times at which the military propaganda is expected to operate. The term strategic psychological warfare is used to denote mass communications directed to a very large audience or over a considerable expanse of territory. Tactical psychological warfare, on the other hand, implies a direct connection with combat operations, the commonest form being the surrender demand. Consolidation psychological warfare consists of messages distributed to the rear of one's own advancing forces for the sake of protecting the line of communications, establishing military government, and carrying out the administrative tasks by such a government.

The communications media most commonly used in psychological warfare are the same as those used in civilian life; radio, newspapers, motion pictures, books, and magazines form a large part of the output. Leaflets are very widely used. (The World War II leaflet output of the western Allies alone, excluding the Soviet Union, was estimated to be at least 8,000,000,000 sheets.) Loudspeakers are often used in the front lines; both sides used them in the Korean War.

psychologism, in philosophy, the view that problems of epistemology (*i.e.,* of the validity of human knowledge) can be solved satisfactorily by the psychological study of the development of mental processes. John Locke's *Essay Concerning Human Understanding* (1690) may be regarded as the classic of psychologism in this sense. A more moderate form of psychologism maintains that psychology should be made the basis of other studies, especially of logic. A classical attack on both forms of psychologism was Edmund Husserl's *Logische Untersuchungen* (1900–01; "Logical Investigations").

Psychologism, however, continued to find adherents. Early in the 20th century, James Ward developed a genetic psychology that he considered essential to any adequate epistemology; Brand Blanshard's monumental *The Nature of Thought,* 2 vol. (1939), insisted that epistemological studies must be rooted in psychological investigation; and Jean Piaget conducted considerable psychological research on the genesis of thought in children, accepted by some philosophers as a contribution to epistemology. Similarly, empirical studies of innateness (via the "visual cliff," in which an infant placed at the edge of a glassed-over "cliff" shows behaviour suggestive of innate depth perception) continue to be seen as epistemologically significant.

psychology: *see under* descriptive word (*e.g.,* phenomenological psychology; social psychology), except as below.

psychology, scientific discipline that studies behaviour and the behavioral manifestations of experience in humans and other animals.

A brief treatment of the discipline of psychology follows. For full treatment, *see* MACROPAEDIA: Psychology. The subject matter of the discipline is treated in a variety of articles in the MACROPAEDIA. For an overview of animal and human behaviour, *see* Behaviour, Animal; Behaviour, Development of Human. For a treatment of the conscious experience of environment, *see* Attention; Sensory Reception; Perception, Human. For a treatment of internal states affecting behaviour and conscious experience, *see* Emotion and Motivation, Human; Sex and Sexuality; Sleep and Dreams; Alcohol and Drug Consumption. For a treatment of mental capacity and the processes of thought and learning, *see* Intelligence, Theories and Distribution of; Learning, Animal; Learning and Cognition, Human; Memory; Thought and Thought Processes. For a treatment of the integration and disintegration of the person's mental being as a whole, *see* Personality; Mental Disorders and Their Treatment. For a treatment of techniques for assessing human capacities and traits, *see* Personality; Psychological Tests and Measurement. For a treatment of psychosocial phenomena, *see* Collective Behaviour; Social Sciences. For related philosophical and religious aspects, *see* Epistemology; Mind, Philosophy of; Religious Experience.

For a description of the place of psychology in the circle of learning and for a list of both MACROPAEDIA and MICROPAEDIA articles on the subject, *see* PROPAEDIA: Part Four, Division III.

Psychology is the science of individual or group behaviour. The word psychology literally means "study of the mind"; the issue of the relationship of mind and body is pervasive in psychology, owing to its derivation from the fields of philosophy and physiology. Psychology is intimately related to the biological and social sciences. Its applications can be readily seen in almost every field of study and are continuing to spread in areas such as the behaviour of electronic devices and artificial intelligence.

The broad reach of psychology sometimes gives it the appearance of disunity and promotes the lack of a universally accepted theoretical structure. Some of the divisions within psychology are applied fields, while others are more experimental in nature. The various applied fields include clinical; counseling; school; industrial, engineering, or personnel; consumer; and environmental. The broad field known as experimental psychology includes specializations in educational, social, developmental, physiological, and comparative psychology. Issues studied cover a wide spectrum, comprising learning, cognition, intelligence, motivation, emotion, perception, personality (including the study of processes of adjustment and maladjustment, known as psychopathology), and the study of the extent to which individual differences are inherited or shaped environmentally, known as behaviour genetics.

Methods. Experimental work using humans as subjects involves legal and ethical limitations. Therefore, a significant amount of research is done with animals, with the hope of transferring the knowledge gained concerning psychophysiological or behavioral functioning to humans.

The methods used in human research include observation (sometimes in nonlaboratory settings), interviews, psychological testing (also called psychometrics), laboratory experimentation, and statistical analysis. Psychometrics has in fact become a field in its own right, with psychometrists devising new tools for data collection, analysis, and new designs for experimental research.

Licensing requirements for U.S. psychologists are regulated by their professional organization, the American Psychological Association (APA). The APA stipulates that in most divisions the bearer of the title "psychologist" must have a doctoral degree from an accredited institution. Principal employment settings include educational institutions, hospitals, prisons, business and industry, military establishments, and private practice. Many psychologists pursue a combination of private practice or consulting, research, and teaching.

History. The history of psychology is the history of thought about human consciousness and conduct. Psychological theory has its roots in ancient Greek philosophy and has been fed from streams such as epistemology (the philosophy of knowing), metaphysics, religion, and Oriental philosophy.

Over the centuries psychology and physiology became increasingly separated. A split developed between the essentially phenomenological (experiential) and mechanistic (physiological) conceptions of psychology. In general, through the end of the the 19th century the British and German traditions were phenomenological, while the French and American were mechanistic. The history of psychology from the 19th century may be viewed as a debate between schools of systematic thought concerning the mind, such as associationism, structuralism, and fuctionalism; or alternatively, as a history of experimentation and research in various areas. Twentieth-century psychology began with structuralism, which employed the method of introspection to describe mental events. It then evolved into psychoanalysis, a derivative of psychiatric tradition, and produced behaviourism and Gestalt psychology, which were reactions against structuralism. Humanistic psychology represented a rebellion against the reductionist and deterministic leanings of earlier schools.

By World War II, "schools" of psychology had largely faded away, leaving a common pool of psychological knowledge to which theoreticians, researchers, experimenters, and clinicians all contributed. Biopsychology, a study combining psychology and physiology, grew in conjunction with these developments.

psychometry, also called OBJECT READING, process whereby facts or impressions about a person or thing are received through contact with an object associated with the subject of the impressions. Rings, photographs, and similar tokens are often used, but sometimes the physical presence of a person may bring about images or visions in the psychometrist's mind that correspond to real facts (sometimes still in the future) in the life of the subject. A degree of lowered consciousness (that is, a state sometimes approaching trance) is thought to improve psychometric "readings." Psychometric visions are usually too haphazard to be of much practical value. The parapsychological institute of the Rijksuniversiteit te Utrecht, The Netherlands, was one of the first to perform experiments using psychometry in finding lost persons or things and in solving crimes.

psychomotor learning, development of organized patterns of muscular activities in response to changing sensory signals from the environment.

A brief treatment of psychomotor learning follows. For full treatment, *see* MACROPAEDIA: Learning and Cognition, Human.

Any organized, conscious, brain-directed physical activity such as walking, playing an instrument, or performing a sport, is a psychomotor skill. Psychomotor skills can be accurately analyzed only in the laboratory, where scientists have devised specialized machines that require specific skills to operate. Researchers have concentrated specifically on coordinated movements of feet and arms, and hands and fingers, where rates of learning are easily measurable.

About 20 different mechanical devices are commonly used to test a wide range of skilled actions. Scores such as correct-response-and-error percentages, range, speed and strength of hand or foot movements, and reaction time are computed mathematically and are useful in predicting how a subject would perform at applied tasks.

Despite such variables as motivation and effectiveness of reinforcement that affect psychomotor learning even in the laboratory, researchers have constructed a formula which states that learning develops as a mathematical function of the amount of reinforced practice. Relevant feedback (information telling the subject how he is progressing) is necessary for learning to occur; the more feedback the subject receives, the faster he learns.

Researchers have found that speed and accuracy increase rapidly in the first few practice periods and that the learning rate then drops off gradually the more one practices. In general, studies conclude that a learning schedule of short practice sessions broken up by rest periods is most efficient for learning psychomotor skills.

Learning one skill may affect, positively or negatively, one's ability to learn a related skill in a phenomenon known as generalization, or transfer. Usually, the more related are the two tasks, the more generalization there will be. *See* training, transfer of.

Motor skills are generally more easily remembered than are verbal skills. Researchers theorize that this greater retention is due to the fact that motor skills are more likely to be over-learned (repeated more often) than are verbal skills.

Studies with twins indicate that perceptual, spatial, and motor abilities are, to a high degree, controlled by heredity. The factor that most influences motor ability is chronological age. Subjects generally grow more proficient from the age of 5 until the end of their 20s, when their abilities plateau for a few years and then slowly decline.

Studies showing differences in psychomotor learning between the sexes and among ethnic groups remain controversial. Most experts agree that these differences are caused by a combination of environmental and hereditary factors, noting that environmental demands influence hereditary traits over generations.

psychomotor seizure, type of epilepsy characterized by a subjective sensory, psychical, or emotional sensation that is followed by clouding of consciousness and automatic behaviour. The subjective sensations, or auras, of psychomotor attacks include unpleasant odours or tastes, illusions in which objects or people in the environment seem unreal or events witnessed for the first time seem to have been experienced before (déjà vu), identifiable or unidentifiable sounds, and visual hallucinations and memories. Other experiences of onset include intense fear, abdominal sensations, and awareness of increased respiration or heartbeat. The form of the onset is, in most cases, very much the same from attack to attack. After experiencing the aura, the individual becomes unresponsive but may pick at his clothes, examine objects around him, or walk about. In his state of depressed awareness, he may actively resist efforts to restrain him. On recovery from the attack, which usually lasts from one to three minutes, the patient has no memory of the attack, except for the aura. Occasionally, frequent mild psychomotor seizures may merge into a prolonged period of confusion, which can last for hours or days with fluctuating levels of awareness and inappropriate behaviour. The psychomotor attack, usually originating in the temporal lobe, is one of the most common types of cerebral seizure. Attacks beginning with hallucinations most frequently originate in the lateral portion of the lobe; those beginning with automatic behaviour, in the medial temporal structures, including the amygdaloid nucleus and its overlying cerebral cortex. Psychomotor attacks may also be initiated by lesions in the posterior frontal lobe and the lateral aspect of the frontal lobe and the insula.

Aphasic seizures, characterized by impaired comprehension and expression of speech, originate in either the temporal or the frontal lobe of the dominant hemisphere. Psychic seizures also arise from the temporal or the frontal lobe, but of either hemisphere. Visceral attacks, such as paroxysmal abdominal pain in children, can originate in a number of brain areas. *See also* epilepsy.

psychoneurosis, also called NEUROSIS, plural PSYCHONEUROSES, or NEUROSES, mental disorder that causes a sense of distress and deficit in functioning.

A brief treatment of psychoneuroses follows. For full treatment, *see* MACROPAEDIA: Mental Disorders and Their Treatment.

Neuroses are characterized by anxiety, depression, or other feelings of unhappiness or distress that are out of proportion to the circumstances of a person's life. They may impair a person's functioning in virtually any area of his life, relationships, or external affairs, but they are not severe enough to incapacitate the person. Neurotic patients generally do not suffer from the loss of the sense of reality seen in persons with psychoses.

Psychiatrists first used the term "neurosis" in the mid-19th century to categorize symptoms thought to be neurological in origin; the prefix "psycho-" was added some decades later when it became clear that mental and emotional factors were important in the etiology of these disorders. The terms are now used interchangeably, although the shorter word is more common.

Theories. An influential view held by the psychoanalytic tradition is that neuroses arise from intrapsychic conflict (conflict between different drives, impulses, and motives held within various components of the mind). Central to psychoanalytic theory, which is based on the work of Sigmund Freud, is the postulated existence of an unconscious part of the mind which, among other functions, acts as a repository for repressed thoughts, feelings, and memories that are disturbing or otherwise unacceptable to the conscious mind. These repressed mental contents are typically sexual or aggressive urges or painful memories of an emotional loss or an unsatisfied longing dating from childhood. Anxiety arises when these unacceptable and repressed drives threaten to enter consciousness; prompted by anxiety, the conscious part of the mind (the ego) tries to deflect the emergence into consciousness of the repressed mental contents through the use of defense mechanisms such as repression, denial, or reaction formation. Neurotic symptoms often begin when a previously impermeable defense mechanism breaks down and a forbidden drive or impulse threatens to enter consciousness.

The psychoanalytic theory of neurosis is influential in the United States and western Europe. Another view of neurosis, popular in the Soviet Union and to some extent in western Europe, is that it is a learned, inappropriate response to stress that can be unlearned. This view holds that the neurotic is not sick but rather is suffering from maladaptive habits that are the legacy of conditioning.

Types. Obsessive-compulsive disorders are characterized by the irresistible entry of unwanted ideas, thoughts, or feelings into consciousness or by the need to repeatedly perform ritualistic actions that the sufferer perceives as unnecessary or unwarranted. Obsessive ideas may include recurrent violent or obscene thoughts; compulsive behaviour includes rituals such as repetitive hand washing or door locking. The drug clomipramine has recently proved effective in treating many patients with obsessive-compulsive disorders.

Somatoform disorders, which include the so-called hysterical, or conversion, neuroses, manifest themselves in physical symptoms, such as blindness, paralysis, or deafness that are not caused by organic disease. Hysteria was among the earliest syndromes to be understood and treated by psychoanalysts, who believe that such symptoms result from fixations or arrested stages in an individual's early psychosexual development.

In anxiety disorders, anxiety is the principal feature, manifesting itself either in relatively short, acute anxiety attacks or in a chronic sense of nameless dread. Persons undergoing anxiety attacks may suffer from digestive upsets, excessive perspiration, headaches, heart palpitations, restlessness, insomnia, disturbances in appetite, and impaired concentration. Phobias, a type of anxiety disorder, are inappropriate fears triggered by specific situations or objects. Some common objects of phobias are open or closed spaces, fire, high places, dirt, and bacteria.

Depression, when neither excessively severe nor prolonged, is regarded as a neurosis. A depressed person feels sad, hopeless, and pessimistic and may be listless, easily fatigued, slow in thought and action, and have a reduced appetite and difficulty in sleeping.

Posttraumatic stress disorder is a syndrome appearing in people who have endured some highly traumatic event, such as a natural disaster, torture, or incarceration in a concentration camp. The symptoms include nightmares, a diffuse anxiety, and guilt over having survived when others perished. Depersonalization disorder consists of the experiencing of the world or oneself as strange, altered, unreal, or mechanical in quality.

Treatment. Psychiatrists and clinical psychologists treat neuroses in a variety of ways. The psychoanalytic approach is to attempt to discover the origins of a neurosis in early life experiences, the memories of which are held in the unconscious part of the mind. According to psychoanalysts, to become aware of these repressed impulses, feelings, and traumatic memories leads to the disappearance of symptoms and enables a person to achieve personality growth through a better and deeper understanding of himself. Those who hold that neuroses are the result of learned responses recondition the neurotic through a process known as desensitization: a patient afraid of heights, for example, would be gradually exposed to progressively greater heights over several weeks. Many psychiatrists prefer physical approaches, such as drugs and electroconvulsive (shock) therapy. Antidepressants have proved effective in alleviating depression, and antianxiety drugs are of some help in reducing anxiety. Electroconvulsive therapy is sometimes effective in treating depression, presumably because the shock alters brain chemistry. Many psychiatrists advocate combinations of these approaches, the exact nature of which depend on the patient and his complaint.

psychopathology, also called ABNORMAL PSYCHOLOGY, the study of mental disorders and unusual or maladaptive behaviours. An understanding of the genesis of mental disorders is critical to mental health professionals in psychiatry, psychology, and social work. One controversial issue in psychopathology is the distinction between dysfunctional, or aberrant, and merely idiosyncratic behaviours.

psychopharmacology, the development, study, and use of drugs for the modification of behaviour and the alleviation of symptoms, particularly in the treatment of mental disorders. One of the most striking advances in the treatment of mental illnesses in the middle of the 20th century was the development of the series of pharmacological agents commonly known as tranquilizers (*e.g.,* chlorpromazine, reserpine, and other milder agents) and antidepressants, including the highly effective group known as tricyclic antidepressants. Lithium is widely used to allay the symptoms of affective disorders and especially to prevent recurrences of both the manic and the depressed episodes in manic-depressive individuals. The many commercially marketed antipsychotic agents (including thiothixene, chlorpromazine, haloperidol, and thioridazine) all share the common property of blocking the dopamine receptors in the brain. (Dopamine acts to help transmit nerve impulses in the brain.) Since scientists have found a direct relationship between dopamine blockage and reduction of schizophrenic symptoms, many believe that schizophrenia may be related to excess dopamine.

These drugs contrast sharply with the hypnotic and sedative drugs that formerly were in use and that clouded the patient's consciousness and impaired his motor and perceptual abilities. The antipsychotic drugs can allay the symptoms of anxiety and reduce agitation, delusions, and hallucinations, and the antidepressants lift spirits and quell suicidal impulses. The heavy prescription use of drugs to reduce agitation and quell anxiety has led, however, to what many psychiatrists consider an overuse of such medications. An overdose of a tranquilizer may cause loss of muscular coordination and slowing of reflexes, and prolonged use can lead to addiction. Toxic side effects such as jaundice psychoses, dependency, or a reaction similar to Parkinson's disease may develop. The drugs may produce other minor symptoms (*e.g.,* heart palpitations, rapid pulse, sweating) because of their action on the autonomic nervous system.

Though particular drugs are prescribed for specific symptoms or syndromes, they are usually not specific to the treatment of any single mental disorder. Because of their ability to modify the behaviour of even the most disturbed patients, the antipsychotic, antianxiety, and antidepressant agents have greatly affected the management of the hospitalized mentally ill, enabling hospital staff to devote more of their attention to therapeutic efforts and enabling many patients to lead relatively normal lives outside of the hospital.

psychophysical parallelism, in the philosophy of mind, a theory that excludes all causal interaction between mind and body inasmuch as it seems inconceivable that two substances as radically different in nature could influence one another in any way. Mental and physical phenomena are seen as two series of perfectly correlated events; the usual analogy is that of two synchronized clocks that keep perfect time. Thus, for parallelism, the mental event of a man's wishing to raise his arm is followed immediately by the physical event of his arm being raised, yet there is no need to postulate any direct causal connection.

Parallelism is usually associated with Gottfried Wilhelm Leibniz, a 17th-century German philosopher, scientist, and mathematician who maintained that perfect correlation between mind and body was ensured by the Creator at the beginning of time in a "preestablished harmony."

Parallelism has been criticized on the grounds that a refusal to postulate causal connections in the face of constant correlation conflicts with the empirical procedures recognized in modern science, which call for the supposition of a cause wherever the coefficient of correlation between two sets of phenomena approaches 1. The case for parallelism, however, has been said to depend more on the validity of the arguments discrediting the possibility of interaction between mind and body than upon statistical theory.

psychophysics, study of quantitative relations between psychological events and physical events, or, more specifically, between sensations and the stimuli that produce them.

Physical science permits, at least for some of the senses, accurate measurement on a physical scale of the magnitude of a stimulus. By determining the stimulus magnitude that is just sufficient to produce a sensation (or a response), it is possible to specify the minimum sensible stimulus or the absolute stimulus threshold (stimulus limen) for the various senses. It is also possible, although practically more difficult, to determine the lowest stimulus magnitude that produces maximal sensation, the terminal threshold—*i.e.,* that point on the physical scale beyond which no increase in stimulus produces any appreciable increase in sensation. Thus are determined limiting stimulus values, between which changes in stimulus intensity are accompanied by changes in sensation. The central inquiry of psychophysics pertains to the search for a lawful, quantitative relation between stimulus and sensation for the range of stimuli between these limits.

Psychophysics was established by a German scientist and philosopher, Gustav Theodor Fechner, who coined the word, invented the fundamental methods, conducted elaborate psychophysical experiments, and began a line of investigation that still persists in experimental psychology. Fechner's classic book *Elemente der Psychophysik* (1860) may be looked upon as the beginning not only of psychophysics but also of experimental psychology. Trained in physics, Fechner in his later life became interested in metaphysics and searched for a way of relating the spiritual to the physical world. He hit upon the notion of measuring sensation in relation to its stimulus. A German physiologist named Ernst Heinrich Weber had discovered that the amount of change in magnitude of a given stimulus necessary to produce a just-noticeable change in sensation always bore an approximately constant ratio to the total stimulus magnitude. This fact, properly speaking, is Weber's law: if two weights differ by a just-noticeable amount when separated by a given increment, then, when the weights are increased, the increment must be proportionally increased for the difference to remain noticeable. Fechner learned of Weber's law and undertook to use it for the measurement of sensation in relation to a stimulus. The resulting formula Fechner named Weber's law, although it is really Fechner's law (often called the Fechner–Weber law). It expresses the simple relation that the magnitude of a stimulus must be increased geometrically if the magnitude of sensation is to increase arithmetically. For Fechner it meant that the relation between the spiritual and physical worlds is statable and that there is therefore only one world, the spiritual; but for physiologists and for many philosophers it meant the measuring of sensation in relation to a measured stimulus and thus the possibility of a scientific quantitative psychology.

The data and theories on which Fechnerian psychophysics is based were challenged in the 1950s by the American theoretical psychologist S.S. Stevens, whose theory of signal detectability questioned the classical methods for assessing the psychophysical thresholds. The American theoretical psychologist Eugene Galanter wrote in 1974 that experiments generated by the theory of signal detectability "have included those designed to elucidate nonperceptual features of the experiment that are important in influencing judgments about perceptual events."

Another direction of modern psychophysics has been the experimental repudiation of Fechner's theory of measurement as an accurate representation of the psychic effects of stimulus magnitudes. Psychophysicists have suggested that psychic magnitudes be assessed by direct scaling experiments rather than by deriving a sensation scale based upon discrimination judgments.

Psychophysical methods are used today in studies of sensation and in such practical areas as product comparisons and evaluations (*e.g.,* tobacco, perfume, and liquor) and in psychological and personnel testing.

psychophysiologic disorder: *see* psychosomatic disorder.

psychosis, plural PSYCHOSES, any of several major mental illnesses that can cause delusions, hallucinations, serious defects in judgment and insight, defects in the thinking process, and the inability to objectively evaluate reality.

A brief treatment of psychoses follows. For full treatment, *see* MACROPAEDIA: Mental Disorders and Their Treatment.

It is difficult to clearly demarcate psychoses from the class of less severe mental disorders known as psychoneuroses (commonly called neuroses) because a neurosis may be so severe, disabling, or disorganizing in its effects that it actually constitutes a psychosis. But, in general, patients suffering from the recognized psychotic illnesses exhibit a disturbed sense of reality and a disorganization of personality that sets them apart from neurotics. Such patients also frequently believe that nothing is wrong with them, despite the palpable evidence to the contrary as evinced by their confused or bizarre behaviour. Psychotics may require hospitalization because they cannot take care of themselves or because they may constitute a danger to themselves or to others.

Psychoses may be divided into two categories—organic and functional. Organic psychoses are those caused by a known physical abnormality, which in most cases is some organic disease of the brain. All other psychoses are called functional ones.

Functional psychoses. Schizophrenia (*q.v.*) is the most common and the most potentially severe and disabling of the psychoses. Schizophrenia is characterized by a withdrawal from reality, delusions and hallucinations, a loosening and incoherence of a person's thought processes, and deficiencies in feeling appropriate or normal emotions. Other symptoms may include apathy, reduced drive and initiative, inability to feel any emotion whatsoever, and a preoccupation with silly or bizarre fantasies. The symptoms of schizophrenia typically first manifest themselves during the teen years or early adult life. The course of the disease is variable: some schizophrenics suffer one acute episode and then permanently recover; others suffer from repeated episodes with periods of remission in between; and still others become chronically psychotic and must be permanently hospitalized.

Despite prolonged research, the cause or causes of schizophrenia remain largely unknown. It is clear, however, that there is a genetic predisposition to the disease that is inherited. Thus the children of schizophrenic parents stand a greatly increased chance of themselves becoming schizophrenic. The symptoms of schizophrenia can be treated, but not cured, with such antipsychotic drugs as chlorpromazine and other phenothiazine drugs and by haloperidol. Psychotherapy may be useful in alleviating distress and helping the patient to cope with the effects of his illness.

The affective psychoses, which are also known as major affective disorders, consist of states of extreme and prolonged depression, extreme mania, or alternating cycles of both of these mood abnormalities. Depression is a sad, hopeless, pessimistic feeling that can cause listlessness; loss of pleasure in one's surroundings, loved ones, and activities; fatigue; slowness of thought and action; insomnia; and reduced appetite. Mania is a state of undue and prolonged excitement that is evinced by accelerated, loud, and voluble speech; heightened enthusiasm, confidence, and optimism; rapid and disconnected ideas and associations; rapid or continuous motor activity; impulsive, gregarious, and overbearing behaviour; heightened irritability; and a reduced need for sleep. When depression and mania alternate cyclically or otherwise appear at different times in the same patient, the person is termed to be suffering from a manic-depressive psychosis. Manic-depressive patients also frequently suffer from delusions, hallucinations, or other overtly psychotic symptoms. Manic depression often first manifests itself around age 30, and the disease is a long-lasting one. Many such patients can be treated by long-term maintenance on lithium carbonate, which reduces and prevents the attacks of mania and depression.

Depression alone can be psychotic if it is severe and disabling enough, and particularly if it is accompanied by delusions, hallucinations, or paranoia. Depression can be effectively treated by a variety of antidepressant drugs, including the tricyclic antidepressants and the monoamine oxidase inhibitors. Electroconvulsive (shock) therapy is useful in some cases, and psychotherapy and behavioral therapy may also be effective. Mania and many cases of depression are believed to be caused by deficiencies or excesses of certain neurotransmitters in the brain. (Neurotransmitters are chemicals that play key roles in the transmission of nerve impulses.)

Paranoia is a special syndrome that can be a feature of schizophrenia (paranoid schizophrenia) and manic-depressive psychosis or can exist by itself. A person suffering from paranoia thinks or believes that other people are plotting or trying to harm, harass, or persecute him in some way. The paranoiac exaggerates trivial incidents in everyday life into menacing or threatening situations and cannot rid himself of his suspicions and apprehensions. Paranoid syndromes can sometimes be treated or alleviated by antipsychotic drugs.

The functional psychoses are difficult to treat, and drug treatments are the most common and successful approach. Psychoanalysis and other psychotherapies, which are based on developing a patient's insight into his presumed underlying emotional conflicts, are difficult to apply to psychotic patients.

Organic psychoses. Dementia is the gradual and progressive loss of such intellectual abilities as remembering, thinking, paying attention, and perceiving; it is often a chronic condition. Delirium is a clouded, confused state of consciousness and is usually only a temporary condition. Dementia is the principal syndrome in the most common and widespread organic psychosis, Alzheimer's disease. An elderly person with this disease experiences chronic confusion and loss of memory and may experience paranoia or other personality changes. The memory loss becomes more and more far-reaching, and the patient gradually becomes lethargic, inactive, and then dies. Disturbances in the blood supply to the brain caused by cerebral arteriosclerosis (hardening of the arteries) produce symptoms similar to those of Alzheimer's disease.

Chronic alcoholics often exhibit psychotic symptoms. Alcohol-induced brain damage can result in memory defects and a major decline in intellectual abilities and social skills. Poisoning, head injuries, syphilis, brain tumours, and neurologic abnormalities such as epilepsy can produce a variety of symptoms resembling the psychoses.

psychosomatic disorder, also called PSYCHOPHYSIOLOGIC DISORDER, condition in which psychological stresses adversely affect physiological (somatic) functioning to the point of distress. It is a condition of dysfunction or structural damage in bodily organs through inappropriate activation of the involuntary nervous system and the glands of internal secretion. Thus, the psychosomatic symptom emerges as a physiological concomitant of an emotional state. In a state of rage, for example, the angry person's blood pressure is likely to be elevated and his pulse and respiratory rate to be increased. When the anger passes, the heightened physiologic processes usually subside. If the person has a persistent inhibited aggression (chronic rage), however, which he is unable to express overtly, the emotional state remains unchanged, though unexpressed in the overt behaviour, and the physiological symptoms associated with the angry state persist. With time, such a person becomes aware of the physiological dysfunction. Very often he develops concern over the resulting physical signs and symptoms, but he denies or is unaware of the emotions that have evoked the symptoms.

Psychosomatic disorders may affect almost any part of the body, though they are usually found in systems not under voluntary control. Research by psychiatrist Franz Alexander and his colleagues at the Chicago Institute of Psychoanalysis in the 1950s and 1960s suggested that specific personality traits and specific conflicts may create particular psychosomatic illnesses, but it is generally believed that the form a disorder takes is due to individual vulnerabilities. Emotional stress is assumed to aggravate existing illnesses, and there is some evidence that it may precipitate illnesses not usually considered to be psychosomatic (*e.g.,* cancer, diabetes) in individuals predisposed to them.

Psychosomatic disorders resulting from stress may include hypertension, respiratory ailments, gastrointestinal disturbances, migraine and tension headaches, pelvic pain, impotence, frigidity, dermatitis, and ulcers.

Many patients suffering from psychosomatic diseases respond to a combination of drug therapy, psychoanalysis, and behaviour therapy. In less severe cases, patients can learn to manage stress without drugs. *See also* stress.

psychosurgery, the treatment of psychoses or other mental disorders by means of brain surgery. The first such technique was developed by a Portuguese neurologist, António Egas Moniz, and the first operation was performed by his colleague, Almeida Lima, in 1935. The operation, called prefrontal lobotomy, or leucotomy, was based on experimental studies demonstrating that certain neurotic symptoms induced in chimpanzees could be modified by cutting brain fibres. Egas Moniz' original operation consisted of cutting two openings in the skull, one on each side above the temple, and then severing the nerve fibres connecting the thalamus with the frontal lobes of the brain. (*See* lobotomy.)

Prefrontal lobotomy has come to be generally regarded as a radical procedure to be followed only after all other forms of treatment have proved ineffective and the patient remains severely distressed or tormented by his illness; since the introduction of antipsychotic drugs and tranquilizing agents, the condition of only a very few patients has warranted such a drastic measure. In the 1930s, '40s, and '50s psychosurgery was performed on patients who showed chronic agitation and severe distress, persistent depression, emotional aggressiveness, and excited and impulsive behaviour. Such patients frequently did show a reduction of such symptoms after the surgery, but they also exhibited reduced drive and initiative, increased apathy, and, in general, reduction in the depth and intensity of their emotional response to life. Radical psychosurgery of this type is almost never used now owing to the undesirable effects of the operation.

In addition to antipsychotic drugs, psychosurgery that involves the placement of tiny lesions in specific areas of the brain and that has virtually no effect on intellectual function or on the so-called quality of life has also been developed. These techniques are used in cases of obsessive-compulsive behaviour and occasionally in cases of severe anxiety. This form of neurosurgery is also used in the management of chronic pain, such as that caused by damage to the nervous system or that associated with terminal cancer.

psychotherapy, any form of treatment for psychological or emotional disorders in which a trained person establishes a relationship with one or several patients for the purpose of modifying or removing existing symptoms and promoting personality growth. Drugs may be used as adjuncts, but the healing influence is exerted primarily by words and actions that are believed by sufferer, therapist, and the group to which they both belong to have healing powers and that create an emotionally charged relationship between or among them. Modern individual and group psychotherapeutic methods are used to treat all forms of suffering in which emotional factors play a part. These include behaviour disorders of children and adults; emotional reactions to the ordinary hardships or crises of life; psychoses, characterized by derangements of thinking and behaviour usually so severe as to require hospitalization; psychoneuroses, which are chronic disorders of personal functioning often accompanied by bodily symptoms of emotional strain; addictions; psychosomatic disorders, in which tissue damage is caused or aggravated by emotional components; and stress. Psychotherapeutic principles are also emphasized in rehabilitation programs for the disabled and chronically ill.

Early treatment of mental illness was based on either a religio-magical or a naturalistic view of disease. The former, originating before recorded history, saw certain forms of personal suffering or of alienation from one's fellows as caused by an evil spirit that gained entrance into the sufferer. Treatment was based on participation in suitable rites under the guidance of a priest-physician, medicine man, or shaman. The naturalistic tradition viewed mental illness as a phenomenon that could be scientifically studied and treated. Treatment consisted of measures to promote bodily well-being and mental tranquillity. Psychotherapy of nonhospitalized patients in the naturalistic tradition was not distinguishable from ordinary medical practice until the latter half of the 19th century. The emergence of psychotherapy as a specialized treatment probably is traceable to the late 18th century. A dramatic demonstration by an Austrian mystic and physician, Franz Anton Mesmer, showed that many symptoms could be made to disappear by putting a patient into a trance. Mesmerism was the precursor of hypnotism, which became a widely used psychotherapeutic method. Through it, Josef Breuer and Sigmund Freud together made the epochal observations on the relationship to later mental illness of emotionally charged, damaging experiences in childhood. From these discoveries grew the theory and practice of psychoanalysis, which, with its many modifications, immensely influenced the subsequent development of psychotherapy.

Modern psychotherapeutic methods for influencing patients directly include giving advice, persuasion, suggestion, and training in specific curative activities. Behaviour therapies are aimed at correcting specific pathological emotional states or behaviour patterns by appropriate countermeasures. They are based largely on the conditioned-reflex theory of I.P. Pavlov and on other theories of learning.

Individual therapies that aim to foster a patient's general personality growth emphasize helping him to gain insight into his feelings and behaviour. To facilitate this they try to create a therapeutic situation that will enable the patient to express himself with complete freedom, while the therapist maintains a consistent, warm, nonjudgmental interest. Feeling himself understood and accepted by someone whom he admires and to whom he feels close, the patient will progressively dare to reveal those shameful or frightening aspects of himself that he has pushed out of awareness.

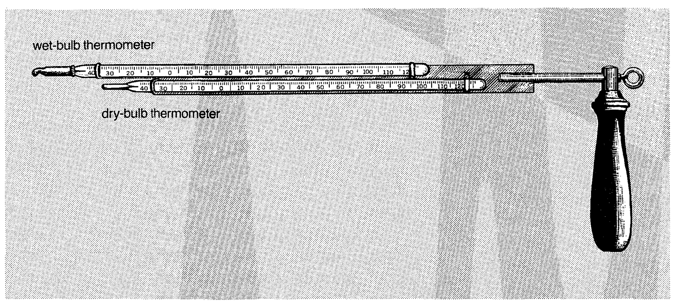
Some schools of psychotherapy hold that the consistent, warm "unconditional positive regard" of the therapist for the patient is sufficient to produce important changes. Therapies in the psychoanalytic tradition, while also emphasizing the importance of the therapeutic relationship, try to help the patient understand and master his feelings by analyzing them. They differ in their concepts and in the relative emphasis placed on different types of material produced by the patient. Traditional psychoanalysis emphasizes the use of dreams as short cuts to the patient's deeper feelings. It also puts great stress on helping the patient to rediscover, reexperience, and "work through" the traumatic emotional experiences of early life in which his current difficulties are believed to originate. Later modifications of psychoanalysis put more emphasis on analysis of the patient's current problems, and some emphasize helping the patient to gain a better philosophy of life. All agree that in an intimate, prolonged relation with the therapist, the patient will eventually experience toward him the feelings that trouble his relationships with persons emotionally close to him in his past and present life. Since both therapist and patient can observe these "transference reactions," as Freud termed them, exploring their inappropriateness is deemed a powerful means of resolving them.

There is no convincing evidence that the results of one form of treatment are better than any other. Despite differences in emphasis, most schools of psychotherapy agree that mental illnesses are, at least in part, expressions of chronic states of anxiety and frustration related to unresolved inner conflicts or unsuccessful ways of dealing with other persons. Though genetically or physiologically caused vulnerabilities might contribute to the difficulties of these patients, unfortunate early experiences with family members and other emotionally significant persons are believed to play a major role.

Chances of successful treatment are generally held to be related to the degree of the patient's emotional involvement in the treatment process. This is influenced by the intensity of his suffering and by his faith in the therapist and the treatment method. The patient's expectation of help is enhanced by the therapist's ability to convince the patient that he understands him intimately and is dedicated to his welfare. Personal qualities of the therapist seem important in the development of a successful therapeutic relationship. *See also* behaviour therapy; nondirective psychotherapy; group therapy.

psychotomimetic drug: *see* psychedelic drug.

psychrometer, a hygrometer composed of two similar thermometers. The bulb of one thermometer is kept wet (by means of a thin, wet cloth wick) so that the cooling that results from evaporation makes it register a lower temperature than the dry-bulb thermometer. When readings are taken simultaneously, it is possible (with the use of psychrometric tables) to determine the relative humidity and dew-point temperature of the air. A decrease in the humidity of the air brings an increase in the difference between dry- and wet-bulb temperatures, called the wet-bulb depression. *See also* hygrometry.



Psychrometer

By courtesy of the Central Scientific Co.

psykter, ancient Greek pottery vessel with a tall, cylindrical foot, rounded body, and short neck, used for cooling wine. Filled with wine,

Red-figure psykter by Oltos depicting athletes practicing, 520–510 BC; in the Metropolitan Museum of Art, New York City

By courtesy of the Metropolitan Museum of Art, New York City, Rogers Fund, 1910

it could be placed inside a larger vessel, such as a krater, which had been filled with snow; or the psykter itself might be filled with snow and placed inside a larger vessel containing the wine.

psywar: *see* psychological warfare.

Pszczyna, town, Katowice *województwo* (province), southern Poland, situated on the Pszczynka River, a tributary of the Vistula. A cultural and historical site, the town is known for its fine lace and collection of Silesian folk costumes. Nearby, an important dam across the Vistula creates an artificial lake to supply water to the Upper Silesia industrial district. One of Poland's two bison reserves is located in the Pszczyńskie forests.

Pszczyna, home of the Piast dynasty of Polish princes and kings, developed around their 12th-century castle. It received town rights in the 15th century, passed to Prussia (1742) with the rest of Silesia, and was returned to Poland in 1921. Pop. (1987 est.) 38,600.

PTA: *see* National Congress of Parents and Teachers.

Ptah, also spelled PHTHAH, in Egyptian religion, creator of the universe and maker of things, a patron of craftsmen, especially sculptors; his high priest was called "supreme leader of craftsmen." The Greeks identified Ptah with Hephaestus (Vulcan), the divine blacksmith. Ptah was originally the local deity of Memphis, capital of Egypt from the 1st dynasty onward; the political importance of Memphis led to the expansion of Ptah's cult over the whole of Egypt. With his consort Sekhmet and their son Nefertum, he was also worshiped as one of the "Memphite Triad." He was always represented in purely human form, often swathed in a winding sheet. The

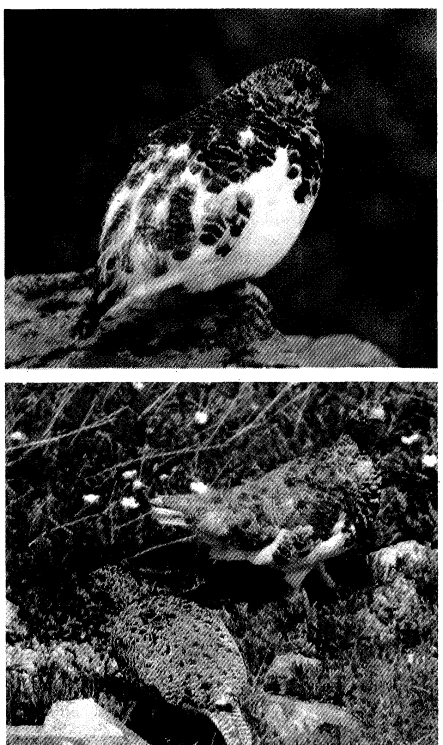
Ptah, holding the emblem of life, bronze statuette, Memphis, *c.* 600–100 BC; in the British Museum

By courtesy of the trustees of the British Museum

sacred bull Apis had his stall in the great temple of Ptah at Memphis and was called the intermediary between men and the god.

Ptahhotep (fl. 2400 BC), vizier of ancient Egypt who attained high repute in wisdom literature. His treatise "The Maxims of Ptahhotep," probably the earliest large piece of Egyptian wisdom literature available to modern scholars, was written primarily for young men of influential families who would soon assume one of the higher civil offices. Ptahhotep's proverbial sayings upheld obedience to a father and a superior as the highest virtue, but they also emphasized humility, faithfulness in performing one's own duties, and the ability to keep silence when necessary.

ptarmigan, any of three or four species of partridge-like grouse of cold regions, belonging to the genus *Lagopus* of the grouse family,



White-tailed ptarmigan (*Lagopus leucurus*), (top) as winter approaches, (bottom) in summer

(Top) Kenneth W. Fink from Root Resources—EB Inc., (bottom) C.A. Morgan

Tetraonidae. They undergo seasonal changes of plumage, from white against winter snowfields to gray or brown, with barring, in spring and summer against tundra vegetation. Ptarmigan differ from other members of the grouse family in having the toes covered with stiff feathers above and below.

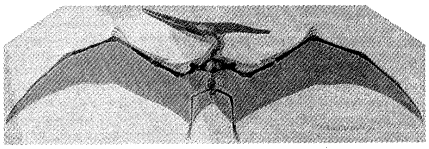
The common ptarmigan (*L. mutus*) ranges in the British Isles, Europe, and North America, where it is called rock ptarmigan. Also distributed circumpolarly is the willow ptarmigan, or willow grouse (*L. lagopus*), a more northerly bird of lowlands. On Rocky Mountain tundra south to New Mexico is the white-tailed ptarmigan (*L. leucurus*).

Ptarmigan survive winter in the Arctic and mountain-top fastnesses by browsing shrubs and scratching up lichens and leaves; they burrow in snow to sleep. Males, which have harsh cackling calls, begin to display socially in early spring and then separate and display singly in adjoining territories.

The name snow partridge, given in many localities to ptarmigan, is best reserved for a ptarmigan-like Asian partridge (*see* partridge).

PTC tasting (genetics): *see* phenylthiocarbamide tasting.

Pteranodon, genus of extinct flying reptiles found as fossils in Late Cretaceous deposits of



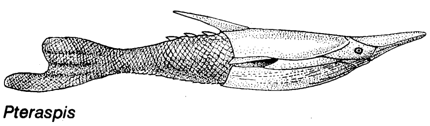
Pteranodon skeleton and restoration of wings

By courtesy of the American Museum of Natural History, New York

Europe, Asia, and North America (the Cretaceous Period began 144,000,000 years ago and lasted 77,600,000 years). *Pteranodon,* a highly developed form that marks the height of pterosaur evolution, was very large, with a wingspan of about 7.5 metres (25 feet). Its toothless jaws were very long and pelican-like. A crest, present at the back of the skull, may have functioned as a sort of counterbalance to the long jaws. As compared to the wings, the body was very small, only about as large as a modern turkey. Because of the relatively light weight the wings had to support, *Pteranodon* was a very efficient glider; it is thought unlikely that the wings were flapped bird fashion since *Pteranodon* lacked the keel at the breast to which the powerful flight muscles found in most birds attach. The eyes were relatively large, and the animal may have relied heavily upon sight.

Pteranodon fossils are frequently found in rocks formed in marine environments, indicating that the animal spent much time gliding over the ocean waters searching for fish that must have made up the bulk of its diet. It is probable that *Pteranodon* took off from the ground by running, perhaps downhill, until it was travelling fast enough for its wings to generate enough lift for flight. It is likely that the animal exhibited nesting behaviour. *See also* pterodactyl; pterosaur.

Pteraspis, genus of extinct jawless fishlike vertebrates found as fossils in Early Devonian rocks in North America and Europe (the De-



Pteraspis

Reprinted from *Vertebrate Paleontology* by A.S. Romer, by permission of the University of Chicago, copyright 1933, 1945, 1966; all rights reserved

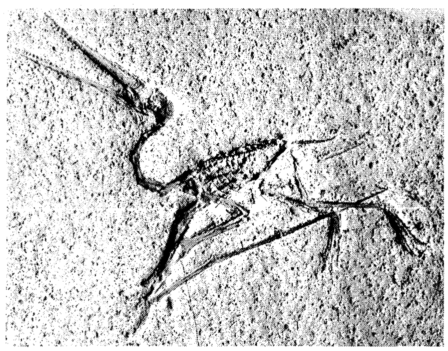
vonian Period began 408,000,000 years ago and lasted 48,000,000 years). *Pteraspis* was approximately 16 centimetres (6.5 inches) in length and had a heavy, rounded, bony shield that covered the anterior parts of the body. The remainder of the body was encased in small scales; it is probable that *Pteraspis* was an active, though inefficient, swimmer.

Pteria, ancient capital of the "White Syrians" of northern Cappadocia in eastern Anatolia, which, according to the Greek historian Herodotus, was taken, enslaved, and ruined by the Lydian king Croesus (547 BC). The exact location of Pteria is unknown. The identification of Pteria with the ruins near modern Boğazköy is uncertain. Since, according to Herodotus, Pteria was not very far from Sinope (modern Sinop), a position nearer the Black Sea seems more likely.

pteridophyte, any of the spore-bearing plants also known as vascular cryptogams. The name pteridophyte, no longer used in systematic taxonomy, is derived from Greek words meaning feather plant. In earlier classifications the Pteridophyta included the club mosses, horsetails, ferns, and various fossil groups. In more recent classifications, pteridophytes and spermatophytes (seed-bearing plants) are in the division, or phylum, Tracheophyta. *See* tracheophyte.

pterobranch, any small marine invertebrate of the class Pterobranchia (phylum Hemichordata). Pterobranchs are found mainly in the Southern Hemisphere, but a few species occur in northern waters. The body of a pterobranch, like that of the related acornworm (*q.v.*), can be divided into three regions: a proboscis (*i.e.*, a tubular sucking organ); a collar with tentacles used to filter food, usually small planktonic plants and animals, from the surrounding water; and a trunk containing a U-shaped gut. There are three genera of pterobranchs. Two of them, *Rhabdopleura* and *Cephalodiscus*, live in secreted tubes, organized into a colonial structure called a coenecium. The third genus, *Atubaria*, lives on hydroids. All three genera are rare.

pterodactyl, any member of a genus (*Pterodactylus*) of extinct flying reptiles first known



Pterodactyl (*Pterodactylus*), property of F.X. Mayer; in the Eichstätt Museum, Eichstätt, Ger.

Lilly Stunzi-Zurich-New York

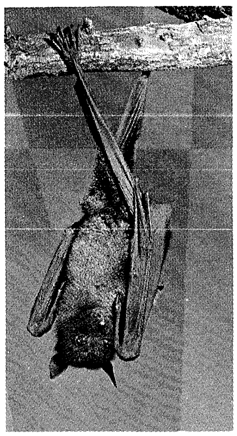
from fossils in Late Jurassic deposits in East Africa and Europe and present in European Cretaceous deposits (the Jurassic Period ended 144,000,000 years ago and was followed by the Cretaceous Period, which lasted 77,600,000 years). The genus *Pterodactylus* (order Pterosauria) comprises several related forms or species. They were small, some no larger than sparrows, and had slender and delicate teeth. In some forms, the numerous teeth were angled forward; it is possible that these forms used the teeth as straining devices, much as the bills of modern ducks. The tail in *Pterodactylus* was very small. The animal was probably an able glider but was inefficient as an active flier, since the musculature was not sufficiently developed to have sustained birdlike flight. It is probable that *Pterodactylus* and related forms played the same ecological roles as do the modern birds. It is uncertain whether these animals exhibited nesting behaviour. *See also* pterosaur.

pteropod, also called SEA BUTTERFLY, small marine gastropods of the subclass Opisthobranchia having a pair of winglike flaps (parapodia) that are used for swimming. Once grouped as the order Pteropoda, these gastropods live at or near the sea surface; most are less than 1 centimetre (0.4 inch) long.

Those that lack a shell and have complicated mechanisms for capturing and eating other small animals comprise the order Gymnosomata; those having a shell and feeding by means of cilia comprise the order Thecosomata. The shell is delicate and translucent; contrasting forms are seen in the straight-needle pteropod (*Creseis acicula*) and the long-snouted pteropod (*Cavolina longirostris*).

Pteropodidae, family of tropical Old World bats of the suborder Megachiroptera, including about 154 species of large-eyed, fruit-eating or flower-feeding bats commonly known as fruit bats and flying foxes. The Pteropodidae are widely distributed from Africa to southeastern Asia and Australasia. With the exception of the dog-faced bats (*Rousettus*), they rely on vision rather than echolocation (animal "sonar") as a means of avoiding obstacles.

Some species are solitary, some gregarious.



Flying fox (*Pteropus giganteus*)
Toni Angermayer—Photo Researchers

Most species roost in the open in trees, but some inhabit caves, rocks, or buildings. The largest of the pteropodids, and the largest of all bats, are the flying foxes (*Pteropus*), some of which attain a head and body length of about 40 centimetres (16 inches) and a wingspan of 1.5 metres (5 feet). Among the smallest members of the family are the pollen- and nectar-eating, long-tongued fruit bats (*Macroglossus*), which attain a head and body length of about 6–7 cm and a wingspan of about 25 cm. Colour varies among the pteropodids; some are red or yellow, some striped or spotted.

Among the best known pteropodids are the flying foxes, or fox bats. About 65 species are found on tropical islands from Madagascar to Australia and Indonesia. Flying foxes cannot be imported into the United States because they may damage cultivated trees and thus are potential pests.

Other representatives of the family include the abundant short-nosed fruit bats (*Cynopterus*) of Asia; the epauletted fruit bats (*Epomophorus*) of Africa, in which the male has tufts of pale hair on the shoulders; and the hammer-headed fruit bat (*Hypsignathus monstrosus*), another African form, which has a large, blunt muzzle and pendulous lips.

pteropsid, any of a group of vascular plants (tracheophytes) that includes ferns, extinct seed ferns, gymnosperms (conifers, etc.), and angiosperms (flowering plants). Pteropsids manifest a great variety of vegetative and reproductive characteristics. For example, ferns produce spores, and gymnosperms and angiosperms form seeds. The characteristic common to the members of this class is the leaf with branched venation.

Pteroptochidae, family of Latin American birds, based on the genus *Pteroptochas*—in this encyclopaedia classified as part of the tapaculo family (Rhinocryptidae *q.v.*).

To make the best use of the Britannica, consult the INDEX *first*

pterosaur, member of a group of flying reptiles that flourished in the Jurassic and Cretaceous periods of the Mesozoic Era. The order Pterosauria is one component of the major reptile group of the Archosauria, or "ruling reptiles," to which dinosaurs and crocodilians also belong and from which birds are descended. Triassic archosaurs tended toward a bipedal gait; thus the forelimbs were free for use in some other fashion; both birds and pterosaurs converted them into wings. Like bats rather than birds, pterosaurs formed a wing surface by means of a membrane of skin. In bats all of the fingers except the thumb support the membrane. In pterosaurs, however, the membrane was attached solely to one elongated finger—the fourth—and extended thence back along the flank to the knee; an accessory membrane lay between the neck and the "arm." The first three fingers were slender, clawed, clutching structures. The pterosaur membrane appears to have been well adapted to soaring and gliding but less manoeuvrable and more fragile than bat or bird wings.

The body was compact; the hind legs were long but slender, and their structure suggests that pterosaurs were little adapted to upright locomotion or perching but hung by the hind limbs when at rest. The neck appears to have been held upright in flight, with the head attached to it at right angles and pointing forward. The skull was lightly but strongly built, with fusion of most of the component bones; there was a long, slender beak. The eyes were large, and the eyeball, as in many birds, was reinforced by a series of bony plates (sclerotic ring) lying in its walls.

The brain was large and apparently comparable to that of birds in pattern; as in that group, sight rather than smell appears to have been the dominant sense. Most remains of pterosaurs are found in marine sediments, hence it is probable that they obtained food by diving for fish; but it is difficult to understand how they could have risen from land or water after alighting.

Two major groups of pterosaurs are known. *Rhamphorhynchus* (*q.v.*) of the Late Jurassic Solenhofen slates is typical of the more primitive division, although earlier forms are present in the Early Jurassic (Lias). Characteristics of this group include strong, sharply pointed teeth, relative shortness of the bones supporting the fingers (the metacarpals), and a long tail, which in *Rhamphorhynchus* had a diamond-shaped rudder at its tip. *Rhamphorhynchus* had a wingspread of about two feet.

A second group of pterosaurs appeared in the Late Jurassic and continued on into the Cretaceous. The typical Jurassic form is *Pterodactylus*, of which numerous examples are known from Solenhofen. A pterodactyl (*q.v.*) was a small reptile, some specimens being no larger than a sparrow. Features include a few small teeth, long metacarpal bones, and a short tail.

Descendants of the pterodactyl type continued on into the Cretaceous and were generally much larger. They are best represented by *Pteranodon* (*q.v.*) of the Kansas chalk. Parts of the skeletons of three very large pterosaurs in Late Cretaceous nonmarine sediments in Big Bend National Park, Texas, were discovered in 1975. From the size of these bones, the wingspan of the largest specimen was about 15.5 metres (51 feet), making it by far the largest flying animal of which there is knowledge. The anatomy of these reptiles and the landform of the region in which their remains were found indicate that they fed on carrion rather than on fish.

No pterosaur remains are more recent than the Cretaceous; their place in nature was taken over by true birds.

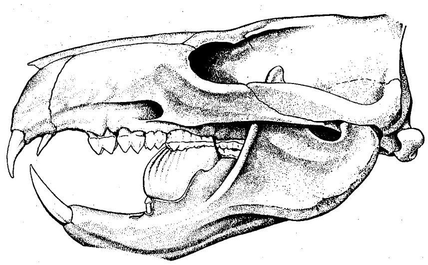
Pterostyrax, genus of about four species of deciduous trees or shrubs, of the storax family (Styracaceae), native to East Asia. A few species, notably *P. hispidus* and *P. corymbosus*, both of which are called the epaulette tree, are cultivated in other regions as ornamentals. The genus is characterized by alternate stalked leaves and fragrant white flowers borne in large clusters. The five petals are separate. The fleshy fruit has one or two seeds. *P. hispidus* grows to about 15 metres (50 feet) tall, has rather oblong, finely toothed leaves that are 17–25 centimetres (about 7–10 inches) long, and bristly fruit with 10 ribs.

pteroylglutamic acid: *see* folic acid.

pterygium, wing-shaped fold of membrane, an abnormal growth that develops from the inner or the outer (the nasal or the temporal) corner of the eye toward its centre; the growth obscures vision if it encroaches upon the pupil. The membrane is firmly attached at its base to the conjunctiva (the mucous membrane that lines the eyelid) and in its central portion to the white of the eye (the sclera). Pterygium results from exposure to bright sunlight, wind, and dust. Treatment is surgical removal of the membrane.

PTFE (resin): *see* polytetrafluoroethylene.

Ptilodus, extinct genus of mammals found as fossils in middle and late Paleocene deposits of North America (the Paleocene Epoch began 65,000,000 years ago and lasted 11,000,000 years). *Ptilodus* was a multituberculate, a group that once comprised the dominant



Ptilodus montanus skull
By courtesy of the American Museum of Natural History, New York

herbivorous mammals of the Earth and in many respects was similar in function to the modern rodents. *Ptilodus'* teeth included long, rodent-like incisors, bladelike shearing teeth with striations, and molars with parallel rows of cusps. The palate had large vacuities, and powerful chewing muscles were attached to the lower jaw.

Ptilonorhynchidae (bird family): *see* bowerbird.

Ptochoprodromus: *see* Prodromus, Theodore.

Ptolemaic system, theoretical model of the universe describing the positions and apparent motions of the Sun, Moon, and planets, formulated by the Alexandrian astronomer and mathematician Ptolemy (*q.v.*) about AD 140 and recorded by him in his *Almagest*.

Ptolemais, modern TOLMEITA, or ṬULMAYTHAH, coastal city of ancient Cyrenaica (now part of Libya). The site was easily defensible and provided the only safe anchorage between Euhesperides-Berenice (modern Benghazi) and Apollonia (modern Sūsah in Libya). In the 3rd century BC the city received the name Ptolemais from Ptolemy III, who united Cyrenaica with Egypt. Its economy was based on trade with the interior, and the city flourished in Hellenistic times, in the early period of the Roman Empire, and, again, from late in the 3rd century AD, when Diocletian made it the metropolis of the Roman province of Upper Libya.

From the beginning of the 5th century it suffered from raids by the inland Austuriani, as recorded in the letters of Bishop Synesius. Some occupation continued after the Arab conquest (AD 642) to the 11th century.

Ptolemaís, town, Kozani *nomós* (department), west central Macedonia, northern Greece. It is situated in a mountain pass, the Stená Komános; nearby an earth-fill dam across the Perdika River was completed in 1962 for water distribution. The first of six thermal electric power plants was completed there in 1959. These are fuelled by abundant local lignite. The power stations enhanced the emergence of Ptolemaís as an industrial centre for the production of sulfuric acid and nitrate fertilizers, as well as lignite. Pop. (1981) 22,109.

Ptolemy, name of Macedonian kings of Egypt, grouped below chronologically and indicated by the symbol •.

• Ptolemy I SOTER (Greek: Saviour) (b. 367/366 or 364 BC, Macedonia—d. 283/282, Egypt), Macedonian general of Alexander the Great, who became ruler of Egypt (323–285 BC) and founder of the Ptolemaic dynasty,

Ptolemy I Soter, portrait on a silver tetradrachm; in the British Museum

By courtesy of the trustees of the British Museum

which reigned longer than any other dynasty established on the soil of the Alexandrian empire and only succumbed to the Romans in 30 BC.

Early life and career. Ptolemy was the son of the nobleman Lagus, a native of the Macedonian district of Eordaea whose family was undistinguished until Ptolemy's time, and of Arsinoe, who was related to the Macedonian Argead dynasty. He was probably educated as a page at the royal court of Macedonia, where he became closely associated with Alexander. He was exiled in 337, along with other companions of the crown prince. When he returned, after Alexander's accession to the throne in 336, he joined the King's bodyguard, took part in Alexander's European campaigns of 336–335, and in the fall of 330 was appointed personal bodyguard (*sōmatophylax*) to Alexander; in this capacity he captured the assassin of Darius III, the Persian emperor, in 329. He was closely associated with Alexander during the advance through the Persian highland. As a result of Ptolemy's successful military performance on the way from Bactria (in northeastern Afghanistan) to the Indus River (327–325), he became commander (*triērarchos*) of the Macedonian fleet on the Hydaspes (modern Jhelum in India). Alexander decorated him several times for his deeds and married him to the Persian Artacama at the mass wedding at Susa, the Persian capital, which was the crowning event of Alexander's policy of merging the Macedonian and Iranian populations.

Satrap of Egypt. Ptolemy, who distinguished himself as a cautious and trustworthy troop commander under Alexander, also proved to be a politician of unusual diplomatic and strategic ability in the long series of struggles over the throne that broke out after Alexander's death in 323. Convinced from the outset that the generals could not maintain the unity of Alexander's empire, he proposed during the council at Babylon, which followed Alexander's death, that the satrapies (the provinces of the huge empire) be divided among the generals. He became satrap of Egypt, with the adjacent Libyan and Arabian regions, and methodically took advantage of the geographic isolation of the Nile territory to make it a great Hellenistic power. He took steps to improve internal administration and to acquire several external possessions in Cyrenaica (the easternmost part of Libya), Cyprus, and Syria and on the coast of Asia Minor; these, he hoped, would guarantee him military security. Although he pursued a friendly policy toward Greece that secured his political influence there, he also succeeded in winning over the native Egyptian population.

In 322 Ptolemy, taking advantage of internal disturbances, acquired the African Hellenic towns of Cyrenaica. In 322–321, as a member of a coalition of "successors" (*diadochoi*) of Alexander, he fought against Perdiccas, the ruler (*chiliarchos*) of the Asiatic region of the empire. The coalition was victorious and Perdiccas died during the fighting. Ptolemy's diplomatic talent was put to the test during this war. When the satrapies were redistributed at Triparadisus in northern Syria, Antipater, the general of the European region, became regent of the Macedonian empire and Ptolemy was confirmed in possession of Egypt and Cyrene. He further strengthened his position by marrying Eurydice, the third daughter of Antipater.

About 317 he married Berenice I, the granddaughter of Cassander, the son of Antipater. Cassander, at his father's death in 319, refused to accept his father's successor, made war upon him, seized part of the empire, and in 305 assumed the title of king of Macedonia. In the coalition war of 315–311, Ptolemy obtained possession of Cyprus. In this war he scored his most important victory in the battle near Gaza in 312, in which the Egyptian contingents were decisive. But war broke out anew in 310, and he lost Cyprus again in 306. He temporarily lost Cyrene as well and was unable to hold the important Greek positions of Corinth and neighbouring Sicyon and Megara, which he had captured in 308. He ultimately suffered overwhelming defeat in 306 in the naval battle near Salamis on Cyprus. The victor in this battle, Antigonus I Monophthalmus, who was assisted by his son, Demetrius Poliorcetes, assumed the title of king in 306. The remaining satraps, led by Ptolemy after he successfully resisted Antigonus' attack on Egypt, also took the title of king in 305–304.

King of Egypt. After naming himself king, Ptolemy's first concern was the continuing war with Antigonus, which was now focussed on the island of Rhodes. In 304 Ptolemy aided the inhabitants of Rhodes against Antigonus and was accorded the divine title Soter (Saviour), which he was commonly called from that time. The dissolution of Alexander's empire was brought to a close with the battle near Ipsus in Asia Minor in 301. During this battle Antigonus was defeated by the other kings. This led to the attempt by the remaining successors of Alexander to define their kingdoms. For this reason a dispute arose between Ptolemy and Seleucus I Nicator of Babylon over Syria, particularly the southern Syrian ports, which served as terminal points for the caravan routes. This quarrel, however, was temporarily settled peacefully through compromise. In addition to Coele Syria (Palestine), Ptolemy apparently also occupied Pamphylia, Lycia, and part of Pisidia in southern Asia Minor.

During the last 15 years of his reign, because of the defeats he suffered between 308 and 306, Ptolemy preferred to secure and expand his empire through a policy of alliances and marriages rather than through warfare. In 300 he concluded an alliance with Lysimachus of Thrace (modern Bulgaria) and gave him his daughter Arsinoe II in marriage in 299/298. At approximately the same time he married his stepdaughter Theoxena to Agathocles, the tyrant of Syracuse (southeastern Sicily). About 296 he made peace with Demetrius Poliorcetes, to whom he betrothed his daughter Ptolemais. To Pyrrhus of Epirus, Demetrius' brother-in-law, who was at the Egyptian court as a hostage, he gave his stepdaughter Antigone. He finally brought rebellious Cyrene into subjection in 298, and in approximately 294 he gained control over Cyprus and the Phoenician coastal towns of Tyre and Sidon.

In a last coalition war in 288–286, in which Ptolemy, Seleucus, Lysimachus, and Pyrrhus opposed Demetrius, the Egyptian fleet participated decisively in the liberation of Athens from Macedonian occupation. During this war Ptolemy obtained the protectorate over the League of Islanders, which was established by Antigonus Monophthalmus in 315 and included most of the Greek islands in the Aegean. Egypt's maritime supremacy in the Mediterranean in the ensuing decades was based on this alliance.

Ptolemy was able to evaluate the chaotic international situation of this post-Alexandrian era, which was characterized by constantly renewed wars with shifting alliances and coalitions, in realistic political terms. Adhering to a basically defensive foreign policy, he secured Egypt against external enemies and expanded it by means of directly controlled foreign possessions and hegemonic administrations. He did not, however, neglect to devote attention to the internal organization of the country and to provide for a successor. In 290 he made his wife Berenice queen of Egypt and in 285 (possibly on June 26) appointed his younger son Ptolemy II Philadelphus, who was born to Berenice in 308, co-regent and successor. The provision for the succession, which was based on examples from the time of the pharaohs, made possible a peaceful transition when Ptolemy died in the winter of 283–282. The early Ptolemies were occupied with the economic exploitation of Egypt, but, because of the lack of first-hand information, the details of Ptolemy's participation in the process cannot be determined. It is certain, however, that discrimination against the Egyptians took place during his reign. The only town he founded was Ptolemais in Upper Egypt. He probably placed Macedonian military commanders alongside the Egyptian provincial administrators and intervened unobtrusively in legal and financial affairs. In order to regulate the latter, he introduced coinage, which until that time was unknown in Egypt.

He found it necessary from the outset, however, to pursue a conciliatory policy toward the Egyptians, since Egyptians had to be recruited for his army, which initially numbered only 4,000 men. Ptolemy won over the Egyptians through the establishment in Memphis of the Sarapis cult, which fused the Egyptian and Greek religions; through restoration of the temples of the pharaohs, which had been destroyed by the Persians; and through gifts to the ancient Egyptian gods and patronage of the Egyptian nobility and priesthood. Finally, he founded the Museum (Mouseion), a common workplace for scholars and artists, and established the famous library at Alexandria. Besides being a patron of the arts and sciences, he was a writer himself. In the last few years of his life Ptolemy wrote a generally reliable history of Alexander's campaigns. Although it is now lost, it can be largely reconstructed through the extensive use made of it later by the historian Arrian.

Several times during his life Ptolemy was proclaimed a deity by certain classes of people. After his death he was raised to the level of a god by all the Egyptians. (R.We.)

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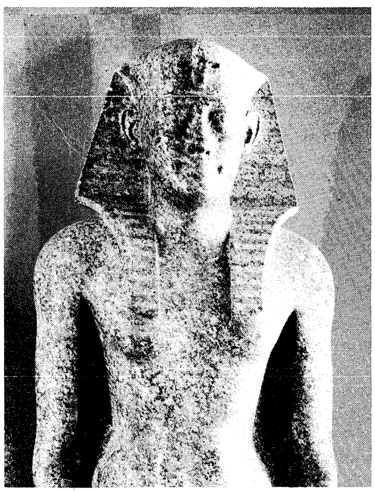
• **Ptolemy II** PHILADELPHUS (Greek: Brother-loving) (b. 308 BC, Cos—d. 246), king of Egypt (285–246 BC), second king of the Ptolemaic dynasty, who extended his power by skillful diplomacy, developed agriculture and commerce, and made Alexandria a leading centre of the arts and sciences.



Ptolemy II Philadelphus, upper portion of a colossal red granite statue from Heliopolis, c. 260 BC; in the Vatican Museum
By courtesy of the Vatican Museum

Life. Reigning at first with his father, Ptolemy I Soter, he became sole ruler in 283–282 and purged his family of possible rivals. This dynastic strife led also to the banishment of his first wife, Arsinoe I, daughter of King Lysimachus of Thrace. Ptolemy then married his sister, Arsinoe II, an event that shocked Greek public opinion but was celebrated by the Alexandrian court poets. Taking advantage of the difficulties of the rival kingdoms of the Seleucids and Antigonids, Ptolemy II extended his rule in Syria, Asia Minor, and the Aegean at their expense and asserted at the same time his influence in Ethiopia and Arabia. Egyptian embassies to Rome as well as to India reflect the wide range of Ptolemy's political and commercial interests.

While a new war with the Seleucids (from 274 to 270) did not affect the basic position of the rival kingdoms, the so-called Chremonidean War (268?–261), stirred up by Ptolemy against Antigonus II Gonatas, king of Macedonia, resulted in the weakening of Ptolemaic influence in the Aegean and brought about near disaster to Ptolemy's allies Athens and Sparta. Ptolemy was no more successful in the Second Syrian War (*c.* 260–253), fought against the coalition of the Seleucid king Antiochus II and Antigonus Gonatas. The unsuccessful course of the military operations was compensated for, to a certain degree, by the diplomatic skill of Ptolemy, who first managed to lure Antigonus into concluding a separate peace (255) and then brought the war with the Seleucid Empire to an end by marrying his daughter, Berenice—provided with a huge dowry—to his foe Antiochus II. The magnitude of this political masterstroke can be gauged by the fact that Antiochus, before marrying the Ptolemaic princess, had to dismiss his former wife, Laodice. Thus freed for the moment from Seleucid opposition and sustained by the considerable financial means provided by the Egyptian economy, Ptolemy II devoted himself again to Greece and aroused new adversaries to Antigonid Macedonia. While the Macedonian forces were bogged down in Greece, Ptolemy reasserted his influence in the Aegean, making good the setback suffered during the Chremonidean War. He further improved his position by arranging for the marriage of his son (and later successor) Ptolemy III Euergetes to the daughter of King Magas of Cyrene, who had proved so far a very troublesome neighbour. Not aiming at outright hegemony (even less imperialistic conquest) in the Hellenistic world of the eastern Mediterranean, Ptolemy II tried nonetheless to secure for Egypt as good a position as possible, holding at large his rivals beyond a wide buffer zone of foreign possessions. Without being completely successful, he managed to let his allies bear the brunt of the heaviest reverses, healing his own military wounds with diplomatic remedies. The influence on Ptolemy of his wife and sister Arsinoe II, particularly in foreign affairs, was certainly substantial, though not as extensive as claimed by some contemporary authors.

Influence. Ptolemy II's record in domestic affairs is no less impressive. From pharaonic times onward, agriculture and the work of artisans in Egypt had been highly organized. Under Ptolemy's supervision and with the help of Greek administrators, this system developed into a kind of planned economy. The peasant masses of the Nile Valley provided cheap labour, so that the introduction of slavery on a broad basis was never considered an economic necessity in Ptolemaic Egypt. Ptolemy II became a master at the fiscal exploitation of the Egyptian countryside; the capital, Alexandria, served as the main trading and export centre. Ptolemy II displayed a vivid interest in Greek as well as in Egyptian religion, paid visits to the sanctuaries in the countryside, and spent large sums erecting temples. Anxious to secure a solid position for, and religious elevation of, his dynasty, the King insisted upon divine honours not only for his parents but also for his sister and wife Arsinoe II and himself as *theoi adelphoi* ("brother gods"). He thus became one of the most ardent promoters of the Hellenistic ruler cult, which in turn was to have a far-reaching influence on the cult of the Roman emperors.

Under Ptolemy II, Alexandria also played a leading role in arts and science. Throughout the whole Mediterranean world the King acquired a reputation for being a generous patron of poets and scholars. Surrounding himself with a host of court poets, such as Callimachus and Theocritus, he expanded the library and financed the museum, a research centre founded as a counterweight to the more antimonarchial Athenian schools. Learning there was not confined to philosophy and literature but extended also to include mathematics and natural sciences. The age of Ptolemy II coincided with the apex of Hellenistic civilization; its vigour and glamour were a result of the still fresh forces of Greek leadership in the eastern Mediterranean. Ptolemy II was no man of peace, but neither was he one of the warlike Hellenistic soldier-kings. A prudent and enlightened ruler, he found his strength in diplomatic ability and his satisfaction in a vast curiosity of mind. (He.H.)

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• **Ptolemy III** EUERGETES (Greek: Benefactor) (fl. 246–221 BC), Macedonian king of Egypt, son of Ptolemy II; he reunited Egypt and Cyrenaica and successfully waged the Third Syrian War against the Seleucid kingdom.

Almost nothing is known of Ptolemy's youth before 245, when, following a long engagement, he married Berenice II, the daughter of Magas, king of Cyrene; thereby he reunited Egypt and Cyrenaica, which had been divided since 258. Shortly after his accession and marriage, Ptolemy invaded Coele Syria, to avenge the murder of his sister, the widow of the Seleucid king Antiochus II. Ptolemy's navy, perhaps aided by rebels in the cities, advanced against Seleucus II's forces as far as Thrace, across the Hellespont, and also captured some islands off the Asia Minor coast, but were checked *c.* 245. Meanwhile, Ptolemy, with the army, penetrated deep into Mesopotamia, reaching at least Seleucia on the Tigris, near Babylon. According to classical sources he was compelled to halt his advance because of domestic troubles. Famine and a low Nile, as well as the hostile alliance between Macedonia, Seleucid Syria, and Rhodes, were perhaps additional reasons. The war in Asia Minor and the Aegean intensified as the Achaean League, one of the Greek confederations, allied itself to Egypt, while Seleucus II secured two allies in the Black Sea region. Ptolemy was pushed out of Mesopotamia and part of North Syria in 242–241, and the next year peace was finally achieved. Ptolemy managed to keep the Orontes River region and Antioch, both in Syria; Ephesus, in Asia Minor; and Thrace and perhaps also Cilicia.

Within Egypt, Ptolemy continued the colonization of al-Fayyūm (the oasis-like depression southwest of Cairo), which his father had developed. He also reformed the calendar, adopting 311 as the first year of a "Ptolemaic Era." The Canopus decree, a declaration published by a synod of Egyptian priests, suggests that the true duration of the year (365¼ days) was now recognized, for an extra day was added to the calendar every four years. The new calendar failed, however, to achieve popular acceptance. The priests and classical sources also credited Ptolemy with the restoration of the divine statues plundered from the temples during Persian rule. In addition, the King initiated construction at Edfu, the Upper Egyptian site of a great Ptolemaic temple, and made donations to other temples.

Ptolemy avoided involvement in the wars that continued to plague Syria and Macedonia. He did, however, send aid to Rhodes, after earthquakes devastated the island, but he refrained from subsidizing the schemes of the Spartan king against Macedonia, though he granted him asylum in 222. In Asia Minor, when a pretender to one of the kingdoms, who was the instigator of much of the trouble there, sought asylum in Ptolemaic territory, Ptolemy promptly interned him. His policy was to maintain an equilibrium of power, guaranteeing the safety of his own territory. After declaring his son his successor, Ptolemy died, leaving Egypt at the peak of its political power, and internally stable and prosperous. Ptolemy III's reign is discussed in W.W. Tarn's *Hellenistic Civilisation* (3rd ed., 1952) and in the first volume of A. Bouche Leclercq's *Histoire des Lagides* (1903).

• **Ptolemy IV** PHILOPATOR (Greek: Loving His Father) (b. *c.* 238 BC–d. 205 BC), Macedonian king of Egypt (reigned 221–205 BC), under whose feeble rule, heavily influenced by favourites, much of Ptolemaic Syria was lost and native uprisings began to disturb the internal stability of Egypt.

Classical writers depict Ptolemy as a drunken, debauched reveller, completely under the influence of his disreputable associates, among whom Sosibius was the most prominent. At their instigation, Ptolemy arranged the murder of his mother, uncle, and brother.

Following the defection of one of Ptolemy's best commanders, Egypt's Syro-Palestinian territory, Coele Syria, was seriously threatened by Antiochus III, the Syrian Seleucid ruler. In 219, when the Seleucid ruler captured some of the coastal cities, Sosibius and the Ptolemaic court entered into delaying negotiations with the enemy, while the Ptolemaic army was reorganized and intensively drilled. So grave was the threat that for the first time under the Ptolemaic regime native Egyptians were enrolled into the infantry and cavalry and trained in phalanx tactics. In 218 the negotiations collapsed, and Antiochus renewed his advance, overrunning Ptolemy's forward defenses. In the spring of 217, however, Ptolemy's new army met the Seleucid forces near Raphia in southern Palestine, and with the help of the Egyptian phalanx Ptolemy was victorious. Although holding the initiative, the Egyptian king, on Sosibius' advice, negotiated a peace, and the Seleucid army withdrew from Coele Syria.

After Raphia, Ptolemy married his sister, Arsinoe, who bore him a successor in 210. The Egyptians, however, sensing their power, rose in a rebellion that Polybius, the Greek historian, describes as guerrilla warfare. By 205 the revolt had spread to Upper Egypt.

To the south, Ptolemy maintained peaceful relations with the neighbouring kingdom. In the Aegean, he retained a number of islands, but, in spite of honours granted him, he refused to become embroiled in the wars of the Greek states. In Syria, also, Ptolemy avoided involvement in local struggles, though Sosibius attempted to embroil Egypt there. According to Polybius, Ptolemy's debauched and corrupt character, rather than his diplomatic acumen, kept him clear of foreign involvements. As his reign progressed he fell increasingly under the influence of his favourites, and around November 205 he died. His clique of favourites kept Ptolemy's death a secret, and about a year later murdered Queen Arsinoe, leaving the young successor at their mercy.

• **Ptolemy V** EPIPHANES (Greek: Illustrious) (b. *c.* 210—d. 180 BC), Macedonian king of Egypt from 205 BC under whose rule Coele Syria and most of Egypt's other foreign possessions were lost.

After Sosibius, Ptolemy IV's corrupt minister, had murdered Ptolemy V's mother, the five-year-old king was officially elevated to the throne; Sosibius became his guardian. According to the 2nd-century BC Greek historian Polybius, all prominent officials were banished from Egypt while Sosibius' clique announced the young king's accession and the death of his parents. The rulers of Macedonia and of the Syrian-based Seleucid kingdom, however, realizing Egypt's weakness, conspired to partition that Kingdom's Asiatic and Aegean possessions.

When Sosibius retired about 202, Agathocles, another member of the clique, became Ptolemy's guardian. Soon, however, he provoked Tlepolemus, the governor of Pelusium (Egypt's eastern frontier city), who marched on Alexandria, where his supporters roused a mob, compelling Agathocles to resign in favour of another courtier. When the boy king, enthroned in the stadium while the mob clamoured for the murderers of his parents, nodded in confusion at the prompting of a courtier, the mob searched out and butchered Agathocles and his family. Tlepolemus, however, soon proved incompetent and was removed.

During the confusion in Egypt, Antiochus III, the Seleucid king, made serious inroads into Coele Syria. Ptolemy's forces mounted a counteroffensive, capturing Jerusalem; but in 201 the Seleucid king returned, defeating the Ptolemaic army and later seizing the Ptolemaic lands in Asia Minor. Roman diplomatic intervention finally halted the war; and in 194/193 BC, as part of the peace treaty, Cleopatra I, a daughter of Antiochus, was married to Ptolemy.

Within Egypt the revolts that had begun under Ptolemy's father continued; in 197 the King fought rebels in the Nile Delta, exhibiting great cruelty toward those of their leaders who capitulated. In Upper Egypt troubles persisted until 187/186. Though an adult, the King still was under the control of his guardians and advisers. To forestall further insurrections, he extended the authority of the governor of Thebes to include all Upper Egypt. In 196 he promulgated the decree inscribed on the Rosetta Stone; found in 1799, it provided the key to the hieroglyphic, or pictographic writing, of ancient Egypt. The decree, which reveals the increasing influence of Egyptian natives, remitted debts and taxes, released prisoners, pardoned rebels who surrendered, and granted increased benefactions to the temples.

Ptolemy retained existing alliances in Greece. Late in his reign an able eunuch was sent to recruit Greek mercenaries; but whatever the King's plans may have been, he died suddenly, about May 180, leaving two sons and a daughter, with the Queen as their regent.

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

• **Ptolemy VI** PHILOMETOR (Greek: Loving His Mother) (fl. *c.* 180–145 BC), Macedonian king of Egypt under whom an attempted invasion of Coele Syria resulted in the occupation of Egypt by the Seleucids. After Roman intervention and several ventures of joint rule with his brother, however, Ptolemy was able to reunite his realm.

Ptolemy VI Philometor, portrait on a silver tetradrachm; in the British Museum
By courtesy of the trustees of the British Museum

The son of Ptolemy V Epiphanes and Cleopatra I, Ptolemy VI ruled as co-regent with his mother, who, although a daughter of a Seleucid king, did not take sides in Syria and remained friendly with Rome. Mother and son governed effectively until her death in 176, when Ptolemy fell under the influence of two ambitious courtiers. Around 173 Ptolemy was married to his sister, Cleopatra II. Under his advisers' guidance, preparations were made to invade Coele Syria. In 170 Ptolemy VIII Euergetes, his brother, was associated on the throne with Ptolemy VI and Cleopatra II, and Coele Syria was invaded, but the Seleucid ruler Antiochus IV decisively defeated the Egyptians and seized Pelusium, the Egyptian frontier city. Antiochus invaded Egypt in 170 and again in 168, but withdrew under pressure from the Ptolemies' ally, Rome. About October 164 Philometor was expelled from Alexandria by his brother and fled to Rome for support. The Romans thereupon partitioned the Ptolemaic realm, ordering Euergetes into Cyrenaica and giving Philometor Cyprus and Egypt.

Euergetes, not content with Cyrenaica alone, journeyed to Rome twice to ask for Cyprus also. The Senate finally decided to grant the brother's request; Philometor, however, delayed the Romans by clever diplomacy and in 154 defeated his brother, who attempted to seize Cyprus by force. Nevertheless Philometor restored his brother to Cyrenaica, married a daughter to him, and granted him a grain subsidy. In Rome, meanwhile, the Roman statesman Cato the Elder, deploring the continuous intrigues, praised Ptolemy VI as a good and beneficent ruler. At last Philometor's kingdom became relatively secure.

In 155, however, the Seleucid ruler of Syria had incurred Ptolemy's enmity by conspiring to seize Cyprus. When a pretender, Alexander Balas, appeared, Philometor hastened to aid him in 153, and later even gave him a daughter in marriage. About 148, however, the Egyptian king found himself in Syria again when another pretender appeared. When Alexander Balas failed in his attempt to have Philometor assassinated, the Egyptian ruler bestowed his daughter, Balas' wife, on the new pretender. Although Ptolemy supported him, the people of Antioch and the Syrian army asked the Egyptian monarch himself to become their ruler. Ptolemy declined, but he was soon drawn into a battle in which Alexander Balas was defeated and slain. During the battle Ptolemy fell from his horse and fractured his skull, dying a few days later.

• **Ptolemy VII** NEOS PHILOPATOR (Greek: New Philopator) (d. 144 BC), younger son and co-ruler with Ptolemy VI Philometor, king of Egypt, whom he succeeded in 145 BC. Still a minor, he was the ward of his mother, who also served as his co-ruler. He was soon displaced by his uncle, Ptolemy VIII, who executed him the following year.

Classical and even contemporary Egyptian sources are confused concerning the placement of Neos Philopator in the royal sequence because at least one other son of Philometor, also named Ptolemy, served as co-ruler earlier in the reign. Modern scholars have gathered evidence to show that Neos Philopator became co-ruler in 147 BC. Following his father's death, he ruled from about July to late August 145, with the support of Cleopatra II. His father's army, however, had been dispersed in Syria; and Neos Philopator and his mother enjoyed only limited support. After the opposition factions invited the young king's uncle, Ptolemy VIII, to assume the kingship, Neos Philopator was deposed. He was executed the following year, after his uncle married his mother.

• **Ptolemy VIII** EUERGETES II (Greek: "Benefactor II"), also called PHYSCON (Greek: "Potbellied") (d. 116 BC), Macedonian king of Egypt who played a divisive role in trying to win the kingship, making himself subservient to Rome and encouraging Roman interference in Egypt.

Ptolemy VIII ruled jointly with his brother, Ptolemy VI Philometor, in 170–164 BC and alone during the next year; he was king of Cyrenaica (in modern Libya) in 163–145, and sole ruler of Egypt from 145 to his death in 116, except for a brief exile in 131–129. Continuously quarreling with his queen, Cleopatra II, the widow of Philometor, he caused civil war and economic collapse in Egypt. Late in his reign (118) he instituted extensive reforms to restore the country.

Around 117 an expedition sponsored by Ptolemy completed the first sea voyage to India via the Red Sea and Indian Ocean, beginning Egypt's interest in the spice trade.

• **Ptolemy IX** SOTER II, byname LATHYRUS (Greek: "Chickpea") (fl. 2nd–1st century BC), Macedonian king of Egypt (reigned 116–110, 109–107, and 88–81 BC) who, after ruling Cyprus and Egypt in various combinations with his brother, Ptolemy X Alexander I, and his mother, Cleopatra III, widow of Ptolemy VIII Euergetes II, gained sole rule of the country in 88 and sought to keep Egypt from excessive Roman influence while trying to develop trade with the East.

The unusual will of Euergetes II partitioned Egypt's possessions, leaving Cleopatra III as the effective ruler of Egypt and Cyprus. Although she preferred his younger brother, Ptolemy Alexander, popular sentiment forced the dowager queen to dismiss him and to associate Ptolemy Soter on the throne with herself. After compelling the king in 115 to divorce his strong-willed sister-queen, Cleopatra IV, his mother forced Ptolemy to marry his younger, more pliable sister, Cleopatra Selene. The next year, after his brother was sent to Cyprus as governor, Ptolemy Soter appeared with his mother as joint ruler of Egypt. The latent hostility between the son and his mother finally erupted in October 110, when Cleopatra expelled him from Egypt and recalled his brother from Cyprus. Soter II returned in early 109 but was evicted anew by his mother in March of the following year.

After a reconciliation in May 108 he fled a third time and established himself in Cyprus, from where in 107 he invaded northern Syria to assist one of the claimants to the Seleucid empire, while his mother, allying herself with the Jewish king in Palestine, actively aided another Seleucid pretender. During the protracted war his mother died (101) and Ptolemy X Alexander became the sole ruler of Egypt, while Soter II remained entrenched in Cyprus.

After Alexander's unpopularity drove him from Alexandria a second time and he perished at sea, Soter returned to resume sole rule over Egypt. Lacking a queen, he brought back his brother's widow, who was also his own daughter, Berenice III, and associated her on the throne with himself. Shortly before Soter's return in 88 a serious native rebellion erupted around Thebes in Upper Egypt. After three years of hard fighting Thebes capitulated and was sacked in retribution.

Ptolemy Soter refused to give aid to the Romans in the course of their war with Pontus, a Black Sea kingdom, and after the Roman sack of Athens in 88 the Egyptian rulers helped rebuild the city, for which commemorative statues of them were erected. Ptolemy IX died in 81, leaving his daughter and widow as his successor.

• **Ptolemy X** ALEXANDER I (d. 88 BC), Macedonian king of Egypt (reigned 107–88 BC) who, under the direction of his mother, Cleopatra III, ruled Egypt alternately with his brother Ptolemy IX Soter II and around 105 became involved in a civil war in the Seleucid kingdom in Syria.

Son of Ptolemy VIII Euergetes II, Ptolemy Alexander was sent to Cyprus as governor in 114 after the opposition of the people of Alexandria prevented his mother from securing the kingship of Egypt for him. When, at the instigation of the queen mother, his elder brother, Ptolemy Soter, was expelled from Egypt in 110, Ptolemy Alexander was recalled from Cyprus and replaced him as coregent in Egypt. Following a reconciliation in early 109, Soter returned and occupied the throne, while Ptolemy Alexander departed for Cyprus as king of the island. Another bitter quarrel between his brother and mother brought Ptolemy Alexander back to Egypt as coregent in 107, but Cleopatra III took official precedence and was the actual ruler.

While the queen mother continued to pursue the family dispute, Ptolemy Alexander found himself drawn into a civil war in the Seleucid kingdom, after his brother lent active aid to the opponents of his mother's allies. With the queen's death in 101 the war ended, and Ptolemy Alexander was reconciled with his brother and even married Soter's daughter, Berenice III.

In 89 the army in Alexandria turned against Ptolemy Alexander, and he was forced into exile. After gathering a mercenary force in Syria-Palestine, the king returned the following year, but when he plundered the temple-tomb of Alexander the Great in Alexandria to pay his troops, the infuriated populace of the city expelled him again, and he was killed at sea between Lycia in Asia Minor and Cyprus. His widow, who had accompanied him into exile, subsequently returned to Egypt to become his brother Soter's queen.

Ptolemy Alexander extended the rights of Egyptian natives, who pressed for further extensions. In 88, the year of his death, a rebellion erupted in the region of Thebes in Upper Egypt with the aim of establishing a native dynasty; this was finally suppressed under his predecessor and successor, Ptolemy IX.

• **Ptolemy XI** ALEXANDER II (b. *c.* 115—d. 80 BC), last fully legitimate Ptolemaic king of Egypt, who, after marrying Berenice III, Ptolemy IX Soter II's widow, and joining her as coruler, murdered her and seized sole power. He was killed by the infuriated people of Alexandria.

Ptolemy XI was a son of Ptolemy X Alexander I, ruler of Egypt and Cyprus. During the war with the Seleucid empire conducted by his grandmother Queen Cleopatra III, and his father, he was sent, with substantial treasure, to the Aegean island of Cos for safekeeping.

Around the time of his father's death in 88 he was captured by Mithradates VI Eupator, king of Pontus in northern Anatolia, who had just routed a Roman general and seized Cos, among other territories. Although the Pontic king treated him well and even educated him, Ptolemy Alexander fled to the Roman dictator Lucius Cornelius Sulla during a battle between the Romans and Mithradates in 84. Carried off to Rome, he remained there as a politically valuable hostage until 81, when his uncle Ptolemy IX Soter II died. After Soter II's widow, Berenice III, assumed sole rule, Sulla, without consulting either the queen or the people of Egypt, sent Ptolemy Alexander to marry Berenice. Unable to coexist with the queen, who insisted on ruling alone, Ptolemy murdered her after about 19 days of joint rule. The people of Alexandria, who had greatly admired the queen, killed him in revenge, thus eliminating the last fully legitimate member of the Ptolemaic dynasty.

• **Ptolemy XII** AULETES (Greek: "Flute Player"), in full PTOLEMY XII THEOS PHILOPATER PHILADELPHUS NEOS DIONYSOS AULETES (b. *c.* 112—d. 51 BC), Macedonian king of Egypt, whose quasi-legitimate royal status compelled him to depend heavily upon Rome for support for his throne. During his reign Egypt became virtually a client kingdom of the Roman republic.

Following the sudden, violent deaths of the last two fully legitimate members of the Ptolemaic family in Egypt, the people of Alexandria in 80 invited Ptolemy XII to assume the throne. Although he was known as a son of Ptolemy IX Soter II, the identity of his mother is not certain. In 103 he was sent by his grandmother, Cleopatra III, queen of Egypt, in the company of his brother and Ptolemy XI Alexander II, his predecessor, to Cos, an Aegean island near Asia Minor, for safekeeping. Captured in 88 by Mithradates VI Eupator, ruler of Pontus, a kingdom in Asia Minor that was then at war with Rome, young Ptolemy appeared in 80 in Syria, from where, according to the Roman historian and politician Cicero, he arrived in Egypt, while his brother became king of Cyprus.

Shortly after his arrival in Egypt Ptolemy married Cleopatra V Tryphaeana, perhaps his sister, and in 76 he was crowned in Alexandria according to Egyptian rites. At Rome, however, the democratic faction in 65 raised the issue of Ptolemy's legitimacy, producing a questionable will of Ptolemy XI Alexander II purporting to bequeath Egypt to the Roman people. The aristocracy at Rome, including Cicero, opposed the annexation, while Ptolemy, seeking Roman support, sent troops to assist the consul and general Pompey the Great in Palestine. Facing serious opposition from the people of Alexandria and still unsure of his status at Rome, he bribed Julius Caesar, one of the Roman consuls for the year 59, with 6,000 talents, in return for which Caesar passed a law acknowledging his kingship. Rome nevertheless divested Egypt of Cyprus the next year, and, when his brother in Egypt failed to support him, the island's king committed suicide.

Fearing popular insurrection over the loss of Cyprus, Ptolemy in 58 went to Rome to seek military aid and left his queen and his eldest daughter, Berenice IV, as regents in Egypt. Residing at Pompey's villa at Rome, he employed bribery to obtain the support of the Roman senators. He also arranged the assassination of delegations sent by his opponents from Alexandria, where, following his queen's death, the people had made Berenice IV sole ruler. While the Senate delayed an answer, Ptolemy, continuing to dispense bribes, fell deeper into debt to Roman moneylenders. Late in 57 the Senate passed a resolution to support Ptolemy, but, when a prophecy forbade the granting of active aid, the Egyptian king departed for Ephesus, a city in Asia Minor.

In 55, after promising Pompey's lieutenant Aulus Gabinius, proconsul of Syria, 10,000 talents, Ptolemy was returned to Egypt with a Roman army. Once restored, he executed his daughter, who had headed the opposition at Alexandria. Shortly before his death in 51 he proclaimed his eldest surviving daughter, the celebrated Cleopatra VII, and his eldest son coregents.

• **Ptolemy XIII** THEOS PHILOPATOR (Greek: "God Loving His Father") (b. 63—d. 47 BC, near Alexandria), Macedonian king of Egypt, and coruler with his famous sister, Cleopatra VII. He was killed while leading the Ptolemaic army against Julius Caesar's forces in the final stages of the Alexandrian War.

A son of Ptolemy XII Auletes, Ptolemy XIII became joint ruler of Egypt with his sister following his father's death. In 49 Ptolemy, seeking to retain his father's allies, supplied the Roman general and former triumvir Pompey the Great with ships and troops. Subsequently a court clique, headed by Theodotus, the eunuch Pothinus, and the general Achillas, gained influence over the King, fanning the growing rivalry between him and his strong-willed sister. Expelled from Egypt by the King and his clique in 48, she quickly raised an Arab army and besieged Pelusium, a city on the northeast frontier of Egypt. As the opposing forces prepared for war, Pompey, decisively defeated by Caesar at Pharsalus in Thessaly, appeared at Pelusium seeking refuge. He was murdered however, on orders of the palace clique, which sought to gain favour with Caesar.

Shortly afterward, Caesar arrived at Alexandria and, seizing the palace quarter, ordered the warring factions to submit to his arbitration as authorized by the will of Ptolemy's father. Leaving General Achillas with the army, Ptolemy went with Pothinus to Caesar's camp, while Cleopatra arrived in the palace, reportedly concealed in a carpet. With all the members of the Ptolemaic royal family in his grasp, Caesar effected a reconciliation between Ptolemy and his sister.

Pothinus' group, however, continued to foment trouble against the Romans and their Egyptian allies; and after Achillas brought up the army to besiege Alexandria, Ptolemy's youngest sister, Arsinoe, escaped to the native forces. Caesar, meanwhile persuaded Cleopatra to execute Pothinus, while Achillas was killed after feuding with Arsinoe, thus effectively destroying the clique. Pressed hard by the native forces under Arsinoe and her tutor, Caesar negotiated an exchange of Ptolemy for Arsinoe. The King immediately took command of the Egyptians; but Caesar, reinforced by an army from Pergamum, a city in Asia Minor, outmanoeuvred the Ptolemaic forces; and the King was killed, probably by drowning as he attempted to flee.

• **Ptolemy XIV** THEOS PHILOPATOR II (Greek: God Loving His Father) (b. *c.* 59—d. July 44 BC), Macedonian king of Egypt from 47 to 44 BC, co-ruler with his elder sister, the famous Cleopatra VII, by whom he was reportedly killed in 44 to make way for Ptolemy XV Caesar (Caesarion), her son by Julius Caesar.

Following the death of his brother Ptolemy XIII Theos Philopator at the end of the Alexandrian War between Caesar and the Ptolemaic forces, Ptolemy XIV was elevated by Caesar to co-rulership with Cleopatra. When his sister followed Caesar to Rome in 46, Ptolemy accompanied her. Little is recorded about his stay there; but after Caesar's death, when his sister returned to Egypt, the young king died—probably at Cleopatra's command—and her son, Ptolemy Caesar, became joint ruler with the Queen.

• **Ptolemy XV** CAESAR, in full PTOLEMY PHILOPATOR PHILOMETOR CAESAR, byname CAESARION (b. June 47 BC—d. 30 BC), king of Egypt (reigned 44–30 BC), son of Julius Caesar and Cleopatra VII. Ptolemy was his mother's co-ruler, killed by Octavian, later the emperor Augustus, after Cleopatra's death in 30.

Ptolemy was the child of Cleopatra and Caesar, although a few classical authors, perhaps for political reasons, expressed doubts about his paternity. After Cleopatra's arrival in Rome in 46, Caesar himself, however, officially recognized the child as his son. When his father was assassinated in 44, Cleopatra returned with the boy to Egypt, where she probably arranged the death of her younger brother, Ptolemy XIV Theos Philopator II, to make room for her son on the throne. Her ambition was to make Caesarion Caesar's successor, although in the meantime she remained first in the royal succession.

After Cleopatra had begun her liaison with Mark Antony, the Roman triumvir of the East, Caesarion appeared at Alexandria in 34 with the title "King of Kings," while his mother called herself "Queen of Kings." Following Antony's disastrous defeat at Actium in 31 during the war against his fellow triumvir Octavian, Cleopatra sent Caesarion to Berenice, a seaport on the Red Sea coast of Upper Egypt; but Octavian lured him back to Alexandria, where the young king was executed.

Ptolemy, Latin in full CLAUDIUS PTOLEMAEUS (fl. AD 127–145, Alexandria), ancient astronomer, geographer, and mathematician who considered the Earth the centre of the universe (the "Ptolemaic system"). Virtually nothing is known about his life.

Astronomical work. Ptolemy's astronomical work was enshrined in his great book *Hē mathēmatikē syntaxis* ("The Mathematical Collection"), which eventually became known as *Ho megas astronomos* ("The Great Astronomer"). During the 9th century, however, Arab astronomers used the Greek superlative *Megistē* to refer to the book. When the definite article *al* was prefixed to the term, its title then became known as the *Almagest,* the name still used today.

The *Almagest* is divided into 13 books, each of which deals with certain astronomical concepts pertaining to stars and to objects in the solar system (the Earth and all other celestial bodies that revolve around the Sun). It was, no doubt, the encyclopaedic nature of the work that made the *Almagest* so useful to later astronomers and that gave the views contained in it so profound an influence. In essence, it is a synthesis of the results obtained by Greek astronomy; it is also the major source of knowledge about the work of Hipparchus, most probably the greatest astronomer of antiquity. Although it is often difficult to determine which findings in the book are those of Ptolemy and which are those of Hipparchus, Ptolemy did extend some of the work of Hipparchus through his own observations, apparently using somewhat similar instruments. For example, whereas Hipparchus had compiled a star catalog (the first of its kind) containing 850 stars, Ptolemy expanded the number in his own catalog to 1,022 stars.

On the motions of the Sun, Moon, and planets, Ptolemy again extended the observations and conclusions of Hipparchus—this time to formulate his geocentric theory, which is popularly known as the Ptolemaic system. In the first book of the *Almagest,* Ptolemy describes his geocentric system and gives various arguments to prove that, in its position at the centre of the universe, the Earth must be immovable. Not least, he showed that if the Earth moved, as some earlier philosophers had suggested, then certain phenomena should in consequence be observed. In particular, Ptolemy argued that since all bodies fall to the centre of the universe, the Earth must be fixed there at the centre, otherwise falling objects would not be seen to drop toward the centre of the Earth. Again, if the Earth rotated once every 24 hours, a body thrown vertically upward should not fall back to the same place, as it was seen to do. Ptolemy was able to demonstrate, however, that no contrary observations had ever been obtained. As a result of such arguments, the geocentric system became dogmatically asserted in Western Christendom until the 15th century, by which time detailed observations had made the system so complex that its validity had to be seriously questioned. In 1543 the geocentric system was supplanted by the heliocentric (Sun-centred) system of Nicolaus Copernicus (*q.v.*), a Polish astronomer.

Ptolemy accepted the following order for celestial objects in the solar system: Earth (centre), Moon, Mercury, Venus, Sun, Mars, Jupiter, and Saturn. He realized, as had Hipparchus, that the inequalities in the motions of these heavenly bodies necessitated either a system of deferents and epicycles or one of movable eccentrics (both systems devised by Apollonius of Perga, the Greek geometer of the 3rd century BC) in order to account for their movements in terms of uniform circular motion.

In the Ptolemaic system, deferents were large circles centred on the Earth, and epicycles were small circles whose centres moved around the circumferences of the deferents. The Sun, Moon, and planets moved around the circumference of their own epicycles. In the movable eccentric, there was one circle; this was centred on a point displaced from the Earth, with the planet moving around the circumference. These were mathematically equivalent schemes. Even with these, all observed planetary phenomena still could not be fully taken into account. Ptolemy therefore exhibited brilliant ingenuity by introducing still another concept. He supposed that the Earth was located a short distance from the centre of the deferent for each planet and that the centre of the planet's deferent and the epicycle described uniform circular motion around what he called the equant, which was an imaginary point that he placed on the diameter of the deferent but at a position opposite to that of the Earth from the centre of the deferent—*i.e.,* the centre of the deferent was between the Earth and the equant. He further supposed that the distance from the Earth to the centre of the deferent was equal to the distance from the centre of the deferent to the equant. With this hypothesis, Ptolemy could better account for many observed planetary phenomena.

In the Ptolemaic system, the plane of the ecliptic is that of the Sun's apparent annual path among the stars. The planes of the deferents of the planets were believed to be inclined at small angles to the plane of the ecliptic, while the planes of their epicycles were inclined by equal amounts to those of the deferents, so that the planes of the epicycles would always parallel that of the ecliptic. The planes of the deferents of Mercury and Venus were assumed to oscillate above and below the plane of the ecliptic, and likewise the planes of their epicycles were thought to oscillate with respect to the planes of the deferents.

Although Ptolemy realized that the planets were much closer to the Earth than the "fixed" stars, he seems to have believed in the physical existence of crystalline spheres, to which the heavenly bodies were said to be attached. Outside the sphere of the fixed stars, Ptolemy proposed other spheres, ending with the *primum mobile* ("prime mover"), which provided the motive power for the remaining spheres that constituted his conception of the universe.

Work in mathematics and geography. As a geometrician of the first order, Ptolemy performed important work in mathematics. He devised new geometrical proofs and theorems; and, in a book entitled *Analemma* (Greek *Peri analēmmatos;* Latin *De analemmate*), he discussed the details of the projection of points on the celestial sphere (an imaginary sphere extending outward from the Earth for an infinite distance and on whose surface the objects in space appear to be located) onto three planes at right angles (90°) to each other—the horizon, the meridian, and the prime vertical. In another book, the *Planisphaerium,* Ptolemy is concerned with stereographic projection—the delineation of the forms of solid bodies on a plane—and here he used the south celestial pole as his centre of projection.

Ptolemy also prepared a calendar that gave, in addition to weather indications, the risings and settings of the stars in the morning and evening twilight. Other mathematical publications include a work, in two books, entitled *Hypotheseis tōn planōmenōn* ("Planetary Hypothesis") and two separate geometrical works, one of which is concerned with proving that there cannot be more than three dimensions of space; the other contains an attempted proof for a postulate on parallel lines that had been devised by Euclid. According to one authority, Ptolemy wrote three books on mechanics; another authority, however, credits him with only one mechanical work, *Peri ropōn* ("On Balancing").

Ptolemy's work on optical phenomena appeared in *Optica,* the original edition of which consisted of five books. In the last book, he deals with a theory of refraction (the change in direction of light and other energy waves when they pass obliquely from a medium of one density into a medium of different density), and he discusses the refraction suffered by light from celestial bodies at various altitudes. This is the first recorded attempt at a solution of this observational problem. Ptolemy also wrote a three-book treatise on music known as the *Harmonica.*

As a geographer, Ptolemy's reputation rests mainly on his *Geōgraphikē hyphēgēsis* (*Guide to Geography*), which was divided into eight books; it included information on how to construct maps and lists of places in Europe, Africa, and Asia tabulated according to latitude and longitude. There were, however, many errors in the *Guide—e.g.,* the Equator was placed too far north, and the value used for the circumference of the Earth was nearly 30 percent less than a more accurate value that had already been determined—as well as some contradictions between the text and maps. Moreover, as a whole, the *Guide* cannot be considered "good geography"; it does not mention anything about the climate, natural products, inhabitants, or peculiar features of the countries with which it deals, and Ptolemy's treatment of the geographical importance of such factors as rivers and mountain ranges is careless and of little use.

In spite of its faults, the *Guide* is an important work from a historical point of view because, like the *Almagest,* it exerted a great influence on later generations. Christopher Columbus, for example, used it to strengthen his belief that Asia could be reached by travelling westward because Ptolemy had indicated that Asia extended much farther east than it actually does. Even as late as 1775, it was believed that the Indian Ocean was bounded by a southern continent, as Ptolemy had suggested; the return voyage from the Southern Hemisphere of Capt. James Cook in July of that year proved otherwise. (C.A.R.)

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Ptolemy APION (fl. *c.* 116–96 BC), ruler of Cyrenaica who separated it from Egypt and in his will bequeathed the country to Rome.

Son of Ptolemy VIII Euergetes II, king of Egypt, by a concubine, Ptolemy Apion, according to classical sources, received Cyrenaica as his portion of his father's will. Contemporary documents, however, suggest that as late as 109–108 BC Cyrenaica was at least nominally under the suzerainty of the main Ptolemaic house.

The King's motives for the donation of his realm to Rome at his death remain obscure. His two half brothers were still ruling at the time in Egypt and Cyprus, but there is no evidence of hostility between them and Apion. He may have been without an heir. Rome, after it accepted the bequest, did not administer the region for another 22 years.

Ptolemy OF MAURETANIA (b. before 19 BC, Numidia—d. AD 40), North African client ruler for Rome (AD 23–40) who assisted Roman forces in suppressing a Berber revolt in Numidia and Mauretania, but was assassinated in AD 40 after arousing the jealousy of the Roman emperor Caligula. He was the last known living descendant of the famous Cleopatra VII of Egypt and of the Ptolemaic royal family.

Ptolemy was the son of Juba II, the scholarly king of Numidia (a country approximately corresponding to modern Algeria), and Cleopatra Selene, the daughter of Mark Antony, the Roman triumvir of the East, and Queen Cleopatra VII of Egypt. After receiving a thorough Hellenistic education, Ptolemy succeeded to the throne of Mauretania, a client kingdom of Rome to which the Romans had transferred his father from his native Numidia.

When a guerrilla war that had erupted in AD 17 in Numidia spread into Mauretania, Ptolemy was in 24 mobilized with his auxiliary forces by the Roman governor of Africa, who utilized the rebels' own tactics to end the uprising. In recognition for his services, Ptolemy was confirmed as king and an ally and friend of the empire; but he was assassinated by order of Caligula. Following his death a fresh revolt erupted in Mauretania, after which the country was organized into two provinces.

ptosis, drooping of the upper eyelid. The condition may be congenital or acquired. In congenital ptosis, which is frequently hereditary, the muscle that elevates the lid (the levator palpebrae superioris) is either absent or imperfectly developed. The condition is often associated with other abnormalities of the eye muscles and with congenital cataracts (opacity of the lens).

Acquired ptosis is usually due to injury or disease of the nerves that control the movements of the levator muscle. In a disorder called Horner's syndrome, ptosis occurs in association with excessive contraction of the pupil and abnormally sunken eyes.

p'u (Chinese: "simple," "in primordial condition"), in Chinese Taoism, metaphorical expression often translated as "uncarved block" and signifying the primordial condition of the mind before it has been affected by experiences. In the state of *p'u* there are no distinctions between right and wrong, black and white, beautiful and ugly. Taoists desire to return to this state of childhood by abandoning conventional knowledge and by suppressing desires that bind them to the world. Because truth becomes relative, ideas have no value and all contradictions are resolved. The goal is thus to restore the human mind to the state of an "uncarved block." Individuals who achieve this state of mental unity thereby align their existence with the unity of the Absolute Tao, the mysterious, undefinable, transcendent reality that, according to Taoists, produces all things.

P'u-chou, Pinyin PUZHOU, town in east central Shansi Province (*sheng*), China. It stands on the east bank of the Huang Ho (Yellow River), on the north side of the western spur of the Chung-t'iao Shan (mountains). A short distance to the south is Feng-ling-tu, from which there is a ferry to T'ung-kuan.

In ancient times P'u-chou was a place of great strategic importance, controlling the westward route from which any invasion of the Wei Ho Valley had to pass from Shansi. In early times it was called P'u-pan. Under the Han dynasty (206 BC–AD 220) it became the chief city of the commandery (district under the control of a commander) of Ho-tung. Under the Northern Chou in the 6th century it received its present name and became a place of importance. In 538 a great pontoon bridge was built across the Huang Ho at this point; it was replaced by a more permanent bridge in 724. Across this bridge and through the customs station at its eastern end passed all the land traffic from Shansi to the capital at Ch'ang-an, now Hsi-an, in Shensi Province. Then the county town was called Ho-tung, and the prefecture of which it was the seat was known as either P'u-chou or (later) Ho-chung Superior Prefecture (*fu*). These names were kept through the Sung period (960–1126) and the following Chin (Juchen) period.

Pu-chou's importance declined, however, with that of Shensi, as Ch'ang-an ceased to be a capital city and as the centre of political power shifted first to K'ai-feng, in Honan Province, and then to Peking. Under the Ming dynasty (1368–1644) the town was renamed San-chou and was made subordinate to the superior prefecture of P'ing-yang. The Ch'ing dynasty (1644–1911), having seen rebel armies threaten Peking from Shensi and Szechwan provinces by this route in the last days of Ming rule, reestablished it as P'u-chou, building 2 mi (3 km) of defensive walls and making it the seat of Yung-chi County.

It again went into decay, however, and in 1912 reverted to county seat status. Later it declined still further—the county seat being transferred to Chao-i-chen, farther to the east—the city itself becoming a subordinate town named P'u-chou-chen. By the 1930s much of the walled area was unoccupied; even the arrival in 1935 of the railway linking it with T'ai-yüan did nothing to revive it. The terminus of the line was at Feng-ling-tu, where a steel railway bridge crossed the Huang Ho to T'ung-kuan, and this replaced the crossing at P'u-chou as the major force from Shansi to the Wei Ho Valley. Despite its decline, however, there are still many historic buildings, temples, and sites associated with P'u-chou. Pop. (mid-1970s est.) fewer than 10,000.

P'u-i, Pinyin PUYI, also called HENRY P'U-I, reign title (Wade-Giles romanization) HSÜAN-T'UNG (b. Feb. 7, 1906, Peking—d. Oct.17, 1967, Peking), last emperor of the Ch'ing (Manchu) dynasty in China and Japan's puppet emperor of Manchoukuo (Manchuria) from 1934 to 1945. P'u-i succeeded to the Manchu throne at the age of three, when his uncle, the Kuang-hsü emperor, died on Nov. 14, 1908. He reigned under a regency for three years, and then on Feb. 12, 1912, in response to the Republican Revolution of the previous year, he was forced to abdicate, ending the 267-year Manchu rule of China and the 2,000-year-old Imperial system. He was permitted to continue living in the palace in Peking. P'u-i chose Henry as a given name and was thereafter known as Henry P'u-i in the West. In 1924 he secretly left Peking to reside in the Japanese concession (colony) at Tientsin. On March 9, 1932, he was installed as president, and from 1934 to 1945 was emperor of the Japanese puppet state of Manchoukuo under the reign title of K'ang-te. At the end of World War II he was taken prisoner by the Russians (August 1945) and returned to China for trial as a war criminal in 1950. He was pardoned in 1959 and went again to live in Peking, where he worked in the mechanical repair shop of a botanical garden. His autobiography, *From Emperor to Citizen,* was published in English in 1964–65.

P'u Sung-ling, Pinyin PU SONGLING, courtesy title (Wade–Giles romanization) LIU-HSIEN, or CHIEN-CH'EN (b. June 5, 1640, Tzu-ch'uan, Shantung Province, China—d. Feb.

25, 1715, Tzu-ch'uan), Chinese fiction writer whose *Liao-chai chih-i* (1766; "Strange Stories from Liao-chai's Studio"; Eng. trans., *Strange Stories from a Chinese Studio*) resuscitated the classical genre of short stories. Completed in 1679, this impressive collection of 431 tales of the unusual and supernatural departed from the prevailing literary fashion that was dominated by more realistic *hua-pen* stories written in the colloquial language. P'u instead wrote his stories in the classical idiom, freely adopting forms and themes from the old *ch'uan ch'i*, or "marvel tales," of the T'ang and Sung dynasties. Although P'u lived and died as an obscure provincial schoolteacher, his work gained fame when first printed, inspiring many imitations and creating a new vogue for classical stories. P'u did, however, write in the vernacular. He is credited with having adapted several of his tales into "drum songs," a popular dramatic form of the time; and the colloquial novel *Hsing-shih yin-yüan chuan* ("A Marriage to Awaken the World"), which realistically portrays an unhappy contemporary marriage, is attributed to him by some scholars.

puberty, in human physiology, the stage or period of life when a child transforms into an adult normally capable of procreation.

A brief treatment of puberty follows. For full treatment, *see* MACROPAEDIA: Growth and Development, Biological.

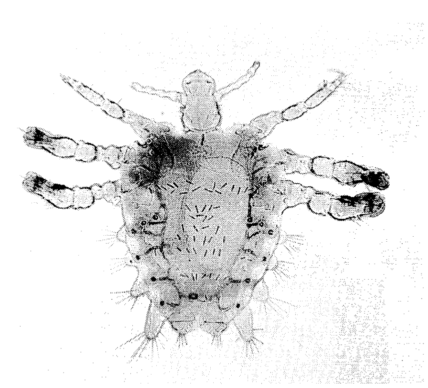
The timing of puberty varies from person to person and from country to country owing to genetic, environmental, and other factors but usually occurs between ages 11 and 16. Among moderately well-off British or North American children, puberty on the average peaks at about age 12 for girls and age 14 for boys. The rapidity with which a child passes through the several stages of puberty also varies. In girls the interval from the first indication of puberty to complete maturity may vary from 18 months to 6 years. In boys a similar variation occurs; the male genitalia may take between 2 and 5 years to attain full development.

In puberty both girls and boys experience a swift increase in body size, a change in shape and composition of the body, and a rapid development of the reproductive organs and other characteristics marking sexual maturity. In a girl the first observable change is usually noted in the breasts; the nipples start to enlarge, and a few months later the breast tissue begins to grow. A few pubic hairs develop, and she enters into a period of relatively rapid growth. The ovaries begin producing estrogen, causing fat deposits to develop on the hips and thighs, and the slim, angular girl moves steadily toward a more rounded female contour. The larynx undergoes minor structural changes so that her voice alters and becomes less childlike (but the changes are not nearly so radical as those in a boy). Meanwhile, her adrenal glands are manufacturing male sex hormones, which play a key role in the development of pubic and underarm hair and contribute to the physical growth. The first menstrual period is generally the final event, usually occurring about two or more years after the entire puberty process is under way. During the following two years, the girl's menses are apt to be irregular; her normal cyclic hormonal pattern has not yet been established, and ovulation is infrequent. Eventually, however, her menstruation and ovulation cycles become more regular.

In boys, the first sign of puberty is usually an accelerated growth of the testes and scrotum, with reddening and wrinkling of the scrotal skin. The first pubic hair may begin at the same time or a little later. About a year later the boy's height is apt to be increasing again at the rapid rate that he last experienced at about age two. At this time the penis also grows, as do the seminal vesicles, the prostate, and the bulbo-urethral glands, all of which contribute their secretions to the seminal fluid. The time of the first ejaculation of seminal fluid varies but usually occurs about a year after the beginning of accelerated penis growth. Unlike the girl's initial irregularity in menses and ovulation, the boy's fertility may be almost constant after initial ejaculation. In a final stage, averaging about two years after the beginning of pubic hair growth, hair begins to appear on the armpits and face, and there may soon appear hair on the chest and other parts of the body (though much of this general hair growth may occur after puberty). The voice changes in pitch because of the enlargement of the larynx and lengthening of the vocal cords, initiated by action of the male hormone testosterone.

Numerous factors may retard maturation or prevent normal growth, including hormonal disorders, metabolic defects, hereditary conditions, and inadequate nutrition.

pubic louse, also called CRAB LOUSE, plural of louse LICE (species *Phthirus pubis*), sucking louse found principally at the pubic and perianal areas, occasionally on the hairs of the thighs and abdomen, and rarely on other hairy regions of the human body. It is broad and small, averaging 1.5 to 2 mm in length. Its first pair of legs is smaller than the other



Pubic louse (*Phthirus pubis*)
William E. Ferguson

two pairs. When seen under magnification, it looks like a crab.

The eggs, attached to a pubic hair, hatch in two or three weeks. This bloodsucking louse causes itching and inflammation of the skin that may result in eczema.

public administration, those activities involved in carrying out the policies and programs of governments. Modern public administration often involves some responsibility in determining governmental policies, but it entails principally the planning, organizing, directing, coordinating, and controlling of government operations.

A brief treatment of public administration follows. For full treatment, *see* MACROPAEDIA: Public Administration.

Public administration is an occupational field common to all systems of government, for all countries require machinery to effect policies. Within nations, public administration is practiced by central and local governments and, in federal systems, by provinces and states as well. Modern public administration is a byproduct of the emergence of nation-states from the feudal societies of Europe. The growth and centralization of power in monarchical courts generated the need for a full-time corps of public administrators who specialized in fields of national activity. Four patterns of administrative thought and practice have developed: continental European, British, American, and Soviet.

The continental system is characterized by a legally oriented bureaucracy that provides permanence and stability despite changes in government. The British system is known for its elitist bureaucrats of general-education background who provide policy advice to ministers. The American system is noted for its egalitarian nature, for the instability of administrative offices because of political patronage, and for the high degree of specialization of its bureaucrats. The traditional Soviet system is characterized by highly concentrated and centralized power, single-party control of administrative agencies, and increasingly technocratic bureaucrats.

Efforts to improve public administration have taken different forms in these systems. One of the central goals in the 20th century has been bureaucratic reform, which has been based on the assumption that administrative processes can and should be improved. In the American system, for example, there has been a substantial increase in the number of bureaucrats hired on a merit basis, while in the British system efforts have been made to recruit from a broader range of candidates. Other goals for the improvement of public administrations have included improving their economy and efficiency; improving the structure of their formal organization; and the development of the budget as a principal tool in planning, allocating resources, linking the executive with the legislature, and developing accountability.

public debt, obligations of governments, particularly those evidenced by securities, to pay certain sums to the holders at some future time. Public debt is distinguished from private debt, which consists of the obligations of individuals, business firms, and nongovernmental organizations.

A brief treatment of public debt follows. For full treatment, *see* MACROPAEDIA: Government Finance.

The debt owed by national governments is usually referred to as the national debt and is thus distinguished from the public debt of state and local government bodies. In the United States, bonds issued by the states and local governments are known as municipals. In the United Kingdom, debt or loans incurred by local authorities are referred to as corporation or county loans, thus distinguishing them from central government debt, which is frequently referred to as simply as funds. In the past, paper money was frequently regarded in the United States as a portion of the public debt but in more recent years money has been regarded as a distinct type of obligation, in part because paper money is usually no longer payable in gold, silver, or other specific items of intrinsic value. Public debt is an obligation of a government, and while individuals are called upon in their capacity as taxpayers to provide funds for payment of interest and principal on the debt, their own property cannot be attached to meet the obligations if the government fails to do so. Similarly, government property normally cannot be seized to meet these obligations. With sovereign governments the debt holders can take only such legal action to enforce payment as the governments themselves prescribe.

Forms of public debt can be classified in a number of different ways: (1) according to maturity, as short-term (maturing in less than five years, often in a matter of weeks) or long-term (maturing in more than five years, up to an indefinite period), (2) by type of issuer, as direct obligations (issued and backed by the government), contingent obligations (issued typically by a governmental corporation or other quasi-governmental body but guaranteed by the government), or revenue obligation (backed by anticipated revenues from government-owned commercial enterprises such as toll highways, public utilities, or transit systems, and not by taxes), (3) by location of the debt, as internal (held within the government's jurisdiction) or external (held by a foreign jurisdiction), or (4) according to marketability, as negotiable securities (marketable) or nonnegotiable securities (such as the low-denomination U.S. savings bonds).

Much debate has centred on such questions as how large the national debt may safely be allowed to grow, how and when public debt should be retired, what effects public borrowing has on the economy, and even whether governments should borrow at all or should finance all expenditures out of current revenues. In general it has been felt that debt financing is appropriate when the tax burden of current financing for certain circumstances would be practically or politically infeasible; examples are, for national governments, war, and for local governments, large capital projects such as highways, schools, and so on. The level of public debt varies from country to country, from less than 10 percent of the gross national product (GNP) to more than double the GNP. Public borrowing is generally believed to have an inflationary effect on the economy and for that reason is often resorted to in recessionary periods to stimulate consumption, investment, and employment. However, concern over the adverse effects of increasing national debt caused the United States to adopt in 1985 the Balanced Budget and Emergency Deficit Control Act, commonly called the Gramm-Rudman-Hollings Act. Such legislation that is aimed at controlling the rate of growth of public debt may have a braking effect on economic growth.

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

public defender, attorney permanently employed by a government to represent indigent persons accused of crimes. Public defenders, used primarily in the United States, are to be distinguished from assigned counsel (*q.v.*), who are private lawyers appointed by the courts to handle particular cases. *See also* legal aid.

public enterprise, a business organization wholly or partly owned by the state and controlled through a public authority. Some public enterprises are placed under public ownership because, for social reasons, it is thought the service or product should be provided by a state monopoly. Utilities (gas, electricity, etc.), broadcasting, telecommunications, and certain forms of transport are examples of this kind of public enterprise.

Although the provision of these services by public enterprises is a common practice in Europe and elsewhere, in the United States private companies are generally allowed to provide such services subject to strict legal regulations. In some countries industries such as railways, coal mining, steel, banking, and insurance have been nationalized for ideological reasons, while another group, such as armaments and aircraft manufacture, have been brought into the public sector for strategic reasons. In communist countries most forms of production, commerce, and finance belong to the state; in many newly independent and less-developed countries there is a very large public-enterprise sector.

In Europe the prevailing pattern is a mixed economy with the public enterprises operating side by side with private corporations. In Great Britain during the early years of the 20th century, the post office, utilities, armaments, and the Port of London belonged to the public sector; to them were later added public transport, civil airways, and London passenger transport, thus markedly widening the role of the state sector. Under the 1946–50 Labour government a massive nationalization program was effected embracing coal mining, the iron and steel industry, the gas industry, railways, and long-distance road transport. Steel was denationalized in 1953 but renationalized in 1967. During the Conservative regime of Prime Minister Margaret Thatcher, many more public enterprises were privatized. The postwar French government undertook a similar extensive nationalization program that included banks, insurance companies, finance houses, and manufacturing concerns. Many were subsequently privatized.

The United States has few public enterprises. They include, ironically, one of the world's models for such undertakings, the Tennessee Valley Authority, established in 1933. In 1970 the U.S. postal system, until then a department of the executive branch of the federal government, became a government-owned corporation.

Public enterprises are by definition intended to be operated in the public interest. This gives rise to a number of organizational and commercial issues. One problem is how to reconcile the need for close political control with the need for sufficient management autonomy. The public corporation form, used extensively in Great Britain and widely copied in other parts of the world, is created by a special act of Parliament that defines its powers, management structure, and relationship with government bodies. As a corporation it has legal entity. Its capital requirements are met by the treasury, but it is supposed to meet its current expenses from its normal commercial operations. Its employees are not civil servants, and the top management is often appointed by the minister in charge. Another administrative form that is popular in parts of the world is the state company, which is simply an ordinary joint-stock company whose shares are owned wholly or partly by the state.

Public enterprises are usually intended to pay their way in the longer term, and yet they may be subject to political constraints in their pricing policy that could be in conflict with that objective. Conversely, for social reasons they may receive hidden subsidies or enjoy additional protection not available to competitors. Such factors tend to distort the normal commercial operations of the corporation or the company and often lead to managerial disorientation. Partly because of these noncommercial considerations, public enterprises may appear to be highly inefficient and, in times of difficult trading conditions, may be a drain on public resources. However, the measurement of the efficiency of a public enterprise is no easy matter. When it produces a marketable product, such as coal or steel, that competes with other products, the normal commercial criterion of profit may be adopted to assess its performance. In the case of a utility enjoying monopoly power, economists have developed concepts like cost-benefit analysis as a performance measurement tool. In recent years many state enterprises in the developed world have been given financial targets that take into account both social and commercial responsibilities.

public health, science and art of preventing disease, prolonging life, and promoting health and human efficiency through organized community efforts. These efforts are directed toward sanitation of the environment, control of communicable infections, education of individuals in personal hygiene, organization of medical and nursing services for the early diagnosis and preventive treatment of disease, and the development of social machinery to ensure for every individual a standard of living adequate for the maintenance of health.

A brief treatment of public health follows. For full treatment, *see* MACROPAEDIA: Medicine.

Public health in modern times was greatly influenced by general scientific progress. Rapid advances in medical science in the 19th century revolutionized ideas about the basis of health. Physiological chemistry gave rise to the science of nutrition; clinical medicine established the specificity of disease. Most important, the centuries-old erroneous theories of how epidemics spread were finally routed. Oliver Wendell Holmes (1809–94) in the United States and I.P. Semmelweis (1818–65) in Vienna added puerperal (childbed) fever to the lengthening list of diseases known to be conveyed by human contact. F.G.J. Henle put forward the hypothesis that the infectious process was biological (1840); Sir John Burdon-Sanderson established it in 1866. John Snow published his pamphlet *On the Mode of Communication of Cholera* (1849) and in 1854 gave convincing evidence of its waterborne spread; William Budd did the same for typhoid (1873). The end of the century was notable for Louis Pasteur's identification of pathogenic bacteria and the final disproof of the theory of spontaneous generation. Robert Koch isolated the tubercle bacillus in 1882, and, in rapid succession, the same was done for many common infectious maladies. An important result of the germ theory of disease was the transformation of hospitals. They took on new meaning when the antisepsis principles of Joseph Lister were applied, and by the end of the century they began to take the chief position in community health services. During the 20th century science continued, by the discovery of vitamins, antibiotics, and much else, to give public health new tools. The study of society, particularly by means of the social survey, extended the basic concepts of public health, and the medical officer of health became something of a social scientist as well.

Public health collaboration among countries originated in the fear of epidemic spread and the inconvenience to trade arising out of the practice of quarantine. From 1851 a series of International Sanitary Congresses was held in the capitals of Europe and the United States, leading eventually to the formation of the Pan American Sanitary Bureau (1902), with headquarters in Washington, D.C., and L'Office Internationale d'Hygiène Publique (1909), with headquarters in Paris. After World War I the health section of the League of Nations was created (1923) with headquarters at Geneva. It was followed after World War II by the World Health Organization (1948), a specialized agency of the United Nations. WHO, also with headquarters in Geneva, absorbed both the League health office and the Paris office and thus became the sole international health organization, excepting the Pan American Sanitary Bureau, which continued to operate independently but acted also as the WHO regional office for the Americas. Cooperation among the nations has continued in the control of the spread of disease and has widened into the field of aid in strengthening medical services and medical education in the developing countries.

public house, byname PUB, in Britain and regions of British influence, an establishment providing alcoholic liquors to be consumed on the premises. English common law early imposed social responsibilities for the well-being of travelers upon the inns and taverns, declaring them to be public houses which must receive all travelers in reasonable condition who were willing to pay the price for food, drink, and lodging.

In Tudor England (1485–1603), selected innkeepers were required by a royal act to maintain stables; in addition, some innkeepers acted as unofficial postmasters and kept stables for the royal post. In the mid-1600s, some public houses even issued unofficial coins which the innkeepers guaranteed to redeem in the realm's currency.

By the 1800s, many of these establishments were divided internally to segregate the various classes of customers. Public houses—inns or taverns—were considered socially superior to alehouses, beerhouses, and ginshops.

The early inns or taverns were identified by simple signs, such as lions, dolphins, or black swans. Many colourful pub names (*e.g.,* Bag o'Nails, Gost and Compass, and Elephant and Castle) are actually corrupted forms of historical, ecclesiastical, or other proper phrases and titles (*e.g.,* "Bacchanals," "Great God Encompassing," and "Infanta de Castile," respectively). In the 18th century, the word Arms was appended to many pub names, indicating that the establishment was under the protection of a particular noble family, although some heraldic signs were references to the original ownership of the land on which the inn or tavern stood. Some 200 of the old coaching and posting inns, including a few which date back more than 400 years, are still operating in England and Wales under the management of Trust House companies, groups begun in the early 20th century in order to prevent the old inns from becoming merely local taverns.

Although public houses were traditionally owned and operated by licensed victuallers or publicans, by the early part of the 20th century many of them were owned or otherwise connected to a comparatively small number of brewery companies.

public international law: *see* international law.

public opinion, an aggregate of the individual views, attitudes, and beliefs about a particular topic as expressed by a significant proportion of a community.

A brief treatment of public opinion follows. For full treatment, *see* MACROPAEDIA: Public Opinion.

There is little agreement among political scientists, sociologists, and social psychologists regarding the nature of public opinion. The term has been loosely used to denote the firmly settled convictions of a group; to denote the process of developing opinions, as distinguished from the product; or to denote statements that are the result of a process of logical reasoning as contrasted with those arrived at by illogical means.

Nineteenth-century commentators stressed the rationality of the opinion process; those of the 20th century do not. In 1828 W.A. Mackinnon declared, "Public opinion may be said to be that sentiment on any given subject which is entertained by the best informed, most intelligent, and most moral persons in the community, which is gradually spread and adopted by nearly all persons of any education or proper feeling in a civilized state." Later, A.L. Lowell wrote, "An opinion may be defined as the acceptance of one among two or more inconsistent views which are capable of being accepted by the rational mind as true."

After 1900 the developing science of social psychology increasingly emphasized nonrational factors involved in the opinion process; and the manipulative techniques of the practitioners of publicity, advertising, and propaganda further eroded faith in rationality. Political democracy, however, holds to the principle that the opinions of some persons are based on reason and that it is possible to bring popular judgments to positions that are rationally defensible.

According to one definition, relatively stable beliefs should not be considered a part of the opinion process. A state of agreement following an opinion controversy is referred to as a consensus. There is consensus of the type that Montesquieu designated the *esprit général,* that Jean-Jacques Rousseau spoke of as the *volonté générale,* and that the English theorists called "public will." Wilhelm Bauer wrote of organic opinion as the relatively fixed views as distinguished from transient opinions. But one may consider that public opinion deals with those topics which are controversial and discussable and not with those on which opinions are firmly fixed.

public relations, byname PR, aspect of communications involving the relations between an entity subject to or seeking public attention and the various publics that are or may be interested in it. The entity seeking attention may be a business corporation, an individual politician, a performer or author, a government or government agency, a charitable organization, a religious body, or almost any other person or organization. The publics may include segments as narrow as female voters of a particular political party who are between 35 and 50 years of age or the shareholders in a particular corporation; or the publics may be as broad as any national population or the world at large. The concerns of public relations operate both ways between the subject entity, which may be thought of as the client, and the publics involved. Acquainting the client with public perceptions of that client is an important element of public relations; so is affecting these perceptions by focusing, curtailing, amplifying, or augmenting information about the client as it is conveyed to the publics.

The empire builders of the 19th century often disdained a curious public and an inquisitive press, but this attitude soon came under fire from muckraking journalists. In 1906 Ivy Lee, a former newspaperman, became publicity adviser to a group of American anthracite coal-mine operators who had aroused the anger of the press by their haughty attitudes toward miners and the press in labour disputes. Lee persuaded the mine owners to abandon their refusal to answer questions, and he shortly sent out an announcement that the operators would supply the press with all possible information. Later that year he was retained by the Pennsylvania Railroad and brought into effect a new practice: giving the press full information about railroad accidents. In this he was forging a major ingredient of what had not yet come to be called public relations.

Government agencies began hiring publicists in Great Britain and the United States; U.S. legislation (1913) required congressional authorization to spend government funds on "publicity experts," whereupon the experts masqueraded under such euphemisms as "director of information." The natural affinity of government for public relations, little explored since Machiavelli, was flowering. From 1924 to 1933 in England, the Empire Marketing Board used large-scale publicity to promote trade; it has been called "the archetype of government public relations departments." In Great Britain, as in the United States, the appointment of public relations directors by various government departments during World War II was a prelude to greatly increased postwar emphasis on public relations. Within a decade hardly an agency of any government was without its public relations staff. Perhaps more importantly, public relations had come to be recognized as indispensable to any organization subject to attention in the press and the rapidly developing broadcast media.

There was, however, no uniformly accepted simple definition of the craft, trade, dodge, or art of public relations, and there is none today. This is true in large part because of the great variety of its elements. These include generating favourable publicity and knowing what kind of story is likely to be printed or broadcast. This rudimentary aspect of public relations is complicated by the variety of media; besides newspapers, magazines, and radio and television, there are publications of professional associations, recreational groups, and trade associations; producers of stage, motion-picture, and television entertainment; direct mail lists, and others.

Public relations embraces a serious element of the ethical counseling and sociological education of the client. One of the great American practitioners, Earl Newsom, would force his carefully selected clients' attention to the 19th-century classic *The Crowd* (1896; *La Psychologie des foules,* 1895), by the French sociologist Gustave LeBon, to persuade them that kings (and business potentates) were no longer the rulers but that the crowd—the public—was now sovereign and must be pleased. Public relations counselors to airplane manufacturers and airlines persuaded their clients, as Ivy Lee had done the railroads, to be candid and forthright with the facts and to supply the background necessary for context and understanding when airplane crashes occurred. This element of public relations is complicated and sometimes obscured by the flamboyance of self-promoters in the field and by the excesses of occasional charlatans. It is also complicated by divergent views, for a minority of practitioners believes that silence and secrecy—"stonewalling," if need be—are the proper response to a deluge of adverse publicity.

The role of public relations was once defined by Edward L. Bernays, one of its pioneers, as "the engineering of consent." The characterization is accurate, but out of context it oversimplifies and has been used to attack public relations as cynical and manipulative. The real tasks of public relations in the business world may focus on corporate interests or those of marketing products or services; on image creation or defense against attack; on broad public relations or straight publicity. In general, the strategic goal of public relations is to project a favourable public image, one of corporate good citizenship; but this cannot be accomplished with lights and mirrors in an age of investigative journalism, and the first responsibility of public relations is to persuade management that the reality must correspond with the desired image. Public relations is concerned with creating a favourable climate for marketing the client's products or services, including maintaining good relations with merchants and distributors as well as placing product publicity and disseminating information to trade and industrial groups. This calls for the preparation of technical articles addressed to technicians and engineers and of others translating technical information for lay readers. It further includes publicizing praiseworthy activities by company personnel. Financial public relations involves relations with a company's own stockholders (stockholder relations) as well as with the investment community.

To a large extent, the job of public relations is to optimize good news and to forestall bad news, but when disaster strikes, the public relations practitioner's task, in consultation with legal counsel, is to assess the situation and the damage, to assemble the facts, together with necessary background information, and to offer these to the news media, along with answers to their questions of fact. When a client is under attack, it is a public relations responsibility to organize the client's response—usually involving several complicated issues—to be both lucid and persuasive.

Government relations is often included in public relations under the general designation of public affairs and encompasses lobbying. Industrial relations (*i.e.,* labour-management relations), employee relations, and customer relations sometimes are accounted part of public relations. Community relations is important wherever a client has an office or plant.

Modern corporate executives often do not excel at public speaking or writing in nonbusiness language, and a duty of public relations is to translate executives' knowledge into speeches or articles intelligible to nonspecialists. In fact, the prime responsibility of public relations can be seen as interpreting the client to the public and vice versa.

From the 1940s responsible public relations practitioners have endeavoured to codify and uphold ethical standards. Many have attempted to bring the status of a profession to their calling, through associations such as the Public Relations Society of America, the Public Relations Consultants Association (London), the Fédération Europêene des Relations Publiques (Brussels), and the International Public Relations Association (London). Many colleges and universities offer not only courses but also academic majors in public relations. Boston University was the first to establish a School of Public Relations (later, Communications) in 1947.

Public Safety, Committee of, French COMITÉ DE SALUT PUBLIC, political body of the French Revolution that gained virtual dictatorial control over France during the Reign of Terror (September 1793 to July 1794).

The Committee of Public Safety was set up on April 6, 1793, during one of the crises of the Revolution, when France was beset by foreign and civil war. The new committee was to provide for the defense of the nation against its enemies, foreign and domestic, and to oversee the already existing organs of executive government. The members of the committee, at first numbering 9 and later increased to 12, were elected by the National Convention (representative assembly) for a period of one month and were eligible for reelection.

From April to July 10, 1793, the Committee of Public Safety was dominated by Georges Danton and his followers, who pursued a policy of moderation and reconciliation but who failed to deal adequately with the precarious military situation. These men were replaced in July by men more determined and more radical in the defense of the Revolution, among them Maximilien Robespierre.

From September 1793 to July 1794, the Committee of Public Safety was composed of the same men (with the exception of Marie-Jean Hérault de Séchelles, who was guillotined in April), and it controlled France, dominating the National Convention and relying on the support of the Jacobins (radical democrats). Under its direction, harsh measures were taken against the alleged enemies of the Revolution, the economy was placed on a wartime basis, and mass conscription was undertaken. While decisions were taken in common, the members of the committee specialized in different areas: Robespierre, Georges Couthon, and Louis de Saint-Just (called the Triumvirate) in general political matters, Lazare Carnot in military affairs, and Robert Lindet in supplies.

Dissension within the committee contributed to the downfall of Robespierre in July 1794, after which the Committee of Public Safety waned in importance; its powers were strictly limited to the areas of diplomacy and war.

public school, in the United Kingdom, one of a relatively small group of institutions educating secondary-level students for a fee and independent of the state system as regards both endowment and administration. The term public school emerged in the 18th century when the reputation of certain grammar schools spread beyond their immediate environs. They began taking students whose parents could afford residential fees and thus became known as public, in contrast to local, schools. By the late 20th century the term independent school was increasingly preferred by the institutions themselves.

The typical great public school—such as Eton, Harrow, Winchester, Westminster, Rugby, Shrewsbury, or Charterhouse—evolved from an institution founded by a single benefactor during the late European Middle Ages or Renaissance. Such charitable foundations, almost invariably for males only, had usually been intended to educate local boys from relatively humble backgrounds. From about the 17th century the upper classes took increasing advantage of the tuition afforded by these foundations. As pupils paying the market rate became more numerous, the schools were increasingly transformed into boarding establishments. (Some, however, such as St. Paul's or Merchant Taylors' in London, remained day schools; others took both day boys and boarders.) The public schools were seen as preparing students for the ancient universities of Oxford and Cambridge (though not all students proceeded then or proceed now to a university) and for public service—another origin of the appellation "public" school.

The curriculum from the beginning placed heavy emphasis on the Greek and Roman classics and continued to do so until well into the 20th century. Organized games, in contrast, were a late development, and before their introduction disorderly conduct was intermittently considerable, particularly in the early 19th century. When the demand for men to administer the British Empire led to scores of new foundations during the 19th century, however, the schools tended to adopt the more disciplined, duty-bound, and athletic model established at Rugby by Dr. Thomas Arnold in the 1830s.

From late in the 19th century a number of girls' public schools were established, as were also denominational or other special-purpose schools, though such Roman Catholic foundations as Ampleforth and Downside had existed for some time already. Institutions loosely termed public schools also sprang up overseas, predominantly in countries under British cultural influence.

The impact of the public schools in Britain was historically immense. Perhaps in no other post-Renaissance country did an ethos directly and concentratedly inculcated in so few citizens exercise such influence nationally—and internationally, given the crucial role of the public school ethos in helping Britain build its empire. The ethos in question was less an academic one than a class-conscious code of behaviour, speech, and appearance. It set the standard for conduct in the life of officialdom in Britain from the early 19th century to the mid-20th.

Since the end of World War II, the style and content of education at the public schools have changed as the schools have become more consciously part of wider groupings of independent schools and have developed multifarious links with schools in the state sector.

The following is a list of the nine best-known public schools, in the order of their founding.

Winchester College, in Winchester, Hampshire county, was chartered in 1382 by William of Wykeham, bishop of Winchester, and opened by him in 1394.

Eton College, in Eton, Berkshire county, was founded by Henry VI in 1440.

St. Paul's School, in Hammersmith, west London, was founded and endowed by John Colet in 1509.

Shrewsbury School, in Shrewsbury, Shropshire county, was founded by King Edward VI in 1552.

Westminster School, also called St. Peter's College, in west London, was probably a cathedral school and was reestablished by Queen Elizabeth I in 1560.

Merchant Taylors' School, in London, was founded, endowed, and controlled by the Merchant Taylors' Company of London in 1560; it moved to the Charterhouse buildings in 1875.

Rugby School, in Rugby, Warwickshire, was founded by Lawrence Sheriff, a wealthy London merchant, in 1567. It began rugby football (1823).

Harrow School, at Harrow (or Harrow-on-the-Hill), northwest of London, was founded in 1571.

Charterhouse School, in Godalming, Surrey county, was founded by Thomas Sutton in 1611. In 1872 Charterhouse School was moved from London to Godalming.

public transportation: *see* mass transit.

public utility, enterprise that provides certain classes of services to the public, including common carrier transportation (buses, airlines, railroads, motor freight carriers, pipelines, etc.); telephone and telegraph; power, heat, and light; and community facilities for water, sanitation, and similar services. In most countries such enterprises are state-owned and state-operated, but in the United States they are mainly privately owned and are operated under close governmental regulation.

A brief treatment of public utilities follows. For full treatment, *see* MACROPAEDIA: Public Enterprises.

The classic explanation for the need to regulate public utilities is that they are enterprises in which the technology of production, transmission, and distribution almost inevitably leads to complete or partial monopoly—that they are, in a phrase, natural monopolies. The monopolistic tendency arises from economies of scale in the particular industry, from the large capital costs typical of such enterprises, from the inelasticity of demand among consumers of the service, from considerations of the excess capacity necessary to meet demand peaks, and other considerations. It is often also the case that the existence of competing parallel systems—of local telephones or natural gas, for examples—would be inordinately expensive, wasteful, and inconvenient. Given the tendency to monopoly and the potential therefore of monopolistic pricing practices, public regulation has for more than a century been applied to certain classes of business.

In the United States the earliest objects of public regulation were railroads and grain elevators, whose discriminatory price policies came under attack in several Midwestern states in the 1860s. In the case of *Munn* v. *Illinois* in 1877 the U.S. Supreme Court defined a class of businesses "affected with a public interest" and upheld state laws regulating them. The legal definition of public utility has undergone much refinement since, but the principle of public regulation has repeatedly been upheld. On the federal level regulation is held to be encompassed within the commerce clause of the Constitution, while on the state level it is within the purview of the general police power.

In practice, regulation aims to ensure that the utility serves all who apply for and are willing and able to pay for its services, that it operates in a safe and adequate manner, that it serves all customers on equal terms, and that its rates are just and reasonable. All states have regulatory commissions, and the federal government has several, including the Interstate Commerce Commission, the Civil Aeronautics Board, the Federal Power Commission, the Federal Communications Commission, and the Securities and Exchange Commission.

Public Works Administration (PWA; 1933–39), in U.S. history, New Deal government agency designed to reduce unemployment and increase purchasing power through the construction of highways and public buildings. Authorized by the National Industrial Recovery Act (June 1933), the agency was set up by President Franklin D. Roosevelt under the administration of his secretary of the interior, Harold L. Ickes. During its existence, the PWA spent about $4,000,000,000 in the construction of more than 70 percent of the nations' new educational buildings; 65 percent of its new courthouses, city halls, and sewage disposal plants; 35 percent of its new public health facilities; and 10 percent of all new roads, bridges, and subways. As the nation moved into a war economy, beginning in 1939, the PWA was gradually liquidated.

publican, Latin PUBLICANUS, plural PUBLICANI, ancient Roman public contractor, who erected or maintained public buildings, supplied armies overseas, or collected certain taxes, particularly those supplying fluctuating amounts of revenue to the state (*e.g.,* tithes and customs). The system for letting contracts was well established by the 3rd century BC; at Rome they were normally let for five years at auctions by the censor; in Sicily they were annually let by the governor. In order to have sufficient security, publicans formed partnerships and companies (*societates publicanorum*) under officials known as magister at Rome.

The publicans, primarily members of the equestrian order (equites), gained significant power in the provinces and in Rome when equestrians became jurors in the court of extortion, which investigated the activities of provincial governors (122 BC). Under the early empire (after 27 BC) the publicans' business was curtailed; they were more tightly controlled and the government forced them to accept unprofitable contracts. The system fell into disuse in the late empire.

Publilius Syrus (fl. 1st century BC), Latin mime writer contemporary with Cicero, chiefly remembered for a collection of versified aphorisms that were extracted by scholars from his mimes, probably in the 1st century AD.

Early incorporation of non-Publilian verses and scribal distortions of authentic lines in these have considerably aggravated the labours of the textual critic. Modern editions contain more than 700 verses, alphabetically arranged; most of these are iambic senarii, some trochaic septenarii. Publilius, who went to Rome as a slave from Syria, was soon manumitted. He defeated the veteran mime writer Decimus Laberius, in a contest held in 45 BC, when the latter was "invited" by Julius Caesar to perform in one of his own mimes.

publishing, the selection, preparation, and marketing of printed matter—including books, newspapers, magazines, and pamphlets. It has grown from its small, ancient, and law- or religion-bound origins into a vast industry that disseminates every kind of information imaginable.

A brief treatment of publishing follows. For full treatment, *see* MACROPAEDIA: Publishing.

Although publishing can be said to have begun with the invention of writing in about the 4th millennium BC, publishing in the modern sense, a copying industry supplying a lay readership, was first established in Hellenistic Greece, in Rome, and in China. Papermaking, invented in China in AD 105, did not reach the West until the 11th century, several centuries after Arabs expropriated the technology from the Chinese in 751. The most important technological innovation in Western publishing, following paper itself, was Johannes Gutenberg's invention of printing by movable type about 1440–50.

Printing spread quickly throughout Europe. Competition grew keen, and such further innovations as copyright libraries and printers' codes were instituted in France by 1539. In England printing grew more slowly. The first English printer, William Caxton, set up his press in 1474, and by 1500 there were only five printers in England. Publishing grew steadily, but it was not until the 19th century, with the introduction of inexpensive paper, steam power, and typesetting, that it became a substantial trade in terms of both financial success and effect on society. In the 20th century further advances such as offset printing and computerized typesetting continued to revolutionize the industry and contribute to its growth. The ever increasing levels of literacy and leisure time, as well as the increased complexity of life and concomitant need for information of all kinds, account in large part for the continued expansion of the industry.

Although a free press is often taken for granted today, publishing has always had to battle censorship and continues to do so. Almost simultaneously with the invention of the printing press the Roman Catholic church began to ban books written by the so-called reformers. Individual rulers also engaged in censorship. In England the Stationer's Company operated by royal charter (1557), which protected it against competition, and a similar monopolistic organization was established in France (1618). By the 18th century, however, the general spread of more rational notions led to the waning of censorship in most Western countries. Though problems still remain, a free press is commonly regarded in the West as a social necessity.

In addition to censorship, the publishing industry has had to accommodate a number of internal and external adaptations, including copyright law, royalties for authors, commissions for literary agents, constant changes in public taste requiring new marketing techniques, the paperback revolution, the growth of broadcast media and the computer industry, and editorial independence in the face of pressure from advertisers.

Published material may be divided into two main categories: periodical publications, which appear at more or less regular intervals, and nonperiodical publications, which appear on single occasions. Periodicals further divide into newspapers and magazines. Newspapers generally have large, unfastened pages and contents with a high degree of immediacy; magazines have smaller pages, are usually fastened or bound, and have more specialized, less time-dependent contents.

The first true newspaper publishing began in 1605 in Antwerp and soon spread throughout Europe, across America, and to Japan and the East. Inasmuch as newspapers, being far cheaper than books, could reach a mass circulation, they came to have great power. Some publishers took this power as a serious responsibility and attempted to ensure accurate reporting; others, such as the American publisher William Randolph Hearst, practiced "yellow journalism," which utilized sensationalized stories and scare headlines.

Since 1900 newspaper publishing has expanded dramatically, and every stage of press development and type of journal can be found in one country or another, from state-controlled propaganda organs to a free press, from small sheets to huge newspapers. In more populous countries, newspaper publishing is big business and has undergone labour strife, mergers, consolidation into chains, and the absorption of smaller papers into larger ones.

Western magazine publishing began in Germany in 1663 when a theologian and poet launched "Edifying Monthly Discussions." The early periodicals continued in this learned vein, but by 1672 magazines of a lighter type began to appear in France. In the 18th century magazine publishing thrived. Sir Richard Steele and Joseph Addison's *Spectator* appeared in England and Benjamin Franklin's *General Magazine* appeared in Philadelphia. In the 19th century the magazine industry began to supply reading materials to a wider public in addition to the leisure class. The resultant increase in circulation in magazines with mass audiences made these publications a good advertising medium, and revenue from this source made it possible to sell the magazine, like the newspaper, for less than the cost of its production. Contents of magazines from the 1830s on ranged from women's service topics to critical reviews of contemporary issues, from scholarly interests to popular "how-to" information. At the turn of the 20th century, general magazines in the United States underwent a muckraking period, during which they were responsible for some major social reforms, but the movement petered out by 1912 because of financial pressures.

The principle of informing the public responsibly continued as a press tradition with the 1923 founding of *Time* magazine, which aimed at a brief and systematic presentation of the whole of the world's news. This creation of Henry Luce and Briton Hadden was subsequently imitated in Germany (*Der Spiegel*), France (*L'Express*), and other countries.

Although general magazines take the limelight, the larger number of periodicals are those devoted to specialized professional and nonprofessional interests, including trade and technical journals, association organs, politically oriented magazines, and hobby publications. Generally speaking, whenever an activity or interest becomes sufficiently popular, the need for information is fulfilled by some segment of the publishing industry. Throughout its long history, publishing has disseminated all manner of cultural material from the most lofty to the most trivial. Its effect on civilization is incalculable.

Publius (ancient Roman personal name, or praenomen): *see under* gens or family name or honorific (*e.g.,* under Scipio for Publius Cornelius Scipio Africanus).

Pubna (Bangladesh): *see* Pābna.

Pucallpa, city, capital of Coronel Portillo *provincia,* and Ucayali *departamento,* eastern Peru. It lies on the Ucayali River in the hot, humid Amazonian rain forest. Although the community dates from the early colonial era (1534), it remained isolated until 1945, when the Lima-Pucallpa highway, 526 miles (846 km) long, was completed. The largest community in Ucayali *departamento,* Pucallpa can be reached by air and by 3,000-ton vessels from Iquitos, downstream on the Amazon River. Pucallpa is a frontier community, equipped with electricity but lacking paved streets and sewers in many areas. In addition to being a market for local agricultural produce, it is an industrial centre, with sawmills and plants for extracting rosewood oil. A petroleum refinery is at the terminus of a pipeline 47 miles (76 km) long from the Ganso Azul oil fields in Huánuco *departamento.* Numerous missionary groups have headquarters in and around Pucallpa, as do projects for colonization of the area. Pop. (1990 est.) 153,000.

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

Pucará, pre-Columbian site and culture in the southern highlands of present-day Peru in the northern basin of Lake Titicaca. The site is known for its unusual horseshoe-shaped temple or sanctuary of stone masonry. Pucará-style stone sculptures and Pucará pottery show resemblances to those of Tiahuanaco, in the southern Titicaca basin. Because the earlier levels at Tiahuanaco show Pucará-type pottery, it is apparent that the Pucará culture was a forerunner of the Classic Tiahuanaco styles. The Pucará is generally dated to the earlier part (*c.* 200 BC–AD 200) of the Early Intermediate Period.

Pucci, Emilio, MARCHESE (Marquess) DI BARSENTO (b. Nov. 20, 1914, Naples, Italy), fashion designer who contributed significantly to the popularity of Italian fashion in the mid-20th century.

Pucci, who came from a wealthy, aristocratic Florentine family, was educated for a diplomatic career. He earned his B.A., M.A., and Ph.D. in social science but entered the Italian Air Force in 1941 and remained in the service after the end of World War II. When Pucci was on leave from the air force in 1947, a *Harper's Bazaar* photographer noticed his original ski outfit and asked him to design women's ski clothes. His brilliantly coloured, free-moving sportswear was first presented as a complete collection in 1950 and was enthusiastically received. He became best known for tight, shantung "Pucci" pants, and, among his most widely copied creations, vividly printed silk jersey dresses and blouses. Pucci designed undergarments, knitwear, swimwear, and accessories. He also manufactured ceramics and perfume and branched into male fashion design. The colourful, less formal uniforms he created for Braniff Airways flight attendants were the first of their kind. Pucci received many awards for his designs, including the Neiman Marcus Fashion Award (1954) and the Harper's Bazaar Medallion.

From the early 1960s he was an active member of the Liberal Party. Representing the Florence constituency, Pucci held a seat in the Italian Parliament from 1963 to 1972, and he continued to serve as a Florence city counsellor.

Puccini, Giacomo (Antonio Domenico Michele Secondo Maria) (b. Dec. 22, 1858, Lucca, Tuscany—d. Nov. 29, 1924, Brussels), Italian composer, one of the greatest exponents of operatic realism, who virtually

Puccini
Alinari—Art Resource/EB Inc.

brought the history of Italian opera to an end. His mature operas include *La Bohème* (1896), *Tosca* (1900), *Madama Butterfly* (1904), and *Turandot*, left incomplete.

Early life and marriage. Puccini was the last descendant of a family that for two centuries had provided the musical directors of the cathedral of S. Martino in Lucca. Puccini initially dedicated himself to music, therefore, not as a personal vocation but as a family profession. He was orphaned at the age of five by the death of his father, and the municipality of Lucca supported the family with a small pension and kept the position of cathedral organist open for Giacomo until he became of age. He first studied music with two of his father's former pupils, and he played the organ in small local churches. A performance of Verdi's *Aida,* which he saw in Pisa in 1876, convinced him that his true vocation was opera. In the autumn of 1880 he went to study at the Milan Conservatory, where his principal teachers were Antonio Bazzini, a famous violinist and composer of chamber music, and Amilcare Ponchielli, the composer of the opera *La gioconda.* On July 16, 1883, he received his diploma and presented as his graduation composition *Capriccio sinfonico,* an instrumental work that attracted the attention of influential musical circles in Milan. In the same year, he entered *Le villi* in a competition for one-act operas. The judges did not think *Le villi* worthy of consideration, but a group of friends, led by the composer-librettist Arrigo Boito, subsidized its production, and its premiere took place with immense success at Milan's Teatro dal Verme on May 31, 1884. *Le villi* was remarkable for its dramatic power, its operatic melody, and, revealing the influence of Wagner's works, the important role played by the orchestra. The music publisher Giulio Ricordi immediately acquired the copyright, with the stipulation that the opera be expanded to two acts. He also commissioned Puccini to write a new opera for La Scala and gave him a monthly stipend: thus began Puccini's lifelong association with Giulio Ricordi, who was to become a staunch friend and counsellor.

After the death of his mother, Puccini fled from Lucca with a married woman, Elvira Gemignani. Finding in their passion the courage to defy the truly enormous scandal generated by their illegal union, they lived at first in Monza, near Milan, where a son, Antonio, was born. In 1890 they moved to Milan, and in 1891 to Torre del Lago, a fishing village on Lake Massaciuccoli in Tuscany. This home was to become Puccini's refuge from life, and he remained there until three years before his death, when he moved to Viareggio. But living with Elvira proved difficult. Tempestuous rather than compliant, she was justifiably jealous and was not an ideal companion. The two were finally able to marry in 1904, after the death of Elvira's husband. Puccini's second opera, *Edgar,* based on a verse drama by the French writer Alfred de Musset, had been performed at La Scala in 1889 and it was a failure. Nevertheless, Ricordi continued to have faith in his protégé and sent him to Bayreuth in Germany to hear Wagner's *Die Meistersinger.*

Mature work and fame. Puccini returned from Bayreuth with the plan for *Manon Lescaut* based, like the *Manon* of the French composer Massenet, on the celebrated 18th-century novel by the Abbé Prévost. Beginning with this opera, Puccini carefully selected the subjects for his operas and spent considerable time on the preparation of the librettios. The psychology of the heroine in *Manon Lescaut,* as in succeeding works, dominates the dramatic nature of Puccini's operas. Puccini, in sympathy with his public, was writing to move them so as to assure his success. The score of *Manon Lescaut,* dramatically alive, prefigures the operatic refinements achieved in his mature operas: *La Bohème*, *Tosca*, *Madama Butterfly*, and *La fanciulla del west* (1910; *The Girl of the Golden West*). These four mature works also tell a moving love story, one that centres entirely on the feminine protagonist and ends in a tragic resolution. All four speak the same refined and limpid musical language of the orchestra that creates the subtle play of thematic reminiscences. The music always emerges from the words, indissolubly bound to their meaning and to the images they evoke. In *Bohème, Tosca,* and *Butterfly,* he collaborated enthusiastically with the writers Giuseppe Giacosa and Luigi Illica. The first performance (Feb. 17, 1904) of *Madama Butterfly* was a fiasco, probably because the audience found the work too much like Puccini's preceding operas.

In 1908, having spent the summer in Cairo, the Puccinis returned to Torre del Lago and Giacomo devoted himself to *Fanciulla.* Elvira unexpectedly became jealous of Doria Manfredi, a young servant from the village who had been employed for several years by the Puccinis. She drove Doria from the house threatening to kill her. Subsequently, the servant girl poisoned herself, and her parents had the body examined by a physician, who declared her a virgin. The Manfredis brought charges against Elvira Puccini for persecution and calumny, creating one of the most famous scandals of the time. Elvira was found guilty, but through the negotiations of the lawyers was not sentenced, and Puccini paid damages to the Manfredis, who withdrew their accusations. Eventually the Puccinis adjusted themselves to a coexistence, but the composer from then on demanded absolute freedom of action.

The premiere of *La fanciulla del west* took place at the Metropolitan in New York City on Dec. 10, 1910, with Arturo Toscanini conducting. It was a great triumph, and with it Puccini reached the end of his mature period. He admitted "writing an opera is difficult." For one who had been the typical operatic representative of the turn of the century, he felt the new century advancing ruthlessly with problems no longer his own. He did not understand contemporary events, such as World War I. In 1917 at Monte-Carlo in Monaco, Puccini's opera *La rondine* was first performed and then was quickly forgotten.

Always interested in contemporary operatic compositions, Puccini studied the works of Claude Debussy, Richard Strauss, Arnold Schoenberg, and Igor Stravinsky. From this study emerged the *Il trittico* (*The Triptych;* New York City, 1918), three stylistically individual one-act operas—the melodramatic *Il tabarro* (*The Cloak*), the sentimental *Suor Angelica,* and the comic *Gianni Schicchi.* His last opera, based on the fable of *Turandot* as told in the play *Turandot* by the 18th-century Italian dramatist Carlo Gozzi, is the only Italian opera in the Impressionistic style. Puccini did not complete *Turandot,* unable to write a final grand duet on the triumphant love between Turandot and Calaf. Suffering from cancer of the throat, he was ordered to Brussels for surgery, and a few days afterward he died with the incomplete score of *Turandot* in his hands.

Turandot was performed posthumously at La Scala on April 25, 1926, and Arturo Toscanini, who conducted the performance, concluded the opera at the point Puccini had reached before dying. Two final scenes were completed by Franco Alfano from Puccini's sketches.

Solemn funeral services were held for Puccini at La Scala in Milan, and his body was taken to torre Del Lago, which became the Puccini Pantheon. Shortly afterward, Elvira and Antonio were also buried there. The Puccini house became a museum and an archive.

Accomplishments. The majority of Puccini's operas illustrate a theme defined in *Il tabarro:* "Chi ha vissuto per amore, per amore si morì" ("He who has lived for love, has died for love"). This theme is played out in the fate of his heroines—women who are devoted body and soul to their lovers, are tormented by feelings of guilt, and are punished by the infliction of pain until in the end they are destroyed. In his treatment of this theme, Puccini combines compassion and pity for his heroines with a strong streak of sadism: hence the strong emotional appeal but also the restricted scope of the Puccinian type of opera.

The main feature of Puccini's musicodramatic style is his ability to identify himself with his subject; each opera has its distinctive ambience. With an unfailing instinct for balanced dramatic structure, Puccini knew that an opera is not all action, movement, and conflict; it must also contain moments of repose, contemplation, and lyricism. For such moments he invented an original type of melody, passionate and radiant, yet marked by an underlying morbidity; examples are the "farewell" and "death" arias that also reflect the persistent melancholy from which he suffered in his personal life.

Puccini's approach to dramatic composition is expressed in his own words: "The basis of an opera is its subject and its treatment." The fashioning of a story into a moving drama for the stage claimed his attention in the first place, and he devoted to this part of his work as much labour as to the musical composition itself. The action of his operas is uncomplicated and self-evident, so that the spectator, even if he does not understand the words, readily comprehends what is taking place on the stage.

Puccini's conception of diatonic melody is rooted in the tradition of 19th-century Italian opera, but his harmonic and orchestral style indicate that he was also aware of contemporary developments, notably the work of the Impressionists and of Stravinsky. Though he allowed the orchestra a more active role, he upheld the traditional vocal style of Italian opera, in which the singers carry the burden of the music. In many ways a typical fin de siècle artist, Puccini nevertheless can be ranked as the greatest exponent of operatic realism.

(C.Sa.)

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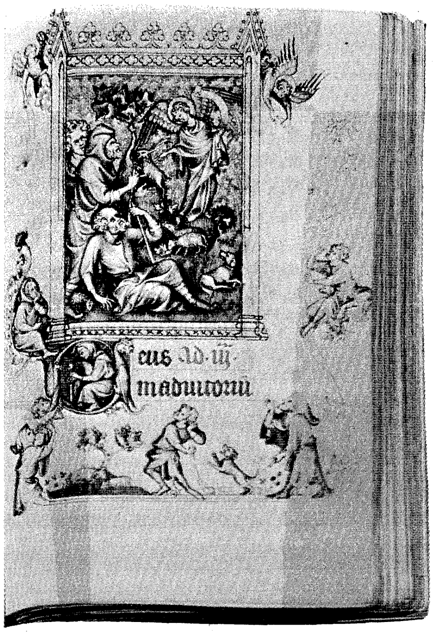
Pucelle, Jean (Jehan) (b. 1300?—d. 1355?), an outstanding painter of miniatures and an



"The Annunciation to the Shepherds," manuscript illumination by Jean Pucelle from the *Hours of Jeanne d'Évreux*, 1325–28; in The Cloisters, Metropolitan Museum of Art, New York City

By courtesy of the Metropolitan Museum of Art, New York City, the Cloisters Collection, Purchase, 1954

illuminator who excelled in the invention of drolleries (marginal designs) and in traditional iconography.

There is little information concerning Pucelle's background. In the 1300s he apparently made a trip to Italy that resulted in Florentine and Sienese features in his work, though the basis remained essentially Gothic and French. Pucelle returned to France, where he was master of an illuminator's workshop, which dominated Parisian painting during the first half of the 14th century. During this time he apparently also enjoyed court patronage.

Pucelle's most celebrated works are his reflections of the "Maestà" (*c.* 1325) by Duccio, a Sienese painter noted for his use of architecture, in the Belleville Breviary and his *Hours of Jeanne d'Evreux* (a private prayer book, *c.* 1325–28). The latter was done as a royal commission to Jeanne d'Evreux, the queen of France. This work is a reflection of the artist's synthesis of sources that influenced his style. Pucelle makes excellent use of the drolleries to give playful tone to what is essentially a religious work.

Puch'ŏn, city, Kyŏnggi *do* (province), northwestern South Korea, located halfway between Seoul and Inch'ŏn. It became a municipality in 1973 and developed rapidly as a satellite city of Seoul. Principal industries include the manufacture of wigs, sewing machines, cement and other construction materials, vinyl products, and automobiles. The surrounding area is well known for its peaches. Pop. (1985) 456,292.

Puchta, Georg Friedrich (b. Aug. 31, 1798, Kadolzburg, Bavaria [Germany]—d. Jan. 8, 1846, Berlin), German jurist noted for his works on ancient Roman law.

Puchta's father, Wolfgang Heinrich Puchta (1769–1845), was a legal writer and district judge. From 1811 to 1816 the young Puchta attended the gymnasium at Nürnberg, and in 1816 he went to the University of Erlangen, Bavaria. Taking his doctor's degree, he established himself there in 1820 as a privatdocent (unsalaried teacher recognized by the university) and in 1823 was made professor extraordinary of law. In 1828 he was appointed ordinary professor of Roman law at Munich; in 1835 he took the chair of Roman and ecclesiastical law at Marburg. He left that post for Leipzig in 1837, and in 1842 he succeeded the great jurist Friedrich Karl von Savigny at the University of Berlin.

In 1845 Puchta was made a member of the Council of State (Staatsrat) and the legislative commission (Gesetzgebungskommission).

Puchta's writings include *Lehrbuch der Pandekten* (1838; "Textbook on the Pandects [Pandectae]"), in which he elucidated the dogmatic essence of ancient Roman law, and the *Kursus der Institutionen* (1841–47; "Course of the Institutions"), which gave a clear picture of the organic development of law among the ancient Romans. Other works were *Das Gewohnheitsrecht* (1828–37; "Customary Law") and *Einleitung in das Recht der Kirche* (1840; "Introduction to the Law of the Church"). Puchta's *Kleine zivilistische Schriften* ("Brief Civil Writings"), a collection of 38 essays on various branches of Roman law, was published posthumously in 1851.

puck, in medieval English folklore, a malicious fairy or demon. In Elizabethan lore

Puck, or Robin Goodfellow, illustration from *Robin Goodfellow, his mad prankes and merry jests*, 1628

By courtesy of the Folklore Society Library, University College, London; photograph, R.B. Fleming

he was a mischievous, brownielike fairy also called Robin Goodfellow, or Hobgoblin. As one of the leading characters in William Shakespeare's *Midsummer Night's Dream*, Puck boasts of his pranks of changing shapes, misleading travelers at night, spoiling milk, frightening young girls, and tripping venerable old dames. The Irish pooka, or *púca*, and the Welsh *pwcca* are similar household spirits.

pudding, any of several foods whose common characteristic is a relatively soft, spongy, and thick texture. In the United States, puddings are nearly always sweet desserts of milk or fruit juice variously flavoured and thickened with cornstarch, arrowroot, flour, tapioca, rice, bread, or eggs. The rarer savoury puddings are thickened vegetable purées, soufflé-like dishes, or like corn pudding, custards. Hasty pudding is a cornmeal mush.

In Britain the word pudding is used as a generic term for sweet desserts. In addition to dessert puddings of the American type are boiled puddings of fruit enclosed in a suet crust; steamed puddings made of leavened batter; boiled puddings of sweetened dough or pastry, often mixed with dried or fresh fruit; and rich boiled puddings of which the Christmas plum pudding represents the acme: mixtures of dried fruits (the original dried plums having been replaced by raisins and currants hundreds of years since), candied fruit peels, spices, breadcrumbs, chopped suet, eggs, and brandy or other spiritous flavouring.

Savoury puddings are boiled or steamed dishes consisting of meats (steak and kidney being the best known), game, poultry, and vegetables enclosed in suet pastry. Black and white puddings are sausages with cereal added, the black being coloured with pig's blood. The Yorkshire pudding eaten with roast beef is a baked egg-rich batter.

Pudovkin, Vsevolod Illarionovich (b. Feb. 28 [Feb. 16, Old Style], 1893, Penza, Russia—d. June 30, 1953, Moscow), Soviet film

Pudovkin

By courtesy of the National Film Archive, London; photograph, E. Bieber, Berlin

director and theorist who is best known for visually interpreting the inner motivations and emotions of his characters.

Wounded and imprisoned for three years in World War I, Pudovkin returned to the study of chemistry but was attracted to the theatre. After seeing D.W. Griffith's film *Intolerance* (1916), he applied for admission to the State Institute of Cinematography in Moscow. There he worked with the Russian film theorist and director Lev Kuleshov exploring the psychological possibilities of editing and juxtaposing images into emotional statements.

Pudovkin's first motion picture was *Mekhanika golovnovo mozga* (1925; *Mechanics of the Brain*), an educational film about Pavlov's theories of action and reaction. He then directed *Mat* (1926; *Mother*). Based on Maksim Gorky's novel, it exemplifies Pudovkin's use of elaborate crosscutting of images (montage) to represent complex ideas; *e.g.*, a sequence of scenes showing a prison riot is intercut with shots of ice breaking up on a river. Other important films were *Konets Sankt-Peterburga* (1927; *The End of St. Petersburg*), *Potomok Chingis-Khan* (1928; *Heir to Genghis Khan,* or *Storm over Asia*), and the sound films, *Dezertir* (1933; *Deserter*), *Suvorov* (1941; *General Suvorov*), and *Admiral Nakhimov* (1946–47). His early motion pictures often presented characters of heroic stature caught in the violent evolution of history.

In two books, *Film Technique* (1933) and *Film Acting* (1935), written for Soviet film classes and first published outside the U.S.S.R. in 1929, Pudovkin explained his principles of scenario, directing, acting, and editing. His emphasis on depicting mood influenced the work of filmmakers such as the Hollywood director of suspense thrillers Alfred Hitchcock.

Pudukkottai, town, administrative headquarters of Pudukkottai district, Tamil Nādu state, southern India, located 237 mi (381 km) south of Madras city, the state capital. It was founded by Raghunath, raja of Tondaimandalam (the region around the ancient port of Tondi on India's southeastern coast). Industries include peanut (groundnut) oil and sesame oil extraction. Pudukkottai is connected by railway to Tiruchchirāppalli, Madurai, and Thanjāvūr towns.

Pudukkottai district is located in the southeastern part of the state and has an area of 1,815 sq mi (4,700 sq km). It is bounded by Tiruchchirāppalli district on the northwest, Thanjāvūr district on the northeast, and Rāmnathapuram district on the south. It has a short coastline fronting the Bay of Bengal on the east. Part of the Coromandel Coast, the district is located in the delta of the Vellār River. Agriculture is the basis of the economy; rice, pulse (legumes), sugarcane, cotton, peanuts (groundnuts), and sesame seeds are grown. Industries produce textiles and fertilizer; rice milling and sawmilling are also important. Pop. (1981) town, 87,952; district, 1,156,813.

Puebla, inland state, east central Mexico. It is bounded on the east by Veracruz; on the south by Oaxaca; on the west by Guerrero, Morelos, and the Federal District; and on the northwest by Tlaxcala and Hidalgo. Its northeast tip reaches into the Gulf lowlands between Veracruz on the east and Tlaxcala and Hidalgo on the west and north. Its 13,090-sq-mi (33,902-sq-km) territory occupies the southeastern corner of the Anáhuac Plateau. It varies in elevation from 5,000 to 8,000 ft (1,500 to 2,400 m), with numerous fertile valleys formed by the Sierra Madre Oriental. The region has long been densely populated. Pre-Columbian Nahuatl-speaking peoples had a highly developed civilization, as the innumerable archaeological sites attest. In turn, the Spaniards made Puebla a focus of economic and religious activity. Since the 19th century Puebla has developed as an agricultural–industrial area in the important Mexico City–Veracruz corridor. Coffee, sugarcane, fibres, corn (maize), and cereals are its principal crops, and onyx, gold, and other metals occur in its richly veined mountains. Highways and railroads traverse the state, passing through Puebla (*q.v.*) city, the capital. Towns and villages include Cholula, Atlixco, and Tehuacán Pop. (1980) 3,347,685.

Puebla, in full PUEBLA DE ZARAGOZA, city, capital of Puebla state, central Mexico. Founded as Puebla de los Angeles in 1532, the city lies on a broad plain 7,093 ft (2,162 m) above sea level in the Sierra Madre Oriental foothills. Since viceregal days, Puebla, because of its strategic position on the route between Mexico City, 80 mi (130 km) northwest, and

Courtyard of the Teatro Principal, Puebla city, Mex.
De La Torre—Plessner International

the Gulf of Mexico port of Veracruz, 140 mi (225 km) east, has been considered a military key to Mexico. It was occupied in 1847 by United States forces during the Mexican War. In 1862 the French were repulsed at Puebla by Gen. Ignacio Zaragoza; thereafter the city was renamed Puebla de Zaragoza. The following year the French captured Puebla, occupying it until 1867, when Porfirio Díaz recaptured it.

Puebla is characteristically Spanish, with noteworthy architecture similar to that of Toledo, Spain's great fortress city. The sumptuous cathedral, the interior of which is rich with onyx, marble, and gold, was made a bishopric in 1550, an archbishopric in 1903. The church of Santo Domingo, with its gold-leafed Chapel of the Rosary, dates from 1596–1659; the Casa del Alfeñique, now a museum, from the 17th century; and the Teatro Principal from 1790. The city houses the Autonomous University of Puebla (1937).

The centre of an important agricultural and industrial region, Puebla is known for its onyx working, glazed ceramic tiles, cotton and woollen textiles, glass, and pottery. A plant for the assembly of Volkswagon automobiles was built in 1970. The city can be reached by railroad, highway, and air. In August 1973 it was badly damaged by a massive earthquake that rocked central Mexico. Pop. (1980) 771,000.

Puebla, Battle of (May 5, 1862), battle fought at Puebla, Mex., between the army of the liberal government headed by Benito Juárez and the French forces sent by Napoleon III to establish a French satellite state in Mexico. The battle, which ended in a Mexican victory, is celebrated in the national calendar of Mexican holidays as the "Cinco de Mayo" (5th of May).

The route taken by the French invaders toward the capital was blocked by the fortified city of Puebla. Incautiously the French general Charles Latrille Laurencez ordered a frontal assault up the steep Cerro de Guadalupe against the Mexican position, which was fortified by a ditch and a brick wall. The Mexicans under Gen. Ignacio Zaragoza repulsed the attackers, who lost about 1,000 men and then retreated to the coast. In honour of its defender, Puebla was officially renamed Puebla de Zaragoza.

The following March, the French general Élie-Frédéric Forey, with reinforcements from France, laid seige to Puebla. Its approximately 30,000 defenders, commanded by Gonzáles Ortega, after having used up all ammunition and food, surrendered; most were sent to France as prisoners. On April 2, 1867, Díaz retook the city, ending the imperialist occupation.

Pueblo, city, seat (1861) of Pueblo County, south central Colorado, U.S., situated on the Arkansas River, near its confluence with Fountain Creek, at an elevation of 4,690 ft (1,430 m). James Beckwourth, a mulatto trader and onetime warchief of the Crow Indians, established a trading post on the site in 1842. A community called Fountain City developed in 1858 but was later absorbed by Pueblo City (laid out in 1860). Growth was stimulated by the arrival of the Denver and Rio Grande Western Railroad in 1872 and the Santa Fe line in 1876. It lies near coalfields and is an important manufacturing, retail, and trucking centre for the surrounding Arkansas Valley irrigated agricultural region. At nearby Minnequa is the Colorado Fuel and Iron Corporation, one of the nation's largest steel plants. The Pueblo Army Depot (1942) is just to the east. The University of Southern Colorado originated as Pueblo Junior College (1933). A flood-control system along the Arkansas River was constructed to prevent recurrence of the 1921 flood disaster, and a dam impounds a large reservoir 6 mi upstream from the city. San Isabel National Forest (to the west) is headquartered at Pueblo. Inc. 1885. Pop. (1980) city, 101,686; metropolitan area (SMSA), 125,972; (1982 est.) 125,600.

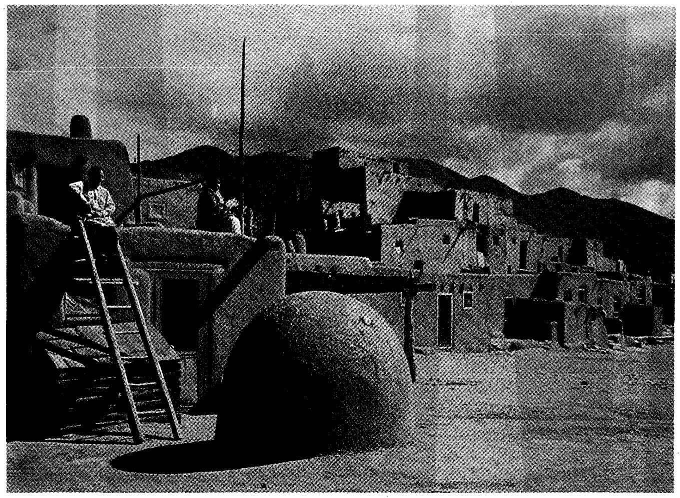
pueblo (Spanish: "town"), community of the Pueblo Indians of the southwestern United States. The construction of the multistoried, permanent, tenement houses they occupy was modelled after the cliff dwellings (*q.v.*) built by their ancestors, and it began around AD 1300.

The pueblo was constructed by stacking large adobe blocks, sun-dried and made from clay and water, usually measuring 8 by 16 inches (20 by 40 centimetres) and 4 to 6 in. (10 to 15 cm) thick. These blocks form the walls of the building, up to five stories tall, and were built around a central courtyard. Usually each floor is set back from the floor below, so that the whole building resembles a zigzag pyramid. The method also provides terraces on those levels made from the roof tops of the level below. Movement between levels is by means of wooden ladders through a hole in the ceiling. Most rooms above the first level can be entered also by doorways from adjoining rooms. Ground floor rooms have no outside, ground level doors and are used exclusively for storage, primarily of grain.

If a family had more than one room, which was commonly the case, they were arranged in a line radiating out from the centre of the pueblo. Rooms added to the family's section of the pueblo were added above and below the original rooms. Most likely the elders lived on the lower levels, leaving it to the younger members of the family to climb to upper stories. Each pueblo had at least two, and often more kivas (*see* kiva), or ceremonial rooms.

Pueblo Incident, capture of the USS "Pueblo," a Navy intelligence ship, and its 83 crewmen by North Korean patrol boats off the coast of North Korea on Jan. 23, 1968. The United States, maintaining that the "Pueblo" had been in international waters, began a military buildup in the area. It also initiated negotiations that resulted in an agreement that secured the release of the 82 surviving crewmen (one died from wounds suffered during the capture) on Dec. 23, 1968. The agreement allowed the United States to publicly disavow the confession the crew had signed, admitting the ship's intrusion, apologizing, pledging to cease all future action, and acknowledging the truth of confessions obtained during captivity. A naval inquiry into these confessions and the actions of Comdr. Lloyd M. Bucher produced no apparent disciplinary action.

Pueblo Indians, the historic descendants of the prehistoric Anasazi peoples (*see* Anasazi culture) who live in several locations in northeastern Arizona and northwestern New Mexico in compact, permanent settlements known as pueblos (Spanish *pueblo,* "village" or "town"). Just as there was considerable re-



Taos Pueblo, New Mexico, with baking oven in the foreground
Ray Manley—Shostal/EB Inc.

gional diversity among the prehistoric Anasazi, there is similar diversity, both cultural and linguistic, among their Pueblo descendants. The contemporary Pueblos are divided into eastern and western. The eastern Pueblos include all the New Mexico Pueblos along the Rio Grande, while the western Pueblos include the Hopi villages of northern Arizona and the Zuni, Acoma, and Laguna villages, all in western New Mexico. Linguistically, the Pueblos are quite diverse, falling into four distinct families, with several subfamilies. The eastern Pueblos are divided into speakers of Tewa languages and Keresan languages. Tewa is distantly related to Uto-Aztecan, but Keresan has no known affinities. Of the western Pueblos, Acoma and Laguna speak Keresan; the Zuni speak Zuni, a language of Penutian affiliation, and the Hopi Pueblos, with one exception, speak Hopi, a Uto-Aztecan language. The exception is the village of Hano, composed of Tewa refugees from the Rio Grande.

Both eastern and western Pueblos are primarily farmers, but the type of farming and the ownership of property have varied. In the Rio Grande area farming of maize and cotton is done in irrigated fields in river bottoms. Today men do all the cultivation, but formerly, when hunting was also important, women shared in the farming. Many of the Rio Grande Pueblos had special hunting societies that hunted deer and antelope in the mountains, and easterly Pueblos such as the Taos and Picuris sometimes sent hunters to the Plains for bison. Among all Pueblos communal rabbit hunts were held, and women gathered wild plants to eat. Among the western Pueblos, especially the Hopi, farming was less certain because the climate was much drier.

Prior to Spanish contact, each pueblo was politically autonomous, governed by a council composed of the heads of religious societies. These societies were centred in the kivas, subterranean ceremonial chambers, which also functioned as private clubs or lounging rooms for males. The Spanish introduced new political forms, such as the pueblo governor, an official elected for one year as village head. The number of pueblos diminished greatly after European contact from more than 80 to about 25 or 30. As a rule Pueblo Indians were peaceful and kept much to themselves. In 1680, however, led by Popé, a Tewa of San Juan, all Pueblo—Rio Grande, Hopi, and Zuni—rose against the Spanish and drove them out of their territory for 12 years. No other American Indians matched this feat.

Modern Pueblo social life centres on the village (which is also the political unit), though the pueblos are essentially theocracies. The western Pueblos are organized into clans and lineages, and secret societies, each owned or controlled by a particular clan, perform calendrical rituals for rain and tribal welfare. A tribal-wide kachina (katcina) cult is concerned with ancestors, and men's societies are responsible for protection and fertility ritual. In the Rio Grande region there is a dual village division into so-called Summer and Winter people, alternately responsible for pueblo activities; secret societies there deal primarily with curing rituals, and the kachina cult is less developed than it is in the other pueblos.

Native arts and crafts are especially active among the Hopi, where weaving and basketry are practiced and where the Hopi-Tewa revived pottery making in the 1890s. Silver and turquoise jewelry is produced in most pueblos, but silver working is not aboriginal.

Modern Pueblo Indians have retained the pre-Spanish way of life to a surprising degree. They have added to their material inventory such items as livestock, metal tools, new crops (such as wheat, aches, and chili peppers), modern clothing, automobiles, radios, and television. These changes necessarily have affected ideas, attitudes, and general outlook. Even in the Rio Grande pueblos near Santa Fe and Albuquerque, however, the basic fabric of Pueblo social system, community of organization, and native religion, with modifications only of detail, has survived.

Pueblo Libre, community in Pueblo Libre (formerly Magdalena Vieja) district, southwestern Lima–Callao metropolitan area, Peru. Mainly a middle-income residential community, it is dotted with small parks. Although many of the homes are modern, some predate Peru's independence from Spain (1824). The liberators Simón Bolívar and José de San Martín both lived in Pueblo Libre in what is now the Museo de la República. The town also houses the Museo Nacional de Antropología y Arqueología and the private Museo Arqueológico "Rafael Larco Herrera," a museum of indigenous cultures. Pueblo Libre (founded 1822) contains an engineering school and other departments of the Pontificia Universidad Católica del Peru (1917). Pop. (1981 prelim.) district, 82,709.

Pueblo pottery, one of the most highly developed of the American Indian arts, still produced today in a manner almost identical to the method developed during the Classic Pueblo period about AD 1050–1300. During the five previous centuries when the Pueblo Indians became sedentary, they stopped using baskets for carrying and began to manufacture and use clay pots, which had been cumbersome, breakable, and generally unsuited to their former nomadic lifestyle.

Pueblo pots, made only by the women of the tribe, are constructed not on a potter's wheel but by hand. Long "sausages" of clay are coiled upward around a flat base of clay until the pot reaches the desired height; when the coiling is completed, the interior and exterior of the pot are smoothed, and the round coils are pressed together to form a smooth wall of the pot. The pots are then coated with slip, a watery clay substance, polished, decorated, and fired.

Pottery made by the Pueblo Indians
(Left) Acoma waterjar, 1890, (centre) Santa Clara vase, *c.* 1880, (right) San Ildefonso waterjar, 1906; in the Denver Art Museum, Colo.
By courtesy of the Denver Art Museum, Denver, Colo.

Designs include geometric patterns, usually angular, and floral, animal, and bird patterns. Colour schemes may be polychromatic, black on black, or black on cream.

Pueblo Rebellion (1680), carefully organized revolt of Pueblo Indians (in league with Apaches), who succeeded in overthrowing Spanish rule in New Mexico for 12 years. A traditionally peaceful people, the Pueblos had endured much after New Mexico's colonization in 1598. Catholicism was forced on them by missionaries who burned their ceremonial pits (*kivas*), masks, and other sacred objects. Indians were tried in Spanish courts and received severe punishments—hanging, whipping, dismemberment (of hands or feet), or condemnation to slavery.

From 1645 on there were several abortive revolts, after each of which medicine men were especially singled out for reprisals. One medicine man, Popé of the San Juan pueblo, embittered by imprisonment, believed himself commanded by the tribal ancestor spirits (*kachinas*) to restore the old customs; on Aug. 10, 1680, he led a full-scale revolt in which almost all the Pueblos participated. On August 21 the Spaniards were forced to flee, leaving 400 dead, including 21 priests. The Indians celebrated their victory by washing off the stains of Christian baptism, annulling Christian marriages, and destroying churches. They remained free until 1692, when New Mexico was reconquered by Gov. Pedro de Vargas.

Puelche, also called GUENNAKIN, extinct South American Indian tribe that inhabited the grassy Pampas in the vicinity of the Río Negro and Río Colorado and ranged north as far as the Río de la Plata. The Puelche had their own language but in social and economic characteristics resembled their Patagonian and Pampean neighbours, especially the Tehuelche.

Little is known of the Puelche prior to the introduction of the horse in the early 18th century. The horse was used not only for transportation but also as a staple food, and its introduction caused radical changes in their social organization, giving rise to intersocietal hostilities, political leadership changes, and other new problems. The Puelche moved in mounted bands numbering 100 to 120 persons, carrying their skin-covered shelters with them. They fought with lances and bolas and wore hide coats and helmets to protect themselves.

Puente-Genil, town, Córdoba province, in the *comunidad autónoma* ("autonomous community") of Andalusia, southern Spain, located south of Córdoba city, on the Córdoba–Málaga railway. An agricultural centre, Puente-Genil produces olive oil, quince and other fruit jellies, linen, and insecticides. It takes its name from the bridge (*puente*) over the Genil River connecting the two sections of the town. Pop. (1981) 25,615.

puerperal fever, also called CHILDBED FEVER, infection of some part of the female reproductive organs following childbirth or abortion. Cases of fever of 100.4° F (38° C) and higher during the first 10 days following delivery or miscarriage are notifiable to the civil authority in most developed countries, and the notifying physician clarifies the diagnosis later, if possible. Puerperal infection is most commonly of the raw surface of the interior of the uterus after separation of the placenta (afterbirth); but pathogenic organisms may also affect lacerations of any part of the genital tract. By whatever portal, they can invade the bloodstream and lymph system to cause septicemia (blood poisoning), cellulitis (inflammation of cellular tissue), and pelvic or generalized peritonitis (inflammation of the abdominal lining). The severity of the illness depends on the virulence of the infecting organism, the resistance of the invaded tissues, and the general health of the patient. Abortions performed in unhygienic surroundings commonly result in puerperal fever.

Organisms commonly producing this infection are *Streptococcus pyogenes;* staphylococci (inhabitants of the skin and of pimples, carbuncles, and many other pustular eruptions); the anaerobic streptococci, which flourish in devitalized tissues such as may be present after long and injurious labour and unskilled instrumental delivery; *Escherichia coli* and *Clostridium welchii* (inhabitants of the lower bowel); and, rarely and fatally, the bacillus of tetanus.

In the second half of the 20th century puerperal fever has become very rare in developed countries. The decline of the disease may be partly attributed to improved environmental conditions, better obstetrical care, and the use of sulfonamides and antibiotics. Another reason appears to be a lessening of the virulence or invasiveness of *Streptococcus pyogenes.* This organism is also the cause of scarlet fever, which over the same period has also declined markedly in severity and incidence.

puerperium, the period of adjustment after childbirth during which the mother's reproductive system returns to its normal prepregnant state. It generally lasts six to eight weeks and ends with the first ovulation and the return of normal menstruation.

Puerperal changes begin almost immediately after delivery, triggered by a sharp drop in the levels of estrogen and progesterone produced by the placenta during pregnancy. The uterus shrinks back to its normal size and resumes its prebirth position by the sixth week. During this process, called involution, the excess muscle mass of the pregnant uterus is reduced, and the lining of the uterus (endometrium) is reestablished, usually by the third week. While the uterus returns to its normal condition, the breasts begin lactation. Colostrum, a high-protein form of milk, is produced by the second day after the birth and is gradually converted to normal breast milk, which has less protein and more fat, by the middle of the second week.

The chief medical problems associated with the puerperium include usually mild, transient depression, resulting from emotional letdown and discomfort associated with puerperal changes; clotting disorders, caused by blood stasis and prevented by an early return to normal activity; bleeding from a retained placenta; and puerperal fever, a major cause of maternal death until the 19th century. A combination of improved sanitary measures and modern antibiotics has now greatly reduced the mortality associated with puerperal fever.

Puerta del Sol, main plaza of Madrid, Spain. It was reputedly named for a gate (*puerta*) that stood there until 1510 and had on its front a representation of the sun (*sol*). Throughout Madrid's history the square has been the focal point of transportation and of intellectual and economic activity. It was the first part of the city to be equipped with modern conveniences (electric lights, streetcars) and is the site of a New Year's celebration similar to that of St. Mark's Square, Venice.

Puerto Aisén, also spelled PUERTO AYSÉN, capital of Aisén province and commune in Aisén region, southern Chile, located on the Aisén River at the head of a deep fjord facing the Chonos Archipelago. Colonization of the surrounding area of rugged topography and rigorous climate began only in the 19th century. Puerto Aisén is a port and commerical centre for the developing agricultural, mining, and lumbering communities to the south and east. Cattle and sheep are raised there, and wool is an important trade item. Tourism is also significant. There is boat service to Puerto Montt, 270 miles (435 km) north. An all-weather road links the capital to Coihaique and Balmaceda; another road crosses the Andes into Argentina. Pop. (1985 est.) commune, 19,749.

Puerto Ayacucho, city, capital of Amazonas territory, southern Venezuela, situated on the Orinoco River just below the Atures Rapids, which block navigation on the river. Puerto Ayacucho is the trading centre for the large but sparsely populated territory, which produces mainly rubber and balata. From the city a road leads 55 miles (90 km) south-southwestward to the river port of Samariapo, thus circumventing the rapids. Although it has about two-thirds of Amazonas' known population, Puerto Ayacucho was not accessible by highway until the 1970s, when a road, usable only in the dry season, was built from Caicara in Bolívar state. It is served by a domestic airline. Pop. (1987 est.) 51,636.

Puerto Barrios, town, northeastern Guatemala, on Amatique Bay, off the Gulf of Honduras. Until the 1970s it was the principal port of Guatemala, used primarily for shipping agricultural commodities. It was constructed at the beginning of the 20th century as the Caribbean terminus of the railway built by foreign contractors from the coast to Guatemala City, which realized a century-old Guatemalan dream of a national commercial outlet through a deepwater Atlantic port. The government became dissatisfied with control of the facilities by foreign interests, however, and constructed a government-owned and managed general cargo port at Santo Tomás de Castilla (*q.v.*), just 6 miles (10 km) to the south, and a highway paralleling the railroad. Puerto Barrios was seriously damaged by the earthquake of 1976. Pop. (1981) 24,235.

Puerto Bello (Panama): *see* Portobelo.

Puerto Berrío, city, eastern Antioquia department, northwestern Colombia, situated on the Magdalena River. It has been an important transportation hub almost since its founding in 1875 and a commercial and manufacturing centre for the agricultural and forest products of its hinterland. A cement factory and marble quarries are located nearby. Puerto Berrío is the major river port for Antioquia department, handling coffee, textiles, and other manufactures from the Medellín industrial area. Pipelines connect the city with the oil fields of central and northern Colombia and with Medellín, Cali, and Bogotá. It is also a major railroad junction, where a line from Popayán and the Cauca Valley meets one that runs from Santa Marta to Bogotá. There is also an airport. Pop. (1985) 21,414.

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Puerto Cabello, port city, northern Carabobo state, north-central Venezuela, situated on the Caribbean Sea. In colonial times, the waters of its well-protected harbour were said to be so smooth that a single hair (Spanish *cabello*) could moor a vessel to the dock, hence the name. The settlement has played a prominent part in Venezuelan history as a target of pirate attacks, a smuggling centre, and a battlefield during the struggle for independence. The city's deepwater harbour has excellent port facilities, and commerce dominates the economy of the city; however, there are some small processing industries, and a modern petroleum-chemical plant is nearby. Puerto Cabello is connected to Valencia, the state capital, by highway and railroad and is a natural outlet for the agriculturally rich and commercially important Valencia Basin. Pop. (1987 est.) 86,647.

Puerto Carreño, capital of Vichada commissariat, eastern Colombia, situated at the junction of the Meta River and the Orinoco, across from Puerto Páez, Venezuela. The easternmost of Colombia's urban centres and a potentially important port on the Orinoco River, the city is a collection centre for the cattle and livestock products, corn (maize), gums, and resins that are produced in the surrounding llanos (plains). Puerto Carreño is accessible by highway from Villavicencio, the capital of Meta department, situated about 500 miles (800 km) to the west-southwest. Travel in the area, however, is by river or air. Pop. (1985) 3,324.

Puerto Cortés, city, northwestern Honduras, situated on the Gulf of Honduras. It is backed by Alvarado Lagoon and extends for 2 miles (3 km) along the southern shore of Caballos Point. Puerto Cortés serves as the seaport for San Pedro Sula and the Sula Valley. The town was founded in 1524 as Puerto Caballos, just to the south across Cortés Bay, but was moved and had its name changed to Puerto Cortés in 1869, when construction of the railway to Potrerillos was begun. In 1974 Hurricane Fifi inflicted serious damage on the city, but by the late 1970s it had recovered. The port works, including one of the best container facilities in Central America, handle a large portion of Honduras' trade; bananas, coffee, coconuts, hardwood, and flour are the principal exports. The hot and rainy city is also a prosperous industrial centre, housing dairies, flour mills, and plants processing such foods as fish, banana flour, and coconut oil, in addition to African palm oil, beverages, soap, and leather goods; it has a small oil refinery, and a thermal-electric generating plant has been added. In 1977 a free-trade zone for an industrial park was established in the city, and by 1979 two foreign clothing factories were in operation. Puerto Cortés is linked by railroad and highway to several other centres, and a road leads to Tegucigalpa, the national capital. An airport serves domestic airlines. Pop. (1987 est.) 42,100.

Puerto de Mahón (Spain): *see* Mahón.

Puerto de San José, port town, south-central Guatemala, situated along the Pacific Ocean. Opened in 1853 and now the nation's third largest port, it is a roadstead with a long wharf; passengers and cargo are transferred from ships anchored 1 mile (1.6 km) offshore. San José handles a considerable portion of Guatemala's imports, especially petroleum; the port's chief exports are molasses, coffee, cotton, sugar, lumber, and honey. A major project to make the port a deepwater facility to handle its increasing traffic was begun in 1979. The resort of Iztapa, once a Spanish fort, lies to the east. San José is linked to Escuintla, 26 miles (42 km) to the north, and to Guatemala City by railroad and highway. Pop. (1981 prelim.) mun., 23,099.

Puerto La Cruz, city, northeastern Anzoátegui *estado* ("state"), northeastern Venezuela, situated along the Caribbean Sea. The former fishing village has become a busy, thriving, populous port city with the development of the petroleum industry since the 1930s in the eastern Llanos (plains). Pipelines running from the Anzoátegui fields and from fields in neighbouring Guárico and Monagas states carry the petroleum to Puerto La Cruz, where immense storage facilities and refineries are located. From Puerto La Cruz, petroleum is accessible for industrial and domestic use in Venezuela's densely populated central-highlands region. The city has also shared in the urban-industrial growth experienced by the Barcelona–Guanta–Puerto La Cruz area. Pop. (1981 est.) 81,800.

Puerto Lempira, town, northeastern Honduras. The town lies on an islet, which forms part of Tânsin Island, facing the main passage into the Caratasca Lagoon. Fishing is the major economic activity of the area, and the town has a shrimp-packing plant. In the 1970s oil exploration was begun in the offshore waters. The shallow, swampy nature of the lagoon and the dense jungle vegetation of the hinterland have precluded the development of a port. An airfield provides the principal communications link with the rest of Honduras; the town has no highway. Pop. (1975 est.) 742.

Puerto Maldonado, capital of Tambopata *provincia* and of Madre de Dios *departamento,* southeastern Peru. It lies at the confluence of the Tambopata and Madre de Dios rivers, at 840 feet (256 m) above sea level in the hot, humid rain forest known as the selva. It was named for Dom Pedro Maldonado, an 18th-century Spanish explorer, but was not mentioned in official documents until 1902. The smallest of all Peruvian departmental capitals (excepting Chachapoyas), the community serves as the administrative and commercial centre for an area producing Brazil nuts, rubber, rice, sugarcane, cassava, and other tropical crops. There is gold washing in the vicinity. Local travel is mainly by river craft, but Puerto Maldonado is accessible by air and by a 162-mile (261-kilometre) road from Cuzco. Pop. (1987 est.) 19,000.

Puerto Montt, port and capital of Llanquihue *provincia* and of Los Lagos *región,* southern Chile. It lies at the head of Reloncaví Bay (an inlet of the Pacific), adjacent to Tenglo Island. Founded in 1853, the settlement was named for Manuel Montt, then president of Chile. Early German settlers have given it a distinctive appearance. Puerto Montt is a commercial centre for an agricultural hinterland, which yields grains (especially wheat), potatoes, and livestock, as well as for the offshore fishing grounds. The city's industries include fish canning, tanning, and sawmilling. The Pan-American Highway and main north-south railroad terminate in the city, as do sea routes through the archipelagoes southward to Punta Arenas. It also has an international airport. Its setting amid forested hills, fjords, lakes, and snowcapped Andes have made it a popular resort, despite earthquakes. Pop. (1987 est.) 113,488.

Puerto Padre, city, northeastern Las Tunas *provincia,* eastern Cuba. Lying on sheltered Puerto Padre Bay, off the Atlantic Ocean, the city is a commercial and manufacturing centre for a fertile irrigated hinterland. Sugarcane, tobacco, fruit, and livestock produced in the area are processed in the city, which also contains brickyards and sawmills. Saltworks, asphalt deposits, and a thermal-power plant are situated nearby. The city is connected by highway to Holguín city. Pop. (1987 est.) 54,560.

Puerto Plata, in full SAN FELIPE DE PUERTO PLATA, city and port, northwestern Dominican Republic. It lies at the foot of Isabel de Torres Peak, along the Atlantic Ocean. Puerto Plata was founded in 1503 by Christopher Columbus. Serving the fertile Cibao Valley, the port handles the produce of one of the nation's leading coffee-growing regions. The agricultural hinterland is also a major tobacco-producing area, and bananas, sugarcane, and dairy products are also significant. Puerto Plata's port handles principally tobacco, coffee, cacao, rice, sugarcane, bananas, and lumber. Fishing is important to the city, as are processing and manufacturing plants; chocolates, matches, dairy products, foodstuffs, and liquor are among the leading products. Puerto Plata is accessible by secondary highways from coastal and inland urban centres, and an international airport was constructed for the city in the late 1970s. The ruins of La Isabela, founded by Columbus in 1493 and one of the first European towns in the New World, are located 30 miles (50 km) west of the city. Pop. (1983 est.) 47,000.

Puerto Presidente Stroessner, city, eastern Paraguay. Founded in 1957, the city is situated on the right bank of the Paraná River at the border with Brazil; it has been converted in only two decades from a tropical forest into Paraguay's second most important city after Asunción, the national capital. Puerto Presidente Stroessner's economy is based on the ceramic industry and increasingly on the production of canned food, particularly sausages. The major reasons for the city's rapid growth are its commercial connection with Brazil, symbolized by the 1,600-foot (500-metre) Puente de la Amistad (Friendship Bridge; opened 1964), and its association with the nearby Itaipú Dam on the Paraguay–Brazil border, which is one of the largest hydroelectric facilities in the world. Tourism also plays an important role in the city, and the Itaipú Dam and Iguaçu Falls are popular attractions. Pop. (1985 est.) 63,828.

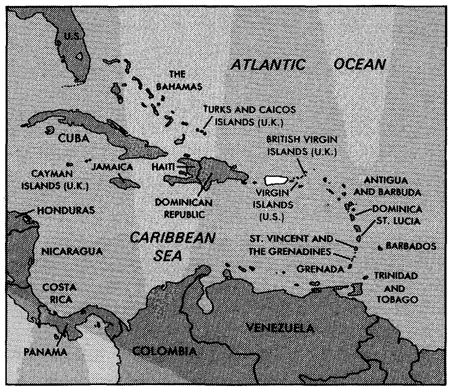
Puerto Princesa, city, east-central Palawan, Philippines. It is an important port on a sheltered inlet of the Sulu Sea, south of Honda Bay, and it has an airport. The city was formerly called Cuyo. The site of a penal colony during the Spanish regime, Puerto Princesa has become one of several resettlement sites on the island for migrants from Luzon and the western Visayan region. Copra, lumber, rattan, and livestock are exported from the port. The only Philippine deposits of cinnabar (an ore from which mercury is extracted) are worked at the nearby village of Tagburos; metallurgical-grade chromite is also produced. Puerto Princesa is the centre of large fishing operations and has scattered sawmills. It is the site of Palawan Teachers College (1972), and Palawan National Agricultural College (1910) is at Aborlan to the south. A game refuge and bird sanctuary are located near the city. Pop. (1980) 60,234.

Puerto Rico, officially COMMONWEALTH OF PUERTO RICO, Spanish ESTADO LIBRE ASOCIADO DE PUERTO RICO, self-governing island commonwealth of the West Indies, associated with the United States. It covers an area of 3,515 square miles (9,104 square km) and occupies a central position among the islands of the West Indies in the northern Caribbean. The capital is San Juan. Roughly rectangular in shape, the island of Puerto Rico extends about 111 miles (179 km) from east to west and 40 miles (64 km) from north to south. Two islands off the east coast, Vieques and Culebra, are also part of the nation. Puerto Rico is located about 1,000 miles (1,600 km) southeast of Florida (U.S.). The population in 1990 was estimated at 3,316,000.

A brief treatment of Puerto Rico follows. For full treatment, *see* MACROPAEDIA: West Indies.

For current history and for statistics on society and economy, *see* BRITANNICA WORLD DATA ANNUAL.

The land. Puerto Rico is a mountainous island with little flat land. It is divided into three main geographic regions: the mountainous interior, the northern plateau, and the coastal plains. The central mountain range, which is known as the Cordillera Central, rises to 4,389 feet (1,338 m) at Mount Punta, the country's highest peak. This mountain range slopes steeply to the southeast, and rivers have eroded its gentler northern slope. The northern plateau is crossed by small hills, and



Puerto Rico

toward the interior the land is covered by hillocks and gullies. The coastal plains are discontinuous, particularly at the eastern and western ends of the island, where hilly spurs run down to the sea. Puerto Rico has many rivers and streams. Because most of Puerto Rico's precipitation falls on the north-facing mountain slopes, the rivers flowing north are larger and more numerous, while the river courses on the southern coast are dry most of the year. Several marshes, moors, and lakes occupy the low-lying coastal plains.

Puerto Rico's pleasant climate is greatly influenced by the Caribbean Sea and its warm currents. Moisture-laden winds from the east and northeast bring on frequent rainy periods during winter. Mean annual rainfall ranges from 36 inches (914 mm) in Ponce on the south coast to 60 inches (1,500 mm) in San Juan on the north coast. Temperatures average 80° F (27° C) in the lowlands and overall seldom fall below 66° F (19° C), with the highest recorded daily average at 89° F (32° C) and the lowest at 60° F (16° C). Devastating hurricanes may strike Puerto Rico between June and November, and the island is subject to earthquakes. The El Yunque mountain rain forest contains orchids and giant ferns and lies mostly within the Caribbean National Forest, a sanctuary of about 45 square miles (116 square km) that preserves the tropical hardwoods once abundant on the island. Palms and mangrove trees flourish along the coast, and bamboo grows in great clumps along the roads and streams. Included among Puerto Rico's wildlife are nonpoisonous snakes, lizards, mongoose (introduced), and a number of species of birds.

Aside from its picturesque beaches and tropical climate, Puerto Rico is relatively poor in resources. About one-seventh of the country's area is considered arable, and almost two-fifths of the land is used for grazing cattle and sheep. The country has yet to develop its deposits of copper, discovered in the early 1970s, and its deposits of nickel.

The people. The people of Puerto Rico are the homogeneous products of a mixture of diverse ethnic strains, mainly Spanish and African. Although Spanish and English are both official languages, Puerto Rico remains predominantly Spanish-speaking. Most of the people are Roman Catholics. Family-planning programs and birth-control measures have contributed to a sharp decline in the birth rate. Migration to the U.S. mainland has helped slow Puerto Rico's population growth and alleviate the island's overcrowding somewhat. The death rate has declined in part due to improvements in health conditions. Most of the nation's population lives in the coastal lowlands. Puerto Rico is highly urbanized, with the San Juan metropolitan area alone accounting for more than 1.5 million people.

Economy. Puerto Rico has a developing free-market economy. The gross national product (GNP) is growing much more rapidly than the population, and the GNP per capita is one of the highest in the Caribbean. Manufacturing, trade, and financial services are the major components of the GNP and the largest employers.

Once the mainstay of the economy, agriculture now only accounts for a tiny percentage of the GNP. Plantation sugar production dominated Puerto Rico's economy until the 1940s. Since then sugarcane has remained important, but more diversified farming produces coffee, tobacco, starchy vegetables, pineapples, and citrus fruits. The principal livestock are cattle, pigs, and poultry.

Industry is the main source of income for the island. Puerto Rico's major manufactures include petrochemicals, processed foods, clothing, textiles, electrical and electronics equipment, machinery, and metal products. Trade is mostly with the United States. Approximately seven-eighths of Puerto Rico's exports are destined for U.S. markets and the remainder for Caribbean countries. Exports include pharmaceuticals, food products, electrical machinery, and petroleum. The island's imports come mostly from the United States. Major imports include food products, chemicals, crude petroleum and petroleum products, and transportation equipment. Tourism has also become an important source of income.

Imported petroleum is used to generate nine-tenths of the island's energy; the remainder is generated by hydroelectric plants.

Most of Puerto Rico's roads are paved. Local and international air services provide easy access to various points on the island. Most international commerce is carried on by ocean transport; San Juan, Ponce, and Mayagüez are the major ports. San Juan has one of the best harbours in the Caribbean. Principal revenue sources are income taxes, excise taxes, and U.S. grants-in-aid. The main government expenditures are on health, education, and welfare.

Government and social conditions. Puerto Rico is a commonwealth in free association with the United States; its residents are U.S. citizens. According to the constitution of 1952, executive power resides in the governor, who is elected directly for a term of four years. A bicameral legislature consists of a Senate of 27 members and a House of Representatives of 51 members; members of both houses are elected for four-year terms. In addition, Puerto Rico is represented in the U.S. Congress by a nonvoting resident commissioner who is directly elected for a four-year term. Puerto Rico's judicial system is headed by a Supreme Court, which administers the Commonwealth's unified system of superior and district courts. Judges and justices at all levels are appointed by the governor with the advice and consent of Puerto Rico's Senate. The United States is responsible for the commonwealth's defense. As a commonwealth, Puerto Rico participates in most U.S. federal social-welfare programs, although at a level lower than that of the U.S. national averages.

Health standards in the commonwealth are generally comparable with those of the United States. These standards are reflected in an infant-mortality rate well below regional averages and life-expectancy rates that are comparable with those of developed countries: 71 years for men and 79 years for women.

Education is a matter of high priority and is evident in the island's overall literacy rate of 90 percent. Enrollment rates are high at both the primary and secondary levels; enrollment in higher education is dispersed among some 30 institutions, headed by the University of Puerto Rico, which comprises a state university system.

Cultural life. Puerto Rico is an ebullient mixture of Antillean, African, Spanish, and North American cultural influences, although the principal language is Spanish. The Puerto Rico Institute of Culture and the Ateneo Puertorriqueño preserve artifacts and traditions reaching back to the culture of the pre-Columbian Arawak (Taino) Indians. Literature is vigorous and usually of island or regional focus; the Puerto Rican author best-known to wider audiences is the 19th–20th century teacher and essayist Eugenio María de Hostos, whose writings led the way for social reform and political independence in the Caribbean. Music is widely performed, and the world-famous Festival Casals (after 1956) was the inspiration for the establishment of the Casals Museum in San Juan, commemorating the cellist Pablo Casals. Other performing arts, including theatre and television, are also active.

History. The early inhabitants of Puerto Rico migrated from either southern Florida or the Orinoco River basin of South America. When Christopher Columbus arrived there in 1493, the island was inhabited by the peaceful Arawak Indians, who were being challenged by the warlike Carib Indians.

Juan Ponce de León founded the town of Caparra in 1508 and initiated the first efforts at gold mining and agriculture. During the late 16th century, attacks by both the English and Dutch caused the Spanish to build strong fortifications on the island, but Puerto Rico remained largely undeveloped economically until the late 18th century.

After 1830 the island gradually developed a plantation economy founded on three export crops: sugarcane, coffee, and tobacco. In the late 19th century, Puerto Ricans began to press for political independence. In 1897 the island was granted broad powers of self-government by Spain.

In the following year U.S. troops occupied Puerto Rico during the Spanish-American War, after which the island was ceded to the United States. Early U.S. governors attempted to Americanize Puerto Rico and its residents, arousing the resentment of many who had struggled for autonomy under Spain. In 1917 limited self-government was granted to Puerto Rico, and the residents were given U.S. citizenship.

In the 1930s Puerto Rico's political parties divided over the island's future status, one supporting independence and the other advocating U.S. statehood. In 1946, U.S. President Harry Truman appointed the first native Puerto Rican governor of the island, and, from 1948, governors were popularly elected. The Commonwealth of Puerto Rico was established in 1952.

In the period from the 1940s to the late 1960s, Puerto Rico's economy was transformed from one based on agriculture to one based on labour-intensive manufacturing industries. Workers left the sugarcane fields and coffee plantations and moved into the cities, where social services and working conditions were better.

A Puerto Rican independence movement engaged in sporadic terrorist acts in the United States, including an attempt on the life of Truman and a shooting spree in the U.S. Congress. The major political issue in the 1970s and '80s, however, centred not on independence but on whether to retain commonwealth status or to seek full statehood within the United States.

Puerto Rico Trench, submarine depression in the North Atlantic Ocean, roughly parallel to the northern coast of the island of Puerto Rico and lying about 75 miles (120 km) to the north. The Puerto Rico Trench is about 1,090 miles (1,750 km) long and 60 miles (100 km) wide. The deepest point in the Atlantic Ocean, the Milwaukee Depth, lies at a depth of 27,-493 feet (8,380 m) in the western end of the trench, about 100 miles (160 km) northwest of Puerto Rico. The origin of the trench can be traced back to the beginning of the Tertiary period. The Puerto Rico Trench appears to be part of a complex system of sinistral strike-slip faults in the north Caribbean; the trench seems to have been open continuously for about 70 million years. It is partially filled with sediments.

Where the same name may denote a person, place, or thing, the articles will be found in that order

Puerto Suárez, town, extreme eastern Bolivia. It is situated on the marshy shores of Lake Cáceres, just west of Corumbá, Brazil, and is connected by the Tamengo Canal to the Paraguay River. An isolated port and trading centre for rubber, coffee, and other local products, the town lies on the Corumbá–Santa Cruz railway and is accessible by air from Santa Cruz 350 miles (565 km) to the west. Iron ore and manganese reserves are located nearby. Pop. (1976) 4,253.

Puerto Vallarta, formerly LAS PEÑAS, city, western Jalisco *estado* ("state"), west-central Mexico. It lies on Banderas Bay, on the Pacific coastal lowland, 6 miles (10 km) south of the mouth of the Ameca River. It is the major port of Jalisco state and exports bananas, coconut oil, hides, and fine woods. Beans and bananas are grown in the hinterland, which is also used for raising pigs, horses, and bees. Puerto Vallarta's population has increased sharply, for it has become an international tourist resort, known for its aquatic sports, fishing (especially for sharks), and hunting. It can be reached by road from Guadalajara, the state capital, to the east, and by air, as well as by sea. Pop. (1980) 36,645.

Puertollano, city, Ciudad Real *provincia,* in the autonomous community (region) of

Castile-La Mancha, south central Spain, just south-southwest of Ciudad Real city. Located on the Madrid–Ciudad Real–Mérida railway with rich coal, iron, lead, manganese, and copper pyrite mines in the vicinity, Puertollano's population has tripled in the 20th century. The mines form the basis of important metallurgical and chemical industries, and there are also foundries, limekilns and mineral baths. Pop. (1981) 48,747.

Pufendorf, Samuel, Freiherr von (baron of) (b. Jan. 8, 1632, Dorfchemnitz, near Thalheim, Saxony—d. Oct. 13, 1694, Berlin), German jurist and historian, best known for his defense of the idea of natural law. He was created a baron in the last year of his life.

Pufendorf, detail of an oil painting by Carl Peter Mörth, 1735, after David Klöcker Ehrenstrahl; in the Nationalmuseum, Stockholm
By courtesy of the Svenska Portrattarkivet, Stockholm

Early life and works. Pufendorf was the son of a Lutheran pastor. Though the family was poor, financial help from a rich nobleman enabled his father to send both Samuel and his older brother Esaias to a well-known school in Grimma. There he acquired a sound classical education. He became a student of theology at Leipzig University, then a stronghold of Lutheran orthodoxy, but soon turned his attention to jurisprudence, philology, philosophy, and history. In 1656 he went to Jena, where he was introduced to the method of Descartes and also read the works of Hugo Grotius and Thomas Hobbes.

In 1658 Pufendorf took employment as a tutor in the home of the Swedish ambassador in Copenhagen. When war broke out between Sweden and Denmark, he was imprisoned along with the rest of the ambassador's retinue. During the eight months of confinement he occupied himself by elaborating his first work on natural law, *Elementorum Jurisprudentiae Universalis Libri Duo,* ("Two Books on the Elements of Universal Jurisprudence"), published in 1660. In it he developed the ideas of Grotius and Hobbes. The elector palatine Karl Ludwig, to whom the work was dedicated, created a chair of natural law for Pufendorf in the arts faculty at Heidelberg, the first of its kind in Germany. Pufendorf taught there from 1661 to 1668, writing during this time his next work *De Statu Imperii Germanici ad Laelium Fratrem Dominum Trezolani Liber Unus* (*The Present State of Germany,* 1690). It was published in 1667 and took the form of a bitter attack, supposedly by a Veronese nobleman, on the constitution of the Holy Roman Empire and the house of Austria. It was based on wide reading in constitutional law and history and created an immediate sensation throughout Europe. The work was banned by the imperial censor; perhaps for that very reason it was translated into many languages and published abroad.

Career in Sweden. In 1668 Pufendorf left Heidelberg to accept the chair of natural law at the new University of Lund in Sweden. The 20 years he was to spend there proved to be his most fruitful ones. In 1672 he published his great work, *De Jure Naturae et Gentium Libri Octo* (*Of the law and nature of nations,* 1703) and, in 1673 an excerpt from it titled *De Officio Hominis et Civis Juxta Legem Naturalem Libri Duo* (*The whole duty of man according to the law of nature,* 1698). In these works Pufendorf departed from the traditional approach of the medieval theologians to natural law and based it on man's existence as a social being (*socialitas*). Every individual, he held, on the basis of human dignity has a right to equality and freedom. He insisted that, despite the teaching of Aristotle, there is no such creature as a natural slave; master–servant relationships can exist only on the basis of an agreement. Pufendorf's theory of civil, penal, and constitutional law also derived from the same principle of *socialitas.*

His great influence was not won without a struggle. His views were subjected to numerous attacks by conservative Protestant theologians in Sweden and Germany. The philosopher Leibniz dismissed him as "a man not a lawyer and scarcely a philosopher at all." The Swedish government, however, protected him. In the pamphlets signed *Eris Scandica,* which he published in 1686, he defended his beliefs very effectively.

In 1677, after the Danish occupation of Lund, Pufendorf became the royal historiographer in Stockholm, where he devoted much of his time to writing the history of Sweden from Gustav II Adolf to Charles X Gustav. In 1687 he also published *De Habitu Religionis Christianae ad Vitam Civilem* ("Of the Power of the Christian Religion in Relation to the Life of a Citizen"), setting forth the civil superiority of the state over the church but at the same time defending the church's power in ecclesiastical matters as well as the freedom of conscience of the individual. His approach became the basis of the collegial, or council, system of church government that was further developed in the 18th century to become the basis of church and state relations in Germany. The book also contained a justification of the idea of tolerance in general and in particular of the elector of Brandenburg, who had offered asylum to the Huguenots when they were driven out of France in 1685.

In 1688 Pufendorf went to Berlin as historiographer to the elector of Brandenburg. He was created baron in 1694 and died in the same year. A posthumous work, *Jus Feciale Sive De Consensu et Dissensu Protestantium* ("Law of Diplomacy, or Agreement and Disagreement of Protestants"), was published in 1695. It expounded more of his ideas on ecclesiastical law and argued for the formation of a united Protestant church from the Reformed and Lutheran churches.

The 18th century saw a great number of editions of Pufendorf's works. John Locke and Jean-Jacques Rousseau recommended them as reading for young people. The emperor Joseph II of Austria was instructed in *De officio* as a boy. One of Pufendorf's disciples was John Wise (1652–1725), an American clergyman and pamphleteer who greatly influenced American ecclesiastical law and the struggle for civil and religious liberty in the colonies. (Ha.We.)

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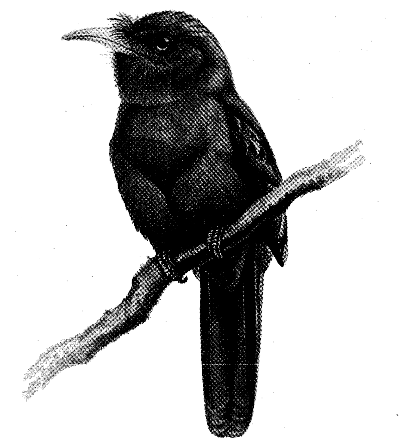
puffback flycatcher (bird): *see* wattle-eye.

puffbird, any of 30 species of tropical American birds that constitute the family Bucconidae (order Piciformes). They are named for their habit of perching tamely in the open with the feathers of their large heads and short necks puffed out. Some species are known as nunlets and nunbirds.



Black-fronted nun bird (*Monasa nigrifrons*)
Painting by H. Jon Janosik

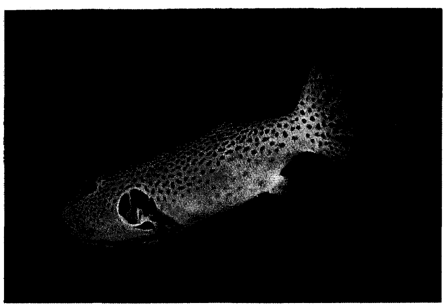
Puffbirds feed on flying insects. They resemble their close relatives the jacamars in habits but are thick-billed and plain coloured—rather shrikelike. They nest in holes that they dig in sloping or flat ground. Widespread species include the collared puffbird (*Bucco capensis*) 18 centimetres (7 inches) long, in northern South America east of the Andes, and the white-necked, or large-billed, puffbird (*Notharchus macrorhynchos*), 24 cm long, ranging from Mexico to Argentina.

The six or seven species of the genus *Malacoptila* are medium-sized brownish puffbirds, many with conspicuous patches of white on the face. The white-whiskered puffbird (*M. panamensis*) has the interesting habit of plugging the entrance to its nest burrow with green leaves at night.

The smallest species is the lanceolated monklet (*Micromonacha lanceolata*) from deep forests of northern South America. This 14-cm species derives its name from its quiet habits and modest brown plumage.

The five species of nunlets (*Nonnula*) and the six nun birds (*Monasa*) are also dull-coloured quiet puffbirds, the former about 13–16 cm, the latter 20–30 cm.

puffer, also called SWELLFISH, or BLOWFISH, any of about 90 species of fishes of the family Tetraodontidae, noted for their ability when disturbed to inflate themselves so greatly with air or water that they become globular in form. Puffers are found in warm and temper-



Puffer (*Arothron stellatus*)
Douglas Faulkner

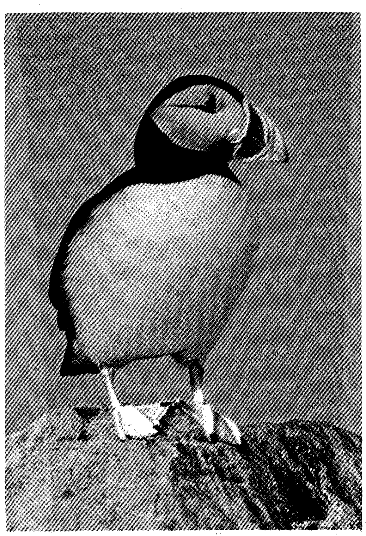
ate regions around the world, primarily in the sea but also, in some instances, in brackish or fresh water. They have tough, usually prickly skins and fused teeth that form a beaklike structure with a split in the centre of each jaw. The largest puffers grow about 90 centimetres (3 feet) long but most are considerably smaller.

Many species are poisonous; a highly toxic substance, tetraodontoxin, is especially concentrated in the internal organs. Although this substance can cause death, puffers are sometimes used as food. In Japan, where the fishes are called *fugu,* they must be carefully cleaned and prepared by a specially trained chef.

Related to the puffers are about 12 species, also capable of inflating themselves, known as the sharp-nosed puffers. These fishes, which comprise the genus *Canthigaster* and the family Canthigasteridae, are found throughout the world. They are small fishes with rather long, pointed snouts and, unlike the puffers, inconspicuous nostrils. They are brightly coloured and no more than about 20 centimetres long. Like some puffers, they are sometimes kept in marine aquariums.

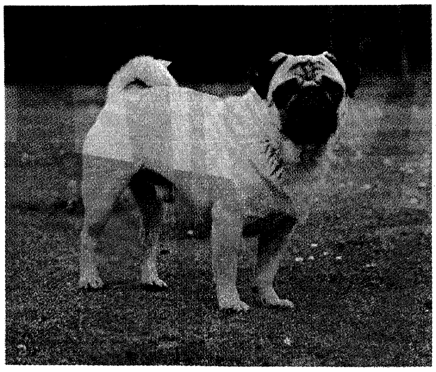
puffin, also called BOTTLENOSE, or SEA PARROT, any of three species of diving birds that belong to the auk family, Alcidae (order Charadriiformes). They are distinguished by their large, brightly coloured, triangular beaks. Puffins nest in large colonies on seaside and island cliffs, usually laying only one egg, in a burrow dug one or two metres (three to six feet) deep. Hatched in about six weeks, the young bird fattens on fish, supplied by both parents. After about six weeks of feeding, the parent birds desert their young, which then waits alone until it becomes thin and its flight-feathers have grown, and then it flies out to sea by itself. Puffins eat a variety of marine organisms. They are able to catch as many as ten small fish in succession and to carry them crosswise in the bill to the nest.

The common, or Atlantic, puffin (*Fratercula arctica*) occurs on Atlantic coasts from the Arctic south to Brittany and Maine. It is about 30 centimetres (12 inches) long, black above, white below, with gray face plumage, red-orange feet, a blue-gray, yellow, and red bill, and horny plates of skin around the beak and on the eyelids. The horned puffin (*F. corniculata*) is a Pacific relative of the Atlantic species. Of more southerly Pacific distribution is the tufted puffin (*Lunda cirrhata*), which is black with red legs and bill, a white face, and straw-coloured plumes curving backward from behind the eyes.



Common puffin (*Fratercula arctica*)
Ben Goldstein—Root Resources

pug, breed of toy dog that probably originated in China and was introduced to England near the end of the 17th century by Dutch traders. The pug has a short muzzle and a tightly curled tail. It is a squarely built, muscular dog, with a large head, prominent dark eyes, and small, drooping ears. At maturity, it stands 10 to 11 inches (25.5 to 28 centimetres) and weighs about 13 to 18 pounds (6 to 8 kilograms). Its coat is short and glossy; colour is given in the breed standard as black or as silver or apricot fawn, with a black line on the back and a black mask on the face. Typically loyal and alert, the pug is a valued companion dog.



Pug
Sally Anne Thompson—EB Inc.

Pugachov, Yemelyan Ivanovich, Pugachov also spelled PUGACHEV (b. *c.* 1742, Zimoveyskaya-na-Donu, Russia—d. Jan. 21 [Jan. 10, old style], 1775, Moscow), leader of a major Cossack and peasant rebellion in Russia (Pugachov Rebellion, 1773–75).

Pugachov, detail of a portrait by an unknown artist; in the State Historical Museum, Moscow
By courtesy of the State Historical Museum, Moscow

An illiterate Don Cossack, Pugachov fought in the Russian Army in the final battles of the Seven Years' War (1756–63), in Russia's campaign in Poland (1764), and in the Russo-Turkish War of 1768–74. Following the siege and conquest of Bendery (1769–70), however, he returned home as an invalid. For three years after his recovery, he wandered, particularly among settlements of Old Believers, a dissident religious group that exercised considerable influence over him.

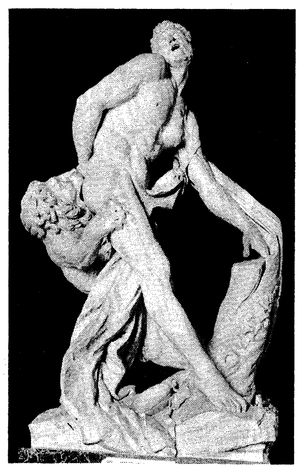
Learning in the course of his travels of the Yaik (Ural) Cossack Rebellion of 1772 and of its cruel suppression, Pugachov proceeded to Yaitsky Gorodok (now Uralsk), where the Cossacks remained discontented. Although he was arrested there for desertion from the army, imprisoned at Kazan, and sentenced to be deported to Siberia, he escaped and in June 1773 appeared in the steppes east of the Volga River. Claiming to be Emperor Peter III (who had been deposed by his wife, Catherine II the Great, and assassinated in 1762), Pugachov decreed the abolition of serfdom and gathered a substantial following, including Yaik Cossacks, peasant workers in the mines and factories of the Urals, agricultural peasants, clergymen, and the Bashkirs. Planning ultimately to depose Catherine, Pugachov stormed and laid siege to Orenburg, an important commercial and industrial centre of the Ural region (fall 1773). As the landowners of the region, fearing for their lives, fled to Moscow, Catherine recognized the seriousness of the rebellion and sent an army commanded by Gen. A.I. Bibikov against Pugachov (January 1774). In the spring Bibikov defeated Pugachov at Tatishchevo, west of Orenburg, but Pugachov proceeded to Kazan and burned the city (July 1774). He was defeated again several days later, but he crossed the Volga River, intending to gather reinforcements among the Don Cossacks. He captured Saratov (August 1774) and besieged Tsaritsyn (now Volgograd), where Gen. A.V. Suvorov finally defeated him (Sept. 3 [Aug. 23, old style], 1774). Pugachov escaped but was betrayed by some Yaik Cossacks, sent to Moscow, and executed.

Puget, Pierre (b. Oct. 16, 1620, at or near Marseille, Fr.—d. Dec. 2, 1694, Marseille), the most original of French Baroque sculptors, also a painter and architect.

Puget travelled in Italy as a young man (1640–43), when he was employed by a muralist, Pietro da Cortona, to work on the ceiling decorations of the Barberini Palace in Rome and the Pitti Palace in Florence. Between 1643 and 1656 he was active in Marseille and Toulon chiefly as a painter, but he also carved colossal figureheads for men-of-war. An important sculpture commission in 1656 was for the doorway of the Hôtel de Ville, Toulon; his caryatid figures there, although in the tradition of Roman Baroque, show a strain and an anguish that are similar to the Mannerist works of Michelangelo. Such feelings are passionately expressed in works like the "Milo of Crotona" (*c.* 1671–84), in which the athlete Milo, whose hand is caught in a tree stump, is portrayed under attack by a lion.

In 1659 Puget went to Paris, where he attracted the attention of Louis XIV's minister Fouquet. The latter fell from power in 1661 while Puget was in Italy selecting marble for the Hercules commissioned by him (now the "Hercule gaulois" in the Louvre). Puget remained in Italy for several years, establishing a considerable reputation as a sculptor in Genoa. A "St. Sebastian" in Sta. Maria de Carignano is among his best works there.

After 1669 Puget's life was spent mainly in Toulon and Marseille, where he was engaged in architectural work and the decoration of



"Milo of Crotona," marble statue by Pierre Puget, 1671–84; in the Louvre, Paris
Giraudon—Art Resource/EB Inc.

ships as well as sculpture. His difficult and somewhat arrogant temperament made him unacceptable to Louis XIV's powerful minister Colbert, and it was only late in life that he achieved some degree of court patronage. His "Milo of Crotona" was taken to Versailles in 1683, and the "Perseus and Andromeda" was well received there in 1684. But Puget was soon the victim of intrigues by his rivals, and his success at court was short-lived. His fine low relief of "Alexander and Diogenes" (*c.* 1671–93) never reached Versailles, other works planned for Versailles were either refused or frustrated, and Puget became embittered by these failures.

Puget Sound, deep inlet of the eastern North Pacific indenting northwest Washington state, U.S. It stretches south for 100 miles (160 km) from Admiralty Inlet and Whidbey Island (beyond which lie the straits of Georgia and Juan de Fuca). Hood Canal is a large western extension. The sound is the submerged northern end of the Cowlitz-Puget trough, which extends for some 350 miles (565 km) between the Cascade Range and the Coast Ranges. The southern end of this trough is the Willamette River valley. Many streams enter the sound from the east, of which the Skagit, Snohomish, and Duwamish Waterway are navigable for a portion of their lengths. Puget Sound has many excellent deepwater harbours, including Seattle, Tacoma, Everett, and Port Townsend, which serve as outports for rich farmlands along the river estuaries. Bremerton's naval shipyard adds military shipping to the large volume of local and international trade. The sound also serves as the southern terminus of the Inside Passage to Alaska. It provides a sheltered playground for pleasure boats and still yields a salmon catch, though the latter is much reduced from former levels.

The sound, called Whulge by the Indians, was explored in 1792 by British navigator George Vancouver; he named it for Peter Puget, a second lieutenant in his expedition, who probed the main channel.

Pugin, Augustus Welby Northmore (b. March 1, 1812, London, Eng.—d. Sept. 14, 1852, London), English architect, designer, author, theorist, antiquarian, and participant in the English Roman Catholic and Gothic revivals.

Pugin was the son of the architect Augustus Charles Pugin (1762–1832), who gave him his architectural and draftsmanship training. His mature professional life began in 1836 when he published *Contrasts,* which conveyed the argument with which Pugin was throughout his life to be identified, the link between the quality and character of a society with the calibre of its architecture. Pugin, who became a Roman Catholic in 1835, contended that decline in the arts was a result of a spiritual decline occasioned by the Reformation.

Between 1837 and 1840 Pugin enjoyed a growing architectural practice. His employment by John Talbot, Earl of Shrewsbury, and other Roman Catholic laymen and clergy resulted in his identification with the leadership of the Roman Catholic revival. His plans for St. Chad's Cathedral, Birmingham, and St. George's Cathedral, Southwark, show both the unsettled condition of his tastes and his imaginativeness and brilliance. The Church of St. Oswald, Old Swan, Liverpool (1839; demolished), was the finest of his designs of these years and the one that set the pattern for Gothic revival parish churches in England and abroad. His *True Principles of Pointed or Christian Architecture* (1841) was used by John Ruskin as a foundation for his criticism.

Pugin was at the crest of his productiveness between 1840 and 1844: his theoretical position on the need for a revival of Gothic was refined and relatively free of the religious bias that had earlier dominated it; his literary gifts were equal to his powers as an architectural caricaturist and illustrator; his circle of patrons loyally supported him. From these years come Pugin's splendid drawings for Balliol College, Oxford (1843), which convey the excitement and fervour of the Oxford Movement, the richly brilliant St. Giles, Cheadle, Staffordshire (1841–46), and extensive repairs and additions to Alton Towers, Staffordshire.

Pugin's last major works are his own house, The Grange, and St. Augustine's Church, both at Ramsgate, Kent. The Rolle family chapel at Bicton, Devon, the decorations of the House of Lords, and the chapel at St. Edmund's College, Old Hall Green, Hertfordshire, well represent the elegant, erudite yet original Gothic of which he was capable.

The death of his second wife in 1844 and the recurrence of an old illness cast a shadow over Pugin's last years. His practice declined as other architects emerged to serve Roman Catholic clients. During his last years he worked with Sir Charles Barry on the new Palace of Westminster.

BIBLIOGRAPHY. Phoebe Stanton, *Pugin* (1971), is a good introduction.

Puglia, also called APULIA, *regione,* southeastern Italy, extending from the Fortore River in the northwest to Cape Santa Maria di Leuca at the tip of the Salentine Peninsula (the "heel" of Italy), comprising the *provincie* of Foggia, Bari, Taranto, Brindisi, and Lecce, with a total area of 7,470 square miles (19,348 square km). The northern third of the region is centred on Puglia Tableland, flanked by the limestone massif of Gargano Promontory (the "spur" of the peninsula) and the Neapolitan Apennines (west). The central third is occupied by the low Murge plateau, limited in the west by a depression, the "fossa premurgiana," and sloping gradually to the narrow coastal plains of the Adriatic in the east. The Salentine Peninsula consists of the lowlands of Lecce, Taranto, and Brindisi and low plateaus east of Taranto and south of Lecce. The predominant rock material of Puglia is limestone, except on the coastline, which is mainly low and sandy. The only rivers of significance are the Fortore and the Ofanto, both in the north, but there are numerous springs, some under the sea near the coastline. Absence of surface water over large areas led to construction of the Apulian Aqueduct (1906–39), largest of its kind in Italy, which supplies the region with water from the Sele River on the western slope of the Apennine watershed.

Comprising the area of ancient Apulia and part of ancient Calabria, Puglia was ruled in the early European Middle Ages by Goths, Lombards, and Byzantines and knew its greatest glory under the Hohenstaufen emperors. It was a favourite of Frederick II, Holy Roman emperor, and Romanesque cathedrals and palaces bear witness to the flowering of Puglia at that time. Thereafter a long period of decline set in, accentuated by the neglect of the distant rulers (French, Spanish, Austrian, Neapolitan, Bourbon) and by Arab slave raids along the coast. In 1860 Puglia became part of the Italian kingdom.

The region is predominantly agricultural. Wheat and oats are grown on the plain and in the more fertile parts of the plateaus, while olives, grapes, almonds, figs, and vegetables predominate farther south; tobacco is a specialty of the Lecce Plain. The wines of Puglia are the strongest in Italy and are used to fortify other, lighter varieties. Fishing is carried on in many ports, particularly those of the Gargano Promontory and in Barletta, Monopoli, and Taranto. Nomadic sheepherding is still extensive, although it has decreased in importance with the expansion of the cultivated area. Salt is produced from seawater at Margherita di Savoia near Foggia, and bauxite is mined on the Gargano. While small food-processing industries are widespread, commerce and industry are largely concentrated at Bari (chemicals and petrochemicals), the regional capital; Taranto (iron and steel); and Brindisi and Barletta. Foggia is the main rail centre with connections to all parts of the peninsula. Pop. (1989 est.) 4,059,309.

Pugno, (Stéphane) Raoul (b. June 23, 1852, Montrouge, Fr.—d. Jan. 3, 1914, Moscow, Russia), French pianist, organist, composer, and teacher renowned particularly for his chamber recitals with violinist Eugène Ysaÿe.

Pugno studied with Georges Mathias (piano) and Ambroise Thomas (composition) at the Paris Conservatory from 1866 to 1869. He was organist at the Church of St. Eugène from 1872 to 1878, the church's choirmaster from 1878 to 1892, professor of harmony at the Conservatory from 1892 to 1896, and professor of piano from 1896 to 1901. He was also known as a composer, writing *opéras-comiques,* ballets, songs, and piano pieces. Not until 1893 did he begin going on concert tours, making his English debut in 1894, his American in 1897. In 1903 he made several recordings. It is for his performing that he is remembered; his teaching was more influential than his compositions.

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

Pugwash Conference, formally CONFERENCE ON SCIENCE AND WORLD AFFAIRS, any of a series of meetings of scientists from different countries of the world to discuss problems of nuclear weapons and world security. The first of the conferences met in July 1957 at the estate of the philanthropist Cyrus Eaton in the village of Pugwash, Nova Scotia, in response to an appeal by Bertrand Russell, Albert Einstein, Frédéric Joliot, and other prominent scientific figures. Subsequent conferences have been held in many countries including the Soviet Union, Great Britain, Yugoslavia, India, Czechoslovakia, Romania, Sweden, and the United States.

The chief concern of Pugwash has been to bring together leading scholars from many countries to discuss ways of reducing armaments and tempering the arms race. Another purpose has been to examine the social responsibility of scientists toward such world problems as economic development, population growth, and environmental destruction.

The activities are sponsored by national Pugwash groups under the guidance of an international Continuing Committee headed by a secretary-general with an office in London. During the years since its founding, the Pugwash movement has issued a number of reports on problems of arms control and disarmament. Its spokesmen have credited these with helping to prepare the way for the major international treaties limiting the development and testing of nuclear weapons.

Puig, Manuel (b. Dec. 28, 1932, General Villegas, Arg.—d. July 22, 1990, Cuernavaca, Mex.), Argentine novelist and motion-picture scriptwriter. He was at one time a translator and language teacher.

Puig learned English as a child by seeing every American film he could. He went to Rome in 1957 to study film directing and resided for a time in Stockholm and London. When Puig returned to Buenos Aires his film scripts were not well received, and he decided that the cinema was not to be his only career.

His first novel, *La traición de Rita Hayworth* (1968; *Betrayed by Rita Hayworth*), captures the sterile life of a typical middle-class family of the Argentine provinces. He used shifting points of view, flashbacks, interior monologue, and a language laden with ironic possibilities to portray the frustration and alienation of his characters, whose only escape is offered by the vacuous world of films and pop art. The style of his second novel, *Boquitas pintadas* (1969; "Painted Little Mouths"; Eng. trans. *Heartbreak Tango*), parodies the serialized novels that are popular in Argentina. *The Buenos Aires Affair* (1973; Eng. trans., 1976) is a detective novel describing the psychopathic behaviour of characters who are sexually repressed. *El beso de la mujer araña* (1976; *Kiss of the Spider Woman*) is a novel told in dialogues between a middle-aged homosexual and a younger revolutionary who are detained in the same jail cell. The book's denunciation of sexual and political repression, treated poetically and with an uncommon degree of tenderness, contributed to its success. His later books included *Pubis angelical* (1979; "Angelic Pubis") and *Maldición eterna a quien lea estas páginas* (1980; *Eternal Curse on the Reader of These Pages*). The major novels were translated into more than a dozen languages, and several of his film scripts won awards.

puja, also spelled POOJA, or POOJAH, Sanskrit PŪJĀ, in Hinduism, ceremonial worship, ranging from brief daily rites in the home to elaborate temple ritual. The components of a puja vary greatly according to the sect, community, part of the country, time of day, needs of the worshiper, and religious text followed. Generally speaking, in a puja, a deity, manifested in his image, is accorded the honour given to a royal guest. The attentions (*upacāras*) paid to him begin in the morning, when he is gently roused from sleep, and extend through the day, including ritual bathing and dressing, the serving of the usual three meals, and the final ceremony of putting him to bed for the night.

A puja may also include a circumambulation (*pradakṣiṇa*) of the image or shrine and, in an elaborate ritual, a sacrifice (*bali*) and oblation to the sacred fire (*homa*). Special ceremonies according to the festival calendar may also be observed, such as swinging the god or playing games according to the season.

Some pujas may be performed by the worshiper alone, while others may require the services of a ritually pure person such as a priest. A puja may be performed for a specific announced purpose or simply as an act of devotion.

Scholars are not certain of the origin of the word *puja*. One explanation relates it to the Dravidian *pūcu*, or *pūsu* ("to paint, daub, smear"), and those holding to that theory find in the widespread practice of daubing sacred objects with oil and red and yellow colour a substitute for the application of blood, the intent being to avert evil influence.

Pukaki, Lake, lake in central South Island, New Zealand, occupying 65 square miles (169 square km) of a valley dammed by a terminal moraine (glacial debris). The lake, 1,640 feet (500 m) above sea level, receives the Tasman and Hooker rivers, which draw some of their waters from melting glaciers east of the Southern Alps; its total drainage basin is 523 square miles (1,355 square km). Pukaki is 5 miles (8 km) wide and 9.5 miles (15 km) long. It drains southward by the Pukaki River; a dam at the outlet, near the town of Lake Pukaki, regulates the lake's surface elevation as it releases water to power hydroelectric stations on the Waitaki River. *Pukaki* is a Maori term meaning "bunched-up water."

Pukaskwa National Park, national park, central Ontario, Canada, on the northeastern shore of Lake Superior. Established in 1971, it is the province's largest national park, with an area of 725 square miles (1,878 square km). Pukaskwa includes areas of rugged Canadian Shield wilderness, as well as 50 miles (80 km) of the shoreline of Lake Superior, with rocky islets and coves and spectacular cliffs; there are many small lakes and streams within the park. Some excavations of prehistoric Indian remains have been made. Wildlife includes beaver, muskrat, timber wolf, black bear, marten, fisher, mink, lynx, white-tailed deer, moose, and woodland caribou. The park has vast forests of white and black spruce, jack pine, poplar, and birch.

puku, antelope species of the genus *Kobus* (*q.v.*).

Pula, Italian POLA, major port and industrial centre and seat of the *kotar* regional administration in Croatia, Yugoslavia, at the southern

Roman amphitheatre, Pula, Yugos.
Art Resource—EB Inc.

tip of the Istria at the head of the Bay of Pula. It is linked to Trieste and Ljubljana by road and rail. Pula has a large, almost landlocked harbour in which there is a naval base and the Uljanik shipyards.

Conquered by Rome in the 2nd century BC, Pula by the 2nd century AD was the seat of a Christian bishop, and in later centuries it was part of the territories of Byzantium, of the Franks, and of Venice. In 1380 the Genoese exacted revenge raids on Pula. For some 400 years Pula declined in importance, until the 19th century. Plagues reduced the population to only hundreds in the 1630s. Austria took the town in 1797; after 1866 it became the main harbour and arsenal of the Austro-Hungarian navy. It passed to Italy in 1920 and after 1947 became part of Yugoslavia.

The town's outstanding monument is the elliptical Roman amphitheatre completed about AD 80 and seating 23,000. A temple of Augustus and a Byzantine basilica were extensively restored after the destructive conflict between Genoa and Venice. The Kaštel, on the hill at the centre of the old town, is a museum, previously a fortress of Rome, Venice, France, and Austria in turn.

Manufactures include machinery, textiles, cement, and glass. Pop. (1981 prelim.) mun., 77,278.

Pułaski, Kazimierz, English CASIMIR PULASKI (b. March 4, 1747, Winiary, Pol.—d. Oct. 11?, 1779, at sea, between Savannah, Ga., and Charleston, S.C., U.S.), Polish patriot and U.S. colonial army officer, hero of the Polish anti-Russian insurrection of 1768 (the Confederation of Bar) and of the American Revolution.

Having distinguished himself in the defense of Berdichev (1768) and Częstochowa (1770–71) against the Russians, Pułaski unsuccessfully attempted to kidnap King Stanisław II to the confederates' camp (October 1771) and was falsely accused of trying to murder the king. After the Prussian and Austrian invasion of Poland in the spring of 1772, Pułaski left Częstochowa for Saxony; he later moved to France and lived in financial straits.

In December 1776, in Paris, Pułaski met the American statesman Benjamin Franklin, who recommended him to General George Washington. Pułaski landed in America in June 1777. In Washington's army he served at Brandywine, was made general and chief of cavalry by Congress, and fought at Germantown and in the winter campaign of 1777–78. The Pułaski Legion, a mixed corps he formed in 1778, exploited his experience in guerrilla warfare. In May 1779 he defended Charleston. Wounded at Savannah on Oct. 9, 1779, he died aboard the *Wasp* en route to Charleston.

BIBLIOGRAPHY. Biographies include Wladyslaw Konopczyński, *Casimir Pulaski* (1947); and Clarence A. Manning, *Soldier of Liberty: Casimir Pulaski* (1945).

Pulcher, Publius Claudius: *see* Claudius Pulcher, Publius.

Pulcher, Publius Clodius: *see* Clodius Pulcher, Publius.

Pulcheria (b. Jan. 19, 399, Constantinople [now Istanbul, Tur.]—d. 453), Roman empress, regent for her younger brother Theodosius II (Eastern Roman emperor 408–450) from 414 to about 416, and an influential figure in his reign for many years thereafter.

Pulcheria's parents were the Eastern Roman emperor Flavius Arcadius (reigned 383–408) and his wife, Eudoxia. Pulcheria assumed the regency upon her appointment as augusta on July 4, 414, and the court she ruled was characterized by extreme piety and chastity. In 421 she arranged the marriage of Theodosius with Athenais, who assumed the name Eudocia. But the two women quarreled about 440, and Eudocia in 443 withdrew permanently to Jerusalem. The grand chamberlain Chrysaphius then acquired the dominant influence over Theodosius. When this adviser fell from power shortly before Theodosius' death (in July 450), Pulcheria again came into

Pulcheria, gold coin; in the British Museum
The Mansell Collection

prominence. She selected Marcian as Theodosius' successor and agreed to become his nominal wife in order to preserve the Theodosian dynasty.

Throughout her life Pulcheria remained a devout Christian. On Oct. 25, 451, she attended the Council of Chalcedon and was loudly acclaimed by the bishops assembled there. She built several churches in Constantinople and left all her possessions to the poor.

Pulci, Luigi (b. Aug. 15, 1432, Florence [Italy]—d. November? 1484, Padua, Republic of Venice), Italian poet whose name is chiefly associated with one of the outstanding epics of the Renaissance, *Morgante*, in which French chivalric material is infused with a comic spirit born of the streets of Florence. The use of the ottava rima stanza for the poem helped establish this form as a vehicle for works of a mock-heroic, burlesque character.

For many years Pulci lived under the protection of the Medici family, especially Lorenzo the Magnificent, who first introduced him into the circle of poets and artists that was gathering round him and later, after assuming power, entrusted him with various embassies and diplomatic missions. Nevertheless, poverty and other hardships caused him, when about 38 or 40, to enter the service of a north-

Pulci, detail from a fresco by Filippino Lippi, 1482–90; in the Brancacci Chapel, Sta. Maria del Carmine, Florence

Alinari—Art Resource/EB Inc.

ern condottiere, Roberto Sanseverino, with whom he remained until his death.

Pulci's literary output, all in Italian, was very large. His masterpiece is the *Morgante,* or *Morgante Maggiore,* an epic in 23 cantos, later expanded to 28, begun about 1460, of which the earliest surviving complete edition is dated 1483. This work's mainly comic and burlesque tone is varied by a more serious mood in which the author expresses at times deep and sincere feeling, at times a bitter experience of life. Similarly, Pulci's ambivalent attitude toward morals, shaped by an age that considered success the criterion of salvation, contrasts with his deeply felt religious concerns, which constitute a large part of the poem. This complexity and richness of feeling makes the *Morgante* both one of the most original poems in Italian literature and an essential text for understanding the Renaissance.

The first of the 28 cantos was translated by Lord Byron in 1823. D. De Robertis' *Morgante e lettere* (1962) is a modern edition.

Pulcinella (puppetry): *see* Punch.

puli, small Hungarian sheep-dog breed taken to Hungary about 1,000 years ago by the Magyars. A nimble and vigorous dog, the puli has a long, fine-textured coat that is especially shaggy on the head and muzzle. The coat is

Puli

Sally Anne Thompson—EB Inc.

unusual in forming mats, or cords, through the natural tangling of a soft undercoat with the long outer coat. The most characteristic colour is a unique dull black, either slightly grayed or tinged with bronze; the coat may also be solid gray or white. The puli stands 16 to 19 inches (41 to 48 cm) and weighs about 30 pounds (13.5 kg).

Pulicat Lake, saltwater lagoon on the Coromandel Coast of Andhra Pradesh state, southern India. It extends from the extreme southeastern portion of Andhra Pradesh into the adjacent portion of Tamil Nādu state and has a length of about 30 miles (50 km) and a width of 3–10 miles (5–16 km). The lake is located on the swampy, sandy Andhra plains, and the surrounding area is sparsely settled. Towns along the lake include Armagon (Dugarāju-patnam) and Pulicat. The lake yields salt and prawns. Srīharikota Island separates Pulicat Lake from the Bay of Bengal. The only sea entrance into the lake is north of Pulicat town.

Pulitzer, Joseph (b. April 10, 1847, Makó, Hung.—d. Oct. 29, 1911, Charleston, S.C., U.S.), American newspaper editor and publisher who helped establish the pattern of the modern newspaper. In his time he was one of the most powerful journalists in the United States.

Reared in Budapest, Pulitzer sought a military career and emigrated to the United States in 1864 as a recruit for the Union Army in

Pulitzer, detail of a portrait by C. de Grimm from *The Curio,* November 1887

By courtesy of the Library of Congress, Washington, D.C.

the American Civil War (1861–65). After the war he went to St. Louis, where in 1868 he became a reporter on a German-language daily newspaper, the *Westliche Post.* In 1871 he bought a share of that paper but soon resold it at a profit. Pulitzer had meanwhile become active in politics, and he was elected to the Missouri state legislature in 1869. In 1871–72 he helped to organize the Liberal Republican Party in Missouri, which nominated Horace Greeley for president in 1872. After the party's subsequent collapse, Pulitzer became and remained a lifelong Democrat.

In 1874 Pulitzer acquired another St. Louis German paper, the *Staats-Zeitung,* and advantageously sold its Associated Press franchise to the St. Louis *Globe* (later *Globe-Democrat*). Four years afterward he gained control of the St. Louis *Dispatch* (founded 1864) and the *Post* (founded 1875) and merged them as the *Post-Dispatch,* soon the city's dominant evening newspaper. On Oct. 5, 1882, Pulitzer's chief editorial writer shot to death a political opponent of the *Post-Dispatch.* Public reprobation and his own ill health prompted Pulitzer to shift his newspaper interests to New York City, where he purchased (May 10, 1883) a morning paper, the *World,* from the financier Jay Gould. He soon turned that paper into the leading journalistic voice of the Democratic Party in the United States. Pulitzer founded the *World's* evening counterpart, the *Evening World,* in 1887.

In his newspapers Pulitzer combined exposés of political corruption and crusading investigative reporting with publicity stunts, blatant self-advertising, and sensationalistic journalism. In an effort to further attract a mass readership, he also introduced such innovations as comics, sports coverage, women's fashion coverage, and illustrations into his newspapers, thus making them vehicles of entertainment as well as of information.

The *World* eventually became involved in a fierce competition with William Randolph Hearst's *New York Morning Journal,* and the blatant sensationalism that both newspapers resorted to in espousing the Spanish-American War of 1898 led to the coining of the term "yellow journalism" to describe such practices. Failing eyesight and worsening nervous disorders forced Pulitzer to abandon the management of his newspapers in 1887. He gave up his editorship of them in 1890, but he continued to exercise a close watch over their editorial policies.

In his will Pulitzer endowed the Columbia University School of Journalism (opened 1912) and established the prestigious Pulitzer prizes, awarded annually since 1917.

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Pulitzer Prize, any of a series of annual awards given originally for outstanding public service and achievement in American journalism and letters and later in music. The prizes, endowed with a gift of $500,000 from the newspaper magnate Joseph Pulitzer, are highly esteemed and have been awarded each May since 1917. Pulitzer's gift, administered by the trustees of Columbia University, provides for eight prizes in the field of journalism—for the most meritorious public service performed by a newspaper, the best local reporting, the best local reporting done without pressure of a deadline, the best reporting of national news, the most distinguished reporting of international affairs, the most distinguished editorial, the best cartoon, and the best news photograph. Five prizes are awarded for American literature—for the best novel, preferably with an American theme, the best play, the finest volume of poetry, the most distinguished work on American history, and the best biographic or autobiographic work with a theme of public service or patriotism. Since 1943, a prize has also been awarded for the best musical composition. Winners of the Pulitzer Prize in journalism have included war correspondent Ernie Pyle (1944) and cartoonist Bill Mauldin (1945, 1959). The prizes in literature have been awarded to many important figures in 20th-century American letters.

Pulkovo Observatory, astronomical observatory founded in 1839 near St. Petersburg (now Leningrad). Its founder and first director, under the patronage of the Russian emperor Nicholas I, was Friedrich Georg Wilhelm von Struve. The 38-centimetre (15-inch) refracting telescope was in 1839 the largest in the world, and the observatory was notable from the beginning for the quality of observations made there. In 1878 a 76-centimetre (30-inch) refractor was built, the largest in the world for about 10 years. Destroyed during World War II, the observatory was rebuilt and reopened in 1954.

pulley, in mechanics, a wheel that carries a flexible rope, cord, cable, chain, or belt on its rim. Pulleys are used singly or in combination to transmit energy and motion. Pulleys with grooved rims are called sheaves. In belt drive, pulleys are affixed to shafts at their axes, and power is transmitted between the shafts by means of endless (ends joined together) belts running over the pulleys. One or more independently rotating pulleys can be used to gain mechanical advantage, especially for lifting weights. The shafts about which the pulleys turn may affix them to frames or blocks, and a combination of pulleys, blocks, and rope or other flexible material is referred to as a block and tackle. Archimedes (3rd century BC) is reported to have used compound pulleys to pull a ship onto dry land. Together with the lever, wedge, wheel and axle, and screw, the pulley is considered one of the five simple machines. *See also* belt drive; block and tackle.

Pullman, city, Whitman County, southeastern Washington, U.S., at the edge of a major wheat belt, on the South Fork of the Palouse River, near Moscow, Idaho, and the Idaho state line. It was settled in 1875 by Bolin Farr, who laid out the town of Three Forks in 1882 at the confluence of three creeks. Renamed for George M. Pullman (of railroad sleeping car fame), it was reached by a railroad spur in 1885 and suffered a disastrous fire in 1890. Later, it became a major stop on the Northern Pacific Railway and developed as a shipping point for grain and livestock. Washington State University (which began there in 1892 as an agricultural college) adds significantly to the city's economy. Inc. 1888. Pop. (1986 est.) 24,022.

Pullman, George M(ortimer) (b. March 3, 1831, Brocton, N.Y., U.S.—d. Oct. 19, 1897, Chicago), American industrialist and inventor of the Pullman sleeping car for use on railroads.

Pullman
Brown Brothers

Pullman moved to Chicago in 1855, accumulated some capital as a contractor, and began to devise a sleeping car. The first real Pullman car, the "Pioneer," invented jointly with Pullman's friend Ben Field, appeared in 1865. It contained folding upper berths and seat cushions that could be extended to make lower berths. Pullman became president of the Pullman Palace Car Company, organized in 1867, which built sleeping cars and operated them under contract to the railroads.

To house his employees he built the town of Pullman, located south of Chicago (and later incorporated in it). The town (most of which remains unchanged) includes both public buildings, such as the impressive Victorian-style Florence Hotel and a greenstone church, and private dwellings. The paternalistic company-owned town was a widely discussed social experiment.

Pullman Strike (May 11, 1894–*c.* July 20, 1894), in U.S. history, widespread railroad strike that focused attention upon the application of U.S. antitrust laws to activities by labour unions.

The Panic of 1893 had caused the Pullman Palace Car Company to cut wages by about 25 percent. At Pullman, its company town near Chicago, no corresponding reduction was made in rents and other charges, which led to a local strike initiated May 11, 1894, by members of the American Railway Union. After the company president, George M. Pullman, had refused arbitration of the dispute, the union's national council, led by its president, Eugene V. Debs, called for a nationwide boycott of Pullman cars. Sympathy strikes by union locals occurred in 27 states and territories from Ohio to California, and violence of disputed origin and intensity broke out, centring in Chicago. Governor John P. Altgeld of Illinois, sympathetic toward the strikers, refused to call out the militia. On July 2, in part acceding to railroad management requests, U.S. Attorney General Richard Olney procured an injunction from federal judges to halt acts impeding mail service and interstate commerce; on July 4, President Grover Cleveland, acting on Olney's advice, ordered 2,500 federal troops to Chicago. The strike ended within the week, and the troops were recalled July 20. When Debs was convicted of contempt of court and conspiring against interstate commerce, leaders of both industry and organized labour recognized that the Sherman Antitrust Act could be enforced against unions and, even more ominous from the viewpoint of labour, federal injunctions could be employed to defeat action by the unions.

pulmonary alveolus, plural PULMONARY ALVEOLI, any of the small air spaces in the lungs where carbon dioxide leaves the blood and oxygen enters it. Air, entering the lungs during inhalation, travels through numerous passageways called bronchi and then flows into approximately 300,000,000 alveoli at the ends of the bronchioles, or lesser air passages. During exhalation, the carbon-dioxide-laden air is forced out of the alveoli through the same passageways.

The alveoli form clusters, called alveolar sacs, that resemble bunches of grapes. By the same analogy, the alveolar ducts leading to the sacs are like the stems of individual grapes, but, unlike grapes, the alveolar sacs are pocketlike structures made up of several individual alveoli.

The thin walls of each alveolus, containing numerous capillaries, are the sites of gas exchange, which occurs by diffusion. The relatively low solubility (and hence rate of diffusion) of oxygen necessitates the large internal surface area (about 80 square m [96 square yards]) and very thin walls of the alveoli. Weaving between the capillaries and helping to support them is a meshlike fabric of elastic and collagenous fibres. The collagen fibres, being more rigid, give the wall firmness, while the elastic fibres permit expansion and contraction of the walls during breathing.

Among the cells found in the alveolar walls are a group called granular pneumocytes (Type II cells), which secrete a film of fatty substances believed to contribute to the lowering of alveolar surface tension. Without this coating, the alveoli would collapse and very large forces would be required to re-expand them. Another type of cell, known as an alveolar macrophage, wanders about in the air cavities of the alveoli, the alveolar ducts, and bronchioles. They are mobile scavengers that serve to engulf foreign particles in the lungs, such as dust, bacteria, carbon particles, and blood cells from injuries.

Consult
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pulmonary circulation, system of blood vessels that forms a closed circuit between the heart and the lungs, as distinguished from the systemic circulation between the heart and all other body tissues. On the evolutionary cycle, pulmonary circulation first occurs in lungfishes and amphibians, the first animals to acquire a three-chambered heart. The pulmonary circulation becomes totally separate in crocodilians, birds, and mammals, when the ventricle is divided into two chambers, producing a four-chambered heart. In these forms the pulmonary circuit begins with the right ventricle, which pumps deoxygenated blood through the pulmonary artery. This artery divides above the heart into two branches, to the right and left lungs, where the arteries further subdivide into smaller and smaller branches until the capillaries in the pulmonary air sacs (alveoli) are reached. In the capillaries the blood takes up oxygen from the air breathed into the air sacs and releases carbon dioxide. It then flows into larger and larger vessels until the pulmonary veins (usually four in number, each serving a whole lobe of the lung) are reached. The pulmonary veins open into the left atrium of the heart. *Compare* systemic circulation.

pulmonary embolism, obstruction of a pulmonary artery or one of its branches. The pulmonary arteries carry blood from the right side of the heart to the lungs. A pulmonary embolism may be the result of a blood clot that has formed elsewhere, has broken loose, and has traveled through the circulatory system to the point of obstruction; or it may be due to some other obstruction, such as fat or a bubble of air.

pulmonary emphysema (lung disorder): *see* emphysema.

pulmonary heart disease, also called COR PULMONALE, enlargement and eventual failure of the right ventricle of the heart because of disorders of the lungs, or of the blood vessels of the lungs or because of abnormalities of the chest wall.

The most common causes of chronic cor pulmonale are chronic bronchitis and emphysema, an abnormal distension of the lungs with air. The condition is such that the network of capillaries in the lungs is progressively destroyed, causing pressure in the pulmonary artery—the artery carrying blood from the right ventricle to the lungs—to be increased. The resultant back pressure on the right ventricle increases the work and the size of the chamber, leading to heart enlargement and eventually, if uncorrected, heart failure. Acute cor pulmonale may be produced by an embolism, such as a blood clot, in a pulmonary vessel.

A person with pulmonary heart disease has a chronic cough, experiences difficulty in breathing after exertion, wheezes, and is weak and easily fatigued. Fluid may collect in the legs; pain may be felt in the right upper portion of the abdomen; digestive disturbances may be noted; the neck veins are distended; and the fingertips may be clubbed.

Treatment of the acute form of the disease is often by removal of the pulmonary blockage. Treatment of chronic cor pulmonale includes the use of antibiotics to combat respiratory infection and the use of a respirator to ease the sufferer's breathing, the restriction of sodium intake, and administration of diuretics and digitalis.

pulmonary stenosis, narrowing of either the pulmonary valve—the valve through which blood flows from the right ventricle, or lower chamber, of the heart on its way to the lungs—or the infundibulum, or of both. The infundibulum (Latin: "funnel") is the funnel-shaped portion of the right ventricle that opens into the pulmonary artery. Its narrowing is also called infundibular stenosis. Pulmonary stenosis is usually a congenital defect and may be associated with other cardiovascular congenital defects.

Persons may have mild pulmonary stenosis without being conscious of the defect or may experience difficulty in breathing and have a tendency to faint after exertion. Characteristic heart sounds lead to the diagnosis.

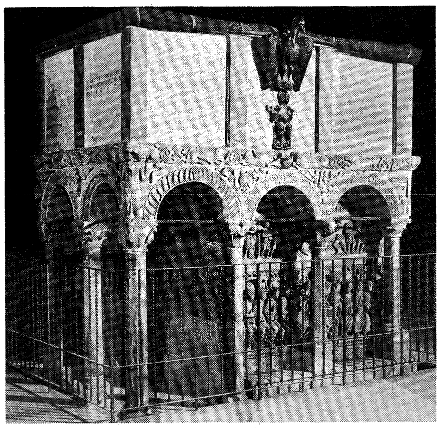
If the stenosis is severe, the right ventricle is enlarged and under abnormal pressure in the effort to maintain normal blood flow to the lungs. Failure to maintain adequate blood flow—right-sided heart failure—causes increased pressure in the peripheral veins, enlargement of the liver, cyanosis (a bluish tinge to the skin), and accumulation of fluid in the legs. The treatment for severe pulmonary stenosis is the surgical correction of the defect.

pulmonate (subclass Pulmonata), any of various land and freshwater (a few marine) snails, class Gastropoda, that breathe by means of a "lung"—a saclike modification of the mantle cavity. The slugs lack an external shell, but most pulmonates have a spiral shell that may be attenuated or flattened. They are anatomically more advanced than other snails: all are detorted (bilaterally symmetrical, with an unlooped nerve cord) as adults, and the auricle of the heart is anterior to the ventricle. All are hermaphroditic—*i.e.,* with both male and female reproductive organs in one animal.

pulp, paper: *see* paper pulp.

pulpit, in Western church architecture, an elevated and enclosed platform from which the sermon is delivered during a service.

Beginning in about the 9th century two desks called ambos were provided in Christian churches—one for reading from the Gospels, the other for reading from the Letters. The former, which became increasingly ornate, was the forerunner of the pulpit. By the 13th century what could be called modern pulpits were being installed in Italian churches.



Stone pulpit, San Ambrogio, Milan, late 12th century
Alinari—Art Resource/EB Inc.

In a cruciform church, with the altar traditionally at the east end, the pulpit may be geographically located on the north side of the nave. Often it is erected against a pillar and sometimes upon a short, free-standing base or slender column. Usually hexagonal or octagonal in form, it is reached by a short flight of steps. There may be a tester, or canopy, above it, serving as a decorative sounding board. English pulpits often have two or three stories, with the lowest for a clerk, the middle one for a reading desk, and the third for the preaching of the sermon. There are also external, outdoor pulpits that are entered from within the church. Elevated desks in refectories, from which monks read during meals, are sometimes also called pulpits.

Pulpits have been executed in every style and from every building material that was in vogue at the time of their execution, from elaborately carved stone to intricate forms in wrought iron. As Protestant sects developed and began to build their own churches, the pulpit became inseparable from the reading desk. It was centrally placed on a platform at the end of the church facing the congregation and was, in some cases, occupied by the minister throughout the service.

pulque, Mexican beer, cloudy and whitish in appearance, with sour buttermilk-like flavour, and about 6 percent alcohol content. It is made from fermented *agua miel* ("honey water"), the sap of the agave, or maguey, plant (often called century plant), collected by cutting the flower bud from a four- to six-year-old plant, leaving a basinlike cavity. After several months the cavity walls and surrounding leaf bases are scraped, the first sap is drawn, and the plant refills, providing up to 15 pints a day until it dies. The sap, containing approximately 10 percent sugar, is fermented in vats for several days, often with the addition of previously fermented pulque (*madre pulque*) to hasten the process.

The freshly fermented beverage is consumed unaged, still containing suspended yeast cells, sometimes with added fruit-juice flavouring (*pulque curado*). It is sold in containers, sometimes pasteurized before bottling, or by the barrel to drinking houses (*pulquerías*). An important and inexpensive source of carbohydrates, amino acids, and vitamins for Mexico's lower-income population, pulque may in some regions provide the major liquid intake during the dry season.

pulsar, in full PULSATING RADIO STAR, any of a class of cosmic objects that emit extremely regular pulses of radio waves; a few such objects are known to give off short rhythmic bursts of visible light, X rays, and gamma radiation as well.

Pulsars are thought to be rapidly spinning neutron stars, extremely dense stars composed almost entirely of neutrons and having a diameter of only 20 km (12 miles) or less. A neutron star is formed when the core of a violently exploding star called a supernova collapses inward and becomes compressed together. Neutrons at the surface of the star decay into protons and electrons. As these charged particles are released from the surface, they enter an intense magnetic field that surrounds the star and rotates along with it. Accelerated to speeds approaching that of light, the particles give off electromagnetic radiation by synchrotron emission. This radiation is released as intense beams from the pulsar's magnetic poles.

These magnetic poles do not coincide with the rotational poles, and so the rotation of the pulsar swings the radiation beams around. As the beams sweep regularly past the Earth with each complete rotation, an evenly spaced series of pulses is detected by ground-based telescopes.

Antony Hewish and Jocelyn Bell, astronomers working at the University of Cambridge, first discovered pulsars in 1967 with the aid of a radio telescope specially designed to record very rapid fluctuations in radio sources. Subsequent searches have resulted in the detection of more than 300 pulsars. A significant percentage of these objects are concentrated toward the plane of the Milky Way Galaxy, the enormous galactic system in which the Earth is located.

Although all known pulsars exhibit similar behaviour, they show considerable variation in the length of their periods—*i.e.,* the intervals between successive pulses. The periods of the slowest pulsars so far observed are about four seconds in duration. The fastest, the Millisecond Pulsar (discovered in 1982), has a period of 0.00155 second, or 1.55 milliseconds, which is considerably shorter than that of any known pulsar. It has been determined that the Millisecond Pulsar is spinning 642 times per second. This is close to the theoretical limit for a pulsar because a neutron star rotating only four times faster would fly apart as a result of "centrifugal force" at its equator, notwithstanding a gravitational pull so strong that the star's escape velocity is about half the speed of light.

Careful timing of radio pulsars shows that they are slowing down very gradually at a rate of typically a millionth of a second per year. The ratio of a pulsar's present period to the average slow-down rate gives some indication of its age. This so-called timing age is in close agreement with the actual age of the one pulsar whose time of birth is known independently: the Crab Pulsar, which was formed during a supernova explosion observed in AD 1054. The Crab Pulsar is the youngest known, followed by the Vela Pulsar that has a projected timing age of 11,000 years.

The Crab and Vela pulsars are losing rotational energy so precipitously that they also emit radiation of shorter wavelength. The Crab Pulsar appears in optical photographs as a moderately bright (magnitude 16) star in the centre of the Crab Nebula. Soon after the detection of its radio pulses in 1968, astronomers at the Steward Observatory in Arizona found that visible light from the Crab Pulsar flashes at exactly the same rate. The star also produces regular pulses of X rays and gamma rays. The Vela Pulsar is much fainter at optical wavelengths (average magnitude 24) and was observed in 1977 during a particularly sensitive search with the large Anglo-Australian Telescope situated at Parkes, Australia. It also emits X rays though it does not seem to pulse at those wavelengths. The Vela Pulsar does, however, give off gamma rays in regular pulses and is the most intense source of such radiation in the sky.

Older radio-emitting pulsars are slowing down at a lesser rate than the young ones and have long periods. Moreover, it has been determined on the basis of timing ages that pulsars "switch off" after about 10 million years when their magnetic fields have weakened appreciably. The number of pulsars detected relatively close to the Sun indicates that there must be some one million active pulsars in the Milky Way Galaxy. These two figures taken together suggest that an object of this kind must be born every 10 years, a rate which is inexplicably five times greater than the rate of occurrence of supernovae generally thought to produce neutron stars.

pulsating radio source: *see* pulsar.

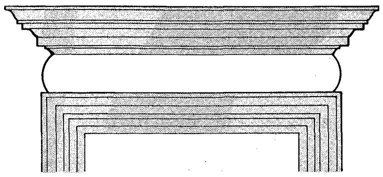
pulse, arterial pressure wave generated by the opening and closing of the aortic valve in the heart. This wave can be felt by applying firm fingertip pressure to the skin at sites where the arteries travel near the skin's surface; it is more evident when surrounding muscles are relaxed. The pulse is more defined at pulse points close to the heart, where several distinct sections of the wave can be distinguished. Common pulse points include the carotid artery of the neck, the brachial artery inside the elbow, and the radial artery in the wrist.

The association of pulse with the action of the heart was recognized by the ancient Egyptians, and it remains a valuable indicator of cardiac function in modern medicine. Pulse rate, strength, and rhythm and the contour of the pulse wave all provide valuable diagnostic information; for example, the regular alteration between strong and weak pulses can indicate life-threatening heart failure. It is also important that pulse information be used in connection with the individual's medical history. A rapid pulse, for example, may indicate serious cardiac disease, a relatively innocuous fever, or simply vigorous exercise; a slow pulse may be a result of head injuries, but it is also normal in highly trained athletes with exceptional heart function.

Pulse rates vary from person to person and from country to country. The normal pulse rate of an adult at rest may range from 50 to 85 beats per minute, although the mean rate is about 70 to 72 for men and 78 to 82 for women. In infants the rate ranges from 110 to 140; the rate decreases with age, and the rate for adolescents is 80 to 90; the normal rate for the elderly may be 50 to 70.

Pulteney, William: *see* Bath, William Pulteney, 1st Earl of.

pulvinated frieze, in Classical architecture, frieze that is characteristically convex, appearing swollen or stuffed in profile. This type of frieze, or entablature midsection, located below the cornice and above the architrave, is most often found in the Ionic order of Clas-



A Roman pulvinated frieze

From M.S. Briggs, *Everyman's Concise Encyclopaedia of Architecture;* E.P. Dutton & Co., Inc., and J.M. Dent & Sons Ltd.

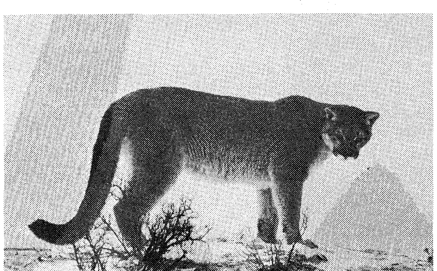
sical decoration. Its surface treatment may be absolutely plain or ornately carved or painted. There are examples of the pulvinated frieze in late Roman designs, as in the Pantheon in Rome; and it is frequently featured in the works of Italian Renaissance architects. The pulvinated frieze, the name of which is derived from the Latin word *pulvinus* ("pillow"), is also sometimes called the pillowed or cushioned frieze.

Pulzone, Scipione, also spelled SCIPIO POLZONE, or PULZONI, also called IL GAETANO (b. *c.* 1550, Gaeta, near Naples—d. Feb. 1, 1598, Rome), Italian Renaissance painter whose early work typified the 16th-century International style. In his painting of the "Assumption of the Virgin" (1585; Rome), Pulzone displayed references to pre-Mannerist, Venetian, and Sienese traditions in his style of religious figuration.

The artist painted many of the aristocracy and clerics of Rome. The "Portrait of Cardinal Alessandro Farnese" (National Gallery, Rome) and "Portrait of a Cavalier" (Galleria Nazionale d'Arte Antica, Rome) are characteristic of his work. Although little is known of Pulzone's personal life, it is believed that he was a pupil of Jacopino del Conte.

puma, also called AMERICAN LION, COUGAR, DEER TIGER, MEXICAN LION, PANTHER, PAINTER, MOUNTAIN LION, or CATAMOUNT (*Felis concolor*), large, graceful cat, family Felidae, exceeded in size only by the jaguar among cats of the New World. The name puma is derived from usage by the Inca Indians. The puma ranges widely from British Columbia to Patagonia in habitats as varied as mountains, deserts, and jungles. In many regions, however, local races or subspecies have been eliminated by humans, and pumas are now generally restricted to wilderness areas. The eastern puma (*F.c. cougar*) of North America and the Florida cougar (*F.c. coryi*) of the southern United States are considered endangered.

A wide range of coloration exists among pumas, from pale buff to reddish brown. The ears and tail tip are generally dark, while the rump and belly are white. There is no mane. The weight of the adult ranges from about 35 to more than 100 kilograms (77 to 220 pounds). A large male may be about 3 metres



Puma (*Felis concolor*)

Kenneth W. Fink—Root Resources

(9 feet) long, one-third of which is tail, and may stand 60–75 centimetres (24–30 inches) tall at the shoulder. The female is smaller.

The voice of the puma is like that of a domestic cat, but louder; its mating call is a harsh scream. Breeding occurs at any time of year, the female usually bearing young every other year. A litter consists of one to five spotted kittens born after a gestation period of about 90 days. The young are playful and begin to follow the female on hunts in about two months. Sexual maturity is attained at two or three years.

The puma eats a wide range of foods; in North America it shows a preference for deer when they are available. Occasionally it kills livestock, but like other predators it is valuable in maintaining the balance of nature by preventing overpopulation of prey animals.

The puma is hunted, for bounty or for sport, by such means as dogs, traps, and open pits. As there are few authentic reports of attacks on people, it is not considered a particularly dangerous animal.

pumhart (musical instrument): *see* bombard.

pumice, a very porous, frothlike volcanic glass that has long been used as an abrasive in cleaning, polishing, and scouring compounds. After 1945 it saw further use as railroad ballast and as a lightweight aggregate in precast masonry units, poured concrete, insulation and acoustic tile, and plaster.

Pumice is pyroclastic igneous rock that was almost completely liquid at the moment of effusion and was so rapidly cooled that there was no time for it to crystallize. When it solidified, the vapours dissolved in it were suddenly released, the whole mass swelling up into a froth that immediately consolidated. Had it cooled under more pressure, it would have formed a solid glass, or obsidian; in fact, if fragments of obsidian are heated in a crucible until they fuse, they will change to pumice when their dissolved gases are set free. Any type of lava, if the conditions are favourable, may assume the pumiceous state, but basalts and andesite do not so often occur in this form as do trachytes and rhyolites.

Small crystals of various minerals occur in many pumices; the most common are feldspar, augite, hornblende, and zircon. The cavities (vesicles) of pumice are sometimes rounded and may also be elongated or tubular, depending on the flow of the solidifying lava. In pumice occurring among old volcanic rocks, the cavities are usually filled with deposits of secondary minerals introduced by percolating water. The glass itself forms threads, fibres, and thin partitions between the vesicles. Rhyolite and trachyte pumices are white, andesite pumices often yellow or brown, and pumiceous basalts (such as occur in the Hawaiian Islands) pitch black.

Pumices are most abundant and most typically developed from acid (silica-rich) igneous rocks; accordingly, they commonly accompany obsidian. Useful pumice occurs in Iceland, Hungary, Tenerife Island in the Canaries, New Zealand, Germany, and Greece. In the United States it is mined in the Rocky Mountain states, the Pacific Coast states, and Hawaii.

In minute fragments, it has an exceedingly wide distribution over the Earth's surface. It occurs in all the deposits that cover the floor of the deepest portion of the oceans and is especially abundant in the abyssal red clay. In some measure this pumice has been derived from submarine volcanic eruptions, but its presence is also accounted for by the fact that it will float on water for months and is thus distributed over the sea by winds and currents. After a long time it becomes waterlogged and sinks to the bottom, where it gradually disintegrates and is incorporated in the muds and oozes of the ocean floor.

After the great eruption of Krakatoa in 1883, banks of pumice covered the surface of the sea for many kilometres and rose, in some cases, about 1 1/2 metres (4 or 5 feet) above the water level. In addition, much finely broken pumice was thrown into the air to a great height and was borne away by the winds, ultimately settling in the most distant parts of the continents and oceans.

Pumlumon (Wales): *see* Plynlimon.

pummelo (tree): *see* shaddock.

pump, a device that expends energy to raise, transport, or compress fluids. The earliest pumps were devices for raising water, such as the Persian and Roman waterwheels and the more sophisticated Archimedes screw (*q.v.*).

The mining operations of the Middle Ages led to development of the suction (piston) pump, many types of which are described by Georgius Agricola in *De re metallica* (1556). A suction pump works by atmospheric pressure; when the piston is raised, creating a partial vacuum, atmospheric pressure outside forces water into the cylinder, whence it is permitted to escape by an outlet valve. Atmospheric pressure alone can force water to a maximum height of about 34 feet (10 metres), so the force pump was developed to drain deeper mines. In the force pump the downward stroke of the piston forces water out through a side valve to a height that depends simply on the force applied to the piston.

Classification of pumps. Pumps are classified according to the way energy is imparted to the fluid. The basic methods are (1) volumetric displacement, (2) addition of kinetic energy, and (3) use of electromagnetic force.

A fluid can be displaced either mechanically or by the use of another fluid. Kinetic energy may be added to a fluid either by rotating it at high speed or by providing an impulse in the direction of flow. In order to use electromagnetic force, the fluid being pumped must be a good electrical conductor. Pumps used to transport or pressurize gases are called compressors, blowers, or fans. Pumps in which displacement is accomplished mechanically are called positive displacement pumps. Kinetic pumps impart kinetic energy to the fluid by means of a rapidly rotating impeller.

Broadly speaking, positive displacement pumps move relatively low volumes of fluid at high pressure, and kinetic pumps impel high volumes at low pressure.

A certain amount of pressure is required to get the fluid to flow into the pump before additional pressure or velocity can be added. If the inlet pressure is too small, cavitation (the formation of a vacuous space in the pump, which is normally occupied by liquid) will occur. Vaporization of liquid in the suction line is a common cause of cavitation. Vapour bubbles carried into the pump with the liquid collapse when they enter a region of higher pressure, resulting in excessive noise, vibration, corrosion, and erosion.

The important characteristics of a pump are the required inlet pressure, the capacity against a given total head (energy per pound due to pressure, velocity, or elevation), and the percentage efficiency for pumping a particular fluid. Pumping efficiency is much higher for mobile liquids such as water than for viscous fluids such as molasses. Since the viscosity of a liquid normally decreases as the temperature is increased, it is common industrial practice to heat very viscous liquids in order to pump them more efficiently.

Positive displacement pumps. Positive displacement pumps, which lift a given volume for each cycle of operation, can be divided into two main classes, reciprocating and rotary. Reciprocating pumps include piston, plunger, and diaphragm types; rotary pumps include gear, lobe, screw, vane, and cam pumps.

The plunger pump is the oldest type in common use. Piston and plunger pumps consist of a cylinder in which a piston or plunger moves back and forth. In plunger pumps the plunger moves through a stationary packed seal and is pushed into the fluid, while in piston pumps the packed seal is carried on the piston that pushes the fluid out of the cylinder. As the piston moves outward, the volume available in the cylinder increases, and fluid enters through the one-way inlet valve. As the piston moves inward, the volume available in the cylinder decreases, the pressure of the fluid increases, and the fluid is forced out through the outlet valve. The pumping rate varies from zero at the point at which the piston changes direction to a maximum when the piston is approximately halfway through its stroke. The variation in pumping rate can be reduced by using both sides of the piston to pump fluid. Pumps of this type are called double acting. Fluctuations in pumping rate can be further reduced by using more than one cylinder.

Overall pumping rates of piston pumps may be varied by changing either the reciprocating speed of the piston rod or the stroke length of the piston. The piston may be driven directly by steam, compressed air, or hydraulic oil or through a mechanical linkage or cam that transforms the rotary motion of a drive wheel to a reciprocating motion of the piston rod.

Piston and plunger pumps are expensive, but they are extremely reliable and durable. Piston pumps are known to have been running without repair or replacement for more than 100 years.

The action of a diaphragm pump is similar to that of a piston pump in which the piston is replaced by a pulsating flexible diaphragm. This overcomes the disadvantage of having piston packings in contact with the fluid being pumped. As in the case of piston pumps, fluid enters and leaves the pump through check valves. The diaphragm may be actuated mechanically by a piston directly attached to the diaphragm or by a fluid such as compressed air or oil.

Diaphragm pumps deliver a pulsating output of liquids or gases or a mixture of both. They are useful for pumping liquids that contain solid particles and for pumping expensive, toxic, or corrosive chemicals where leaks through packing cannot be tolerated.

Diaphragm pumps can be run dry for an extended period of time. Furthermore, the pumping rate of most such pumps can be changed during operation.

The most common type of gear pump is illustrated in Figure 1. One of the gears is driven and the other runs free. A partial vacuum, created by the unmeshing of the rotating gears, draws fluid into the pump. This fluid is then transferred to the other side of

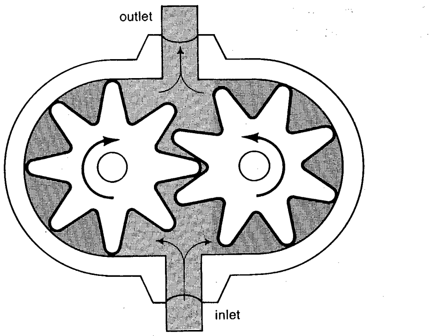


Figure 1: External gear pump

the pump between the rotating gear teeth and the fixed casing. As the rotating gears mesh together, they generate an increase in pressure that forces the fluid into the outlet line. A gear pump can discharge fluid in either direction, depending on the direction of the gear rotation.

An internal gear pump is shown in Figure 2. The driven gear is a rotor with internally cut teeth, which mesh with the teeth of an externally cut idler gear, set off-centre from the rotor. The crescent part of the fixed casing divides the fluid flow between the idler gear and

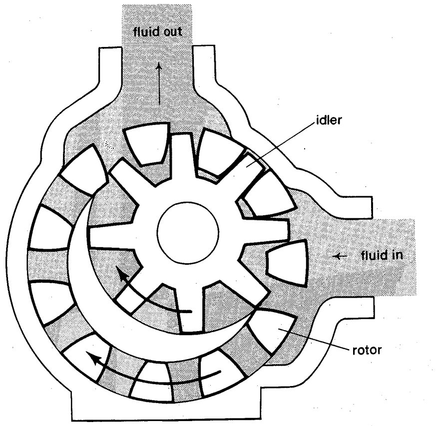


Figure 2: Internal gear pump

the rotor. Gear pumps can pump liquids containing vapours or gases. Since they depend on the liquid pumped to lubricate the internal moving parts, they are not suitable for pumping gases. They deliver a constant output with negligible pulsations for a given rotor speed. Erosion and corrosion lead to an increase in the amount of liquid slipping back through the pump. Since gear pumps are subject to clogging, they are not suitable for pumping liquids containing solid particles. Since they do not need check valves, however, they can be used to pump very viscous liquids.

Lobe pumps resemble external gear pumps, but have rotors with two, three, or four lobes in place of gears; the two rotors are both driven. Lobe pumps have a more pulsating output than external gear pumps and are less subject to wear. Lobe-type compressors are also used to pump gases; each rotor has two lobes.

In a screw pump, a helical screw rotor revolves in a fixed casing that is shaped so that cavities formed at the intake move toward the discharge as the screw rotates. As a cavity forms, a partial vacuum is created, which draws fluid into the pump. This fluid is then transferred to the other side of the pump inside the progressing cavity. The shape of the fixed casing is such that at the discharge end of the pump the cavity closes, generating an increase in pressure that forces the fluid into the outlet line.

Screw pumps can pump liquids containing vapours or solid particles. They deliver a steady output with negligible pulsations for a given rotor speed. Since screw pumps do not need inlet and outlet check valves, they can be used to pump very viscous liquids. Although screw pumps are bulky, heavy, and expensive, they are robust, slow to wear, and have an exceptionally long life.

A sliding vane pump is illustrated in Figure 3. The rotor is mounted off-centre. Rectangular vanes are positioned at regular intervals around the curved surface of the rotor. Each vane is free to move in a slot. The centrifugal force from rotation throws the vanes outward to form a seal against the fixed casing. As the rotor revolves, a partial vacuum is created at the suction side of the pump, drawing in fluid. This fluid is then transferred to the other side of the pump in the space between the rotor and the fixed casing. At the discharge side, the available volume is decreased, and the resultant increase in pressure forces the fluid into the outlet line; the pumping rate can be varied by changing the degree of eccentricity of the rotor. Vane pumps do not need inlet and outlet check valves; they can pump liquids containing vapours or gases but are not suitable for pumping liquids containing solid particles. Vane-type compressors are used to pump gases.

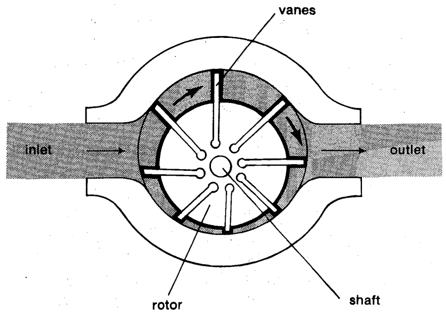


Figure 3: Vane pump

Vane pumps deliver a constant output with negligible pulsations for a given rotor speed. They are robust, and their vanes, easily replaced, are self-compensating for wear. Pumping capacity is not affected until the vanes are badly worn.

Kinetic pumps. Kinetic pumps can be divided into two classes, centrifugal and regenerative. In kinetic pumps a velocity is imparted to the fluid. Most of this velocity head is then converted to pressure head. Even though the first centrifugal pump was introduced about 1680, kinetic pumps were little used until the 20th century.

Centrifugal pumps include radial, axial, and mixed flow units. A radial flow pump is commonly referred to as a straight centrifugal pump; the most common type is the volute pump, illustrated in Figure 4. Fluid enters the

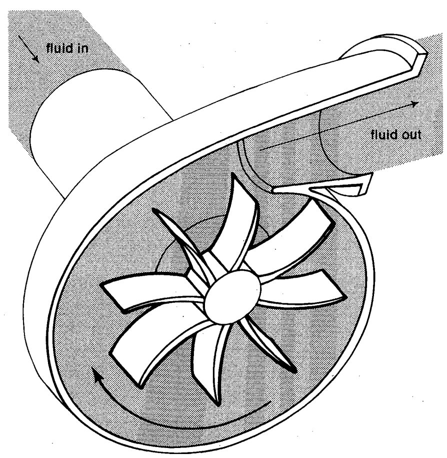


Figure 4: Volute centrifugal pump

pump near the axis of an impeller rotating at high speed. The fluid is thrown radially outward into the pump casing. A partial vacuum is created that continuously draws more fluid into the pump.

Volute centrifugal pumps are robust and relatively inexpensive, quiet, and dependable, and their performance is relatively unaffected by corrosion and erosion. They are compact, simple in construction, and do not require inlet and outlet check valves.

Volute centrifugal pumps can pump liquids containing solid particles, but, when pumping liquids containing more than a small amount of vapour, their suction is broken by cavitation. Volute centrifugal pumps operate best when pumping relatively nonviscous liquids, and their capacity is greatly reduced when used to pump viscous liquids.

Another type of radial flow centrifugal pump is the diffuser pump, in which, after the fluid has left the impeller, it is passed through a ring of fixed vanes that diffuse the liquid, providing a more controlled flow and a more efficient conversion of velocity head into pressure head.

In axial flow centrifugal pumps the rotor is a propeller. Fluid flows parallel to the axis as illustrated in Figure 5. Diffusion vanes are located in the discharge port of the pump to eliminate the rotational velocity of the fluid imparted by the propeller. Axial flow compressors are also used to pump gases. In mixed flow pumps, fluid is discharged both radially and axially into a volute-type casing.

A regenerative pump is also called a turbine, or peripheral, pump. The impeller has vanes on both sides of the rim that rotate in a ringlike channel in the pump's casing. The fluid does not discharge freely from the tip

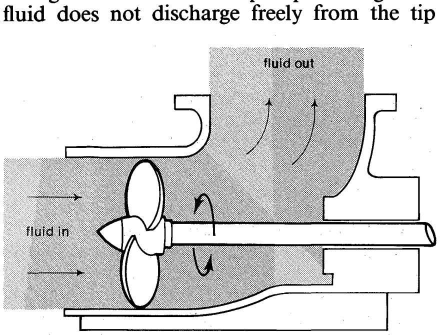


Figure 5: Axial flow centrifugal pump

of the impeller but is recirculated back to a lower point on the impeller diameter. This recirculation, or regeneration, increases the head developed. Because of close clearances, regenerative pumps cannot be used to pump liquids containing solid particles. They can pump liquids containing vapours and gases, and in fact they can pump gases provided that they contain sufficient liquid to seal the close clearances. Regenerative pumps are suitable only for pumping mobile liquids.

Electromagnetic pumps. These can be used only to pump fluids that are good electrical conductors. The pipe carrying the fluid is placed in a magnetic field and a current passed crosswise through the fluid, so that it is subjected to an electromagnetic force in the direction of the flow. The current and the field can be produced in a variety of ways. The principle of the electromagnetic pump is the same as that of the electric motor. Electromagnetic pumps are used for pumping liquid metals, which are used for cooling nuclear reactors.

Other types of pumps. Gas lifts are used to raise liquids from the bottoms of wells. Compressed gas is introduced into the liquid near the bottom of the well as in Figure 6. The resulting mixture of gas and liquid is lighter and more buoyant than the liquid alone so that the mixture rises and is discharged. Gas lifts have no moving parts, and they can be

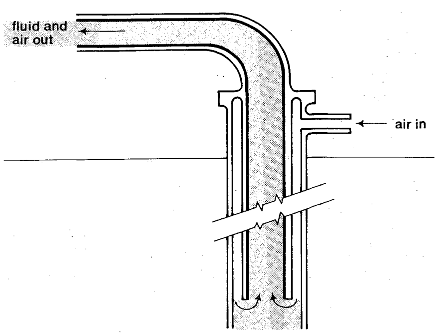


Figure 6: Air, or gas, lift pump

used to pump liquids containing solid particles. Although air, or gas, lifts are now little-used, they were once widely used for pumping water, brine, and oil.

In the jet ejector pump, fluid passes through a venturi nozzle (*see* venturi tube) and develops a suction that causes a second stream of fluid to be entrained. In the aspirator pump, water flows through a venturi nozzle and develops a suction for drawing in air. Steam ejectors are widely used for pumping large volumes of vapours and gases at low pressures. Steam at high velocity enters the main body of the pump and transfers some of its momentum to the gas, which is sucked in from the inlet line. A mixture of steam and gas enters the main venturi nozzle known as the diffuser. Kinetic energy is converted to pressure energy, and the mixture of steam and gas is compressed. Thus, energy in the steam is used to compress gas from a low to a higher pressure. Jet ejector pumps have been used since about 1850.

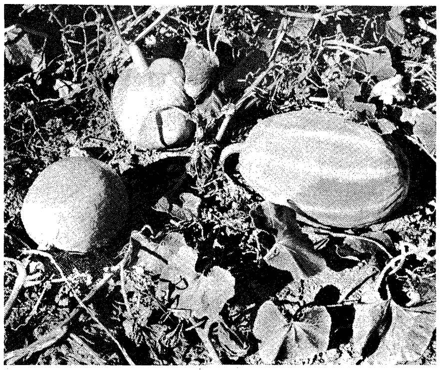
The hydraulic ram pump uses the energy of a downward-flowing stream of water to lift a proportion of the water to a higher level. Flowing water in the inlet pipe causes a check valve to close. As in a water hammer (in which a flow of water is suddenly stopped, producing a hammering action), kinetic energy is converted to pressure energy, and a second check valve is opened to allow some water into the air chamber and up the discharge pipe. The pressure falls in the inlet water pipe, and the first check valve reopens. The compressed air closes the check valve to the air chamber, and the whole cycle is repeated. Approximately 15 percent of the water flowing in the inlet pipe may be raised to a height of five times the fall in the inlet pipe. Hydraulic ram pumps were developed in the late 18th century and are still used in some domestic water systems.

Vacuum pumps are simply compressors that take in gas at a pressure lower than atmospheric pressure, compress it, and discharge the gas at atmospheric pressure. Since gas at low pressures has a large volume, vacuum pumps tend to be bulky. Steam jet ejectors are extensively used industrially for creating vacuum. Reciprocating piston and rotary-vane pumps are also widely used for producing vacuum.

Pumpelly, Raphael W. (b. Sept. 8, 1837, Oswego, N.Y., U.S.—d. Aug. 10, 1923, Newport, R.I.), American geologist and scientific explorer known for his studies and explorations of the iron-ore and copper deposits in the Lake Superior region in 1866–75.

Pumpelly graduated from the Royal School of Mines at Freiberg, Saxony, in 1859 and explored coal deposits and loess formations in China before becoming the first professor of mining at Harvard University (1866–75). He then worked as a geologist for various states and for the federal government, as well as for the Northern Pacific Railway. He served as head of the New England section of the U.S. Geological Survey from 1884 to 1889, during which time he published important studies of the geology of the Green Mountains. In 1903 he led an expedition to Central Asia that resulted in several more important monographs. His scientific works include *Geological Researches in China, Mongolia, and Japan* (1867) and *Archeological and Physico-geographical Reconnaissance in Turkestan* (1905). His autobiography, *My Reminiscences,* was published in 1918.

pumpkin, fruit of certain varieties of *Cucurbita pepo* or of *C. moschata,* members of the family Cucurbitaceae. The names pumpkin and squash, especially in the United States, are applied inconsistently to certain varieties of both these species. The quick-growing, small-fruited bush, or nontrailing, varieties of *C. pepo* are called squash (*q.v.*) in America, while the long-season, long-trailing, large-fruited varieties are called pumpkin.



Pumpkin (*Cucurbita pepo*)
Walter Chandoha

The fruits are large, generally 4–8 kg (9–18 pounds) or more, are yellowish to orange in colour, and vary from oblate through globular to oblong. The rind is smooth and usually lightly furrowed or ribbed; the fruit stem is hard and woody, ridged or angled, and in *C. pepo* not flared at its point of attachment to the fruit. The very largest varieties of pumpkin are called winter squash, *C. maxima,* and may weigh 34 kg (75 pounds) or more. Pumpkins produce very long vines and are planted individually or in twos or threes on little hills about 2.5 to 3 m (8 to 10 feet) apart. Pumpkins mature in early autumn, and those of *C. maxima* can be stored for a few months in a dry place well above freezing temperatures.

Pumpkins are commonly grown in North America, Great Britain, and Europe for human food and also for livestock feed. The rind is removed, and when cooked the pulp is edible for humans. In Europe pumpkin is mainly served as a vegetable; in the United States and Canada pumpkin pie is a traditional Thanksgiving and Christmas dessert. The fruit is also used in puddings and soups. It may be used interchangeably with squash in various prepared dishes. Pumpkins are used in the United States as Halloween decorations, one such being the jack-o'-lantern, in which the interior of the pumpkin is cleaned out and a light inserted to shine through a face carved through the wall of the fruit.

pumpkinseed, popular food and sport fish and a species of sunfish (*q.v.*).

Puná Island, Spanish ISLA PUNÁ, island off the coast of southern Ecuador, at the head of the Gulf of Guayaquil, opposite the mouth of the Guayas River. It is flanked by two channels: the Jambelí Channel on the east and the Morro Channel on the west. Its area is about 330 square miles (855 square km).

In the 16th century the island served as a stopping point for Spanish conquistadors (including Francisco Pizarro) on their way south from Panama; it was originally inhabited by the aboriginal Tumbez Indians, whom not even the Inca had conquered. The present population is concentrated around the village of Puná at the island's northeastern tip. Punta Salinas is a fishing and hunting resort on the southwestern cape. Pop. (1980 est.) 5,566.

Articles are alphabetized word by word, not letter by letter

Punakha, town in the eastern Himalayas, west-central Bhutan. It lies at an elevation of about 5,000 feet (1,500 m) above sea level at a point where several streams converge to form the Sankosh River. The town, founded in 1577, was once the capital of Bhutan. The old *dzong* (fortress, or castle) is on a promontory between the Pho and Mo rivers, tributaries of the Sankosh. Pop. (1982 est.) 1,100.

Punch, in full PUNCHINELLO, Italian PULCINELLA, hooknosed, humpbacked charac-

"Mr. Punch," drawing by George Cruikshank

By courtesy of the Princeton University Library, New Jersey

ter, the most popular of marionettes and glove puppets and the chief figure in the Punch-and-Judy puppet show. Brutal, vindictive, and deceitful, he is usually at odds with authority. His character had roots in the Roman clown and the comic country bumpkin. More modern origins can be traced to Pulcinella, a character who appeared in the Italian commedia dell'arte in the 17th century. It is not certain who was the first Pulcinella, although claims have been made on behalf of Silvio Fiorillo, a professional comedian who was performing at the beginning of the 17th century. In early pictorial representations, he is depicted as large, shambling, and stupid-looking, dressed in a loose white shirt and very full trousers.

The Italian actors soon began to travel throughout Europe, bringing with them the puppet showmen. Polichinelle, the French adaptation of the character Pulcinella, became firmly established in France by the middle of the 17th century. The origin of the grotesque, humpbacked, and hooknosed marionette Polichinelle may have resulted from a fusion of the Italian character Pulcinella with an earlier French tradition of humpbacked fools.

A similar tradition of the humpbacked fool existed in England when the first Italian puppeteers arrived after the restoration of Charles II in 1660. Two years later, the first references to Punchinello, soon shortened to Punch, appeared in the writings of the English diarist Samuel Pepys. By 1700 practically every puppet show in England featured Punch, and his wife, Judy, originally called Joan, was also a well-known figure. Travelling showmen carried these plays to country wakes (festivals) in the summer and visited London for the fairs in August and September.

In the 1790s the marionettes lost their popularity at the fairs. There was, however, a new interest in the humbler glove puppets, and in this form the Punch-and-Judy play became a success. Plots varied, but the principal players were Toby the Dog, the Baby, the Doctor, the Negro Servant, the Beadle, the Clown, the Hangman, the Ghost of Judy, Mr. Jones, Hector the Horse, the Crocodile, and the Devil. The hooked nose, the humped back, the tendency to wife beating and outrageous lawlessness typical of the English Punch were established characteristics by the 19th century.

In England in the second half of the 20th century, more than 50 professional puppeteers carried on the vigorous tradition of Punch's humour. His influence survives in the name of the English humour magazine *Punch* and in common phrases such as "pleased as Punch."

In France the puppet Polichinelle had a similar history. His popularity, however, declined during the 19th and 20th centuries, and he has disappeared as a comic figure, being replaced by Guignol.

Other puppets have developed from the same origins as Punch, such as Petrushka (Petrouchka) in Russia.

Pūnch, also spelled POONCH, town, administrative headquarters of Pūnch district in the Indian-held sector of Jammu and Kashmir state, in the northern part of the Indian subcontinent. The town is connected by road (via Hāji Pīr pass) with Uri.

Pūnch district, with an area of 1,658 sq mi (4,294 sq km), is bounded on the north by the Jhelum River and on the east by the magnificent Pīr Panjāl Range. Agriculture (corn [maize], wheat, and rice) vies with mining (petroleum, coal, and limestone) in the economy of the district. A sizable reserve of bauxite has been discovered. Pop. (1981) town, 14,171; district, 224,197.

Punch, or the London Charivari, English illustrated periodical founded in 1841, famous for its satiric humour and caricatures and cartoons. The first editors, of what was then a weekly radical paper, were Henry Mayhew, Mark Lemon, and Joseph Stirling Coyne. Among the most famous early members of the staff were the authors William Makepeace Thackeray and Thomas Hood and the illustrator-cartoonists John Leech and Sir John Tenniel. The cover drawing by Richard Doyle was used from 1849 until 1956, when each issue's cover was made different and printed in colour, although the traditional figures of Punch and his dog Toby usually appear somewhere.

punch press, machine that changes the size or shape of a piece of material, usually sheet metal, by applying pressure to a die in which the workpiece is held. The form and construction of the die determine the shape produced on the workpiece.

A punch press has two coacting components, the punch, which is attached to the reciprocating ram of the machine, and the die, which is clamped onto a bed or anvil whose flat surface is perpendicular to the path of the ram. In operation, the punch pushes against the workpiece, which is held in the die. A blanking die shears out a slug of sheet metal to make it into a blank that will fit dies for subsequent punch-press operations. These include forming or bending and drawing, in which cup-shaped articles are produced by a process that entails some plastic flow of the metal.

Punch presses are usually driven by electric motors, and conversion from the rotary motion of the drive shaft to reciprocation of the ram is effected by either a crank, a toggle, or a cam mechanism. Since the power demands are intermittent, a flywheel is attached to the drive shaft to store energy during the idling period between strokes of the ram and to deliver energy to the shaft during a punching operation, thus reducing the required capacity of the driving motor. *See also* hydraulic press.

punchayet (caste government): *see* pañcāyat.

Punchinello (puppet): *see* Punch.

punch'ŏng pottery, Japanese MISHIMA, decorated celadon (*q.v.*) produced in Korea during the early Yi period (15th and 16th centuries). *Punch'ŏng* ware evolved from the celadon ware of the Koryŏ style; combined with the celadon glaze is the innovative Yi surface decoration, which includes inlaying, stamping, incising, sgraffito, and the application of a white slip (liquid clay) beneath the final coating of transparent glaze.

At the beginning of the 15th century the inlay technique of Koryŏ celadon, in which the pattern was incised freehand, was taken over by Yi potters; but they soon began to use stamps to produce in a matter of minutes an overall tiny floral pattern. Sometimes they also used sgraffito decoration in which patterns were incised through a grayish-white slip. The potters of the 16th century abandoned designs altogether and simply coated the vessel with a white slip either entirely or partially.

punctuation, a standard set of signs, spaces, and various typographical devices in written and printed texts that are used to make meaning clear and to separate elements of sentences.

A brief treatment of punctuation follows. For full treatment, *see* MACROPAEDIA: Writing.

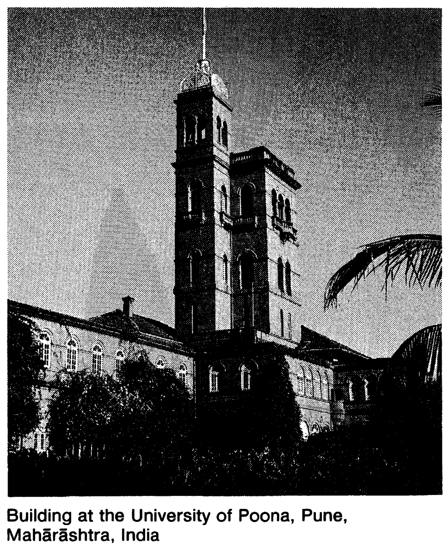
Punctuation is the conventional practice of "pointing" a written composition so as to divide it into sentences and portions of sentences, which the "points" mark at their close, thus indicating what would in speech be pauses or changes of expression (Latin *punctum,* a "point").

In English, the "full stop" or "period" (.) marks the end of a sentence. The "colon" (:) is at the transition point of the sentence. The "semicolon" (;) separates different clauses, or statements. The "comma" (,) separates clauses, phrases, and particles. The terms period, colon, and comma were borrowed from the Greek grammarians, who originally described either the whole sentence or a part of it in this way.

The "dash" (—) marks abruptness or irregularity. The "exclamation" (!) marks surprise. The "interrogation" or "query" (?) asks a question. The apostrophe (') marks elisions or the possessive case. "Quotes," quotation-marks, or "inverted commas" (" ") define quoted words. Interpolations in a sentence are marked by various forms of bracket [] or parenthesis (). Usage and practice vary widely, however.

In the earlier forms of European writing the letters ran on continuously in lines; only by degrees were words divided up by spacing within the line; later came the distribution into sentences by points and the introduction by Aldus Manutius (16th century) of a regular system for these. The chief signs were derived from the dots of the Greek grammarians, but these have often changed meanings; thus the Greek interrogation mark (;) became the English semicolon.

Pune, also called POONA, city, administrative headquarters of Pune district, Mahārāshtra state, western India, at the junction of the Mulā and Mutha rivers. Named "Queen of the Deccan," Pune is the cultural capital of the Marāṭhā peoples. The city first gained impor-



Building at the University of Poona, Pune, Mahārāshtra, India

Foto Features

tance as the capital of the Bhonsle Marāṭhās in the 17th century. It was temporarily captured by the Mughals but again became the official

Marāṭhā capital from 1714 until its fall to the British in 1817. It served as the seasonal capital of the Bombay Presidency and is now a popular tourist resort, offering cool weather, historic and religious monuments, museums, and parks, hotels, and cultural attractions.

Pune has long been a major educational and cultural centre; former prime minister Jawaharlal Nehru referred to it as the "Oxford and Cambridge of India." The city houses some 30 constituent and affiliated colleges of the University of Poona (1948); the Bhandarkar Oriental Research Institute (1917) is renowned for research and instruction in the Sanskrit and Prākrit languages and has more than 20,000 ancient manuscripts. Pune is also the headquarters of the southern command of the Indian army, with the Khadakwasla Academy located nearby.

A sprawling complex of industrial suburbs has developed around the city. Large factories producing a wide variety of products are distributed along the roads radiating from Pune to Bombay, Ahmadnagar, Sholāpur, and Sātāra. The old city is largely residential and commercial and is served by large-scale commuter transport. In 1961 the Panshet Dam collapsed, washing away a substantial part of the old town.

The region surrounding Pune includes the Sahyādri Hills, the Bālāghāt Range (north), and the Mahādeo Hills (south), which enclose the northern Bhīma River valley. Chief crops are jowar (sorghum), bajra (pearl millet), sugarcane, and rice. Most of the important religious, historical, and tourist attractions of the region are located in the Sahyādri Hills. Some of the famous hill forts of the Marāṭhās, such as Sinhgad, have become modern resorts. The important religious centres include Bhīmashankar, site of a Jyotirliṅga shrine; Dehu, birthplace of the Marāṭhī poet-saint Tukārām; Alandi, home of Jñāneśvara (Jñānadeva), author of a well-known commentary on the *Bhagavadgītā;* and Kārli, site of famous Buddhist caves. Nearby are Meherazad and Meherabad, sites associated with Meher Baba. Pop. (1981) city, 1,203,351; metropolitan area, 1,686,109.

p'ungsuchirisol (Korean: "theory of wind, water, and land"), in Korean religion, geomancy, a belief that the natural environment of a particular location can influence the fortune of its inhabitants and descendants. It derives from the Chinese notion of *feng–shui* ("wind–water"), which developed from observation of chronic catastrophies wrought in China by winds and floods. Also implied is the Chinese concept of *yin–yang* (two contrary but complementary principles that explain all change) and the doctrine of the five elements that constitute all reality.

According to *p'ungsuchirisol,* each plot of land possesses two of four attributes: that which has *wang* ("prosperous") and *sŏn* ("right"), for example, is fit for graves, houses, and important buildings; that which has *shoe* ("decay") and *yŏk* ("reversion") is propitious for temples. A good site for buildings and graves is marked by a majestic mountain linked to smaller mountains trailing off into the distance. The site also should be flanked on the left by a mountain shaped like the Blue Dragon (protector of good fortune) and on the right by one shaped like the White Tiger (expeller of evil). Finally, a mountain behind the site should face another distant mountain. A hill that resembles a cow lying down to eat fodder will secure a life free from worry about food and lodging. A site resembling a hen sitting on eggs will be the birthplace of great men.

Three types of sites are to be avoided: a place close to a road with heavy traffic, a town whose ditches overflow during the rainy season, and a spot where dragon- and tiger-shaped mountains come together.

Yi Sŏng-gye, founder of the Yi dynasty (1392–1910), moved the national capital to Seoul because the site was said by a monk to fulfill all the requirements of *p'ungsuchirisol.*

Punic alphabet, a form of the Phoenician alphabet (*q.v.*).

Punic War, FIRST (264–241 BC), also called FIRST CARTHAGINIAN WAR, first of three wars between the Roman Republic and the Carthaginian (Punic) Empire that resulted in the destruction of Carthage.

The first Punic war was fought to establish control over the strategic islands of Corsica and Sicily. In 264 the Carthaginians intervened in a dispute between the two principal cities on the Sicilian west coast, Messana and Syracuse, and so established a presence on the island. Rome, responding to this challenge, attacked Messana and forced the Carthaginians to withdraw. In 260 a Roman fleet failed to gain complete control of Sicily but opened the way to Corsica, from which the Carthaginians were expelled. A second Roman fleet sailed in 256 and established a beachhead on the African continent. Carthage was prepared to surrender, but the terms offered by Rome were too severe, and in 255 Carthage attacked with a new army built around cavalry and elephants and drove the invaders to the sea.

The battle for Sicily resumed in 254 but was largely stalemated until 241, when a fleet of 200 warships gave the Romans undisputed control of the sea lanes and assured the collapse of the Punic stronghold in Sicily. One year later Carthage surrendered, ceding Sicily and the Lipari Islands to Rome and agreeing to pay an indemnity.

Punic War, SECOND (218–201 BC), also called SECOND CARTHAGINIAN WAR, second in a series of wars between the Roman Republic and the Carthaginian (Punic) Empire that resulted in Roman hegemony over the western Mediterranean.

In the years after the First Punic War, Rome wrested Corsica and Sardinia from Carthage and forced Carthaginians to pay an even greater indemnity than the payment exacted immediately following the war. Eventually, however, under the leadership of Hamilcar Barca, his son Hannibal, and his son-in-law Hasdrubal, Carthage acquired a new base in Spain, whence they could renew the war against Rome.

In 219 Hannibal captured Saguntum (Sagunto) on the east coast of the Iberian Peninsula. Rome demanded his withdrawal, but Carthage refused to recall him, and Rome declared war. Because Rome controlled the sea, Hannibal led his army overland through Spain and Gaul and across the Alps, arriving in the plain of the Po River valley in 218 BC with 20,000 infantry and 6,000 cavalry. Roman troops tried to bar his advance but were outmatched, and Hannibal's hold over northern Italy was established. In 217 Hannibal, reinforced by Gallic tribesmen, marched south. Rather than attack Rome directly, he marched on Capua, the second largest town in Italy, hoping to incite the populace to rebel. He won several battles but still refrained from attacking the city of Rome, even after annihilating a huge Roman army at Cannae in 216. The defeat galvanized Roman resistance. A brilliant defensive strategy conducted by Quintus Fabius Maximus Cunctator harried the Carthaginians without offering battle. Thus, the two armies remained deadlocked on the Italian peninsula until 211 BC, when Rome recaptured the city of Capua.

In 207 Hasdrubal, following Hannibal's route across the Alps, reached northern Italy with another large army supported by legions of Ligurians and Gauls. Hasdrubal marched down the peninsula to join Hannibal for an assault on Rome. Rome, exhausted by war, nevertheless raised and dispatched an army to check Hasdrubal. Gaius Nero, commander of the southern Roman army, slipped away north also and defeated Hasdrubal on the banks of the Metauros River. Hannibal maintained his position in southern Italy until 203, when he was ordered to return to Africa; Italy was free of enemy troops for the first time in 15 years. During the long mainland campaign, fighting had continued as well on Sardinia and Sicily, which had become Rome's chief sources of food. Aided by internal upheaval in Syracuse, Carthage reestablished its presence on the island in 215 and maintained it until 210. Meanwhile, in Spain, Roman forces maintained pressure on Carthaginian strongholds. The Roman general Publius Scipio won a decisive battle at Ilipa in 206 and forced the Carthaginians out of Spain.

After his Spanish victory Scipio determined to invade the Carthaginian homeland. He sailed for Africa in 204 and established a beachhead. The Carthaginian council offered terms of surrender but reneged at the last minute, pinning its hopes on one last battle. The massed Carthaginian army, led by Hannibal, was defeated at Zama. The Carthaginians accepted Scipio's terms for peace: Carthage was forced to pay an indemnity and surrender its navy, and Spain and the Mediterranean islands were ceded to Rome.

Punic War, THIRD (149–146 BC), also called THIRD CARTHAGINIAN WAR, third of three wars between the Roman Republic and the Carthaginian (Punic) Empire that resulted in the final destruction of Carthage, the enslavement of its population, and Roman hegemony over the western Mediterranean.

The first and second Punic wars (264–241 BC and 218–201 BC) had effectively deprived Carthage of its political power. Nevertheless, its commercial enterprises expanded rapidly in the 2nd century BC, exciting the envy of Rome's growing mercantile community. When the Carthaginians in 150 resisted Masinissa's aggressions by force of arms, thus formally breaking the treaty with Rome, a Roman army was dispatched to Africa. Although the Carthaginians consented to make reparation by giving hostages and surrendering their arms, they were goaded into revolt by the further stipulation that they must emigrate to some inland site, where commerce by sea would no longer be possible. Carthage resisted the Roman siege for two years. In 147, however, the command was given to Scipio Aemilianus, the adopted grandson of the former conqueror of Carthage. Scipio made the blockade stringent by walling off the isthmus on which the town lay and by cutting off its sources of supplies from overseas. His main attack was delivered on the harbour side, where he effected an entrance in the face of a determined and ingenious resistance. House by house he captured the streets that led up to the citadel.

Of a city population that may have exceeded a quarter of a million, only 50,000 remained at the final surrender. The survivors were sold into slavery; the city was razed, and the territory was made a Roman province under the name of Africa.

punishment, the infliction of some kind of pain or loss upon a person for a misdeed—*i.e.,* the transgression of a law or command. Punishment may take forms varying from capital punishment, flogging, and mutilation of the body to imprisonment, fines, and even deferred sentences that come into operation only if an offense is repeated within a specified time.

A brief treatment of punishment follows. For full treatment, *see* MACROPAEDIA: Crime and Punishment.

In primitive society, punishment was left to the individuals wronged or to their families and was vindictive or retributive: in quantity and quality it would bear no special relation to the character or gravity of the offense. Gradually there arose the idea of proportionate punishment, such as is reflected in the dictum "an eye for an eye." The next stage was punishment by individuals under the control of the state or community; eventually, with the growth of law, the state took over the punitive function and provided itself with the machinery of "justice" for the maintenance of public order. Under such a system, crimes are against the state, and the exaction of punishment by the wronged individual (*e.g.*, by lynching) is illegal.

Even at the legal stage the vindictive or retributive character of punishment remains, but gradually, and especially after the humanist movement under such thinkers as Cesare Beccaria and Jeremy Bentham, new theories begin to emerge. Two chief trains of thought have combined in the condemnation of primitive theory and practice. On the one hand, the retributive principle itself has been very largely superseded by the protective and the reformative; on the other, punishments involving bodily pain have become objectionable to the general sense of society. Consequently corporal and even capital punishment occupy a far less prominent position. It began to be recognized also that stereotyped punishments, such as belong to penal codes, fail to take due account of the particular condition of an offense and the character and circumstances of the offender. A fixed fine, for example, operates very unequally on rich and poor.

Modern theories date from the 18th century, when the humanitarian movement began to teach the dignity of the individual and to emphasize his rationality and responsibility. The result was the reduction of punishment both in quantity and in severity, the improvement of the prison system, and the first attempts to study the psychology of crime and to distinguish between classes of criminals with a view to their improvement. These latter problems are the province of criminal anthropology and criminal sociology, sciences so called because they view crime as the outcome of anthropological and social conditions. In this view, the individual who breaks the law is seen as a product of social evolution and cannot be regarded as solely responsible for his disposition to transgress. Habitual crime is thus to be treated as a disease. According to this view, punishment can be justified only insofar as it (1) protects society by removing temporarily or permanently one who has injured it, or by acting as a deterrent, or (2) aims at the moral or social regeneration of the criminal.

In the latter half of the 20th century, many people objected to this view of punishment, feeling that it placed too little responsibility on the offender for his actions, that it undervalued the deterrent effect of stiff punishment, and that it ignored society's right to retribution. In response to such attitudes, many governments enacted stiffer penal codes. For example, many states in the United States adopted mandatory, fixed prison sentences for certain crimes, and capital punishment saw a resurgence in the United States.

Punjab, constituent state of the Republic of India, situated in the northwestern corner of the country. It is bounded on the north by the territory of Jammu and Kashmir, on the east by the Indian state of Himāchal Pradesh, on the south by Haryāna and Rājāsthan, and on the west by Pakistan.

A brief treatment of Punjab follows. For full treatment, *see* MACROPAEDIA: India.

The word Punjab is a compound of two Persian words, *panj* ("five") and *āb* ("water"), signifying historically the land of five waters, or rivers. Owing to territorial changes, however, only two rivers (the Sutlej and the Beās) lie within India's Punjabi boundaries.

The foundations of Punjab may be said to have been laid by Bandā Singh Bahādur, a hermit who became a military leader and who with his fighting band of Sikhs temporarily liberated the eastern portion of Punjab from Mughal rule in 1709–10. The Sikhs later established their power over the area, building a powerful kingdom and adding more territory. The Punjab came under British rule in 1849. With Indian independence in 1947, the area was split between the new sovereign states of India and Pakistan, the smaller eastern portion going to India. Then in 1966 the state was further divided on the basis of language into the two new states of Punjab and Haryāna, with Hindī-speaking groups inhabiting the latter. Chandīgarh is the joint capital of Punjab and Haryāna.

More than 95 percent of the total area of Punjab is a flat plain, sloping gently from about 900 feet (275 m) in the northeast to about 550 feet (170 m) in the southwest. The region's physiography is divisible into the Siwālik Hills in the northeast, about 900 to 3,000 feet (275 to 920 m) high; the narrow, undulating foothill zone dissected by closely spaced seasonal torrents; and the flat tract, with fertile alluvial soils on low-lying floodplains along rivers.

Punjab has an inland subtropical location, and its climate is continental, semiarid to subhumid. Summers are very hot, the mean temperature during June being 93° F (34° C), rising above 113° F (45° C) on exceptional days. Winters are cool, the January mean temperature being 55° F (13° C) and night temperatures sometimes touching the freezing mark. Annual rainfall varies from about 49 inches (1,250 mm) in the northeast to about 14 inches (360 mm) in the southwest. More than 70 percent of the annual precipitation is concentrated in the monsoon months of July to September. Winter rains occurring from December to March account for nearly 15 percent of the total rainfall.

Punjab is the only Indian state with a majority of Sikhs—60 percent—and Punjābī is the mother tongue of about two-thirds of the people. The remainder speak Hindī. Hindus make up more than one-third of the population, and there are smaller minorities of Christians, Jainas, and Buddhists. About one-quarter of the population lives in cities and towns. The cities are fast-growing centres of industry and manufacture.

The state's economy is characterized by agriculture and small-scale industry. The per capita income is growing despite a rapid rise in population. With about 70 percent of its people engaged in agriculture, Punjab accounts for as much as one-quarter of India's output of wheat. Other crops include corn (maize), rice, millet, barley, and edible seeds, together with cotton, sugarcane, potatoes, and oilseeds. Most of the land is irrigated through various river-valley projects. The area's great success in increasing agricultural production since the 1950s has been part of the Green Revolution, which stressed the introduction of modern farming methods, new seeds and fertilizers, and irrigation.

Punjab lacks mineral and fossil-fuel resources, and industrial development is thus associated with agriculture and consumer goods. The principal industries produce cotton, woolen, and silk textiles; sugar; machine tools; fertilizers and agricultural implements; and such consumer goods as sewing machines, bicycles, sports equipment, automotive parts, and flour and milk products. Although Punjab has an extensive system of roads, most long-distance transport is confined to railways. Air passenger service exists between Delhi and some Punjab cities such as Chandīgarh, Amritsar, Ludhiāna, and Patiāla.

Folklore, ballads of love and war, fairs and festivals, dancing, music, and Punjabi literature are characteristic of the state's cultural life. The whole populace joins in religious and seasonal festivals such as Dussehra, Dīwāli, and Baisākhi and in the anniversary celebrations in honour of gurus and saints. The *giddha,* a native Punjabi form, is a women's song-dance. In addition to Sikh religious music, semiclassical Mughal forms continue to be popular. The outstanding architectural monument is the Golden Temple at Amritsar, blending Indian and Saracenic styles. The temple is rich in gold-filigree work of the most delicate kind and in panels with floral designs and marble facings inlaid with coloured stones. There is also the Hindu Temple of Durgiāna, at Amritsar, and an outstanding mosque at Kapūrthala.

The universities in Punjab include Punjabi University at Patiāla, the Gurū Nānak University at Amritsar, the Punjab Agricultural University at Ludhiāna, and the Panjab University at Chandīgarh. In addition, the state has numerous professional, medical, and engineering colleges. Area 19,445 square miles (50,362 square km). Pop. (1981) 16,788,915.

Consult the INDEX *first*

Punjab, province of eastern Pakistan, bordered by the territory of Jammu and Kashmir to the north, the Indian states of Punjab and Rājasthān to the east, Sind province to the south, and Baluchistan and North-West Frontier provinces to the west.

Urbanized civilization existed in the Indus River valley from about 2500 BC. The area was successively conquered by Aryans, Greeks, Parthians, Arabs, Mughals, Afghans, Sikhs, and British. When the Indian subcontinent received its independence in 1947, Punjab was split between Pakistan and India, with the larger western portion becoming part of Pakistan. The present provincial boundaries were established in 1970. Its capital, Lahore, is located in the east-central region, near the border with India. It is the second largest province, after Baluchistan, and the most densely populated.

Its area consists of an alluvial plain formed by the southward-flowing Indus River and its tributaries, the Jhelum, Chenāb, Rāvi, and Sutlej rivers. The plain has a diversity of landforms. An active floodplain is flooded every rainy season and contains changing river channels; a meander floodplain, adjacent to the active floodplain, is marked by relict and abandoned channels. A covered floodplain contains deposits resulting from sheet flooding, and interfluvial highland areas have practically no relief. In the north are the Murree and Rāwalpindi and the Pabbi hills, part of the Sub-Himalayas, and in the far north is the Potwar Plateau. The province lies on the margin of the monsoon climate. Temperatures are generally high, with seasonal variations, and rainfall is low, except in the Sub-Himalayan and northern areas.

The major ethnic groups are the Jats, Rājputs, Arain, Gūjars, and Awan. Punjabi is spoken by the vast majority of the population.

Agriculture provides a major source of income and employment. The majority of the cultivated land is irrigated. Wheat and cotton are the principal crops. The Punjab is one of the most industrialized provinces in Pakistan; major manufacturing industries are textiles, machinery, electrical appliances, surgical instruments, metal industries, bicycles and rickshas, floor coverings, and food processing. Pakistan's main north–south road and railway connect Lahore with Islāmābād, the capital of Pakistan, to the north and with the ocean port of Karāchi to the south. Punjab is connected by road or railway to India, the People's Republic of China, and Afghanistan, and its major cities are linked by road. Lahore's airport provides domestic service.

The University of Punjab and the University of Engineering and Technology are located in Lahore, as well as other colleges, museums, libraries, and cultural centres. Area 79,704 sq mi (206,433 sq km). Pop. (1981 prelim.) 47,116,000.

Punjab, University of the, Urdu JAMIA PUNJAB, residential, and affiliating university located in Lahore, Pakistan. Originally Indian, Punjab was founded in 1882 to take on some of the colleges then affiliated with the University of Calcutta, whose jurisdiction included most of northern India and parts of Burma. After the creation of Pakistan in 1947, the university relinquished its colleges on Indian territory, which then became affiliated with the newly established Punjab University in Chandīgarh, India. The original university in Lahore comprises a number of colleges and postgraduate faculties of arts, science and engineering, Islāmic and Oriental learning, law, commerce, medicine and dentistry, and education. Instruction is in English and Urdu.

Punjab Himalayas, westernmost section of the Himalayas, lying in the Kashmir region of northern India and Pakistan and extending east-southeast for 350 mi (560 km) from the bend of the Indus River to the Sutlej River. The upper Indus separates them from the Karakoram Range to the north. Included within the Punjab Himalayas are the Zāskār Range, the Pīr Panjāl Range, and part of the Siwālik Hills (*qq.v.*). The Jhelum River rises in these mountains before flowing westward through the Vale of Kashmir. The highest point is Nānga Parbat (26,660 ft [8,126 m]), at the northwest end of the range. Dalhousie is a noted mountain resort.

Punjab Plain, large alluvial plain in northwestern India, having an area of about 38,300 sq mi (99,200 sq km) and covering the states of Punjab and Haryāna and the union territory of Delhi except for the Shāhdara zone. It is bounded by the Yamuna River on the east, the Siwālik Hills on the north, the arid zone of Rājasthān on the south, and the Rāvi and Sutlej rivers on the northwest and southwest, respectively. The plain, an area of early Aryan settlement, was, according to the Hindu epic the *Mahābhārata*, the site of the epic war fought between the Pāṇḍavas and Kauravas. The Punjab Plain was ruled by ancient northern Hindu dynasties until the Muslims established firm control after the defeat of Pṛthvīrāja Cauhān by Muḥammad Ghūrī in AD 1192. The death of Aurangzeb in 1707 and the weakening of the Mughal rule at Delhi enabled the Sikh dynasty to seize power. The region has considerable strategic importance, since its western boundary coincides with the India–Pakistan border. Its geological origin is Tertiary (except in the extreme south), its surface having been built up by the silting action of meandering streams. The plain is slightly undulating, sloping from 2,140 ft (650 m) in the southeast to 700 ft in the northeast. The Rāvi, Beās, Sutlej, and Yamuna are perennial rivers. Tropical thorn forests grow in the southeast, and tropical dry deciduous forests are found in the submontane region in the north. Agriculture is the mainstay of the region's economy, and most of the plain is farmed; cereals, cotton, sugarcane, and oilseeds are grown. Most of the region is crisscrossed by irrigation canals. Large-scale industries centered in New Delhi, Amritsar, Ludhiāna, Jullunder, and Chandīgarh produce textiles, bicycle parts, machine tools, agricultural implements, sporting goods, rosin, turpentine, and varnish.

Punjabi language, also spelled PANJABI, central Indo-Aryan language spoken in Punjab (around Lahore and Amritsar), an area now divided between India and Pakistan; to the west, modern Punjabi merges into the Lahnda language (*q.v.*). Punjabi is one of the 14 regional languages recognized in the Indian constitution. In vocabulary it is very similar to Western Hindi. It has little literature and shows little borrowing from Persian, Arabic, or Sanskrit. Two alphabets are used: Lahnda, indigenous to the region and related to Devanāgarī; and Gurmukhi, devised by the Sikh Gurū Aṅgad (ruled 1539–52) to be used for the scriptures of the Sikhs and now employed for general purposes as well. Earlier, Punjabi was transported to other regions in India and even to China.

puñña (Pāli: "merit"), primary attribute sought by Buddhists, both monks and laymen, in order to build up a better *karman* (the cumulative consequences of deeds) and thus to achieve a more favourable future rebirth. The concept is particularly stressed in the Theravāda tradition of Southeast Asia.

Puñña can be acquired through *dāna* ("giving," such as offering food and robes to monks or donating a temple or monastery); *sīla* (the keeping of the moral precepts); and *bhāvanā* (the practice of meditation). Merit can also be transferred from one being to another. This is a central feature of the Mahāyāna schools, in which the ideal Buddhist is the *bodhisattva* ("Buddha-to-be"), who dedicates himself to the service of others and transfers merit from his own inexhaustible store to benefit others.

Punnett, Reginald Crundall (b. June 20, 1875, Tonbridge, Kent, Eng.—d. Jan. 3, 1967, Bilbrook, Somerset), English geneticist who, with the English biologist William Bateson, discovered genetic linkage.

Educated at Cambridge University, Punnett began his professional research with structural studies of marine worms. Later his interest turned to genetics, and, while a demonstrator in zoology at Cambridge (1902–05), he joined a genetic study group under Bateson. Through his contact with Bateson, Punnett came to support the theories of Gregor Mendel, the founder of modern genetics. Subsequently, he wrote *Mendelism* (1905), the first textbook on the subject.

Using poultry and sweet peas, Punnett and Bateson discovered some of the fundamental processes of Mendelian genetics, including linkage, sex determination, sex linkage, and the first example of autosomal (nonsexual chromosome) linkage. In 1910 Bateson and Punnett founded the *Journal of Genetics*, which they jointly edited until Bateson's death (1926). In 1912 Punnett became a fellow of the Royal Society of London and was named professor of genetics at Cambridge.

During World War I, when many foods were scarce, Punnett pointed out the value of employing sex-linked plumage-colour factors to distinguish male from female chickens; early identification of the less valuable males was thus made possible. The process, known as autosexing, is treated in his *Heredity in Poultry* (1923).

Puno, department (formed 1822) of southern Peru, bounded by Bolivia (east). It occupies an area of 27,947 sq mi (72,382 sq km) and lies partly in high, windswept plateaus and the basin of Lake Titicaca and partly in rugged mountains. Many of Puno's rivers flow into Lake Titicaca, but the Tambopata and Inambari rivers—major affluents of the Madre de Diós—also arise in the department.

Settled since pre-Inca times, Puno contains extensive archaeological ruins, especially near Lake Titicaca. The mainly Indian population is predominantly rural. Puno (*q.v.*) city, the departmental capital, and Juliaca, the main transportation hub, are the largest cities.

Cultivated crops include potatoes and barley and other cereals. Cattle and sheep are bred extensively; wool, from both sheep and alpaca, is exported. Silver, antimony, tungsten, gold, and copper are important mineral resources. Puno is traversed by the Pan-American Highway; railroads from Cuzco and Arequipa meet in Juliaca and extend to Puno city. Pop. (1984 est.) 984,000.

Puno, capital of Puno province and department, southern Peru, on the western shore of Lake Titicaca at 12,549 ft (3,826 m) above sea level, on the high, cold Collao Plateau. Founded in 1668 as San Carlos de Puno, in honour of Charles (Carlos) II of Spain, the city has retained a colonial flavour, particularly in its churches and cathedral (built 1754). Pre-Columbian funeral towers are nearby. Puno serves as a commercial and communications centre of the southern Peruvian Andes and trades in the wool of llamas and alpacas. Steamers regularly ply Titicaca, the world's highest navigable lake, between Puno and Guaqui, Bolivia (which is linked by road to La Paz). Puno is also the terminus of rail lines from Cuzco and Arequipa, which unite in Juliaca, and it is accessible by road and air. Tourism is an economic asset. The city is the seat of the Universidad Nacional Têchnica del Altiplano (1885). Pop. (1981) city, 66,477; (1981 prelim.) province, 177,667.

Punt, ancient Egyptian name for the southern coast of the Red Sea and adjacent coasts of the Gulf of Aden, corresponding to modern coastal Ethiopia and Djibouti.

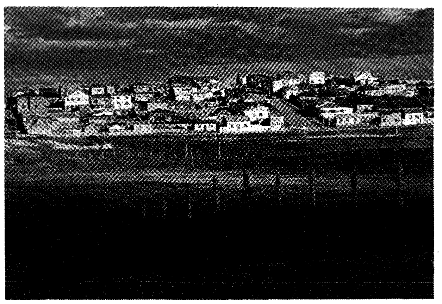
To the ancients, Punt was a place of legend and fable, illustrated by Herodotus' account (in Book II of his *History*, 5th century BC) of the exploits of an Egyptian pharaoh, one Sesostris, who took a fleet of ships and made conquests along the shores of the Erythaean Sea (the Red Sea and adjacent waters) and then traversed "the whole continent of Asia."

Historically verified is an expedition made during the reign of Pepi II Neferkare *c.* 2200 BC to the land of Punt, as are voyages undertaken during the 11th dynasty (*c.* 2040–*c.* 1991 BC), chiefly under Mentuhotep III. Queen Hatshepsut (reigned *c.* 1503–1482 BC) made a voyage to Punt and had the details of the journey recorded on the walls of her temple at Dayr al-Bahrī. Voyages to the "Divine Land" eventually became routine. The so-called Ethiopian dynasty—the 25th—which came from the south to rule Egypt in 716–656 BC, has sometimes been used in an attempt to prove an even closer connection between Egypt and Ethiopia, but these invaders came in fact from Nubia (Cush).

The designation "Ethiopian" was first used by Ancient Greek writers to describe any African with more or less dark skin. Their concept of the land whence these dark-skinned inhabitants derived sometimes comprised the whole African continent and sometimes only what is now Ethiopia. Only after Alexander the Great and the ascension of the Ptolemies to the throne of Ancient Egypt late in the 4th century BC were the trade routes to Punt opened to the Greeks. Thereafter, manuals of navigation were compiled and depots were constructed along the coast, where ivory, skins, ostrich feathers, and even live elephants could be housed. A stela inscribed with hieroglyphs, put up in Egypt during the reign of Ptolemy II Philadelphus (reigned 285–246 BC) and found at Pithon, refers to Ptolemy's founding the city of Ptolemais Theron on the Erythraen coast. Eratosthenes later recorded a reference to what may have been Ethiopia's Lake Tana (known to the Greeks as Psebo or Koloë) and to its island, Dak. Agatharchides, a Greek historian and geographer of the 2nd century BC, observed the habits of cave-dwellers in Punt; and Artemidorus, a Greek geographer of *c.* 100 BC, described the coast's configuration, naming various ports, and the desert region of

Danakil, where he indicated the existence of certain lakes—possibly Assal (in present-day Djibouti) and Awsa (in Ethiopia). Beyond lay an incense-producing region, and beyond that was what can perhaps be identified as the district of Harer and the Valley of Awash (both now in Ethiopia). But no one really knew the interior of the country, where, except for great rivers such as the Astaboras (Tekeze) and lakes such as Psebo, there was only speculation.

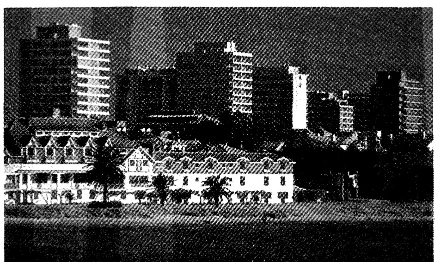
Punta Arenas, capital of Magallanes province and Magallenas y La Antarctica Chilena region, southern Chile, on the Strait of Magellan between the Pacific and Atlantic oceans. It is the southernmost large city in the world.



Punta Arenas, Chile
Reflejo—EB Inc.

Founded in 1849 by Col. José de los Santos Mardones, it flourished as a port of call and coaling station until the opening of the Panama Canal (1914) and the replacement of coal (still mined nearby) by fuel oil as a maritime fuel. Now the service centre of a large sheep-raising area, it processes and exports hides, wool, and frozen mutton. Its port facilities also handle local lumber and petroleum products. The nearby Tierra del Fuego oil fields, the attractions of the free port, and the maintenance of naval, air, and army garrisons have all contributed to the city's modern growth. Surface communication and an international airport connect it with the north and Tierra del Fuego. Pop. (1982 prelim.) 98,785.

Punta del Este, city and beach resort, southern Maldonado department, southeastern Uruguay, on a peninsula jutting into the Atlantic Ocean, east of Montevideo, the national capital. The breezy summers originally attracted families from Buenos Aires and Montevideo who built the beach-side chalets that give Punta del Este its distinctive charm. In later years new hotels, casinos, and the Cantegril country club, scene of international film festivals, made Punta del Este a leading playground of South America. The resort achieved international prominence as the locale of the 1961 meeting of the Inter-American Economic and Social Council, which proclaimed the Alliance for Progress; of the 1962 inter-American foreign ministers conference, which suspended Cuba from membership in the Organization of American States (OAS); and of the 1967 meeting of the presidents of the American republics. Fish, including weakfish, drumfish, and bluefish, are caught off the Atlantic coast. The city is linked to Montevideo by a highway. Pop. (1975 prelim.) 6,914.

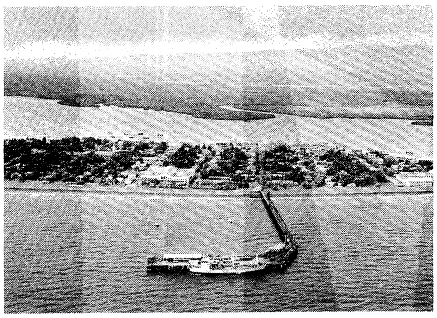


Beachside chalets overlooked by highrise buildings at Punta del Este, Uruguay
Walter Aguiar—EB Inc.

Punta Gorda, town, administrative headquarters of Toledo district (area 1,704 sq mi [4,413 sq km]), southern Belize (formerly British Honduras), lies on a coastal plain, backed by a mountainous interior, between the mouths of the Grande and Moho rivers. It is a port on the Gulf of Honduras and exports sugarcane, bananas, and coconuts. Livestock (hogs and cattle) are raised locally. Punta Gorda is linked to Belmopan, the national capital, by the Southern and Hummingbird highways via Dangriga (formerly Stann Creek). Its inhabitants are predominantly Caribs. Pop. (1980) town, 2,396; district, 11,762.

Puntarenas, province, western Costa Rica, bounded on the west and southwest by the Pacific Ocean and on the east by Panama. The largest of Costa Rica's seven provinces, Puntarenas has an area of 4,364 sq mi (11,302 sq km). Its Pacific shore extends from the Gulf of Nicoya to the southeastern shore of the Gulf of Dulce and includes the southern tip of Nicoya Peninsula and the entire Osa Peninsula. Although much of the province is lowland, it extends inland southward to the crest of the Talamanca Cordillera. The province was Costa Rica's fastest growing in the 1960s as new areas for banana growing opened on the Pacific coast; but thereafter the growth rate slowed. The chief town and general cargo port is Puntarenas, the provincial capital; the port of Golfito is also prominent. Northern and southern Puntarenas is traversed by the Pan-American Highway. The Pacific Railway runs through the province, and there are numerous rail lines from banana plantations to the main ports. Pop. (1983 est.) 286,082.

Puntarenas, capital, Puntarenas province, western Costa Rica. It is located on a long spit of land protruding into the Gulf of Nicoya and enclosing Estero Lagoon. First known as Bruselas, in colonial times it linked Costa Rican commerce with Panama and South America. A royal order of 1814 initiated improvement of the harbour facilities; and a cart road from San José, the national capital, was opened in the 1840s. Puntarenas was the shipping centre for most of the Costa Rican coffee that went to Europe around Cape Horn. Later connected with San José by the Pacific Railway, Puntarenas became an increasingly important port for export of bananas and coffee and for imports from the United States' West Coast. The nation's principal fishing port, Puntarenas has facilities for canning and freezing fish and for repairing ships; and it is the site of an international jet airport. Pop. (1983 est.) 35,414.



Puntarenas, Costa Rica
Herbert Lanks—Black Star/EB Inc.

punto a groppo (Italian: "knotted lace"), ancestor of bobbin lace (*q.v.*). It was worked in 16th-century Italy by knotting, twisting, and tying fringes, all without weights, or bobbins. Patterns were geometric, sometimes interspersed with schematic human figures. It is thought that bobbin, or pillow, lace developed when the threads came to be attached with lead weights and the design anchored on a pad, or pillow. Macrame (*q.v.*) work is a modern form of *punto a groppo.*

Punto Fijo, city, northern Falcón state, northwestern Venezuela, at the southwestern tip of the bulge of the Península de Paraguaná, on the shores of the Golfo de Venezuela. Punto Fijo emerged during the 1960s as the peninsula's major urban centre. With the development of large oil refineries there, the small ports of Punta Cardón and Amuay, the airport of Las Piedras, and the town of Punto Fijo grew into one industrial–urban complex. Oil is piped from the Lake Maracaibo fields; deep-draft tankers have easy access to the refineries. The complex is linked to Coro, the state capital, and to other mainland cities by highway. Pop. (1981 est.) 123,000.

punto in aria (Italian: "lace in air"), the first true lace (*i.e.,* lace not worked on a woven fabric). As reticella (*q.v.*) became more elaborate, its fabric ground was eventually replaced by a heavy thread or braid tacked onto a temporary backing (*e.g.,* parchment); the finished lace thus provided its own structure. While the early *punto in aria,* first mentioned in a pattern book by Tagliente (1528), retained the geometric pattern of reticella, it soon included such motifs as animal figures, biblical scenes, and scrolls.

punto tagliato (fabric design): *see* cutwork.

punto tirato (fabric design): *see* drawn thread work.

pupa, plural PUPAE, or PUPAS, life stage in the development of some insects, occurring between the larval and adult stages (imago) in insects exhibiting complete metamorphosis. During pupation, larval structures break down and adult structures form: wings appear for the first time. The adult emerges either by splitting the pupal skin and chewing its way out or by secreting a fluid that softens the cocoon. The process of pupation is controlled by hormones.

One of the most commonly recognized pupal stages is the cocoon of butterflies and moths (Lepidoptera). In this protective covering the caterpillar is transformed into an adult. Cocoons may be found hanging from twigs or bushes, hidden in rolled leaves, in underground litter, or in burrows. Some insects spend the winter in this stage.

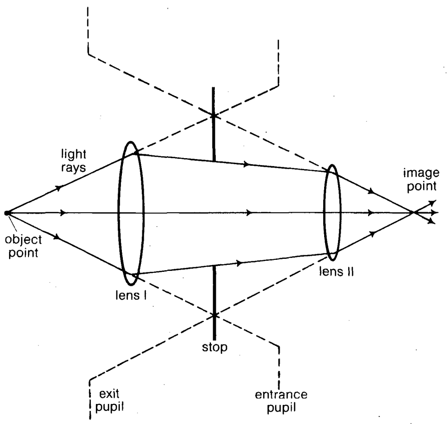
Cocoons of the monarch butterfly (*Danaus plexippus*)
Louis Quitt—Photo Researchers

Pupienus Maximus, in full MARCUS CLODIUS PUPIENUS MAXIMUS (b. 164—d. 238, Rome), Roman co-emperor with Balbinus for a few months of 238.

Pupienus was a distinguished soldier, who at the advanced age of 74 was chosen by the Senate with Balbinus to resist the barbarian Maximinus. It was arranged that Pupienus should take the field against Maximinus, while Balbinus remained at Rome to maintain order, a task in which he signally failed. A revolt of the praetorians was not repressed until much blood had been shed and a considerable part of the city reduced to ashes. On his march, Pupienus, having received the news that Maximinus had been assassinated by his own troops, returned in triumph to Rome. Shortly afterwards, when both emperors were on the point of leaving the city on an expedition—Pupienus against the Persians and Balbinus against the Goths—the praetorians, who had always resented the appointment of the senatorial emperors and cherished the memory of the soldier-emperor Maximinus, seized the opportunity of revenge. When most of the people were at the Capitoline games, they forced their way into the palace, dragged Balbinus and Pupienus through the streets, and put them to death.

pupil, in anatomy, opening at the front of the eye through which light passes before reaching the lens and being focused onto the retina. The size of the opening is governed by the muscles of the iris, which rapidly constrict the pupil when exposed to bright light and expand it more gradually in dim light. The pupil also narrows greatly when focusing on close objects and dilates for more distant viewing. At its maximum contraction, the adult pupil may be less than 1 mm (0.04 inch) in diameter, increasing 10 times to its maximum dilation. The size of the human pupil also varies somewhat with age and is greatest in adolescence.

pupil, in optical systems, the virtual image of an aperture associated with mirrors, prisms, and lenses and their combinations. The Figure shows the case of an optical system composed of two lenses with a stop between them. The



Optics of the pupil

virtual image of the aperture for lens I (as seen from the object point) is called the entrance pupil. The amount of light leaving the object and traversing the system is limited, in effect, by the entrance pupil, just as it is actually by the stop aperture. The image of the aperture for lens II is the exit pupil. In general, an optical system has one effective aperture, and the entrance pupil is formed by all lenses preceding the stop, whereas the exit pupil is formed by all lenses following it.

In visual instruments, the exit pupil falls at the eye position. In the microscope and telescope the objective acts as the aperture, its image is the exit pupil, and all light reaching the objective passes through the exit pupil. Thus, it is important for the exit pupil to be no larger than the pupillary diameter of the eye to take advantage of the light-gathering power of the instrument.

Pupin, Michael Idvorsky (b. Oct. 4, 1858, Idvor, Hung.—d. March 12, 1935, New York, N.Y., U.S.), American physicist who devised a means of greatly extending the range of long-distance telephone communication by placing loading coils (of wire) at predetermined intervals along the transmitting wire.

Pupin, detail of a portrait
By courtesy of Columbia University

The son of illiterate parents who encouraged his education, Pupin in 1890 became an instructor in mathematical physics at Columbia University, New York City. Six years later he discovered that atoms struck by X rays emit secondary X-ray radiation. He also invented a means for taking short-exposure X-ray photographs. In 1901 the Bell Telephone Company and some German telephone interests acquired the patent for his invention of long-distance telephony.

Pupin received the 1924 Pulitzer Prize in biography for his autobiographical work *From Immigrant to Inventor* (1923).

puppetry, the making and manipulation of puppets for use in some kind of theatrical show. A puppet is a figure—human, animal, or abstract in form—that is moved by human, and not mechanical, aid. These definitions exclude a child's doll or any kind of automaton such as a windup toy unless it is worked or introduced as part of a show by the hand of the puppeteer.

A brief account of puppetry follows. For full treatment, *see* MACROPAEDIA: Puppetry.

Puppets may be two- or three-dimensional and exist in a wide variety of types. They vary in size from finger puppets to bigger than life size and range from simplest shapes to elaborately articulated figures. A puppet may itself be controlled by several puppeteers or may be one among many simultaneously controlled by one puppeteer. The four most common kinds of puppet are glove puppets, rod puppets, shadow puppets that are operated from below, and string puppets, or marionettes, that are operated from above. This difference has an important bearing on the kind of stage adopted. Whichever puppet the puppeteer uses, he has traditionally sought to hide his presence by clothing that merges with his background or by a booth that screens him from the spectators. It has become increasingly common, however, for the puppeteer to be fully visible throughout the performance.

The origins of puppetry may lie with ritual magic, and, undoubtedly, primitive people made puppets before the invention of writing. From its beginnings in tribal society, puppetry has been part of every subsequent civilization. Ancient Egypt, Greece, and Rome recorded it, and later the Christian church incorporated puppets in biblical plays and finally outlawed them. Forced onto the streets, and from town to town, wandering showmen continued to present their repertoire of farce, slapstick, and bristling phantasmagoria. In the 17th century the strutting puppet character, then as ever a type rather than an individual, appeared as Pulcinella in Naples, Polichinelle in France, Petrushka in Russia, and Punch in London.

Despite a similar foundation in folklore and heroic drama, Far Eastern puppetry developed along somewhat different lines. Like other puppets they are modeled, carved, and dressed in materials that are durable, light, and capable of being worked to a high degree of expressiveness. The shadow puppets of Java, Bali, and Thailand are sometimes flat and sometimes rounded, but they are manipulated by rods against a transparent screen lit from behind. In 18th-century Japan the puppet master Uemura Bunrakuken gave his name to the most stylized and sophisticated puppetry yet devised. Bunraku puppets are less than life size but are operated by the puppet master who controls the head, eyes, and right arm of the puppet, while one assistant moves the left arm, and another the legs.

By the 18th century, puppetry in Europe had become so popular that showmen, once itinerant, set up permanent theatres. Although contemporary opera was often parodied by puppets, two prolific composers of serious opera, Alessandro Scarlatti and Josef Haydn, wrote operas specially for marionettes. The Italian Antonio Bibiena, a theatre designer, painted scenery for a marionette production in London in 1780. Puppet theatres sprang up in both Americas, and the new puppet satires and burlesques were frequented by the rich and famous, as well as the masses. At no other time have puppets been so widely accepted. However, no puppeteer became a household name, and the great artists briefly associated with puppet theatres had lent their skills from other spheres.

In the 19th century large traveling shows performed pantomimes, and collecting toy theatres became a popular domestic pastime. Puppet cabarets, some displaying breathtaking ingenuity, were given in private drawing rooms. By 1900 many puppet acts had been shortened to vaudeville turns, although the traditional Punch and Judy—along with Baby, Policeman, and Hangman—survived. The revival of puppetry has attempted to win back adult audiences, meeting with some success. The writer and theatrical visionary Edward Gordon Craig encouraged dramatists to discard the limitations for the potentialities of the puppet, and in the 1920s the German Lotte Reiniger exploited film techniques to produce a remarkable series of silhouette shows based on shadow figures.

In the second half of the 20th century, puppets reached a large audience through television. The Muppets, created by American puppeteer Jim Henson and made famous in the educational television show "Sesame Street," are now popular in many parts of the world. Touring companies presenting the time-honoured stories of the French Guignol, the Italian Arlecchino, and the German Kasperle are today joined by others with new tales or those combining puppets with masks, acrobatics, and acting. Different again, but equally significant, are the lavish and imaginative productions sponsored by governments in eastern Europe.

Purāṇa (Sanskrit: "Ancient Lore"), in Hindu sacred literature, any of a number of popular encyclopaedic collections of myth, legend, and genealogy, varying greatly as to date and origin.

Traditionally a *Purāṇa* treats five subjects: primary creation of the universe, secondary creation after periodical annihilation, genealogy of gods and saints, grand epochs, and history of the royal dynasties. *Purāṇa*s are connected in subject with the *Mahābhārata* ("Great Epic of the Bharata Dynasty") and have some relationship to the lawbooks (*Dharma-śāstra*s). Around this central core has amalgamated much other material of religious concern during the period *c.* AD 400 to *c.* 1000, which describes such things as customs, ceremonies, sacrifices, festivals, caste duties, donations, construction of temples and images, and places of pilgrimage. *Purāṇa*s are written almost entirely in narrative couplets in much the same easy, flowing style as the epic poems, though some scholars judge them poetically inferior to the epics.

The 18 principal surviving *Purāṇa*s are often grouped loosely according to whether they exalt Vishnu, Śiva (Shiva), or Brahmā, but each sect made an attempt to include its own teaching in the popular *Purāṇa*s as a way of influencing the people, and they all deal with similar material. The main *Purāṇa*s are usually regarded as (1) the *Viṣṇu-*, *Nāradīya-*, *Bhāgavata-*, *Garuḍa-*, *Pādma-*, and *Varāha-*; (2) the *Mātsya-*, *Kūrma-*, *Liṅga-*, *Śiva-*, *Skanda-*, and *Agni-*; and (3) the *Brāhmāṇḍa-*, *Brahmavaivarta-*, *Mārkandeya-*, *Bhaviṣya-*, *Vāmana-*, and *Brāhma-Purāṇa*s. By far the most popular is the *Bhāgavata-Purāṇa* (*q.v.*), which in its treatment of the early life of Krishna has had profound influence on the religious beliefs of India. There are also 18 "lesser," or *Upapurāṇa*s, treating similar material, and a large number of *sthala-Purāṇa*s, or *māhātmya*s, glorifying temples or sacred places, which are recited in the services of the temples.

Purandhar, Treaty of (March 1, 1776), pact between the peshwa (chief minister) of the Marāthā people and the supreme government of the British East India Company in Calcutta. It was an example of the tangled relations between the British and the Marāthās.

After the death of the peshwa Narāyan Rāo in 1773, his uncle Raghunath Rāo tried to secure the succession. The company's Bombay government supported Raghunath's claim in the Treaty of Surat (March 7, 1775) in return for Salsette Island and Bassein. But the supreme government disallowed this treaty and sent its own agent to renegotiate. The resulting Treaty of Purandhar annulled that of Surat. Raghunath was pensioned and his cause abandoned, but Salsette and the Broach revenues were retained by the British. The tangle was increased by the support of the London authorities for Bombay, which in 1778–79 again supported Raghunath. Peace was finally restored in 1782.

Purari River, river rising on the southern slopes of the Bismarck Range of the central highlands, Papua New Guinea, and flowing southwest and south for 290 mi (467 km) to the Gulf of Papua, off the Coral Sea, southwestern Pacific Ocean (the second longest stream to do so after the Fly). In the highlands the Purari, fed by its principal tributaries, the Erave, Wahgi, and Tua rivers, flows through gorges and densely populated areas. Its middle course crosses a forested coastal plain. In its lowest 25 mi (40 km) the stream subdivides into five main channels, which lace through a well-settled 1,000-sq-mi (2,600-sq-km) swampy delta. It is navigable for 120 mi (193 km) above the mouths. Although found and partially charted by the British explorer Theodore Bevan in 1887, the river system was not fully traced until the 1930s.

Purba Champāran, also called EAST CHAMPĀRAN, district, Bihār state, northeastern India, in the northern Middle Ganges Plain, with an area of 1,673 sq mi (4,334 sq km). Located in the northwestern corner of the state, it is bounded by Nepal on the north, Sītāmarhi district on the east, West Champāran district on the west, and Saran, Muzaffarpur, and Gopālganj districts on the south. Part of a region where Buddhism flourished in the 3rd century, the district was successively included in the dominions of the Mauryas, Guptas, Śuṅgas, Kanvas, and Pālas until in the 12th century it passed under Muslim rule. It was at Motīhāri, now the district headquarters, that Mahatma Gandhi started his *satyāgraha* (noncooperation) movement in 1917. The dense Champāran Forest consists mostly of sal (*Shorea*) and teak. The alluvial plain is dotted by banyan, tamarind, mahua, margosa, and date palms; it is drained by the Gandak, Lāl Bakya, and Sikrāna rivers. Irrigated agriculture is the basis of the economy; rice (the principal crop), gram (chick-pea), wheat, barley, corn (maize), pulse (legumes), oilseeds, sugarcane, and jute are grown. Sugar and rice mills are scattered throughout the district. Cottage industries produce handwoven textiles, shellac, embroidery (brocade), fireworks, silver jewelry, brass ware, and leather goods. Clay and sand are the only minerals worked. Roads and railways in the district parallel the navigable rivers. The important towns are Sagauli, Chakia, Raxaul Bazar, and Motīhāri. Pop. (1981) 2,425,501.

Purbeck, district, county of Dorset, southern England, occupying an area of 157 sq mi (405 sq km) on the English Channel in the southeastern corner of the county. It includes the nearly landlocked, shallow Poole Harbour on its northeastern border and derives its name from its southeasterly peninsula, the Isle of Purbeck. The central part of Purbeck is a westerly extension of the infertile Hampshire Basin sands and clays. These lowlands are almost entirely barren heathlands, marshlands, or pine woodlands. Some mixed farming (mostly dairy cattle and cereals) occurs on the slightly elevated chalk plains at Purbeck's northern edge and amidst the assorted chalk and limestone ridges running generally parallel to the English Channel on the south. The Trent and Frome rivers drain central Purbeck from the west, discharging into Poole Harbour. Wareham, near the mouth of the Trent, is the small district seat. The only other town of consequence is the isolated coastal resort of Swanage on the southeastern tip. Purbeck marble, quarried from the hills inland of Swanage (and now worked on a very small scale), was once used in the construction of many famous churches in England. Oilfields, first worked in the mid and late 1970s, are located north and south of Wareham and are the United Kingdom's principal onshore oilfield operation. A prototype nuclear power station and adjacent research establishment are located near the small parish (town) of Winfrith Newburgh in the district's southwest corner. Poole Harbour, separating the district from the resort town of Poole farther northeast, is popular with boaters. The south coast, officially designated an Area of Outstanding Beauty, has excellent examples of differential marine erosion because of its diverse geological strata. The entirety of Purbeck district, with its sparsely populated ridges, secluded coves, marshes, and forests, was long recognized as a smuggler's haven. Pop. (1983 est.) 40,800.

Purbeck Beds, uppermost division of Jurassic rocks in Great Britain. (The Jurassic Period began about 190,000,000 years ago and lasted about 54,000,000 years.) The Purbeck Beds overlie rocks of the Portland Beds and characterize the Purbeckian Stage, a worldwide standard division of Jurassic rocks and time. Rocks of the Purbeck Beds are highly varied and indicate major alterations in the geographical conditions of the Jurassic Period. Limestones, marls, clays, and old soil horizons occur and may attain a thickness of about 170 metres (560 feet).

Many of the varied rock types of the Purbeck were deposited in lagoons and some in freshwater. Ancient land soils in the Lower Purbeck Beds include the fossilized remains of coniferous trees and cycads, primitive palmlike trees. The Middle and Upper Purbeck consist of freshwater limestones that are quarried for use as building stone. Marls and shales are interbedded with the limestones; included are the famous Insect Beds that contain a remarkably well-preserved insect fauna. The Cinder Bed consists of enormous quantities of oyster shells, trigonids (rare Mesozoic clams), and fragments of echinoids, or sea urchins. The Purbeck Beds have provided a wealth of Jurassic vertebrate remains as well.

Purcell, E(dward) M(ills) (b. Aug. 30, 1912, Taylorville, Ill., U.S.), U.S. physicist, joint winner, with Felix Bloch of the United States, of the Nobel Prize for Physics in 1952 for his independent discovery (1946) of nuclear magnetic resonance in liquids and in solids. Nuclear magnetic resonance (NMR) has become widely used to study the molecular structure of pure materials and the composition of mixtures.

During World War II Purcell headed a group studying radar problems at the Massachusetts Institute of Technology, Cambridge. In 1946 he developed his NMR detection method, which was extremely accurate and a major improvement over the atomic-beam method devised by the U.S. physicist Isidor I. Rabi.

Purcell became professor of physics at Harvard University in 1949 and in 1952 detected the 21-centimetre-wavelength radiation emitted by neutral atomic hydrogen in interstellar space. Such radio waves had been predicted by the Dutch astronomer H.C. van de Hulst in 1944, and their study enabled astronomers to determine the distribution and location of hydrogen clouds in galaxies and to measure the rotation of the Milky Way. In 1960 Purcell became Gerhard Gade professor at Harvard, and in 1980 he became professor emeritus. The same year he received the National Medal of Science.

Purcell, Henry (b. *c.* 1659, London—d. Nov. 21, 1695, London), English composer of the early Baroque period, most remembered for his more than 100 songs, the miniature opera *Dido and Aeneas*, and his incidental

Henry Purcell, portrait by John Closterman; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

music to a version of Shakespeare's *Midsummer Night's Dream,* called *The Fairy Queen.*

Not very much is known of Purcell's life. His father was a gentleman of the Chapel Royal, in which musicians for the royal service were trained, and the son received his earliest education there as a chorister. When his voice broke in 1673, he was appointed assistant to John Hingston, keeper of the king's instruments, whom he succeeded in 1683. From 1674 to 1678 he tuned the organ at Westminster Abbey and was employed there in 1675–76 to copy organ parts of anthems. In 1677 he succeeded Matthew Locke as the composer for Charles II's string orchestra and in 1679 was appointed organist of Westminster Abbey in succession to the composer John Blow. A further appointment as one of the three organists of the Chapel Royal followed in 1682. He retained all his official posts through the reigns of James II and William III and Mary. He married in 1680 or 1681 and had at least six children, three of whom died in infancy. His son Edward was also a musician, as was Edward's son Edward Henry (died 1765). Purcell seems to have spent all his life in Westminster. A fatal illness prevented him from finishing the music for the operatic version of John Dryden and Sir Robert Howard's verse tragedy *The Indian Queen* (1664), which was completed after his death by his brother Daniel (d. 1717). Daniel Purcell had also been brought up as a chorister in the Chapel Royal and was organist of Magdalen College, Oxford, from 1688 to 1695. Before his brother's death, he was little known as a composer, but from 1695 to 1707 he was in considerable demand for music for stage productions in London until the advent of Italian opera brought his activities to an end.

To later ages Purcell was best known as a songwriter because so many of his songs were printed in his lifetime and were reprinted again and again after his death. The first evidence of his mastery as a composer, however, is an instrumental work—a series of fantasias (or "fancies") for viols in three, four, five, six, and seven parts. The nine four-part fantasias all bear dates in the summer of 1680, and the others can hardly be later. Purcell was here reviving a form of music that was already out of date and doing it with the skill of a veteran. Probably about the same time he started to work on a more fashionable type of instrumental music—a series of sonatas for two violins, bass viol, and organ (or harpsichord). Twelve of these were published in 1683, with a dedication to Charles II, and a further nine, together with a chaconne for the same combination, were issued by his widow in 1697. The foreword to the 1683 set claimed that the composer had "faithfully endeavour'd a just imitation of the most fam'd Italian Masters"; but side by side with the Italianate manner there was a good deal that derived from the English chamber music tradition.

The instrumental movements are the most striking part of the earliest of Purcell's *Welcome Songs* for Charles II—a series of ceremonial odes that began to appear in 1680. Possibly he lacked experience in writing for voices, at any rate on the scale required for works of this kind; or else he had not yet achieved the art of cloaking insipid words in significant music. By 1683 he had acquired a surer touch, and from that time until 1694, when he wrote the last of his birthday odes for Queen Mary, he produced a series of compositions for the court in which the vitality of the music makes it easy to ignore the poverty of the words. The same qualities are apparent in the last of his odes for St. Cecilia's Day, written in 1692.

Purcell's genius as a composer for the stage was hampered by there being no public opera in London during his lifetime. Most of his theatre music consists simply of instrumental music and songs interpolated into spoken drama, though occasionally there were opportunities for more extended musical scenes. His contribution to the stage was in fact modest until 1689, when he wrote *Dido and Aeneas* (libretto by Nahum Tate) for performance at a girls' school in Chelsea; this work achieves a high degree of dramatic intensity within a narrow framework. From that time until his death, he was constantly employed in writing music for the public theatres. These productions included some that gave scope for more than merely incidental music—notably music for *Dioclesian* (1690), adapted by Thomas Betterton from the tragedy *The Prophetess,* by John Fletcher and Philip Massinger; for *King Arthur* (1691), by John Dryden, designed from the first as an entertainment with music; and for *The Fairy Queen* (1692), an anonymous adaptation of Shakespeare's *Midsummer Night's Dream,* in which the texts set to music are all interpolations. In these works Purcell showed not only a lively sense of comedy but also a gift of passionate musical expression that is often more exalted than the words. The tendency to identify himself still more closely with the Italian style is very noticeable in the later dramatic works, which often demand considerable agility from the soloists.

Purcell's four-part fantasias, his first court ode, and his first music for the theatre, *Theodosius,* a play by Nathaniel Lee, all date from 1680. Some of his church music may be earlier than that, but it is not possible to assign definite dates. As far as is known, most of his anthems, whether for the full choir (full anthems) or with sections for soloists (verse anthems), were written between 1680 and 1685, the year of Charles II's death. The decline of the Chapel Royal during the reigns of James II and of William and Mary may have been responsible for the comparatively few works he produced during that period, or, alternatively, he may have been so busy with stage music and odes that he had little time or inclination for church music. The style of his full anthems, like that of the fantasias, shows a great respect for older traditions. His verse anthems, on the other hand, were obviously influenced, in the first instance, by his master at the Chapel Royal, Pelham Humfrey, who had acquired a knowledge of Continental styles when he was sent abroad to study in the mid-1660s. The most notable feature of these latter works is the use of expressive vocal declamation that is pathetic without being mawkish. The same characteristics appear in the sacred songs he wrote for private performance. Since composers for the Chapel Royal in Charles II's reign had the string orchestra at their disposal, Purcell took the opportunity to include overtures and ritornellos that are both dignified and lively. The most elaborate of all his compositions for the church are the anthem *My heart is inditing,* performed in Westminster Abbey at the coronation of James II in 1685, and the festal *Te Deum and Jubilate,* written for St. Cecilia's Day in 1694. Of these the anthem is the more impressive; the *Te Deum and Jubilate* suffers on the whole from a forced brilliance that seems to have faded with the passage of time.

Though the main period of Purcell's creative activity lasted for little more than the last 15 years of his life, he managed to crowd into it a large number of compositions, including more than 100 secular songs and about 40 duets, apart from those that he contributed to plays. Many of the songs are quite substantial pieces, incorporating recitative and arias on the lines of the Italian solo cantata. A favourite device used widely by Purcell in his secular music, though rarely in his anthems, was the ground bass (a short melodic phrase repeated over and over again as a bass line, with varying music for the upper parts). This device can have an invigorating effect in lively pieces, while in laments, such as Dido's farewell, it can intensify the expression of grief. The chaconne in the second set of sonatas uses the same technique with impressive results. Works of this kind represent the composer at the height of his capacity. The numerous catches (rounds for three or more unaccompanied voices written as one melody with each singer taking up a part in turn), on the other hand, though accomplished enough are little more than an experienced musician's contribution to social merrymaking. Purcell seems to have abandoned instrumental chamber music after his early years. His keyboard music forms an even smaller part of his work: it consists of suites and shorter pieces for harpsichord and a handful of pieces for organ.

Apart from a large number of songs that appeared in vocal collections, little of Purcell's music was published in his lifetime. The principal works were the *Sonatas of III Parts* (1683); *Welcome to all the pleasures,* an ode for St. Cecilia's Day, written in 1683 (published in 1684); and *Dioclesian,* composed in 1690 (1691). After his death his widow published a collection of his harpsichord pieces (1696), instrumental music for the theatre (1697), and the *Te Deum and Jubilate* (1697); and the publisher Henry Playford issued a two-volume collection of songs entitled *Orpheus Britannicus* (1698 and 1702), which went through three editions, last appearing at mid-18th century.

A few of Purcell's dramatic works, odes, and anthems were printed in the late 18th and early 19th centuries, but not until 1876, when the Purcell Society was founded, was a serious attempt made to issue all of Purcell's works. The first volume was published in 1878, the second in 1882. From 1889 to 1928 volumes appeared at intervals. Then the scheme was in abeyance until 1957, when a volume of miscellaneous odes and cantatas was published. It was finally completed in 32 volumes in 1965. Revision of earlier volumes proceeded simultaneously with the issue of later ones, beginning with a revised edition of *Dioclesian* in 1961.

Purcell, the most important English composer of his time, composed music covering a wide field: the church, the stage, the court, and private entertainment. In all these branches of composition he showed an obvious admiration for the past combined with a willingness to learn from the present, particularly from his contemporaries in Italy. With alertness of mind went an individual inventiveness that marked him as the most original English composer of his time as well as one of the most original in Europe. (J.A.W.)

MAJOR WORKS. *Stage works.* One opera, *Dido and Aeneas* (first performed 1689); semi-operas, *Dioclesian* (1690), *King Arthur* (1691), *The Fairy Queen* (adaptation of *A Midsummer Night's Dream,* 1692), *The Indian Queen* (1695), *The Tempest* (composed ? 1695); incidental music to 43 plays.

Vocal music. 15 odes, including six for Queen Mary's birthday and four for St. Cecilia's Day; anthems, including the coronation anthem, *My heart is inditing* (composed 1685); *Te Deum and Jubilate* (1694); sacred songs, catches, duets, and secular songs.

Instrumental music. Chacony in G Minor; 13 *Fantasias* (1680); two *In Nomines;* five *Pavans;* 12 *Sonatas of III Parts* (1683); 10 *Sonatas of IV Parts* (published 1697); violin sonata; three overtures.

Kebyoard works. Eight harpsichord suites (1696); *Musick's Handmaid,* part 2 only (published 1689); miscellaneous pieces and transcriptions.

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(1967), an indispensable work of reference, with a thematic *incipit* for each piece; *Henry Purcell, 1659–1695: His Life and Times* (1967), a detailed biography, with an account of Purcell's environment; and "Purcell's Family Circle Revisited and Revised," *Journal of the American Musicological Society,* 16:373–381 (1963), further details about Purcell's family, with particular reference to his parentage.

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Purchas, Samuel (b. *c.* 1577, Thaxted, Essex, Eng.—d. 1626, London), English compiler of travel and discovery writings who continued the encyclopaedic collections begun by the British geographer Richard Hakluyt in *Hakluytus Posthumus or Purchas his Pilgrimes; Contayning a History of the World, in Sea Voyages and Lande Travells, by Englishmen and Others* (4 vol., 1625; 20 vol., 1905–07).

Purchas studied at St. John's College, Cambridge, and at the University of Oxford. He was vicar first of a Thames-side parish in Essex and later in London, and he met many seafarers in the course of his duties. As an editor and compiler he sought to interest the general public of his day. During a time when travel literature had the patriotic purpose of inspiring Englishmen to engage in overseas expansion and enterprise, his collections were read with enthusiasm. Though Purchas lacked the editorial genius of Hakluyt, his collection is frequently the only source of information on important questions relating to geographical history and early exploration. Nearly two centuries after it was first published, *Purchas his Pilgrimes* was the favourite reading of Samuel Taylor Coleridge.

purdah, also spelled PARDAH, Hindi PARDA ("screen," or "veil"), practice that was inaugurated by Muslims and later adopted by various Hindus, especially in India, and that involves the seclusion of women from public observation by means of concealing clothing (including the veil) and by the use of high-walled enclosures, screens, and curtains within the home.

The practice of purdah is said to have originated in the Persian culture and to have been acquired by the Muslims during the Arab conquest of what is now Iraq in the 7th century AD. Muslim domination of northern India in turn influenced the practice of Hinduism, and purdah became usual among the Hindu upper classes of northern India. During the British hegemony in India, purdah observance was strictly adhered to and widespread among the highly conscious Muslim minority. Since then, purdah has largely disappeared in Hindu practice, though the seclusion and veiling of women is practiced to a greater or lesser degree in many Islāmic countries. *See also* harem.

Purdy, James (b. July 17, 1923, Ohio, U.S.), American novelist and short-story writer whose works explored the American way of life and presented a vision of human alienation, indifference, and cruelty.

Purdy, who grew up in small Ohio towns, was educated at the universities of Chicago and Puebla (Mexico). He served as an interpreter and taught for a few years before turning to writing full-time. His first two works—*Don't Call Me by My Right Name and Other Stories* and *63: Dream Palace,* a novella (both 1956)—were rejected by a number of American publishing houses and were first published by Purdy through a subsidy publisher. These books won the support of Dame Edith Sitwell and, following their publication in England, met with critical acclaim in America as well.

Purdy's fiction examines the relationships between individuals and the effects of family life. *Malcolm* (1959) tells the story of the experiences of a 15-year-old boy in a fruitless search for his identity. In Purdy's later works, such as *The Nephew* (1960) and *Cabot Wright Begins* (1964), he further develops the bleak worldview that he first propounded in *Malcolm.* In his trilogy, *Sleepers in Moon-Crowned Valleys*—consisting of *Jeremy's Vision* (1970), *The House of the Solitary Maggot* (1974), and *Mourners Below* (1981)—Purdy explores small-town American life and destructive family relationships.

Although critical response to Purdy's work was mixed, he was generally considered a powerful writer and an original, skillful black humorist. Purdy published a number of novels, including *I Am Elijah Thrush* (1972), *In a Shallow Grave* (1975), and *Candles of Your Eyes* (1986), and several collections of stories, plays, and poems.

pure culture, in microbiology, a laboratory culture containing a single species of organism. A pure culture is usually derived from a mixed culture (one containing many species) by transferring a small sample into new, sterile growth medium in such a manner as to disperse the individual cells across the medium surface or by thinning the sample manyfold before inoculating the new medium. Both methods separate the individual cells so that, when they multiply, each will form a discrete colony, which may then be used to inoculate more medium, with the assurance that only one type of organism will be present. Isolation of a pure culture may be enhanced by providing a mixed inoculum with a medium favouring the growth of one organism to the exclusion of others.

Pure Land Buddhism, Chinese (Wade–Giles romanization) CH'ING-T'U, Pinyin QINGTU, Japanese JŌDO, devotional cult of the Buddha Amitābha ("the Buddha of Infinite Light"). Known in China as O-mi-t'o-fo and in Japan as Amida, it is one of the most popular forms of Mahāyāna Buddhism in eastern Asia today. Pure Land schools believe that rebirth in Amitābha's Western Paradise, Sukhāvatī (known as the Pure Land, or Pure Realm), is ensured all those who invoke Amitābha's name with sincere devotion (*nembutsu,* referring to the Japanese formula of invocation, *namu Amida Butsu*).

The Pure Land belief is based on three Sanskrit scriptures, the *Amitāyus-vipaśyana-sūtra* ("Discourse Concerning Meditation on Amitāyus") and the "larger" and "smaller" Pure Land sutras (*Sukhāvatī-vyūha-sūtra*s ["Description of the Western Paradise Sūtras"]). These texts relate the story of the monk Dharmākara, the future Amitāyus, or Amitābha, who made a series of vows that were meant to be fulfilled with the certainty of natural law when he became a buddha. The most important of these, the 18th, promised rebirth in the Pure Land to all the faithful who called upon his name, who would then remain in that beautiful land, free from pain and want, until they were ready for final Enlightenment.

In the larger Pure Land sutra, Buddha tells the story of Amitābha: many eons ago, as a monk, he learned from the 81st Buddha about the glories of innumerable Buddha Lands, whereupon he vowed to create his own Buddha Land (which he is now doing), making it 81 times more excellent than all the others and drawing into it all creatures who invoked his name. According to this sutra, in addition to calling upon Amitābha, one needs to accumulate merit and concentrate on Enlightenment. In the later, smaller Pure Land sutra, however, the Blessed Land is not a reward for good works but is accessible to anyone who invokes Amitābha at the hour of death.

In China the beginnings of the Pure Land cult can be traced back as far as the 4th century, when the scholar Hui-yüan formed a society of monks and laymen who meditated on the name of Amitābha. T'an-luan and his successors Tao-ch'o and Shan-tao systematized and spread the doctrine in the 6th and 7th centuries and are recognized as the first patriarchs of the school. In art, new emphasis was given representation of Amitābha, together with his attendant bodhisattvas Avalokiteśvara and Mahāsthāmaprāpta. It has survived as an independent sect in China and has had its beliefs accepted by many members of other Buddhist sects in that country.

The Pure Land teaching was transmitted to Japan by monks of the Tendai school but by the 12th–13th century had separated as a distinct sect, mainly through the efforts of the priest Hōnen, founder of the Japanese Pure Land sect. Hōnen believed that most men were, like himself, incapable of obtaining buddhahood on this earth through their own efforts (such as learning, good deeds, or meditation) but were dependent on Amida's help. Hōnen stressed the recitation of *nembutsu* as the one act necessary to gain admittance to the Pure Land.

Hōnen's disciple Shinran is regarded as the founder of the Shin, or True, sect, the largest of the Pure Land groups. According to the Shin school, faith alone is sufficient. Mere recitation of the name of Amida (as practiced by the Jōdo school) is still indicative of a certain reliance on self-effort, just as are other forms of works such as doctrinal studies, austerities, meditations, and rituals. Shin interprets the continued repetition of the name as an expression of gratitude for the salvation that is assured from the very moment faith is first expressed. The school insists on exclusive devotion to Amida; the other Buddhist deities are not worshiped. The Shin sect has abandoned monastic practice, contrary to the usual Buddhist tradition.

The Jōdo sect itself split up into five branches of which two are still in existence—the Chinzei, the larger of the two and often referred to simply as Jōdo, and the Seizan. The Ji, or Time, sect was another variant; its name derived from the sect's rule of reciting the hymns of Shan-tao (Japanese: Zendo) six times a day.

purga: *see* blizzard.

purgatory, in Roman Catholic doctrine, the state of existence or condition of the soul of a person who has died in a state of grace but who has not been purged, or purified, from all possible stain of unforgiven venial sins (pardonable less-serious offenses against God), forgiven mortal sins (serious offenses against God that destroy sanctifying grace), imperfections, or evil habits. Souls in such conditions must thus be purified before entering heaven.

The doctrine of purgatory is derived from 2nd–1st-century-BC Jewish concepts that persons will be judged by God according to their deeds and that the faithful should pray that God show mercy to souls, a view implied in the New Testament. In II Maccabees, an Old Testament work not accepted as canonical (authoritative) by Jews and Protestants, is found the primary basis for the Roman Catholic doctrine of purgatory: "But if he was looking to the splendid reward that is laid up for those who fall asleep in godliness, it was a holy and pious thought. Therefore he made atonement for the dead, that they might be delivered from their sin" (12:45). In addition to this citation, other indirect references to purgatory, according to Roman Catholic teaching, occur in the New Testament.

During the period of the early church the existence of purgatory was classified by several theologians as a required belief, but it was not until the councils of Lyon and Florence in the Middle Ages and the Council of Trent in the Reformation period that the teaching was authoritatively defined. The matter of the place, duration, and nature of the punishments of purgatory has not been definitively answered.

In addition to the authoritative teaching that purgatory exists, Roman Catholic doctrine holds that the souls in purgatory may be aided by the faithful on Earth through prayers, almsgiving, indulgences, fasting, sacrifices, and other works of piety.

The existence of purgatory has been denied as unbiblical by Protestant churches and most Eastern Orthodox churches, as well as by the independent churches of Eastern Christianity (*e.g.,* Syrians, Nestorians, and Monophysites), although most Eastern Christians believe that the dead can be helped by the prayers and good deeds of the living faithful.

purge trials, also called GREAT PURGE, three widely publicized show trials and a series of closed, unpublicized trials held in the Soviet Union during the late 1930s, in which many prominent Old Bolsheviks were found guilty of treason and executed or imprisoned. All the evidence presented in court was derived from preliminary examinations of the defendants and from their confessions. It was subsequently established that the accused were innocent, that the cases were fabricated by the secret police (NKVD), and that the confessions were made under pressure of intensive torture and intimidation.

The trials successfully eliminated the major real and potential political rivals and critics of Stalin. The trials were the public aspect of the widespread purge that sent millions of alleged "enemies of the people" to prison camps in the 1930s.

The first trial opened in August 1936, while Genrikh G. Yagoda was head of the secret police. The main defendants were Grigory Yevseyevich Zinovyev, Lev Borisovich Kamenev, and Ivan Smirnov, all of whom had been prominent Bolsheviks at the time of the October Revolution (1917) and during the early years of the Soviet regime. With 13 codefendants they were accused of having joined Leon Trotsky in 1932 to form a terrorist organization in order to remove Stalin from power. The prosecution blamed the group for the assassination of Sergey Mironovich Kirov (December 1934) and suggested that it planned to murder Stalin and his close political associates. On Aug. 24, 1936, the court found the defendants guilty and ordered their executions.

The second trial opened in January 1937, after N.I. Yezhov had replaced Yagoda as chief of the NKVD. The major defendants were G.L. Pyatakov, G.Y. Sokolnikov, L.P. Serebryakov, and Karl Radek, all prominent figures in the Soviet regime. They and their 17 codefendants were accused of forming an "anti-Soviet Trotskyite centre," which had allegedly collaborated with Trotsky to conduct sabotage, wrecking, and terrorist activities that would ruin the Soviet economy and reduce the defensive capability of the Soviet Union. They were accused of working for Germany and Japan and of intending to overthrow the Soviet government and restore capitalism. They were found guilty on Jan. 30, 1937; Sokolnikov, Radek, and two others were given 10-year sentences, and the rest were executed.

At the third trial (March 1938), the prosecution suggested that the Zinovyev–Trotsky conspiracy also included Nikolay Ivanovich Bukharin and Aleksey Ivanovich Rykov, the leaders of the right-wing opposition to Stalin that had been prominent in the late 1920s. Yagoda was also accused of being a member of the conspiracy, as were three prominent doctors who had attended leading government officials. A total of 21 defendants were accused of performing numerous acts of sabotage and espionage with the intent to destroy the Soviet regime, dismember the Soviet Union, and restore the capitalist system. They were also charged with responsibility for Kirov's death, and it was alleged that Yagoda had ordered the three doctors to murder the former secret police chief V.R. Menzhinsky, the author Maksim Gorky, and a member of the Politburo, V.V. Kuibyshev. Bukharin was accused of having plotted to murder Lenin in 1918. Although one defendant, N.N. Krestinsky, retracted his guilty plea, and Bukharin and Yagoda skillfully responded to the prosecutor Andrey Yanuaryevich Vyshinsky's questions to demonstrate their innocence, all the defendants except three were sentenced to death on March 13, 1938.

In addition to the so-called show trials, a series of closed trials of top Soviet military leaders was held in 1937–38, in which a number of prominent military leaders were eliminated; the closed trials were accompanied by a massive purge throughout the Soviet armed forces. Stalin's liquidation of experienced military leadership during this purge was one of the major factors contributing to the poor performance of Soviet forces in the initial phase of the German invasion of the Soviet Union in June 1941.

Puri, town, administrative headquarters of Puri district, eastern Orissa state, eastern India, on the Bay of Bengal. The seacoast town is a market centre, rail terminus, and resort; its industries include handicrafts, fish curing,

The great temple of Jagannātha, Puri, Orissa, India
H. Miller—Shostal/EB Inc.

and rice milling. Puri is also a famous Hindu pilgrimage centre, the site of the 12th-century temple of Jagannātha. About two miles away is Jagannātha's Garden House, to which pilgrims pull his image on a chariot during a festival each summer. (The English word *juggernaut* comes from the name *Jagannātha,* meaning "lord of the world.") Puri, the summer residence of the state governor, has two colleges, an observatory, and a palace.

Puri district, 3,922 sq mi (10,159 sq km) in area, comprises a rice-growing alluvial plain in the east and a forested hilly region crossed by the Eastern Ghāts range in the west. The forests provide bamboo and sal (a resin source). The district encompasses most of Chilka Lake, one of India's largest, a shallow, saline water body that produces large numbers of fish. Industries include rice milling, metalworking, and weaving. The town of Khurda, the divisional headquarters of the Eastern Railway, has an arts college. Bhubaneswar, the capital of Orissa, is located in Puri district.

Puri fell under British rule in 1803. The Raja of Khurda rebelled in 1804, and there was a peasant uprising in 1817–18. Many of the district's people died in the 1866 Orissa famine. Pop. (1981) town, 100,942; district, 2,921,045.

Purí and Coroado, two South American Indian tribes closely related in language and culture. According to a Coroado tradition, a feud between two families had caused the aboriginal tribe to divide in two. They lived in the lowlands of Mato Grosso state, Brazil. The Purí language is a dialect of Coroado, of the Macro-Ge linguistic group.

Before contact with white settlers at the end of the 18th century, both tribes were hunters and gatherers in the forests and mountains of eastern Brazil near the coast, without agriculture or domesticated animals. They hunted in bands of one or two extended families numbering about 40 people led by an elder. Under colonial pressures they declined greatly in number; of the Coroado, perhaps fewer than 1,000 remained in the late 20th century.

The Purí and Coroado had shamans who interceded with the spirits to cure sickness and to foretell future events. The shamans used tobacco to induce their trances.

purification, the use of ritual techniques to protect against what are held to be unclean, sinful, or otherwise undesirable situations. In a society with a strong sense of solidarity, if one individual violates a taboo, the whole community may feel itself menanced until the violator is purified.

Childbirth, puberty, marriage, warfare or bloodshed, and death are commonly marked by purifying rites. Contaminating factors may include foods (as the flesh of totem animals), persons (as menstruating women or persons of inferior caste), places, and so on. Rituals of purification may entail the use of water (as in baptism), mutilation (as in circumcision), fasting, prayer, and confession.

The subject is treated in full in MACROPAEDIA: Rites and Ceremonies, Sacred.

purification, water: *see* water purification.

Purification Clique (Confucian group): *see* Ch'ing-liu tang.

Purim (Hebrew: "Lots"), English FEAST OF LOTS, a joyous Jewish festival commemorating the survival of the Jews who, in the 5th century BC, were marked for death by their Persian rulers. The story, probably fictitious, is related in the Old Testament Book of Esther.

Haman, chief minister of King Ahasuerus, incensed that Mordecai, a Jew, held him in disdain and refused obeisance, convinced the

Illustration from the Megillat Esther, late 15th–early 16th century, Italian, showing the gallows upon which Haman and his sons were hanged; in the Jewish Museum, New York
Jewish Museum, New York City—Art Resource/EB Inc.

King that the Jews living under Persian rule were rebellious and should be slaughtered. With the King's consent, Haman set a date for the execution (the 13th day of the month of Adar) by casting lots and built a gallows for Mordecai.

When word of the planned massacre reached

Esther, beloved Jewish queen of Ahasuerus and adopted daughter of Mordecai, she risked her life by going uninvited to the King to suggest a banquet that Haman would attend. At the meal she pleaded for the Jews and accused "this wicked Haman" of plotting the annihilation of her people. Upset, the King stepped out into the palace gardens. On returning, he found Haman "falling on the couch where Esther was." The King mistook Haman's frantic pleas for mercy as an attack upon the queen. The outraged King ordered that Haman be hanged and that Mordecai be named to his position. Esther and Mordecai then obtained a royal edict allowing Jews throughout the empire to attack their enemies on Adar 13. After an exhilarating victory they declared the following day a holiday and (alluding to the lots Haman had cast) named it Purim.

The ritual observance of Purim begins with a day of fasting, Taʿanit Esther (Fast of Esther) on Adar 13, the day preceding the actual holiday. The most distinctive aspect of the synagogue service is the reading of the Book of Esther. On Purim Jews are also enjoined to exchange gifts and make donations to the poor. Through the years many nonreligious customs have come to be associated with the festival, among them the baking of the three-cornered pastries called *hamantaschen* ("Haman's ears"). Purim plays, which became popular during the 17th century, contribute to the carnival atmosphere especially enjoyed by children.

purine, any of a class of organic compounds of the heterocyclic series characterized by a two-ringed structure composed of carbon and nitrogen atoms. The simplest of the purine family is purine itself, a compound with a molecular formula $C_5H_4N_4$. Purine is not common, but the purine structure occurs in many natural substances.

Uric acid, the first purine derivative to be discovered, was isolated in 1776 from urinary calculi; xanthine was obtained from the same source in 1817. Xanthine also occurs in tea, as does caffeine, another purine compound. Guanine, found in guano, the accumulated excrement and dead bodies of birds, bats, and seals, and adenine were identified in 1891 as products of the chemical decomposition of nucleic acids, the cell constituents that determine hereditary characteristics. Purine itself and several purine compounds were synthetically prepared from uric acid in the 1890s.

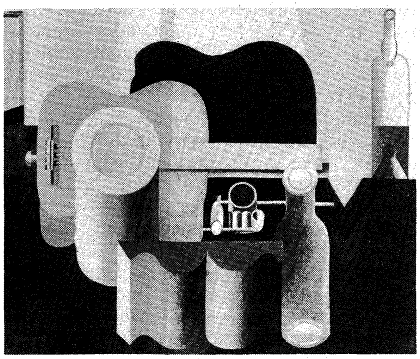
Purishkevich, Vladimir Mitrofanovich (b. Aug. 24 [Aug. 12, old style], 1870, Kishinyov, Russia—d. February 1920, Novorossiysk), Russian politican and right-wing extremist who in 1905 was one of the founders of the Union of the Russian People (URP), a reactionary group active before the Russian Revolution and noted for its violent attacks against Jews and leftists.

A landowner and onetime government official, Purishkevich also served as a deputy to the second through fourth state Dumas (parliaments), in which he made anti-Semitic speeches. Purishkevich quickly established himself as a leader of the extreme reactionaries in the Duma, claiming at one point, "To the right of me there is only the wall." He combined unswerving loyalty to the monarchy with a firm commitment to ethnic Russian domination of the Empire's minority nationalities, and he had an unyielding hatred for liberals, socialists, and Jews.

In 1908, after a personality clash with other URP leaders, Purishkevich formed a splinter group known as the Union of the Archangel Michael. A vigourous supporter of the Russian war effort during World War I, Purishkevich was one of the conspirators in the murder of Grigory Rasputin in December 1916.

After the abdication of the Tsar in February 1917, Purishkevich planned the escape of the imperial family from the provisional government. During the revolution in November (October, O.S.) he led a counterrevolutionary conspiracy in Petrograd. Imprisoned by a Soviet court, he was amnestied in May 1918 and moved to southern Russia, where he worked with White forces and published an anti-Soviet newspaper. He died of typhus.

Purism, in painting, a variant of Cubism (*q.v.*) developed in France in about 1918 by the painter Amédée Ozenfant and the architect and painter Charles-Édouard Jeanneret (Le Corbusier). The two artists, critical of the later decorative trend in Cubism and the creation of arbitrary and fantastic forms, advocated a return to clear, precise, ordered forms, expressive of the modern machine civilization. The collaboration of the two artists began with their book *Après le cubisme*, of 1918, and continued with essays published from 1920 to 1925 in their review, *L'Esprit Nouveau.*



"Still Life," Purist painting by Le Corbusier, oil on canvas, 1920; in the Museum of Modern Art, New York City

By courtesy of the Museum of Modern Art, New York City, Van Gogh Purchase Fund

In an essay entitled "Purism," which appeared in this review, the authors defined painting as "an association of purified, related, and architectured elements." This concept of painting is reflected in their still-life canvases, which present clean, pure, integral forms. In "Still Life" (1920), for example, Le Corbusier repeats the rhythmic, curving contours of a guitar (a favourite Cubist motif) in the shoulders of a bottle and in other objects on the table; by tilting the tops of the objects toward the spectator, he gives an added emphasis to their cubic volume. A motif of circles is carried out in the various sizes of the openings in bottles, pipes, and containers. The colour scheme is purified to include only the neutrals—gray, black, and white—and monochromes of green. Paint is smoothly applied to enhance the cool, harmonious shapes of the objects. He thus creates a "symphony of consonant and architectured forms."

As a movement in painting, Purism did not have an appreciable following. There were many painters, however, who, like the Purists, were attracted to a machine-inspired aesthetic; most notable were the French painter Fernand Léger and the American Precisionist painters of the 1920s. *See* Precisionism.

Puritanism, a religious reform movement in the late 16th and 17th centuries which sought to "purify" the Church of England from remnants of Roman Catholic "popery" that the Puritans claimed had been retained after the religious settlement reached early in the reign of Queen Elizabeth I. Puritans became noted for a spirit of moral and religious earnestness that determined their whole way of life, and they sought through church reform to make their lifestyle the pattern for the whole nation. Their efforts to transform the nation led to civil war in England and to the founding of colonies in America as working models of the Puritan way of life.

A brief treatment of Puritanism follows. For full treatment, *see* MACROPAEDIA: Protestantism.

King Henry VIII separated the Church of England from Rome in 1534, and the cause of Protestantism advanced rapidly under Edward VI (reigned 1547–53). During the reign of Queen Mary (1553–58), however, England returned to Roman Catholicism, and many Protestants were martyred or forced into exile. Many of the exiles found their way to Geneva, where John Calvin's church provided a working model of a disciplined church. Out of this experience also came the two most popular books in Elizabethan England—the Geneva Bible and John Foxe's *Book of Martyrs*—which provided a view of England as an elect nation chosen by God to complete the work of the Reformation. Thus, Elizabeth's accession was enthusiastically welcomed by these Protestants in 1558, but her settlement disappointed those who sought extensive reform, and they were unable to achieve their objectives in the Convocation, the primary governing body of the church.

Many of these Puritans—as they came to be known during a controversy over vestments in the 1560s—sought parliamentary support for an effort to institute a presbyterian form of polity for the Church of England. Other Puritans, concerned with the long delay in reform, decided upon a "reformation without tarrying for any." These "Separatists" repudiated the state church and formed voluntary congregations based on a covenant with God and among themselves. Both groups, but especially the Separatists, were repressed by the establishment. Denied the opportunity to reform the established church, English Puritanism turned to preaching, pamphlets, and a variety of experiments in religious expression and in social behaviour and organization. Its successful growth also owed much to patrons among the nobility and in Parliament and its control of colleges and professorships at Oxford and Cambridge.

Puritan hopes were again raised when the Calvinist James VI of Scotland succeeded Elizabeth as James I of England in 1603. But at the Hampton Court Conference in 1604 he dismissed the Puritans' grievances with the phrase "no bishop, no king." Puritans remained under pressure. Some were deprived of their positions; others got by with minimal conformity; and still others, who could not accept compromise, fled England. The pressure for conformity increased under Charles I (1625–49) and his archbishop, William Laud. Nevertheless, the Puritan spirit continued to spread, and when civil war broke out between Parliament and Charles in the 1640s, Puritans seized the opportunity to urge Parliament and the nation to renew its covenant with God. Parliament called together a body of clergy to advise it on the government of the church, but this body—the Westminster Assembly—was so badly divided that it failed to achieve reform of church government and discipline. Meanwhile, the New Model Army, which had defeated the royalist forces, feared that the Assembly and Parliament would reach a compromise with King Charles that would destroy their gains for Puritanism, so it seized power and turned it over to its hero, Oliver Cromwell. The religious settlement under Cromwell's Commonwealth allowed for a limited pluralism that favoured the Puritans. A number of radical Puritan groups appeared, including the Levellers, the Diggers, the Fifth Monarchy Men, and the Quakers (the only one of lasting significance).

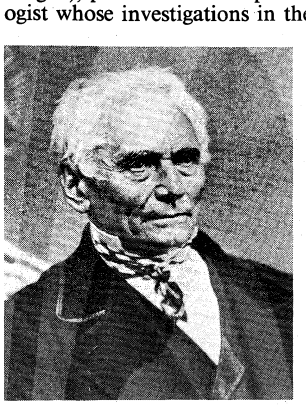
After Cromwell's death in 1658, conservative Puritans supported the restoration of King Charles II and a modified episcopal polity. However, they were outmaneuvered by those who reinstituted Laud's strict episcopal pattern. Thus, English Puritanism entered a period known as the Great Persecution. English Puritans made a final unsuccessful attempt to secure their ideal of a comprehensive church during the Glorious Revolution, but England's religious solution was defined in 1689 by the Act of Toleration that continued the established church as episcopal but also tolerated dissenting groups.

The Puritan ideal of realizing the Holy Commonwealth by the establishment of a covenanted community was carried to the American colony of Virginia by Thomas Dale, but the greatest opportunity came in New England. The original pattern of church organization in the Massachusetts Bay Colony was a "middle way" between presbyterianism and Separatism, yet in 1648 four New England Puritan colonies jointly adopted the Cambridge Platform, establishing a congregational form of church government. The New England Puritans fashioned the civil commonwealth according to the framework of the church. Only the elect could vote and rule. When this raised problems for second-generation residents, they adopted the Half-Way Covenant, which permitted baptized, moral, and orthodox persons to share the privileges of church membership. Other variations of the Puritan experiment were established in Rhode Island by Roger Williams, who was banished from the Massachusetts Bay Colony, and in Pennsylvania by the Quaker William Penn.

Puritanism may be defined primarily by the intensity of the religious experience it fostered. Puritans believed that conversion was necessary to redeem one from one's sinful condition; that God had chosen to reveal salvation through preaching; and that the Holy Spirit rather than reason was the energizing instrument of salvation. This naturally led to the rejection of much that was characteristic of contemporary Anglican preaching and ritual. In its place the Puritans emphasized plain preaching that drew on images from scripture and from everyday experience. Still, because of the importance of preaching, the Puritans placed a premium on a learned ministry. The conversion experience that was characteristic of Puritans combined with the doctrine of predestination inherited from Calvinism to produce a sense of themselves as elect spirits chosen by God to revolutionize history.

Purity, Brethren of: *see* Ikhwān aṣ-Ṣafā'.

Purkinje, Jan Evangelista (German), Czech JAN EVANGELISTA PURKYNĚ (b. Dec. 17, 1787, Libochovice, Bohemia—d. July 28, 1869, Prague), pioneer Czech experimental physiologist whose investigations in the fields of histology, embryology, and pharmacology helped create a modern understanding of the eye and vision, brain and heart function, mammalian reproduction, and the composition of cells.



Purkinje
CTK—Czechoslovak News Agency

Purkinje's research at the University of Prague (M.D., 1819), where he later served as professor of physiology (1850–69), led to his discovery of a phenomenon known as the Purkinje effect (as light intensity decreases, red objects are perceived to fade faster than blue objects of the same brightness). His studies of human vision attracted the attention of the German poet Goethe, who befriended the Bohemian student and may have been instrumental in obtaining for him the chair of physiology and pathology (1823–50) at the University of Breslau, Prussia. There Purkinje created the world's first independent department of physiology (1839) and the first official physiological laboratory (Physiological Institute; 1842).

Considered the founder of laboratory training in connection with university teaching in Germany, Purkinje is best known for his discovery of large nerve cells with many branching extensions found in the cortex of the cerebellum of the brain (Purkinje cells; 1837) and of the fibrous tissue that conducts the pacemaker stimulus along the inside walls of the ventricles to all parts of the heart (Purkinje fibres; 1839). In describing young animal embryos, he introduced protoplasm as a scientific term.

First to use the microtome (a mechanical device for slicing thin tissue sections), glacial acetic acid, potassium bichromate, and Canada balsam in the preparation of tissue samples for microscopic examination, Purkinje also described the experimental effects on humans of camphor, opium, belladonna, and turpentine (1829) and the visual images produced by poisoning with digitalis and belladonna. He discovered the sweat glands of the skin (1833) and the germinal vesicle, or nucleus of the unripe ovum, that now bears his name (1825), recognized fingerprints as a means of identification (1823), and noted the protein-digesting power of pancreatic extracts (1836).

purl stitch, also called LINK-AND-LINK STITCH, or GARTER STITCH, basic knitting stitch in which loops are pulled alternately to the front and back of the fabric, producing horizontal ridges, or courses, on both sides. It is a filling knit construction and can be made by hand and on both flat and circular knitting machines.

The fabric produced is thicker, wider, and shorter than plain-stitch types, with more stretch in the length than in the width. The purl stitch is used for infant's and children's wear and for bulky sweaters, and it is often combined with other stitches in the same garment.

Pūrṇaprajña (Hindu philosopher): *see* Madhva.

Purnea, town, administrative headquarters of Purnea district, Bihār state, northeastern India, east of the Saura River, a tributary of the Ganges. Purnea is a major rail and road junction and is heavily engaged in agricultural trade. Rice and jute milling are the major industries. It was constituted a municipality in 1864 and has a state hospital.

Purnea district (3,050 sq mi [7,900 sq km]) occupies the eastern portion of the northern Bihār plains, drained chiefly by the Mahānanda River. Purnea is the major jute-producing district of Bihār; other crops include grains, tobacco, and oilseeds. Cattle raising is extensive. Kishanganj is an important commercial centre. Pop. (1981) town, 91,144; metropolitan area, 109,875; district, 3,595,707.

Purple Heart, the first U.S. military decoration, instituted by George Washington in 1782 and awarded for bravery in action. The records show that only three men received it during the Revolutionary War, all of them noncommissioned officers. Two of these coveted badges still exist. The original medal, sewn onto the coat, was simply a purple heart-shaped piece of cloth edged with silver braid. Although this was the medal of honour of the Revolution, it seems to have been forgotten for about 150 years. The 200th anniversary of Washington's birth marked the revival of the award (Feb. 22, 1932).

The current purpose of the medal is as an award for those wounded or killed (awarded posthumously) in the service of their country. An Oak Leaf Cluster is granted to a person previously wounded who already has a Purple Heart.

Perhaps one of the most beautifully designed of all U.S. decorations, the medal is a purple heart-shaped badge with bronze edges that depicts a profile relief bust of Washington in the uniform of a general in the Continental Army. The reverse side has the inscription "For Military Merit" with the recipient's name below.

purple medic (plant): *see* alfalfa.

purple sail, also called BY-THE-WIND SAILOR (*Velella*), any of a genus of floating marine animals usually classified in the order Siphonophora (class Hydrozoa) characterized by a sail-like pneumatophore, or gas-filled float. Below the sail hang various structures: tentacles armed with nematocysts, or stinging cells; gonozooids, which have a reproductive function; and a single, central gastrozooid, the feeding and digesting organ.

purpura, presence of large and small hemorrhages in the skin, often associated with bleeding from natural cavities and in tissues. It occurs as a result of failure of hemostasis (arrest of bleeding), which, in turn, has five major causes: (1) damage to the wall of small arterial vessels (vascular purpura), which may be due to vitamin deficiency (scurvy), bacteria, viruses, allergic reactions, or heredity (pseudohemophilia); (2) deficiency of platelets (small bodies that not only plug leakages in the vessel wall mechanically but also contain many chemicals active in the coagulation of blood) in association with such disorders as thrombocytopenia, immunothrombocytopenia, lupus erythematosus, and thrombasthenia; (3) deficiency of clotting factors, either congenital (as in hemophilia, Christmas disease, hypoprothrombinemia, afibrinogenemia) or acquired in the course of disease (especially of the liver), and the administration of anticoagulant drugs; (4) development of circulating anticoagulants of various types (abnormal proteins, antibodies) that prevent normal interaction of the various clotting factors and that are found in some blood disorders (multiple myeloma, leukemias), in diseases of the connective tissue, in radiation injury, and following drug therapy; (5) fibrinolysis, caused by the activation of a usually dormant system that is able to destroy the blood fibrin clot; this condition may occur during accidents of pregnancy, delivery, and surgery. A paradoxical type of bleeding is found when tissue materials (as the consequence of shock, trauma, burns) enter the bloodstream and cause clotting within the vessels. As the patient is depleted of clotting factors, he becomes a bleeder. This mechanism is often found behind severe hemorrhage at delivery.

Treatment of purpura depends on the causative mechanism. Corticosteroid hormones are effective in controlling vascular purpura and the bleeding of thrombocytopenia. Transfusion of platelets may be a useful technique for a bleeding emergency, and surgical removal of the spleen is resorted to in certain forms of thrombocytopenic purpura when other therapy has failed. The administration of either blood or plasma or of the fractions specifically absent is the basis of the treatment of acute bleeding in disorders of blood coagulation.

Pursat (Kampuchea): *see* Poŭthĭsăt.

purse (ancient Roman treasury): *see* fiscus.

purslane, any of certain small, fleshy annual plants of the genus *Portulaca,* of the family Portulacaceae, with prostrate, reddish stems, egg-shaped leaves attached by the narrower end, and small yellow flowers that open in the sunlight. The common purslane (*P. oleracea*), or pusley, is a widespread weed, but the variety *P. o. sativa,* known as kitchen garden pusley, is grown to some extent as a potherb, mostly in Europe. All plants of the genus are known for their persistence; they grow well even in dry waste soil and can retain enough moisture to bloom and ripen seeds long after they have been uprooted. The capsules, which open by a lid, scatter many small seeds of great longevity.

The purslane tree (*Portulacaria afra*), native to South Africa, is a fleshy-leaved, soft-wooded tree up to 4 metres (12 feet) high. It is grown in California as a specimen plant for its succulent habit and its tiny pink flowers in clusters and is also cultivated widely as an indoor pot plant.

pursuit racing, in bicycle racing, an event in which teams or individuals start on opposite sides of an oval track with the goal of overtaking the opponents. Since it is unusual, in skilled competition, for one individual or team to overtake the opposition, the winner is declared to be the one who, in the shortest time, covers the prescribed distance of 5,000 metres (5,500 yards) for professionals and 4,000 metres (4,400 yards) for amateurs.

In team pursuit races, the leading bicyclist is followed closely by his teammates in single file so that only the leader has to break the resistance of the wind with his forward movement. The tiring lead position is periodically assumed by each team member in his turn.

Amateur and professional individual pursuits were introduced in the 1939 Milan world championships, although only the heats were conducted before the games were called off; they were revived in 1946 at Zürich. Women's individual pursuit racing was introduced in 1958, and women's team pursuit was added in 1962.

Puruhá, Ecuadorian Indians of the Andean highlands at the time of the Spanish conquest. Although the highlands are still inhabited by persons of Indian descent, their linguistic, cultural, and tribal identity has been lost, so that there is no longer an identifiable Puruhá people. The Puruhá language is extinct, and there are no written records.

At the time of the conquest the Puruhá were an agricultural people cultivating corn (maize), beans, squash, and potatoes. They also hunted. Their settlements, probably of mud-plastered houses with thatched roofs, were scattered over the mountainside. The Puruhá were skillful weavers of cotton and cabuya (maguey, or century-plant) fibres. Clothing consisted of a cotton tunic for men, as well as a blanket for warmth; the women's costume is not known.

Their cohesive, rather feudal political system was organized under local chieftains and a regional king. They believed that two local volcanoes, Chimborazo and Tungurahua, were their divine ancestors, and they offered human sacrifices to Chimborazo.

Purūlia, town, administrative headquarters of Purūlia district, West Bengal state, northeastern India. Just north of the Kāsai River, the town is a major road and rail junction and the district's major agricultural distribution centre. Oilseed milling, silk and cotton weaving, and canework and shellac manufacture are the major industries. Nearby are several 7th-century Jaina temple ruins. Purūlia, constituted a municipality in 1876, has four colleges affiliated with the University of Burdwān.

Purūlia district (2,415 sq mi [6,259 sq km]) was formed in 1956. It comprises an undulating plain of the eastern Choṭa Nāgpur plateau, forested in the west and south. A dam across the Kāsai near Purūlia town provides a reservoir, flood control, and irrigation for the area. Rice, corn (maize), wheat, and barley are the chief crops; iron ore, clay, dolomite, limestone, mica, and kyanite deposits are worked. Pop. (1981) town, 166,762; district, 1,853,801.

Purus River, Portuguese RIO PURUS, Spanish RÍO PURÚS, river that rises in several headwaters in Loreto department, Peru. It flows in a generally northeasterly direction through the rain forests of Peru and Acre state, Brazil. Entering Amazonas state, Brazil, the Purus meanders sluggishly northward, eastward, and northeastward to join the stretch of the Amazon River upstream from Manaus, known as the Solimões River. At its mouth (3,900 ft [1,200 m] wide) the river divides into numerous branches that emerge across from Ilhas (islands) Ananás e Consciência. The Purus is practically a great drainage ditch for the half-submerged, lake-flooded district it traverses. Most of its 1,995-mi (3,211-km) course is navigable, as are the many lakes formed near its shores. The river, once known as the Coxiuara, is one of the world's most crooked streams, the straight-line distance from its rising to its mouth being less than half that by its meanders. Rubber is gathered from forests along its course.

Where the same name may denote a person, place, or thing, the articles will be found in that order

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puruṣa (Sanskrit: "person," or "spirit"), in Indian philosophy, the soul, or self. The existence of an eternal, unchanging self is accepted by most schools of Indian philosophy, though they differ in their description of its essence and the proofs for its existence.

In the dualistic philosophies of Sāṃkhya and Yoga, *puruṣa* is opposed to *prakṛti* ("matter"), as the two ontological realities. All animate and inanimate objects and all psychomental experiences are emanations of *prakṛti.* It is confusion of *puruṣa* with *prakṛti* that is the soul's bondage; disassociation of *puruṣa* from *prakṛti* is the soul's liberation.

Puruṣa is also, in one of the early creation myths related in the Vedas, the primal man from whose body the universe was created. He was both sacrificer and victim, and his rite was the imagined prototype for all later Vedic and Hindu sacrifices.

Purvachal, also called EASTERN HIGHLANDS, mountain ranges in eastern India, extending over about 37,900 sq mi (98,000 sq km) in Arunāchal Pradesh, Nāgāland, Manipur, Mizorām, Tripura, and eastern Assam states. The Patkai and other associated mountain ranges (including the Aka, Dafla Mīri, Abor, and Mishmi hills) that run through this region are referred to collectively as Purvachal (*purva,* "east," and *achal,* "mountain"). The area is bounded by Bangladesh in the southwest, Burma in the southeast, and China in the northeast. The Hindu epic the *Mahābhārata* has several references to the region. The Purvachal was ruled by the Ahoms from the beginning of the 13th century. It was occupied by the British in the last quarter of the 19th century.

Geologically, the region is unstable; it is crisscrossed by several faults. Its north–south-aligned hill ranges are defined by narrow parallel valleys tending toward the west. The highest peak in the region is the Dapha Bum (in Lohit district of Arunāchal Pradesh), with an elevation of 14,822 ft (4,517 m). The major rivers are the Lohit, Burhi Dihang, Diyung, Kusiyara, Gumti, Kaladan, Manipur, Tixu, Nantaleik, and Naurya. The vegetation is diverse, ranging from tropical evergreen to temperate evergreen and coniferous, and includes oak, chestnut, birch, magnolia, cherry, maple, laurel, and fig; there are also extensive bamboo jungles.

Rice, millet, corn (maize), pulse (legumes), sesame, rapeseed, mustard, sugarcane, potatoes, barley, wheat, and cassava are grown by means of shifting cultivation with traditional implements. Poultry farming and livestock raising are also important. Industry, mainly cottage and small-scale, produces woven textiles, baskets, wooden utensils, bows and arrows, traps, sleeping benches, sugar, paper, metalware, traditional embroidered costumes, bricks, tiles, soap, hosiery, and preserved fruit. Mineral resources include lime, lignite, coal, iron ore, copper ore, rock salt, clay, and ochre. The Nocte, Wancho, Tangsa, Nāga, Kuki, Lushai, Lakher, Chakma, and Panei ethnic groups compose most of the population. The North East Frontier Railway passes through Cāchār and North Cāchār districts, and the National Highway connects only Imphāl and Kohīma. As a result, the administrative headquarters of most of the districts in the region are linked by air.

purveyance, in English history, the prerogative of the sovereign to compel the sale of goods at a reduced price to maintain himself and his household as they traveled through the country, a constant source of grievance from the Middle Ages into the 17th century. King's officers compulsorily purchased (purveyed) from the great fairs or in local markets in advance of the king's itinerant court. Purveyance included not only the acquisition of goods but the hiring of horses and carts to convey the goods and often forced personal labour. Profiteering officials aggravated the hardship, especially when local surpluses were small. The first limitation of this prerogative was won in the Magna Carta (1215), and in the next three centuries several statutes and petitions were issued against its excesses. The custom nevertheless persisted until the 17th century; Francis Bacon spoke against purveyors in the first Parliament of James I. Purveyance fell out of use during the Commonwealth and was abolished in 1660 at the Restoration.

Pūsa, town, Samāstipur district, Bihār state, northeastern India, just west of the Burhi Gandak River. In 1796 the estate site was acquired by the government for use in horse breeding and later as a tobacco farm. The estate was given in 1904 to the Imperial Agricultural Department of the Indian government and became its headquarters. A research institute was founded in 1905, with an experimental farm and agricultural college, at which rust-resistant wheat strains were produced. Research on fungus pests and selective breeding of cattle was also carried out. After the 1934 earthquake, work was transferred to New Delhi. Rajendra Agricultural University, with several research stations, was opened in Pūsa in 1970. Pop. (1981) 122,086.

Pusan, also spelled BUSAN, city and port, South Korea, at the southeast tip of the Korean Peninsula. The capital of Kyŏngsang-namdo (South Kyŏngsang Province), in 1963 it was given the status of a special city under the direct control of the home minister, with administrative status equal to that of a province. During the Koryo dynasty (10th to late 14th century) it was named Pusanpo: Korean *pu,* meaning "kettle"; *san,* "mountain" (from the shape of the mountain behind it); and *po,* "bay," or "harbour." It is now the nation's largest port and second largest city.

On a deep, well-sheltered bay at the mouth of the Naktong-gang (river) facing the Japanese islands of Tsushima, across the Korean Strait, Pusan was opened to the Japanese in 1876 and to general foreign trade in 1883. Under the Japanese (1910–45) it developed into a modern port, with ferry service connecting the city with Shimonoseki, Japan, and rail lines connecting Korea to China and the Soviet Union terminating in Pusan. It now also has an international airport. The city became

Pusan city and harbour, South Korea
Knodel—Shostal/EB Inc.

overpopulated with repatriates from overseas when Korea gained independence in 1945 and again with refugees during the Korean War (1950–53), when it was the temporary capital of the Republic of Korea.

The port is divided by Yŏng-do (island), which is connected to the mainland by drawbridge. The bigger eastern port is used for foreign trade and the smaller western port for fishing. Industries include shipbuilding and automobile, electric, metal, ceramic, chemical, paper, and various mechanical and other manufacturing plants. Construction on the city's first subway began in 1980. Its plywood industry is the nation's largest, producing significant exports after 1961. There are two universities and seven colleges, including Pusan National University, Pusan National Fishery College, and the College of Oceanography. Bathing and hot springs are located in the northeastern suburbs, and old temples are found near the mountains. Outside the city is a cemetery honouring the United Nations soldiers who died during the Korean War. Pop. (1982 est.) 3,343,783.

Pusey, E(dward) B(ouverie) (b. Aug. 22, 1800, Pusey, Berkshire, Eng.—d. Sept. 16, 1882, Ascot Priory, Berkshire), English Angli-

E.B. Pusey, drawing by George Richmond; in the National Portrait Gallery, London
By courtesy of the National Portrait Gallery, London

can theologian, scholar, and a leader of the Oxford Movement, which sought to revive in Anglicanism the High Church ideals of the later 17th-century church.

In 1823 Pusey was elected to a fellowship at Oriel College, where he met the churchmen John Keble and John Henry Newman (later Cardinal Newman), with whom he subsequently shared leadership of the Oxford Movement. After studying theology and Oriental languages in Germany, he was nominated regius professor of Hebrew at Oxford by the Duke of Wellington.

Pusey's association with the Oxford Movement began in 1833. He contributed a tract on fasting to *Tracts for the Times* in 1834, and a year later he wrote for the series an extensive tract on Baptism. The hostility of university authorities was aroused in 1843 by his sermon asserting the doctrine of the Real Presence in the Eucharist, and he was suspended from university preaching for two years. The ensuing notoriety substantially helped the sale of the tracts. Newman, who edited them, wrote of Pusey: "He at once gave us a position and a name."

Pusey was known as a warmhearted, sincere, and humble man, whose activities included the building of St. Saviour's Church, Leeds, at his own expense (1842–45) and service to the sick during the cholera epidemic of 1866. In 1845 he helped found in London the first Anglican sisterhood, which revived monastic life in the Anglican Church. Conservative in his biblical criticism, he subscribed to the principle of revelation as interpreted by the historic authority of the church and opposed the use of philosophical systems in constructing a theology. His many books include *The Doctrine of the Real Presence* (1855) and *The Real Presence* (1857) as well as scholarly works, such as *The Minor Prophets, with a Commentary* (1860) and *Daniel the Prophet* (1864). Pusey House, Oxford, founded by his friends two years after his death, preserves his library and some personal effects.

Pusey, Nathan (Marsh) (b. April 4, 1907, Council Bluffs, Iowa, U.S.), U.S. educator, president of Harvard University (1953–71), who greatly enhanced the school's endowment and educational facilities and revitalized its teaching of the humanities. From 1971 until his retirement in 1975 he was president of the Andrew W. Mellon Foundation.

Pusey was educated at Harvard (A.B., 1928; M.A., 1932; Ph.D., 1937), and began his teaching career as a tutor in an experimental liberal arts program at Lawrence College in Appleton, Wis., and then as a teacher at Scripps College in Claremont, Calif. In 1940 he returned to New England to develop a freshman–sophomore liberal arts program at Wesleyan University in Middletown, Conn., where he became associate professor of classics in 1943. In 1944 Pusey returned to Lawrence College as president, and in 1953 he was appointed president of Harvard, succeeding James B. Conant.

Pusey immediately devoted his efforts to increasing Harvard's endowment—as he had done at Lawrence College—and his efforts were highly successful. He was also instrumental in raising faculty salaries and adding new buildings to the campus. Antiwar protests in the late 1960s twice forced the closing of the campus, and in 1969 bloodshed resulted when Pusey called in the Cambridge police to end a student sit-in.

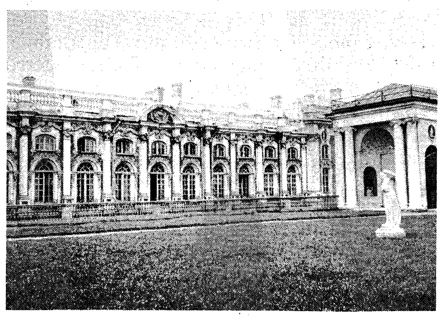
pusher lace, lace made in the 19th century at Nottingham, Eng., on the "pusher" machine, patented in 1812 by S. Clark and J. Mart. Modified by J. Synyer in 1825, the pusher machine was the first to produce a twisted patterned lace. In 1839, when combined with

Detail of a parasol cover of imitation Chantilly lace made on the pusher machine from Nottingham, Eng.; in the Museum and Art Gallery, The Castle, Nottingham, Eng.
By courtesy of the Museum & Art Gallery, The Castle, Nottingham, Eng.

the Jacquard apparatus, the pusher machine could copy convincingly such handmade laces as Chantilly, except for the outlining thread, which continued to be hand run.

Pushkar, town, Ajmer district, Rājasthān state, northwestern India. The town, a pilgrimage centre, contains five principal temples, all of modern construction since the earlier buildings were destroyed by the Mughal emperor Aurangzeb (reigned 1658–1707). The principal temple and Pushkar Lake are dedicated to the god Brahmā. Bathing *ghāṭs* (stairways descending to the water) surround the lake, to which great sanctity is attached, and a religious fair there is attended annually by thousands of pilgrims. Pop. (1981) 9,368.

Pushkin, formerly (from 1728) TSARSKOYE SELO (Tsar's Village), or (1918–37) DETSKOE SELO (Children's Village), city, Leningrad



Garden facade of Empress Catherine's palace in Pushkin, Russian S.F.S.R.
Vance Henry—Globe

oblast (administrative region), northwestern Russian Soviet Federated Socialist Republic, 14 mi (22 km) south of Leningrad city. Tsarskoye Selo grew up around one of the main summer palaces of the Russian royal family. Catherine I commissioned the palace (1717–23); it was later enlarged (1743–48) and rebuilt (1752–57) in the Russian Baroque style by Bartolomeo Francisco Rastrelli. The palace and its park, also laid out by Rastrelli, were considerably embellished under Catherine II the Great by the Scottish architect Charles Cameron. Deliberately gutted by the Germans during World War II, the palace has been restored. In the park are the smaller Alexander Palace, built by the Italian Giacomo Quarenghi in 1792–96, and many pavilions, statues, and monuments, including the Hermitage, designed by Rastrelli, and the Agate Pavilion of Cameron. Cameron also designed the Rococo Chinese Village rebuilt by Stasov in 1822. Immediately adjacent to the main palace is the Lycée, now converted to a museum in honour of the Russian poet Aleksandr Pushkin, who studied at the Lycée from 1811 to 1817 and for whom the city was renamed in 1937 (at the 100th anniversary of his death). The first railway in the Russian Empire was built in 1837 from St. Petersburg to Tsarskoye Selo. The Leningrad Agricultural Institute is located in the city. Pop. (1983 est.) 90,000.

Pushkin, Aleksandr (Sergeyevich) (b. June 6 [May 26, old style], 1799, Moscow—d. Feb. 10 [Jan. 29, O.S.], 1837, St. Petersburg, Russia), Russian poet, novelist, dramatist, and short-story writer; he has often been considered his country's greatest poet and the founder of modern Russian literature.

The early years. Pushkin's father came of an old boyar family; his mother was a granddaughter of Abram Hannibal, who, accord-

Pushkin, oil painting by Orest Kiprensky, 1827; in the State Tretyakov Gallery, Moscow
By courtesy of the State Tretyakov Gallery, Moscow

ing to family tradition, was an Abyssinian princeling bought as a slave at Constantinople and adopted by Peter the Great, whose comrade in arms he became. Pushkin immortalized him in an unfinished historical novel, *Arap Petra Velikogo* (published 1837; *The Negro of Peter the Great*). Like many aristocratic families in early 19th-century Russia, Pushkin's parents adopted French culture, and he and his brother and sister learned to talk and to read in French. They were left much to the care of their maternal grandmother, who told Aleksandr, especially, stories of his ancestors in Russian. From Arina Rodionovna Yakovleva, his old nurse, a freed serf (immortalized as Tatyana's nurse in *Yevgeny Onegin*), he heard Russian folktales. During summers at his grandmother's estate near Moscow he talked to the peasants and spent hours alone, living in the dream world of a precocious, imaginative child. He read widely in his father's library and gained stimulus from the literary guests who came to the house.

In 1811 Pushkin entered the newly founded Imperial Lyceum at Tsarskoye Selo (later renamed Pushkin) and while there began his literary career with the publication (1814, in *Vestnik Evropy,* "The Messenger of Europe") of his verse epistle "To My Friend, the Poet." In his early verse, he followed the style of his older contemporaries, the Romantic poets K.N. Batyushkov and V.A. Zhukovsky, and of the French 17th- and 18th-century poets, especially the Vicomte de Parny.

While at the Lyceum he also began his first completed major work, the romantic poem *Ruslan and Lyudmila* (published 1820), written in the style of the narrative poems of Ariosto and Voltaire but with an old Russian setting and making use of Russian folklore. Ruslan, modelled on the traditional Russian epic hero, encounters various adventures before rescuing his bride, Lyudmila, daughter of Vladimir, grand prince of Kiev, who, on her wedding night, has been kidnapped by the evil magician Chernomor. The poem flouted accepted rules and genres and was violently attacked by both of the established literary schools of the day, Classicism and Sentimentalism. It brought Pushkin fame, however, and Zhukovsky presented his portrait to the poet with the inscription "To the victorious pupil from the defeated master."

St. Petersburg. In 1817 Pushkin accepted a post in the foreign office at St. Petersburg, where he was elected to the exclusive Arzamás, a literary society founded by his uncle's friends. Pushkin also joined the Green Lamp association, which, though founded (in 1818) for discussion of literature and history, became a clandestine branch of a secret society, the Union of Welfare. In his political verses and epigrams, widely circulated in manuscript, he made himself the spokesman for the ideas and aspirations of those who were to take part in the Decembrist rising of 1825, the unsuccessful culmination of a Russian revolutionary movement in its earliest stage.

Exile in the south. For these political poems, in May 1820 Pushkin was banished from St. Petersburg to a remote southern province. Sent first to Yekaterinoslav (now Dnepropetrovsk), he was there taken ill and, while convalescing, travelled in the northern Caucasus and later to the Crimea with General Rayevski, a hero of 1812, and his family. The impressions he gained provided material for his "southern cycle" of romantic narrative poems: *Kavkazski plennik* (1822; *The Prisoner of the Caucasus*), *Bratya razboiniki* (1821–22, published 1827; *The Robber Brothers*), and *Bakhchisaraysky fontan* (1821–23, published 1824; *The Fountain of Bakchisaray*).

Although this cycle of poems confirmed the reputation of the author of *Ruslan and Lyudmila* and Pushkin was hailed as the leading Russian poet of the day and as the leader of the romantic, liberty-loving generation of the 1820s, he himself was not satisfied with it. In May 1823 he started work on his central masterpiece, the novel in verse, *Yevgeny Onegin* (published 1833), on which he continued to work intermittently until 1831. In it he returned to the idea of presenting a typical figure of his own age but in a wider setting and by means of new artistic methods and techniques.

Yevgeny Onegin unfolds a panoramic picture of Russian life. The characters it depicts and immortalizes—Onegin, the disenchanted skeptic; Lensky, the romantic, freedom-loving poet; and Tatyana, the heroine, a profoundly affectionate study of Russian womanhood: a "precious ideal," in the poet's own words—are typically Russian and are shown in relationship to the social and environmental forces by which they are molded. Although formally the work resembles Lord Byron's *Don Juan,* Pushkin rejects Byron's subjective, romanticized treatment in favour of objective description and shows his hero not in exotic surroundings but at the heart of a Russian way of life. Thus, the action begins at St. Petersburg, continues on a provincial estate, then switches to Moscow, and finally returns to St. Petersburg.

Pushkin had meanwhile been transferred first to Kishinyov (1820–23) and then to Odessa (1823–24). His bitterness at continued exile is expressed in letters to his friends—the first of a collection of correspondence that became an outstanding and enduring monument of Russian prose. At Kishinyov, a remote outpost in Moldavia, he devoted much time to writing, though he also plunged into the life of a society engaged in amorous intrigue, hard drinking, gaming, and violence. At Odessa he made passionate love to the wife of his superior, Count Vorontsov, governor general of the province. He fought several duels, and eventually the Count asked for his discharge. Pushkin, in a letter to a friend intercepted by the police, had stated that he was now taking "lessons in pure atheism." This finally led to his being again exiled to his mother's estate of Mikhaylovskoye, near Pskov, at the other end of Russia.

At Mikhaylovskoye. Although the two years at Mikhaylovskoye were unhappy for Pushkin, they were to prove one of his most productive periods. Alone and isolated, he embarked on a close study of Russian history; he came to know the peasants on the estate and interested himself in noting folktales and songs. During this period the specifically Russian features of his poetry became steadily more marked. His ballad "Zhenikh" (1825; "The Bridegroom"), for instance, is based on motifs from Russian folklore; and its simple, swift-moving style, quite different from the brilliant extravagance of *Ruslan and Lyudmila* or the romantic, melodious music of the "southern" poems, emphasizes its stark tragedy.

In 1824 he completed *Tsygany* (published 1827; *The Gypsies*), begun earlier as part of the "southern cycle." At Mikhaylovskoye, too, he wrote the provincial chapters of *Yevgeny Onegin;* the poem *Count Nulin* (1825, published 1827), based on the life of the rural gentry; and, finally, one of his major works, the historical tragedy *Boris Godunov* (1824–25, published 1831).

The latter marks a break with the Classicism of the French theatre and is constructed on the "folk-principles" of William Shakespeare's plays, especially the histories and tragedies, plays written "for the people" in the widest sense and thus universal in their appeal. Written just before the Decembrist rising, it treats the burning question of the relations between the ruling classes, headed by the tsar, and the masses; it is the moral and political significance of the latter, "the judgment of the people," that Pushkin emphasizes. Set in Russia in a period of political and social chaos on the brink of the 17th century, its theme is the tragic guilt and inexorable fate of a great hero—Boris Godunov, son-in-law of Malyuta Skuratov, a favourite of Ivan the Terrible, and here presented as the murderer of Ivan's little son, Dmitri. The development of the action on two planes, one political and historical, the other psychological, is masterly and is set against a background of turbulent events and ruthless ambitions. The play owes much to Pushkin's reading of early Russian annals and chronicles, as well as to Shakespeare, who, as Pushkin said, was his master in bold, free treatment of character, simplicity, and truth to nature. Although lacking the heightened, poetic passion of Shakespeare's tragedies, *Boris* excels in the "convincingness of situation and naturalness of dialogue" at which Pushkin aimed, sometimes using conversational prose, sometimes a five-foot iambic line of great flexibility. The character of the pretender, the false Dmitri, is subtly and sympathetically drawn; and the power of the people, who eventually bring him to the throne, is so greatly emphasized that the play's publication was delayed by censorship. Pushkin's ability to create psychological and dramatic unity, despite the episodic construction, and to heighten the dramatic tension by economy of language, detail, and characterization make this outstanding play a revolutionary event in the history of Russian drama.

Return from exile. After the suppression of the rising of Dec. 14 (O.S.), 1825, the new tsar Nicholas I, aware of Pushkin's immense popularity and knowing that he had taken no part in the Decembrist "conspiracy," allowed him to return to Moscow in the autumn of 1826. During a long conversation between them, the Tsar met the poet's complaints about censorship with a promise that in the future he himself would be Pushkin's censor and told him of his plans to introduce several pressing reforms from above and, in particular, to prepare the way for liberation of the serfs. The collapse of the rising had been a grievous experience for Pushkin, whose heart was wholly with the "guilty" Decembrists, five of whom had been executed, while others were exiled to forced labour in Siberia.

Pushkin saw, however, that without the support of the people, the struggle against autocracy was doomed. He considered that the only possible way of achieving essential reforms was from above, "on the tsar's initiative," as he had written in "Derevnya." This is the reason for his persistent interest in the age of reforms at the beginning of the 18th century and in the figure of Peter the Great, the "tsar-educator," whose example he held up to the present tsar in the poem "Stansy" (1826; "Stanzas"), in *The Negro of Peter the Great,* in the historical poem *Poltava* (1828, published 1829), and in the poem *Medny vsadnik* (1833, published 1837; *The Bronze Horseman*).

After returning from exile, Pushkin found himself in an awkward and invidious position. The Tsar's censorship proved even more exacting than that of the official censors, and his personal freedom was curtailed. Not only was he put under secret observation from the police but he was openly supervised by its chief, Count Benckendorf. Moreover, his works of this period met with little comprehension from the critics, and even some of his friends accused him of apostasy, forcing him to justify his political position in the poem "Druzyam" (1828; "To My Friends"). The anguish of his spiritual isolation at this time is reflected in a cycle of poems about the poet and the mob (1827–30) and in the unfinished *Egipetskiye nochi* (published 1837; *Egyptian Nights*).

Yet it was during this period that Pushkin's genius came to its fullest flowering. His art acquired new dimensions, and almost every one of the works written between 1829 and 1836 opened a new chapter in the history of Russian literature. He spent the autumn of 1830 at his family's Nizhny Novgorod (now Gorky) estate Boldino, and these months are the most remarkable in the whole of his artistic career. During them he wrote the four so-called "little tragedies"—*Skupoy rytsar* (1836; *The Covetous Knight*), *Mozart i Salieri* (1831; *Mozart and Salieri*), *Kamenny gost* (1839; *The Stone Guest*), *Pir vo vremya chumy* (1832; *Feast in Time of the Plague*)—the five short prose tales collected as *Povesti pokoynogo I.P. Belkina* (1831; *Tales of the Late I.P. Belkin*); the comic poem of everyday lower class life *Domik v Kolomne* (1833; *A Small House in Kolomna*); and many lyrics in widely differing styles, as well as several critical and polemical articles, rough drafts, and sketches.

Among Pushkin's most characteristic features were his wide knowledge of world literature, as seen in his interest in such English writers as Shakespeare, Lord Byron, Sir Walter Scott, and the Lake poets; his "universal sensibility"; and his ability to re-create the spirit of different races at different historical epochs without ever losing his own individuality. This is particularly marked in the "little tragedies," which are concerned with an analysis of the "evil passions" and, like *Pikovaya Dama* (1834; *The Queen of Spades*), exerted a direct influence on the subject matter and techniques of the novels of Dostoyevsky.

Last years. In 1831 Pushkin, after a turbulent courtship and objections from her mother, married Natalya Nikolayevna Goncharova and settled in St. Petersburg. Once more he took up government service and was commissioned to write a history of Peter the Great. Three years later he received the rank of *Kammerjunker* (gentleman of the emperor's bedchamber), partly because the Tsar wished Natalya to have the entrée to court functions. The social life at court, which he was now obliged to lead and which his wife enjoyed, was ill-suited to creative work, but he stubbornly continued to write. Without abandoning poetry altogether, he turned increasingly to prose. Alongside the theme of Peter the Great, the motif of a popular peasant rising acquired growing importance in his work, as is shown by the unfinished satirical *Istoriya sela Goryukhina* (1830, published 1837; *History of the Village of Goryukhino*); the novel *Dubrovsky* (1832–33, published 1841); *Stseny iz rytsarskikh vremen* (1835, published 1837; dramatic *Scenes from the Age of Chivalry*); and finally, the most important of his prose works, the historical novel of the Pugachov Rebellion, *Kapitanskaya dochka* (1833–36, published 1836; *The Captain's Daughter*), which had been preceded by a historical study of the rebellion, *Istoriya Pugachova* (1833, published 1834; "A History of Pugachov").

Meanwhile, both in his domestic affairs and in his official duties, his life was becoming more intolerable. In court circles he was regarded with mounting suspicion and resentment, and his repeated petitions to be allowed to resign his post, retire to the country, and devote himself entirely to literature were all rejected. Finally, in 1837, Pushkin was mortally wounded defending his wife's honour in a duel forced on him by influential enemies.

Assessment. Even during his lifetime Pushkin's importance as a great national poet had been recognized by Nikolay Vasilyevich Gogol, his successor and pupil, and it was his younger contemporary, the great Russian critic, democrat, and revolutionary Vissarion Grigoryevich Belinsky, who produced the fullest and deepest critical study of Pushkin's work, which still retains much of its relevance. To the later classical writers of the 19th century, Pushkin, the creator of the Russian literary language, the author of the standard works of Russian literature, the "poet of reality," stands as the cornerstone of Russian literature, in Maksim Gorky's words, "the beginning of beginnings."

Pushkin has become an inseparable part of the cultural and spiritual world of the Russian people and of the other peoples of the former tsarist empire to whom he bequeathed his work. He has exerted, too, a profound influence on other aspects of Russian culture, most notably in opera.

Pushkin's work—with its nobility of conception and its emphasis on civic responsibility (shown in his command to the poet-prophet to "fire the hearts of men with his words"); its life-affirming vigour; and its confidence in the triumph of reason over prejudice, of light over darkness, of human charity over slavery and oppression—has struck an echo all over the world. Translated into all the major languages, his works are regarded both as expressing most completely Russian national consciousness and as transcending national barriers.

(D.D.B./Ed.)

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Pushkin Fine Arts Museum, formally STATE FINE ARTS MUSEUM IN THE NAME OF A.S. PUSHKIN, Russian GOSUDARSTVENNY MUZEY IZOBRAZITELNYKH ISKUSSTV IMINI A.S. PUSHKINA, collection in Moscow of ancient and medieval art and western European painting, sculpture, and graphic arts. Especially noteworthy is the French art from the 18th to the 20th century gathered by the Russian collectors Shchukin and Morozov.

The museum is in a Neoclassical-style building dating from 1812. It is unrelated, except in name, to the Alexandr Pushkin Museum, also in Moscow, that specializes in the life and times of that author and has specialized collections of contemporary literature, portraits, and drawings and watercolours of St. Petersburg (now Leningrad) and Moscow.

Pushmataha, also spelled PUSHMATAHAW (b. *c.* 1765, on Noxuba Creek, Miss.—d. Dec. 24, 1824, Washington, D.C.), Choctaw Indian chief whose compliance facilitated U.S. occupation of Indian land in the early 19th century. In 1805, shortly after being elected chief, he signed the Treaty of Mount Dexter, ceding much of his people's land in Alabama and Mississippi for white occupancy. His opposition was an important factor in the failure of the Shawnee chief Tecumseh's effort to include the Southern Indians in his antiwhite confederation (1811). Pushmataha persuaded the Choctaws to ally themselves with the United States during the Creek War (1813–14) and fought with distinction in the Battle of Holy Ground (Econochaca), Dec. 23, 1813. He made further land cessions in 1816 and 1820.

Pushtu language: *see* Pashto language.

Pushtun (people): *see* Pashtun.

pusley (plant): *see* purslane.

pussy-toes, also spelled PUSSY'S-TOES (*Antennaria*), any of several species of low-growing, gray-white, wooly plants of the aster family (Asteraceae), native to North and South America, northern Europe, and Asia. Typically the basal leaves are large, with smaller and fewer leaves along the upright stem. Some species cultivated for the dried flower heads, in clusters resembling a cat's paw (hence "pussy-toes"), are also called everlasting. A few species are grown in rock gardens.

Antennaria dioica has several cultivated varieties of white, wooly appearance and with small clusters of white to rose flowers. In some species, including smaller pussy-toes (*A. neodioica*), male flowers are rare. The plantain-leaved pussy-toes (*A. plantaginifolia*), also called ladies' tobacco, has longer and broader basal leaves.

pustular dermatitis (animal disease): *see* sore mouth.

Pusur River, also spelled PUSSUR, tributary of the Padma (Ganges) River, southwestern Bangladesh. It leaves the Madhumati River (there called the Baleswar) northeast of Khulna city and flows 110 miles (177 km) south past Chālna and Mungla through the Sundarbans to the Bay of Bengal. In its upper course it is called the Athārabānki.

Puteaux, town, Hauts-de-Seine *département,* Paris region. It is a northwestern residential and industrial suburb of Paris and is situated on the west bank of the Seine River opposite the suburb of Neuilly-sur-Seine and the Bois de Boulogne, which separate it from the capital. The town is connected to Paris by a regional express railway running from the Rond Point de la Défense. Modern high-rise buildings have been built along the Défense Quartier and the Avenue du Général-de-Gaulle (a prolongation of the Champs-Élysées and the Avenue de la Grande Armée). The monumental Palais des Expositions, built of steel, concrete, and glass in 1957–59, has about three times as much space as the old Grand Palais in the Champs-Élysées in Paris itself. Puteaux's industries include automobile construction, printing, and the manufacture of perfumes, cosmetics, and rubber products. Pop. (1982) 36,095.

Putnam, Frederic Ward (b. April 16, 1839, Salem, Mass., U.S.—d. Aug. 14, 1915, Cambridge, Mass.), American anthropologist who was a leader in the founding of anthropological science in the United States. He developed two of the nation's foremost centres of anthropological research at Harvard University and the University of California, Berkeley, and had a prominent part in founding or building four major anthropological museum collections.

Entering Harvard College (1856), Putnam served as assistant (1857–64) to the eminent naturalist Louis Agassiz. He left Harvard without a degree and held zoological curatorships before becoming curator of the Peabody Museum of American Archaeology and Ethnology at Harvard (1875–1909). Putnam was one of the first to recognize and examine American archaeological remains, and he directed pioneer field expeditions in Ohio, New Jersey, the Southwest, Mexico, and Central and South America.

Putnam was appointed professor of ethnology at Harvard in 1887, and in 1891 he began organizing the anthropological section of the World's Columbian Exposition of 1893 in Chicago. That collection became the basis of Chicago's well-known Field Museum of Natural History. In 1894 he began devoting half his time to the curatorship in anthropology at the American Museum of Natural History, New York City, and was influential in dispatching the productive Jessup North Pacific Expedition to northeastern Asia and northwestern North America. In 1903 he went to the University of California, Berkeley, to organize both the new department of anthropology and the anthropological museum. Putnam published more than 400 zoological and anthropological articles, reports, and notes and was also a founder and the editor of the periodical *American Naturalist.*

Putnam, Herbert (b. Sept. 20, 1861, New York City—d. Aug. 14, 1955, Woods Hole, Mass., U.S.), American librarian who built the Library of Congress into a world-renowned institution.

Putnam graduated from Harvard in 1883 and thereafter studied law at Columbia University, being admitted to the bar in 1886. His true calling was as a librarian, however. He served as librarian of the Minneapolis Athenaeum in 1884–87 and of the Minneapolis Public Library in 1887–91. After a few years practicing law in Boston (1892–95), he served as librarian of the Boston Public Library from 1895 to 1899. In the latter year he was appointed librarian of the Library of Congress, and he retained this position until 1939.

Putnam was primarily responsible for transforming the Library of Congress from what was little more than a reference collection for congressmen into one of the great national libraries of the world. A man of remarkable administrative talents, he greatly enlarged the library's scope and holdings and established many new library services and methods, including the publishing of bibliographies, the development of the Library of Congress system of classification, the publication of the National Union Catalog, the establishment of an interlibrary loan service and a photoduplication service, and the printing and nationwide distribution of the library's catalog cards. Many of these practices were eventually adopted by other national libraries. Putnam also served as president of the American Library Association in 1898 and 1904.

Putnam, Israel (b. Jan. 7, 1718, Salem Village [now Danvers], Mass.—d. May 29, 1790, Pomfret, Conn., U.S.), American general in the U.S. War of Independence.

Putnam received little formal schooling. After moving to Pomfret, Conn., in about 1740, he became a prosperous farmer. He saw service throughout the French and Indian War, being captured by Indians and rising to the rank of lieutenant colonel in 1759. By this time his numerous adventures on the frontier had given him a formidable reputation for strength and bravery. At the outbreak of the American Revolution in 1775, he was appointed a major general in the Continental Army. He distinguished himself at the Battle of Bunker Hill in June 1775, but at the Battle of Long Island he commanded the divisions in Brooklyn that were defeated. In May 1777 he was put in charge of American defenses in the Hudson highlands, including Forts Montgomery and Clinton. When he abandoned these forts to the British soon afterward, he was faced with a court of inquiry, which nevertheless exonerated him. A paralytic stroke put an end to his active service in December 1779.

George Washington and others had originally placed high hopes in Putnam as a Continental commander, given his near-legendary feats as an Indian fighter and regimental commander. But Putnam proved disappointing as a tactician, being unable to plan and coordinate operations involving large numbers of troops. His dilatory execution of orders from Washington further diminished his effectiveness on the battlefield. Although brave, self-confident, and energetic, Putnam was not competent to fill the generalship that his popularity had brought him, and after 1777 Washington was forced to withhold important commands from him.

Putnam, Rufus (b. April 9, 1738, Sutton, Mass.—d. May 4, 1824, Marietta, Ohio, U.S.), American soldier and pioneer settler in Ohio.

Putnam fought in the French and Indian War from 1757 to 1760, worked as a millwright in 1761–68, and from then on until the outbreak of the American Revolution was a farmer and surveyor. In 1775 he entered the Continental Army as a lieutenant colonel. He organized the batteries and fortifications in Boston and New York City in 1776–77 and then successfully commanded a regiment under General Horatio Gates at the Battle of Saratoga. In 1778 he built new fortifications at West Point, and in 1779 he served under General Anthony Wayne. He was promoted to brigadier general in 1783.

After the war Putnam became interested in the settlement of the Western lands, and in 1786 he helped found the Ohio Company of Associates with the purpose of obtaining a land grant in the Ohio country for settlement by veterans of the War of Independence. The company obtained a grant from Congress of 1,500,000 acres (606,000 hectares) there, and Putnam was appointed the company superintendent of the colonizing activities. In 1788 he led a small party that founded Marietta, Ohio; this was the first white settlement in the Northwest Territory.

Putnam afterward served as a territorial judge in Ohio and as a brigadier general before being appointed surveyor general of the United States in 1796; his service in this post was less than satisfactory, however, owing to his deficiency in mathematics, and in 1803 he was dismissed by President Thomas Jefferson. In 1802 he served as a member of the Ohio state constitutional convention.

Putnik, Radomir (b. Jan. 24, 1847, Kragujevac, Serbia—d. May 17, 1917, Nice, Fr.), Serbian army commander who was victorious against the Austrians in 1914.

Educated at the artillery school, Putnik was commissioned in 1866. He graduated from the staff college in 1889 and became a general in 1903. Except for three periods when he was war minister (1904–05, 1906–08, 1912), he was chief of staff from 1903 to 1916. It was he who was mainly responsible for the skill, good equipment, and fighting spirit of the Serbian Army.

Putnik
H. Roger-Viollet

Putnik headed a brigade in the two wars against Turkey (1876, 1877–78) and headed a divisional staff in the war against Bulgaria (1885). He was commander in chief in the two Balkan Wars (1912–13), routing the Turks at Kumanovo (October 1912) and—as field marshal—at Monastir, Tur. (now Bitolj, Yugos.; November 1912). Largely because of him, the Bulgarians were defeated at Bregalnica (June–July 1913). When World War I began, Putnik, then in Austria, was escorted to Romania. In poor health, he resumed the post of commander in chief and routed overwhelming Austrian forces on Cer Mountain (August 1914), the first Allied victory in the war, and on the Kolubara River (November–December 1914). A year later, Putnik, carried in a sedan chair, shared in the retreat of his army across Albania. Relieved of his command, he retired to Nice.

Putoran Mountains, also called PUTORAN PLATEAU, Russian GORY PUTORANA, or PUTORANA PLATO, deeply dissected range on the northwestern edge of the Central Siberian Plateau in Krasnoyarsk *kray* (territory), central Russian Soviet Federated Socialist Republic. The mountains are the highest part of the plateau, rising to 5,581 feet (1,701 m) in Mount Kamen. They have been much affected by volcanic action and glaciation. Their higher parts are characterized by mountain tundra, while the more sheltered valleys have coniferous forests. Many of the valleys running west, toward the Yenisey River, and south have been drowned by large lakes.

Putte, Isaac Dignus Fransen van de (b. March 22, 1822, Goes, Neth.—d. March 3, 1902, The Hague), Liberal Dutch statesman who energetically attacked the exploitative, colonial Culture System, which extracted wealth from the Dutch East Indies using forced labour, and who succeeded in abolishing some of its abuses.

Van de Putte spent 10 years at sea before becoming a sugar planter on Java in 1849. By the time he returned to The Netherlands in 1860 he was well informed about conditions in the Indies. He advocated direct taxation instead of compulsory labour, and private enterprise instead of government monopoly. By 1862 he was a Liberal leader of Parliament and in 1863 was appointed minister of colonies. When he became prime minister (1866), his plan to abolish communal ownership of land on Java met with great resistance, and he was forced to resign. The power of the Liberal Party was broken, but in Parliament he continued to fight for reform. He succeeded in limiting both the types of crops under forced cultivation and the amount of land available to the government. He reduced corruption by abolishing the practice of rewarding officials according to the amount of produce their district brought in. The Culture System was abolished in 1870.

puttee, covering for the lower leg, consisting of a cloth or leather legging held on by straps or laces or a cloth strip wound spirally around

Three soldiers (centre) wearing puttees in "Types of English Regiments of the Line," watercolour by Archibald Elliot Haswell-Miller, 1920; in the Imperial War Museum, London

By courtesy of the Imperial War Museum, London; photograph, A.C. Cooper Ltd.

the leg. In ancient Greece a type of puttee was worn by peasants, who wrapped irregular linen straps around their legs.

The word puttee, however, is derived from the Hindu *paṭṭī*, meaning "bandage," or "strip of cloth." Such puttees were first worn by members of the Anglo-Indian army in the late 19th century. During World War I they were worn by U.S. and British infantrymen.

Puttenham, George (b. *c.* 1520—d. autumn 1590, London), English courtier, generally acknowledged as the author of the anonymously published *The Arte of English Poesie* (1589), one of the most important critical works of the Elizabethan age.

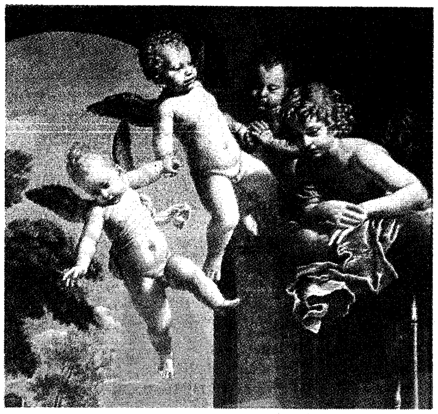
Little is definitely known of his early life. His mother was the sister of Sir Thomas Elyot; his sister married Sir John Throckmorton; and by his own marriage (*c.* 1560) to Lady Elizabeth Windsor he was connected with other wealthy and influential families. Perhaps educated abroad, he visited Flanders and other countries between 1563 and 1578. He had matriculated at Cambridge in 1546 and was admitted to the Inner Temple in 1556. Throckmorton paid his debts and rescued him from prison in 1569, when he was charged with conspiring to murder the Calvinist bishop of London, and in 1570, when he criticized the Queen's counselors too freely. His knowledge of law and public affairs is shown by *A Justificacion of Queen Elizabeth in Relacion to the Affair of Mary Queen of Scottes,* undertaken at the Queen's request and anonymously circulated, but attributed to Puttenham in two of eight extant copies of the manuscript.

George Puttenham's authorship of *The Arte of English Poesie*—early attributed to him but later disputed in favour of his brother, Richard, and of Lord Lumley—is supported by comparison of its style and opinions with those of others of his works and also by the known facts of Puttenham's life and abilities with those revealed in the *Arte.*

The *Arte* is divided into three books: I, "Of Poets and Poesy," defending and defining poetry; II, "Of Proportion," dealing mainly with prosody as an indispensable formal element of the art of poesy; and III, "Of Ornament," defined as all that renders poetic utterance attractive to eye and ear. Its importance lies in its treatment of English poetry as an art, at a period when this was still disputed; in its appeal to "right reason" as the best judge of poetry and the poetic technique; and in its emphasis on the creative, imitative, and "image-forming" faculties of the poet and on poetry's primary purpose as giving pleasure rather than instruction. In its treatment of English prosody and of poetic kinds and in its critical estimate of a broad range of English poetry, it is a pioneer work.

putting-out system (manufacturing): *see* domestic system.

putto, a nude, chubby child figure, often with wings, frequently appearing in both mythological and religious paintings and sculpture, especially of the Renaissance and Baroque pe-



Detail of the "Last Communion of St. Jerome," oil painting by Domenichino, 1614; in the Vatican Museum, Rome

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riods. Derived from personifications of love, or Eros figures, in Greek and Roman art, putti came to be used to portray cherubim in Italian paintings of the 15th century, especially those of the Madonna and Child. With the revival of classical mythological subjects in the late 15th century, the child god Cupid was commonly represented as a putto figure, and numbers of anonymous putti were frequently depicted in attendance on gods and other immortals.

putty, cementing material made of whiting (finely powdered calcium carbonate) and boiled linseed oil, beaten or kneaded to the consistency of dough and used to secure sheets of glass in sashes, to stop crevices in woodwork, and to fill nail holes. Whiting putty of a high grade consists of 85 to 90 percent whiting blended with 10 to 15 percent boiled linseed oil. White-lead whiting putty has an admixture of 10 percent white lead, reducing the amount of whiting proportionately. Prepared putty should roll freely in the hands without exuding oil. Synthetic glazing and filling compounds have supplanted putty in many applications.

The name putty is also applied to substances resembling putty, such as iron putty, a mixture of ferric oxide and linseed oil; and red-lead putty, a mixture of red and white lead and linseed oil. Certain doughlike plastics are also called putty. Putty powder (tin oxide) is used in polishing glass, granite, and metal.

putty-nosed monkey, African primate, a species of guenon (*q.v.*).

Putumayo, intendency, southern Colombia, bounded by the Río Caquetá on the northeast, Ecuador on the south, and Peru on the southeast. Its area of 9,608 sq mi (24,885 sq km) consists of forested lowlands, except where it rises abruptly into the Andes on the west. The intendency is thought to have great petroleum reserves; oil is piped from Puerto Asís, on the Río Putumayo, over the Andes to Tumaco, on the Pacific. In addition, lime is extracted, and there are deposits of marble, coal, and other minerals. The cultivation of rice, sugarcane, beans, corn (maize), bananas, and cassava is steadily increasing. A highway descends from Pasto, Nariño department, to Puerto Asís, with a branch leading to the intendency capital of Mocoa. Other travel is by river or by air. Pop. (1981 est.) 78,595.

Putumayo River, Spanish RÍO PUTUMAYO, tributary, 1,000 mi (1,609 km) long, of the Amazon. It originates as the Río Guamués, which flows from the Laguna (lake) de La Cocha, high in the Andes near Pasto, Colombia. It flows southeastward into the densely forested plains of South America past Puerto Asís, Colom., after which point it is known as the Putumayo.

The river continues its southeasterly course through tropical rain forest, forming most of the border between Colombia and Ecuador and Colombia and Peru. At Santa Clara, Colom., it enters Brazil, where it is known as the Içá. The river joins the Amazon at Santo Antônio do Içá, Brazil.

The Putumayo is a major transportation artery, navigable for almost its total length. On its banks are numerous small river ports, and rubber is gathered from forests along its course.

Puu Kukui, volcanic peak, Maui County, western Maui Island, Hawaii, U.S. It is the highest peak (5,788 ft [1,764 m]) of an 18-mi (29-km) stretch of mountains, the Honolua volcanic series, which dominates the western peninsula. Puu Kukui (meaning "candlenut hill") was formed by a volcano whose caldera has eroded into the scenic valley of Iao.

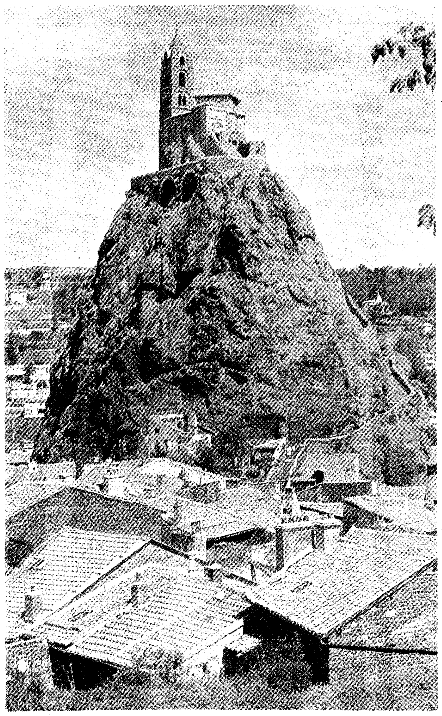
Puvis de Chavannes, Pierre(-Cécile) (b. Dec. 14, 1824, Lyon—d. Oct. 24, 1898, Paris), the leading French mural painter of the later 19th century. He was largely independent of the major artistic currents of his time and was much admired by a diversified group of artists and critics, including Georges Seurat, Paul Gauguin, Charles Baudelaire, and Théophile Gautier.

Puvis' teachers included Thomas Couture and Eugène Delacroix. Although he exhibited regularly at the Paris Salons, Puvis is best remembered for the huge canvases he painted for the walls of city halls and other public

"The Poor Fisherman," oil on canvas by Puvis de Chavannes, 1881; in the Louvre, Paris
By courtesy of the Musee du Louvre, Paris; photograph, Marc Garanger

buildings throughout France. He developed a style embodying simplified forms, rhythmic line, and pale, flat, fresco-like colouring for allegorical pieces and idealizations of themes from antiquity. Among his major commissions is a series of panels in the Panthéon, Paris, illustrating the life of St. Geneviève. Begun in 1876, the work was completed by his students after his death. Other important Paris murals are in the Sorbonne (1887–89) and the Hôtel de Ville (completed in 1893). He also painted the staircase of the public library at Boston (1894–98).

Puy, Le, town, capital of Haute-Loire *département,* Auvergne region, southern France, in the Massif Central, at 2,251 ft (686 m) above sea level, 2 mi (3 km) from the left bank of the Loire River. It is situated in the middle of a basin surrounded by basalt plateaus bristling with strange volcanic peaks. The town was already a Christian centre in the 4th century. After Muslim invasions forced the neighbouring bishop to seek refuge there in the 6th century, Le Puy became one of the main pilgrimage centres in France. During the Wars of Religion, in the latter part of the 16th century, it sided with the Catholic League. On the highest hill, the Rocher Corneille (2,300 ft above sea level), a statue (53 ft high) of Our Lady of France was erected in 1860. At the foot of the hill, on a platform surrounded by the steep narrow streets of the Old Town, stands the mainly 13th-century Romanesque cathedral of Notre-Dame, which shows Byzantine influence in its octagonal cupolas and decoration. The adjacent cloister is mainly Romanesque but has Carolingian capitals. On the outskirts of the town a volcanic needle 260 ft high is crowned by an 11th-century church, Saint-Michel-d'Aiguilhe, ingeniously designed to cover the irregular surface of the rock. About 3 mi away, the ruined castle of Polignac stands on a basalt plateau rising sheer from the plain.



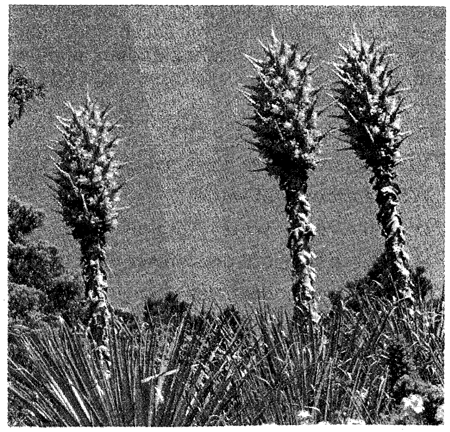
Church of Saint-Michel-d'Aiguilhe atop the residual volcanic hill, Rocher d'Aiguilhe, Le Puy, Fr.
Ray Manley—Shostal/EB Inc.

Le Puy is primarily a market town, but has also been a centre for lace-making since the 17th century; a fine collection of lace is kept in the Crozatier Museum. The traditional workshops of the lace, leather, and brewing industries are in decline, however. Pop. (1982) 22,806.

Puy-de-Dôme, *département,* Auvergne region, central France, created from the northern half of the historic province of Auvergne and from parts of Bourbonnais and Lyonnais. Its area of 3,071 sq mi (7,955 sq km) takes in several distinct physical regions in the Massif Central, including three main mountain ranges between which rivers flow in a general northerly direction. (1) The Monts (mountains) du Forez chain and its prolongation, the Bois (woods) Noirs, extend along the entire eastern boundary with Loire *département;* covered with forests and pastureland, they rise to 5,261 ft (1,634 m) at Pierre-sur-Haute. To the west the Dore River flows through the Ambert Valley to join the Allier at the northeastern border. (2) The Allier is separated from the Dore Valley in the south by the Livardois range, the forested mountains of which reach 3,996 ft (1,218 m) at Signal de Notre-Dame des Monts. As the Allier flows northward, the narrow Limagne Valley through which it passes opens out onto a broad, fertile plain in which Clermont-Ferrand, the capital, and Riom are situated. (3) The highest mountains, the Monts Dore in the southwest, display extensive ash and lava remains of three powerful volcanoes of the Quaternary Period (within the past 2,500,000 years). They reach 6,184 ft (1,885 m) at the summit of the Puy de Sancy, the highest point in central France. At its foot are the headwaters of the Dordogne River, which flows through the spas of Le Mont-Dore and La Bourboule before descending the Avèze gorges and flowing out of the southwest corner of the *département.* The Sioule River, which also rises in the Monts Dore, flows through gorges across the Combrailles Plateau in the west. The chain of the Monts Dôme extends northward beyond the Monts Dore. It is dominated by the Puy-de-Dôme, 4,614 ft (1,464 m) high, which is the most imposing of 60 tree-covered, extinct volcanic cones.

The climate is rigorous, with long winters and hot summers. The *département* is chiefly agricultural—cereals, livestock, and fruit. Such industries as rubber, textiles, and printing have spread in the Clermont-Ferrand area, and Thiers has a long-established cutlery industry. The mountain spas and winter sports resorts attract many visitors. Puy-de-Dôme is noted for its Romanesque churches, including those of Issoire, Saint-Nectaire, and Orcival and the cathedral of Clermont-Ferrand. The basalt Plateau de Gergovia south of Clermont-Ferrand, where in 52 BC the Gallic chieftain Vercingetorix repulsed Julius Caesar during the Roman conquest of Gaul, is a historic monument. The philosopher Blaise Pascal was born in Clermont-Ferrand in 1623. The *département* is divided into the *arrondissements* of Clermont-Ferrand, Ambert, Issoire, Riom, and Thiers. It is in the educational division of Clermont-Ferrand. Pop. (1982) 594,365.

Puya, genus of South American plants of the pineapple family (Bromeliaceae) that contains about 120 species, including the tallest bromeliads. *P. gigas* (*P. raimondii*), native to northern South America, grows to over 10 metres (about 33 feet) tall. It forms a flower stalk nearly 5.4 m tall.



Puya chilensis
H.R. Allen—EB Inc.

Most species grow on the cool, dry, stony slopes of the Andes mountains. The stems are rather thick and woody. The stiff, spiny-edged leaves are long and narrow and grow in a dense rosette. Several species, such as *P. alpestris* and *P. chilensis,* are cultivated indoors as decorative plants. The leaves of *P. chilensis* are the source of a fibre sometimes used to make fishing nets.

Puyguilhem, Antonin-Nompar de Caumont, marquis de: *see* Lauzun, Antonin-Nompar de Caumont, comte et duc de.

Puyi, also spelled JUI, or YOI, Wade–Giles romanization CHUNG-CHIA, ethnic group inhabiting large parts of Kweichow Province in southwestern China. They have been in southern China since early times. Their language is similar to Tai, but they had no written script of their own until the Chinese Communists supplied them with one based upon the Latin alphabet.

A Chinese account of 1730 relates that the Puyi were a group of former Chinese banished to Kweichow in pre-Christian times. More likely they were a Tai group forced from more favoured agricultural lowlands into the poorer valley lands of the Kweichow plateau and hills. In 1978 they were reported to number about 1,700,000 in Kweichow, mostly distributed at the south of the province and centred in the autonomous countries of Ts'e-heng and Wang-mo in the valley of the Nan-p'an Chiang (river). The related Tung people, who had an estimated population of 1,100,000 in 1978, inhabit the districts east of them.

Many of the Puyi have become so Sinicized that they are no longer counted as tribesmen. The Communist government has organized their districts into a number of "autonomous minority nationality districts." In southern Kweichow there is the Ch'ien-nan (south Kweichow) Puyi and Miao Autonomous Prefecture (Ch'ien-nan Pu-i-tsu Miao-tsu Tzu-chih-chou). In eastern Kweichow the Tung and Miao are similarly organized.

The culture and religion of the Puyi are not unlike those of the Chinese around them. Their traditional beliefs involve numerous gods and spirits like those of the Chinese folk religion, although there are some Buddhists and a few Christians.

Puyi (Chinese emperor): *see* P'u-i.

Puyo, town, east-central Ecuador. It lies along an affluent of the Pastaza River near the eastern slopes of the Andes Mountains. It is a missionary settlement and the most important trading centre in El Oriente region (the forested lowland jungle east of the Andes); the economy is based on local trade and barter with the surrounding Indian population. Products include sugarcane and cassava. Pop. (1983 est.) 8,399.

Puzhou (China): *see* P'u-chou.

PVC (chemistry): *see* polyvinyl chloride.

PW: *see* prisoner of war.

PWA: *see* Public Works Administration.

PWAP: *see* Public Works of Art Project.

Pwyll, in Celtic mythology, king of Dyfed, a beautiful land containing a magic caldron of plenty; he became a friend of Arawn, king of Annwn (the underworld), and exchanged shapes and kingdoms with him for a year and a day, thus gaining the name Pwyll Pen Annwn ("Head of Annwn"). With the aid of the goddess Rhiannon, who loved him, Pwyll won her from his rival, Gwawl. She bore him a son, Pryderi, who was abducted by Gwawl. Pryderi was later restored to his parents and succeeded Pwyll as ruler both in Dyfed and Annwn. In Arthurian legend, Pwyll's caldron became the Holy Grail, and Pwyll appeared as Pelles, the keeper of the Grail.

Pyandzh River, Pashto ĀB-E PANJ, headstream of the Amu Darya in central Asia. It is 700 miles (1,125 km) long and serves as part of the Afghan–U.S.S.R. border. The Pyandzh River is formed between the Hindu Kush and the Pamir Mountains, by the junction of the Vākhān River (Afghanistan) and the Pamir River (Afghan–U.S.S.R. border) just southeast of Karl Marx Peak. Fed by glacier streams, it flows southwest, then north, and finally southwest again, joining the Kowkcheh River to form the Amu Darya.

Pyanopsia, also spelled PYANEPSIA, in ancient Greek religion, a festival in honour of Apollo, held at Athens on the seventh day of the month of Pyanopsion (October). The festival's rites incorporated remnants of rustic magic, including two offerings, consisting of a hodgepodge of pulse (edible seeds) and a branch of olive or laurel bound with wool, around which were hung fruits of the season, pastries, and small jars of honey, oil, and wine. The offerings were carried to the Temple of Apollo, where they were suspended on the gate. The doors of private houses were similarly adorned. Both offerings have been connected with the Cretan expedition of Theseus, who vowed a thank offering to Apollo if he were successful in slaying the Minotaur.

Pyapon, town, lower Myanmar (Burma). It lies along the Pyapon River, 45 miles (72 km) southwest of Yangon (Rangoon). It is a rice-collecting centre and the site of a diesel electric plant. The surrounding area, part of the Irrawaddy delta, is drained by the Pyapon and Bogale distributaries, and its broken coastline fronts the Andaman Sea. Reclamation of its alluvial marshlands for paddy-rice cultivation early in the 20th century attracted a large number of settlers, primarily Burmans and Karens. The rice is shipped to Yangon. Pop. (latest est.) 21,947.

Pyarnu (Estonian S.S.R.): *see* Pärnu.

Pyat, (Aimé-) Félix (b. Oct. 4, 1810, Vierzon, Fr.—d. Aug. 3, 1889, Saint-Gratien), French journalist, dramatist, and member of the Paris Commune of 1871.

Pyat studied law but eventually quit the bar in order to pursue a career as a radical journalist. During the 1848 revolution Pyat was a Montagnard (radical) deputy. His participation in the insurrection of June 1849 forced him to flee the country and remain in exile for 20 years. During this period Pyat was active in socialist groups in Switzerland, Belgium, and England.

Returning to France after the 1869 amnesty, he wrote so many seditious articles that he had to flee a second time. The fall of the Second Empire enabled him to return to Paris; elected to the National Assembly in February 1871, he refused to vote for peace with Germany and was elected to the Commune, the leftist government of Paris, in March. After the fall of the Commune, he fled France a third time. Though condemned to death in his absence, he was allowed to return after the amnesty of 1880. In 1888 he was elected deputy for Marseille on the extreme left and was active in the opposition to General Georges Boulanger, who threatened a coup d'état against the Third Republic.

Pyat, lithograph by C. Deshayes
By courtesy of the Bibliotheque Nationale, Paris

Pyatakov, Georgy Leonidovich (b. Aug. 6, 1890, Kiev Province, Russian Empire—d. January 1937), Old Bolshevik economist who held prominent administrative posts in the Soviet government during the 1920s and '30s. He was a victim of Stalin's Great Purge.

Pyatakov became involved in revolutionary activities while in secondary school, and he joined the Russian Social-Democratic Workers' Party (RSDRP) in 1910 while studying economics at St. Petersburg University. He was soon expelled from the university, and in 1914 he sought exile abroad. He became closely associated with Nikolay Bukharin before returning to Russia after the February Revolution of 1917. He soon became chairman of the executive committee of the Kiev Soviet and headed various Bolshevik-dominated party and governmental bodies that sought to retain control of the Ukraine during the Russian Civil War.

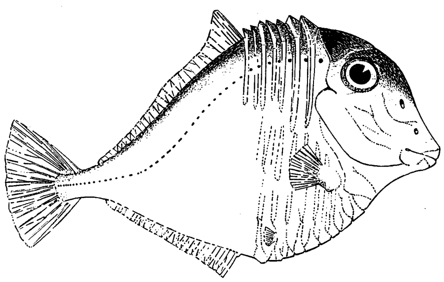
In 1921 Pyatakov began a long career as an able and effective economic administrator in the Soviet Union's central government. In 1923 he became deputy chairman of the Supreme Council of the National Economy, and in 1923 he became a full member of the Central Committee of the Communist Party. Pyatakov was a prominent member of the Trotskyite opposition to Stalin from 1923 to 1927, at which time he was expelled from the party. He was readmitted to the party in 1928 after recanting his opposition, and in 1930 he became a member of the Supreme Economic Council, was put in charge of the nation's chemical industry, and was seated on the Central Committee. He was deputy head of the Soviet Union's heavy industry in 1933–34.

Stalin continued to draw on Pyatakov's talents as an industrial administrator until 1936, when he had Pyatakov arrested. Along with Karl Radek, Pyatakov was the central figure in the second purge trial, or Moscow show trial, of January 1937. He confessed to various antiparty and anti-Soviet activities and was executed in January 1937. Pyatakov was posthumously cleared of all charges by the Soviet Supreme Court in 1988.

Pyatigorsk, also spelled P'ATIGORSK, or PIATIGORSK, city, Stavropol *kray* (region), southwestern Russian Soviet Federated Socialist Republic. It lies along the Podkumok River in the northern foothills of the Caucasus Mountains. It has long been a spa famous for its gentle climate and mineral springs.

The city was built around the springs near the fortress Konstantinogorskaya (1780) and was named Pyatigorsk ("Five Mountains") for the surrounding hills. In the 19th century it became a fashionable resort among the nobility and attracted many artists, including the poet Mikhail Lermontov, who was killed in a duel near there in 1841. Some of the original hotels and bath houses are still in use. The city also has a number of therapeutic baths and health establishments. Other attractions include Lermontov House, where the poet spent his last days, natural underground grottoes, and a walking trail up neighbouring Mount Mashuk. Pop. (1987 est.) 121,000.

Pycnodontiformes, order of extinct fishes of the class Actinopterygii, containing the genus *Pycnodus,* common in the Jurassic seas of 144 million to 208 million years ago. *Pycnodus* is typical of pycnodonts, which were characterized by deep, narrow bodies that were very circular in outline in side view. The pycnodonts had a downturned beak and small mouth with an abundance of teeth. It is probable that they were adapted to feeding on coralline animals in the warm Jurassic seas.



Pycnodus
By courtesy of the trustees of the British Museum (Natural History)

pycnogonid: *see* sea spider.

Pycnonotidae (bird family): *see* bulbul.

Pydna, Battle of (June 22, 168 BC), decisive military engagement in the Roman victory over Macedonia in the Third Macedonian War. The Roman general Lucius Aemilius Paullus, by adroit tactical maneuvering, enticed the Macedonian king Perseus from his impregnable position on the Elpeus (Mavrólongos) River to occupy a weaker position in the plain south of Pydna (now Kítros, Greece; the actual site was probably near Kateríni).

During the battle the Macedonian phalanx, in a state of disorder after crossing broken ground, was penetrated by the Roman legionaries, whose short swords were more effective in close combat than were the Macedonian pikes. Perseus' left wing of Thracians and light troops was defeated by the Roman allies. Macedonian losses were great; Perseus fled, allowing the Romans to end the Macedonian monarchy and divide Macedonia into four republics.

Pyè, also called PROME, town, lower Myanmar (Burma), on the Irrawaddy River. It is a trading centre and the site of a diesel electric plant. The name *Prome* is a mispronunciation of the town's Burmese name by non-Burmese natives and the British; it has become so conventional as to be virtually official. The Burmans call the town Pyè ("Capital"), recalling the old capital of the Pyu people, who were one of the earliest Tibeto-Burman groups to enter Burma after the 3rd century. They occupied the Irrawaddy River valley, and their capital, Śrī Kṣetra ("City of Splendour"), 5 miles (8 km) southeast of Pyè, was probably built in the 7th century. By the time Śrī Kṣetra fell to the Mons in the 8th century, the Pyus had retreated north to another site. During the 9th century they disappeared from historical records as a distinct people. In 1056 the Burmans invaded from the north and made Pyè one of their chief centres. It was taken by the British in 1825 and in 1852.

The actual site of Śrī Kṣetra is now known as Hmawza. Excavations, which began there in 1907, revealed the uniquely Pyu culture as opposed to the Mon and Burman. The city was almost circular, its walls enclosed in an area of about 18 square miles (47 square km), the northern portion being planted in rice. The Shwesandaw pagoda is encircled by 83 small gilded temples. The Shwenattaung pagoda is reputed to have been built by the Pyu queen of the founder of Pyè. Pop. (1973) 148,123.

pyelonephritis, infection and inflammation of the kidney tissue and the renal pelvis (the cavity formed by the expansion of the upper end of the ureter, the tube that conveys urine to the bladder). The infection is usually bacterial. The most common type of renal disorder, pyelonephritis may be chronic or acute.

Acute pyelonephritis generally affects one specific region of the kidney, leaving the rest of the kidney structure untouched. In many instances pyelonephritis develops without any apparent precipitating cause. Any obstruction to the flow of blood or urine, however, may make the kidneys more susceptible to infection, and fecal soiling of the urethral opening is thought to increase the incidence of the disease in infants (the urethra is the channel for urine from the bladder to the outside). Women may suffer injury of the urinary passages during intercourse or pregnancy, and catheterization (mechanical draining of urine) can cause infection.

In acute pyelonephritis the lining of the renal structures into which urine drains, the renal pelvis and the calyces, may be inflamed. Abscesses may form in the kidney tissue, and some of the nephron tubules (urine-producing structures) may be destroyed. Medical treatment abates the infection over a period of one to three weeks. As healing takes place, scar tissue forms at the site of infection, but there is usually sufficient healthy tissue to maintain relatively normal renal functions. The symptoms of acute pyelonephritis usually include fever, chills, pain or aches in the lower back and flanks, bladder inflammation, tenderness in the kidney region, white blood cells in the urine, and a high urine bacterial count. Treatment usually requires suppression of bacterial growth by means of antibiotic drugs.

Chronic pyelonephritis results from bacterial infections in the kidneys over a period of years. Each episode of infection may pass unnoticed but may destroy more and more areas of tissue until the amount of functional kidney tissue is far less than the scar tissue that has formed. If only one kidney is involved or if the affected areas are limited, surgery may restore some functioning. Active infections are treated with antibacterial drugs. Frequently there is widespread and permanent destruction of renal tissue by the time the malady is discovered. Death can ensue from urine poisoning (uremia), severe current infections, or heart and vascular disorders precipitated by the renal condition. Use of artificial-kidney machines or a renal transplant can sometimes prolong life.

Pygmalion, in Greek mythology, a king of Cyprus who fell in love with a statue of the goddess Aphrodite. The Roman poet Ovid, in his *Metamorphoses,* invented a more sophisticated version: Pygmalion, a sculptor, made an ivory statue representing his ideal of womanhood and then fell in love with his own creation; the goddess Venus brought the statue to life in answer to his prayer.

pygmy, in anthropology, member of any human group whose adult males grow to less than 59 inches (150 cm) in average height. A member of a slightly taller group is termed pygmoid.

Pygmies living near the Epulu River, Zaire
Hubertus Kanus—Rapho/Photo Researchers

The best-known pygmy groups and those to whom the term is most commonly applied are the Pygmies of tropical Africa; elsewhere in Africa some of the San (Bushmen) of the Kalahari are of pygmy size. All Asian pygmies are known by the generic term Negrito (*see* Negrito local race). These groups are biologically independent in origin.

Culturally, all pygmy peoples are hunters and gatherers, practicing neither agriculture nor stock farming. Nearly all of them maintain close symbiotic relations with culturally advanced tribes in their environment; consequently, in most cases they have lost their indigenous language and adopted that of their hosts.

The famous Pygmy groups of the Ituri Forest in Zaire present an example of a pygmy culture relatively unchanged as a result of acculturation with neighbouring peoples. Known collectively as the Mbuti (*q.v.*), they are probably the earliest inhabitants of the region.

Another well-known Pygmy group in equatorial Africa are the Twa (Batwa), who live in the high mountains and plains around Lake Kivu, in Zaire, Rwanda, and Burundi, in symbiosis with the pastoral Tutsi, the agricultural Hutu, and other tribes. Many specialize in pottery, which they market; others hunt; some act as court musicians and attendants.

Westward, in the marshes south of the Congo River, is the large group of Tswa (Batswa), who, like the Twa, have adopted much of the culture and language of neighbouring tribes. They live largely by fishing and trapping.

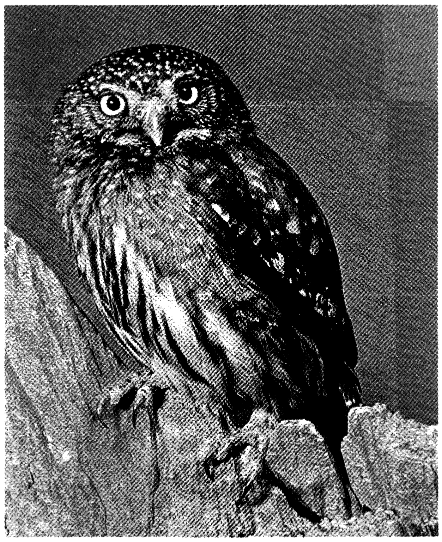
North of the Congo, in the forest west of the Ubangi River, are the Babinga. This is also an acculturated group of pygmoids, but perhaps because of similarity of habitat they have retained more of the traits of the pure Pygmies of the Ituri Forest than have the Twa and Tswa and are still mainly nomadic hunters and gatherers.

Farther to the west, in Cameroon and Gabon, there are other scattered groups that are even closer, physically, to the true Pygmy.

pygmy grasshopper, also called GROUSE LOCUST, any small (about 15 mm [0.6 inch] long), brown, gray, or moss-green insect of the orthopteran family Tetrigidae (about 700 species). Though related to the true grasshopper, the pygmy grasshopper has forewings that either are reduced to small pads or are absent. In addition, its folded membranous hindwings are protected by a pointed elongation of the thoracic shield. The pygmy grasshopper is distinguished from the short-horned grasshopper by its practice of depositing its eggs singly in small grooves in the soil, rather than in underground chambers. It is abundant in fields containing short grasses and on muddy shores; many species are dimorphic (*i.e.,* have both a short form with reduced hindwings and a long form with functional hindwings). Sound-producing and hearing organs are absent in pygmy grasshoppers.

The Tetrigidae family ranges worldwide, but it is best-represented in the tropics, where bizarre forms with humped backs, spines, or crests are found. The genus *Paratettix* has been used in genetic studies concerned with the inheritance of form and colour. Although it is herbivorous, the pygmy grasshopper is not considered to be an economically significant pest.

pygmy owl, any of about 12 species (genus *Glaucidium*) of small owls of the family Strigidae. They are distributed through parts of North and South America and include several African and Southeast Asian species called owlets. Pygmy owls are only about 20 cm (8 inches) long. Often active during the day, these owls hunt in the evening hours, taking insects and small birds, reptiles, and mammals. They usually nest in tree holes.



Pygmy owl (*Glaucidium gnoma*)
Ruth A. Cordner—Root Resources

pygmy sand cricket, also called PYGMY MOLE CRICKET, any member of the orthopteran family Tridactylidae of about 60 species that often inhabits moist sandy surfaces near a lake or stream. Tridactylidae have forelegs, modified for digging, that resemble those of a mole. Adult pygmy sand crickets are up to 10 mm (about 0.4 inch) long and are active jumpers. The males do not sing.

pyjamas: *see* pajamas.

Pyle, Ernie, byname of ERNEST TAYLOR PYLE (b. Aug. 3, 1900, near Dana, Ind., U.S.—d. April 18, 1945, Ie Shima, Ryukyu Islands), American journalist who was one of the most famous war correspondents of World War II.

Pyle studied journalism at Indiana University and left school to become a reporter for a small-town newspaper. Later, after various editorial jobs, he acquired a roving assignment

Ernie Pyle, 1944
By courtesy of the U.S. Army

for the Scripps-Howard newspaper chain; his daily experiences furnished him material for a column that eventually appeared in as many as 200 newspapers before World War II. His coverage of the campaigns in North Africa, Sicily, Italy, and France brought him a Pulitzer Prize for reporting in 1944, as well as several other awards. The motion picture *G.I. Joe* (1945) was about Pyle's coverage of the Italian campaign. He was with the U.S. forces in the Pacific on Iwo Jima, and during the Okinawa campaign he visited the nearby island of Ie Shima, where he was killed by Japanese machine-gun fire. Compilations of his columns appeared in book form: *Ernie Pyle in England* (1941), *Here Is Your War* (1943), *Brave Men* (1944), and *Last Chapter* (1946).

The Story of Ernie Pyle was written by Lee Graham Miller in 1950.

Pyle, Howard (b. March 5, 1853, Wilmington, Del., U.S.—d. Nov. 9, 1911, Florence), American illustrator, painter, and author, best known for the children's books that he wrote and illustrated.

Pyle studied at the Art Students' League, New York City, and first attracted attention

"Robin shooteth his Last Shaft," drawing by Howard Pyle for *The Merry Adventures of Robin Hood,* 1883
By courtesy of the British Museum; photograph, J.R. Freeman & Co. Ltd.

by his line drawings after the style of Albrecht Dürer. His magazine and book illustrations are among the finest of the turn-of-the-century period in the Art Nouveau (*q.v.*) style. Pyle wrote original children's stories as well as retelling old fairy tales. Many of Pyle's children's stories, illustrated by the author with vividness and historical accuracy, have become classics—most notably *The Merry Adventures of Robin Hood* (1883); *Otto of the Silver Hand* (1888); *Jack Ballister's Fortunes* (1895); and his own folktales, *Pepper & Salt* (1886), *The Wonder Clock* (1888), and *The Garden Behind the Moon* (1895).

Later Pyle undertook mural paintings, executing, among others, "The Battle of Nashville" (1906) for the capitol at St. Paul, Minn. Dissatisfied with his style in painting, he went to Italy for further study but died shortly afterward. Pyle had established a free school of art in his home in Wilmington, where many successful American illustrators received their education.

pylon (Greek: "gateway"), in modern construction, any tower that gives support, such as the steel towers between which electrical wires are strung, the piers of a bridge, or the columns from which girders are hung in certain types of structural work. Originally, pylons were any monumental gateways or tower-like structures.

Ancient pylons were most often massive stone structures that flanked the doors to temples. The Egyptians made frequent use of them, usually in the form of foreshortened pyramids to mark the entrances of tombs. Pylons were decorated with carvings, moldings, and cornices. The Pont Alexandre III in Paris features pylons in the form of decorative quadrangle pillars. The word may also refer to any isolated tower, especially serving monumental purposes.

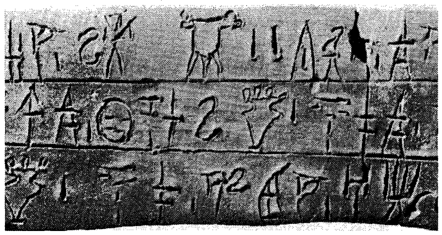
pylorus, cone-shaped constriction in the gut tube of most vertebrates that demarcates the end of the stomach and the beginning of the small intestine. Its main functions are to prevent intestinal contents from reentering the stomach when the small intestine contracts and to limit the passage of large food particles or undigested material into the intestines.

The internal surface is covered with a mucous-membrane lining that secretes gastric juices. Beneath the lining, circular muscle tissue allows the smaller tapered portions (sphincter) of the pylorus to open or close, permitting food to pass or be retained. The valve remains in an open or relaxed state two-thirds of the time, permitting small quantities of food to pass into the duodenum, the upper portion of the small intestine. When the duodenum begins to fill, pressure increases and causes the pyloric sphincter to contract and close. Muscular contractions (peristaltic waves) in the duodenum then push food deeper into the intestine. As the valve is relatively narrow, only small amounts of well-emulsified food can pass by it even while it is open. Surgical removal of the valve does not significantly affect the gastric emptying of the stomach. The term pylorus is used to refer to the valve opening and can also be applied to that portion of the stomach immediately above the pyloric sphincter.

For a depiction of the pylorus in human anatomy, shown in relation to other parts of the body, *see* the colour Trans-Vision in the PROPAEDIA: Part Four, Section 421.

Pylos, Modern Greek PÍLOS, also called NAVARINO, any of three sites in Greece. The most important of them is identified with the modern Pílos (or Navarino, locally called Neókastro), the capital of the *eparkhía* (province) of Pylia in the *nomós* (department) of Messenia, Greece, on the southern headland of the Órmos (bay) Navarínou, a deepwater shipping channel on the southwest coast of the Peloponnese. It is protected and almost blocked from the sea by the island of Sphakteria (Sfaktiría), which has a summit (Mt. Illia) of 450 ft (137 m). The smaller island of Pílos to the south has a lighthouse and a monument to French sailors who fell at the Battle of Navarino (1827). The ancient historian Thucydides described Pylos as a deserted headland in 425 BC, when Athens defeated Sparta there in a land and naval battle during the Peloponnesian war. The modern town behind the south headland of the bay was built in 1829 by the French.

Much confusion over the proper place-names for Pylos began in the Middle Ages. One of the present alternative names, Navarino, may be derived from a group of Avars (a people of unknown origin and language) who settled there during the 6th to 8th century AD. The Venetians later corrupted the name of their castle, Ton Avarinon, to Navarino. In 1278 the Franks built the Paleo Kastro (Old Castle), which still commands the west channel to the harbour. In 1381 a company of Gascon and Navarrese adventurers took over Pylos. The Turks in 1573 built the citadel at the foot of Mt. Áyios Nikólaos, calling it Neo Kastro to distinguish it from the Frankish structure. From 1498 to 1821 Navarino and its bay



Detail of a clay tablet with Linear B script, Pylos, 13th century BC; in the National Archaeological Museum, Athens
Emile Serafis

were in the hands of the Turks except for two periods (1644–48 and 1686–1715), when it was held by the Venetians. The bay was the scene of a notable naval battle between European and Turkish fleets in 1827, which consolidated the independence of Greece. Local inhabitants prefer the name Neókastro, after the Turkish-Venetian fortifications.

Scholarly dispute over the location of Pylos, the capital of King Nestor described in Homer, may have begun as early as the 3rd century BC. An impressive Mycenaean palace compound that was occupied from about 1700 BC to just before 1200 was unearthed north of present Pylos–Navarino–Neókastro in 1939. This Epano Englianos palace, together with dependent despoiled tombs, appears to match closely the dignity and position of the royal seat as described by Homer. Transcending the Pylos locational controversy, however, was the discovery at Epano Englianos of hundreds of inscribed clay tablets baked hard by the fire that destroyed the palace. The tablets are inscribed in the so-called Linear B script found earlier in the palace at Knossos in Crete, as well as those discovered after 1952 in excavations at Mycenae.

Two other Greek sites of this name are Pylos in Elis, on the Peneus (Pinios) River in the northwestern Peloponnese, and Pylos in Triphylia (near Kakóvatos), once thought to be the site of Homeric Pylos.

Pym, Barbara (Mary Crampton) (b. June 2, 1913, Oswestry, Shropshire, Eng.—d. Jan. 11, 1980, Oxford), English novelist, a recorder of post-World War II upper middle-class life, whose elegant and satiric comedies of manners are marked by poignant observation and psychological insight.

Pym was educated at Huyton College, Liverpool, and at St. Hilda's College, Oxford. She worked for the International African Institute in London from 1946 until she retired in 1974 and edited the anthropological journal *Africa* for more than 20 years. In her novels Pym rejected overt drama and emotionalism and instead chose to depict the quiet, uneventful surface of her characters' lives in order to describe human loneliness and the corresponding impulse to love. Her works include *Some Tame Gazelle* (1950), *Excellent Women* (1952), *A Glass of Blessings* (1958), *Quartet in Autumn* (1977), and *The Sweet Dove Died* (1978). *A Few Green Leaves* (1980) and *An Unsuitable Attachment* (1982) were published posthumously, as was *A Very Private Eye* (1984)—her diaries and letters edited as an autobiography.

Pym, John (b. 1583/84, Brymore, Somerset, Eng.—d. Dec. 8, 1643, London), prominent member of the English Parliament (1621–43) and architect of Parliament's victory over King Charles I in the first phase (1642–46) of the English Civil Wars. Pym also was largely responsible for the system of taxation that survived in England until the 19th century and for the enduring close relations between the English government and the City of London.

Life. Pym was the eldest son of Alexander Pym of Brymore, Somerset, who died when John was a child; his mother married Sir Anthony Rous, a client of the Russells, the earls of Bedford. Pym was educated at Oxford, but took no degree, and at the Middle Temple, but was not called to the bar. Through Bedford influence he became a local official of the Exchequer. From 1621 to his death Pym sat in every Parliament, usually for the Russell borough of Tavistock. He soon made a name as an enemy of popery and Arminianism (high-church Anglicanism) in high places,

John Pym, detail of an engraving by G. Glover, 1644, after a portrait by Edward Bower

By courtesy of the trustees of the British Museum

and as a sound financier, an expert on colonial affairs, and a good committeeman. He was no extremist, however, but a loyal subject anxious to maintain good relations between crown and Parliament.

From 1630 Pym was treasurer of the Providence Island Company, which sought to open trade with Spanish America—peacefully, if possible, by force, if not. From 1629 to 1640, during which period the King chose to rule without Parliament, this company brought together the men, mostly Puritans, who were to lead the Parliamentary party in the 1640s. Opposition to Charles's tax of Ship Money to support the Royal Navy (a tax without parliamentary approval) was organized by adventurers of the company; in August 1640 the petition of 12 peers demanding a Parliament was drafted by Pym and another adventurer.

When the Long Parliament met in November 1640, Pym headed what has been called the middle group, whose central position allowed it to dominate the House of Commons. His policy was that of his patron, the Earl of Bedford: to force the King to accept a government in which Parliament, representing the wealth of the country, had confidence. Their main obstacle was Charles's toughest adviser, Thomas Wentworth, 1st earl of Strafford, who was executed as a traitor in May 1641. It was difficult to prove a man deep in the King's confidence a traitor, but Pym argued that "to endeavour the subversion of the laws of this kingdom was treason of the highest nature." Thus, by implication, even a king was capable of committing treason: here was the germ of the charge on which Charles was to be executed in 1649. There were great popular demonstrations in London calling for Strafford's execution, and Pym was accused of fomenting them.

Pym forced Charles to accept an act forbidding the dissolution of Parliament without its consent. This was followed by acts abolishing the whole apparatus of personal government and finance. On paper Charles had accepted that he must rule through Parliament, but he had no real intention of accepting this, and he had to be coerced. The main issue became control of the armed forces. When rebellion broke out in Ireland (October 1641), all agreed that it must be crushed; but Parliament rightly feared a military coup if the King were given command of the army. The House of Commons said it would act in Ireland without the King unless Charles changed his ministers. This virtual declaration of revolution was reinforced by the Grand Remonstrance, listing the grievances of the kingdom as Pym's group saw them and demanding ministers trusted by Parliament and an Assembly of Divines nominated by Parliament to reform the church. This Remonstrance, carried by 159 votes to 148, was printed and circulated to rally support outside Parliament; its opponents henceforth formed a Royalist party. Pym was one of five members of Parliament whom Charles tried to arrest in January 1642. They took refuge in the City, from which they returned in triumph when the King quitted London.

Before and during the Civil War, Pym's political philosophy was summed up in the phrase "I know how to add sovereign to [the King's] person, but not to his power." He believed that the king reigned but did not rule alone: power should be balanced between him and Parliament. "To have printed liberties," Pym once said, "and not to have liberties in truth and realities, is but to mock the kingdom." Pym never seems to have contemplated abolishing the monarchy, and he was certainly no democrat; but he used popular pressure to achieve his ends. When war started, he set about creating an army, the machinery to administer it, and the excise and assessment (later the land tax) to pay for it. His City connections helped him to raise loans. He created the network of committees at Westminster and in the counties that ran the country for the next 17 years. When military stalemate threatened, Pym called in Scottish assistance even at the price of concessions to Presbyterianism that went further than he wished. Ever pragmatic, when the House of Lords made difficulties, he told them that the Commons could run the country alone.

Assessment. Pym was a sonorously eloquent speaker, arguing each particular issue from first principles without ever being doctrinaire. His skill as a parliamentary tactician was unrivalled. He balanced between radicals—some of whom were republicans—and the peace party, which was so frightened of social upheaval that it would have accepted almost any terms from the King.

Pym preserved the unity of Parliament for three years with no party organization, no discipline, no whips. This great achievement wore him out, and when he died, no one could replace him; Parliament's supporters split into wrangling groups. But by then Pym had laid the basis for victory and had sketched the shape of the England that was to survive the 17th century. (J.E.C.H.)

BIBLIOGRAPHY. There is no definitive biography. Those by John Forster, *John Pym* (1837); C.E. Wade, *John Pym* (1912, reissued 1971); and S.R. Brett, *John Pym, 1583–1643: The Statesman of the Puritan Revolution* (1940), are all inadequate. J.H. Hexter, *The Reign of King Pym* (1941), is the most important modern book, dealing primarily with the period after 1640. A.P. Newton, *The Colonising Activities of the English Puritans* (1914), discusses the Providence Island Company.

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Pynchon, Thomas (b. May 8, 1937, Glen Cove, Long Island, N.Y., U.S.), American novelist and short-story writer whose works combine black humour and fantasy to depict human alienation in the chaos of modern society.

After earning his B.A. in English from Cornell University in 1958, Pynchon spent a year in Greenwich Village writing short stories and working on a novel. In 1960 he was hired as a technical writer for Boeing Aircraft Corporation in Seattle, Wash. Two years later he decided to leave the company and write full-time. In 1963 Pynchon won the Faulkner Foundation Award for his first novel, *V.* (1963), a whimsical, cynically absurd tale of a middle-aged Englishman's search for "V," an elusive, supernatural adventuress appearing in various guises at critical periods in European history. In his next book, *The Crying of Lot 49* (1966), Pynchon describes a woman's strange quest to discover the mysterious, conspiratorial Tristero System in a futuristic world of closed societies. The novel serves as a condemnation of modern industrialization.

Pynchon's *Gravity's Rainbow* (1973) is a tour de force in 20th-century literature. In exploring the dilemmas of human beings in the modern world, the story, which is set in an area of post-World War II Germany called "the Zone," centres on the wanderings of an American soldier who is one of many odd characters looking for a secret V-2 rocket that will supposedly break through the Earth's gravitational barrier when launched. The narrative is filled with descriptions of obsessive and paranoid fantasies, ridiculous and grotesque imagery, and esoteric mathematical and scientific language. For his efforts Pynchon received the National Book Award, and many critics deemed *Gravity's Rainbow* a visionary, apocalyptic masterpiece.

Of his few short stories, most notable are "Entropy" (1960), a neatly structured tale in which Pynchon first uses extensive technical language and scientific metaphors, and "The Secret Integration" (1964), a story in which Pynchon explores small-town bigotry and racism, an issue he further examines in *Gravity's Rainbow*.

P'yŏngan-namdo, English SOUTH P'YŎNGAN PROVINCE, province, west central North Korea, facing the Yellow Sea to the west. Until 1896 it was the southern half of P'yŏngan Province. Its area is 4,700 sq mi (12,200 sq km). The eastern part is a plateau containing the Nangnim-sanmaek (mountains), which form the boundary with Hamgyŏng-namdo (South Hamgyŏng Province) and include the peaks Nangnim-san (7,165 ft [2,184 m]), Myohyang-san (6,263 ft), and Sobaek-san (9,003 ft). The western part is a plain through which the Taedong-gang (river) and its tributaries flow to the Yellow Sea. P'yŏngyang, former capital of the province, is located in the southwestern part of the province, on the Taedong-gang, but was separated in 1949 to become an autonomous special city, P'yŏngyang-si, and the capital of North Korea. One-third of the province's area is cultivated, and the Anju plain is the chief granary (rice, corn [maize], millet, Indian millet, and barley) of North Korea. Apples from Namp'o and chestnuts from Sŏngch'ŏn and Kangdong are especially well known. Mineral resources include gold, silver, copper, iron, zinc, and graphite, in addition to about 350,000,000 tons of anthracite coal, nearly two-thirds of the country's total reserves; the mining industry is well developed. Heavy industries include shipbuilding and the manufacture of machinery, automobiles, cement, lime, and nitrogenous fertilizer; there are various light industries, including textiles.

The province was the cradle of ancient Chosŏn (about 2000–108 BC) and of the Koguryŏ kingdom (37 BC–AD 668), and it was the administrative, economic, and cultural centre of northwestern Korea during the Koryŏ (935–1392) and Yi (1392–1910) dynasties. There are many historical remains, such as mounds and ruins of castles. The provincial capital is P'yŏngsŏng. Pop. (1972 est.) 2,192,000.

P'yŏngan-pukto, English NORTH P'YŎNGAN PROVINCE, province, northwestern North Korea, facing the Yellow Sea to the west. On the northwestern frontier, the Yalu River (Amnok-kang) forms its border with China. Until 1896 it was the northern half of P'yŏngan Province; in 1949 the eastern half was separated with the establishment of Chagang-do, a new province. One-fourth of its 4,700-sq-mi (12,200-sq-km) area is cultivated and produces rice, corn (maize), beans, millet, barley, and tobacco. Sericulture in the Yŏngbyŏn area has been famous since early times. In the northeastern mountain area, forestry and the mining industry are important, with rich mineral reserves, producing gold, anthracite coal, lead, tungsten, nickel, and zinc; the gold mine of Unsan has been well known abroad since the late Yi dynasty (1392–1910). The large hydroelectric power plant at Sup'ung on the lower Yalu, which was constructed in 1941 and reconstructed after the Korean War, supplies the province's industries, such as various machine manufacturing (including the nation's only enamelled ironware plant at Sinŭiju), the largest pulp and paper plants in North Korea, and textile, chemical, and other factories. It also supplies power to other provinces and to industries in China. The provincial capital is Sinŭiju. Pop. (1972 est.) 1,737,000.

P'yŏngsŏng, city and provincial capital of P'yŏngan-namdo (South P'yŏngan Province), western North Korea, located about 20 mi (32 km) northeast of P'yŏngyang, the national capital. P'yŏngsŏng is a new city built near the old provincial capital of Sain-ni, at a place formerly called Sainjang, once only a stop on the P'yŏngyang-Yŏnghŭng rail line. Industry in the early 1980s included chemicals and a large synthetic leather factory, designated one of North Korea's major development projects in the late 1970s, that came into operation in 1980. In addition to its administrative functions, P'yŏngsŏng is the scientific and cultural centre of the province.

P'yŏngyang, capital of North Korea, on the Taedong-gang (Taedong River) about 30 mi (48 km) inland from the Yellow Sea. It is reputed to be the oldest city in Korea. The ancient capital of the legendary Tangun dynasty (2333 BC) was located on the site where, according to legend, the modern city of P'yŏngyang was founded in 1122 BC. The city's recorded history began in 108 BC with the founding of a Chinese trading colony near P'yŏngyang, and the city was subsequently fortified. In 427 P'yŏngyang became the capital of the Koguryŏ kingdom, but in 668 it was captured by Chinese invaders. Later, the kings of the Koryŏ dynasty (918–1392) made P'yŏngyang their secondary capital. The city fell to the Japanese in 1592 and was devastated by the Manchus in the early 17th century.

The scars of successive invasions left their mark on the Koreans, who became suspicious of all foreigners. When Korea finally opened its doors to foreigners, P'yŏngyang became the base of an intensive campaign to bring Christianity to Korea. More than 100 churches were built in the city, which in the 1880s was reputed to have more Protestant missionaries than any other city in Asia.

During the Sino-Japanese War (1894–95), much of P'yŏngyang was destroyed. Plague followed war, and in 1895 P'yŏngyang was left a virtually deserted and ruined city. During the Japanese occupation of Korea (1910–45), P'yŏngyang was built up as an industrial centre. In the Korean War (1950–53), P'yŏngyang was almost totally destroyed. Since 1953 the city has been rebuilt with Soviet and Chinese assistance.

A huge bronze statue of Ch'ŏllima, a winged horse of Korean legend, atop a high pedestal dominates the skyline of P'yŏngyang and symbolizes to the residents the economic progress made after the end of the Korean War. Sections of the Inner and Northern walls and Hyunmoo Gate are still standing, and several temples and pavilions that date from the Koguryŏ kingdom have been reconstructed in the original architectural style. Modern landmarks include the Grand Theatre; the Okryoo Hall, which contains a large banquet hall for official functions and recreation facilities for the workers; and the Moran-bong Stadium. Beneath Moran-bong (Moran Hill), the city's main recreational centre, is a huge underground theatre.

P'yŏngyang is a major textile and food-processing centre. Coal deposits near the city provide fuel for its factories. While silkworms are raised in North Korea, ginned cotton, raw wool, and rayon yarn used by the mills must be imported. The city also contains sugar refineries, rubber factories, ceramics factories, railroad workshops, and an arsenal. The major commercial and financial institutions are operated by the government.

P'yŏngyang is the seat of Kim Il-sung University (1946), a medical school, and a Communist university for training party leaders. Adult education is encouraged through classes taught at the factories. There are numerous institutions for opera, theatre, and dance. The principal museums and libraries are also located there. Pop. (1980 UN est.) 1,283,000.

pyorrhea, suppurating (pus-producing) inflammation of the tissues surrounding the roots of the teeth. Tissues that may be involved include the membrane enclosing the root, the cementum, the bony socket, and the gums (gingivae). *See also* gingivitis.

pyothorax, presence of pus in the pleural cavity, between the membrane lining the thoracic cage and the membrane covering the lung. The most common cause is lung inflammation (pneumonia) resulting in the spread of infection from the lung to the bordering pleural membrane, but pyothorax may also result from a lung abcess or some forms of tuberculosis. When the bronchial tree is involved in the infection, air may get into the pleural cavity. The presence of both air and pus inside the pleural cavity is known as pneumothorax. The treatment of pyothorax requires removal of the pus and the use of antibacterial drugs aimed selectively at the causative organism.

Pyotr (Russian personal name): *see under* Peter.

pyralid moth, any member of the worldwide insect family Pyralididae (or Pyralidae, order Lepidoptera), containing more than 20,000 species. Most pyralid moths have long, narrow forewings, broader hindwings, and a wingspan of 18 to 35 millimetres (3/4 to 1 1/2 inches); a few expand to 75 millimetres (3 inches). Coloration is dull except for bright metallic markings; both adults and larvae vary greatly in habitat.

Cosmopolitan pests of stored products include the larvae of the meal moth, Indian meal moth, and Mediterranean flour moth. Meal moth (*Pyralis farinalis*) caterpillars are white with black heads and live in silken tubes they spin in grains such as cereals, meal, and flour stored while damp or in damp places. The Indian meal moth (*Plodia interpunctella*) originated in Europe but is now widespread throughout most of the world. The green or white larvae attack flour, grain, dried fruit, nuts, and other food products. The webs they spin often contain their excrement and foul the infested material. The white or pink larvae of the Mediterranean flour moth (*Ephestia kuehniella*) are important pests of stored foods. Spinning silken tubes in which they live and feed, they attack stored grains such as wheat and maize (corn), webbing together masses of the infested grain and excrement.

(Top) *Pyrausta funebris,* (centre) European corn borer larva (*Pyrausta nubilalis*), (bottom) meal moth (*Pyralis farinalis*)

(Top) Alexander B. Klots, (centre) E.R. Degginger, (bottom) William E. Ferguson

Destructive borers include the European corn borer and the sugarcane borer and grass webworm; adults of these species are called snout moths because their larvae are characterized by elongated snoutlike mouthparts. The larval stage of the European corn borer (*Pyrausta nubilalis*) is the most important insect pest of maize throughout the world. It also infests other plants, including hemp, potatoes, and gladioli. Full-grown larvae and pupating caterpillars found in the stalks of the host plant in spring emerge during the summer as yellowish-brown moths. Eggs laid on the underside of leaves hatch in about one week. The young larvae feed externally on the host plants, later boring into the stalks, leaves, stems, and ears.

White or pale yellow-brown snout moths are also known as grass, meadow, or lawn moths, depending on the habitat, or close wings because the wings are held close to the body when at rest. The grass, or sod, webworm (larva of the snout moth, *Crambus*) usually bores into the roots, crowns, and stems of grasses, constructing silken webs around the bases and often extensively damaging crops or lawns. The sugarcane borer (*Diatraea*) attacks sugar, sorghums, rice, and corn. It produces up to five generations annually.

Other interesting pyralids include the wax moth (*Galleria mellonella*), also known as bee moth, or honeycomb moth, whose larvae usually live in beehives; they feed on wax and young bees and fill the tunnels of the hive with silken threads. Bee-moth larvae are particularly destructive to old or unguarded colonies and to stored combs. Larvae of the cactus moth (*Cactoblastis cactorum*) destroy cactus plants by burrowing in them. The cactus moth was introduced into Australia from Argentina in 1925 as a biological control measure against the prickly pear cactus. *Laetilia coccidivora* feeds on the eggs and young of scale insects. The freshwater larvae of *Acentropus* occur throughout the world, feeding on water plants and either breathing through their skin and tracheal gills or obtaining oxygen from the plants.

Pyrame de Candolle, Augustin: *see* Candolle, Augustin Pyrame de.

pyramid, in architecture, a monumental structure constructed of or faced with stone or brick and having a rectangular base and four sloping triangular (or sometimes trapezoidal) sides meeting at an apex (or truncated to form a platform). Pyramids have been built at various times in Egypt, The Sudan, Ethiopia, western Asia, Greece, Cyprus, Italy, India, Thailand, Mexico, South America, and on some islands of the Pacific Ocean. Those of Egypt and of Central and South America are the best known.

The pyramids of ancient Egypt were funerary edifices. They were built over a period of 2,700 years, ranging from the beginning of the Old Kingdom to the close of the Ptolemaic Period; but the time at which pyramid building reached its acme, the pyramid age par excellence, was that commencing with the 3rd dynasty and ending with the 6th (*c.* 2686–2345 BC). During those years the pyramid was the regular type of royal tomb. It was not, as such, an isolated structure, but was always part of an architectural complex. The essential components, during the Old Kingdom at any rate, were the pyramid itself, containing or surmounting the grave proper and standing within an enclosure on high desert ground; an adjacent mortuary temple; and a causeway leading down to a pavilion (usually called the valley temple), situated at the edge of the cultivation and probably connected with the Nile by a canal. About 80 royal pyramids have been found in Egypt, many of them, however, reduced to mere mounds of debris and long ago plundered of their treasures.

The prototype of the pyramid was the mastaba, a form of tomb known in Egypt from the beginning of the dynastic era. It was characterized by a flat-topped rectangular superstructure of mud brick or stone with a shaft descending to the burial chamber far below it. Djoser, the second king of the 3rd dynasty, employing Imhotep (*q.v.*) as architect, undertook for the first time the construction of a mastaba entirely of stone; it was eight metres high and had a square ground plan with sides about 63 m each. Once completed it was extended on the ground on all four sides, and its height was increased by building rectangular additions of diminishing size superimposed upon its top. Thus Djoser's original mastaba became a terraced structure rising in six unequal stages to a height of 60 m, its base measuring 120 m by 108 m. This monument, which lies at Ṣaqqārah, is known as the Step Pyramid; it is probably the earliest stone building of importance erected in Egypt. The substructure has an intricate system of underground corridors and rooms, its main feature being a central shaft 25 m deep and 8 m wide, at the bottom of which is the sepulchral chamber built of granite from Aswan. The Step Pyramid rises within a vast walled court 544 m long and 277 m wide, in which are the remnants of several other stone edifices built to supply the wants of the king in the hereafter.

A structure of peculiar shape called the Blunted, Bent, False, or Rhomboidal Pyramid, which stands at Dahshūr a short distance south of Ṣaqqārah, marks an advance in development toward the strictly pyramidal tomb. Built by Snefru, of the 4th dynasty, it is 188 m square at the base and approximately 98 m high. Peculiar in that it has a double slope, it changes inclination about halfway up, the lower portion being steeper than the upper. It comes nearer than Djoser's terraced tomb to being a true pyramid. A monumental structure at Maydūm, also ascribed to Snefru, was a true pyramid, though not originally planned as such. The initial structure was gradually enlarged until it became a gigantic eight-terraced mass of masonry; then the steps were filled in with a packing of stone to form a continuous slope. The entire structure was eventually covered with a smooth facing of limestone; a geometrically true pyramid was the final result. In its ruined condition, however, it has the appearance of a three-stepped pyramid rising to a height of about 70 m. The earliest tomb known to have been designed and executed throughout as a true pyramid is the North Stone Pyramid at Dahshūr, thought by some to have also been erected by Snefru. It is about 220 m wide at the base and 104 m high. The greatest of the Egyptian pyramids are those of the pharaohs Khufu, Khafre, and Menkure at Giza (*q.v.*).

Among American pyramids the best known include the Pyramid of the Sun and the Pyramid of the Moon at Teotihuacán (*q.v.*) in central Mexico, the Castillo at Chichén Itzá (*q.v.*), and various Inca and Chimú structures in Andean settlements. American pyramids were generally built of earth and then faced with stone, and they are typically of stepped form and topped by a platform or temple structure. The Pyramid of the Sun, with base dimensions of 220 m by 230 m, rivals in size the Great Pyramid of Khufu at Giza, which measures 230 m square.

Pyramid Lake, lake in Pyramid Lake Indian Reservation, western Nevada, U.S., between the Lake Range and the Virginia Mountains. A remnant of ancient Lake Lahontan (formed during the Pleistocene Epoch, about 2,000,000 years ago) and the largest natural lake in the state, it is about 30 mi (48 km) long and 7 to 9 mi wide. It is fed from the south by the Truckee River. The lake is known for cutthroat trout and is the home of the Cui-ui (Qee-we), an endangered species of fish. The lake was visited in 1844 by the soldier-explorer John C. Frémont, who named it for the tufa deposits that rise from the lake and resemble the Pyramids of Egypt. Anahoe Island in the lake is a bird sanctuary and a breeding ground for white pelicans.

Pyramid Texts, collection of Egyptian mortuary prayers, hymns, and spells intended to protect a dead king or queen and ensure life and sustenance in the hereafter. The texts, inscribed on the walls of the inner chambers of the pyramids, are found at Ṣaqqārah in several 5th- and 6th-dynasty pyramids, of which that of Unas, last king of the 5th dynasty, is the earliest known. The texts constitute the oldest surviving body of Egyptian religious and funerary writings available to modern scholars.

pyramids, British pocket-billiards game in which 15 red balls are arranged in a pyramid formation to begin. Players use a white cue ball in attempting to pocket the reds, scoring one point for each; the player who scores the highest number of pocketed balls is the winner. Players lose a point and respot a red ball each time they pocket the cue ball or fail to contact a red ball. A player shoots until he fails to pocket a ball, and an opponent then continues play from the point at which the cue ball comes to rest. Pyramids was a forerunner of the game snooker.

Pyramids, Battle of the (July 21, 1798), military engagement in which Napoleon Bonaparte invented his one significant contribution to tactics, the massive divisional square; it was fought during his Egyptian campaign near Embabeh (Imbābah), on the west bank of the Nile River. Napoleon's 25,000-man Army of Egypt faced perhaps 40,000 Egyptians led by Murād Bey. The Egyptians were concentrated near Embabeh, with the ancient pyramids of Giza on their left flank. Most of the Egyptian army was composed of ragtag infantry; their only reliable force was the 6,000-man Mamlūk cavalry. A larger Egyptian force under Ibrāhīm Bey was camped on the east bank of the Nile and remained spectators to the battle. Napoleon formed his forces in five divisional squares. Each was six ranks of infantry deep on all sides and protected cavalry and transport in their centres. These squares could move or fight in any direction. They effectively repulsed the wild massed charges of the Mamlūk horsemen. The French then stormed the Egyptian camp and dispersed their army with only 300 casualties to themselves. After the battle, additional large numbers of disorganized Egyptian infantry were killed, captured, or dispersed.

Pyramus (river, Turkey): *see* Ceyhan River.

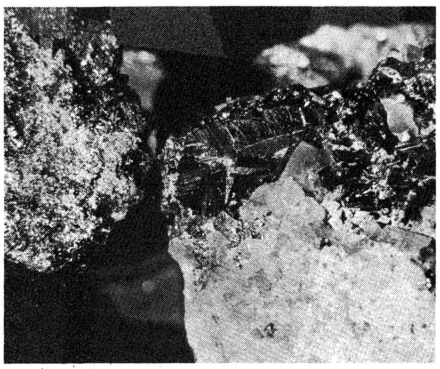
Pyramus and Thisbe, hero and heroine of a Babylonian love story related by Ovid in his *Metamorphoses.* Though their parents refused to consent to their union, the lovers at last resolved to flee together and agreed to meet under a mulberry tree. Thisbe, first to arrive, was terrified by the roar of a lioness and took to flight. In her haste she dropped her veil, which the lioness tore to pieces with jaws stained with the blood of an ox. Pyramus, believing that she had been devoured by the lioness, stabbed himself. When Thisbe returned and found her lover mortally wounded under the mulberry tree, she put an end to her own life. From that time forward, legend relates, the fruit of the mulberry, previously white, was black.

pyran, any of a class of organic compounds of the heterocyclic series in which five carbon atoms and one oxygen atom are present in a ring structure. Of two possible simple pyran compounds, only one is known; it was prepared in 1962 and found to be very unstable. Among the stable members of this family is tetrahydropyran, made by hydrogenating the dihydro compound. Sugars often occur in pyranose forms containing the tetrahydropyran ring: a typical example is the glucose unit present in sucrose, starch, cellulose, and glycogen.

In the pyrones, a carbonyl group (>C=O) replaces the methylene group (>CH_2) of the pyrans. The toad venoms and the toxic principles of squill are pyrones of the steroid family.

The pyrylium salts are coloured substances in which the pyran ring exists as a positively charged ion. The closely related flavylium salts occur as pigments in the rose, the blue cornflower, and certain other flowers.

pyrargyrite, a sulfosalt mineral, a silver antimony sulfide (Ag_3SbS_3), that is an important source of silver, sometimes called ruby silver because of its deep red colour (*see also* proustite). The best crystallized specimens, of hexagonal symmetry, are from St. Andreasberg in the Harz Mountains and from Freiberg, both in Germany; and Colquechaca, Bol. It is mined at Guanajuato, Mex., and near Silver City, Idaho. It is common in small amounts in the silver mines of the western United States and is abundant at the Comstock Lode, Nevada. For detailed physical properties, *see* sulfosalt (table).



Pyrargyrite from Freiberg, Ger.

By courtesy of the Field Museum of Natural History, Chicago; photograph, John H. Gerard—EB Inc.

pyrazine, any of a class of organic compounds of the heterocyclic series characterized by a ring structure containing four atoms of carbon and two of nitrogen. The pyrazine ring is part of many polycyclic compounds of biological or industrial significance. The simplest member of the pyrazine family is pyrazine itself, a colourless, water-soluble solid with molecular formula $C_4H_4N_2$. Pyrazine is seldom prepared. Its hexahydro derivative, piperazine, was first made in 1888; several of its derivatives find use as chemical raw materials.

Other members of the pyrazine family are pteridines, alloxazines, and phenazines. Certain pigments, first isolated from butterfly wings in 1891, are pteridines, as are the folic acids, which participate in a variety of essential chemical reactions in the body. Riboflavin (vitamin B_2), a growth-promoting factor, is an alloxazine compound. Among the large group of phenazine dyes, the best known are Perkin's mauve (the first commercial synthetic dye, discovered in 1856); aniline black; and indanthrene (or indanthrone), the first of the anthraquinone vat dyes.

pyrazole, any of a class of organic compounds of the heterocyclic series characterized by a ring structure composed of three carbon atoms and two nitrogen atoms in adjacent positions. The simplest member of the pyrazole family is pyrazole itself, a compound with molecular formula $C_3H_4N_2$.

The pyrazole compounds are not known to occur in nature; they are usually prepared by the reaction of hydrazines with 1,3-diketones. Many synthetic pyrazole compounds are of importance as dyes and medicinals. Among them are: antipyrine, used as an analgesic and febrifuge; tartrazine, most commonly used as a yellow dye for food; phenylbutazone (Butazolidin), an anti-inflammatory drug used in treatment of arthritis; and a series of dyes used as sensitizing agents in colour photography.

Pyrenean Mountain dog: *see* Great Pyrenees.

Pyrenees, Spanish PIRINEOS, French PYRÉNÉES, Catalan PIRENEUS, mountain chain of southwestern Europe, consisting of flat-topped massifs and folded linear ranges stretching 270 miles (430 km) from the shores of the Mediterranean Sea on the east to the Bay of Biscay of the Atlantic Ocean on the west.

A brief treatment of the Pyrenees follows. For full treatment, *see* MACROPAEDIA: Europe.

Representing the geologic renewal of an old mountain chain, the Pyrenees forms a high wall between France on the north and Spain on the south. Generally the crest of the chain marks the boundary between the two countries, and the tiny, autonomous principality of Andorra lies among its peaks. The Pyrenees range has a maximum width of about 100 miles (160 km) at its centre. The approximately 9,000-foot- (2,750-metre-) high wall of the permanently snow-capped central Pyrenees includes the highest point—the Aneto Peak at 11,169 feet (3,404 m); more easterly and westerly extensions of the range decline sharply, especially to the east. Extensive evidence of Quaternary glaciation (within the past 1.6 million years) in the central Pyrenees includes hanging valleys, cirques, and glacial lakes. Areas of the Pyrenees to the north and west receive greater and more regular amounts of precipitation than areas to the south and east. Corn (maize), cereals, and fruits are grown in the western valleys, and olives and vineyards are commonplace in the eastern valleys. The climatic influence of the Mediterranean Sea and the Atlantic Ocean is less in the central Pyrenees where intermontane valleys experience long, severe winters and the chief occupation is the seasonal grazing of sheep and cattle.

Pyrenees, Peace of the, also called TREATY OF THE PYRENEES (Nov. 7, 1659), peace treaty between Louis XIV of France and Philip IV of Spain that ended the Franco-Spanish War of 1648–59. It is often taken to mark the beginning of French hegemony in Europe.

During the years from the end of the Thirty Years' War until 1659 Spain and France engaged in almost continuous warfare. During the struggle Spain found itself also involved in hostilities with England, and the real decay of the Spanish monarchy became rapidly apparent. Any assistance that might have been hoped for from the Holy Roman emperor was prevented by the formation of leagues of German princes—lay and ecclesiastical—in 1657 and 1658, which had the full support of France. The effect of the formation of the second league (the Rheinbund) was at once apparent: all hope of assistance to Spain from the emperor was seen to have disappeared; and, after Spain's defeat at the Battle of the Dunes (June 1658), progress toward the conclusion of a pacific settlement between France and Spain was accelerated.

According to the treaty, Roussillon and Artois, with a line of strongholds constituting a formidable northern frontier, were ceded to France; and the French acquisition of Alsace and Lorraine under certain conditions was ratified. All French conquests in Catalonia were restored to Spain, and the Great Condé, who had been siding with the Spanish, was pardoned and taken into favour. Finally, the treaty involved a great marriage compact between Louis XIV and the Spanish infanta Maria Teresa de Austria. The actual marriage, which took place the next year, was garnished with a dowry (never paid) and with a renunciation by the infanta of all her rights to the Spanish crown or Spanish possessions. This latter proviso was ignored in 1667, when Louis XIV desired to get hold of the Spanish Netherlands, and 40 years later, when he sought the crown of Spain for his young grandson Philip. The Peace of the Pyrenees and this Spanish marriage firmly established Louis XIV on his throne as the most powerful of European monarchs.

Pyrénées-Atlantiques, formerly (until 1969) BASSES-PYRÉNÉES, *département,* Aquitaine *région,* southwestern France, at the western end of the Pyrenees. Consisting of the former province of Béarn and part of Gascony, it has an area of 2,952 square miles (7,645 square km) and is bounded on the east by the Hautes-Pyrénées *département,* on the south by Spain, and on the west by the Bay of Biscay.

The crestline of the Pyrenees, forming the frontier with Spain, falls westward from Anie Peak with the highest summits barely reaching 6,000 feet (1,800 m). There are easy passes at about 3,000 feet (900 m). A historic road route is by the pass of Roncevaux. The mountains spread out to the north and are drained by left-bank tributaries (Gave de Pau; its tributary, the Gave d'Oloron; and Nive) of the Adour River. The mild wet climate of the western Pyrenees, which have no permanent snow, is responsible for the exceptional verdance of the country. Sheep and cattle graze in the uplands, while the valleys support grain, potatoes, cattle, and poultry. Market towns include Pau, Oloron, and Saint-Jean-Pied-de-Port. Salt is mined near Bayonne and iron pyrites on the frontier at Itxassou. In 1951 one of the world's major deposits of natural gas was discovered near Pau at Lacq. Much of the gas is used locally for electric power stations and for aluminum manufacture (Noguères) and fabrication (Anglet), plastics, and fertilizer plants. As a result of this industrial development, a new town, Mourenx la Neuve, was established near Lacq.

The tourist industry is important. There are several spas in the *département,* notably at Eaux-Bonnes, Les Eaux-Chaudes, Cambo-les-Bains, Saint-Christian, and Salies-de-Béarn. The old fishing port of Biarritz is one of the major seaside resorts of France.

The population of Pyrénées-Atlantiques is largely Basque, and the ancient Basque language still survives north of the Pyrenees in districts near Roncevaux and the Bidassoa.

Pau, capital of the *département;* Bayonne, the chief port; and Oloron give their names to the three *arrondissements* that constitute the *département,* which forms the bishopric of Bayonne. The court of appeal is at Pau, and the *académie* (academic district) is centred at Bordeaux. Pop. (1988 est.) 573,900.

Pyrénées-Orientales, *département,* Languedoc–Roussillon *région,* southern France, bounded on the east by the Mediterranean Sea, on the south by Spain, and on the west by the small principality of Andorra. Created from the historic province of Roussillon, the region of Cerdagne (in Spain, Cerdaña), and fragments of Languedoc, it has an area of 1,589 square miles (4,116 square km). In the west it is dominated by the granite Carlit Peak, 9,583 feet (2,921 m); surrounded by glacial lakes and by other peaks of over 8,500 feet (2,600 m), the Carlit Massif feeds the Ariège, the Aude, and the Têt rivers, the last flowing northeast through Prades and Perpignan, the capital, to the Mediterranean Sea. The upper courses of the rivers are separated by high chains of mountains, which lose height as they extend north and northeast—as does the Pyrenees range along the Spanish line of the border as it approaches the Mediterranean. The imposing Mount Canigou dominates the south-central part of the *département.* The fertile, low-lying plain of Roussillon, bordered by lagoons along the coast, extends across the whole eastern region between the Corbières Massif and the Albères Range. Winters are long and rigorous in the upper valleys, while summers are hot and dry in the plain.

Cultivation of vines, fruit, and vegetables in the plain has been pushed up into the mountain valleys; apricots, peaches, and cherries are specialties. The wine of Corbières is bottled for local consumption, whereas aperitifs such as Byrrh, Banyuls, and Rivesaltes have a nationwide market. The high-grade iron ore of Canigou is still worked; and light industries have been developed around Perpignan, which is also a tourist centre. Seaside resorts are popular, and winter sports attract large numbers of visitors. Music festivals given by the cellist Pablo Casals popularized Prades. A small enclave, Llivia, 1 mile (1.6 km) from the border, has remained Spanish territory. Catalan is widely spoken in Pyrénées-Orientales, and French is spoken with a heavy Catalan accent. The *département* has three *arrondissements,* Perpignan, Céret, and Prades, and is in the educational division of Montpellier. Pop. (1988 est.) 364,000.

pyrethrum, certain plant species of the genus *Chrysanthemum,* native to southwestern Asia, of which the aromatic flower heads, when powdered, constitute the active ingredient in the insecticide called pyrethrum. The plants were formerly considered a separate genus, *Pyrethrum.* The typical species, the perennial *C. coccineum,* is the florists' pyrethrum, commonly called painted lady. Large deep rose-coloured petals surrounding the yellow centre, or disk, are borne on long simple stems above the crown of finely cut leaves. Modern varieties exhibit various colours—white, lilac, and shades of red.

The powdered flower heads of *C. coccineum, C. cinerariaefolium,* and *C. marschalli* are chief sources of the insecticide. The active substances in pyrethrum are contact poisons for insects and cold-blooded vertebrates. The concentrations of pyrethrum powder used in insecticides are nontoxic to plants and higher animals; therefore, these insecticides find wide use in household and livestock sprays as well as in dusts for edible plants.

Pyrex (trademark), a type of glass and glassware that is resistant to heat, chemicals, and electricity. It is used to make chemical apparatus, industrial equipment, including piping and thermometers, and ovenware. Chemically, Pyrex contains borosilicate and expands only about one-third as much as common glass (silicate) when heated. As a result, it is less apt to break when subjected to rapid temperature changes. It is resistant to many chemicals and is an electrical insulator. Fibres and fabrics made of it possess excellent heat insulation and fire-resistant qualities. It is sometimes referred to by the generic term, borosilicate glass.

Pyrgos, Modern Greek PÍRGOS, chief town and capital of the *nomós* (department) of Ilía, western Peloponnese, Greece, situated on the agricultural plain of the lower Alpheus River. Its port, Katákolon, to the west, was founded in 1857 to handle the export of Corinth raisins (currants). Pyrgos lies near ancient Letrinoi, a town on the Sacred Way from Elis to Olympia. The town is linked by rail to Pátrai and Kalámai. Pyrgos has been subject to frequent damaging earthquakes. Pop. (1981) 21,958.

pyridine, any of a class of organic compounds of the aromatic heterocyclic series characterized by a six-membered ring structure composed of five carbon atoms and one nitrogen atom. The simplest member of the pyridine family is pyridine itself, a compound with molecular formula C_5H_5N.

Pyridine is used as a solvent and is added to ethyl alcohol to make it unfit for drinking. It is converted to such products as sulfapyridine, a drug active against bacterial and viral infections; pyribenzamine and pyrilamine, antihistaminic drugs; piperidine, used in rubber processing and as a chemical raw material; and water repellents, bactericides, and herbicides. Compounds not made from pyridine but containing its ring structure include niacin and pyridoxal, both B vitamins; isoniazid, an antitubercular drug; and nicotine and several other nitrogenous plant products.

Pyridine occurs in coal tar, its principal source before development of a synthesis based on acetaldehyde and ammonia. The pure substance is a colourless, flammable, weakly alkaline, water-soluble liquid with an unpleasant odour; it boils at 115.5° C (234° F).

pyrilamine, also called MEPYRAMINE, synthetic drug used to counteract the histamine reaction, as in allergies. Pyrilamine was among the first antihistamines to be introduced; it was first prepared in 1944. Pyrilamine is administered orally, usually in the form of the compound pyrilamine maleate, which occurs as white crystals, soluble in water.

pyrimidine, any of a class of organic compounds of the heterocyclic series characterized by a ring structure composed of four carbon atoms and two nitrogen atoms. The simplest member of the family is pyrimidine itself, with molecular formula $C_4H_4N_2$.

Several pyrimidine compounds were isolated between 1837 and 1864, but their structures were not recognized until 1868. Some well-known pyrimidine compounds include cytosine, thymine, and uracil, present in nucleic acids; thiamine (vitamin B_1); and sulfadiazine, sulfamerazine, and sulfamethazine, drugs used in therapy of bacterial and viral diseases.

pyrite, also called IRON PYRITE, or FOOL'S GOLD, a naturally occurring iron disulfide mineral. The name comes from the Greek word *pyr,* "fire," because pyrite emits sparks when struck by steel. Pyrite is called fool's gold because its colour may deceive the novice into thinking he has discovered a gold nugget. Nodules of pyrite have been found in prehistoric burial mounds, which suggests their use as a means of producing fire. Wheel-lock guns, in which a spring-driven, serrated wheel rotated against a piece of pyrite, were used before development of the flintlock. Pure pyrite (FeS_2) contains 46.67 percent iron and 53.33 percent sulfur; its crystals display isometric symmetry. For detailed physical properties, *see* sulfide mineral (table).

Pyrite is widely distributed and forms under extremely varied conditions. For example, it can be produced by magmatic (molten rock) segregation, by hydrothermal solutions, and as stalactitic growth. It occurs as an accessory mineral in igneous rocks, in vein deposits with quartz and sulfide minerals, and in sedimentary rocks, such as shale, coal, and limestone.

Pyrite occurs in large deposits in contact metamorphic rocks. Deposits of copper-bearing pyrite are widely distributed and often of great size. They usually occur in or near the contact of eruptive rocks with schists or slates. Pyrite weathers rapidly to hydrated iron oxide, goethite, or limonite; pseudomorphs of goethite after pyrite are common. This weathering produces a characteristic yellow-brown stain or coating, such as on rusty quartz.

Pyrite is used commercially as a source of sulfur, particularly for the production of sulfuric acid. Because of the availability of much better sources of iron, pyrite is not generally used as an iron ore.

For many years Spain was the largest producer, the large deposits located on the Tinto River being important also for copper. Other important producers are Japan, the United States (Tennessee, Virginia, California), Canada, Italy, Norway, Portugal, and Czechoslovakia.

pyrobitumen, natural, solid hydrocarbon substance, distinguishable from bitumen (*q.v.*) by being infusible and insoluble. When heated, however, pyrobitumens generate or transform into bitumen-like liquid or gaseous petroleum compounds. Pyrobitumens may be either asphaltic or nonasphaltic. The asphaltic pyrobitumens are derived from petroleum, are relatively hard, and have a specific gravity below 1.25. They do not melt when heated but swell and decompose. The most important of these substances are constituents of oil shale. Others include elaterite (also called mineral rubber because of its elasticity), occurring in the lead mines of Derbyshire, Eng.; wurtzilite, also elastic, occurring in northeastern Utah, U.S.; albertite, occurring in veins at Albert Mines, New Brunswick, Can.; and impsonite, only slightly fusible, occurring in Impson Valley, Oklahoma, U.S. Nonasphaltic pyrobitumens, derived from vegetable matter, include peat, lignite, bituminous and anthracite coal, and lignitic and coal shales.

pyrochlore, a complex oxide mineral composed of niobium, sodium, and calcium ($NaCaNb_2O_6F$) that forms brown to black, glassy octahedral crystals and irregular masses. Tantalum atoms replace niobium atoms in the chemical structure, so that pyrochlore forms a solid-solution series with the mineral microlite [$(Na,Ca)_2Ta_2O_6(O,OH,F)$]. For detailed physical properties, *see* oxide mineral (table).

Pyrochlore is found in alkaline rocks, their associated pegmatites, in metamorphic contact zones, and in greisen (a type of granite composed chiefly of quartz and light-green mica). Such rocks have been recognized at Stavern and Lurvik, Nor.; Alnö, Swed.; Brocq en Menet, Fr.; Miass and Alabashka, U.S.S.R.; and in Maine, Wisconsin, California, and Colorado, U.S. Microlite occurs in the albitized zones of granite pegmatites, as at Låndas, Nor.; Varuträsk, Swed.; Igaliko, Greenland; and in Connecticut, U.S.

pyroelectricity, development of opposite electrical charges on different parts of a crystal that is subjected to temperature change. First observed (1824) in quartz, pyroelectricity is exhibited only in crystallized nonconducting substances having at least one axis of symmetry that is polar (no centre of symmetry; *i.e.,* different crystal faces occur on opposite ends). Portions of the crystal with the same symmetry will develop charges of like sign. Opposite temperature changes produce opposite charges at the same point; that is, if a crystal develops a positive charge on one face during heating, it will develop a negative charge there during cooling. The charges gradually dissipate if the crystal is kept at a constant temperature.

Pyroelectricity and its relative piezoelectricity have been studied using a method devised by the German physicist August A. Kundt. A mixture of finely powdered sulfur and red lead is blown through a cloth screen onto a charged crystal. Through friction the sulfur particles acquire a negative charge and are attracted to the positive charges on the crystal, while the positively charged red lead goes to the crystal's negative charges.

The pyroelectric thermometer is an instrument with which the temperature change can be determined by measurement of the voltage induced by the separation of the charges.

pyrogallol, also called PYROGALLIC ACID, or 1,2,3-TRIHYDROXYBENZENE, an organic compound belonging to the phenol family, used as a photographic film developer and in the preparation of other chemicals.

Pyrogallol was first obtained in 1786 from gallic acid, obtainable from galls and barks of various trees. It is converted to pyrogallol by heating with water under pressure. Pyrogallol is the oldest photographic developer, its rapid deposition of silver from silver salts having first been noted in 1832. Alkaline solutions of pyrogallol absorb oxygen efficiently and are used in determining the oxygen content of gas mixtures.

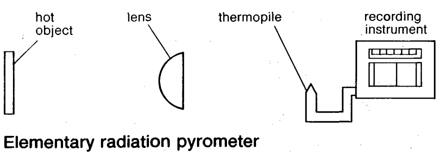
pyrolite, rock consisting of about three parts peridotite and one part basalt. The name was coined to explain the chemical and mineralogic composition of the upper mantle of the Earth. The relative abundances of the principal metallic element components (except iron) are similar to those in chondritic meteorites and in the solar photosphere. Accordingly, it is reasonable to assume that to a first approximation these abundances are applicable to the entire mantle.

pyrolusite, common manganese mineral, manganese dioxide (MnO_2), that constitutes an important ore. Always formed under highly oxidizing conditions, it forms light-gray to black, metallic, moderately heavy coatings, crusts, or fibres that are alteration products of other manganese ores (*e.g.*, rhodochrosite); bog, lake, or shallow marine products; or deposits left by circulating waters. It is mined in the Soviet Union, Germany, Brazil, India, the United States, Cuba, Morocco, Ghana, and South Africa. Pyrolusite is used in the manufacture of steel and manganese bronze; in dry cells; and as a decolorizing agent in glass. For detailed physical properties, *see* oxide mineral (table).

pyromania, impulse-control disorder characterized by the recurrent compulsion to set fires. The term refers only to the setting of fires for sexual or other gratification provided by the fire itself, not to arson for profit or revenge. Pyromania is usually a symptom of underlying psychopathology, often associated with aggressive behaviours. Sigmund Freud, the founder of psychoanalysis, noted that the majority of pyromaniacs are males with a history of bed-wetting and suggested that pyromania is one of many disorders brought on by the denial of instinctual drives, in this case a male desire to control fire by urination. Later psychoanalysts found his explanation too simplistic. Among other suggested causes of pyromania are the feeling of rejection and the wish for the return of an absent father.

Pyromania usually first surfaces in childhood, and only a small percentage of adult fire-setters actually suffer from the disorder. Pyromaniacs fighting an urge to set fires experience increasing tension that can only be relieved by giving in; after repeated failures to control the impulse, they may cease resistance to avoid this tension. The disorder may be treated by family-centred psychotherapy and by antidepressant drugs.

pyrometer, device for measuring relatively high temperatures, such as are encountered in furnaces. Most pyrometers work by measuring radiation from the body whose temperature is to be measured. Radiation devices have the advantage of not having to touch the material being measured. Optical pyrometers, for example, measure the temperature of incandescent bodies by comparing them visually with a calibrated incandescent filament that can be adjusted in temperature. In an elementary radiation pyrometer, the radiation from the hot object is focused onto a thermopile, a collection of thermocouples, which generates an electrical voltage that depends on the intercepted radiation. Proper calibration permits this electrical voltage to be converted to the temperature of the hot object.



Elementary radiation pyrometer

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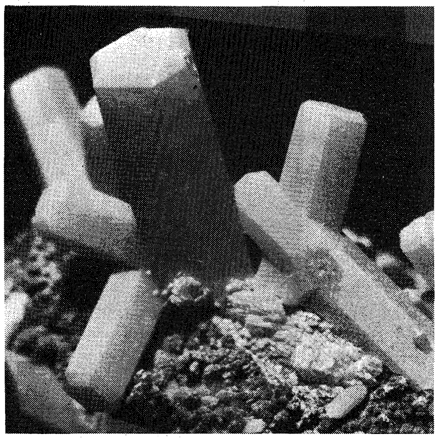
In resistance pyrometers a fine wire is put in contact with the object. The instrument converts the change in electrical resistance caused by heat to a reading of the temperature of the object. Thermocouple pyrometers measure the output of a thermocouple (*q.v.*) placed in contact with the hot body; by proper calibration, this output yields temperature. Pyrometers are closely akin to the bolometer and the thermistor and are used in thermometry.

pyromorphite, phosphate mineral, lead chloride phosphate [$Pb_5(PO_4)_3Cl$], that is a minor ore of lead. It occurs with galena, cerussite, and limonite in the oxidized zone of lead deposits, where it forms very brightly coloured, heavy, barrel-shaped crystals or globular masses. For properties, *see* phosphate mineral (table).



Pyromorphite from Durango, Mex.

Floyd R. Getsinger—EB Inc.

Arsenic and vanadium often replace phosphorus in the pyromorphite structure. Thus, in nature, pyromorphite occurs mixed with both mimetite and vanadinite; these mixtures, called solid-solution series, show continuous chemical variation between the pure compounds. Pyromorphite is a member of a group of minerals related to apatite in structure and properties.

pyrope, also called BOHEMIAN GARNET, or CAPE RUBY, magnesium aluminum garnet (Mg_3Al_2), the transparent form of which is used as a gemstone. Its colour varies from brownish red to purplish red. A beautiful, deep-red pyrope is often called ruby, in combination with the locality of occurrence, as Cape ruby from South Africa. It is also used in jewelry as the Bohemian garnet.

pyrophyllite, very soft, pale-coloured silicate mineral, hydrated aluminum silicate, $Al_2(OH)_2Si_4O_{10}$, that is the main constituent of some schistose rocks. The most extensive commercial deposits are in North Carolina, but pyrophyllite is also mined in California, Canada, and South Africa. Talclike foliated masses occur in the Urals, in Switzerland, and in other localities. For detailed physical properties, *see* silicate mineral (Table 2).

Pyrophyllite has long been used in slate pencils and tailor's chalk and was carved by the ancient Chinese into small images and ornaments. It has good insulating properties, and because it does not become fluid when fired, it is more useful than talc in refractory applications.

pyrosilicate: *see* sorosilicate.

pyroxene, any of a group of important rock-forming silicate minerals of variable composition, among which calcium-, magnesium-, and iron-rich varieties predominate.

A brief treatment of pyroxenes follows. For full treatment, *see* MACROPAEDIA: Minerals and Rocks.

Common pyroxenes belong to either the low-calcium enstatite–(ortho)ferrosilite series, $(Mg,Fe)SiO_3$, or high-calcium diopside–hedenbergite series, $Ca(Mg,Fe)Si_2O_6$. The pyroxenes have a crystal structure composed of single chains of silicon tetrahedrons sharing two oxygen atoms with adjacent tetrahedrons. Their crystals are typically elongated and show two good cleavages at about 90°. The metal ions are in six-fold coordination between chains in two symmetry-distinct sites. Low-calcium, high-magnesium pyroxenes usually have orthorhombic symmetry and are termed orthopyroxene or hypersthene, while high-calcium and low-calcium, moderate-iron pyroxenes have monoclinic symmetry and are termed clinopyroxene or augite. Pyroxenes with compositions intermediate between augite and hypersthene are termed pigeonite and are common in basic volcanic rocks. Submicroscopic to visible lamellar intergrowths are a common feature owing to unmixing of low- and high-calcium pyroxenes at subsolidus temperatures. Rapidly cooled rocks such as basalts show a wide range in composition from early magnesium-rich to late iron-rich within a single grain. In contrast, slowly cooled igneous and metamorphic rocks typically show narrow compositional ranges. Enstatite is an important constituent of the upper mantle of the Earth. Other rare pyroxenes include jadeite, aegirine (or acmite), and johannsenite.

pyroxenite, dark-coloured, intrusive igneous rock that consists chiefly of pyroxene. Pyroxenites are not abundant; they occur in discrete inclusions, in layered sills (tabular bodies inserted between other rocks) and lopoliths (laccoliths with basin-shaped bases), in branching veins, in narrow dikes (tabular bodies injected in fissures), and at the edges of silica-poor plutons (intrusive igneous rock bodies). Many of the pyroxenites have been named according to their dominant pyroxene mineral—*e.g.*, diopsidite, which occurs in the Pyrenees, and bronzitite, which occurs in the Bushveld of South Africa. Others occur at Newry, County Down, Ire. (biotite pyroxenite); in the province of Quebec, Can. (hornblende pyroxenite); and at Ben More Assynt, Scot. (melanite pyroxenite).

pyrrhocorid bug (insect): *see* red bug.

Pyrrhon OF ELIS, Pyrrhon also spelled PYRRHO (b. *c.* 360 BC—d. *c.* 272), Greek philosopher from whom Pyrrhonism takes its name; he is generally accepted as the father of Skepticism.

Pyrrhon was a pupil of Anaxarchus of Abdera and in about 330 established himself as a teacher at Elis. Believing that equal arguments can be offered on both sides of any proposition, he dismissed the search for truth as a vain endeavour. While traveling with an expedition under Alexander the Great, Pyrrhon saw in the fakirs of India an example of happiness flowing from indifference to circumstances. He concluded that man must suspend judgment (practice *epochē*) on the reliability of sense perceptions and simply live according to reality as it appears. Pyrrhonism permeated the Middle and New Academy of Athens and strongly influenced philosophical thought in 17th-century Europe with the republication of the Skeptical works of Sextus Empiricus, who had codified Greek Skepticism in the 3rd century AD. Pyrrhon's teaching was preserved in the poems of Timon of Phlius, who studied with him.

pyrrhotite, iron sulfide mineral ($Fe_{1-x}S$) in the niccolite group; in it, the ratio of iron to sulfur atoms is variable but is usually slightly less than one. It commonly is found with pentlandite and other sulfides in silica-poor igneous rocks, as at Kongsberg, Nor.; Andreas-Berg, Ger.; Trentino, Italy; and Sudbury, Ont. The variety troilite, with a composition near that of iron sulfide (FeS), is an important constituent of some meteorites. The crystals possess hexagonal symmetry; for detailed physical properties, *see* sulfide mineral (table).

Pyrrhus (b. 319 BC—d. 272, Argos, Argolis), king of Hellenistic Epirus whose costly military successes against Macedonia and Rome gave rise to the phrase "Pyrrhic victory." His *Memoirs* and books on the art of war were quoted and praised by many ancient authors, including Cicero.

Upon becoming ruler at the age of 12, Pyrrhus allied himself with Demetrius, son of Antigonus I Monophthalmus of Macedonia. Dethroned by an uprising in 302, Pyrrhus fought beside Demetrius in Asia and was sent to Alexandria as a hostage under the treaty between Ptolemy I Soter and Demetrius. Ptolemy befriended Pyrrhus and in 297 restored him to his kingdom. At first Pyrrhus reigned with a kinsman, Neoptolemus, but soon he had his colleague assassinated.

In 294 he exploited a dynastic quarrel in Macedonia to obtain the frontier areas of Parauaea and Tymphaea, along with Acarnania, Ampholochia, and Ambracia. Corcyra and Leucas were given to him in a marriage dowry. Next, he went to war against his former ally, now Demetrius I Poliorcetes of Macedonia. Pyrrhus took Thessaly and the western half of Macedonia and relieved Athens from Demetrius' siege, but was driven back into Epirus by Lysimachus (who had supplanted Demetrius) in 284.

In 281 Tarentum (in southern Italy) asked for Pyrrhus' assistance against Rome. He crossed to Italy with about 25,000 men, and in 280 won a complete, if costly, victory over a Roman army at Heraclea. In 279 Pyrrhus, again suffering heavy casualties, defeated the Romans at Ausculum (Ascoli Satriano) in Apulia. He then crossed to Sicily (278) and, as "king of Sicily," conquered most of the Punic province except Lilybaeum (Marsala). However, his despotic methods provoked a revolt of the Greek Sicilians, and in 276 (or early 275) he returned to Italy. In 275 he suffered heavy losses in a battle against Rome at Beneventum (Benevento).

The next year he defeated the new Macedonian ruler, Antigonus II Gonatas, whose troops hailed Pyrrhus as king. Suddenly abandoning Macedonia, however, he launched an unsuccessful attack on Sparta to restore Cleonymus (272). Pyrrhus was killed in a night skirmish in the streets of Argos.

pyrrole, any of a class of organic compounds of the heterocyclic series characterized by a ring structure composed of four carbon atoms and one nitrogen atom. The simplest member of the pyrrole family is pyrrole itself, a compound with molecular formula C_4H_5N. The pyrrole ring system is present in the amino acids proline and hydroxyproline; and in coloured natural products, such as chlorophyll, heme (a part of hemoglobin), and the bile pigments. Pyrrole compounds also are found among the alkaloids, a large class of alkaline organic nitrogen compounds produced by plants.

In heme and chlorophyll, four pyrrole rings are joined in a larger ring system known as porphyrin. The bile pigments are formed by decomposition of the porphyrin ring and contain a chain of four pyrrole rings.

pyrvinium pamoate, red cyanine dye used in medicine to eradicate pinworm (*Enterobius vermicularis*) infection in man. One dose, given orally, is usually sufficient.

Pythagoras (b. *c.* 580 BC, Samos, Ionia—d. *c.* 500, Metapontum, Lucania), Greek philosopher, mathematician, and founder of the Pythagorean brotherhood that, although religious in nature, formulated principles that influenced the thought of Plato and Aristotle and contributed to the development of mathematics and Western rational philosophy (*see* Pythagoreanism).

Pythagoras, contorniate medallion engraved between AD 395 and 410; in the Bibliothèque Nationale, Paris

By courtesy of the Bibliotheque Nationale, Paris

Pyroxenes

name formula	colour	lustre	Mohs hardness	specific gravity	habit	fracture or cleavage	refractive indices	crystal system space group	remarks
aegirine $NaFe^{+3}Si_2O_6$	green to greenish black	vitreous	6	3.4–3.6	crystals	one good cleavage of 87°	α = 1.700–1.776 β = 1.710–1.820 γ = 1.730–1.836	monoclinic $C\frac{2}{c}$	forms a solid solution series with aegirine-augite, which has Ca replacing Na, and Fe^{+2}, Mg, and Al replacing Fe^{+3}
augite $(Ca,Mg,Fe,Ti,Al)_2(Si,Al)_2O_6$	brown; green; black	vitreous	5½–6	3.2–3.5	short, thick, tabular crystals	one good cleavage of 87°	α = 1.671–1.735 β = 1.672–1.741 γ = 1.703–1.761	monoclinic $C\frac{2}{c}$	continuous variation between augite and the diopside-hedenbergite series
diopside $CaMgSi_2O_6$	white, pale to dark green (diopside); brownish green, dark green, black (hedenbergite)	vitreous	5½–6½	3.2–3.6	slender prismatic crystals; granular or lamellar masses	one good cleavage of 87°	α = 1.664–1.732 β = 1.672–1.730 γ = 1.694–1.757	monoclinic $C\frac{2}{c}$	forms a continuous solid solution series with hedenbergite in which Fe^{+2} replaces Mg; also continuous variation between the diopside-hedenbergite series and augite
jadeite $NaAlSi_2O_6$ (often with Fe,Ca)	green; apple-green; emerald green; variable	vitreous	6	3.2–3.4	cryptocrystalline aggregates and nodules	one good cleavage of 87°	α = 1.640–1.658 β = 1.645–1.663 γ = 1.652–1.673	monoclinic $C\frac{2}{c}$	Fe-rich varieties sometimes called chloromelanite; Ca-rich varieties sometimes called diopside-jadeite
johannsenite $Ca(Mn,Fe)Si_2O_6$	clove-brown, grayish, green	vitreous	6	3.4–3.6	prismatic crystals and fibres in radiating, columnar, or spherical aggregates	one good cleavage of 87°	α = 1.703–1.716 β = 1.711–1.728 γ = 1.732–1.745	monoclinic $C\frac{2}{c}$	
orthopyroxene $(Mg,Fe)_2Si_2O_6$	usually green; colourless, gray, yellow, brown	pearly to vitreous	5–6	3.2–4.0	fibrous or lamellar masses	one good cleavage of 88°	α = 1.650–1.768 β = 1.653–1.770 γ = 1.658–1.788	orthorhombic Pbca	orthopyroxene is the name for the continuous solid solution series between enstatite, $Mg_2Si_2O_6$, and ferrosilite, $Fe_2Si_2O_6$
pigeonite $(Mg,Fe)(Mg,Fe,Ca)Si_2O_6$ (contains 5–15% Ca)	brown, greenish brown, black	vitreous	6	3.3–3.5		one good cleavage of 87°	α = 1.682–1.722 β = 1.684–1.722 γ = 1.705–1.751	monoclinic $P\frac{2_1}{c}$	
spodumene $LiAlSi_2O_6$	commonly grayish white; also green, lilac, yellowish, colourless	vitreous	6½–7	3.0–3.2	flattened prismatic crystals (sometimes as large as 6 ft × 42 ft); cleavable masses	one good cleavage of 87°	α = 1.648–1.663 β = 1.655–1.669 γ = 1.662–1.679	monoclinic $C\frac{2}{c}$	

Pythagoras migrated to southern Italy about 532 BC, apparently to escape Samos' tyrannical rule, and established his ethico-political academy at Croton (now Crotona).

It is difficult to distinguish Pythagoras' teachings from those of his disciples. None of his writings has survived, and Pythagoreans invariably supported their doctrines by indiscriminately citing their master's authority. Pythagoras, however, is generally credited with the theory of the functional significance of numbers in the objective world and in music. Other discoveries often attributed to him (*e.g.,* the incommensurability of the side and diagonal of a square, and the Pythagorean theorem for right triangles) were probably developed only later by the Pythagorean school. More probably the bulk of the intellectual tradition originating with Pythagoras himself belongs to mystical wisdom rather than to scientific scholarship.

Pythagoras (b. Samos; fl. 5th century BC), noted Greek sculptor of Rhegium, in Italy (present Reggio di Calabria), a contemporary of Myron and Polyclitus and their rival in making statues of athletes. One of these, that of the boxer Euthymus of Locri, was erected after the latter's third victory at Olympia in 472 BC.

Pythagoras migrated in his youth to Rhegium. He made a statue of Philoctetes, noted for the physical expression of pain; an Apollo shooting the Python at Delphi; and a man singing to the lyre. His technical improvements went far in ending Archaic stiffness in Greek sculpture. No existing work can be certainly attributed to him, and, although his influence must have been widespread, attempts to identify copies of his works remain conjectural.

Pythagoreanism, a philosophical school and religious brotherhood, believed to have been founded by Pythagoras about 525 BC, holding: (1) that at its deepest level, reality is mathematical in nature; (2) that philosophy can be used for spiritual purification; (3) that the soul can rise to union with the divine; (4) that certain symbols have a mystical significance; and (5) that all brothers of the order should observe strict loyalty and secrecy.

A brief treatment of Pythagoreanism follows. For full treatment, *see* MACROPAEDIA: Philosophical Schools and Doctrines, Western.

The organization was, in its origin, a religious brotherhood or an association for the moral reformation of society rather than a philosophical school. The Pythagorean brotherhood had much in common with the Orphic communities that sought by rites and abstinences to purify the believer's soul and enable it to escape from the "wheel of birth."

The new order held sway for a time over a considerable part of Magna Graecia, but this entanglement with politics led to the suppression of the society. The first reaction against the Pythagoreans, led by Cylon, seems to have taken place in the lifetime of the master. Cylon was able to bring about the retirement of Pythagoras to Metapontum, where he remained until his death. In the middle of the 5th century, the order was violently suppressed. Its meetinghouses were everywhere sacked and burned; mention is made in particular of "the house of Milo" in Croton, where 50 or 60 Pythagoreans were surprised and slain. Those who survived took refuge at Thebes and other places. As a philosophical school the Pythagoreans became extinct about the middle of the 4th century.

To the legacy of Pythagoreanism can be ascribed the following philosophical and ethical teachings: the dictum "all is number," meaning that all things can be ultimately reduced to numerical relationships; the dependence of the dynamics of world structure on the interaction of contraries, or pairs of opposites; the viewing of the soul as a self-moving number experiencing a form of metempsychosis, or successive reincarnation in different species until its eventual purification (particularly through the intellectual life of the ethically rigorous Pythagoreans); and the understanding, as in Pre-Socratic tradition, that all existing objects were fundamentally composed of form and not of material substance. Further Pythagorean doctrine applied number relationships to music theory, acoustics, geometry, and astronomy; identified the brain as the locus of the soul; and prescribed certain secret cultic practices.

Pythagoreanism deeply influenced the development of classical Greek philosophy and medieval European thought (especially the astrological belief that the number harmony of the universe decidedly affects all human endeavour). Pythagorean astronomical concepts were acknowledged by Copernicus as a forerunner of his hypothesis that the Earth and the other planets rotate in orbits around the Sun.

Pytheas (b. Massalia, Gaul; fl. 300 BC), navigator, geographer, astronomer, and the first Greek to visit and describe the British Isles and the Atlantic coast of Europe. Though his principal work, *On the Ocean,* is lost, something is known of his ventures through the Greek historian Polybius (*c.* 200–*c.* 118 BC).

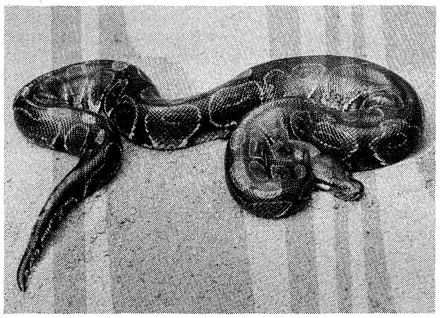
Sailing from the Mediterranean Sea into the Atlantic, Pytheas stopped at the Phoenician city of Gades (present-day Cádiz, Spain), probably followed the European shoreline to the tip of Brittany, and eventually reached Belerium (Land's End, Cornwall), where he visited the tin mines, famous in the ancient world. He claimed to have explored a large part of Britain on foot; he accurately estimated its circumference at 4,000 miles (6,400 km). He also estimated the distance from north Britain to Massalia (Marseille) at 1,050 miles (1,690 km); the actual distance is 1,120 miles (1,800 km). He visited some northern European countries and may have reached the mouth of the Vistula River on the Baltic Sea. He also told of Thule, the northernmost inhabited island, six days' sail from northern Britain and extending at least to the Arctic Circle; the region he visited may have been Iceland or Norway.

His comments on small points—*e.g.,* on the native drinks made of cereals and honey and the use of threshing barns (contrasted with open-air threshing in Mediterranean regions)—show acute observation. His scientific interests appear from his calculations made with a sundial at the summer solstice and from notes on the lengthening days as he traveled northward. He also observed that the polestar is not at the true pole and that the Moon affects tides.

Pythian Games, in ancient Greece, various athletic and musical competitions held in honour of Apollo, chiefly those at Delphi. The musicians' contest there dated from very early times. In 582 BC it was made quadrennial, and athletic events including foot and chariot races were added in emulation of the Olympic Games. Open to all Greeks, the contests were held either at the Delphic shrine on Mount Parnassus or on the Crisaean plain below. The victor was awarded a laurel wreath. The games took place in August of the third year of each Olympiad (the four-year period between Olympic Games). The interval between them was known as a Pythiad. They continued to be held until the 4th century AD.

Python, in Greek mythology, a huge serpent that was killed by the god Apollo at Delphi either because it would not let him found his oracle, being accustomed itself to giving oracles, or because it had persecuted Apollo's mother, Leto, during her pregnancy. In the earliest account the serpent is nameless and female, but later it is male and named Python (Pytho was the old name for Delphi). Python was traditionally the child of Gaea (Earth) who had an oracle at Delphi before Apollo came. The Pythian Games held at Delphi were supposed to have been instituted by Apollo to celebrate his victory over Python.

python (subfamily Pythoninae), any of 20 to 25 species of snakes of the family Boidae, found in tropical and temperate regions from western Africa to China, Australia, and the Pacific islands. The dwarf python (*Loxocemus bicolor*) of Central America is sometimes placed in this subfamily. Pythons are not venomous; they kill by constriction. Most species are found near water; some are arboreal. All lay eggs—15 to about 100, depending on body size—and in a number of species the female incubates them for 60 to 80 days. Pythons are sluggish, docile snakes. The largest can swallow a small goat, pig, or deer but normally take much smaller prey; those that live in towns are often valued as ratcatchers. Many pythons are killed for meat and leather.



Ball, or royal, python (*Python regius*)
By courtesy of the New York Zoological Society

The reticulated python (*Python reticulatus*) is a comparatively slender, splotched species ranging from southern Myanmar (Burma) to Indonesia and the Philippines. It commonly occurs in cities, usually near riverbanks, and is probably the world's longest snake (the anaconda reaches greater weight)—often 8 m (26 feet). Specimens 9.6 m long are recorded. A python of this species is known to have eaten a 14-year-old Malay boy on the island Salebabu, in Indonesia, one of the few such authenticated cases.

The Indian python (*P. molurus*) is common throughout southern Asia. It is thick-bodied and usually less than 4 m long but sometimes twice that length. This species is a favourite of carnival snake handlers. The 2.7-metre short-tailed, or blood, python (*P. curtus*) of Malaya, Sumatra, and Borneo is reddish.

The African python (*P. sebae*), also called rock python, often reaches a length of 7 m. The 1.5-metre ball, or royal, python (*P. regius*), confined to equatorial western Africa, curls into a tight ball with its head inside.

pyx, in Christianity, vessel containing the consecrated bread used in the service of Holy Communion. Although pyxes were made in various shapes, such as that of a dove, the most common form was that of a small, cylindrical box fitted with a cover, which is generally conical. An English pyx dating from the first half of the 14th century, known as the Godsfield Pyx, is of gilt bronze with engraved foliage decorating the lid and body. Another well-known English medieval example is the Swinburne Pyx (*c.* 1310); a small, circular box fitted with a flat lid, it is silver gilt, with traces of translucent enamel. Changes in the liturgy of the church led to the pyx being placed upon a stand; this form is probably the predecessor of the monstrance, a vessel in which the host is exposed. The few pyxes surviving from the 17th and 18th centuries are usually flat and cylindrical.

Q, pseudonym of Sir Arthur Thomas Quiller-Couch (*q.v.*).

Q fever, also called RICKETTSIAL PNEUMONIA, or BALKAN GRIPPE, acute, self-limited, systemic disease caused by the rickettsia *Coxiella burnetii.*

Q fever was first recognized in 1935 in Queensland, Australia, by Edward Holbrook Derrick. According to him, Q stands for "query," an appellation applied because of the many unanswered questions posed by the new disease at the time of its first description. The disease was originally encountered among abattoir workers, cattle ranchers, and dairy farmers in Australia and later among sheep ranchers, and it was first thought to be restricted to that continent. Several outbreaks of what was ultimately shown to be Q fever, however, occurred among Axis and Allied troops in the eastern Mediterranean during the winter of 1944–45. These were the first naturally occurring outbreaks of Q fever recognized outside Australia; the disease thereafter was reported from various parts of the world.

While many species of ticks in various parts of the world have been found to be naturally infected, the role of these arthropods in the dissemination and maintenance of the rickettsiae is unclear. It seems likely that some small mammal, perhaps a rodent, serves as a reservoir of the rickettsiae and that ticks keep the infection alive in nature by spreading the rickettsiae from animal to animal within the host species. Humans and their domestic livestock are not necessary to the survival of the rickettsiae in nature and are infected only accidentally.

Tick-transmitted Q fever appears to be rare in humans and, in some parts of the world at least, in domestic livestock as well. Because the rickettsiae are found in cows' and goats' milk, the ingestion of infected dairy products may play a role in the infection of humans and livestock. Inhalation of infected material, however, appears to constitute the common mode of infection. The infected animal sheds the rickettsiae through its milk, excreta, and, most importantly, through the placenta and the birth fluids. Contamination of the environment leads to airborne dissemination of the rickettsiae and thus to infection of persons in close contact with livestock, contaminated clothing, and other infected sources.

The incubation period of the disease is from two to four weeks, averaging about 18 to 21 days. The onset may be gradual but generally is sudden, and the disease is ushered in by fever, chills or chilly sensations, headache, muscle aches, loss of appetite, disorientation, and profuse sweating. Symptoms in the upper respiratory tract may be present but generally are infrequent and minimal; and pneumonia, even when relatively extensive, may be detectable only by X-ray examination. Although Q fever is, on the whole, a mild disease, it can sometimes result in severe and protracted illness. The outlook for recovery is excellent; the mortality rate is believed to be less than 1 percent. The disease is amenable to therapy with wide-spectrum antibiotics, which are highly effective. Q fever seems to be in large part an infection associated with particular occupations, and vaccines prepared from killed *C. burnetii* can be used to protect persons whose work makes them likely to be exposed to infection.

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

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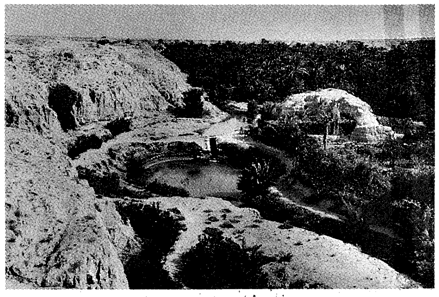
qa, also spelled KA, Babylonian liquid measure equal to the volume of a cube each dimension of which is one handbreadth (3.9 to 4 inches [9.9 to 10.2 cm]) in length. The cube held one great mina (about 2 pounds [or 1 kg]) of water by weight. Five *qa* made up a *gin*, 100 *qa* equaled an *imêru* (donkey load), and 300 *qa* equaled a *gur*. The *gur* was the equivalent of about 80 U.S. gallons (302 l).

Qābis, also spelled GABÈS, Latin TACAPA, town, southeastern Tunisia. The town is located at the mouth of the Qābis River, which has its source 6 miles (10 km) upstream at the Ras al-Oued (springs), the town's main water source. Situated on a Mediterranean oasis along the Gulf of Gabes, Qābis was founded as the Roman trading centre of Tacapa. Declining somewhat under Turkish rule, it experienced a modest revival during the French Protectorate (1881–1955) when a railway, a road network, and a port were constructed. The modern town is still an important oasis and trade centre, with some fishing, fruit growing, and textile milling in the vicinity. Industrial developments include a chemical complex and iron and cement works.



A pool in the oasis at Qābis, Tunisia
A.F. Kersting

The surrounding area embraces much of semiarid south-central Tunisia. It contains the settlements of Maṭmāṭah (Matmata), which is the home of Berber olive growers, al-Ḥāmmah (el-Hamma), which is a trading centre of the Beni Zid nomads, and several other important oases. Pop. (1984) town, 92,298.

Qābūs ibn Saʿīd, also spelled QABOOS BIN SAID (b. Nov. 18, 1940, Muscat and Oman), sultan of Oman.

Qābūs was educated at Bury Saint Edmunds, Suffolk, Eng., and at Sandhurst, the Royal Military Academy, in Berkshire. He was called home in 1965 by his father, Saʿīd ibn Taymūr, who kept his son a prisoner for six years while maintaining his subjects in a state of medieval backwardness despite the country's growing oil revenues. In 1970 Qābūs took over the palace in a coup with British support and exiled his father. He immediately undertook a range of ambitious modern projects, including the construction of roads, hospitals, schools, communications systems, and industrial and port facilities. He abrogated his father's moralistic laws and established a 17-member Cabinet and a system of municipal councils.

Political power, however, remained concentrated in the royal family. Qābūs' regime faced such problems as labour unrest, fiscal instability, a shortage of technocrats, and threats from Dhofar rebels. He did make considerable progress in ending Oman's isolation by joining the Arab League and the United Nations, aligning his country with the moderate Arab powers.

Qacentina (Algeria): *see* Constantine.

Qaḍārif, al-, also spelled EL-GEDAREF, town, east-central Sudan. It is situated about 120 miles (200 km) southwest of Kassalā town. Located at an elevation of 1,975 feet (608 m), it is a commercial centre for the cotton, cereals, sesame seeds, and fodder produced in the surrounding area. The Gash Irrigation Project is located to the northwest of al-Qaḍārif. Light industries include cotton ginning and spinning mills and soap factories. Al-Qaḍārif is linked by road and railway with Kassalā. The population, mainly Arab or Nubian Sudanese, includes the indigenous Beja. Pop. (1973) 66,465.

Qadarīyah, in Islām, adherents of the doctrine of free will (from *qadar,* "power"). The name was also applied to the Muʿtazilah, the Muslim theological school that believed that man, through his free will, can choose between good and evil. But as the Muʿtazilah also stressed the absolute unity of God (tawhid), they resented the designation because of a saying attributed to the Prophet Muḥammad, "The Qadarīyah are the dualists of this people," and preferred to be called *ahl al-ʿadl* ("the people of justice").

The question of free will and predetermination was one that involved practically all Muslim sects and produced both extreme and compromise views. The Qadarīyah based their stand on the necessity of divine justice. They maintained that without responsibility and freedom man cannot justly be held accountable for his actions. Their opponents disregarded the question of justice and argued that to allow man any freedom is equal to denying God's omnipotence and his absolute creative power. Two compromise views were held by moderate theological schools, the Ashʿarīyah and the Māturīdīyah.

The Qadarīyah as well as their opponents found clear support for their views in the Qurʾān (Islāmic scripture). The Qadarīyah quoted verses such as "Who receives guidance receives it for his own benefit, and who goes astray does so to his own loss" (17:15), and "If you did well you did well for yourselves, if you did evil you did it against yourselves" (17:7). Their opponents countered with such verses as "If God so willed, he could make you all one people, but he leads astray whom he pleases and guides whom he pleases" (16:93). Both extreme positions were considered heretical by some theologians, and the two compromise views were considered vague. Thus, the problem of maintaining both God's justice and his omnipotence remained a point of controversy in Islāmic theology.

Qaddafi, Muammar al-, also spelled MUAMMAR KHADAFY, MOAMMAR GADHAFI, or MUʿAMMAR AL-QADHDHĀFĪ (b. 1942, near Surt, Libya), leader of Libya from 1970 and a controversial Arab statesman.

The son of an itinerant Bedouin farmer, Qaddafi was born in a tent in the Libyan desert. He proved a talented student and graduated from the University of Libya in 1963. A devout Muslim and ardent Arab nationalist, Qaddafi early began plotting to overthrow the Libyan monarchy of King Idrīs I. He graduated from the Libyan military academy in 1965 and thereafter rose steadily through the ranks, all the while continuing to plan a coup with the help of his fellow army officers. Captain Qaddafi seized control of the government in a military coup that deposed King Idrīs in September 1969. Qaddafi was named commander in chief of the armed forces and chairman of Libya's new governing body, the Revolutionary Command Council.

Qaddafi removed the U.S. and British military bases from Libya in 1970. He expelled most members of the native Italian and Jewish communities from Libya that same year, and in 1973 he nationalized all foreign-owned petroleum assets in the country. He also outlawed alcoholic beverages and gambling, in accordance with his own strict Islāmic principles. Qaddafi also began a series of persistent but unsuccessful attempts to unify Libya with other Arab countries. He was adamantly opposed to negotiations with Israel and became a leader of the so-called rejectionist front of Arab nations in this regard. He also earned a reputation for military adventurism; his government was implicated in several abortive coup attempts in Egypt and The Sudan, and Libyan forces persistently intervened in the long-running civil war in neighbouring Chad.

From 1974 onward Qaddafi espoused a form of Islāmic socialism as expressed in *The Green Book*, 2 vol. (1976, 1980). This combined the nationalization of many economic sectors with a brand of populist government ostensibly operating through people's congresses, labour unions, and other mass organizations. Meanwhile, Qaddafi was becoming known for his erratic and unpredictable behaviour on the international scene. His government financed a broad spectrum of revolutionary or terrorist groups worldwide, including the Black Panthers and the Nation of Islam in the United States and the Irish Republican Army in Northern Ireland. Squads of Libyan agents assassinated émigré opponents abroad, and his government was allegedly involved in several bloody terrorist incidents in Europe perpetrated by Palestinian or other Arab extremists. These activities brought him into growing conflict with the U.S. government, and in April 1986 a force of British-based U.S. warplanes bombed several sites in Libya, killing or wounding several of his children and narrowly missing Qaddafi himself.

Qaddish (Judaism): *see* Kaddish.

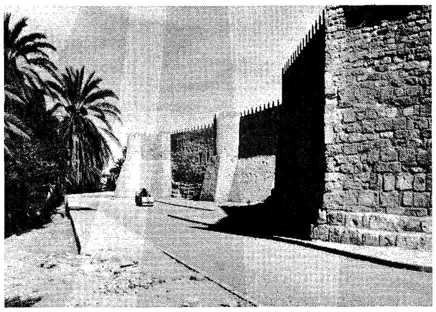
qadi, also spelled CADI, or KADI, Arabic QĀḌĪ, a Muslim judge who renders decisions according to the Sharīʿah, the canon law of Islām. The qadi hears only religious cases such as those involving inheritance, pious bequests (*waqf*), marriage, and divorce, though theoretically his jurisdiction extends to both civil and criminal matters. Originally, the qadi's work was restricted to nonadministrative tasks—arbitrating disputes and rendering judgments in matters brought before him. Eventually, however, he assumed the management of pious bequests, the guardianship of property for orphans, imbeciles, and others incapable of overseeing their own interests, and the control of marriages for women without guardians. The qadi's decision in all such matters was final.

Because the qadi performed an essential function in early Muslim society, requirements for the post were carefully stipulated: he must be an adult Muslim male of good character, possessing sound knowledge of the Sharīʿah, and a free man. In the 7th and 8th centuries the qadi was expected to be capable of deriving the specific rules of law from their sources in the Qurʾān, Ḥadīth (traditions of the Prophet), and *ijmāʿ* (consensus of the community). This view was later modified to allow the qadi to accept as absolute the opinions of one of the four orthodox Muslim law schools.

The second caliph, ʿUmar I, was the first to appoint a qadi to eliminate the necessity of his personally judging every dispute that arose in the community. Thereafter it was considered a religious duty for authorities to provide for the administration of justice through the appointment of qadis.

Qādirīyah, probably the oldest of the Muslim mystic (Ṣūfī) orders, founded by the Ḥanbalī theologian ʿAbd al-Qādir al-Jīlānī (1078–1166) in Baghdad. Al-Jīlānī may have intended the few rituals he prescribed to extend only to his small circle of followers, but his sons broadened this community into an order and encouraged its spread into North Africa, Central Asia, and India. The order, which stresses philanthropy, humility, piety, and moderation, is loosely organized, allowing each regional community to develop its own ritual prayers (dhikrs). The main body (the Qādirīyah proper) maintains an orthodox and peaceful Ṣūfī system and is governed by a descendant of al-Jīlānī, who serves as the keeper of his tomb in Baghdad. A smaller group in North Africa, the Jīlālīyah, worships al-Jīlānī as a supernatural being and combines Islāmic mysticism with pre-Islāmic beliefs and practices.

Qafṣah, also spelled GAFSA, Latin CAPSA, town, west-central Tunisia. The ancient name of the locality is applied to the Mesolithic Capsian industry (here dated about 6250 BC) of the earliest inhabitants. The original Numidian town was destroyed (106 BC) by the Romans; it was rebuilt later by Trajan and was then successively a centre of Byzantine, Arab, Berber, and Ottoman rulers. Qafṣah is a noted irrigated fruit-growing oasis and a major shipping centre for phosphates obtained from the salt flats of Shaṭṭ (lake) al-Jarīd. It is connected to the port of Ṣafāqis (Sfax) by road and rail.



The Casbah (citadel) in Qafṣah, Tunisia
J. Allan Cash—EB Inc.

The surrounding area includes many rich phosphate-mining concessions. It is primarily peopled by nomads and cultivators of esparto grass, cereals, dates, and olives. Pop. (1984) town, 60,970.

Qain (Iran): *see* Qāyen.

Qairouan (Tunisia): *see* Qayrawān, al-.

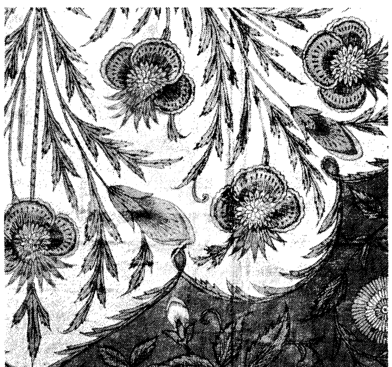
Qājār DYNASTY, the ruling dynasty of Iran from 1794 to 1925.

In 1779, following the death of Moḥammad Karīm Khān Zand, the Zand dynasty ruler of southern Iran, Āghā Moḥammad Khān (reigned 1779–97), a leader of the Turkmen Qājār tribe, set out to reunify Iran. By 1794 he had eliminated all his rivals, including Loṭf ʿAlī Khān, the last of the Zand dynasty, and had reasserted Iranian sovereignty over the former Iranian territories in Georgia and the Caucasus. In 1796 he was formally crowned as shah, or emperor. Agha Moḥammad was assassinated in 1797 and was succeeded by his nephew, Fatḥ ʿAlī Shāh (reigned 1797–1834). Fatḥ ʿAlī attempted to maintain Iran's sovereignty over its new territories, but he was disastrously defeated by Russia in two wars (1804–13, 1826–28) and thus lost Georgia, Armenia, and northern Azerbaijan. Fatḥ ʿAlī's reign saw increased diplomatic contacts with the West and the beginning of intense European diplomatic rivalries over Iran. He was succeeded in 1834 by his grandson Moḥammad, who fell under the influence of Russia and made two unsuccessful attempts to capture Herāt. When Moḥammad Shāh died in 1848 the succession passed to his son Nāṣer od-Dīn (reigned 1848–96), who proved to be the ablest and most successful of the Qājār sovereigns. During his reign Western science, technology, and educational methods were introduced into Iran and the country's modernization was begun. Nāṣer od-Dīn Shāh exploited the mutual distrust between Great Britain and Russia to preserve Iran's independence.

When Nāṣer was assassinated by a fanatic in 1896, the crown passed to his son Moẓaffar od-Dīn Shāh (reigned 1896–1907), a weak and incompetent ruler who was forced in 1906 to grant a constitution that called for some curtailment of monarchial power. His son Moḥammad ʿAlī Shāh (reigned 1907–09), with the aid of Russia, attempted to rescind the constitution and abolish parliamentary government. In so doing he aroused such opposition that he was deposed in 1909, the throne being taken by his son. Aḥmad Shāh (reigned 1909–25), who succeeded to the throne at age 11, proved to be pleasure-loving, effete, and incompetent and was unable to preserve the integrity of Iran or the fate of his dynasty. The occupation of Iran during World War I (1914–18) by Russian, British, and Ottoman troops was a blow from which Aḥmad Shāh never effectively recovered. With a coup d'état in February 1921, Reza Khan (ruled as Reza Shah Pahlavi, 1925–41) became the preeminent political personality in Iran; Aḥmad Shāh was formally deposed by the *majlis* (national consultative assembly) in October 1925 while he was absent in Europe, and that assembly declared the rule of the Qājār dynasty to be terminated.

qalam, ancient reed pen still used in Arabic calligraphy and formerly used for all writing. The *qalam* was cut from between two nodes of the stem of a reed chosen for its straight fibres. As thick as a finger and 8 or 10 inches (20 or 25 cm) long, the reed segment was soaked and sun-dried, and a nib, somewhat resembling that of a steel pen, was fashioned by slicing off the thicker end at an angle and cutting an ink-slot in the tip. Separate nibs were shaped for different calligraphic styles, their points varying in width, sharpness, angle or concavity, and position of the ink-slot. As did the quill pen in some western societies, the *qalam* depicted in military insignia came to represent administrative as distinct from combat personnel. One Islāmic tradition had it that God created the *qalam* first, in order to record what was to come.

qalamkārī textile, painted textile of a type produced during the 17th century at various centres in India, notably at Golconda. The material was called *qalamkārī* ("brushwork") because of the technique employed in executing it and was chiefly made into prayer carpets, hangings, coverlets, and bedcovers.



Detail of a *qalamkārī* hanging from Golconda, India, 17th century; in a private collection
P. Chandra

The textile designs reflect the Persianized tastes of the wealthy ruling class and also the taste of foreign traders seeking the fanciful and exotic. The designs of fabrics intended for export were based on samples supplied by European traders. A striking feature of the painted fabrics was their unusual glowing red colour. Golconda also produced some painted and tinseled temple hangings of great charm that illustrated episodes from the life of the god Krishna.

Qalandarīyah, loosely organized group of wandering Muslim dervishes who form an "irregular" (*bī-sharʿ*) or antinomian Ṣūfī mystical order. The Qalandarīyah seem to have arisen from the earlier Malāmatīyah in Central Asia and exhibited Buddhist and perhaps Hindu influences. The adherents were notorious for their contempt for the norms of Muslim society, their use of drugs, and their coarse behaviour. They shaved their heads, faces, and eyebrows, dressed only in blankets or in hip-length hairshirts, led a wandering, nomadic life, and regarded all acts as lawful.

The movement is first mentioned in Khorāsān in the 11th century; from there it spread to India, Syria, and western Iran. The Qalandarīyah were responsible for several uprisings in the Ottoman Empire prior to the 16th century.

Qalat Jarmo (Iraq): *see* Jarmo.

Qalʿat Sharqāṭ (Iraq): *see* Ashur.

Qalā'ūn, in full AL-MANṢŪR SAYF AD-DĪN QALĀ'ŪN AL-ALFĪ (d. 1290), Mamlūk sultan of Egypt (1279–90), the founder of a dynasty that ruled that country for a century.

In the 1250s Qalā'ūn was an early and devoted supporter of the Mamlūk commander Baybars, and after the latter became sultan of Egypt and Syria in 1260 Qalā'ūn's career advanced rapidly. Upon Baybars' death in 1277, Qalā'ūn quickly deposed and exiled two of Baybar's sons who had briefly succeeded to the sultanate, and in 1279 Qalā'ūn himself became sultan of Egypt. He solidified his power after fighting off a rival claimant to the throne in 1280 and thereupon proceeded to consolidate the Mamlūk position in the Middle East.

Qalā'ūn wished to both expel the Latin crusaders from their remaining footholds in the Middle East and to repel the invading Mongols. He made a truce with the Knights Templars and then ended the Mongol threat to Egypt by defeating the Mongols at the Battle of Homs in 1281. In 1289 he broke his truce with the crusaders and captured the fortified port of Tripoli, which was then the largest town still held by the crusaders. Qalā'ūn died while mounting a campaign to besiege the town of Acre. He was succeeded as sultan by his son Khalīl, who successfully wrested Acre from the crusaders in 1291. Qalā'ūn was a decisive ruler and an able administrator. He encouraged trade and public-welfare activities in Egypt and was responsible for building the Māristān, a large hospital complex in Cairo.

Qalā'ūn Mosque, building complex, including a mausoleum, a madrasah, or theological college, and a hospital, built in 1283–85 on the site of present-day Cairo by the fifth Mamlūk Sultan, Qalā'ūn. The hospital, now in ruins, was one of the most remarkable buildings of the Mamlūk era. The mausoleum and madrasah both open from a central corridor. The madrasah has a unique three-part basilica-like *eyvān,* or vaulted niche, on the richly carved qibla side (the wall facing Mecca) and a smaller *eyvān* opposite. Residential cells for scholars occupy the other sides of the madrasah. A small atrium with a fine carved stucco facade leads into the square space of the richly decorated mausoleum, where pink granite columns are topped by arches supporting a dome that was probably originally wooden. Round horseshoe arches, uncommon at this period, are used throughout the complex.

The outside facades of the buildings are decorated with vertical, flat-backed, arched recesses giving it the look of a Norman church. Coloured glass windows are set in the recesses, and the wall is topped with crenellation and covered with sculpted geometric designs.

Qalyūb, also spelled KALYUB, town at the apex of the Nile Delta, in al-Qalyūbīyah *muḥāfaẓah* (governorate), Lower Egypt. It lies just north of Cairo, near the right bank of the Nile and al-Qanāṭir (barrage) al-Khayrīyah, which controls the division of the Nile's waters into the Rosetta and Damietta branches.

Qalyūb was reputedly constructed with materials taken from the ruins of Heliopolis (modern Miṣr al-Jadīdah), a few miles southeast. Its earliest mention is in AD 641, a year after the Arab invasion of Byzantine Egypt, when the Arab conqueror ʿAmr ibn al-ʿĀṣ built a bridge across the canal there to facilitate subjugation of the towns of Miṣr province. In 1804–05, three years after the Napoleonic forces left Egypt, Qalyūb suffered from depredations by undisciplined soldiery of the Mamlūk sultans. In the mid-19th century Qalyūb lost its status as the capital of the province (now *muḥāfaẓah*) to Banhā.

The modern town preserves several old mosques, notably the Great Mosque (1182, renovated 1735–36). It is linked to the Cairo–Alexandria superhighway and serves as a railway junction for several lines fanning through the delta. Its industries include cotton and silk weaving. Pop. (1985 est.) 81,400.

Qalyūbīyah, al-, also spelled KALYUBIA, small *muḥāfaẓah* (governorate), just north of Cairo at the apex of the Nile Delta, Lower Egypt. It is bounded on the northeast by ash-Sharqīyah *muḥāfaẓah* and on the northwest by the Damietta Branch of the Nile. With a total area of 386 square miles (1,001 square km), it is heavily populated, with an average density of more than 5,600 persons per square mile. About three-fifths of its population relies on agriculture. The alluvial farmland is irrigated mainly by the al-Rayyāḥ (canal) at-Tawfīqī, which parallels the Nile, and by the Turʿat (canal) al-Ismāʿīlīyah to the east. The principal crops are corn (maize), cotton, wheat, and clover. There are also market gardens and orchards catering to the Cairo markets. The *muḥāfaẓah*'s mineral resources are phosphates and basalt, at Abū Zaʿbal, on the eastern fringe of the cultivated zone. There is also a chemicals plant, producing fertilizer, sulfuric acid, oleum, and aerosols. The principal towns are Banhā, (*q.v.*), capital of the *muḥāfaẓah,* and Qalyūb. At Musṭurud there is an oil refinery, located on the Suez–Mediterranean oil pipeline. Pop. (1985 est.) 2,186,000.

Qamdo (China): *see* Ch'ang-tu.

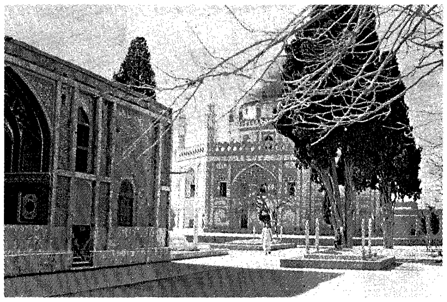
Qāmishlī, al-, also spelled QAMISHLIYE, town in northeastern Syria. It lies along the Turkish border. The border divides the Syrian town of al-Qāmishlī from the Turkish town of Nusaybin. The town was founded in 1926 as a station on the Taurus railway. Its mixed population grew with influxes of Armenian, Assyrian Christian, and Kurdish refugees from Turkey and Iraq. The town also has Sunnite Muslims, Syriac-speaking Christians, and a Jewish community. It is the seat of both an Armenian and a Syrian Catholic archbishopric. Located on the Jaghjaghah River, a tributary of the Khābūr, the town is the centre of an extremely fertile area, growing cotton and wheat. A spur of the railway line extends about 20 miles (32 km) farther east to a wheat and cotton depot. The region is within a zone of moderate rainfall, so dry farming is practiced as well as farming by irrigation.

In recent years, with the discovery and exploitation of oil in the Qarah Shūk region 50 miles east of the town, al-Qāmishlī has begun to grow rapidly. The town has a new sawmill and cement factory. In addition to being a railroad centre on the route from Istanbul, Ankara, Mosul, and Baghdad (the old Orient Express), al-Qāmishlī also connects with Dayr az-Zawr and Aleppo. Domestic air service is provided to Aleppo and Damascus. Al-Qāmishlī is linked by road with both Turkey and Iraq. It serves as a market centre for the whole of northeastern Syria, and its importance has eclipsed that of al-Ḥasakah as a transport, market, and cultural centre. Pop. (1981 prelim.) 92,990.

Qamudah (Tunisia): *see* Sīdī bū Zayd.

qanāt, also spelled KANAT (Arabic), Persian KAREZ, Berber Arabic FOGGARA, ancient type of water supply system developed and still used in arid regions of the world. A *qanāt* taps underground mountain water sources trapped in and beneath the upper reaches of alluvial fans and channels the water downhill through a series of tunnels, often several kilometres long, to the places where it is needed for irrigation and domestic use. The development of *qanāt*s probably began about 2,500 years ago in Iran, their technology then spreading eastward to Afghanistan and westward to Egypt. Currently, several thousand *qanāts* are still used in Iran and Afghanistan, chiefly for irrigation.

Qandahār, also spelled KANDAHĀR, city in south-central Afghanistan. It lies on a plain next to the Tarnak Rūd (river), at an elevation of about 3,300 feet (1,000 m). It is southern Afghanistan's chief commercial centre and is situated at the junction of highways from Kābul, Herāt, and Quetta (Pakistan). The surrounding area is irrigated farmland, and food processing is an important industry in the city, which also has textile factories. The modern city lies just west of the old section, which was built in the 18th century by Aḥmad Shāh Durrānī and contains his monumental mausoleum. Nearby are the ruins of old Qandahār, sacked by the Persian Nāder Shāh in 1738. Qandahār has an international airport, although it is primarily used for domestic flights.



Minor tombs of the children of Aḥmad Shāh Durrānī in Qandahār city, Afg.
Syndication International London Ltd.

Qandahār's strategic location, on main routes to Central Asia (via Kābul) and India, explains the founding of several cities on the site. The Macedonian Alexander the Great built a city there in the 4th century BC that was successively held by a number of Central Asian peoples. It fell under Arab rule in the 7th century AD, under the Ṣaffārids in the 9th, and under the Ghaznavids in the 10th. Qandahār was destroyed by the Mongol invader Genghis Khan and again by the Turkic conqueror Timur (Tamerlane), after which it was held by the Mughals (16th century) and the Persians (17th century). In 1747 it became the first capital of a unified Afghanistan. After their military invasion of Afghanistan in 1979, Soviet forces deployed a motorized rifle division near Qandahār, and by mid-1980 a Soviet military command had been established there. The city continued to be the scene of intermittent heavy fighting in the early 1980s, and it was held for a time in 1981 by Afghan guerrillas based in the surrounding area and across the border in Pakistan. Pop. (1984 est.) 203,177.

Qantas Airways Limited, Australian airline, the oldest in the English-speaking world, founded in 1920 as Queensland and Northern Territory Aerial Services Ltd. (from which the name Qantas was derived). Its first operations were taxi services and joy flights. By the late 20th century, however, its scheduled air routes extended throughout Australasia and farther termini of San Francisco and Vancouver; Tokyo; Harare, Zimbabwe; and London and other European cities. Headquarters are in Sydney.

Qantas' first regular service began in 1922, between Charleville and Cloncurry; in the following years other local routes were added. In 1934 Qantas and Britain's Imperial Airways (later BOAC) formed Qantas Empire Airways Limited to operate the Brisbane–Singapore leg of service from Australia to England. After World War II, in 1947, the Australian Commonwealth government purchased Qantas and designated the company Australia's flag carrier. In the same year, Qantas began regular through service to London, on the "Kangaroo Route." Within a decade it was flying to all the continents. The name Qantas Airways Limited was adopted in 1967.

Qantîr (Egypt): *see* Per Ramessu.

Qara Qoyunlu (Turkmen tribal federation): *see* Kara Koyunlu.

Qaraism (religious movement): *see* Karaism.

Qarakhanid DYNASTY, also spelled KARAKHANID, also called ILEK KHANID, Turkic dynasty (999–1211) that ruled in Transoxania in Central Asia.

The Qarakhanids, who belonged to the Qarluq tribal confederation, became prominent during the 9th century. With the disintegration of the Iranian Sāmānid dynasty, the Qarakhanids took over the Sāmānid territories in Transoxania. In 999 Hārūn (or Ḥasan) Bughra Khān, grandson of the paramount tribal chief of the Qarluq confederation, occupied Bukhara, the Sāmānid capital. The Sāmānid domains were split up between the Ghaznavids, who gained Khorāsān and Afghanistan, and the Qarakhanids, who received Transoxania; the Oxus River thus became the boundary between the two rival empires. During this period the Qarakhanids were converted to Islām.

Early in the 11th century the unity of the Qarakhanid dynasty was fractured by constant internal warfare. In 1041 Muḥammad ʿAyn ad-Dawlah (reigned 1041–52) took over the administration of the western branch of the family, centred at Bukhara. At the end of the 11th century, the Qarakhanids were forced to accept Seljuq suzerainty. With a decline in Seljuq power, in 1140 the Qarakhanids fell under domination of the rival Turkic Karakitai confederation, centred in northern China. ʿUthmān (reigned 1204–11) briefly reestablished the independence of the dynasty, but in 1211 the Qarakhanids were defeated by the Khwārezm-Shāh ʿAlāʾ ad-Dīn Muḥammad and the dynasty was extinguished.

Qarāmiṭah, also called QARMATIANS, also spelled KARMATIANS, a subsect of the Shīʿite Muslim sect, the Ismāʿīlīyah. The Qarāmiṭah flourished in Iraq, Yemen, and especially Bahrain during the 9th to 11th centuries, taking their name from Ḥamdān Qarmaṭ, who led the sect in southern Iraq in the second half of the 9th century. The Qarāmiṭah became notorious for an insurrection in Syria and Iraq in 903–906 and for the exploits of two Bahraini leaders, Abū Saʿīd al-Jannābī and his son and successor, Abū Ṭāhir Sulaymān, who invaded Iraq several times and in 930 sacked Mecca and carried off the Black Stone of the Kaʿbah. *See also* Ismāʿīlīyah.

Qaraqalpaq (people and region): *see* Kara-Kalpak; Kara-Kalpak Autonomous Soviet Socialist Republic.

Qarawīyīn, also spelled QARAWĪYYĪN, KARAWEEN, KARVEEIN, or KAROUIINE, mosque and Islāmic university in Fès, Mor.

The Qarawīyīn Mosque, which was enlarged to its present form in the 12th century, is the largest in North Africa and can accommodate about 22,000 worshipers. Only Muslims are admitted into the mosque, but the interior can be glimpsed through the building's 14 doors. The mosque's roof is supported by 270 pillars forming 16 naves each of 21 horseshoe arches; because of the vast area (about 7 acres [3 hectares]) covered, the roof appears very low. The mosque's large lamp is said to weigh 1,763 lb (800 kg) and to have 509 lights.

The Qarawīyīn Mosque is the centre of a university that was founded in AD 859; several of its schools (madrasahs) are grouped around it. The university has been renowned since the Middle Ages as a centre of Islāmic culture. When the Muslims were expelled from Spain beginning in the 13th century, many came to Fès and to Qarawīyīn, bringing with them knowledge of European and Moorish arts and sciences. By the 14th century there were said to be 8,000 students at the university. The university gradually declined and by the 20th century retained only traces of its former greatness. But after Moroccan independence (1956) much was done to modernize the university: a new faculty of law was established, women were admitted for the first time, and the tuition system was reorganized. In 1963 the traditional program of studies—Islāmic law, theology, and Arabic studies—was divided into three separate faculties, the latter two being relocated at Tétouan and Marrakech. Qarawīyīn had about 5,000 students in the mid-1980s.

qāriʾ (Muslim reciter): *see* qurrāʾ.

Qarluq confederation, Turkic tribal confederation of Central Asia, from whose ranks came the Qarakhanid dynasty.

The origins of the Qarluq Turkmens are somewhat obscure. About 745 they rose in rebellion against the Türküt, then the dominant tribal confederation in the region, and established a new tribal confederation in conjunction with the Turkic Uighur and Basmil tribes.

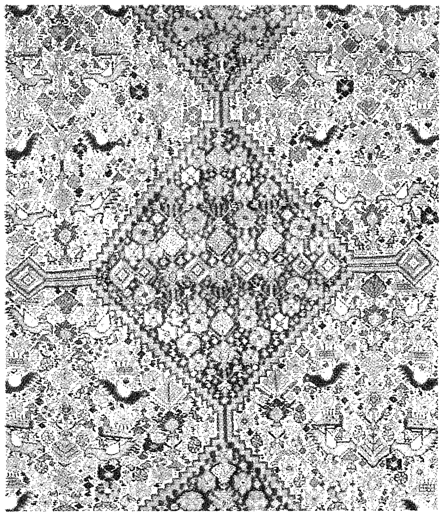
The internal political organization of the Qarluq confederation was based on a system of social organization known as dual kingship. The western, paramount branch of the Qarluq confederation was centred at Balāsāghūn (now in the Kirgiz S.S.R.). The eastern branch was centred at Kashgar (now in the Sinkiang Uighur Autonomous Region of China). Each branch had its own tribal chief and a distinct hierarchy of offices and functions, based on various sections of the tribes. Upon promotion from a lower to a higher office, an officeholder would change his regnal name; thus certain names were always held by the holders of certain offices. The eastern tribal leader was always called *arslan* ("lion"), while the western tribal chief, the paramount leader of the Qarluq, held the title of *bughra* ("camel").

The western branch of the Qarluq came into increasing contact with the Iranian Sāmānid dynasty in the 9th century. With the disintegration of the Sāmānid polity at the end of the 10th century, the Qarluq established themselves as the new ruling dynasty in Transoxania.

Qaro, Joseph ben Ephraim: *see* Karo, Joseph ben Ephraim.

Qarqār (fortress): *see* Karkar.

Qashqāʾī rug, Qashqāʾī also spelled KASHGAI, floor covering handwoven by the Qashqāʾī tribe, known as the best rug from the Shīrāz district of Iran. They are the brightest in colouring, with rich blues and reds and some use of golden yellow. Usually their designs are geometric, perhaps with a row of three diamond medallions against a background replete with tiny forms of all kinds, including stylized animals and birds.



Diamond medallion against a field that includes stylized birds, detail of a Qashqāʾī rug, late 19th century; in the Textile Museum, Washington, D.C.

Textile Museum Collection, Washington, D.C.; photograph, Otto E. Nelson—EB Inc.

Because the designs are reminiscent of Caucasian rugs, as are the Ghiordes knotting on an all-wool foundation and the general mosaic effect, the tribe has been thought to have a Caucasian origin. Mecca-Shīrāz is a dealers' term for such rugs, with little apparent reason.

qasida, also spelled KASIDA, Arabic QAṢĪDAH, poetic form developed in pre-Islāmic Arabia and perpetuated throughout Islāmic literary history into the present.

The classic qasida is an elaborately structured ode of between 60 and 100 lines, maintaining a single end rhyme that runs through the entire piece; the same rhyme also occurs at the end of the first hemistich (half-line) of the first verse. Virtually any metre is acceptable for the qasida except the *rajaz*.

The qasida opens with a short prelude, the *nasīb,* which is elegiac in mood and is intended to gain the audience's involvement. The *nasīb* depicts the poet stopping at an old tribal encampment to reminisce about the happiness he shared there with his beloved and about his sorrow when they parted; Imruʾ al-Qays is said to have been the first to use this device, and nearly all subsequent authors of qasida imitate him. After this conventional beginning follows the *raḥīl,* which consists of similes and descriptions of the poet's horse or camel, of desert animals, scenes of desert events, Bedouin life and warfare; it may conclude with a piece on *fakhr,* or self-praise. The main theme, the *madīḥ,* or panegyric, often coupled with *hijaʾ* (satire of enemies), is last and is the poet's tribute to himself, his tribe, or his patron.

The qasida has always been respected as the highest form of the poetic art and as the special forte of the pre-Islāmic poets. While poets with a classical tendency maintained the genre, with its confining rules, the changed circumstances of the Arabs made it an artificial convention. Thus, by the end of the 8th century the qasida began to decline. It was successfully restored for a brief period in the 10th century by al-Mutanabbī and has continued to be cultivated by the Bedouin. Qasida were also written in Persian, Turkish, and Urdu until the 19th century.

Qaṣr al-Kabīr, al- (Morocco): *see* Ksar el-Kebir.

Qaṣr ʿAmrah, also spelled QAṢR AL-ʿAMRAH (built AD 712–715), palace in Jordan, about 50 miles (80 km) east of Amman. It served as both a hunting lodge and a fortress, and it is one of the best-preserved monuments of Islāmic architecture from the Umayyad period. Its main chamber is roofed with three parallel vaults that rest on broad arches. The vaults are covered with frescoes of people and animals in scenes from daily life; a grouping of rulers and a caliph, thought to be al-Walīd I; and a zodiac. A complete bath forms part of the complex.

Qaṣr as-Saʿīd, al-, Treaty of (1881): *see* Bardo, Treaty of.

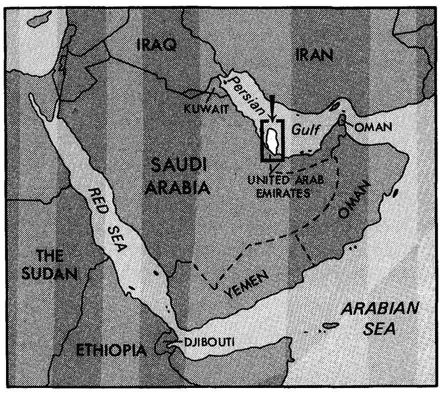
Qaṣrayn, al-, also spelled KASSERINE, town, west-central Tunisia. The town is an important market, road, and rail junction and is the centre of an irrigated agricultural area. Its

Making silage for cattle on a farm, al-Qaṣrayn, Tunisia
F. Botts—M. Grimoldi

economic activities include the cultivation of olives and esparto grass and the manufacture of paper pulp. Kasserine Pass to the northwest was the scene of a decisive battle of the Tunisian campaign in World War II, which contributed to the collapse of German resistance in northern Africa.

The surrounding area is one of sheep and cattle raising and irrigated grain growing. Oil fields, connected by pipeline with aṣ-Ṣukhayrah (La Skhirra) on the Gulf of Gabes, are located at ad-Dūlāb (Douleb). The chief towns of the area, besides al-Qaṣrayn, are Tālah (Thala), Subayṭilah (Sbeitla), and Furīyānah (Feriana). The ruins of ancient Roman settlements, Sufetula and Cillium, are near the towns of Subayṭilah and al-Qaṣrayn, respectively. Pop. (1975) 22,594.

Qatar, officially STATE OF QATAR, Arabic DAWLAT QAṬAR, country on the western coast of the Persian Gulf, occupying a peninsula of about 4,400 square miles (11,400 square km). Qatar projects northward into the gulf for about 100 miles (180 km) and has a maximum width of 50 miles. Its 35 miles (56 km) of land boundaries meet those of Saudi Arabia and the United Arab Emirates, and it has 350 miles (560 km) of coastline. The capital city is Doha (ad-Dawḥah) on the east coast. The population in 1988 was estimated at 420,000.



Qatar

A brief treatment of Qatar follows. For full treatment, see MACROPAEDIA: Arabia.

For current history and for statistics on society and economy, *see* BRITANNICA WORLD DATA ANNUAL.

The land. Qatar's basically flat terrain is marked by a gradual rise from the east to a central limestone plateau. There are hills of up to 130 feet (40 m) in height along the western coast and some low cliffs at the northern end of the eastern coast. Windblown sand covers much of the south, and sand dunes predominate in the southeast. Most of the rest of the country is stony, sandy, and barren, consisting of salt flats, dune desert, and arid plains. Of the numerous islands and coral reefs belonging to Qatar, Ḥālūl, in the Persian Gulf 60 miles (97 km) east of Doha, is of special importance. It is the collecting and storage point for the country's three offshore oil fields.

Qatar is hot and humid during the summer and mild in the winter; midday temperatures in July and August can reach 104° F (40° C), with the humidity exceeding 85 percent. In the winter, there is less humidity and temperatures range between 50° and 68° F (10° and 20° C). Winter weather also includes chilly nights and rainfall averaging 2 to 3 inches (50 to 75 mm) a year.

Much less than 1 percent of Qatar's total area is arable, and less than 5 percent is suitable as pastureland. Vegetation is found only in the north, where Qatar's new irrigated farming areas are located and where the desert's approximately 150 plant species blossom briefly during the spring when rain falls. Animal life in Qatar includes the rhim gazelle, jerboa, sand rat, gerbil, hare, and hedgehog. Amphibians and reptiles include a hissing gecko, dhabrom, desert monitor, and toad-headed agama.

High mineral content makes the underground water unsuitable for drinking. The distillation of seawater now provides more than half the country's water supply. Though agriculture was introduced into the barren desert of Qatar only 20 years ago, and despite the scant rainfall, irrigation from deep underground wells produces good crops of fruits and vegetables.

The people. Qatar was originally settled by nomads from the central part of the Arabian Peninsula. Immigrant workers, however, now form the majority of the Qatari population, and most of the population is urban. The ethnic divisions include: 20 percent native Qatari, 25 percent other Arab, 34 percent South Asian, 16 percent Iranian, and 5 percent other. The ratio of men to women stands at approximately 2 to 1. Arabic is spoken by the majority of the population, while English is commonly used as a second language.

Though most Qataris, indigenous and migrants alike, follow the dictates of the Wahhābī interpretation of Sunnite Islām, Qatar is not as strict as neighbouring Saudi Arabia. Non-Muslims can purchase liquor sold under license. In spite of protests from religious leaders, television has been introduced. Traditional conservatism has prevailed, however, and in the early 1980s a law forbade women from driving motor vehicles. Nevertheless, economic necessity and the relatively small number of native Qatari workers has resulted in relative freedom for women.

The capital, Doha, having grown from a fishing village to a busy urban centre, holds about two-thirds of the country's population. The discovery of petroleum in Qatar in 1939 spurred the development of two other cities, the ports of Zikrīt near Dukhān on the western coast and Musayʿīd (Umm Saʿīd) on the eastern coast.

The economy. The government owns all of the agricultural land and generates most of the economic activity in Qatar, while the private sector participates in trading and contracting on a limited scale. The government has adopted a policy of increased participation in the economy by the private sector, however.

The gross national product (GNP) per capita, which is not growing as rapidly as the population, is nevertheless one of the highest in the world. The oil sector accounts for about one-third of the GNP and for more than four-fifths of government revenues.

Always considered barren, Qatar nevertheless underwent considerable agricultural development during the 1970s. Production of vegetables meets most of the needs of the local market and even provides small seasonal surpluses for export. Still, Qatar must import raw and manufactured food products. Fishing supplies the local market.

Qatar's oil production represents much less than 1 percent of the world's total output. Proved reserves are limited, and the total production of crude oil fluctuated in the 1980s. With the prospect of a decline in oil production as reserves are depleted, natural gas is expected to provide the long-term basis for the Qatari economy. The government has introduced a policy to expand the use of gas as a fuel for domestic industries and as raw material in the production of export-oriented gas liquids. Natural-gas production in the country's four oil fields is subject to depletion with the crude oil, and Qatar therefore plans to tap the vast reserves of unassociated natural gas in, among other sites, Qatar's huge offshore North Field (also known as the Northwest Dome).

In 1939 the discovery of oil near the village of Dukhān on the western coast marked the beginning of the income that led to industrial development. Oil and natural-gas exploration have spurred major industrial development at Musayʿīd. A fertilizer plant began producing ammonia and urea fertilizer there in 1973, and a steel mill opened in 1978. Two petroleum refineries operate at Musayʿīd, which is also the site of the Qatar Petrochemicals Plant. The country's other prominent industries include a flour mill and cement plants.

About 90 percent of the labour force are non-Qataris. Expatriates fill administrative, educational, medical, and technical positions, but the Qatari government has launched a Qatarization policy with the aim of filling the positions by eliminating illiteracy among the younger generation of Qataris.

Banking activity in Qatar is unrestricted, and the country has become an important banking centre in the Persian Gulf region. The government of Qatar and Qatari nationals hold equal shares in the principal bank, the Qatar National Bank.

Qatar has made improvements in roads and sewage disposal to keep up with economic development. The existing road network has been improved, rather than new roads being built. A 65-mile (105-kilometre) highway from Doha to the border with Saudi Arabia near Salwa provides Qatar with vehicular access to the Mediterranean and Europe through its connection with the Saudi Arabian road system. Qatar has several airfields, and Doha International Airport is served by numerous foreign airlines.

Qatar's exports are almost double its imports annually. Its exports consist chiefly of crude petroleum (about 90 percent of the total), liquefied gas, and small quantities of steel and vegetables. Imports consist mainly of machinery and transport equipment, manufactured goods, food and live animals, and chemicals and chemical products. Qatar's main trading partners are Japan, the United Kingdom, France, and Germany.

Administration and social conditions. A traditional monarchy, the State of Qatar declared independence in 1971, when the British protectorate was terminated. The constitution promulgated in April 1970 and revised since declared Qatar an independent and sovereign state with executive power vested in the emir, who holds the post of prime minister. The great majority of the government are members of the royal family, whose ancestry has been traced back to the Banī Tamīm, one of the Sharīf tribes of ancient Arabia. The executive branch consists of a council of ministers, or cabinet, and an advisory council of 30 appointed members. The advisory council, which represents landowners, farmers, and businessmen, reviews litigation given to them by the council of ministers. Civil and criminal codes were introduced in 1971, and a system of secular courts hears all civil and criminal cases. The Islāmic (Sharīʿah) courts are based on religious law and confined essentially to personal and family matters.

Oil revenues have permitted the government to revolutionize public services. Education, advanced housing and home-ownership schemes, the completion of a large general hospital, and social welfare intended to care for native Qataris from the cradle to the grave have all resulted from the oil boom. On the other hand, the large majority of nonnationals do not share in the welfare privileges.

Education is free and compulsory for all residents, citizens and noncitizens alike. Government-run and private schools provide primary and secondary education. The University of Qatar, founded in 1973 (university status in 1977), is the country's only institution of higher education.

An Earth satellite inaugurated in 1976 has helped telecommunications in Qatar. Numerous Arabic newspapers and magazines are published in the country. Qatar has radio- and television-broadcasting services, a fully automated Telex service, and the highest rate of telephone ownership in the Arab world.

Cultural life. The Qatari people still strongly espouse Bedouin traditions. Tribal traditions have remained very much alive. Men wear the traditional *abah,* and women, who rarely appear outside the home, wear not only heavy black veils but also face masks when in public. The strong streak of puritanism in Qatari life, however, has undergone considerable strain with the heavy influx of foreign workers.

History. Qatar is first mentioned in literature by several 10th-century Arab writers. In the 18th century, when Āl Khalīfah (the Khalīfah family) migrated to az-Zubārah, in northwestern Qatar, from their homes farther west and north on the Arabian Peninsula, the Persians considered them a threat and in 1783 invaded Qatar. The Āl Khalīfah defeated them and moved their headquarters to Bahrain Island, ultimately becoming rulers of the independent State of Bahrain and claiming the territory surrounding az-Zubārah as Bahraini. The rift between the sheikhs of Bahrain and their nominal subjects on Qatar grew, and in 1867 full-scale war broke out. Bahrain, aided by the sheikh of Abu Dhabi, routed the Qataris, and the town of Doha was completely destroyed. In the following year the British, concerned about the unrest in the area and the frequent outbreaks of piracy, installed Muḥammad ibn Thānī Āl Thānī, scion of the leading family in Qatar, as ruling sheikh; he signed an agreement referring all matters of dispute between him and his neighbours to the British resident for settlement.

The Ottoman Empire, as nominal suzerain of most of the Arabian Peninsula in the 19th century, endeavoured to station troops in Qatar from 1871; their unsuccessful efforts led to an armed conflict in 1893 in which they were defeated by the sheikh's forces. After the outbreak of World War I in 1914, Turkish influence in the Persian Gulf came to an end, and in November 1916 Great Britain and Qatar concluded a treaty whereby Qatar became a British protected state, on the model of the Trucial States (now the United Arab Emirates). By that time, piracy, which had been a major problem in the region for centuries, was virtually extinct. The Qatari economy then depended almost entirely on pearl diving, fishing, and camel breeding. Oil was struck in 1940, and, after World War II, Qatar rapidly modernized.

Qatar, together with nearby Bahrain, was scheduled to join with the seven emirates of the Trucial Coast to form the United Arab Emirates when Great Britain left the Persian Gulf area in 1971; both Bahrain and Qatar, however, chose to become separate independent states. Qatar became a sovereign independent state in September 1971 and was admitted to the United Nations and to the Arab League.

Qaṭīf, al-, also spelled KATIF, town and oasis, northeastern Saudi Arabia. It lies along the Persian Gulf and is sited over the al-Qaṭīf petroleum field. Since the development of the oil fields in the late 1940s, al-Qaṭīf has lost its status as an important port to ad-Dammām. In addition to several oil wells, al-Qaṭīf has oil–gas separator plants, pipelines, and large residential quarters for workers. A major irrigation project (completed 1964) transformed the oasis into one of the largest agricultural areas in Saudi Arabia, producing dates, alfalfa, rice, fruits, and vegetables. The Baḥārinah, a group of settled Shīʿites, form a large proportion of the local population. Pop. (latest est.) 11,795.

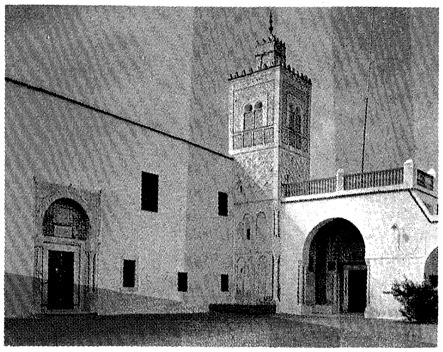
Qatna (ancient Syria): *see* Katna.

Qattara Depression, arid Libyan Desert (Eastern Saharan) basin in northwestern Egypt. Covering about 7,000 square miles (18,100 square km) and containing salt lakes and marshes, it descends to 435 feet (133 m) below sea level. During World War II, because it was impassable to military traffic, the depression formed a natural anchor at the southern end of the British defense lines at el-Alamein (al-ʿAlamayn; in northwestern Egypt) against the final advance of Field Marshal Rommel's German army in July 1942. In the late 1970s oil deposits were discovered in the southern part of the depression.

Qāyen, also spelled QAIN, town, northeastern Iran. Qāyen is a place of great antiquity and complex history. The present town, which lies in a broad valley, was founded in the 15th century to replace an older town. Later, the Uzbeks (a Turkic people) took possession of Qāyen and held it until Shāh ʿAbbās I (1588–1629) expelled them. In the 18th century it fell under the control of the Afghans.

The modern town is surrounded by a mud wall; more affluent residential areas lie outside it. The town's chief industries produce felts and carpets. The surrounding area consists of hill ranges of 9,000 feet (2,750 m) running northwest–southeast and sinking to the Sīstān Basin in the south. The region specializes in the cultivation of saffron, supplying nearly all Iran. The area's principal products also include grain, vegetables, and wool. Pop. (1985 est.) 13,200.

Qayrawān, al-, also spelled QAIROUAN, or KAIROUAN, town, north-central Tunisia. The town, one of the holy cities of Islām, lies on the Low Steppes, a semiarid alluvial plain southeast of the Central Tell. Founded in 670 on the site of the Byzantine fortress of Kamouinia, it served as the camp from which the offensive was launched that resulted in the Islāmic political and religious subjugation of the Maghrib (northwest Africa). Al-Qayrawān was chosen as the capital of the Maghrib by the first Aghlabid ruler in about 800. Subsequently, it served (with al-Mahīdyah) as the political centre through the Fāṭimid and Zīrid dynasties into the 11th century, becoming one of the great administrative, commercial, religious, and intellectual centres of Islām. As a result of Bedouin incursions in the 11th century, the decline of steppe cultivation in favour of nomadic life, and the rise of Tūnis as capital, Al-Qayrawān declined into an isolated market town for nomads.


The outer courtyard of the *zāwiyah* (religious college) of Sidi Sahab near al-Qayrawān, Tunisia
A.F. Kersting

Al-Qayrawān now trades in grain and livestock and is an important carpet and handicrafts centre. A road and railway link it with Sūsah (Sousse), 38 miles (61 km) to the east. Al-Qayrawān's rampart-enclosed medina (75 acres [30 hectares]) contains the Great Mosque, a 115-foot (35-metre) structure. Originally built by Sidi Okba in the 7th century, the present mosque is the fifth mosque built on the site and dates from Aghlabid times. Outside the town is the *zāwiyah* (seat of a religious fraternity) of Sidi Sahab, containing the tomb of one of the companions of Muḥammad, and an Aghlabid reservoir, an open circular pool 420 feet in diameter dating from the 9th century.

The surrounding area is a semiarid steppe region suited to the cultivation of cereals and olives and the raising of livestock. It includes the towns of Ḥaffūz, Bū Ḥajalah, and as-Subaykhah. Pop. (1984) town, 72,254.

Qazvīn (Iran): *see* Kazvin.

qedesha, also spelled KEDESHA, or KEDESHAH, Akkadian QADISHTU, one of a class of sacred prostitutes found throughout the ancient Middle East, especially in the worship of the fertility goddess Astarte (Ashtoreth). Prostitutes, who often played an important part in official temple worship, could be either male or female.

In Egypt, a goddess named Qedeshu, Lady of Kadesh (Syria), was worshiped in the 19th and 20th dynasties (1317–1085 BC). Her representation is found on private stelae of middle-class workers. She is shown nude, posed frontally on a lioness (or a leopard), holding arrows in her hands.

Although Israelite prophets and reformers repeatedly denounced sacred prostitution, the early Israelites seem to have adopted the local Canaanite rites, which they apparently practiced publicly until the reform of King Josiah about 622 BC.

Qena (Egypt): *see* Qinā.

Qeshm, also spelled QISHM, Persian JAZĪREH-E-QESHM, Arabic JAZĪRAT AṬ-ṬAWĪLAH, largest island in the Persian Gulf, belonging to Iran. The Arabic name means "long island." It lies parallel to the Iranian coast, from which it is separated by Clarence Strait. With an area of 460 square miles (1,200 square km), it has an irregular outline and a generally rocky coast except for sandy bays and mud flats fringing the northwest. Irregular table-topped hills almost cover Qeshm; several are over 900 feet (270 m) high and one, Kīsh Kūh, reaches 1,331 feet (406 m). Salt is mined on the southeastern coast, and there are naphtha springs. The island is mostly barren, but cereals, vegetables, melons, and dates are grown, and there is fishing and weaving. A sheikh of the Banū Ma'īn tribe administers the island for the Iranian government. Pop. (1985 est.) 7,600.

Qeys Island, also spelled QAIS, Persian JAZĪREH-YE QEYS, island in the Persian Gulf, lying about 10 miles (16 km) off mainland Iran. It rises 120 feet (37 m) above sea level to a plateau and is almost without vegetation except for a few date groves and stunted herbage. Qeys attained importance only in the late 1st millennium AD, when a prince obtained it, built a fleet, and gradually extended his power. He captured Sīrāf (modern Ṭāherī), then a large market, but in the 11th century, Qeys supplanted Sīrāf. At its zenith the dynasty of Qeys also ruled over part of the Arabian shore; the islanders traded in Persian, Mesopotamian, Arabian, and Indian products. The site of the old city is marked by the ruins known as Harīreh (modern Deh) on the northern coast. Qeys lost its importance in the 14th century. Pop. (latest census) 1,834.

Qi (Chinese state): *see* Ch'i.

qi (in Chinese philosophy): *see* ch'i.

Qi Baishi: *see* Ch'i Pai-shih.

Qian-long (Chinese emperor): *see* Ch'ien-lung.

Qiangtang (China): *see* Ch'iang-t'ang.

qibla, also spelled QIBLAH, or KIBLAH, Arabic QIBLAH, the direction of the sacred shrine of the Ka'bah in Mecca, toward which Muslims turn five times each day when performing the salat (daily ritual prayer). Soon after Muḥammad's emigration (hegira, or hijrah) to Medina in 622, he indicated Jerusalem as the qibla, probably influenced by Jewish tradition. When Jewish–Muslim relations no longer seemed promising, Muḥammad changed the qibla to Mecca.

The qibla is used not only for prayer but also for burial; the dead, including slaughtered animals, are interred facing Mecca. In a mosque, the qibla is indicated by the mihrab, a niche in the mosque's interior wall facing Mecca.

Qiddush: *see* Kiddush.

Qifṭ, also spelled KUFT, Greek COPTOS, or KOPTOS, agricultural town, Qinā *muḥāfaẓah* (governorate), Upper Egypt. It is situated at the large bend of the Nile below Luxor (al-Uqṣur) and lies along the east bank of the river. Known to the ancient Egyptians as Qebtu, the town was of early dynastic foundation. It was important for nearby gold and quartzite mines in the Eastern Desert, worked during the 1st and 2nd dynasties, and as a starting point for expeditions to Punt (in modern Somalia). Qebtu was associated with the god Min (temple ruins remain) and the goddess Isis, who, according to legend, found part of Osiris' body there. Destroyed in AD 292 by Diocletian, Qifṭ later became a Christian community, lending its name to the Coptic Christians of Egypt and also to Egypt, via the Greek name Aegyptos. Important as a medieval caravan trade centre, the town is now known chiefly for its ruins. The famous road to the Red Sea, via Wādī Hammamat, that made the town important starts just to the east at the desert edge. Pop. (1985 est.) 15,000.

Qijia culture (China): *see* Ch'i-chia culture.

Qilian Shan (Kunlun Mountains): *see* Ch'i-lien Mountains.

Qilin (Chinese mythology): *see* ch'i-lin.

Qimḥi (Hebrew grammarians): *see* Kimhi, David; Kimhi, Joseph; Kimhi, Moses.

Qin DYNASTY (China): *see* Ch'in dynasty.

Qin He (China): *see* Ch'in River.

Qin Ling (China): *see* Tsinling Mountains.

Qin tomb (archaeological site): *see* Ch'in tomb.

Qin Zong (Chinese emperor): *see* Ch'in Tsung.

Qinā, also spelled QENA, *muḥāfaẓah* (governorate) in Upper Egypt, extending 3–4 miles (5–6 km) on each side of the Nile River between the Arabian and Libyan deserts. Occupying the great bend in the Nile Valley, it has an area of 715 square miles (1,851 square km) and contains the celebrated ruins of Thebes and the Valley of the Tombs of the Kings. Qinā has a dense agricultural population (more than 3,000 persons per square mile), and most of its land is under basin irrigation, yielding only one crop annually. Main crops are sugar (about three-fifths of the nation's production), lentils, and grains. Perennial irrigation water, mainly from the Kelabiya and Aṣfūn canals, is supplied from the Isnā Barrage. There are rich phosphate deposits near Isnā, and a fertilizer plant is located there. Sugar refineries are located at Naj' Ḥammādī, Qus, and Dishnā. The principal towns are Qinā (*q.v.*), the capital, Luxor (al-Uqṣur), and Isnā. Pop. (1985 est.) 2,159,000.

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Qinā, also spelled QENA, town and capital of Qinā *muḥāfaẓah* (governorate), Upper Egypt, on a canal 1 mile (1.6 km) east of the Nile River at its great bend, opposite Dandarah. The town was called Caene (New Town) by the ancient Greeks to distinguish it from Coptos (now Qifṭ), 14 miles south, whose trade with Arabia, India, and China it eventually acquired. The shift resulted from the use of a more northerly route across the Eastern Desert to the ports at Būr Safājah and al-Quṣayr. Excavations at al-Quṣayr indicate that the route change occurred after the Mamlūk period (after 1517). The northerly route's trade diminished in the Ottoman period, but the route remained in use for the Muslim Upper Egyptians making the Ḥājj (pilgrimage) to Mecca.

Qinā revived during and after World War II because of its position as terminus of the road to the Red Sea coast, its status as a capital of the governorate, and the construction of a bridge across the Nile, together with the upgrading of the highway through Upper Egypt, which passes through it. The town is served by the Cairo–Aswān railway; there is a military air base in the desert to the east. Qinā is now a market town and service centre for road vehicles, and it has been traditionally noted for its production of porous clay water vessels used throughout Egypt. Pop. (1985 est.) 137,100.

Qing DYNASTY (China): *see* Ch'ing dynasty.

Qing Hai (lake, China): *see* Koko Nor.

Qingdao (China): *see* Tsingtao.

Qingliu dang (Chinese clique): *see* Ch'ing-liu tang.

Qinhuangdao (China): *see* Ch'in-huang-tao.

Qiongshan (China): *see* Ch'iung-shan.

Qiqihar (China): *see* Tsitsihar.

Qiryat Shemona, town, at the northwest of the 'Emeq Ḥula (Hula Valley), extreme northern Israel. The name Qiryat Shemona ("Town of the Eight") commemorates the eight martyrs of nearby Tel Ḥay (*q.v.*). The town, the only urban settlement of the valley, was founded in 1950 as an immigrants' transit camp (*ma'abara*) on the site of the former Arab village of Khalasah. Metulla, the northernmost settlement of Israel per its pre-1967 boundaries, is 6 miles (10 km) north.

In the 1950s many of the town's settlers were engaged in public-works projects connected with the drainage of the Ḥula swamps. Since then, light industries (diamond cutting and the production of textiles, ceramics, and plastics) have been established. Many residents are engaged in seasonal agricultural labour in the nearby collective settlements.

Qiryat Shemona is the seat of the Upper Galilee Regional Council, and its development received further impetus when Israeli settlements began to appear in the Golan Heights. Pop. (1985 est.) 15,700.

Qishm (Iran): *see* Qeshm.

Qishon River, also spelled KISHON RIVER, Hebrew NAḤAL QISHON, stream, northern Israel, one of the country's few perennial rivers. It is formed by small streams and seasonal watercourses (wadis), which rise chiefly in the Hare (Mountains of) Gilboa' to the south and west and the Nazareth Hills of Lower Galilee to the north. From the river's southern sources the Qishon's total length is about 25 miles (40 km); the area of the drainage basin is about 400 square miles (1,000 square km).

The Qishon's headwaters unite in the western Plain of Esdraelon, southwest of kibbutz Sarid. There a dam has been built, impounding a 3-mile-long, multipurpose (flood control, irrigation, fishpond) reservoir, Agam Kefar Barukh. Before this was constructed by Jewish settlers, the Qishon overflowed its banks annually during the winter rains and hindered settlement in the surrounding area. From there the river flows northwest through the plain, is deflected north by the Mount Carmel ridge, and resumes a northwesterly course through the plain of 'Akko (Acre) to the Mediterranean Sea in the Bay of Haifa.

The Qishon in flood is the biblical setting of the Israelite victory over the Canaanite general Sisera, under the leadership of the judge and prophetess Deborah and the commander Barak (Judges 4:7, 12; 5:21). Centuries later, the dramatic confrontation between the prophet Elijah and the prophets of Baal on Mount Carmel ended in Elijah's drowning the 450 false prophets in "the brook Kishon" (I Kings 18:40).

In modern times the river's mouth has been developed as part of the Haifa port complex. The Kishon Port (so spelled by the Israel Ports Authority) has a cargo wharf 2,100 feet (640 m) long, enclosing a protected basin with depths from about 21 to 26 feet. It is the main base of Israel's coastal and deep-sea fishing fleet. The Israel Shipyards Company, located there, builds and repairs smaller craft.

Qiu Ying: *see* Ch'iu Ying.

Qiungzhou (China): *see* Ch'iung-shan.

qiyas, Arabic QIYĀS, in Islāmic law, analogical reasoning as applied to the deduction of juridical principles from the Qur'ān and the Sunnah (the normative practice of the community). With the Qur'ān, the Sunnah, and *ijmā'* (scholarly consensus), it constitutes the four sources of Islāmic jurisprudence (*uṣūl al-fiqh*; *q.v.*).

The need for qiyas developed soon after the death of Muḥammad, when the expanding Islāmic state came in contact with societies and situations beyond the scope of the Qur'ān and the Sunnah. In some cases *ijmā'* legitimized a solution or resolved a problem. Very often, however, qiyas was used to deduce new beliefs and practices on the basis of analogy with past practices and beliefs.

Muslim scholars consider qiyas a specific variant of the general concept of *ijtihād*, which is original interpretation and thought. It is also related to *ra'y*, personal thought and opinion, a forerunner of qiyas criticized by traditional authorities as too arbitrary.

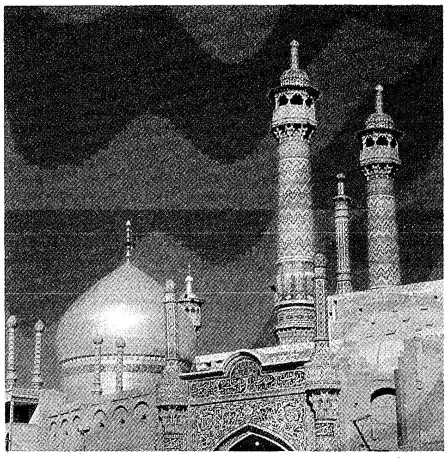
Qiying (Chinese official): *see* Ch'i-ying.

Qīzān (Saudi Arabia): *see* Jīzān.

Qobād (Sāsānian king): *see* Kavadh I.

Qodashim (Hebrew: "Holy Things"), the fifth of the six major divisions, or orders (sedarim), of the Mishna (codification of Jewish oral laws), which was given its final form early in the 3rd century AD by Judah ha-Nasi. *Qodashim* deals primarily with rites and sacrifices that took place in the Temple of Jerusalem, which was destroyed in AD 70 by Roman legions and never rebuilt. The 11 tractates (treatises) of *Qodashim* are *Zevaḥim* ("Animal Sacrifices"), *Menaḥot* ("Meal Offerings"), *Ḥullin* ("Profane Objects"), *Bekhorot* ("Firstborn"), *ʿArakhin* ("Estimates"), *Temura* ("Exchange"), *Keretot* ("Excisions"), *Meʿila* ("Transgression"), *Tamid* ("Burnt Offering"), *Middot* ("Dimensions"), and *Qinnim* ("Birds' Nests"). Gemara (critical commentaries) are found in the Babylonian Talmud on all but the last two of the tractates; the Palestinian Talmud has no Gemara on the *Qodashim*, though some may have been written and subsequently lost.

Qom, also spelled QUM, city, north-central Iran. The town lies on both banks of the Rūd-e Qom and beside a salt desert, the Dasht-e Kavīr, 92 miles (147 km) south of Tehrān.



Dome of the Shrine of Fāṭimah, Qom, Iran
Kurt Scholz—Shostal/EB Inc.

In the 8th century, Qom was one of the centres of Shīʿism; in 816 Fāṭimah, the sister of the *imām* (leader of Shīʿite Islām) ʿAlī ar-Riḍā, died in the town and was buried there. It became a place of pilgrimage in the 17th century, when the Ṣafavid rulers built a golden-domed shrine over Fāṭimah's tomb. The modern city has the largest *madrasah* (theological college) in the country, where students can specialize in Islāmic law, philosophy, theology, and logic. It was at Qom that the Iranian Army surrendered to Islāmic revolutionary militia in 1979. Following the Islāmic Revolution in Iran early in 1979, the revolution's principal figure, the Ayatollah Ruhollah Khomeini, again took up residence in Qom, whence he had been exiled by the shah, and made the town his seat.

Some 10 kings and 400 Islāmic saints are interred in Qom and its neighbourhood. Shāh ʿAbbās II is buried there in a special mausoleum richly adorned with 14 fine silk rugs, dated 1666. On the southern side of the city is a group of five mausoleums (mostly 14th century) distinguished by remarkable polychrome stucco ornaments. Qom has developed into a lively industrial centre owing in part to its proximity to Tehrān. It is a regional centre for the distribution of petroleum and petroleum products, and a natural gas pipeline from Bandar-e Anzalī and Tehrān and a crude-oil pipeline from Tehrān run through Qom to the Abadan refinery on the Persian Gulf. Qom gained additional prosperity when oil fields were discovered at Sarājeh near the city in 1956 and a large refinery was built between Qom and Tehrān. Rural populations migrated to the growing township, and its economic growth accelerated with new investments in the textile industry and the establishment of petrochemical, cement, and brick-making industries. In the 1970s several dams were completed on the upper reaches of the Rūd-e Qom. The city has road connections to Tehrān, Arāk, Kāshān, Sāveh, and Yazd and is on the Trans-Iranian Railway. There are many Muslim shrines in the area, and Kebar, 15 miles (24 km) south of Qom, is the site of an ancient vaulted dam. Wheat, barley, oilseeds, vegetables, fruits, and cotton are grown in the surrounding area. Pop. (1985 est.) 637,700.

QSO (astronomy): *see* quasar.

Qu Qiubai, Wade-Giles romanization CH'Ü CH'IU-PAI, original name (Wade-Giles) CH'U SHUANG, also called SUNG YANG (b. Jan. 29, 1899, Wu-chin, Kiangsu Province, China—d. June 18, 1935, Ch'ang-t'ing, Fukien), prominent leader and, on occasions in the 1920s and early 1930s, head of the Chinese Communist Party. In addition to being a political activist, he is considered one of the most important literary figures of 20th-century China. In the People's Republic of China today, Qu, who was an early mentor of Mao Zedong, is honoured as one of the great martyrs of the Communist revolution.

A well-known student radical, Qu was invited to participate in the first Marxist study groups organized by the eventual cofounder of the Chinese Communist Party, Li Dazhao, in 1919. The following year he went to the Soviet Union as a Moscow correspondent for the Peking *Ch'en pao* ("Morning Post"). His dispatches describing Soviet life were published as *O-hsiang chi-ch'eng* (1921;"Journey to the Land of Hunger"). That book made a considerable impression on Chinese intellectuals, as did his second book, *Ch'ih-tu hsin-shih* (1924; "Impressions of the Red Capital").

In 1922 he officially joined the Chinese Communist Party. Later that year, when the head of the party, Chen Duxiu, visited Moscow, Qu served as his interpreter and returned with him to China, where he was elected to the party's Central Committee. In 1927 he headed an intraparty opposition group criticizing Chen's leadership, which was committed to the orthodox Marxist idea of organizing the urban proletariat. When Chen's faction refused to print Mao's work on the revolutionary potential of the Chinese peasantry, "Report on an Investigation of the Peasant Movement in Hunan," Qu wrote a preface to Mao's essay and published it as a pamphlet.

He by no means, however, completely sympathized with Mao's ideas for a peasant revolution. Qu's attitude became evident in August 1927, when he replaced Chen as head of the party and continued to insist that a Communist victory could be achieved only through the capture of the cities. But that policy met with disaster when an attempted uprising at Canton by Communist cadres was crushed by the Kuomintang after three days. As a result, Qu was accused of "leftist deviationism" and recalled to Moscow. The scheme he devised while there for the romanization of the Chinese language was used widely.

In 1930 Qu returned to China, where he again became active in the party's leadership. His policies, however, again came under attack, and he was removed from the party's ruling Politburo. For a time he assumed the leadership of the League of Left-Wing Writers, which soon became one of the most influential organizations in mobilizing Chinese intellectuals to the support of the party. He also translated many works of important Russian authors previously unknown to the Chinese.

In 1934 Qu went to the southwestern province of Kiangsi, where a Communist enclave had been established by Mao Zedong. When the main body of Communist forces abandoned Kiangsi later that year under pressure from Kuomintang forces, Mao was temporarily ousted from the party leadership, and Qu was forced to remain behind to carry on a propaganda campaign. Early in 1935 he was captured and subsequently executed. During his imprisonment Qu wrote his famous *To-yu te hua* ("Superfluous Words"), in which he revealed the personal anguish he had undergone in submerging his needs for personal expression in order to aid the revolution.

Qu Yuan (Chinese poet): *see* Ch'ü Yüan.

quack grass, also called COUCH GRASS, or QUICK GRASS (*Agropyron repens*), rapidly spreading grass of the family Poaceae. It has flat, somewhat hairy leaves and erect flower spikes; the plant may grow from 30 to 100 cm (about 12 to 40 inches) high. It is native to Europe and has been introduced into other north temperate areas for forage or erosion control. In cultivated land, it is considered a weed because of its persistence.

Quack grass has long, yellowish-white rhizomes, which must be completely dug up to eradicate the plant because broken rhizomes generate new plants. Quack grass has been used in various home remedies in Europe, and the rhizomes have been eaten during periods of famine.

quad, unit of energy equal to a quadrillion (10^{15}) British thermal units (BTU). The quad is a convenient unit for describing national and world energy resources. One quad is also equal to 293 billion (10^9) kilowatt hours, or, for fuels of average heating values, 183,000,000 barrels of petroleum, 38,500,000 tons of coal, or 980,000,000,000 (10^{12}) cubic feet of natural gas.

Quad Cities, an industrial complex at the Iowa–Illinois border, on the Mississippi River, U.S., which includes Rock Island, Moline, and East Moline (*qq.v.*), Ill., and Davenport (*q.v.*), Iowa.

quadrangle, byname QUAD, in architecture, rectangular open space completely or partially enclosed by buildings of an academic or civic character. The grounds of a quadrangle are often grassy or landscaped. Such a quadrangular area, intended as an environment for contemplation, study, or relaxation, was a feature of monastic establishments and thus of the colleges that evolved from them. The term is also used to describe the building or building complex that contains a quadrangular area.

The most celebrated quadrangles, extensively imitated in university and college architecture in English-speaking countries, are those of Oxford and Cambridge, in Great Britain. The buildings of New College, Oxford (completed 1386), are partly connected to form a unified mass. This layout was enormously influential in subsequent collegiate building. One of the best-known quadrangles is that of Gonville and Caius, Cambridge (begun 1565), built by John Caius partly to display the new Renaissance architecture he had seen while journeying in Italy. He created an allegorical "progress" in the quadrangle: one passed in succession through the Gate of Humility, the Gate of Virtue, and finally the Gate of Honour, which led toward the schools.

quadratic equation, in mathematics, an algebraic equation of the second degree (having one or more variables raised to the second power). The general quadratic equation in one variable is $ax^2 + bx + c = 0$, in which a, b, and c are arbitrary constants (or parameters) and a is not equal to 0. Such an equation has two roots (not necessarily distinct), as given by the quadratic formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}.$$

The discriminant $b^2 - 4ac$ gives information concerning the nature of the roots (*see* discriminant). If, instead of equating the above to zero, the curve $ax^2 + bx + c = y$ is plotted, it is seen that the real roots are the x coordinates of the points at which the curve crosses the x axis. The shape of this curve in Euclidean two-dimensional space, E_2, is a parabola (*q.v.*); in Euclidean three-dimensional space, E_3, it is a parabolic cylindrical surface, or paraboloid (*q.v.*).

In two variables, the general quadratic equation is $ax^2 + bxy + cy^2 + dx + ey + f = 0$, in which $a, b, c, d, e,$ and f are arbitrary constants and $a, c \neq 0$. The discriminant, symbolized by the Greek letter delta, Δ, and the invariant $(b^2 - 4ac)$ together provide information as to the shape of the curve. The locus in E_2 of every general quadratic in two variables is a conic section (*q.v.*) or its degenerate.

More general quadratic equations, in the variables $x, y,$ and z, lead to generation (in E_3) of surfaces known as the quadrics, or quadric surfaces.

quadrature, in astronomy, that aspect of a heavenly body in which its direction as seen from the Earth makes a right angle with the direction of the Sun. The Moon at First or Last Quarter is said to be at east or west quadrature, respectively. A superior planet (outside the Earth's orbit) is at west quadrature when its position is 90° west of the Sun. It rises around midnight, reaches the meridian (a great circle on the celestial sphere, passing through the north and south poles and the zenith) near sunrise and sets near noon. At east quadrature the planet is near the meridian at sunset and sets near midnight. At both quadratures the planet is at gibbous phase (more than half but not all of the disk illuminated), but only Mars shows up conspicuously gibbous.

quadrature, in mathematics, process of determining the area of a plane geometric figure by dividing it into a collection of shapes of known area (usually rectangles) and then finding the sum of these areas. When this process is performed with solid figures to find volume, the process is called cubature. A similar process called rectification is used in determining the length of a curve. The curve is divided into a sequence of straight line segments of known length. Because the definite integral of a function determines the area under its curve, integration is still sometimes referred to as quadrature.

Quadratus, SAINT (fl. early 2nd century; feast day May 26), the earliest known Apologist for Christianity.

With only a fragment of his *Apology for Christianity* still extant, preserved in the *Ecclesiastical History* of the 4th-century scholar Eusebius of Caesarea, Quadratus has not been clearly identified. Addressed from Asia Minor to the Roman emperor Hadrian during a persecution either in 124 or 129, the work is thought to have been written by a disciple of the early 2nd-century Eastern Church fathers Ignatius of Antioch and Polycarp of Smyrna. The 5th-century biblical scholar Jerome erroneously identified the author with Bishop Quadratus of Athens, who lived during the reign of Emperor Marcus Aurelius (161–180). Eusebius offered the improbable opinion that the author was a prophet and disciple of Christ's first apostles. More recently, scholars have attempted, unconvincingly, to equate Quadratus' apology with the 2nd-century Christian treatise against paganism and Judaism, the *Letter to Diognetus*, to relate it to anonymous accounts of early Christian martyrs, or to recognize it as part of the early medieval eulogy for monasticism known as the legend of Barlaam and Josaphat.

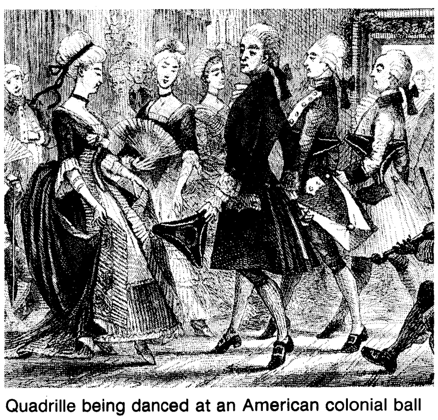
According to Eusebius, Quadratus wrote in response to sharp attacks on the Christian religion. The same source records that the *Apology* expressed a primitive orthodoxy by arguing for the truthfulness of Christ's teachings by reason of his miracles in healing the sick and in restoring life to the dead, some of whom were known to Quadratus. This biblical theological approach is the classical exemplar of the oldest post-apostolic doctrine. The surviving text of Quadratus' *Apology* was edited by E.J. Goodspeed, *Die ältesten Apologeten* (1914; "The Oldest Apologists").

quadriceps femoris muscle, large fleshy muscle group covering the front and sides of the thigh. It has four parts: rectus femoris, vastus lateralis, vastus medialis, and vastus intermedius. They originate at the ilium (upper part of the pelvis, or hipbone) and femur (thighbone), come together in a tendon surrounding the patella (kneecap), and insert at (are attached to) the tibia (shinbone). These muscles extend the legs at the knee and are important for standing, walking, and almost all activities involving the legs.

Quadrilateral, famous combination of four fortresses mutually supporting one another, during the Austrian rule of northern Italy. The four fortified towns were Mantua, Peschiera, Verona, and Legnago, lying between Lombardy and Venetia; the former two were on the Mincio and the latter two on the Adige. The real value of the Quadrilateral, which gave Austria such a firm hold on Lombardy, lay in the great natural strength of Mantua and in the readiness with which troops and supplies could be poured into Verona from Austria to the north.

The term quadrilateral has also been applied to other similar groups of fortresses—for example, the fortresses of Namur, Liège, Maastricht, and Louvain in the old Netherlands and those of Silistra, Ruse, Shumen, and Varna in Bulgaria.

quadrille, fashionable late 18th- and 19th-century dance for four couples in square formation. Imported by English aristocrats in 1815 from elite Parisian ballrooms, it consisted of four, or sometimes five, contredanses; like the contredanse (*q.v.*), the quadrille depended more on the cooperative execution of intertwining figures, or floor patterns, than on intricate stepwork. Each of the quadrille's sections was danced with prescribed combinations of figures, such as the *tour de deux mains*



Quadrille being danced at an American colonial ball
The Bettmann Archive

("two-hand turn"), in which the couple held hands and turned; or the *chaîne des dames* ("ladies' chain"), in which opposite women first passed each other by the right hand, and then each gave her left hand to the opposite man, who turned her into place beside himself. The quadrille was frequently danced to a medley of opera melodies. The lancers, a variation of the quadrille, became popular in the late 1800s and was still danced in the mid-20th century in folk-dance clubs.

Quadruple Alliance, alliance formed Aug. 2, 1718, when Austria joined the Triple Alliance of Britain, the Dutch Republic (United Provinces), and France to prevent Spain from altering the terms of the Treaty of Utrecht (1713). Philip V of Spain, influenced by his wife, Elizabeth Farnese of Parma, and her adviser Giulio Alberoni, seized control of Sardinia and Sicily (assigned to Austria and Savoy, respectively, by the Utrecht treaty). With the backing of the Quadruple Alliance, the British fleet brought Austrian troops to Sicily, and the French sent troops to occupy northern Spain. By the Treaty of The Hague (Feb. 17, 1720), the allies forced Philip to renounce his claims in Italy; Victor Amadeus II of Savoy gave up Sicily to Austria in exchange for Sardinia.

Quadruple Alliance, alliance first formed in 1813, during the final phase of the Napoleonic Wars, by Britain, Russia, Austria, and Prussia, for the purpose of defeating Napoleon, but conventionally dated from Nov. 20, 1815, when it was officially renewed to prevent recurrence of French aggression and to provide machinery to enforce the peace settlement concluded at the Congress of Vienna. The members each agreed to put 60,000 men in the field in the event of French aggression. More significantly, they agreed to meet occasionally to confer on European problems and to keep European political development within terms of the 1815 settlement. This program was partially carried out by the congresses of Aix-la-Chapelle, Troppau, Laibach, and Verona. At the Congress of Aix-la-Chapelle (Aachen, 1818) France was admitted to full participation in the proceedings, creating in effect the Quintuple Alliance.

Although the old alliance was secretly renewed on Nov. 1, 1818, because of some continued fear of France, there was never an occasion for the alliance to oppose France, and it remained inactive. British foreign policy diverged from that of the other powers in the 1820s, weakening the efforts of the Austrian prince Klemens von Metternich to use the alliance for reaction and counterrevolution throughout Europe.

Quadruple Alliance, alliance formed on April 22, 1834, between Britain, France, and the more liberal claimants to the thrones of Spain and Portugal against the conservative claimants to those thrones. The alliance successfully supported Maria Cristiana, who was acting as regent for Isabella II in Spain and had allied herself with the liberals against the pretender Don Carlos in the First Carlist War (1833–39). In Portugal the alliance successfully supported Maria da Glória by intervening in the Miguelite Wars (1828–34) and expelling the reactionary Dom Miguel from Portugal. The cooperation between France and Britain in the affairs of the Iberian Peninsula broke down in 1846, when Isabella and her sister, Luisa, married French princes (*see* Spanish Marriages, Affair of the).

quaestor (Latin: "investigator"), plural QUAESTORS, or QUAESTORES, the lowest ranking regular magistrate in ancient Rome, whose traditional responsibility was the treasury. During the royal period, the kings appointed *quaestores parricidii* (quaestors with judicial powers) to handle cases of murder.

With the advent of the republic in the year 509 BC, each of the two consuls, who at first were called praetors, appointed a quaestor to be the custodian of the public treasury. After 447 BC the two quaestors were elected each year by the tribal assembly. The quaestorship became the first magistracy sought by an ambitious young man. Later in the century it was decreed that plebeians could hold the office, and the number of quaestors was increased to four. Two served as quartermasters to the two consuls when they were in the field, and the other two stayed in Rome to supervise the financial affairs of the treasury.

As Rome proceeded with its conquest of Italy, four more were added and given responsibility for raising taxes and securing recruits from the conquered territories. Each provincial governor had his own quaestor as quartermaster and tax collector. In the provinces the quaestors sometimes performed military functions as well.

In the 2nd century BC the minimum age for quaestors was set at 28. After their term of office expired, it was common for them to enter the Senate. After Sulla became dictator in 82 BC, the minimum age was increased to 30, the quaestors' entrance into the Senate was made automatic, and the number of quaestors was raised to 20. In 45 BC Julius Caesar increased the number to 40, but Augustus returned it to 20 and weakened the powers and responsibility of the office. The quaestors' financial responsibilities were eventually assumed by imperial officers. By the 4th century AD the quaestorship was purely honorary and was held generally by men of wealth for social status.

quagga, also called BONTE QUAGGA, or BURCHELL'S ZEBRA, African species of zebra (*q.v.*).

quahog, edible species of clam (*q.v.*).

quail, any of 130 species of small, short-tailed game birds of the family Phasianidae (order Galliformes), resembling partridges but generally smaller and less robust. The 95 species of Old World quail are classified either in the subfamily Phasianinae or in a separate subfamily, Perdicinae. New World quail—some 36 species, constituting the subfamily Odontophorinae—more nearly resemble Old World partridges.

Quail prefer open country and brushy borders. In spring the hen lays about 12 roundish eggs, which the male may help incubate. The young remain with their parents the first summer. Quail eat mainly seeds and berries but also take leaves, roots, and some insects. Their flesh is delicious, as are their eggs.

New World quail have stronger bills than do the Old World forms, and none has leg spurs. The bobwhite (*Colinus virginianus*) of North America exists in about 20 races from southern Canada to Guatemala. Its name is suggestive of its call. Other than the bobwhite, North American quail include two important game birds introduced widely elsewhere: the California, or valley, quail (*Lophortyx californicus*) and Gambel's, or desert, quail (*L. gambelii*). Both species have a head plume (larger in males) curling forward.

Ranging farther east is the scaled, or blue, quail (*Callipepla squamata*). Grayish, with scaly markings and a white-tipped crest, it is the fastest quail afoot. The mountain, or plumed, quail (*Oreortyx pictus*), gray and reddish with long straight plume, is perhaps the largest New World quail, weighing as much as ½ kilogram (about 1 pound). The singing, or long-clawed, quail (*Dactylortyx thoracicus*), of Central America, has a musical call. The tree quail, or long-tailed partridge (*Dendrortyx macroura*), of Mexico, is a 33-centimetre (13-inch) bird of almost grouselike proportions. Wood quail—large birds of the genus *Odontophorus*—are the only phasianids widely distributed in South America; they are forest dwellers.

Old World quail are smallish plain birds,

Quail
(Top) Old World (*Coturnix coturnix*); (bottom) California (*Lophortyx californicus*)
(Top) H. Reinhard—Bruce Coleman Inc., (bottom) John Tveten

shorter and stockier than their New World counterparts. The bill edge is smooth, and the legs, in many, are spurred. Best known is *Coturnix coturnix*, the common quail of Europe, Asia, and Africa. It is the only migratory gallinaceous bird. Small quail sometimes classified as *Excalfactoria*, rather than *Coturnix*, include the blue quail (*C. adamsoni*), only 13 cm (5 in.) long, of eastern Africa. India has dwarf partridges, usually called bush quail, of the genus *Perdicula*.

Qu'aiti Sultanate, in full, QU'AITI SULTANATE OF SHIHR AND MUKALLA, former semi-independent state in the southern Arabian Peninsula, in what is now Yemen (Aden). It was one of the largest sultanates in the British-ruled Aden Protectorate, the forerunner of independent Yemen (Aden); its capital was the port of al-Mukallā (*q.v.*). Its territory encompassed a stretch of the Gulf of Aden coast and much of the Ḥaḍramawt (*q.v.*), an inland region extending northward to the Rub' al-Khali, the southern Arabian Desert. The sultanate was founded when the powerful Qu'aiti tribe arose early in the 19th century, challenging the dominant Kathiri Sultanate. The two fought for supremacy in the Ḥaḍramawt until British pressure forced them to make peace in 1918. Both sultanates became part of Yemen (Aden) in 1967. The economy is based on agriculture, stock raising, and tanning, weaving, and other industries.

Quakers: *see* Friends, Society of.

quaking grass, any of about 20 species of slender annual or perennial grasses making up the genus *Briza* (family Poaceae). They are named for the spikelets of open flower clusters that are borne on long stalks and quiver in any air current.

They are native to Eurasia. *Briza maxima, B. media,* and *B. minor* (shivery grass) are

Quaking grass (*Briza maxima*)
Syndication International—Photo Trends

cultivated as ornamentals and have become naturalized in temperate areas of Australia, North America, and South Africa.

qualitative chemical analysis, branch of chemistry that deals with the identification of elements or grouping of elements present in a sample. The techniques employed in qualitative analysis vary in complexity, depending on the nature of the sample. In some cases it is necessary only to verify the presence of certain elements or groups for which specific tests applicable directly to the sample (*e.g.,* flame tests, spot tests) may be available. More often the sample is a complex mixture, and a systematic analysis must be made in order that all the constituents may be identified. It is customary to classify the methods into two classes: qualitative inorganic analysis, and qualitative organic analysis.

The classical procedure for the complete systematic analysis of an inorganic sample consists of several parts. First, a preliminary dry

Scheme for separation of cations

HCl or a soluble chloride, preferably NH_4Cl, added to unknown; filtered						
precipitate: contains chlorides of lead (Pb), silver (Ag), and mercurous mercury (Hg) $PbCl_2$ (white) $AgCl$ (white) Hg_2Cl_2 (white)	solution: H_2S passed into the acid solution; filtered					
	precipitate: treated with NH_4OH; ammonium polysulfide, $(NH_4)_2S_x$; and $(NH_4)_2S$; filtered		solution: neutralized with NH_4OH and NH_4Cl; filtered			
	precipitate: contains cupric, lead, cadmium, bismuth, and mercuric sulfides	solution: contains arsenic, antimony, and tin cations	precipitate: contains aluminum (Al), chromium (Cr), and ferric (Fe) hydroxides $Al(OH)_3$ (white) $Cr(OH)_3$ (gray-green) $Fe(OH)_3$ (brown)	solution: H_2S passed into alkaline solution; filtered		
				precipitate: contains cobalt (Co), nickel (Ni), manganese (Mn), and zinc (Zn) sulfides CoS (black) NiS (black) MnS (buff) ZnS (white)	solution: evaporated and NH_4OH and $(NH_4)_2CO_3$ added; filtered	
					precipitate: barium, strontium, and calcium carbonates (all white)	solution: contains magnesium, sodium, and potassium ions
Group I	Group IIa	Group IIb	Group IIIa	Group IIIb	Group IV	Group V

test may be performed, which may consist of heating the sample to detect the presence of such constituents as carbon (marked by the appearance of smoke or char) or water (marked by the appearance of moisture), or introducing the sample into a flame and noting the colour produced. Certain elements may be identified by means of their characteristic flame colours. After preliminary tests have been performed, the sample is commonly dissolved in water for later determination of anionic constituents (*i.e.,* negatively charged elements or groupings of elements) and cationic constituents (*i.e.,* positively charged elements or groupings of elements). The procedure followed is based on the principle of treating the solution with a succession of reagents so that each reagent separates a group of constituents. The groups are then treated successively with reagents that divide a large group into subgroups or separate the constituents singly. When a constituent has been separated it is further examined to confirm its presence and to establish the amount present (quantitative analysis). Portions of the material are dissolved separately, and different procedures are used for each to detect the cationic and anionic constituents. A typical analytical scheme for the separation of the cations into groups is summarized in the table. The analysis for anions is more difficult and less systematic than that for cations.

The organic nature of a compound is generally indicated by its behaviour on being heated in air; solids usually melt, then burn with either a smoky or non-smoky flame, in some instances leaving a black residue of carbon. The elements usually present in these compounds are carbon, hydrogen, oxygen, nitrogen, sulfur, and, occasionally, phosphorus, halogens, and some metals. Specific tests are available for each of the individual elements.

Quanah (Comanche leader): *see* Parker, Quanah.

quandong nut, edible seed of the native peach (*Santalum acuminatum*), a small shrubby tree of the sandalwood family (Santalaceae), native to Australia. Unlike other members of this family, the native peach is grown for its fruit and nuts rather than for its wood. The nutritious, red, pulpy flesh of the fruit is used in jams, pies, and chutneys. The hard-shelled, edible nuts are customarily roasted. The native peach is a partial root parasite; in the late 20th century, botanists in Australia were attempting to develop a variety not dependent upon a host plant.

Quang Nam-Da Nang, *tinh* (province), of central Vietnam. It has an area of 4,629 sq mi (11,989 sq km) and since 1976 has included the former provinces of Quang Nam and Quang Tin. It borders Laos to the west and the South China Sea to the east. Embracing peaks of the Chaîne Annamitique (Annamite Chain; Vietnamese Truong Son), in the west, it drains to the sea in the northeast by the two major branches of the northward flowing Song (river) Thu Bon, which discharges just east of Hoi An. To the north, barren spurs of the Chaîne Annamitique reach the sea to enclose Vung (bay) Da Nang with high promontories. At the base of the 2,274-ft (693-m) southern promontory is the port and provincial seat of Da Nang. Southward from the Thu Bon estuary extends a series of coastal lagoons, beginning with the Truong Giang, which are backed by a narrow coastal plain. The westernmost districts of the province are inhabited by the Mon-Khmer-speaking Phuong and Katu.

Agricultural activities in the province consist of the growing of lowland rice, cassava, sweet potatoes, beans, peanuts (groundnuts), corn (maize), sugarcane, tea, tobacco, cotton, and betel nuts. Mineral resources include limestone, silica sand, and crushed stone; gold, bauxite, graphite, and iron ore in several locations; lead at Duc Bo; mica at Dai Loc; and titanium west of Da Nang. The principal mineral mined, however, is coal, from the Tu Chanh Nong Son open pits 32 mi (52 km) southwest of Da Nang. There is an industrial sector at Song Son-An Hoa, and there are electrical power plants in the province; textiles, beer, soft drinks, machinery, ceramics, porcelain, metalwork, bamboo articles, leather, and furniture are produced. The province is linked by the Thong Nhat (Reunification) Railroad between Hanoi and Ho Chi Minh City (formerly Saigon) and by road, air, and sea to the rest of Vietnam. Among the ruins of the Champa kingdom are the towns of Tra Kien (Siṃhapura) and Dong Duong (Indrapura) in the north; there are also several Champa towers in the province. Pop. (1979) 1,529,520.

Consult the INDEX *first*

Quang Ngai, town, Nghia Binh *tinh* (province), central Vietnam, on the South China Sea coast. It is a minor port on the south bank of the Song (river) Tra Khuc estuary, 125 mi (200 km) southeast of Hue. The town has lighter (barge) facilities, a hospital, and a commercial airport. Across the river at Sin Tinh a highway penetrates the interior to a short distance beyond Phuoc Lam; the highway to Cong Tum in the central highlands begins below Trach Tru. Ruins of the Cham (Champa) kingdom are found at Chau Sa, 4 mi northeast of Quang Ngai, and 2 mi south, where the remains of the Chanh Lo temple are located. Pop. (1971 est.) 46,714.

Quang Ninh, *tinh* (province) of northern Vietnam, situated in the mountainous region of the extreme northeast. It has an area of 2,293 sq mi (5,938 sq km) with a 125-mi (200-km) coastline; mountains rising above 650 ft (200 m) occupy more than one-third of the area. Created in 1963 with the union of Hong Quang Special Zone and Hai Ninh province, it is bounded by Kwangsi Province, China, on the north, by the provinces of Lang Son and Ha Bac on the west, Hai Hung province and Haiphong province-burough on the southwest, and by the Gulf of Tonkin on the east. Coal is mined at Hon Gai (the provincial seat) and Dong Trieu; iron ore, tin, granite, oil shale, titanium, and antimony are other principal resources. The province is second only to Haiphong in the production of fish; a large pine forest along the seacoast supplies the greatest amount of resin among the northern provinces. The main seaports are Hon Gai, Cua Ong, and Dien Cong. The population contains many Tai, Chinese, and mountain peoples. Pop. (1979) 750,055.

Quang Tri, town, Binh Tri Thien *tinh* (province), central Vietnam. It is on the left bank of the Song (river) Thach Han, 45 mi northwest of Hue, on the national coastal highway. A highway from Dong Ha leads over the Chaîne Annamitique (Annamite Chain; Vietnamese Truong Son) via the Deo (pass) Aihao (1,345 ft [410 m]) to Savannakhet, Laos, on the Mekong River. Thon Ai Tu, an ancient Cham (Champa) kingdom centre that in 1558 became the residence of Nguyen Hoang of the Vietnamese Nguyen dynasty, is 3 mi north of Quang Tri. The early 19th-century Vietnamese citadel built by Minh Mang was destroyed during prolonged fighting in the Vietnam War. Pop. (1971 est.) 16,906.

Quant, Mary, married name MRS. A. PLUNKET GREENE (b. Feb. 11, 1934, London), English dress designer of youth-oriented fashions, responsible in the 1960s for the "Chelsea look" of England and the widespread popularity of the miniskirt and "hot pants."

Mary Quant attended Goldsmith's College of Art, London, and spent two years designing hats for the popular Danish milliner Erik. In partnership with her husband and a friend, she opened a boutique called Bazaar, on the King's Road in London in 1957. It was an immediate success, and within seven years the company had expanded throughout Europe and the United States and was mass-producing designs on a multimillion-dollar annual scale.

Mary Quant's designs reflected a shift in fashion from the Establishment to youth as the source of inspiration. Her best known fashions of the 1960s were similar in feeling to the outfits worn by little girls to dancing class—short pleated skirts, white anklets, and black-patent, ankle-strap shoes. In the early 1970s, Quant stopped manufacturing but continued to design clothing, furs, lingerie, household linens, and eyeglass frames. She also continued to direct the cosmetics business that she started in 1955.

Quant was named a member of the Order of the British Empire in 1966, and throughout the late 1960s she received several other awards for her achievements in fashion design. From 1973 to 1974 she held a retrospective exhibition of 1960s fashion at the London Museum, and from 1976 to 1978 Quant worked on the advisory council for the Victoria and Albert Museum. *Quant by Quant*, an autobiography, was published in 1966.

quantification, in logic, the attachment of signs of quantity to the predicate or subject of a proposition. The universal quantifier, symbolized by ($\forall$—) or (—), where the blank is filled by a variable, is used to express that the formula following holds for all values of the particular variable quantified. The existential quantifier, symbolized ($\exists$—), expresses that the formula following holds for some (at least one) value of that quantified variable.

Quantifiers of different types may be combined. For example, restricting epsilon (ε) and delta (δ) to positive values, b is called the limit of a function $f(x)$ as x approaches a if for every ε there exists a δ such that whenever the distance from x to a is less than δ, then the distance from $f(x)$ to b will be less than ε; or symbolically:

$$(\forall\varepsilon)\,(\exists\delta)\,(|x-a|<\delta \supset |f(x)-b|<\varepsilon)\,,$$

in which vertical lines mark the enclosed quantities as absolute values, < means "is less than," and $\supset$ means "if . . . then," or "implies."

Variables that are quantified are called bound (or dummy) variables, and those not quantified are called free variables. Thus, in the expression above, ε and δ are bound; and x, a, b, and f are free, since none of them occurs as an argument of either $\forall$ or $\exists$. *See also* propositional function.

quantifiers, logic of (formal logic): *see* predicate calculus.

quantitative chemical analysis, branch of chemistry that deals with the determination of the amount or percentage of one or more constituents of a sample. A variety of methods is employed for quantitative analyses, which for convenience may be broadly classified as chemical or physical, depending upon which properties are utilized. Chemical methods depend upon such reactions as precipitation, neutralization, oxidation, or, in general, the formation of a new compound. The major types of strictly chemical methods are known as gravimetric analysis (*q.v.*) and volumetric, or titrimetric, analysis (*see* volumetric analysis). Physical methods involve the measurement of some physical property such as density, refractive index, absorption or polarization of light, electromotive force, magnetic susceptibility, and numerous others. An analysis will often require a combination of methods: qualitative for separating desired constituents from a sample and quantitative for measuring the amounts present.

The basic tool in all quantitative analyses is the analytical balance, used for the accurate weighing of samples and precipitates. For usual analytical work the balance should be able to determine differences in mass of 0.1 milligram (about 0.000004 ounce). In microanalyses the balance must be about 1,000 times more sensitive, and, for special work, balances of even higher sensitivity have been constructed.

quantity theory of money, economic theory relating changes in the price level to changes in the quantity of money; in its developed form, it constitutes an analysis of the factors underlying inflation and deflation. As developed by the English philosopher John Locke in the 17th century, the Scottish philosopher David Hume in the 18th century, and others, it was a weapon against the mercantilists, who were accused of regarding wealth and money as identical. If the accumulation of money by a nation merely raised prices, the argument ran, the mercantilist emphasis on a "favourable" balance of trade would increase the supply of money but would not increase wealth. In the 19th century the quantity theory contributed to the victory of free trade over protectionism. In the 19th and 20th centuries it played a part in the analysis of business cycles and in the theory of foreign exchange rates.

The quantity theory came under attack during the 1930s, when monetary expansion seemed ineffective in combating deflation. Economists argued that the level of investment and government spending had more influence than the supply of money in determining the level of economic activity.

In the 1960s the tide of opinion swung back. Experience with postwar inflations and new empirical studies of money and prices restored some of the theory's lost prestige. One implication of the quantity theory is that the size of the stock of money is of prime importance in governmental policies aimed at controlling price levels and maintaining full employment.

Quantrill, William C(larke), pseudonym CHARLEY HART (b. July 8, 1837, Canal Dover, Ohio, U.S.—d. June 6, 1865, Louisville, Ky.), captain of a guerrilla band irregularly attached to the Confederate Army during the U.S. Civil War, notorious for the sacking of the Free State stronghold of Lawrence, Kan. (Aug. 21, 1863), in which 150 people were burned or shot to death.

Growing up in Ohio, Quantrill taught school in Ohio and then Illinois and, in 1857, moved to Kansas, where he first tried farming and then, after a series of jobs, returned to teaching (1859–60). By the end of 1860, while living near Lawrence, he fell into thievery and murder, was charged with horse-stealing, and began life on the run. After the outbreak of the American Civil War he first served with the Confederate Army in Missouri but then, independently, put together a gang of guerrillas, who raided and robbed towns and farms with Union sympathies. The Union forces declared Quantrill's raiders to be outlaws; the Confederates made them an official troop, giving Quantrill the rank of captain.

On Aug. 21, 1863, his troop of about 450 men raided Lawrence, pillaging, burning, and killing. Later donning Federal uniforms, the raiders surprised a detachment of Union soldiers at Baxter Springs, Kan., and slaughtered about 90 of them. After the war Quantrill's followers broke up into smaller bands to continue their criminal pursuits. Quantrill was mortally wounded on a raid into Kentucky.

quantum, in physics, discrete natural unit, or packet, of energy, charge, angular momentum, or other physical property. Light, for example, appearing in some respects as a continuous electromagnetic wave, on the submicroscopic level is emitted and absorbed in discrete amounts, or quanta; and for light of a given wavelength, the magnitude of all the quanta emitted or absorbed is the same in both energy and momentum. These particle-like packets of light are called photons, a term also applicable to quanta of other forms of electromagnetic energy such as X-rays and gamma rays. Submicroscopic mechanical vibrations in the layers of atoms comprising crystals also give up or take on energy and momentum in quanta called phonons.

All phenomena in submicroscopic systems (the realm of quantum mechanics) exhibit quantization: observable quantities are restricted to a natural set of discrete values. When the values are multiples of a constant least amount, that amount is referred to as a quantum of the observable. Thus Planck's constant h is the quantum of action, and $\hbar$ (*i.e.,* $h/2\pi$) is the quantum of angular momentum, or spin.

quantum electrodynamics (QED), quantum theory of the interactions of charged particles with the electromagnetic field. It describes mathematically not only all interactions of light with matter but also those of charged particles with one another. QED is a relativistic theory in that Einstein's theory of special relativity is built into each of its equations. Since the behaviour of atoms and molecules is primarily electromagnetic in nature, all of atomic physics can be considered a test laboratory for the theory. Some of the most precise tests of QED have been experiments dealing with the properties of muons, also called mu-mesons. The magnetic moment of this type of subatomic particle, for example, has been shown to agree with the theory to six significant digits. Agreement of such high accuracy makes QED one of the most successful physical theories so far devised.

In 1931 P.A.M. Dirac laid the foundations for QED with his discovery of an equation describing the motion and spin of electrons that incorporated both the quantum theory and the theory of special relativity. The QED theory was refined and fully developed in the late 1940s by Richard P. Feynman, Julian S. Schwinger, and Shin'ichirō Tomonaga, independently of one another. Feynman's approach, which has proven the most influential, rests on the idea that charged particles (*e.g.,* electrons and positrons) interact by emitting and absorbing photons, the particles of light that transmit electromagnetic forces. These photons are virtual; that is, they cannot be seen or detected in any way because their existence violates the conservation of energy and momentum. The particle exchange is merely the "force" of the interaction, because the interacting particles change their speed and direction of travel as they release or absorb the energy of a photon. Photons also can be emitted in a free state, in which case they may be observed. The interaction of two charged particles occurs in a series of processes of increasing complexity. In the simplest, only one virtual photon is involved; in a second-order process, there are two; and so forth. The processes correspond to all the possible ways in which the particles can interact by the exchange of virtual photons, and each of them can be represented graphically by means of a Feynman diagram. Besides furnishing an intuitive picture of the process being considered, this type of diagram prescribes precisely how to calculate the variable involved. Each subatomic process becomes computationally more difficult than the previous one, and there are an infinite number of processes. The QED theory, however, states that the more complex the process (*i.e.,* the presence of additional virtual photons), the smaller the probability of its occurrence. For each level of complexity, a factor of $(1/137)^2$ decreases the contribution of the process, and thus, after a few levels the contribution is negligible. This factor, symbolized by α, is called the fine-structure constant and serves as a measure of the strength of the electromagnetic interaction. It equals $e^2/\hbar c$, where e is the electron charge, $\hbar$ is Planck's constant (*q.v.*) divided by 2π, and c is the speed of light.

QED is often called a perturbation theory because of the smallness of the fine-structure constant and the resultant decreasing size of higher order contributions. It is also renormalizable, meaning that the theory does not predict particles having infinite mass or infinite charge or exhibiting other non-physical behaviour.

This relative simplicity and the success of QED have made it a model for other quantum field theories. Finally, the picture of electromagnetic interactions as the exchange of virtual particles has been carried over to the theories of the strong, weak, and gravitational forces. *See also* gauge theory.

quantum field theory, body of physical principles designed to account for subatomic phenomena that also has found applications in other branches of physics. The theory arises from the attempt to combine the principles of quantum mechanics with those of relativity in an effort to describe processes such as high-energy collisions in which particles may be created or destroyed.

A brief treatment of quantum field theory follows. For full treatment, *see* MACROPAEDIA: Physical Principles and Concepts: *Field theory.*

The prototype of quantum field theories is quantum electrodynamics (QED), which describes the interaction of electrically charged particles via electromagnetic fields. Here, electric and magnetic forces are regarded as arising from the emission and absorption of exchange particles or photons. These can be represented as disturbances of electromagnetic fields, much as ripples on a lake are disturbances of the water. Under suitable conditions, photons may become entirely free of charged particles; they are then detectable as light and other forms of electromagnetic radiation. Similarly, particles such as electrons are themselves regarded as disturbances of their own quantized fields. Numerical predictions based on QED agree with experimental data to within one part in 100,000,000 in some cases.

There is a widespread conviction among physicists that other forces in nature—the weak force responsible for radioactive beta-decay; the strong force, which binds together the constituents of atomic nuclei; and perhaps also gravitational forces—can be described by theories similar to QED. These theories are known collectively as gauge theories. Each of the forces is mediated by its own set of exchange particles, and differences between the forces are reflected in the properties of these particles. For example, electromagnetic and gravitational forces operate over long distances, and their exchange particles (the photon and the graviton) have no mass. The weak and strong forces operate only over distances shorter than the size of an atomic nucleus. They are mediated by massive particles, which can travel only short distances during the exchange process.

It is also hoped that all the forces can be encompassed in a single gauge field theory. In such a unified theory, all the forces would have a common origin and would be related by mathematical symmetries. The simplest result would be that all the forces had identical properties. A mechanism called spontaneous symmetry breaking is used to account for the observed differences.

A unified theory of electromagnetic and weak forces already has considerable experimental support; it is likely that this theory can be extended to include the strong force. There also exist theories that include the gravitational force, but these are more speculative.

quantum mechanics, the branch of mathematical physics that deals with the interactions of matter and radiation in terms of observable quantities. It is an outgrowth of the concept that all forms of energy are released in discrete units or bundles called quanta.

A brief treatment of quantum mechanics follows. For full treatment, see MACROPAEDIA: Mechanics.

Quantum mechanics is concerned with phenomena that are so small-scale that they cannot be described in classical terms. Throughout the 1800s most physicists regarded Newton's dynamical laws as sacrosanct, but it became increasingly clear during the early years of the 20th century that many phenomena, especially those associated with radiation, defy explanation by Newtonian physics. It has come to be recognized that the principles of quantum mechanics rather than those of classical mechanics must be applied when dealing with the behaviour of electrons and nuclei within atoms and molecules. Although conventional quantum mechanics makes no pretense of describing completely what occurs inside the atomic nucleus, it has helped scientists to better understand many processes such as the emission of alpha particles and photodisintegration. Moreover, the field theory of quantum mechanics has provided some insight into the properties of mesons and other subatomic particles associated with nuclear phenomena.

In the equations of quantum mechanics, Max Planck's constant of action $h = 6.625 \times 10^{-34}$ joule-second plays a central role. This constant, one of the most important in all of physics, has the dimensions mass $\times$ length^2/time. The term "small-scale" used to delineate the domain of quantum mechanics should not be literally interpreted as necessarily relating to extent in space. A more precise criterion as to whether quantum modifications of Newtonian laws are important is whether or not the phenomenon in question is characterized by an "action" (*i.e.,* time integral of kinetic energy) that is large compared to Planck's constant. Accordingly, if a great many quanta are involved, the notion that there is a discrete, indivisible quantum unit loses significance. This fact explains why ordinary physical processes appear to be so fully in accord with the laws of Newton. Quantum mechanics is, in effect, an extension of classical statistical mechanics rather than of Newton's deterministic laws. As a consequence, one of its most important philosophical implications concerns the apparent breakdown of the causality principle in atomic phenomena.

The history of quantum mechanics may be divided into three main periods. The first began with Planck's theory of black-body radiation in 1900, and may be described as the period in which the validity of Planck's constant was demonstrated but its real meaning was not fully understood. The second period began with the quantum theory of spectra proposed by Niels Bohr in 1913. Bohr's ideas gave an accurate formula for the frequency of spectral lines in many cases and were an enormous help in the codification and understanding of spectra. Nonetheless, they did not represent a consistent, unified theory, constituting as they did a sort of patchwork affair in which classical mechanics was subjected to a somewhat extraneous set of so-called quantum conditions that restrict the constants of integration to particular values. True quantum mechanics appeared in 1926, reaching fruition nearly simultaneously in a variety of forms—namely, the matrix theory of Max Born and Werner Heisenberg, the wave mechanics of Louis V. de Broglie and Erwin Schrödinger, and the transformation theory of P.A.M. Dirac and Pascual Jordan. These different formulations were in no sense alternative theories; rather, they were different aspects of a consistent body of physical law.

quantum number, any of several quantities of integral or half-integral value that identify the state of a physical system such as an atom, a nucleus, or a subatomic particle. Quantum numbers refer generally to properties that are discrete (quantized) and conserved, such as energy, momentum, charge, baryon number, and lepton number.

The principal quantum number for electrons confined in atoms, for example, indicates the energy state and the probability of finding the electrons at various distances from the nucleus. The larger the principal quantum number, which has integral values beginning with one, the greater the energy is and the farther the electron is likely to be from the nucleus. The principal quantum number and three others are sufficient to characterize uniquely each electron in an atom. Another set of quantum numbers characterizes the atomic nucleus.

Quantz, Johann Joachim (b. Jan. 30, 1697, Oberscheden, near Göttingen—d. July 12, 1773, Potsdam, Brandenburg), German composer and flute virtuoso who left an important treatise on the flute and who made mechanical improvements in the instrument.

Quantz played the double bass as a child and was taken by his uncle to Merseburg for musical education. Among the instruments he played were the harpsichord and violin. He obtained posts at Radeberg and Dresden and in 1717 studied counterpoint in Vienna with Johann Zelenka and Johann Fux. In 1718 he became oboist in the Polish court chapel. About this time he began to play the flute. In 1728 he became flute instructor to the Crown Prince of Prussia, later Frederick the Great, who after assuming the throne in 1740 persuaded Quantz in 1741 to settle in Berlin as chamber musician and court composer.

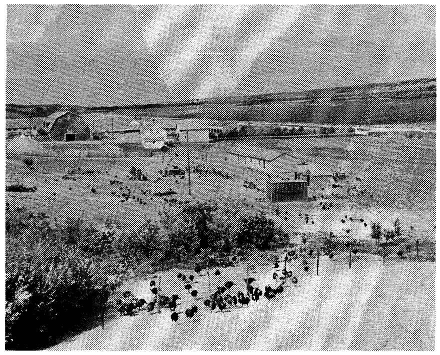
Quantz composed about 300 concerti and 200 other flute pieces for Frederick the Great. He also composed songs. His treatise on flute playing, *Versuch einer Anweisung die Flöte traversiere zu spielen* (1752; facsimile of 3rd German ed., 1953), was reprinted many times. It contains valuable information on ornamentation and performance practices of the 18th century. He added a second key to the flute and invented the sliding end used to tune the instrument. He also wrote an autobiography.

Quanza River (Angola): *see* Kwanza River.

Quanzhou (China): *see* Ch'üan-chou.

Quapaw, also called AKANSA, or ARKANSAS, North American Indian people of the Dhegiha branch of the Siouan language stock. With the other members of this subgroup (including the Osage, Ponca, Kansa, and Omaha [*qq.v.*]), the Quapaw migrated westward from the Atlantic coast. They settled for a time on the prairies of what is now western Missouri, later relocating at or near the mouth of the Arkansas River. They were a sedentary, agricultural people who lived in fortified villages of communal bark-covered lodges built on mounds. They were skillful artisans noted for their red-on-white-ware pottery. In 1673 the Quapaw were contacted by the explorers Jacques Marquette and Louis Jolliet, who reported that they did not hunt buffalo for fear of the tribes to the north and west, wore few clothes, and pierced their ears and noses. In 1818 they ceded their lands, except for a tract on the southern side of the Arkansas River, to the United States. A few years later this land was opened to white settlement and most of the tribe relocated on the Red River in Louisiana. When floods drove them out of their new home, they began an unsuccessful campaign for the return of their original lands. In the mid-19th century they settled on their own reservation in Indian Territory (present-day Oklahoma), but, during the Civil War, their land was so overrun by forces from both sides that they fled en masse to Kansas to the reservation of the Ottawa. Most of the Quapaw later returned to their Oklahoma land, which was allotted among them by themselves. In the late 20th century they numbered about 750.

Qu'Appelle River, tributary of the Assiniboine River, in southern Saskatchewan and southwestern Manitoba, Canada. From its source near The Elbow (a bend in the South Saskatchewan River) and Diefenbaker Lake, northwest of Moose Jaw, Sask., the river flows eastward for 270 mi (430 km) through several lakes and Indian reservations and past Fort-Qu'Appelle and The Fishing Lakes before joining the Assiniboine opposite Saint-Lazare, Man., 10 mi east of the provincial boundary. Its French name, meaning "who calls," was derived from its Cree Indian name Kah-tep-was (River That Calls), referring to the cries of a legendary spirit supposedly haunting its waters. Once a much-frequented fur-trapping region, its basin is now farmed for wheat. The Saskatchewan cities of Regina and Moose Jaw lie on Waskana and Moose Jaw creeks, tributaries of the Qu'Appelle.



Farm in the Qu'Appelle Valley, Sask.
L.M. Kilmister—Shostal/EB Inc.

quarantine, the detention or restraint of human beings or other creatures that may have come into contact with communicable disease until it is deemed certain that they have escaped infection. In general usage the terms quarantine and isolation are used interchangeably in reference to disease control. In the strictest sense, however, isolation is the separation of an infected individual from the healthy until he is unable to transmit the disease. (Isolation may also mean the maintainance of a germfree environment for experimental purposes or out of medical necessity; *see* germfree life).

Early practices. The earliest recognition that diseases might be communicable led to extreme measures designed to isolate infected persons or communities. Fear of leprosy, a slowly progressive mutilating disease, caused wide adoption of the control measures set out in Leviticus 13, namely, isolation of the infected and the cleansing or burning of his garments. Against acute, highly fatal diseases like bubonic plague, which spread rapidly throughout populations, attempts were made by healthy communities to prevent entry of goods and persons from infected communities; in the 7th century AD, for example, armed guards were stationed between plague-stricken Provence and the diocese of Cahors.

In the 14th century the growth of maritime trade and the recognition that plague was introduced by ships returning from the Levant led to the adoption of quarantine in Venice. It was decreed that ships were to be isolated for a limited period to allow for the manifestation of the disease and to dissipate the infection brought by persons and goods. Originally the period was 30 days, *trentina,* but this was later extended to 40 days, *quarantina.* The choice of this period is said to be based on the period that Christ and Moses spent in isolation in the desert. In 1423 Venice set up its first lazaretto, or quarantine station, on an island near the city. The Venetian system became the model for other European countries and the basis for widespread quarantine control for several centuries.

In the 16th century the system was extended by the introduction of bills of health, a form of certification that the last port of call was free from disease; a clean bill, with the visa of the consul of the country of arrival, entitled the ship to free pratique (use of the port) without quarantine. Quarantine was later extended to other diseases besides plague, notably yellow fever, with the growth of American trade, and cholera, which was particularly associated with the pilgrimages to Mecca.

By the mid-19th century the practice of quarantine had become a considerable nuisance. The periods of quarantine were arbitrary and variable from country to country, and there were instances of perverse and bureaucratic application of the quarantine regulations. The disinfection of letters and rummaging of papers could be an excuse for political espionage, and the opportunities for bribery and corruption were frequently exploited. Great discomfort and delay was caused to travelers; the prison reformer John Howard had, in 1786, deliberately sailed from Smyrna to Venice in a ship with a foul bill of health so that he could gain firsthand experience of lazarettos; his account (*An Account of the Principal Lazarettos in Europe* [1789]) presents a depressing picture.

International cooperation. General dissatisfaction with quarantine practice led to the convening of the first international sanitary conference in Paris in 1851. The arguments were conducted at two levels. Commercially, the conflict was between the countries with considerable vested interests in quarantine and the major maritime nations, which favoured its abolition; medically, the opposition was between the "contagionists," who believed that diseases like cholera and plague were transmitted from person to person, and the "miasmatists," who thought that they were caused by infected atmosphere and that the remedy was sanitation, not quarantine. Despite these differences, agreement was reached on some important general principles for the standardization of quarantine procedures. The convention and regulations were not generally ratified, however.

In the next 50 years a succession of sanitary conferences, with better understanding of the epidemiology of communicable disease, reached some agreement on the maximum permissible measures of control and on the removal of the most irksome restrictions of quarantine practice, but the accord reached by the 11th conference, at Paris in 1903, was the first really effective measure to be signed. Out of it came, in 1907, the Office International d'Hygiène Publique ("International Office of Public Health"), the forerunner of the World Health Organization. (The forerunner of the Pan American Sanitary Bureau had been established five years earlier, in 1902).

Present practices. Today, isolation of persons is practiced much less rigidly or extensively than formerly in the control of communicable disease. It may be appropriate in some cases; some physicians, for example, suggest that known asymptomatic carriers of the diphtheria bacillus be isolated during antibiotic treatment, and patients with active pulmonary tuberculosis may be temporarily segregated in hospital in order to prevent the infection of persons thought to be susceptible to the disease. It is recognized, however, that isolation may fail for a variety of reasons. It is ineffective in diseases that are transmitted by an intermediate carrier—*e.g.,* the mosquito in yellow fever and malaria. In plague, isolation is important to prevent person-to-person spread but does not have any effect on the main route of infection—by bites of the rat flea. It is inappropriate to isolate human cases of a disease, such as brucellosis, that is usually acquired by contact with infected farm animals or their products. Even for diseases in which it may protect individuals, isolation will often have little effect on the general epidemic; this may be, as in measles, because infectivity precedes the appearance of the characteristic feature, the rash, by a few days, or, as in polio virus infections, because a number of persons are carriers, harbouring the disease agent without discernible illness. The difficulty of recognizing potentially infective persons often makes isolation impracticable even in situations in which it could be appropriate.

Quarantine is much modified in modern practice because of the better understanding of communicable disease. In its purest form it is applied to animals, as in the control of rabies. In the control of human disease the common practice is surveillance of contacts, with, possibly, daily reporting to a doctor to get prompt recognition of illness but without restricting movement; such a policy, coupled with other control measures, is generally accepted. In some instances modified quarantine is imposed: adult contacts of typhoid should be excluded from food handling until repeated bacteriological examination of feces and urine has shown them to be free of the disease. At one time susceptible children exposed to measles were kept home from school, but the practice was declining even before the widespread use of measles vaccines.

Quarantine and exclusion of plants and of plant products are still widely practiced in accordance with international agreements.

Quare, Daniel (b. *c.* 1648, Somersetshire?, Eng.—d. March 21, 1724 [1723, Old Style], Croydon, Surrey), English clockmaker, inventor of a repeating watch mechanism (1680) that sounded the nearest hour and quarter hour when the owner pushed or squeezed a pin protruding from the case.

Quare's invention was the forerunner of the modern alarm watch that can be set to sound at a predetermined time. He also invented a portable barometer (1695), originally fitted with legs but later designed to hang on a wall.

Quare was admitted to the Clockmakers Company in 1671, becoming a master of the company in 1708, and was appointed clockmaker to King George I.

Quarenghi, Giacomo Antonio Domenico (b. Sept. 20, 1744, Rota d'Imagna, Republic of Venice [Italy]—d. Feb. 18, 1817, St. Petersburg, Russia), Italian Neoclassical architect and painter, best known as the builder of numerous works in Russia during and immediately after the reign of Catherine II the Great. He was named "Grand Architect of all the Russias."

The son of a painter, Quarenghi studied painting first in Bergamo and then in Rome, where he was taught by Anton Raphael Mengs and Stefano Pozzi. Vincenzo Brenna introduced Quarenghi to architecture. In 1779 Baron Friedrich Grimm secured Quarenghi's invitation to Russia by the empress Catherine II.

Among his first important commissions were the English Palace at Peterhof (1781–89; now destroyed) and the Hermitage Theatre (begun 1782). These were the first buildings in Russia in the Palladian style. Other early constructions include the Bourse and the State Bank (1789–96), massive but undistinguished edifices.

His other works in St. Petersburg included St. George's Hall in the Winter Palace (1786–95), several bridges on the Neva, and a number of academic structures, including the Academy of Sciences (1785–90), the Catherine Institute (1804–07; now the Saltykov-Shchedrin Library), and the Smolny Institute (1806–08). At the royal residence of Tsarskoye Selo, Quarenghi designed the baths, concert hall, church, the Alexander Palace, and other structures.

Quarenghi designed simple but imposing Neoclassical buildings that have clear and precise designs. His favourite format was a plain rectangular block fronted by an elegant central portico with pillars and pediment. His buildings give the city of Leningrad much of its pleasant, stately character.

quark, any of a group of subatomic particles believed to be among the fundamental constituents of matter. In much the same way that protons and neutrons make up atomic nuclei, these particles themselves are thought to consist of quarks. Quarks constitute all hadrons (baryons and mesons)—*i.e.,* all particles that interact by means of the strong force, the force that binds the components of the nucleus.

According to prevailing theory, quarks have mass and exhibit a spin (*i.e.,* type of intrinsic angular momentum corresponding to a rotation around an axis through the particle) equal to one-half the basic quantum mechanical unit of angular momentum. The latter property implies that they obey the Pauli exclusion principle, which states that no two particles having half-integral spin can exist in exactly the same quantum state. Quarks appear to be truly fundamental. They have no apparent structure; that is, they cannot be resolved into something smaller. Quarks always seem to occur in combination with other quarks or antiquarks, never alone. For years physicists have attempted to knock a quark out of a baryon in experiments with particle accelerators to observe it in a free state but have not yet succeeded in doing so.

Throughout the 1960s theoretical physicists, trying to account for the ever-growing number of subatomic particles observed in experiments, considered the possibility that protons and neutrons were composed of smaller units of matter. In 1961 two physicists, Murray Gell-Mann of the United States and Yuval Ne'eman of Israel, proposed a particle classification scheme called the Eightfold Way, based on the mathematical symmetry group SU(3), that described strongly interacting particles in terms of building blocks. In 1964 Gell-Mann introduced the concept of quarks as a physical basis for the scheme, adopting the fanciful term from a passage in James Joyce's novel *Finnegans Wake.* (The American physicist George Zweig developed a similar theory independently that same year and called his fundamental particles "aces.") Gell-Mann's model provided a simple picture in which all mesons are shown as consisting of a quark and an antiquark and all baryons as composed of three quarks. It postulated the existence of three types of quarks, distinguished by distinctive "flavours." These three quark types are now commonly designated as "up" (u), "down" (d), and "strange" (s). Each carries a fractional electric charge (*i.e.,* a charge less than that of the electron). The up and down quarks are thought to make up protons and neutrons and are thus the ones observed in ordinary matter. Strange quarks occur as components of K mesons and various other extremely short-lived subatomic particles that were first observed in cosmic rays but that play no part in ordinary matter.

The interpretation of quarks as actual physical entities posed two major problems. First, quarks had to have half-integral spin for the model to work, but at the same time they seemed to violate the Pauli exclusion principle. In many of the baryon configurations constructed of quarks, sometimes two or even three identical quarks had to be set in the same quantum state—an arrangement prohibited by the exclusion principle. Second, quarks appeared to defy being freed from the particles they made up. Although the forces binding quarks were strong, it seemed improbable that they were powerful enough to withstand bombardment by high-energy electrons and neutrinos from particle accelerators.

These problems were resolved by the introduction of the concept of colour, as formulated in quantum chromodynamics (QCD). In this theory of strong interactions, developed in 1977, the term colour has nothing to do with the colours of the everyday world but rather represents a special quantum property of quarks. The colours red, green, and blue are ascribed to quarks, and their opposites, minus-red, minus-green, and minus-blue, to antiquarks. According to QCD, all combinations of quarks must contain equal mixtures of these imaginary colours so that they will cancel out one another, with the resulting particle having no net colour. A baryon, for example, always consists of a combination of one red, one green, and one blue quark. The property of colour in strong interactions plays a role analogous to an electric charge in electromagnetic interactions. Charge implies the exchange of photons between charged particles. Similarly, colour involves the exchange of massless particles called gluons among quarks. Just as photons carry electromagnetic force, gluons transmit the forces that bind quarks together. Quarks change their colour as they emit and absorb gluons, and the exchange of gluons maintains proper quark colour distribution.

The binding forces carried by the gluons tend to be weak when quarks are close together. At a distance of approximately 10^{-13} centimetre—about the diameter of a proton—quarks behave as though they were free. This condition is called asymptotic freedom. When one begins to draw the quarks apart, however, as if attempting to knock them out of a proton, the force grows stronger. This is in direct contrast to the electromagnetic force, which grows weaker with the square of the distance between the interacting bodies. As explained by QCD, gluons have the ability to create other gluons as they move between quarks. Thus, if a quark starts to speed away from its companions after being struck by an accelerated particle, the gluons utilize energy that they draw from the quark's motion to produce more gluons. The larger the number of gluons exchanged among quarks, the stronger the binding forces become. Supplying additional energy to extract the quark only results in the conversion of that energy into new quarks and antiquarks with which the first quark combines.

Although QCD cogently explains the behaviour of quarks and provides a means of calculating their basic properties, it does not account for the flavours of "charm" and "bottom" associated with two types of heavy quarks that were found in the late 1970s. The discovery of the charmed (c) and bottom (b) quarks and their associated antiquarks, achieved through the creation of mesons, strongly suggests that quarks occur in pairs. This speculation led to efforts to find a sixth type of quark called "top" (t) after its proposed flavour. According to theory, the top quark carries a $+ 2/3$ electric charge; its partner, the bottom quark, has a charge of $- 1/3$. The top quark is greater than about 80 billion electron volts (GeV), making it the most massive quark. Arguments of consistency between several types of data suggest that the mass may be in the region of 130 GeV. Most physicists believe that the top quark does indeed exist because it completes the prevailing theoretical scheme of nature's fundamental building blocks.

Quarles, Francis (baptized May 8, 1592, Romford, Essex, Eng.—d. Sept. 8, 1644, London), religious poet remembered for his *Emblemes and Hieroglyphikes,* the most notable emblem book in English. (An emblem book is a collection of symbolic pictures, usually accompanied by mottoes and expositions in verse and by a prose commentary.)

Quarles was educated at the University of Cambridge and at Lincoln's Inn, London; he had private means and was happiest living in scholarly seclusion. With *Emblemes* (1635) Quarles produced a new type of emblem book. Each emblem consisted of a grotesque engraving and a paraphrase of scripture in ornate and metaphysical language and concluded with an epigrammatic verse. *Emblemes* was so successful that Quarles produced another emblem book, *Hieroglyphikes of the life of Man* (1638). Printed together in 1639, *Emblemes and Hieroglyphikes* became possibly the most popular book of verse of the 17th century.

Quarles obtained the post of chronologer to London in 1640 and virtually abandoned poetry to employ his pen more lucratively. His first prose work, *Enchiridion* (1640), was a highly popular book of aphorisms. In the English Civil Wars he is said to have suffered for his allegiance and for writing *The Loyall Convert* (1644), a pamphlet defending Charles I's position.

quarry, open excavation in the Earth's crust from which stone is obtained. Quarried stone is classed either as dimension stone, meaning blocks or slabs cut to size, or as crushed and broken stone. Older quarrying was concerned almost exclusively with dimension stone for use as building material and therefore was limited to areas in which rock of uniform coloration and texture, such as granite or limestone, was available. Rock deposits intersected by numerous joints, or natural partings, are valueless as sources of dimension stone.

After the surface has been cleared, a cut, or channel, is made to separate the rock from the solid bed. For softer rocks, such as limestone and sandstone, a channeling machine is used; this is a power-driven cutter that makes a slot about 5 cm (2 inches) wide and several metres deep. Harder rock, such as granite, may be channeled by drilling closely spaced holes and cutting away the rock remaining between them.

If floor seams are absent, the mass of rock is separated from the quarry floor by drilling horizontal holes beneath the blocks and driving wedges into the holes. In a limestone quarry the masses of rock freed may be in the form of long rectangles weighing several tons, which are cut into more convenient blocks. The separated blocks are conveyed to mills, where they are sawed into slabs, shaped or turned on lathes into columns, and finished by rubbing or polishing.

Crushed stone is used for concrete aggregate, for road building, and, in the case of limestone, as flux in blast furnaces and for chemical applications. The quarrying technique consists of deep drilling and blasting to fragment the rock. A large number of charges are fired simultaneously, producing as much as 20,000 tons of broken stone in a single blast. The broken stone is crushed into smaller pieces that are separated into uniform classes by screening.

quart, unit of capacity in the British Imperial and U.S. Customary systems of measurement. The British system uses one standard quart for both liquid and dry measure, which is equal to 69.36 cubic inches (1,136.81 cubic cm). The U.S. system has two units called a quart, one for liquid measure and a slightly larger unit for dry measure. The U.S. liquid quart is equal to 57.75 cubic inches (946.52 cubic cm), and the dry quart is equal to 67.2 cubic inches (1,101.41 cubic cm). In each system, two pints make up a quart, and four quarts make up a gallon.

The quart was originally a medieval English unit of dry measure that was close to its modern equivalents in volume. By the time of the poet Geoffrey Chaucer's *Miller's Tale* (1370), it was also being used for liquids such as ale.

quarter horse: *see* American quarter horse.

quarter-horse racing, in the United States, the racing of horses at great speed for short distances on a straightaway course, originally a quarter of a mile, hence the name. Quarter-horse racing was begun by the early settlers in Virginia shortly after Jamestown was established in 1607. Traditionally the course was one-fourth mile (400 m), using whatever pathways were available or could be cut through the forests, and later a street of a settlement.

Organized quarter-horse racing began in the 1940s and thereafter came to be held on about 100 tracks in the United States, mainly in the West. There are 11 officially sanctioned race distances from 220 to 870 yards (201 to 796 m). Races of 550 yards or less are run on straight courses; one or part of one turn may be used in the lengthier ("hook") races. Rules and procedures are basically the same as those for Thoroughbred horse races, but timing is to the nearest $1/100$ second from a standing start. The Triple Crown of quarter-horse racing includes the Kansas Futurity, held in June, the Rainbow Futurity, held in July, and the All-American Futurity, held in September on Labor Day, all at Ruidoso Downs, New Mexico.

Long recognized as a distinct type, quarter horses are known for their ability to start quickly and sprint swiftly, producing close contests with many photo finishes. The breed originated in Virginia from a Thoroughbred stallion, Janus, and native mares.

quarter sessions, formerly in England and Wales, sessions of a court held four times a year by a justice of the peace to hear criminal charges as well as civil and criminal appeals. The term also applied to a court held before a recorder, or judge, in a borough having a quarter sessions separate from that of the county in which the borough was situated. Under the Courts Act of 1971, all of the quarter-sessions courts were abolished, and their work was assumed by a system of courts called the Crown Court.

The history of quarter sessions traces to 1327, when Edward III appointed men in every county to keep the peace. By 1368 these justices of the peace were empowered to hear and determine cases brought to them on criminal matters, and in 1388 they were commanded to sit four times a year in their counties. Prior to their abolition in 1971, quarter-sessions courts came to have jurisdiction to hear and determine most of the indictable cases in England and Wales. They became situated between magistrates' courts below and assize courts above. When sitting with a jury, a quarter-sessions court had a wide criminal jurisdiction and could also hear civil and criminal cases on appeal from a magistrates' court.

quarter squares, method of computing the product of two numbers, which can be expressed as the difference of one-fourth the squares of their sum and their difference: $ab = 1/4(a+b)^2 - 1/4(a-b)^2$. This fact has been used to reduce multiplication to addition with the aid of tables of quarter squares or with other methods of generating quarter squares. The quarter square of an odd number always has a fractional part $1/4$, which can be ignored in applying the formula. The method is very old, and many tables of quarter squares have been prepared; however, few tables are easily available. The most extensive table lists quarter squares of integers not exceeding 200,000. Various mechanical and electrical applications have been suggested. The method is still frequently useful and economical.

quartering (ancient English punishment): *see* drawing and quartering.

Quartering Act (1765), in American colonial history, the British parliamentary provision (actually an amendment to the annual Mutiny Act) requiring colonial authorities to provide food, drink, quarters, fuel, and transportation to British forces stationed in their towns or villages. This act was passed primarily in response to greatly increased empire defense costs in America following the French and Indian War and Pontiac's War. Like the Stamp Act of the same year, it also was an assertion of British authority over the colonies, in disregard of the fact that troop financing had been exercised for 150 years by representative provincial assemblies rather than by the Parliament in London. The act was particularly resented in New York, where the largest number of reserves were quartered, and outward defiance led directly to the Suspending Act as part of the Townshend legislation of 1767. After considerable tumult, the Quartering Act was allowed to expire in 1770.

An additional quartering stipulation was included in the Intolerable Acts of 1774.

quarterstaff, a staff of wood from 6 to 9 feet (about 2 to 3 m) long, used for attack and defense. It is probably the cudgel or sapling with which many legendary heroes are described as being armed. The quarterstaff attained great popularity in England in the European Middle Ages. It was usually made of oak, the ends often being shod with iron, and it was held with both hands, the right hand grasping it one-quarter of the distance from the lower end (hence the name) and the left at about the middle. The staff was used as a foil, or practice substitute, for the long, two-handed sword of the period. In earlier times, it may also have been used as a practice weapon for the spear and pike.

quartet, musical composition for four instruments or voices; also the group of four performers. Although any music in four parts can be performed by four individuals, the term has come to be used primarily in referring to the string quartet (two violins, viola, and cello)—the predominant genre of chamber music since about 1750. It may also denote such derivatives as the piano quartet, flute quartet, oboe quartet, etc.—usually a string trio combined with a nonstringed instrument. Or it may denote quartets of mixed instruments such as woodwind or brass quartet, as well as vocal quartets (soprano, alto, tenor, and bass voices), especially in opera, oratorio, church music, and such notable lieders as Johannes Brahms's sets of *Liebeslieder* waltzes, *Zigeunerlieder*.

The development of the string quartet occurs in the works of Joseph Haydn, who established it as the principal chamber-music genre. His early quartets show soloistic writing for the first violin and the dependence of the viola on the cello, whose melodic line it frequently duplicates. Later works show progressive integration of the first violin and increased participation by the lower-pitched instruments. In his Opus 33 he brought the form to its mature Classical style, achieving a texture characterized by equal participation of all four instruments and establishing the genre's standard formal outlines. Specifically, the string quartet follows the sonata's division into several movements and its principles of form and development. Haydn's early quartets follow the divertimento in having five movements; but in his Opus 17 he established four as the standard number. The genre became infused with the sonata principle of contrast between keys. Typically, its first movement utilizes sonata form.

W.A. Mozart's quartets—notably the six dedicated to Haydn and the three dedicated to Frederick William II of Prussia—are cast in the mature form established by Haydn and in turn influenced Haydn. Ludwig van Beethoven's early quartets fall into the established framework, but in his *Razumovsky* quartets he expanded the length and scope of the genre. His late quartets puzzled contemporaries by their conciseness, profundity, and complexity.

The Classical tradition was inherited by Franz Schubert, Johannes Brahms, Aleksandr Borodin, and other Romantic composers. In the 19th century there was a tendency (*e.g.,* in the quartets of Antonín Dvořák) to move away from the intimate workmanship of the Classical quartet to a more orchestrally conceived texture. The genre was largely untouched by the Romantic tendency to program music; a rare example is Bedřich Smetana's quartet *Z mého života* (*From My Life*).

In the 20th century changing styles have proved highly suitable to the quartet. The impressionism of Claude Debussy and Maurice Ravel is revealed in the colouristic harmonies and textures of their quartets. The genre is equally adaptable to the rhythmic drive of Béla Bartók, the quartertone experiments of Ernest Bloch, the polytonality of Darius Milhaud, and the atonality and 12-tone method of Arnold Schoenberg and his followers.

Quarton, Enguerrand: *see* Charonton, Enguerrand.

quartz, widely distributed mineral of many varieties that consists primarily of silica, or silicon dioxide (SiO_2). Minor impurities such as lithium, sodium, potassium, and titanium may be present. Quartz has attracted attention from the earliest times; water-clear crystals were known to the ancient Greeks as *krystallos*—hence the name crystal, or more commonly rock crystal, applied to this variety. The name quartz is an old German word of uncertain origin first used by Georgius Agricola in 1530.

Quartz has great economic importance. Many varieties are gemstones, including amethyst, citrine, smoky quartz, and rose quartz. Sandstone, composed mainly of quartz, is an important building stone. Large amounts of quartz sand are used in the manufacture of glass and porcelain and for foundry molds in metal casting. Quartz is used as an abrasive in sandpaper, sandblasting, millstones, and grindstones. Quartz brick is a high-grade refractory and is used as a flux in smelting calcareous ores. Both quartz and silica glass are used in optics to transmit ultraviolet light. Much of the quartz utilized in the manufacture of optical devices is synthetically produced by means of crystallization from alkaline solutions in pressure vessels at moderate temperatures and pressures. Tubing and various vessels of fused quartz have important laboratory applications; quartz fibres are used in extremely sensitive weighing devices.

Quartz is the second most abundant mineral in the Earth's crust after feldspar. It occurs in nearly all acid igneous, metamorphic, and sedimentary rocks. It is an essential mineral in such silica-rich felsic rocks as granites, granodiorites, and rhyolites. It is highly resistant to weathering and tends to concentrate in sandstones and other detrital rocks. Secondary quartz serves as a cement in sedimentary rocks of this kind, forming overgrowths on detrital grains. Microcrystalline varieties of silica known as chert, flint, agate, and jaspar consist of a fine network of quartz. Metamorphism of quartz-bearing igneous and sedimentary rocks typically increases the amount of quartz and its grain size.

Quartz exists in two forms: (1) alpha-, or low, quartz, which is stable up to 573° C (1,063° F), and (2) beta-, or high, quartz, stable above 573° C. The two are closely related with only small movements of their constituent atoms during the alpha-beta transition. The structure of beta-quartz is hexagonal with either a left- or right-handed symmetry group equally populated in crystals. The structure of alpha-quartz is trigonal, again with either a right- or left-handed symmetry group. At the transition temperature, the tetrahedral framework of high-quartz twists, resulting in the symmetry of low-quartz; atoms move from special space group positions to more general positions. At temperatures above 867° C (1,593° F), beta-quartz changes into tridymite, but the transformation is very slow because bond breaking takes place to form a more open structure. At very high pressures alpha-quartz transforms into coesite (*q.v.*) and at still higher pressures, stishovite (*q.v.*). Such phases have been observed in impact craters.

Quartz is piezoelectric: a crystal develops positive and negative charges on alternate prism edges when it is subjected to pressure or tension. The charges are proportional to the change in pressure. Because of its piezoelectric property, a quartz plate can be used as a pressure gauge, as in depth-sounding apparatus.

Just as compression and tension produce opposite charges, the converse effect is that alternating opposite charges will cause alternating expansion and contraction. A section cut from a quartz crystal with definite orientation and dimensions has a natural frequency of this expansion and contraction (*i.e.,* vibration) that is very high, measured in millions of vibrations per second. Properly cut plates of quartz are used for frequency control in radios, televisions, and other electronic communications equipment and for crystal-controlled clocks and watches.

For detailed physical properties, *see* silica mineral (table).

quartz monzonite, also called ADAMELLITE, intrusive igneous rock (solidified from a liquid state) that contains plagioclase feldspar, orthoclase feldspar, and quartz. It is abundant in the large batholiths (great masses of igneous rocks mostly deep below the surface) of the world's mountain belts. Quartz monzonite differs from granodiorite by containing more alkali feldspar, usually more biotite and less hornblende, and oligoclase instead of andesine as the plagioclase mineral.

quartzite, sandstone that has been converted into a solid quartz rock. Unlike sandstones, quartzites are free from pores and have a smooth fracture; when struck, they break through, not around, the sand grains, producing a smooth surface instead of a rough and granular one. Conversion of sandstone to quartzite may be accomplished by precipitation of silica from interstitial waters below the Earth's surface; these rocks are called orthoquartzites, whereas those produced by recrystallization under high temperatures and pressures are metaquartzites.

Quartzites are snowy white, less often pink or gray; they commonly have a fine angular jointing and break up into rubble under frost action. They yield a thin and very barren soil and, because they weather slowly, tend to project as hills or mountain masses. Many prominent ridges in the Appalachian Mountains are composed of highly resistant tilted beds of quartzite.

The term quartzite implies not only a high degree of hardening (induration), or "welding," but also a high content of quartz; similar rocks that contain appreciable quantities of other minerals and rock particles are impure quartzites, more appropriately called graywacke, litharenite, sandstone, or the like.

Most quartzites contain 90 percent or more quartz, but some contain 99 percent and are the largest and purest concentrations of silica in the Earth's crust. Pure quartzites are a source of silica for metallurgical purposes and for the manufacture of silica brick. Quartzite is also quarried for paving blocks, riprap, road metal (crushed stone), railroad ballast, and roofing granules.

In microscopic section the clastic structure of some quartzites is well preserved; the rounded sand grains are seen with quartz overgrowths deposited in crystalline continuity, so that optical properties of the grains are similar to those of the material surrounding them. In some cases a line of iron oxides may indicate the boundary of the original sand grain. Many quartzites, however, have been crushed, and the quartz largely is a mosaic of small, irregularly shaped crystalline fragments with interlocking margins; if these sheared quartzites contain white mica in parallel crystalline flakes, they become more fissile (easily broken apart) and pass into quartz schists.

quasar, any of a class of rare cosmic objects of high luminosity as well as strong radio emission observed at extremely great distances. The term is also often applied to closely related objects that have the same optical appearance but that are radio quiet—the so-called QSOs, which stands for "quasi-stellar objects."

A brief treatment of quasars follows. For full treatment, *see* MACROPAEDIA: Cosmos; Galaxies.

Quasars are no more than a light-year or two in size, but they are up to 1,000 times more luminous than giant galaxies that have a diameter of about 100,000 light-years. The tremendous brilliance of quasars allows them to be observed at distances of more than 10,000,000,000 light-years. This enormous amount of radiation is released from a small area at the centre of a quasar. Many investigators attribute such energy generation to gas spiraling at high velocity into a massive black hole (*q.v.*). An outer atmosphere of tenuous gas produces emission lines that are observed in the spectrum of quasars. These emission lines are always shifted toward the red, corresponding to large Doppler velocities of recession. According to Hubble's law of the expansion of the universe, these large velocities correspond to large distances—a conclusion about quasar distances disputed by some astronomers. Quasars were more numerous and more luminous about 10 billion years ago than they are at present. The brightest quasar is 3C 273, which lies at a distance of 2,000,000,000 light-years from the Earth. Radio interferometry shows that the radio nucleus of 3C 273 is expanding at nearly the velocity of light.

quasicrystal, also called QUASI-PERIODIC CRYSTAL, matter formed atomically in a manner somewhere between the amorphous solids of glasses (special forms of metals and other minerals, as well as common glass) and the precise pattern of crystals. Like crystals, quasicrystals contain an ordered structure, but the patterns are subtle and do not recur at precisely regular intervals. Rather, quasicrystals appear to be formed from two different structures assembled in a nonrepeating array, the three-dimensional equivalent of a tile floor made from two shapes of tile and having an orientational order but no repetition.

Though their existence was debated for some time, the first quasicrystals were definitely discovered in 1984 by researchers working independently at the National Bureau of Standards (now the National Institute of Standards and Technology) in Gaithersburg, Md., U.S., and at the University of Pennsylvania. Afterwards, investigators at many laboratories pursued studies of this curious new material, finding many new ways to make it (including one, solid-state interdiffusion, that does not even require melting the source materials) and producing for the first time quasicrystals that are large enough to see with the naked eye and have a geometry never before seen in crystallography or mineralogy (a triaconthedron, a polyhedron with 30 identical diamond-shaped faces).

Theorists speculate that some quasicrystals may have value as superconductors. Their lattice structures, which seem to be more rigid than those of crystals, make it probable that quasicrystals will prove to be harder than steel, making them potentially useful for making ultrahard tools.

Quasimodo, Salvatore (b. Aug. 20, 1901, Modica, Italy—d. June 14, 1968, Naples), Italian poet, critic, and translator. Originally a leader of the Hermetic poets, he became, after World War II, a powerful poet commenting on modern social issues. He received the Nobel Prize for Literature in 1959.

Quasimodo was born in Sicily and was the son of a railroad employee. He was first educated near Syracuse and at Messina, studied engineering and mathematics at Palermo, and then left for the north, graduating as an engineer in Rome. He had liked to write even as a child, and, though he spent the next 10 years as an engineer for the Italian government, he wrote poetry in his spare time.

Quasimodo's first poems appeared in the Florentine periodical *Solaria.* Initially he was a disciple of the Hermetic poets Giuseppe Ungaretti and Eugenio Montale. After the publication of his first poetry collection, *Acque e terre* (1930; "Waters and Land"), Quasimodo gradually became a leader of the Hermetic poets; after 1935 he abandoned engineering to teach Italian literature at a conservatory in Milan. Quasimodo's later poetry collections—*Oboe sommerso* (1932; "Sunken Oboe"), *Odore di eucalyptus* (1933; "Scent of Eucalyptus"), and *Erato e Apollion* (1936)—have the dry, sophisticated style and abstruse symbolism of Hermeticism but include many poems that veer away from personal preoccupations to contemporary issues. With two final collections, *Poesie* (1938) and *Ed è subito sera* (1942; "And Suddenly It's Evening"), his Hermetic period came to a close.

Quasimodo
By courtesy of the Italian Foreign Office, Rome

After the war Quasimodo's social convictions shaped his work from the publication of *Giorno dopo giorno* (1947; "Day After Day") until his death. Many of his poems recalled the injustices of the fascist regime, the horrors of the war, and Italian guilt. Later poems in the same vein, simple in language, exhibit a concrete and immediate imagery. Later volumes include *La terra impareggiabile* (1958; *The Incomparable Earth*)—with an inscription from Aeschylus, "I say that the dead slay the living"—*Tutte le poesie* (1960), and *Dare e avere* (1966; *To Give and To Have and Other Poems*).

Between the mid-1930s and his death, Quasimodo published an astonishing range of translations, including a group of *Lirici greci* (1940); plays of the Greek tragic playwrights Aeschylus, Sophocles, and Euripides (collected in *Tragici greci,* 1963); poems of the Latin poets Catullus, Ovid, and Virgil; six plays of William Shakespeare; Molière's *Tartuffe;* and the poetry of the 20th-century poets e.e. cummings (United States) and Pablo Neruda (Chile). He edited two anthologies of Italian poetry and wrote many significant critical essays, collected in *Il poeta e il politico e altri saggi* (1960; *The Poet and the Politician and Other Essays*) and *Scritti sul teatro* (1961), a collection of drama reviews.

quasiparticle, in physics, a disturbance, in a medium, that behaves as a particle and that may conveniently be regarded as one. A rudimentary analogy is that of a bubble in a glass of beer: the bubble is not really an independent object but a phenomenon, the displacement of a volume of beer by carbon dioxide gas, but, because of the characteristics of the surface of liquid in contact with the gas, the bubble retains a certain identity as it rises and floats. It, like a quasiparticle, carries properties characteristic of objects, such as size, shape, energy, and momentum. Two bubbles can bounce off each other; quasiparticles, too, undergo collisions. Some specific quasiparticles are the exciton, phonon, magnon, and polaron (*qq.v.*).

Quasiparticles are studied in connection with solid-state physics and nuclear physics because they play an important role in determining the properties of matter. There is reason to suspect, however, that all particles may actually be disturbances in some underlying medium and, hence, are themselves quasiparticles.

Quaternary Period, interval of geologic time, the youngest of the 11 periods in Earth history. The Quaternary follows the Tertiary Period and is part of the Cenozoic Era. Its boundaries have been defined as 1,600,000 years ago to the present day. It is subdivided into the Pleistocene Epoch (*q.v.;* 1,600,000 to 10,000 years ago) and the Holocene Epoch (*q.v.;* 10,000 years ago to the present).

A brief treatment of the Quaternary Period follows. For full treatment, *see* MACROPAEDIA: Geochronology.

The Quaternary is characterized by major cyclical changes of climate on a global scale. Because these led to repeated invasions of vast areas of mid-latitude North America and northwestern Eurasia by ice sheets, the period is frequently referred to as the Great Ice Age. The onset of this ice age was marked by a major climatic cooling, which is now placed within the preceding Pliocene Epoch of the Tertiary Period at about 2,500,000 years ago.

In the Quaternary Period world sea levels fell more than 100 m (330 feet) during at least one episode of glacial expansion. There was also a sequence of major oscillations between warmer and cooler climatic conditions, occurring during the last 1,700,000 years, that affected the whole planet.

On land these oscillations corresponded with cycles of alternating interglacial and glacial stages recorded from continental geologic sequences in middle latitudes. Interglacial stages of these cycles were relatively short (10,000 to 30,000 years) and were characterized by temperate climates and vegetation conditions similar to those of today. The Holocene is regarded as the latest interglacial stage of the Quaternary Period. During the much longer glacial stages (70,000 to 80,000 years), large areas of North America and Eurasia, as well as southern South America and New Zealand, were affected either by massive advances of glaciers and ice sheets or by dry but cold periglacial climates similar to those found in parts of Arctic Canada and Siberia today. As a result of these climatic changes, there were large and repeated shifts of vegetation belts and their associated faunas, particularly in the Northern Hemisphere. The most recent episode of ice expansion (about 30,000 to 10,000 years ago) is well marked in both North America and northern Europe. A succession of older, sometimes more extensive ice advances, occurring in Europe as far back as 500,000 years ago and in North America before 700,000 years ago, has been recognized.

In the tropics and subtropics, glacial-interglacial cycles influenced the expansion and contraction of glaciers on the highest mountains, thus producing elevational shifts of vegetation zones. The most important climatic and environmental changes in these latitudes, however, are associated with changes in rainfall. Intervals of wet, pluvial climate alternating with drier interpluvial conditions were accompanied by shifts in the boundaries between tropical forest, savanna, and more arid vegetation zones. Changes in rainfall were clearly recorded by the rise and fall of lake levels during the Quaternary, not only in the tropics but in other areas such as Australia, central Asia, and the Great Basin of the western United States. These changes in rainfall regime, however, were not apparently synchronous within the glacial-interglacial cycles in the middle latitudes. The underlying causes of Quaternary climatic changes were complex and are still much disputed. The effects of continental drift on ocean and atmospheric currents, the influence of variations in solar radiation, and the effects of volcanic eruptions probably all played major or minor roles, but the periodicity of the major oscillations that are recorded in the deep-sea sediments does seem to be closely related to long-term geometric variations in the Earth's orbit around the Sun.

Biologically, the major feature of the Quaternary Period has been the evolution and dispersion of humans. Indeed, Soviet scientists refer to the Quaternary as the Anthropogene. During the early and middle Pleistocene, early hominids (*Homo erectus*) spread from Africa to Asia and Europe. Modern man (*Homo sapiens*) reached the Americas and Australia during the last glacial stage. The drastic changes of climate and environment in the Quaternary Period led to rapid rates of evolution and extinction, particularly among the mammals. The extinction of large mammals in North and South America and in Eurasia toward the end of the last glacial stage may also be related to the rapid territorial expansion of humans at that time.

Quatre Bornes, town ("township") on the island of Mauritius, in the western Indian Ocean. It lies in the western highlands region of the country, about 9 miles (14 km) southwest of Port Louis, the national capital. Quatre Bornes (French: "Four Boundaries") was named after the boundary stones that marked the limits of four large sugar estates once situated there. Sugarcane is still produced in the surrounding areas as an important crop. Quatre Bornes is a fast-growing, mainly middle-class, urban centre with a town council, and it has a large government hospital. A surfaced road links the town with the highway connecting Port Louis and Vacoas-Phoenix. Pop. (1988 est.) 64,668.

Quatre Cantons, Lac des (Switzerland): *see* Lucerne, Lake.

Quattrocento, the totality of cultural and artistic events and movements that occurred in Italy during the 15th century, the major period of the Early Renaissance. Designations such as Quattrocento (1400s) and the earlier Trecento (1300s) and the later Cinquecento (1500s) are useful in suggesting the changing intellectual and cultural outlooks of late- and post-medieval Italy.

Trecento, for example, is a convenient way of referring to the interval falling between the Gothic and Renaissance periods, a period of promise and growth that was suddenly aborted by the devastation of the Black Death that erupted in 1348. The Quattrocento was a period of increasing prosperity and steady progression in the arts toward the harmonious balance achieved in the High Renaissance. In concrete terms, the Quattrocento is regarded as beginning in 1401 with a competition to design the east doors for the Baptistery in Florence and ending in 1503 with the election of Cardinal Giuliano della Rovere as Pope Julius II. The Cinquecento delimits a fundamentally different period, one of intense and violent changes in the whole fabric of Italian culture. It refers to the century of the Reformation, of Spanish and Habsburg political domination, and of the uneasy transition to Mannerism in the visual arts. *See also* Renaissance.

quay wall: *see* dock.

Quayle, Sir (John) Anthony (b. Sept. 7, 1913, Ainsdale, Lancashire, Eng.—d. Oct 20, 1989, London), British actor and director, who was well known for his roles in classic plays on the stage as well as for his motion-picture career.

Quayle, who studied briefly at the Royal Academy of Dramatic Art, first appeared in vaudeville (1931) but became a member of the Old Vic Theatre in 1932 and made his New York City debut in *The Country Wife* (1936). He toured with the Old Vic, playing Laertes in its *Hamlet* done at Elsinore (1937) and playing the title role in its *Henry V* presented in Europe and Egypt (1939). During World War II he served as a major of artillery but returned to the stage to play in *The Rivals* in 1945.

Quayle directed *Crime and Punishment* (1946) and *The Relapse* (1947) before becoming director of the Shakespeare Memorial Theatre at Stratford-upon-Avon. He appeared in more than 20 roles with the company and directed 9 of its productions. After leaving Stratford in 1956, his stage work included touring Europe in *Titus Andronicus* (1957), directing and appearing as Moses in *The Firstborn* (New York City, 1958), starring as James Tyrone in *Long Day's Journey into Night* (Edinburgh, 1958), and playing Andrew Wyke in *Sleuth* (London and New York City, 1970), for which he received several awards.

Quayle's screen career began with *Saraband for Dead Lovers* (1948), and his many films, tending toward historical and costume drama, include *Pursuit of the Graf Spee* (1957), *Lawrence of Arabia* (1962), *Anne of the Thousand Days* (1969), *The Tamarind Seed* (1974), and *Murder by Decree* (1979). Quayle was knighted in 1985.

Quayle, Dan, byname of JAMES DANFORTH QUAYLE (b. Feb. 4, 1947, Indianapolis, Ind., U.S.), politician who was vice president of the United States from 1989.

The son of a newspaper publisher, Quayle earned a bachelor's degree in political science from DePauw University (Greencastle, Ind.) in 1969 and earned a law degree from Indiana University in 1974, being admitted to the bar that same year. During his years in law school he held various posts in the Indiana state government, and from 1974 to 1976 he was associate publisher of his family's *Huntington* (Ind.) *Herald-Press* newspaper. He won election to the U.S. House of Representatives in 1976 and was reelected in 1978. In 1980 he was elected to the Senate and was reelected in 1986. In August 1988 Quayle was chosen by George Bush, the Republican presidential candidate, to be his vice presidential running mate. During his vice presidential tenure, Quayle traveled widely around the United States and around the world on political and goodwill missions.

Qūchān, also spelled KUCHAN, town, northeastern Iran. Most of the inhabitants of Qūchān are descended from a tribe of Za'farānlū Kurds resettled there by Shāh 'Abbās I in the 17th century. In return for frontier military service, the resettled Kurds enjoyed a wide-ranging autonomy under a hereditary *ilkhān*, or tribal leader, and were exempt from all tribute. Many of the area's inhabitants are still nomads and live in tents in summer so as to be able to move their flocks to better grazing land.

The region produces much grain, and there are also extensive vineyards. Qūchān town has suffered severely from repeated earthquakes. The present town, dating from 1895, is 8 miles (13 km) east of the earlier settlement, which was destroyed by an earthquake in 1893. About 12,000 people are believed to have perished in that disaster. Lying at an elevation of 3,770 feet (1,149 m), the town is on the main road running from Mashhad to Ashkabad (Turkmenistan). Pop. (1986) 66,531.

Que Que (city, Zimbabwe): *see* Kwekwe.

Queanbeyan, city, southeastern New South Wales, Australia. It lies along the Queanbeyan River, just southeast of the Australian Capital Territory (Canberra). It originated in 1828 as a holding called Queen Bean, a name phonetically derived from an Aboriginal word meaning "clear water." Proclaimed a town in 1838, a municipality in 1885, and a city in 1972, Queanbeyan is one of the state's fastest-growing residential urban centres because of its proximity to Canberra. It serves a district of sheep raising, mixed farming, and mining (iron, coal, silver-lead). Queanbeyan's industries include sawmills, building construction, and engineering works. Pop. (1986) 22,698.

Quebec, French QUÉBEC, an eastern province of Canada. It is bounded by the Hudson Strait and Ungava Bay to the north, Newfoundland to the east, the Gulf of St. Lawrence and New Brunswick to the southeast, the United States to the south, and Ontario and Hudson Bay to the west. Its capital, Quebec city, is Canada's oldest city, and Montreal is one of the largest cities in the country.

A brief treatment of Quebec follows. For full treatment, *see* MACROPAEDIA: Canada.

The original inhabitants of Quebec were members of three Indian peoples: the nomadic Algonquins and Montagnais, who lived by hunting and fishing north of the St. Lawrence River, and the Cree, who lived in the southwestern part of the territory. Later the Inuit (Eskimo) settled in the north around Hudson Bay, where they lived mainly by fishing and hunting. Jacques Cartier, landing at Gaspé in 1534, claimed the region for France, but not until 1608, when Samuel de Champlain built the first European structure at the spot the Indians called Quebec (site of modern Quebec city), did the settlement of the colony of New France begin. Establishing friendly relations with the Algonquins, who traded beaver pelts to them, the French became embroiled in the Algonquins' wars with their southern neighbours, the Iroquois. The English, settled to the south, sided with the Iroquois, and the conflict evolved into the French-British colonial struggle for mastery in North America culminating in the French and Indian War. French control of Quebec effectively ended after the successful British attack by General James Wolfe on Quebec City in 1759.

The proclamation of 1763 ceded the colony to Britain, but the French settlers remained. A large influx of British Loyalists entered Canada from the south during the American Revolution and settled west of the French, across the Ottawa River in what is now Ontario, establishing the basic geographic dichotomy between the French and English. In 1791 Canada was split into Lower Canada

(Quebec) and Upper Canada (the future Ontario), roughly following the Ottawa River boundary. Although throughout the province the rural population remained overwhelmingly French, Montreal became the domain of English merchants who were bitterly anti-French. These English merchants tried in 1822 to obtain an Act of Union that would give the English-speaking population a majority in the country as a whole. The reaction of the French-Canadians to this attempt at domination prepared the way for the 1837 rebellion led by Louis-Joseph Papineau. The rebellion was suppressed. A new Act of Union that was passed in 1841 joined the provinces of Upper and Lower Canada, and in 1867 the British North American Act created the confederation of Canada by the federation of the four provinces of Nova Scotia, New Brunswick, Quebec, and Ontario. French-Canadian nationalism became a permanent feature of Canadian as well as Quebec politics.

Quebec is a sort of "land's end," almost separated from the rest of Canada by Hudson Bay and Hudson Strait. It can be divided into three major geographic areas that reflect its main geologic structure: the Canadian, or Laurentian, Shield; the populated lowlands of the St. Lawrence Plain; and the Appalachians. The sparsely populated and mineral-rich Canadian Shield covers about 80 percent of Quebec. This shield is composed of three main subdivisions: the tree-covered Laurentians, which have become a tourist area; the taiga, a region of stunted trees; and the tundra, which is covered with permafrost. The freshwater area of Quebec amounts to some 71,000 square miles (183,890 square km). Even outside the permafrost regions, Quebec's climate is often severely cold. The period that snow remains on the ground varies from 12 or 13 weeks on the Montreal plain to 23 weeks along the northern coast of the St. Lawrence.

The majority of Quebec's population are of French descent. A low birth rate among French-Canadians, coupled with a high migration rate out of Quebec, have contributed to a slight relative decline in the population. The other nationalities represented are English and Irish, and there are also a growing number of Italians. The Indian and Inuit (Eskimo) population has grown to more than 38,000.

Mining, hydroelectric power, and forestry are the main industries. Until the 1940s agriculture was the largest sector but has since been exceeded by industry. Quebec's greatest economic potential lies with the Canadian Shield, containing one of the world's largest reserves of minerals, including copper, gold, zinc, iron, and asbestos. The government of Quebec created several corporations to survey mineral resources and stimulate their exploitation in terms of both extraction and manufacturing. Only a small part of Quebec's ore, however, is processed in the province. All electric power was nationalized in 1963, and the resulting company, Hydro-Québec, is the largest producer of electricity in Canada. Quebec processes much of its annual forest harvest, which is second only to that of British Columbia in Canada, with more than 50 pulp and paper plants. Complete integration in the general transportation system of Canada and North America has promoted Quebec's economic development.

The French-Canadian movement for national identity has asserted itself in terms of cultural and political struggle. Under the leadership of such men as Papineau, Louis Lafontaine, Henri Bourassa, and the abbé Lionel Groulx, the province evolved its special vocation as the "political home" of French-Canadians, and the government assumed responsibility for the defense of French culture. Premiers Maurice Duplessis and Jean Lesage, during their administrations, politically promoted French-Canadian nationalism. The Front de Libération du Québec was responsible for numerous acts of violence in the 1960s and '70s, including the assassination of Pierre LaPorte, the labour minister of Quebec in 1970. In 1968 René Lévesque defected from Lesage's Liberal Party and formed the Parti Québécois, advocating independence for Quebec. Lévesque's party won the elections in 1976, and as premier he sponsored a legislative program to promote the use of the French language and curtail the use of English in government and commerce. Lévesque's independence program, however, was defeated in a referendum in 1980; he was also the only premier to oppose the Constitution Act of 1982, but the Quebec Supreme Court denied his request for power to veto it. Nevertheless, the Parti Québécois remained in power until its defeat by the Liberals in the 1985 provincial elections, held after Lévesque's retirement. By 1990 Quebec nationalism was again on the rise.

The Quebec provincial government consists of a unicameral National Assembly, elected by universal adult (age 18 and older) suffrage to a four-year term. The leader of the majority party in the assembly becomes the premier and selects the Executive Council. The lieutenant governor is selected by Canada's governor-general to represent the monarch. Judges are appointed by the federal government, but Quebec's civil law follows the French continental model. The province has its own police force, La Sûrete du Québec.

Primary and secondary education through grade 11 is free and compulsory; classes are taught in either French or English in separate schools. Quebec has a collegiate program divided into a two-year general-education course (required for university enrollment) and a three-year professional, technical, and vocational course. The French-language public University of Quebec in Montreal has several campuses, including those at Chicoutimi, Trois-Rivières, Rouyn, Hull, and Rimouski; it also administers research institutes and continuing-education schools as well as a television extension program.

The Ministry of Cultural Affairs, created in 1961, provides financial assistance to museums and theatrical, ballet, and musical companies and to book publishing. Canada's National Theatre School, located in Montreal, promotes both traditional and modern French, English, and bilingual theatre, and Quebec city is a centre for the film industry. Quebec is renowned for folk singing (*chansons*) that has its roots in 17th-century New France. Famous chansonniers have included Félix Leclerc and Gilles Vigneault. Quebec's writers have included French-language novelists Anne Hébert, Roger Fournier, and Yves Thériault. English-language writers have included Mordecai Richler, Leonard Cohen, and Hugh MacLennan. Quebec's French painters have adopted Impressionism to express political and cultural themes. Quebec is also noted for wood carving, both Inuit and French traditional, the latter dating back to 17th-century artisans' efforts to decorate church interiors. The province is renowned for sports—notably hockey, Canadian football, and baseball—all of which have large popular followings. Area 594,860 square miles (1,540,680 square km); Pop. (1990 est.) 6,736,200.

Quebec, French QUÉBEC, city, port and capital of Quebec province, Canada. It lies at the confluence of the St. Lawrence and Saint-Charles rivers, about 150 miles (240 km) northeast of Montreal. The first European to visit the area was Jacques Cartier, a French explorer, who in 1535 found on the site the Huron Indian village of Stadacona. In 1608 Samuel de Champlain installed the first permanent base in Canada at Quebec, which grew as a fur-trading settlement.

In 1629 Quebec was captured by the British, who held it until 1632, when the Treaty of Saint-Germain-en-Laye restored Quebec to France. The colony was then able to develop rapidly.

In 1690 the fleet of Sir William Phipps, governor of Massachusetts, attempted to take Quebec but was beaten back with troops led by its governor, the Count de Frontenac. In 1711 a second attempt to take the city also failed when a British armada crashed on the reefs of the St. Lawrence before reaching Quebec. The city fell to the British in 1759 and was ceded to Great Britain by the Treaty of Paris in 1763. During the U.S. War of Independence, the Americans, under Richard Montgomery and Benedict Arnold, failed in an attempt to capture the city.

In 1791 Quebec was designated as the provincial capital of Lower Canada, which later became the province of Quebec. It was incorporated in 1832 and was given its actual charter in 1840. In 1864 Quebec was the seat of the conference of British North American colonies to plan the confederation of Canada. During World War II U.S. President Franklin D. Roosevelt and British Prime Minister Winston Churchill twice met in Quebec to plan the invasion of Europe.

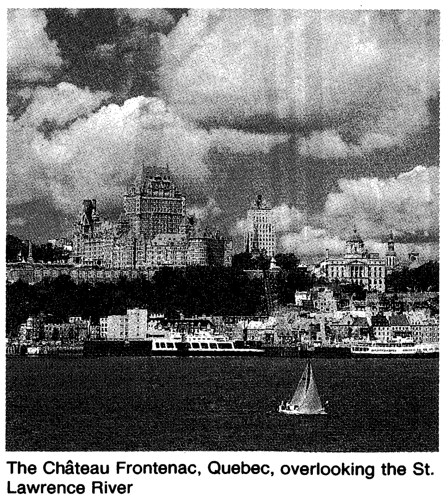
Although Quebec is a major port of Canada, the largest employers in the city are the service and administrative industries. The leading manufactures include newsprint, milled grain, cigarettes, and garments; shipbuilding and tourism are also important.

The majority of the residents of Quebec are Roman Catholic and French speaking. The city has a dual school system—one for Roman Catholics and one for Protestants; instruction is in French and English, respectively.

Quebec's cultural life is concentrated on Laval University and its affiliated teaching institutions. Also notable are the concert hall, the Grand Théâtre, and the numerous museums and libraries throughout the city.

The principal historical buildings are religious in function, many dating from the 17th century. On the Place Royale stands the modest Church of Notre-Dame des Victoires (1688). Other old buildings include the Ursuline monastery, the seminary, the Anglican cathedral (the first such in Canada), and the Catholic basilica, where many of the bishops of Quebec are buried.

Sports are very popular, especially hockey, baseball, Canadian football, golf, and skiing in the many centres in the Laurentian Mountains only a few miles from the city. The Mont Sainte-Anne centre has been the scene of World Cup skiing tournaments. Among the principal local events are the three-week-long winter carnival ending on the night of Mardi

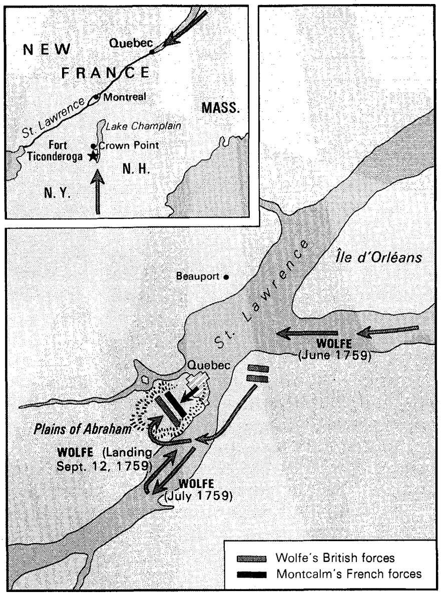


The Château Frontenac, Quebec, overlooking the St. Lawrence River

Gras and the Provincial Exhibition of late August. Pop. (1981) city, 166,474; metropolitan area, 576,075.

Quebec, Battle of (Sept. 13, 1759), in the French and Indian War, decisive defeat of the French under the Marquis de Montcalm by a British force led by Maj. Gen. James Wolfe.

After the fall of Louisbourg, Cape Breton Isl., in 1758, Quebec became the main military target of the British offensive. The following June, young Wolfe led a British force of 250 ships carrying 8,500 regulars to take up strategic positions in the St. Lawrence River. Protected by high jagged cliffs, Quebec resisted a two-month siege by land and water. Finding a narrow, hidden path, Wolfe secretly disembarked more than 4,000 men the evening of September 12, forcing a confrontation on the Plains of Abraham. The next day the French defenders were routed in this battle, in which both commanders were lost. This battle led to the fall of Montreal the next year and the final British victory.



Battle of Quebec, Sept. 13, 1759

From David Eggenberger, *A Dictionary of Battles*, copyright © 1967 by David Eggenberger; reprinted with permission of the publisher, Thomas Y. Crowell Company, Inc.

Quebec, Battle of (Dec. 31, 1775), in the U.S. War of Independence, unsuccessful American attack on the British stronghold. In the winter of 1775–76, American Revolutionary leaders detached some of their forces from the Siege of Boston to mount an expedition through Maine with the aim of capturing Quebec. On Dec. 31, 1775, under Gen. Richard Montgomery and Col. Benedict Arnold, an inadequate force of roughly 1,675 Americans assaulted the fortified city, only to meet with complete defeat. Montgomery was killed, and large numbers of colonials were captured. Demonstrations against Canada were soon discontinued, and Arnold withdrew the remnant of his army in May 1776.

Quebec Act (1774), act of the British Parliament that vested the government of Quebec in a governor and council and preserved the French Civil Code and the Roman Catholic Church. The act was an attempt to deal with major questions that had arisen during the attempt to make the French colony of Canada a province of the British Empire in North America. Among these were whether an assembly should be summoned, when nearly all the inhabitants of the province of Quebec, being Roman Catholics, would, because of the Test Acts, be ineligible to be representatives; whether the practice of the Roman Catholic religion should be allowed to continue, and on what conditions; and whether French or English law was to be used in the courts of justice.

The act, declaring it inexpedient to call an assembly, put the power to legislate in the hands of the governor and his council. The practice of the Roman Catholic religion was allowed, and the church was authorized to continue to collect the tithe. The Test Act was waived and an oath of allegiance substituted so as to allow Roman Catholics to hold office. French civil law continued, but the criminal law was to be English. Because of these provisions the act has been called a generous and statesmanlike attempt to deal with the peculiar conditions of the province.

At the last moment additions were made to the bill by which the boundaries given the province by the Proclamation of 1763 were extended. This was done because no satisfactory means had been found to regulate Indian affairs and to govern the French settlers on the Ohio and Mississippi rivers. It was decided, therefore, to put the territory between the Ohio and the Mississippi under the governor of Quebec, and the boundaries of Quebec were extended southward to the junction of the Ohio and the Mississippi and northward to the height of land between the Great Lakes and Hudson Bay.

This provision of the act, together with the recognition of the Roman Catholic religion, was seen to threaten the unity and security of British America by, in effect, reviving the old French Empire destroyed in 1763. The American colonists viewed the act as a measure of coercion. The act was thus a major cause of the American Revolution and provoked an invasion of Quebec by the armies of the revolting colonies in the winter of 1775–76. Its provisions, on the other hand, did little at the time to win French support of British rule in Quebec; and, except for the clergy and seigneurs, most of the French remained neutral. The act eventually became important to French Canadians as the basis of their religious and legal rights.

Quebec Conferences, two Anglo-American conferences held in the city of Quebec during World War II. The first (Aug. 11–24, 1943), code-named "Quadrant," was held to discuss plans for the forthcoming Allied invasions of Italy and France and was attended by U.S. Pres. Franklin D. Roosevelt and British Prime Minister Winston Churchill. Differences between U.S. and British strategists about the coordination of the Italian campaign with "Operation Overlord" (the planned Normandy invasion) were not resolved and had to be settled at meetings in Moscow, Tehrān, and Cairo later that year.

Roosevelt and Churchill met again at Quebec the following year (the Octagon Conference, Sept. 11–16, 1944). The decision taken there to advance against Germany on two western fronts, instead of making a concerted drive on Berlin, was criticized in the postwar period because it allowed the Soviet Army to take possession of the German capital.

Quebec Party (Canada): *see* Parti Québecois.

Quechua, South American Indians living in the Andean highlands from Ecuador to Bolivia. They speak the Quechua language, which was the language of the Inca Empire and which later became the lingua franca of the Spanish and Indians throughout the Andes.

The Quechua have formed an important part of the agricultural backbone of Andean civilization since the early 15th century, when they were conquered by the Chancas, who were themselves subjugated by the Incas in the later years of that century.

The Inca requirements of public service did not much disturb the traditional Quechua way of life. When the Spanish conquered the Inca Empire in the 16th century, however, and the Quechua came under Spanish rule, Quechua society was drastically altered. The Spanish encomienda system of tribute required the Quechua to produce unfamiliar crops for the Spanish, at the expense of their own food supply. The Spanish system, unlike its Inca predecessor, did not provide for the welfare of the labourer and his family during his term of forced labour. The Spanish concentrated the Quechua in larger, more populous villages than they were accustomed to, thus further straining Quechua political and social institutions. The Roman Catholic Church made additional demands on the time and resources of Christianized Quechua. A growing desire for the trappings of Spanish wealth even further alienated the Quechua from their own society. By the time that Spanish rule ended in the 19th century, the Quechua had been so changed that many remained as servants on the grand haciendas and estates. Others went to the towns and cities of the lowlands to find employment, though some stayed in their mountainous homeland.

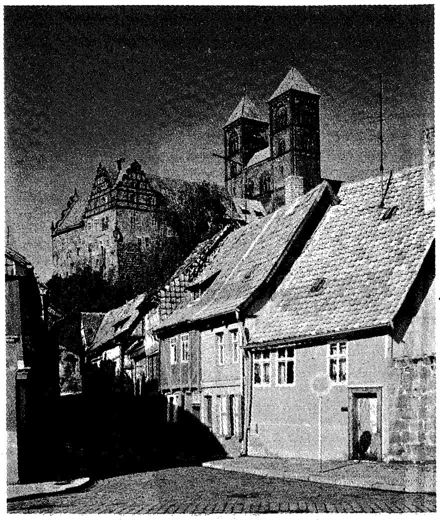
In the 20th century the Quechua lead isolated lives as marginal farmers in the high Andes. Their religion is an amalgam of Roman Catholicism and native folk beliefs. They practice their traditional fibre handicrafts, spinning wool and weaving fabrics for both domestic use and sale to outsiders. Because of the lack of distinct anthropological identity between Quechua speakers and those of Quechua heritage, population estimates in the late 1970s range between 10,000,000 and 13,000,000. The Quechua have been the subject of numerous biological and medical studies aimed at understanding physiological adaptation to high-altitude living.

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

Quechuan languages, the languages of the former Inca Empire in South America and the principal native languages of the central Andes today. According to archaeological and historical evidence, the original languages were probably spoken in a small area in the southern Peruvian highlands until about 1450; after that their geographical range was rapidly enlarged by the Inca conquests. When the Spanish conquered the empire in 1532, Quechuan languages were spoken in western South America from what is now southern Colombia to central Chile and from the Pacific coast to the borders of the Amazon Basin.

Although the languages are still spoken by a large population of Indians, many of whom are monolingual, they are slowly losing ground to the Spanish language, which is the language of government and education. Some scholars place the Quechuan languages and the Aymaran languages together in a Quechumaran grouping.

Quedlinburg, city, Saxony-Anhalt *Land* (state), central Germany, on the Bode River, in the northern foothills of the Lower Harz Mountains, southwest of Magdeburg. Founded in 922 as a fortress by Henry I the Fowler, it became a favourite residence of the Saxon emperors, and in 968 Otto I founded there an imperial abbey (with his daughter Mathilda as abbess), which was secularized in 1803. A member of the Hanseatic League until 1477, the city then came under the protection of the electors of Saxony until it passed to Brandenburg in 1698. The medieval walls and towers, many half-timbered houses, and several medieval churches survive. The city is dominated by the 16th-century castle (now a museum) on the site of the old fortress and the former abbey



Castle and Church of St. Servatius, Quedlinburg, Ger.
W. Krammisch—Bruce Coleman Inc./EB Inc.

church of St. Servatius (1070–1129, incorporating the remains of a 10th-century church). The poet Friedrich Gottlieb Klopstock and the geographer Carl Ritter were born in Quedlinburg.

Dyes, precision instruments, engineering products, vehicles, and paper are manufactured. The site of the Institute for Plant Research, Quedlinburg is an important centre for the cultivation of seeds, flowers, and sugar beets. Pop. (1989 est.) 28,790.

queen: *see* king.

Queen, Ellery, pseudonym of FREDERIC DANNAY and MANFRED B. LEE, original names, respectively, DANIEL NATHAN and MANFORD LEPOFSKY (respectively b. Oct. 20, 1905, Brooklyn, N.Y., U.S.—d. Sept. 3, 1982, White Plains, N.Y.; b. Jan. 11, 1905, Brooklyn, N.Y.—d. April 3, 1971, near Waterbury, Conn.), American cousins who were coauthors of a series of more than 35 detective novels featuring a character named Ellery Queen.

Dannay and Lee first collaborated on an impulsive entry for a detective-story contest; the success of the result, *The Roman Hat Mystery* (1929), started Ellery Queen on his career, and after publication of two more mysteries, the cousins were able to become full-time writers. They took turns creating plots and writing stories about the sleuth Queen, giving clues so that readers might solve each case before seeing the answer. Queen's adventures have been adapted for radio, television, and film. The pair also used the pseudonym Barnaby Ross when writing about their second detective creation, Drury Lane, and they would hold debates posing as Queen and Ross, believed by all to be two distinct authors.

Dannay's and Lee's other ventures included *Ellery Queen's Mystery Magazine,* founded in 1941, which has published some of the best current detective fiction. They also edited numerous anthologies, including *101 Years' Entertainment; Great Detective Stories, 1841–1941* (1945), and cofounded Mystery Writers of America.

Queen Alexandra Range, mountain range of Antarctica, located in Ross Dependency (New Zealand) along the western edge of the Ross Ice Shelf. The range reaches an elevation of 14,856 feet (4,528 m) in Mount Kirkpatrick. The mountain range rises between the Dry Valleys and Queen Maud Range of the Antarctic Mountains and is separated from the latter by the Beardmore Glacier. The range has areas of peneplain, created by past erosion, before it descends to sea level. Mount Falla, capped by 14 flat-lying lava flows of basaltic composition, is located in the range. The range was discovered by the British explorer Ernest H. Shackleton in 1908 and named for Queen Alexandra of England.

Queen Anne style, the period of English decorative arts during the reign (1702–14) of Queen Anne. The term applies to the style that began to evolve during the rule of King William III of England, reached its primacy during the reign of Queen Anne, and persisted after George I ascended the throne. The period also has been called "the age of walnut" because that wood was used almost exclusively in furniture of the time, replacing oak—which, however, was still in use for paneling.

The single most distinctive feature of Queen Anne furniture is the use of the cabriole leg, which is shaped in the form of a double curve—the upper part being convex and the lower part concave—and ends either in a claw-and-ball or paw foot. After 1710, improved design and woodworking created a still further sophistication in silhouette. The Queen Anne chair is identifiable as well for the splat back, which is curved in order to fit the hollow of the spine.

The custom of social tea drinking that developed in the Queen Anne period produced a need for small movable chairs and tables, as well as for china cabinets. Bookcases and

Colonial American Queen Anne furniture
(Left to right) Maple and pine mirror, probably from Boston, 1720–45, above a tulip and maple tea table, Middle Colonies, 1730–40; japanned pine and maple high chest by John Pimm of Boston, 1740–50; and a walnut splat-back Queen Anne armchair; in the Henry Francis du Pont Winterthur Museum, Delaware
Courtesy, the Henry Francis du Pont Winterthur Museum, Delaware

secretaries were also designed in the Queen Anne style. Marquetry, inlay, veneering, and lacquerwork were all skillfully applied to the decorative furniture of Queen Anne design. Typical motifs in this ornamentation are scallop shells, scrolls, Oriental figures, animals, and plants. The Queen Anne style of furniture design became extremely popular among the upper classes in Britain's North American colonies.

Though also known as Queen Anne, the red brick architectural style of the 1870s in Great Britain and the United States had no real connection with the original Queen Anne period.

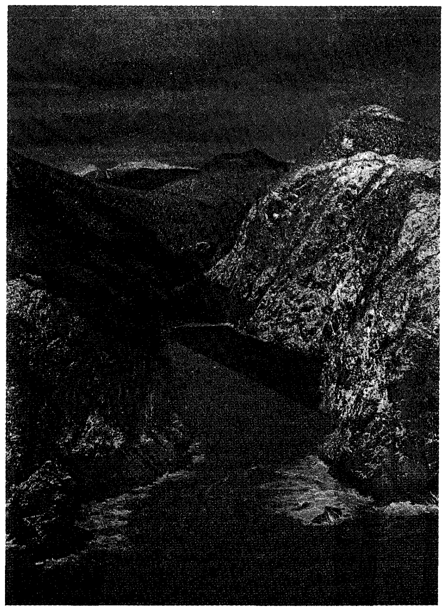
Queen Anne's lace, also called WILD CARROT (*Daucus carota*), biennial species of plant in the parsley family (Apiaceae). It is an ancestor of the cultivated carrot. It grows to 1.5 m (5 feet) tall. The bristly plant has divided leaves, umbels (flat-topped clusters) of white or pink flowers with a single dark-purple flower in the centre, an enlarged and edible but acrid root, and ribbed fruits with sharp spines. It is occa-

Queen Anne's lace (*Daucus carota*)
Peter L. Ames—EB Inc.

sionally cultivated as an ornamental. Eurasian in origin, it is now almost cosmopolitan in range.

Queen Anne's War (1702–13), second in a series of wars fought between Great Britain and France in North America for control of the continent. It was contemporaneous with the War of the Spanish Succession in Europe. British military aid to the colonists was devoted mainly to defense of the area around Charleston, S.C., and the exposed New York–New England frontier with Canada. English settlements were subject to brutal raids by French forces and their Indian allies. After the British capture of the key French fortress of Port Royal in 1710, French-ruled Acadia became the British province of Nova Scotia. In addition, under the terms of the Treaties of Utrecht (1713), Britain acquired Newfoundland and the Hudson Bay region from France.

Queen Charlotte Islands, archipelago of western British Columbia, Canada, south of the Alaskan Panhandle. Extending in a north–



The mountainous Pacific coast of Moresby Island, Queen Charlotte Islands
John de Visser

south direction for roughly 175 miles (280 km) and with a land area of 3,705 square miles (9,596 square km), the islands (about 150 in number) are separated from Alaska, mainland British Columbia, and Vancouver Island by Dixon Entrance, Hecate Strait, and Queen Charlotte Sound, respectively. The two largest of the islands, Graham and Moresby, are irregular in shape and rise to nearly 4,000 feet (1,200 m). The rugged islands have mild winters because of warm ocean currents. Naikoon Provincial Park (280 square miles [725 square km]) occupies the northeastern corner of Graham Island. In 1988 agreement was reached on turning the entire southern half of the Queen Charlotte archipelago, including Moresby Island, into a national park that would preserve the lush temperate rain forests there.

The Spaniard Juan Pérez (1774) and the Englishman Captain James Cook (1778) were the first Europeans to sight the island group, but it was Captain George Dixon who in 1787 surveyed the islands and named them for his ship. The archipelago's small population, including the Haida Indians, engages in fishing and ranching. Pop. (1981) 5,884.

Queen Charlotte Sound, broad, deep inlet of the eastern North Pacific indenting west-central British Columbia, Canada. Bounded on the north by the Queen Charlotte Islands and on the south by Vancouver Island, the sound feeds into a series of straits that once were avenues followed by the continental glaciers as they pushed out to sea. To the north lies Hecate Strait. To the south the sound tapers to Queen Charlotte Strait, a passage 60 miles (100 km) long by 16 miles (26 km) wide threading between Vancouver Island and the mainland to the Strait of Georgia and Puget Sound. These interlocking channels comprise a portion of the Inside Passage from Washington state to Alaska. The sound is bared to the open ocean on the west, while its eastern border is a complex of islands, inlets, and fjords, some of which penetrate far inland.

Queen Elizabeth, largest passenger liner ever built. Launched in 1938 and operated as a troopship during World War II, it entered the regular transatlantic service of the Cunard Line in 1946. The ship was 1,013 feet (313 m) long and 118 feet (36 m) wide and had a draft of 40 feet (12 m) and a gross tonnage of 83,673. The *Queen Elizabeth* was retired in 1968 and sold for conversion to a seagoing university, but it burned and sank in January 1972 during refitting at Hong Kong. Its successor, *Queen Elizabeth 2,* launched in 1967, made its maiden voyage in 1969.

Queen Elizabeth Islands, part of the Canadian Arctic archipelago, encompassing all the islands north of latitude 74°30′ N, including the Parry and Sverdrup island groups. The islands, the largest of which are Ellesmere, Melville, Devon, and Axel Heiberg, have a total land area of more than 150,000 square miles (390,000 square km). They were partially explored (1615–16) by the English navigators William Baffin and Robert Bylot but were probably visited by the Vikings in about AD 1000. The islands, which are administratively a part of the Northwest Territories, were named in 1953 to honour Queen Elizabeth II.

Queen Maud Land, region of Antarctica south of Africa, extending from Coats Land (west) to Enderby Land (east) and including the Princess Martha, Princess Astrid, Princess Ragnhild, Prince Harold, and Prince Olav coasts. A barren plateau covered by an ice sheet up to 1.5 miles (2.4 km) thick, it has a mountainous coastal area where rocky peaks, exceeding 11,800 feet (3,600 m) above sea level, pierce the ice cap.

The region was discovered by a Norwegian expedition in 1930, claimed by Norway in 1939, and declared a dependency of that nation in 1949. It was named for the Norwegian queen. Several countries have operated coastal research stations there.

Queen Maud Mountains, subdivision of the Transantarctic Mountains of central Antarctica, extending southeastward for 500 miles (800 km) from the head of Ross Ice Shelf. Discovered in 1911 by the Norwegian explorer Roald Amundsen, it was named for the queen of Norway. The rugged, glacier-studded range, with several peaks more than 13,000 feet (4,000 m) above sea level, contains extensive coal reserves.

Queenborough-in-Sheppey, town, Swale district, county of Kent, England. It is situated on the Isle of Sheppey, at the mouth of the River Thames. Queenborough was founded on drained marshland in 1339, and in 1366 Edward III named it Regina Burgia and granted it a charter after staying there with his queen, Philippa of Hainaut. In the 16th century the town was important in the wool trade; chemical manufacture, a trade that is still practiced in the town, also began at that time. Other contemporary industries include glassmaking, iron founding, and the manufacture of bathroom fixtures. Queenborough has harbour facilities. Pop. (1981 prelim.) 33,362.

Queens, largest borough in area (121 square miles [313 square km]) of the five boroughs of New York City, coextensive with Queens county, southeastern New York, U.S., on western Long Island. It extends across the width of the island from the junction of the East River and Long Island Sound to the Atlantic Ocean. The first settlement there was made by the Dutch in 1636 near Flushing Bay, followed by the establishment of Newtown (1642), Far Rockaway (1644), Flushing (1645), and Jamaica (1656). These settlements came under English control in 1664, when Peter Stuyvesant surrendered to an English force acting for the Duke of York. In 1683 Queens county was established as one of the 12 counties of the province of New York and was named to honour the queen consort of Charles II, Catherine of Braganza.

Queens was primarily rural during the 19th century, but some of its shore communities began attracting summer vacationists. In 1898 Queens borough became part of Greater New York and at the same time assumed its present size when the towns of Hempstead, North Hempstead, and Oyster Bay opposed joining New York City and were chartered within Nassau county. Construction of the Queensboro Bridge (1909) and the Long Island Rail Road Tunnel (1910) spurred the borough's development.

Queens is both residential and industrial, with extensive manufacturing around Long Island City and storage and shipping facilities lining the East River. New York City's John F. Kennedy International and La Guardia airports are in the borough, as are several branches of the City University of New York and the main campus of St. John's University, New York. Pop. (1984 est.) 1,911,235.

Queens, Valley of the, also called VALLEY OF THE TOMBS OF THE QUEENS, Arabic BĪBĀN AL-ḤARĪM, gorge in the hills of western Thebes in Upper Egypt, burial site of the queens and some royal princes of the 19th and 20th dynasties (1292–1075 BC). Located a short distance behind the temple of Ramses III (1187–56 BC) at Madīnat Habu, the 20 known decorated tombs usually consisted of an entrance passage, a few short halls, and a sarcophagus chamber. In contrast, the burial places of the queens of the 18th dynasty were undecorated and not confined to the Bībān al-Ḥarīm.

Queen's Bench, Court of, also called (during a kingship) COURT OF KING'S BENCH, formerly one of the superior courts of common law in England. Queen's, or King's, Bench was so called because it descended from the English court held *coram rege* ("before the monarch") and thus traveled wherever the king went. King's Bench heard cases that concerned the sovereign or cases affecting great persons privileged to be tried only before him. It could also correct the errors and defaults of all other courts, and, after the close of the civil wars of Henry III's reign (1216–72), it mainly tried criminal or quasi-criminal cases. In 1268 it obtained its own chief justice, but only very gradually did it lose its close connections with the king and become a separate court of common law.

The Court of King's Bench exercised a supreme and general jurisdiction over criminal and civil cases as well as special jurisdiction over the other superior common-law courts until 1830, at which time the Court of Exchequer Chamber became the court of appeal from the three superior common-law courts. King's Bench heard appeals from the Court of King's Bench in Ireland until the end of the 18th century and exercised important jurisdiction over officials and others by means of prerogative writs—*e.g.,* habeas corpus, certiorari, prohibition, and mandamus. By the Judicature Act of 1873 the court was merged in the Queen's Bench Division of the High Court of Justice. The Queen's Bench Division now consists of a chief justice—who is the lord chief justice of England—and 24 judges assigned to the division. Appeals from inferior courts come before a divisional court, composed of two or three judges of the division.

Queensberry rules, Marquess of (boxing): *see* Marquess of Queensberry rules.

Queenscliff, formerly WHALE HEAD, or SHORTLAND BLUFF, town on the south coast of Bellarine Peninsula, west of the entrance to Port Phillip Bay, Victoria, Australia, southwest of Melbourne. Established (1846) as a fishing settlement, it remains the base of a large commercial fleet. It was proclaimed a municipality in 1879. Connected to Geelong City (20 miles [32 km] northwest) by the Bellarine Highway and a rail line, Queenscliff is a resort linked by a ferry to Sorrento, across the bay, during the tourist season. Offshore is the treacherous entrance to Port Phillip Bay, known as "the Rip." Fort Queenscliff (1876), named in honour of Queen Victoria, became the Australian Staff (military) College in 1947. Pop. (1981) 3,420.

Queensland, state of northeastern Australia, occupying the wettest and most tropical part of the continent.

A brief treatment of Queensland follows. For full treatment, *see* MACROPAEDIA: Australia.

Queensland is bounded on the north and east by the Pacific Ocean, on the south by New South Wales, on the southwest by South Australia, and on the west by the Northern Territory. Its coastal region is hilly and sometimes mountainous. The Great Dividing Range runs the entire length of the state, separating east-flowing from west-flowing rivers. The inland regions of Queensland consist of a vast plain broken in a few places by low ranges and hills.

Rainfall ranges from 180 inches (4,500 mm) a year on the wettest part of the northeastern coast to as little as 5 inches (125 mm) in the southwest. All Queensland receives more summer than winter rain, but the latter is important in the southeast, where large quantities of wheat and other winter crops are grown. The wetter or more fertile parts of the east coast foster several areas of dense tropical and subtropical rain forest and softwood scrub. Subcoastal vegetation consists mostly of forests of eucalyptus. Further inland the dominant trees are mostly acacia species, brigalow, mulga, and gidyea, interspersed with large grassy plains and with some areas of desert spinifex, a spiny grass that grows in clumps.

Queensland has a great variety of animals, some 50 species of marsupials, 400 birds, and 1,600 fish. Two egg-laying mammals, or monotremes, are the spiny anteater and the platypus. Marsupials range from the large red and gray kangaroos to the koala, opossum, cuscus, and marsupial mouse. Birds include the flightless emu of the plains, great flocks of coloured parrots, and songbirds of the forest. Fishes include the freshwater Queensland lungfish, various food and game fish, and many and beautiful varieties of reef fishes.

The majority of the populace lives in south Queensland, an area extending about 200 mi inland, including the Darling Downs farming region. Rockhampton, central Queensland's largest city, is the outlet and commercial centre for beef and wool produced in its hinterland. There are also coal and aluminum (bauxite) fields. North Queensland is identified with sugarcane, producing about three-fourths of Australia's annual crop. Townsville serves as the commercial centre for a pastoral hinterland. Interior Queensland is the great pastoral area of the state. Here the grasslands are the largest single resource. The pastoral hinterlands produce wool, beef, and dairy cattle; crops include sugar, grains, peanuts (groundnuts), tobacco, cotton, and many temperate and tropical fruits and vegetables.

Manufacturing industry, mostly centred in Brisbane, slightly exceeds rural industry in magnitude and consists mainly of the processing of primary materials. Rapid development of mining took place in the late 1960s; minerals produced include bauxite, coal, copper, silver, lead, and zinc. Natural gas is found at Roma, and there is a small oil field at Moonie. Tourism is growing rapidly.

State industrial awards (wages and hours fixed by a state-appointed arbitration authority) cover some two-thirds of the employees in Queensland, a larger percentage than elsewhere in Australia. Notable among employee unions is the large Australian Worker's Union, covering shearing, grazing, cane farm, mill, and construction workers.

During the first period of European settlement in Queensland, from 1860 to 1890, the death rate was substantially higher than the Australian average because of tropical diseases. The diseases (believed at the time to have been carried by Asian and Pacific Island workers) were eventually eradicated, but the fears of this period fueled a policy of restrictive immigration. After 1890 the state was developed almost entirely by European labour.

Queensland is the only Australian state with a unicameral parliament, the upper house having voted itself out of existence in 1922. Voting, by universal adult suffrage, is compulsory.

Education is also compulsory between the ages of 6 and 15; correspondence schools always have been important in the remote parts of the state, and more than 10,000 children, including apprentices, are educated in this way. Universities are located in Brisbane and Townsville. The government is particularly concerned in giving equal opportunities to the 30,000 Aborigines, including some Torres Strait Islanders, who are Papuan in ancestry. The state government promotes and coordinates cultural work in remote areas.

Brisbane, the state capital, has the Queensland Symphony Orchestra, which although small is accorded high rank. Vocal music is very popular in Ipswich, where many Welsh coal miners settled. Brisbane is noted for the number of its amateur theatres.

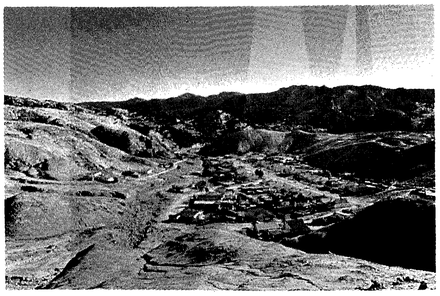
Among the medical research institutes is the Radium Institute, for the treatment of skin cancers, which are widespread in Queensland. The Royal Flying Doctor Service reaches remote farms and settlements.

Area 666,794 sq mi (1,727,000 sq km). Pop. (1981) 2,295,123.

Queenston Delta, Late Ordovician wedge of sediments that spread across an extensive area of northeastern North America and was thickest in New York and Quebec (the Ordovician Period began about 500,000,000 years ago and lasted about 70,000,000 years). The Queenston Delta was produced as sediments, eroded from a rising landmass in the present Appalachian Mountain region, were deposited by streams, and the shoreline migrated westward. Sediments were spread as far westward as the region of the present Lake Huron, over 800 kilometres (500 miles) from the region of the rising highlands. The name of the Queenston Delta is derived from the reddish shale formation, the Queenston Shale, that accumulated over the landward front of the advancing delta. Other shales that accumulated under water became gray in colour because they were not subjected to oxidation.

Queenston Heights, Battle of, Queenston also spelled QUEENSTOWN (Oct. 13, 1812), serious U.S. reverse in the War of 1812, sustained during an abortive attempt to invade Canada. On Oct. 13, 1812, Maj. Gen. Stephen Van Rensselaer, commanding a force of about 3,100 U.S. militia, sent advance units across the Niagara River. They established themselves on the steep escarpment above Queenston and at first successfully defended their position. The main body of U.S. troops, however, refused to cross the river in support. The advance party was then surrounded by the British, who captured 925 Americans. This failure, along with additional reverses on Lake Champlain, temporarily put an end to the U.S. attempt to invade Canada.

Queenstown, town, western Tasmania, Australia, in the west coast ranges, in Queen River Valley. Founded in 1897 after the discovery of gold, silver, and copper at nearby Mt. Lyell, it was named for Queen Victoria and was proclaimed a municipality in 1907. Queenstown lies on the Lyell Highway to the port of Strahan (25 mi [40 km] west) and Hobart (158 mi east). Most of the town's work force is employed in the mines at Mt. Lyell, and the town has concentration, smelting, and refining facilities for processing the ore. Before new ore treatment methods were introduced in 1952, the surrounding hills were stripped of their timber for fuel. Fumes emitted from the smelter killed whatever vegetation remained, and this, coupled with erosion, has left a lunar-like landscape around the town. The regeneration of plant life has since been slow. Pop. (1981) 3,714.



Queenstown, Tasmania
B. Brander—Photo Researchers/EB Inc.

Queenstown, town, eastern Cape Province, South Africa, in an upper valley of the Groot-Kei River. It has a distinctive hexagonal shape, designed by its founder Sir George Cathcart (1853) as a precaution against tribal attack. Queenstown is a regional administrative and cultural centre with state educational institutions, particularly for girls, and scenic public gardens. Within a temperate plateau area often covered by tall native grasses, it is the distributing point for a prosperous wheat-, cattle-, and wool-producing district and has diversified manufactures. The not internationally recognized black states of Transkei (east) and Ciskei (southwest) are nearby. Pop. (1983 est.) 58,870.

Queiroz, Rachel de (b. Nov. 17, 1910, Fortaleza, Braz.), novelist of the Northeastern school of Realism and one of the most highly esteemed women of Brazil.

She was reared on a ranch in the semi-arid backlands of northeastern Brazil. Her works describe the shock of periodic droughts, bandits, backland mystics, and forgotten men of her native Ceará. She has characterized her style as a "free and easy countrywoman's way of saying things." Her first book, *O Quinze* (1930; "The Year '15"), deals with families forced to abandon their homes in the drought of 1915, with special sympathy for the role of women in this semifeudal society. *João Miguel* (1932) is about a poor mestizo (Indian-Portuguese-Negro) who wakes up in jail to learn he has killed a wretch as unfortunate as himself in a drunken brawl. *As Três Marias* (1939; *The Three Marias*, 1963) which follows the lives of three girlhood friends from their meeting in a convent school to adulthood, exposes both the inadequate educational system and the limited role allowed to women in Brazilian society.

She also wrote plays, *Lampião* (1953; 3rd ed. rev., 1979), about the antics of a legendary bandit, and *A Beata Maria do Egito* (1958; "Blessed Mary of Egypt"), which relates the legend of the martyr Saint Maria Egipciaca to the conflicts experienced in a small Brazilian backland town. She acquired a mass audience for her brief journalistic essays on subjects of general interest, published in collections including *O Brasileiro Perplexo* (1963). She was the first Brazilian woman to be offered a place in the Cabinet (minister of education and culture under Jânio Quadros in 1961), which she declined. Her *O Cacador de Tatu* (1967, "The Armadillo Hunter") is a selection of chronicles of her life from the mid-1950s. Later works include *Dora, Doralina* (1975) and *João Miguel: 1932–1972* (1973). Queiroz was awarded the Machado de Assis Prize of the Brazilian Academy of Letters for her life's work.

Queiroz Law (1850), measure enacted by the Brazilian parliament to make the slave trade illegal. In the mid-19th century the British government put pressure on Brazil to halt traffic in West African slaves, 150,000 of whom had arrived in Brazil in 1847–49. The government of the Brazilian emperor Pedro II, while not in favour of the slave trade, resented what it viewed as high-handed British methods to halt it. The Brazilian parliament ended the slave trade in 1850, after British warships had seized some slave ships in Brazilian harbours. Slavery within Brazil, however, was not abolished until 1888. *See also* Rio Branco Law.

quelea, also called RED-BILLED QUELEA, or DIOCH (*Quelea quelea*), small brownish bird of Africa, belonging to the family Ploceidae (*q.v.*; order Passeriformes). It occurs in such enormous numbers that it often destroys grain crops and, by roosting, breaks branches. Efforts to control quelea populations with poisons, napalm, pathogens, and electronic devices have had poor success; but dynamiting the dense colonies, which may contain more than 2,000,000 pairs in less than 50 hectares (125 acres), has achieved local control.

Queleas breed in thorn-scrub country: every bush and tree for miles around may contain hundreds of their globular nests, which are built by the males (black-faced, with pinkish foreparts at that season). Each pair has two or three young, which within the year may wander hundreds of miles and breed in their turn.

The "locust bird" plague has been the indirect and complicated result of man's exploitation

Male quelea (*Quelea quelea*), in pinkish breeding plumage
Bruce Coleman Ltd.

of marginal land for stock raising and of the large-scale cultivation of grains.

Quelimane, town, seaport, and capital of Zambézia province, Mozambique, East Africa, situated near the mouth of the Rio dos Bon Sinais River, on the Indian Ocean. One of the oldest settlements in the province, it was founded by the Portuguese as a trading station in 1544 and in the 18th and 19th centuries it had a slave market. Quelimane became a Portuguese colonial town in 1761 and two years later was established as a *concelho* (municipality). Sisal plantations were organized by German planters in the beginning of the 20th century. A Mozambican-Japanese fishing enterprise has its headquarters in Quelimane and fishing is an important industry along the coast. Serving as a terminus of a railway line extending northward to the Mocuba area, the city also exports tea, sugar, sisal, corn (maize), cotton, tobacco, copra, and coir. Quelimane has one of the world's largest coconut plantations covering about 50,000 ac (20,230 ha) and having 4,000,000 coconut palms. Pop. (1970 prelim.) 71,786.

Quelpart Island (South Korea): *see* Cheju-do.

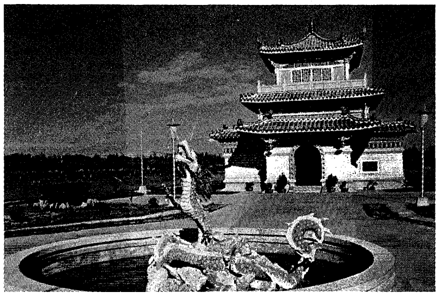
Queluz, town and palace, Lisboa district, Portugal, just northwest of Lisbon. During the 17th century the site was occupied by estates owned by Lisbon nobility. Queluz is known for the Palácio de Queluz. A Rococo edifice built between 1747 and 1794 for Dom Pedro III and his consort, Queen Maria I, it was also the royal residence of Dom João VI

Palácio de Queluz, Queluz, Port.
Ewing Galloway

and Dom Miguel. Restored after being partially destroyed by fire in 1934, the palace is still used for official receptions and includes an exquisite restaurant and a monument to Maria I. Pop. (1981) 42,094.

Quemoy Island, Chinese CHIN-MEN TAO, also spelled KINMEN TAO, island of Taiwan in the Formosa Strait at the mouth of Amoy Bay, People's Republic of China, and 184 mi (296 km) northwest of Kao-hsiung, Taiwan. It has an area of 51 sq mi (132 sq km). Once part of Fukien Province, the island was occupied by the Nationalist Chinese when they were driven from the mainland by Chinese Communist forces to Taiwan in 1949. With Matsu Island, Quemoy was heavily bombarded from the mainland in 1958, an incident that caused the redeployment of the U.S. 7th Fleet and provoked an international diplomatic crisis. Its ownership still contested, the island remained a Nationalist military outpost.

Quemoy is the main island of a group of 12, the Quemoy Islands, which compose Chin-men *hsien* (county). While most of the smaller islands are low and flat, Quemoy Island itself is hilly, with both a tableland and rocky areas. Farming, the main occupation, produces sweet potatoes, peanuts (groundnuts), sorghum, barley, wheat, soybeans, vegetables, and rice. In the 1960s and 1970s, the Taiwan government enhanced production



Ku Wang gate house, Quemoy Island
AP/Wide World Photos

through programs of dam and reservoir construction, irrigation, reforestation, and fishery development. Sorghum liquor (kaoliang) is a significant export. The all-weather port of Shuitou, on the south coast, serves the main town, Quemoy. Pop. (1982 est.) 50,272.

quenching, rapid cooling, as by immersion in oil or water, of a metal object from the high temperature at which it has been shaped. This usually is undertaken to maintain mechanical properties associated with a crystalline structure or phase distribution that would be lost upon slow cooling. The technique is commonly applied to steel objects, to which it imparts hardness. On the other hand, copper objects that have become hardened by hammering or other deformation at ordinary temperatures can be restored to the malleable state by heating and quenching. *Compare* annealing; tempering.

Queneau, Raymond (b. Feb. 21, 1903, Le Havre, Fr.—d. Oct. 25, 1976, Paris), French author who, under the mask of a humorist, produced some of the most important prose and poetry of the mid-20th century.

After working as a reporter for *L'Intransigeant* (1936–38), he became a reader for the prestigious *Encyclopédie de la Pléiade,* a scholarly edition of past and present classical authors, and by 1955 was its director.

From Queneau's Surrealist period in the 1920s he retained a taste for verbal juggling, a tendency toward black humour, and a derisive posture toward authority. The puns, sneers, spelling extravaganzas, and other bizarre linguistic contortions concealed a total pessimism, an obsession with death. His corrosive laughter rang out in the seemingly light verse of his childhood reminiscences in *Chêne et chien* (1937), a novel in verse, and in more philosophical poems: *Les Ziaux* (1943), *Petite Cosmogonie portative* (1950), and *Si tu t'imagines* (1952).

The pattern of his novels was similar: from a familiar setting—whether a suburb with its little cafés, or an amusement park, or a Paris subway—emerged the vision of an absurd world. Such is the format of *Le Chiendent* (1933; *The Bark Tree,* 1968); *Zazie dans le métro* (1959; *Zazie,* 1960), probably his best known work (filmed 1960); *Les Fleurs bleues* (1965; *The Blue Flowers,* 1967); and *Le Vol d'Icare* (1968; *The Flight of Icarus,* 1973). These chronicles of simple people are recounted in pyrotechnical language that ranges from everyday slang to the loftiest poetic diction. Queneau was an enigmatic and versatile Humanist whose rhetorical games had the depth and wit of a latter-day Rabelais.

Quennell, Peter (Courtney) (b. March 9, 1905, London), British translator, editor, biographer, and critic, who was an authority on Lord Byron and John Ruskin.

Quennell was educated at Balliol College, Oxford. After practicing journalism in London, he taught at the Tokyo Bunrika Daigaku (Tokyo University of Science and Literature), Japan, in 1930, but resigned after a year and returned to writing in London. He was editor of the literary and artistic periodical *The Cornhill Magazine* (1944–51) and was editor of the monthly journal *History Today* from 1951.

Among Quennell's most notable works are translations of letters from Princess Lieven to the 19th-century Austrian statesman Metternich (1948); critical works such as *Aspects of Seventeenth Century Verse* (1933); and critical and biographical works on Byron, Ruskin, Charles Baudelaire, Alexander Pope, Queen Caroline (the consort of George II), Thomas More, and Vladimir Nabokov. His autobiography consists of *Marble Foot* (1968) and *The Wanton Chase* (1980).

Quenstedt, Friedrich August (b. July 9, 1809, Eisleben, Saxony—d. Dec. 21, 1889, Tübingen, Ger.), German mineralogist and paleontologist. Quenstedt studied at the University of Berlin under the crystallographer Christian Weiss and the geologist Leopold von Buch. From 1837 he was professor at the University of Tübingen, where he conducted his notable research. By differentiating ammonite fossils, Quenstedt determined the stratigraphic sequence of rocks formed during the Jurassic Period in the Swabian region of southern Germany. He considered species to be indistinctly defined, a view that conflicted with the prevailing doctrine of catastrophism held by many of his contemporaries. He published his highly regarded *Petrefaktenkunde Deutschlands* ("Paleontology of Germany") in seven parts (1846–84).

Quental, Antero Tarquínio de (b. April 18, 1842, Ponta Delgada, Azores—d. Sept. 11, 1891, Ponta Delgada), Portugese poet who was a leader of the Generation of Coimbra, a group of young poets associated with the University of Coimbra in the 1860s who revolted against Romanticism and struggled to create a new outlook in literature and society.

Quental, detail of a portrait by Columbano, 1889; in the National Museum of Contemporary Art, Lisbon
By courtesy of the Museu Nacional de Arte Contemporanea, Lisbon

He came from an aristocratic family that included writers and mystics, and Quental himself had mystical leanings that pervaded his poetry. Between 1858 and 1864, while studying law at Coimbra, he wrote his romantic early poems, *Raios de Extincta Luz* ("Rays of Vanishing Light") and the delicate lyrics published in 1872 as *Primaveras Românticas* ("Romantic Springtimes"). These were soon followed by *Odes Modernas* (1865), a volume that won him intellectual and moral ascendancy among his fellow students. His pamphlet *Bom-senso e Bom-gosto* (1865; "Good Sense and Good Taste"), attacking the hidebound formalism of Portuguese literature, marked the opening of a war against the older literary generation that was waged until 1871, when a series of "democratic lectures," organized by Quental and held in the Lisbon Casino, dealt the deathblow to Romanticism.

After leaving Coimbra, Quental tried a job as a typographer, first in Lisbon and then (1867) in Paris. Six months of working-class life disillusioned him, and eventually ill health forced him to return to Portugal. After a trip in a sailboat to the United States and Canada (1869), he went back to Lisbon, where he engaged in propaganda activities on behalf of the workers and collaborated in the attempt to organize the First International (first international federation of working-class parties) in Portugal. He was influenced by the Socialist theories of Pierre-Joseph Proudhon and edited a Socialist journal.

Amid all this activity, Quental was troubled by increasing discontent. He abandoned many cherished projects and tore up his early poems. He developed a spinal disease for which treatment gave only temporary relief. During a period of renewed calm he wrote some of his last and finest sonnets.

In 1881 he retired to Vila do Conde, near Porto, to supervise the upbringing of two orphan girls he had adopted. He continued to be informed of political developments through his close friend, the historian Oliveira Martins. On a visit to his family in Ponta Delgada, suffering from physical pain, insomnia, and acute depression, he killed himself.

As a poet Quental made few formal innovations. He was a master of the sonnet, and the 109 sonnets of *Os Sonetos Completos* (1886) are a history of his spiritual progress, giving expression to both his personal anxieties and the larger ideological issues of the day. *Sonnets and Poems* (1922), translated by S. Griswold Morley, was reprinted in 1977.

Quepolicán (Araucanian chief): *see* Caupolicán.

Querandí, South American Indians who inhabited the Argentine Pampas between Cabo Blanco on the Atlantic coast and the Córdoba Mountains on the western shores of the Río de la Plata. Their language has been entirely lost. Little is known of the Querandí other than their similarity to related types of plains nomads (*see* South American Nomad Cultures). They were hunters and gatherers, catching game with bolas and fish with nets. The adoption of the horse transformed Querandí life, as it did that of other plains Indians. They formed large nomadic bands and made war against other Indians and against the Spaniards. The Querandí disappeared from history after 1678. They either became totally extinct or survived under the name of Pampa Indians.

Queranus OF CLONMACNOISE, SAINT: *see* Ciaran of Clonmacnoise, Saint.

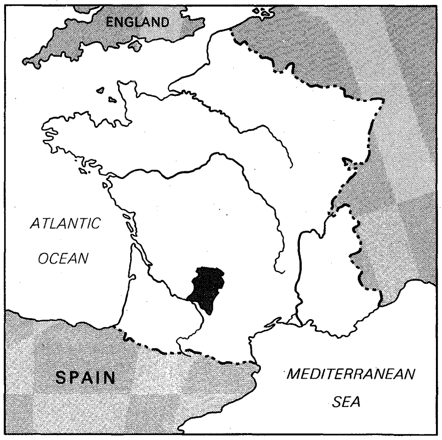
Quercetanus, Andreas: *see* Duchesne, André.

Quercia, Jacopo della: *see* Jacopo della Quercia.

quercitron bark, inner bark of the black oak, *Quercus velutina,* which contains a colouring matter used to dye wool bright yellow or orange. At one time this colorant was used with cochineal to produce scarlets of particular brilliance.

To obtain the colouring matter, the exterior bark is shaved from the tree, which is native to the middle and southern U.S., to expose the inner bark, which is then detached, ground, and subjected to hot water under pressure. The extract deposits a crude quercetin known commercially as yellow flavine. A second variety, known as red flavine, is deposited when an extract of the bark is digested at the boil with dilute acid. These products are used to dye wool mordanted (fixed) with aluminum or tin compounds to bright shades of yellow and orange.

Quercy, historic and cultural region encompassing most of the southwestern French *départements* of Lot and Tarn-et-Garonne and coextensive with the former district of Quercy. The district was organized in Gallo-Roman times as a *civitas* of the Cadurci, a Celtic people whose name is reflected in that of Quercy. It was occupied by the Visigoths in the 5th century and by the Franks in the 6th century. By the Anglo-French Treaty of Paris (1259), the English king received some ill-defined rights in the area, which led to disputes, first diplomatic, then military, between England and France. The French ceded Quercy to England by the Treaty of Brétigny (1360), but the English were finally expelled in 1443 during the last phase of the Hundred Years' War. The district was later included in the French *gouvernement* of Guyenne. In the 16th-century Wars of Religion, Quercy was savagely contested between Catholics and Huguenots; in the 1620s Montauban, one of Quercy's chief towns, became a major centre of Huguenot resistance.



The county of Quercy (or Cahors) *c.* 1035

From W. Shepherd, *Historical Atlas,* Harper & Row, Publishers (Barnes & Noble Books), New York; revision Copyright © 1964 by Barnes & Noble, Inc.

The region comprises a dry limestone plateau (French *causse*) not much used for agriculture but well forested with the oaks (genus Quercus) that give their name to the region. The traditional farmstead has two stories which are linked by an outside stairway. There is often a porch at the top of the stairway. Living quarters are located on the ground floor, which is known as the *cave;* provisions and tobacco are stored above. Dovecotes built between 1750 and 1850 are scattered throughout the countryside. Pigeons were raised for their droppings, which were used to fertilize farmland. Wills made provision for the division of the manure among heirs. Stone walls built by shepherds fragment the countryside of the Causses in Lot.

Quercy is predominantly Roman Catholic, though there is a substantial Protestant enclave in Montauban. Truffles are unearthed in Lot around Lalbenque, Sauzet, Limogne-en-Quercy, and Cahors. Vineyards around Cahors produce a rich red wine which should be aged for 2 to 3 years in a cask and for 10 years in a bottle. Souillac, Saint-Céré, and Sousceyrac also produce fine wines. Occitan continues to be spoken by much of the population.

Querétaro, state, central Mexico. It is bounded north and northeast by San Luis Potosí, southeast by Hidalgo and Mexico, southwest by a corner of Michoacán, and west by Guanajuato. Situated on the central plateau, its 4,420-sq-mi (11,449-sq-km) territory is almost evenly divided between mountainous, mineralized areas in the north and rolling plains and fertile valleys in the south that form part of Mexico's Bajío region. The Otomí-Chichimec Indians occupying the region were conquered in 1531, and Spanish colonization began in the 1550s. Querétaro was administered with Guanajuato before it became a state in 1824. Although deposits of gold, copper, lead, tin, and other metals occur in the state, the chief mineral products are opals and mercury. In the southern lowlands a variety of crops are cultivated, including fruits, grains, medicinal plants, and sweet potatoes. The breeding of fighting bulls is also an important activity. The main Ciudad Juárez–Mexico City highway and railroad traverse the state, linking Querétaro (*q.v.*) city, the state capital, with other plateau cities. Pop. (1980) 740,000.

Querétaro, city, capital of Querétaro state, central Mexico. Situated on the Mexican

The aqueduct leading into Querétaro city, Mex.

W.H. Hodge

Plateau, 6,119 ft (1,865 m) above sea level and 162 mi (261 km) by highway and railroad northwest of Mexico City, it is considered an excellent example of a Spanish colonial city. It was founded by the Otomi Indians and was incorporated into the Aztec Empire in 1446. Until 1531, when it was brought under Spanish control, it served as an Otomi outpost against the warlike tribes to the north. Throughout most of the colonial period, Querétaro was important primarily as a way station and supply centre serving the rich mining districts of Guanajuato and Zacatecas. Colonial buildings include the cathedral (restored several times), the federal palace, and the churches of Santa Rosa, Santa Clara, and San Agustín. The city's 5-mi-long aqueduct, borne on piers 46 ft thick, was built in 1726–38. In 1810 Querétaro was the scene of a plot against Spain that led to the uprising headed by Miguel Hidalgo y Costilla in September of that year. In 1848 the Treaty of Guadalupe Hidalgo, terminating the Mexican War, was signed there. The forces of Benito Juárez defeated those of Emperor Maximilian at Querétaro in 1867; and on a nearby hill Maximilian and his generals faced the firing squads. The Mexican Constitution of 1917 was written in Querétaro, which was also the birthplace of the National Revolutionary Party of Mexico (1929), the dominant political force in the republic.

One of Mexico's oldest and largest cotton factories is located in Querétaro, which also produces textiles and pottery and processes crops cultivated in the agricultural hinterland. The Autonomous University of Querétaro (1951) is located in the city. It is at the junction of three main railway lines to Mexico City, to which it is also linked by highway and air. Pop. (1980) 178,000.

Querido, Israël (b. Oct. 1, 1872, Amsterdam—d. Aug. 5, 1932, Amsterdam), Dutch novelist of the Naturalist movement in The Netherlands, whose novels provide valuable social documentary material. After being employed as a diamondworker, Querido decided to live in close contact with the working classes. By minutely observing them, he was able to reproduce exactly their way of life and their speech style in, for example, *De Jordaan* (1914), a long epic in four parts.

Socialist elements are evident in his treatment of the human condition in such novels as *Menschenwee* (1903; *Toil of Men,* 1909), a detailed description of the miseries he witnessed among the people of Beverwijk, where he was then living. He also wrote historical novels—*e.g., De oude wereld* (1919; "The Old World"), in which his rather heavy style is especially obvious.

quern, ancient device for grinding grain. The saddle quern, consisting simply of a flat stone bed and a rounded stone to be operated manually against it, dates from Neolithic times (before 5600 BC). The true quern, a heavy device worked by slave or animal power, appeared by Roman times. Cato the Elder describes a 2nd-century-BC rotary quern consisting of a concave lower stone and a convex upper, turned by a pair of asses. Many such large querns were found in the ruins of Pompeii. The upper stone was set on a spindle that fitted into the lower. The ground grain passed down through holes in the lower stone.

Great querns excavated at Pompeii
Brown Brothers

Querneus, Andreas: *see* Duchesne, André.

Quervain, Marcel Roland de (b. May 17, 1915, Zürich), Swiss glaciologist known for his fundamental work on the metamorphism and physical properties of snow.

Quervain was assistant director (1943–50), director (from 1950), and titular professor (from 1969 until his retirement in 1980) of the Swiss Snow and Avalanche Research Institute. He offered major contributions in the development of avalanche warning systems and methods of treating snow problems. In 1959 was a member of the International Glaciological Expedition to Greenland, where he studied the stratification and structure of the ice sheet. He served as vice president of the International Association for Scientific Hydrology from 1968 to 1971, and in 1975 Quervain was elected president of the International Glaciological Society.

Quesnay, François (b. June 4, 1694, near Paris—d. Dec. 16, 1774, Versailles, Fr.),

Quesnay, engraving by J.G. Wille after a portrait by J. Chevallier
By courtesy of the Bibliotheque Nationale, Paris

French economist and intellectual leader of the Physiocrats, the first systematic school of political economy.

Quesnay was consulting physician to King Louis XV at Versailles, where he developed an interest in economics. However, he did not publish his first book on the subject until he was in his 60s. With the support of Mme de Pompadour, he and Jean de Gournay attracted the Secte des Économistes, whose members looked to Quesnay as their leader.

Quesnay's system of political economy was summed up in his *Tableau économique* (1758), which displayed diagrammatically the relationship between the different economic classes and sectors of society and the flow of payments among them. In his *Tableau* Quesnay developed the assumption of economic equilibrium, a concept used as a point of departure for much subsequent economic analysis. Of especial importance was his analysis of capital as *avances,* or a stock of wealth that had to be accumulated in advance of production. His classification of these *avances* distinguished between fixed and circulating capital. Quesnay believed savings to be possibly harmful, because if they were uninvested they might disturb the equilibrium of the flow of payments. His analysis is similar to that of J.M. Keynes almost two centuries later.

The methodology of Quesnay's physiocratic system and his principles of policy sprang from an extreme form of the doctrine of natural law. Acceptance of that doctrine led him to proclaim that laissez-faire in economics followed the natural law and therefore represented the divinely appointed economic order. He was, indeed, one of the originators of the 19th-century doctrine of the harmony of class interests and of the related doctrine that the maximum social satisfaction occurs under free competition.

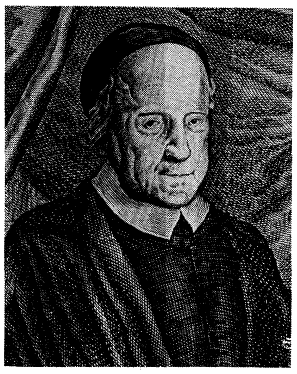
Quesne, Abraham Duquesne, marquis du: *see* Duquesne, Abraham.

Quesnel, town, south central British Columbia, Canada, at the confluence of the Quesnel and Fraser rivers, 411 mi (661 km) north of Vancouver. The river and townsite (Quesnellemouth until 1864) were named for Jules Maurice Quesnelle, who accompanied Simon Fraser's exploring party in 1808. The settlement grew during the Cariboo gold rush of 1862. It is now the service centre for an extensive lumbering, farming, and mining area, and its main industrial establishment is a plywood plant. Tourism has developed mainly because of improved road conditions and the restoration of the historic Barkerville gold-mining area to the east. Quesnel also serves as base for anglers and big-game hunters. Inc. village, 1928; town, 1958. Pop. (1981) 8,240.

Quesnel, Pasquier (b. July 14, 1634, Paris—d. Dec. 2, 1719, Amsterdam), controversial French theologian who led the Jansenists (followers of Bishop Cornelius Jansen's heretical doctrines on predestination, free will, and grace) through the persecution by King Louis XIV of France until they were papally condemned.

Quesnel joined the French Oratory (a religious society of secular priests) in 1657 and was ordained in 1659. His Jansenist sympathies led to his banishment from Paris in 1681, and three years later he was expelled from the Oratory for refusing to accept the anti-Jansenist decrees it promulgated. He fled to Brussels where he lived with the exiled Antoine Arnauld, champion of the Jansenist resistance, until Arnauld's death in 1694. In 1703 he was arrested but soon escaped to Amsterdam, where he finally settled.

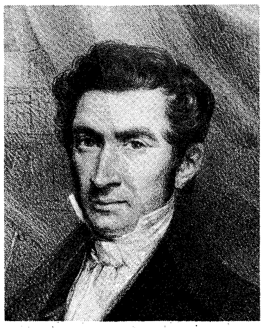
Quesnel's *Nouveau Testament en français avec des réflexions morales* (1692; "New Testament in French with Thoughts on Morality") was a major contribution to the literature of Jansenism, but it caused serious repercussions. It rekindled doctrinal conflicts between the Jansenists and the papacy, which were further complicated by the intervention of Louis XIV. Pope Clement XI's bull *Unigenitus* (1713)—prompted by Louis—condemned 101 sentences from the *Réflexions morales,* yet Quesnel never admitted that his opinions



Quesnel, engraving by Gilbert Schouté, 1717
H. Roger-Viollet

were heretical. Quesnel's correspondence was edited by A. Le Roy (2 vol., 1900).

Quetelet, (Lambert) Adolphe (Jacques) (b. Feb. 22, 1796, Ghent—d. Feb. 17, 1874, Brussels), Belgian mathematician, astronomer, statistician, and sociologist known for his application of statistics and the theory of probability to social phenomena.



Quetelet, detail of an engraving by Jean-Baptiste Madou, 1839
By courtesy of the Bibliotheque Royale, Brussels

Quetelet studied astronomy at the Observatory of Paris and the theory of probability under Pierre-Simon Laplace. He lectured at the Brussels Athenaeum, military college, and museum. He founded (1828) and directed the Royal Observatory, Brussels; served as perpetual secretary of the Belgian Royal Academy (1834–74); and organized the first International Statistical Congress (1853). For the Dutch, and later the Belgian, government he collected and analyzed statistics on crime, mortality, and other subjects and devised improvements in census taking. He also developed methods for simultaneous observations of astronomical, meteorological, and geodetic phenomena from scattered points throughout Europe.

In *Sur l'homme* (1835; *A Treatise on Man and the Development of His Faculties,* 1842), republished in 1869 as *Physique sociale*, he presented his conception of the *homme moyen* ("average man") as the central value about which measurements of a human trait are grouped according to the normal probability curve. His studies of the numerical constancy of such presumably voluntary acts as crimes stimulated extensive studies in "moral statistics" and wide discussion of free will versus social determinism.

In trying to discover through statistics the causes of acts in society, Quetelet conceived of the relative penchant (propensity; *e.g.,* to crime) of specific age groups. This idea, like his *homme moyen*, evoked great controversy among social scientists in the 19th century.

Quetico Provincial Park, wilderness park, southwestern Ontario, Canada, west of Lake Superior and adjoining the U.S. border. Established in 1913, the park has an area of 1,832 sq mi (4,744 sq km). The region was formerly the site of a major east–west route used by Indians, explorers, and traders. Parts of the 19th-century Dawson Trail, used by immigrants to reach the western prairies, can still be seen there. Access to Quetico is by canoe from points on its perimeter, and the only means of travel within the park is by its more than 1,000 lakes and waterways. The park is the site of Indian pictographs. The abundant wildlife includes black bear, moose, wolf, and white-tailed deer; fishes include lake trout, northern pike, pickerel (walleye), bass, and sturgeon.

Quetlavaca (Aztec ruler): *see* Cuitláhuac.

Quetta, also spelled KWATAH, city, district, and division of Baluchistan Province, Pakistan. The name is a variation of *kwatkot,* a Pashto word meaning "fort," and the city is still locally known by its ancient name of Shāl or Shālkot.

The city is the divisional and district headquarters and is an important marketing and communications centre at the north end of the Shāl Valley about 5,500 ft (1,675 m) above sea level. It is the southernmost point in a line of frontier posts and in the system of strategic roads and railways near the northwest (Afghanistan) border. Commanding the Bolān and Khojak passes, Quetta was occupied by the British in 1876; a residency was founded by Sir Robert Sandeman, and the town developed around its strongly garrisoned army station. Incorporated as a municipality in 1896, its Army Command and Staff College was opened in 1907. A violent earthquake partially destroyed the city in May 1935, with a loss of 20,000 lives. Now a market centre for western Afghanistan, eastern Iran, and part of Central Asia, its industries include cotton mills, a sulfur refinery, coke briquetting plants, a thermal power station, and fruit canneries. The city is the site of a geophysical institute, the Geological Survey of Pakistan, Sandeman Library, and two government colleges affiliated with the University of Peshāwar. The University of Baluchistan was established at Quetta in 1970. The city is also an important summer resort.

Quetta district is bounded north by Pishīn district, west by Afghanistan, east by Sibi district, and south by Kalāt and Chāgai districts. Physically it comprises a series of long valleys 4,500–5,500 ft above sea level enclosed by the Central Brāhui range in the south and drained by the Pishīn Lora River and its tributaries. Its climate is dry and temperate and suitable for valley cultivation of grapes, peaches, plums, apricots, apples, almonds, pears, and pomegranates. Wheat, barley, and corn (maize) are common crops; juniper and pistachio forests abound. Horse breeding is widespread. Felts, rugs, silk embroidery, and copper vessels are local handicrafts.

Quetta division (area 53,115 sq mi), constituted in 1955, comprises the districts Quetta, Pishīn, Zhob, Loralai, Sibi, and Chāgai. Mostly mountainous, it is bounded east by the Sulaimān Range and north by the Toba Kākar Range, separating it from Afghanistan. South of Chaman (near the Afghan border) are the Khawāja Amrān and Sarl Ath ranges. Across the former lies the famous Khojak Pass with the Shelabāgh railway tunnel piercing 2.5 mi (4 km) of solid rock. From Nushki (southwest of Quetta city) to Dālbandin (southwest of Nushki), the division consists of a sandy level plain; and farther west beyond Dalbandin, Chāgai district is mainly desert. The Zhob and Pishīn Lora are the chief rivers. Rainfall is scarce, cultivation depending mostly on irrigation from *kārez*es (underground channels) in the submontane area, springs and streams in the highlands, and wells in parts of Sibi Plain. Wheat is the main *rabī* (spring) crop, *jowār* (sorghum) is the chief *kharīf* (autumn) crop in the plains and corn (maize) in the highlands. Potato growing is also increasing. Coking coal is mined at Khost in Sibi and in the Sor Range east of Quetta city. Chromite, sulfur, marble, and gypsum deposits are also worked. Pop. (1981 prelim.) city, 285,800; metropolitan area, 373,000; district, 380,000; division, 1,625,000.

quetzal, any of several birds belonging to the genus *Pharomachrus* of the trogon family. *See* trogon.

Quetzalcóatl (from Nahuatl *quetzalli,* "precious feather," and *coatl,* "snake"), the Feathered Serpent, one of the major deities of the ancient Mexican pantheon. Representations of a feathered snake occur as early as the Teotihuacán civilization (3rd to 8th century AD) on the central plateau. At that time, Quetzalcóatl seems to have been conceived as a vegetation god—an earth and water deity closely associated with the rain god Tlaloc.

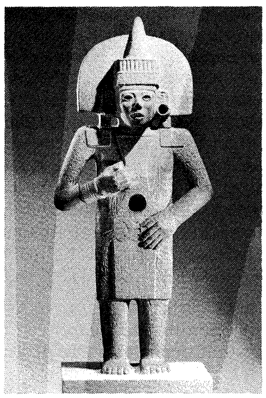
With the immigration of Nahua-speaking tribes from the north, Quetzalcóatl's cult underwent drastic changes. The subsequent Toltec culture (9th through 12th centuries), centred at the city of Tula, emphasized war and human sacrifice linked with the worship of heavenly bodies. Quetzalcóatl became the god of the morning and evening star, and his temple was the centre of ceremonial life in Tula.

In Aztec times (14th through 16th centuries) Quetzalcóatl was revered as the patron of priests, the inventor of the calendar and of books, and the protector of goldsmiths and other craftsmen; he was also identified with the planet Venus. As the morning and evening star, Quetzalcóatl was the symbol of death and resurrection. With his companion Xolotl, a dog-headed god, he was said to have descended to the underground hell of Mictlan to gather the bones of the ancient dead. Those bones he anointed with his own blood, giving birth to the men who inhabit the present universe.

One important body of myths describes Quetzalcóatl as the priest-king of Tula, the capital of the Toltecs. He never offered human victims, only snakes, birds, and butterflies. But the god of the night sky, Tezcatlipoca (*q.v.*), expelled him from Tula by performing feats of black magic. Quetzalcóatl wandered down to the coast of the "divine water" (the Atlantic Ocean) and then immolated himself on a pyre, emerging as the planet Venus. According to another version, he embarked upon a raft made of snakes and disappeared beyond the eastern horizon.

The legend of the victory of Tezcatlipoca over the Feathered Serpent probably reflects historical fact. The first century of the Toltec civilization was dominated by the Teotihuacán culture, with its inspired ideals of priestly rule and peaceful behaviour. The pressure of the northern immigrants brought about a social and religious revolution, with a military ruling class seizing power from the priests. Quetzalcóatl's defeat symbolized the downfall of the Classic theocracy. His sea voyage to the east should probably be connected with the invasion of Yucatán by the Itzá, a tribe that showed strong Toltec features. Quetzalcóatl's calendar name was Ce Acatl (One Reed). The belief that he would return from the east in a One Reed year led the Aztec sovereign Montezuma II to regard the Spanish conqueror Hernán Cortés and his comrades as divine envoys, because 1519, the year in which they landed on the Mexican Gulf coast, was a One Reed year.

In addition to his guise as a plumed serpent, Quetzalcóatl was often represented as a man



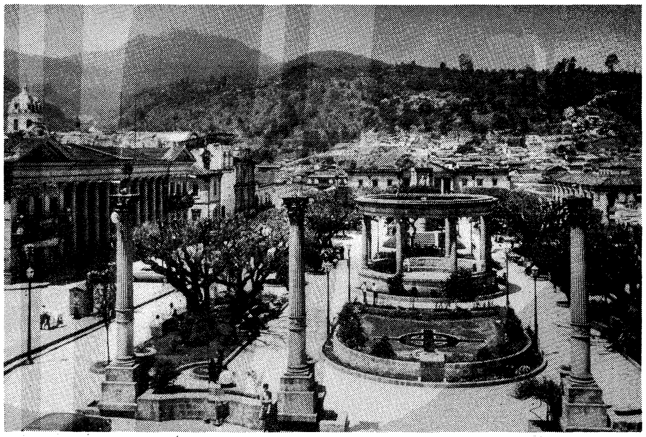
Quetzalcóatl, limestone figure of the Huastec culture, Mexico, AD 900–1250; in The Brooklyn Museum, New York
By courtesy of The Brooklyn Museum, New York, Henry L. Batterman and Frank S. Benson Funds

with a beard; as Ehécatl, the wind god, he was shown with a mask with two protruding tubes (through which the wind blew) and a conical hat typical of the Huastec tribe of northeastern Mexico. The temple of Quetzalcóatl at Tenochtitlán, the Aztec capital, was a round building, a shape that fitted the god's personality as Ehécatl. Circular temples were believed to please Ehécatl because they offered no sharp obstacles to the wind. Round monuments occur particularly often in Huastec territory.

Quetzalcóatl ruled over the days that bore the name *ehécatl* ("wind") and over the eighteenth 13-day series of the ritual calendar. He was also the ninth of the 13 gods of the daytime hours. Although he was generally listed as one of the first-rank deities, no ceremonial month was dedicated to his cult.

As the god of learning, of writing, and of books, Quetzalcóatl was particularly venerated in the calmecac, religious colleges annexed to the temples, in which the future priests and the sons of the nobility were educated. Outside of Tenochtitlán, the main centre of Quetzalcóatl's cult was Cholula, on the Puebla plateau.

Quetzaltenango, formerly QUEZALTENANGO, capital, Quetzaltenango department, southwestern Guatemala, 7,656 feet (2,334 m) above sea level near the foot of the Santa María Volcano. The city's high elevation causes the temperature to drop below freezing in the dry season. It is near the site of the battle in which the Spanish and their Indian allies from Mexico decisively defeated the Quiché Indians in 1524. Before the conquest, Quetzaltenango had been the capital of a Quiché kingdom known as Xelajú; Santa María Volcano, now dormant, destroyed the city in 1902. Now Guatemala's second largest city, Quetzaltenango is a centre for trade between the coast and the highlands, and a processing centre with textile factories, mills, and breweries. The city has preserved much of its dignified Neoclassical architecture. There are several university faculties, and many of Guatemala's best-known scholars, writers, and musicians have lived there. It is linked to Guatemala City, 70 miles (110 km) to the east, by paved highway and by air. Pop. (1989 est.) mun., 88,769.



Central American Park, Quetzaltenango, Guat.
Walter Aguiar—EB Inc.

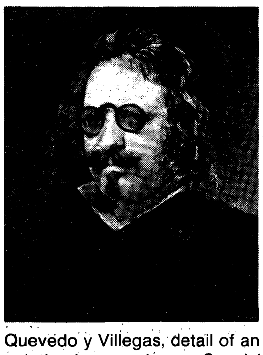
queuing theory, also called WAITING-LINE THEORY, element in operations research and management science that deals with the problem of providing adequate but economical service facilities involving unpredictable numbers and times or similar sequences. In queuing theory the term customers is used, whether referring to people or things, in correlating such variables as how customers arrive, how service meets their requirements, average service time and extent of variations, and idle time. When such variables are identified for both customers and facilities, choices can be made on the basis of economic advantage.

Queuing theory is a product of mathematical research that grew largely out of the need to determine the optimum amount of telephone switching equipment required to serve a given area and population. Installation of more than the optimum requires excessive capital investment, while less than optimum means excessive delays in service.

Quevedo y Villegas, Francisco Gómez de (b. Sept. 17, 1580, Madrid, Spain—d. Sept. 8, 1645, Villanueva de los Infantes), poet and master satirist of Spain's Golden Age, who, as a virtuoso of language, is unequaled in Spanish literature.

Quevedo was born to a family of wealth and distinction. He studied at the universities of Alcalá and Valladolid from 1596 to 1606, was versed in several languages, and by the age of 23 had distinguished himself as a poet and wit. His elder contemporaries, Miguel de Cervantes and Lope de Vega, both expressed their esteem for his poetry, but Quevedo was more interested in a political career. In 1613 he became a counsellor to the Duke de Osuna, viceroy of Sicily and later of Naples, whom he served with distinction for seven years. On the ascension of Philip IV of Spain, Osuna fell from favour and Quevedo was placed under house arrest. He thereafter refused political appointment and devoted himself to writing, producing a steady stream of satirical verse and prose aimed at the follies of his contemporaries. In 1639 he was again arrested, supposedly for a satirical poem, and was confined in a monastery. Released in 1643, broken in health, he died shortly after.

Quevedo reveals his complex personality in the extreme variety of tone in his works, ranging from the obscene to the devout. His learning and wide culture impelled him to write works of high moral seriousness, treatises on Stoic philosophy, and translations of Epictetus and Seneca, but he demonstrates equal familiarity with low life and the cant of the underworld.



Quevedo y Villegas, detail of an oil painting by an unknown Spanish artist; in Apsley House, London
By courtesy of the Victoria and Albert Museum, London

The bulk of his satirical writings were aimed at specific abuses of the day and are no longer of interest, but he is remembered for his picaresque novel *La vida del buscón* (1626; "The Life of a Scoundrel"), which describes the adventures of "Paul the Sharper" in a grotesquely distorted world of thieves, connivers, and impostors. Quevedo's *Sueños* (1627; *Dreams*), fantasies of hell and death, written at intervals from 1606 to 1622, shows his development as a master of the then new Baroque style *conceptismo,* a complicated form of expression depending on puns and elaborate conceits. An anthology of his poems in English translation was published in 1969.

Queyras, high Alpine valley of the Guil River in Hautes-Alpes *département,* in the Provence-Alpes-Côte d'Azur *région* of southwestern France. The Queyras extends from the confluence of the Guil and Durance rivers (near the village of Mont-Dauphin) northeastward to Abriès and then southeastward to the Italian border—a total distance of about 30 miles (50 km). The area is noted for its flora (about 2,000 species), ranging from Mediterranean to Alpine varieties. Flanked by more than 100 peaks of the Cottian Alps, the region is also noted for winter sports, with a number of villages with ski lodges lining the valley. A slim canyon known as the Combe de Queyras is bounded by limestone precipices about 650 feet (200 m) high and narrows occasionally to a mere fissure. The Queyras Regional Park, created in 1977, encompasses 150,000 acres (60,000 hectares).

Quezon (y Molina), Manuel (Luis) (b. Aug. 19, 1878, Baler, Phil.—d. Aug. 1, 1944, Saranac Lake, N.Y., U.S.), Filipino statesman, leader of the independence movement, and first president of the Philippine Commonwealth established under U.S. tutelage in 1935.

Quezon was the son of a schoolteacher and small landholder of Tagalog descent on the island of Luzon. He cut short his law studies at the University of Santo Tomás in Manila in 1899 to participate in the struggle for independence against the United States, led by Emilio Aguinaldo. After Aguinaldo surrendered in 1901, however, Quezon returned to the university, obtained his degree (1903), and practiced law for a few years. Convinced that the only way to independence was through cooperation with the United States, he ran for governor of Tayabas province in 1905. Once elected, he served for two years before being elected a representative in 1907 to the newly established Philippine Assembly.

Quezon
EB Inc.

In 1909 Quezon was appointed resident commissioner for the Philippines, entitled to speak, but not vote, in the U.S. House of Representatives; during his years in Washington, D.C., he fought vigorously for a speedy grant of independence by the United States. Quezon played a major role in obtaining Congress' passage in 1916 of the Jones Act, which pledged independence for the Philippines without giving a specific date when it would take effect. The act gave the Philippines greater autonomy and provided for the creation of a bicameral national legislature modeled after the U.S. Congress. Quezon resigned as commissioner and returned to Manila to be elected to the newly formed Philippine Senate in 1916; he subsequently served as its president until 1935. In 1922 he gained control of the Nacionalista Party, which had previously been led by his rival Sergio Osmeña.

Quezon fought for passage of the Tydings–McDuffie Act (1934), which provided for full independence for the Philippines 10 years after the creation of a constitution and the establishment of a Commonwealth government that would be the forerunner of an independent republic. Quezon was elected president of the newly formulated Commonwealth on Sept. 17, 1935. As president he reorganized the islands' military defense (aided by Gen. Douglas MacArthur as his special adviser), tackled the huge problem of landless peasants in the countryside who still worked as tenants on large estates, promoted the settlement and development of the large southern island of Mindanao, and fought graft and corruption in the government. A new national capital, later known as Quezon City, was built in a suburb of Manila.

Quezon was reelected president in 1941. After Japan invaded and occupied the Philippines in 1942, he went to the United States, where he formed a government in exile, served as a member of the Pacific War Council, signed the declaration of the United Nations against the Fascist nations, and wrote his autobiography, *The Good Fight* (1946). Quezon died of tuberculosis before full Philippine independence was established.

Quezon City, chartered city and capital of the Philippines from 1948 to 1976. The city is located immediately northeast of Manila, in Rizal province, central Luzon. Named for Pres. Manuel Luis Quezon, who selected the site (formerly a private estate) in 1939, it officially replaced Manila as the capital in 1948. Considered part of Metropolitan Manila, the city began to grow after World War II with the construction of government buildings on Capitol Site. Many functions of national government remained in Manila, however, and the seat of government moved back to Manila in 1976. Light industry has developed along Epifanio de los Santos Avenue, a circular road that links Quezon City to other suburbs, and large resettlement housing projects have been built there for low-income government workers. San Francisco del Monte and Kamuning are wealthy residential sectors, and Cubao is the transportation junction, bazaar area, and site of Araneta Coliseum. The University of the Philippines (1908) and the Ateneo de Manila University (a Jesuit institution dating from 1859) are in the city. Other points of interest include Father Aguilar's Zoo, the National Park and Wildlife Grounds, and the Quezon Memorial Hall. Inc. city, 1939. Pop. (1980) 1,165,865.

Consult the INDEX *first*

Qui Nhon, city and provincial seat of Nghia Binh *tinh* (province), central Vietnam. It is on the coast of the South China Sea at the entrance to the shallow 17-mi- (27-km-) long Qui Nhon Bay, which trends north–south. The port was opened to French trade in 1874, the harbour serving as an open roadstead for larger ships until after World War II. In 1965 the port was upgraded with U.S. assistance to support military operations on the Plateau du Cong Tum, to which it is directly linked by road. The harbour was dredged in 1977 and can accommodate ships of 10,000 tons. The city is linked to other coastal centres by extensions of the national coastal highway and the Ho Chi Minh City (formerly Saigon)–Hue railroad. Industries include fishing and salt evaporation. There is a hospital, a modern pediatrics clinic, a teacher-training school, and a vocational school. Pop. (1979) 130,534.

Quibdó, capital of Chocó department, western Colombia, on the Río Atrato, in the Pacific coastal plain. Its receipt of more than 420 in. (10,700 mm) of rain a year probably exceeds that of any other equatorial area on Earth. Founded in 1654 as San Francisco de Quibdó, the city has served as Chocó's capital since 1948. It is a regional commercial and manufacturing centre, housing metalworks, sawmills, and clothing and soft drink plants. Gold and platinum mines and a hydroelectric plant are nearby. Quibdó is accessible by river, highway, and air. Pop. (1973) 29,423.

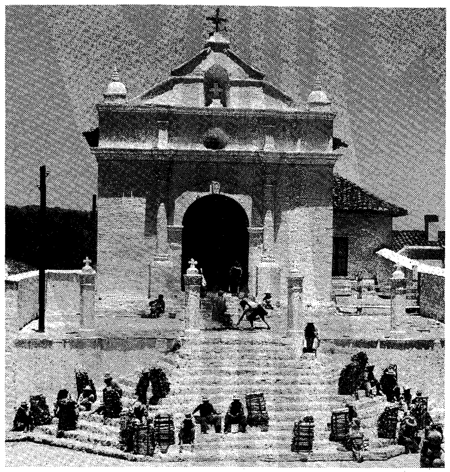
Quibo Island (Panama): *see* Coiba Island.

Quiché, also called QUICHÉ MAYA, Mayan Indians living in the midwestern highlands of Guatemala. The Quiché Maya had an advanced civilization in pre-Columbian times, with a high level of political and social organization. Archaeological remains show large population centres and a complex class structure. Written records of Quiché history and mythology are preserved in the *Popol Vuh,* written down in the Quiché language (using the Latin alphabet) shortly after conquest by the Spaniards in 1524.

The modern Quiché number 700,000 speakers, the largest of all Mayan linguistic groups, though no sense of ethnic unity derives from this common language. Their language is closely related to Tzutujil and Cakchiquel (*qq.v.*), which are spoken by neighbouring peoples. They share an essentially uniform culture with the Tzutujil and Cakchiquel as well as with other peoples to the north. The Quiché and their neighbours are agricultural, practicing the hand-tilled farming of corn (maize), beans, and squash that is characteristic in Middle America. They also plant cash crops such as strawberries and peaches. Homes are thatched huts, maintained generally by each family on its own land. Weaving and pottery are widely practiced crafts, and clothing is often traditional.

The people identify themselves with their community (*municipio*), oriented around a central village, which in this region often has no permanent inhabitants. Village officials are elected annually. Nominally Roman Catholic, the Quiché are organized into village *cofradías,* religious societies that maintain the church and organize fiestas for the local patron saints. Pagan myths and rituals are widely practiced, however, and the saints, the Virgin Mary, and the devil are often identified with Mayan divinities. *See also* Maya.

Quiché, department, northwestern Guatemala, bounded on the north by Mexico. The 3,235 sq mi (8,378 sq km) of the department extend from the valley of the upper Río Motagua across the Sierra de Chuacús and the Altos (mountains) Cuchumatanes to the lowlands of the Río Lacantum, at the Mexican border. Most of the inhabitants, many of whom are Maya Indians, are farmers, raising livestock, corn (maize), beans, and potatoes in the higher elevations and sugarcane, coffee, and tobacco in the lowlands. There is lumbering in the north. Santa Cruz del Quiché (*q.v.*) is the departmental capital, but the best known town is the Indian market and religious centre of Chichicastenango. There are few first-class highways in Quiché. The earthquake of 1976 caused damage to many of the structures and killed about 1,000 persons. Government oppression of the Indians caused many to seek refuge in southern Mexico in the early 1980s. Pop. (1982 est.) 430,003.



Wood sellers on the steps of the church at Chichicastenango, Guatemala
Ace Williams—Black Star/EB Inc.

Quiché language, an American Indian language of the Mayan family, spoken in the western highlands of Guatemala. It is most closely related to the Cakchiquel, Tzutujil, Sacapultee, and Sipacapa languages of central Guatemala and more distantly related to Uspantec, Pocomam, Pocomchí, Kekchí, and other languages of the Eastern Mayan group (*see* Mayan languages). The name Achí is sometimes applied to the easternmost dialects of Quiché.

The major ancient literary work in Quiché is the *Popol Vuh,* a historical chronicle of the Quiché people and their kings and heroes. Other important pre-conquest works include three other histories, like the *Popol Vuh,* written down in the 16th century in a Spanish orthography, and the *Rabinal Achí,* first discovered in the 19th century.

Quiché, like the Yucatec language (*q.v.*), has a set of consonants that includes a voiceless series (*p, t, k,* etc.) and a glottalized series, but it lacks voiced stops such as *b, d, g.* In grammar and syntax Quiché depends heavily on suffixes and also uses prefixes. Particles (small words used as prepositions, pronouns, adverbs, etc.) are very common.

Quicherat, Jules (-Étienne-Joseph) (b. Oct. 13, 1814, Paris—d. April 8, 1882, Paris), French historian and pioneering archaeologist who was a major force in French scholarship during the 19th century.

Quicherat, detail of a lithograph by Tony Toullion
Giraudon—Art Resource/EB Inc.

Quicherat was educated at the Collège de Sainte-Barbe and completed his studies at the École des Chartes in 1835. Following work with the Bibliothèque Royale, he returned in 1847 to the École des Chartes and became its director in 1871.

Quicherat was one of the founders of the study of archaeology in France. He also researched and wrote extensively on medieval France, producing biographies of the historians Jean Castel and Bishop Thomas Basin of Lisieux as well as studies of Charles VII and Louis XI. He edited and published the texts of the trial and rehabilitation of Joan of Arc in five volumes (1841–49). The posthumous publication of Quicherat's two-volume study synthesizing archaeology and the study of history demonstrated the wide range of his scholarship.

quick grass: *see* quack grass.

quicklime, calcium oxide, an alkaline inorganic compound of calcium (*q.v.*).

quicksand, state in which saturated sand loses its supporting capacity and acquires the character of a liquid. Quicksand is usually found in hollows at the mouths of large rivers or along flat stretches of streams or beaches where pools of water become partially filled with sand and an underlying layer of stiff clay or other dense material prevents drainage. Mixtures of sand, mud, and vegetation in bogs often act like true quicksands.

Once considered, especially by construction engineers, to be a special type of sand, quicksand is now recognized as a condition that may be assumed by any sand if its effective weight is temporarily or permanently carried by interstitial water. Some natural sands are in a condition so loose that such minor disturbances as those caused by a footstep may collapse the loose structure and produce a "quick" condition. A person or animal may then become engulfed as in a fluid, but, since the density of the sand–water suspension exceeds that of the human body, the body cannot sink below the surface. Struggling may lead to loss of balance and drowning. This possibility has no doubt led to the superstition, prevalent in literature, that quicksand has the ability to draw a person to his death.

quicksilver: *see* mercury.

Quidde, Ludwig (b. March 23, 1858, Bremen, Ger.—d. March 5, 1941, Geneva), historian, politician, and one of the most prominent German pacifists of the early 20th century, co-winner (with Ferdinand-Édouard Buisson) of the Nobel Prize for Peace in 1927.

During 1889–96 he was editor of the *Deutsche Zeitschrift für Geschichtswissenschaft* and in 1890 became professor and secretary of the Prussian Historical Institute in Rome. In 1892 he returned to Munich and joined the German Peace Society. In 1894 he published a pamphlet, *Caligula,* which had the appearance of a historical study but was actually a caustic satire on William II; the enormously popular publication brought Quidde three months' imprisonment for lese majesty. From 1907 to 1919 Quidde was a liberal member of the Bavarian Landtag (Assembly) and member of the Interparliamentary Union. From 1914 to 1929 he served as chairman of the German Peace Society. During World War I he opposed German sentiments for the annexation of foreign territories as a condition for a peace settlement.

In 1919 he joined the Democratic Party and during 1919–20 served as a member of the National Assembly, where he fought for a proportional electoral system and denounced the German war-guilt clause of the Treaty of Versailles. He was chairman of the German Peace Cartel, 1921–29, representing the right wing of pacifism. Quidde supported the Weimar Republic, advocated Germany's admittance to the League of Nations, and opposed the revival and growth of German militarism. Quidde was arrested in 1924 in Munich after writing in *Welt am Montag* against illegal military training by the German armed forces. In 1927 he received the Nobel Peace Prize. After the Nazis came to power in 1933 Quidde immigrated to Geneva, where he remained in exile for the rest of his life. He published several books on historical and political topics, including some on pacifist subjects.

Quidor, John (b. Jan. 26, 1801, Tappan, N.Y., U.S.—d. Dec. 13, 1881, Jersey City, N.J.), U.S. genre painter and artisan. The subjects for 17 of his approximately 35 paintings were drawn from Washington Irving's stories; *e.g.*, "Ichabod Crane at the Van Tassel's Ball" (1855; Sleepy Hollow Restorations, Inc., Tarrytown, N.Y.) and "The Money Diggers" (1832; Brooklyn Museum, Brooklyn, N.Y.).

Quidor began his career as a painter of tavern signs, parade pennants, and fire engines. This seems to have been his vocation throughout life, for his easel production was small and intermittent. In addition to Irving's works, Quidor used themes from the Bible, *Don Quixote*, and James Fenimore Cooper's Leatherstocking tales. He also painted occasional landscapes of the Hudson River Valley. His literary paintings were not illustrative; he took fanciful literature as a starting point for an intensely personal interpretation of subject and mood.

So much of Quidor's humour and power was achieved by dramatic gesture or exaggerated expression, it has been suggested that he painted from theatrical productions rather than from printed sources. He used flecks of colour in a new way to model flesh and convey atmosphere. Although he received appreciative reviews from contemporary critics, his extraordinary and unrealistic style had little impact on his colleagues, and his work found cool reception at exhibitions. Twentieth-century America, however, has reclaimed him as one of the more intriguing and personal American artists of the 19th century.

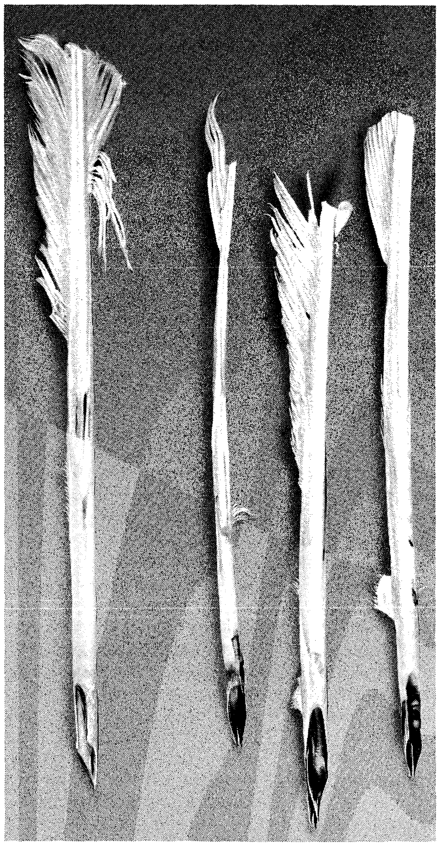
Quidort, John: *see* John of Paris.

Quietism, a doctrine of Christian spirituality that, in general, holds that perfection consists in passivity (quiet) of the soul, in the suppression of human effort so that divine action may have full play. Quietistic elements have been discerned in several religious movements, both Christian and non-Christian, through the centuries; but the term is usually identified with the doctrine of Miguel de Molinos, a Spanish priest who became an esteemed spiritual director in Rome during the latter half of the 17th century and whose teachings were condemned as heretical by the Roman Catholic Church.

For Molinos, the way of Christian perfection was the interior way of contemplation to which anyone with divine assistance can attain and that can last for years, even for a lifetime. This contemplation is a vague, undetermined view of God that inhibits man's interior powers. The soul remains in "dark faith," a state of passive purification that excludes all definite thought and all interior action. To wish to act is an offense against God, who desires to do everything in man. Inactivity brings the soul back to its principle, the divine being, into which it is transformed. God, the sole reality, lives and reigns in the souls of those who have undergone this mystic death. They can will only what God wills because their own wills have been taken away. They should not be concerned about salvation, perfection, or anything else but must leave all to God. It is not necessary for them to perform the ordinary exercises of piety. Even in temptation the contemplative should remain passive. According to Quietist tenets, the devil can make himself master of the contemplative's body and force him to perform acts that seem sinful; but because the contemplative does not consent, they are not sins. Molinos' teachings were condemned by Pope Innocent XI in 1687, and he was sentenced to life in prison.

Quietism was perhaps paralleled among Protestants by some of the tenets of the Pietists and Quakers. It certainly appeared in a milder form in France, where it was propagated by Jeanne-Marie Bouvier de la Motte Guyon, an influential mystic. She gained the support of François de Salignac de la Mothe Fénelon, archbishop of Cambrai, who developed a doctrine of pure love, sometimes called semi-Quietism, which was condemned by Pope Innocent XII in 1699. Both Fénelon and Guyon submitted.

quill, also called CALAMUS, hollow, horny barrel of a bird's feather, used as the principal writing instrument from the 6th century until the mid-19th century, when steel pen points were introduced. The strongest quills were obtained from living birds in their new growth period in the spring. Only the five outer wing feathers (follicles) were considered suitable for writing; the second and third were especially preferred. Quills from the left wing were favoured because the feathers curve outward and away from a right-handed writer.



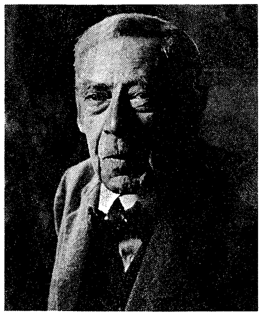
Quill pens used in Stonington, Conn., early 19th century; in the Smithsonian Institution, Copp Collection, Washington, D.C.

By courtesy of the Smithsonian Institution, Washington, D.C.

Goose feathers were the principal source of quills; quills from the scarcer, more expensive swan were preferred; but for making fine lines, quills from crows were better than either. Quill pens made from feathers of the eagle, owl, hawk, and turkey have also been used.

Quiller-Couch, Sir Arthur Thomas, pseudonym "Q" (b. Nov. 21, 1863, Bodmin, Cornwall, Eng.—d. May 12, 1944, Fowey, Cornwall), English poet, novelist, and anthologist noted for his compilation of *The Oxford Book of English Verse 1250–1900* (1900; revised 1939) and *The Oxford Book of Ballads* (1910).

He was educated at Newton Abbot College, Clifton College, and Trinity College, Oxford, where he became lecturer in classics (1886–87). In 1887 he wrote *Dead Man's Rock*, the

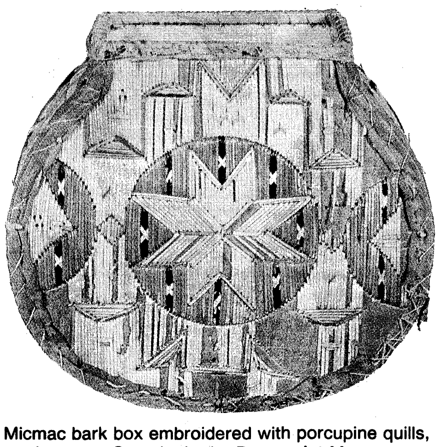


Quiller-Couch, 1943
BBC Hulton Picture Library

first of several novels of Cornwall and the sea. From 1887 to 1892 he worked in London for a publishing firm and as assistant editor of *The Speaker*. A number of short stories that he contributed to it were reprinted in book form as *Noughts and Crosses* (1891), the first of a dozen similar volumes. In 1892 he settled at Fowey, the small Cornish port that appears in his stories as "Troy Town." He was knighted in 1910 and in 1912 was appointed King Edward VII professor of English literature at Cambridge and also elected a fellow of Jesus College.

Poems (1930) is a collection of his serious verse; *Green Bays* (1930) contains light verse. His published works include *On the Art of Writing* (1916), *Shakespeare's Workmanship* (1918), *Studies in Literature* (3 series: 1918, 1922, 1929), *On the Art of Reading* (1920), *Charles Dickens and Other Victorians* (1925), and *The Poet as Citizen, and Other Papers* (1934). He was noted for his clear and apparently effortless style.

quillwork, type of embroidery done with the quills of a porcupine, or sometimes with bird feathers. This type of decoration was used by American Indians from Maine to Virginia and westward to the Rocky Mountains. For all practical purposes the art has died out. Quills were used on tobacco and tinder bags, knife and paintstick cases, cradles, armulets, burden straps, tunics, shirts, leggings, belts,



Micmac bark box embroidered with porcupine quills, northeastern Canada; in the Denver Art Museum, Colorado
By courtesy of the Denver Art Museum, Colorado

moccasins, arm and leg bands, robes, horse trappings, and birchbark containers.

Dyes were compounded of roots, whole plants, and buds and bark of trees. The natural colour of quills was white, with red, yellow, green, blue, and black being produced by steeping in solutions of plant materials. No variegated hues were made and rarely more than one shade of a colour was used. Patterns were stenciled or drawn with a bone paintbrush, stick, or dull knife, on the skin or bark that was to be worked.

Quillwork designs were made up of wide or narrow lines, each composed of a series of close stitches. The decorations put on men's garb were generally related to their work, hunting, and war, while figures worked on children's garments were usually symbolic and expressed prayers for safety, long life, and prosperity. There was considerable borrowing of designs, and figures that were sacred symbols in some tribes came to be purely ornamental in others.

quillwort (*Isoetes* species), any of more than 60 species of small plants that constitute the genus *Isoetes,* of the order Isoetales (class Lycopsida). They are spore-bearing plants with grassy, spikelike leaves, native mostly to swampy, cooler parts of northern North America and Eurasia. The spirally arranged, quill-like leaves are divided into cavities that contain one central conducting strand. The leaves rise from a cormlike or tuber-like base, with roots below. A large, round-to-oblong spore capsule is sunk into each leaf base, where a small, thin structure known as a ligule also occurs. Quillworts grow submerged in water all or part of the year. A few species are strictly terrestrial.

The common quillworts *I. lacustris* of Eurasia and the very similar North American species *I. macrospora* are aquatic. Their stiff, dark green, recurved, spiky leaves grow around a stumpy base. Italian quillwort (*I. malinverniana*) has longer, spiralling leaves that float on the water surface. Sand quillwort (*I. histrix*), an inconspicuous European terrestrial, has very narrow, five- to seven-centimetre- (two- to three-inch-) long leaves that curl back to the ground from a fat, white, tufted base.

Quilmes, *cabecera* (principal built-up area) and *partido* (political subdivision), of Gran (Greater) Buenos Aires, southeast of the city of Buenos Aires, in Buenos Aires province, Argentina, near the Río de la Plata estuary. Colonization of the area began with the second and permanent founding of Buenos Aires (1580). In 1666 Jose Martinez de Salazar (governor of Río de la Plata) established the Indian *reduccione* (work mission) called Santa Cruz de los Quilmes. The mission existed until 1812, when the junta governing Buenos Aires disbanded the mission and freed the Indians. The *partido* was established in 1730 out of the Pago (country district) de la Magdalena. The present-day *partido* covers 48 sq mi (125 sq km) and is bordered by the Río de la Plata (northeast) and by the *partidos* of Berazategui and Florencio Varela (southeast), Almirante Brown and Lomas de Zamora (southwest), and Lanús and Avellaneda (northwest). Besides the *cabecera* of Quilmes, the major localities are Bernal, Ezpeleta, Don Bosco, and San Francisco Solano. In 1806 British troops disembarked on the coast of the *partido* to capture Buenos Aires. In two naval battles off the shores of Quilmes in 1826 and 1827, Argentine warships repulsed attacks by Brazilian fleets.

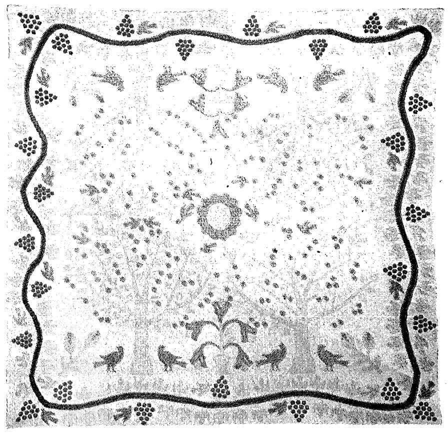
In 1871, Pres. Domingo Faustino Sarmiento founded a 20,000-volume library in the town of Quilmes. In 1916, the town was declared a city and planned as a residential suburb of Buenos Aires. Since then, diversified industry has developed, including one of the world's largest breweries, the Cervecería Argentina (Argentine Brewery). Textiles, ironware, and glass are also manufactured. Quilmes has a museum devoted to transportation in Argentina and also a boarding school for English-speakers. Pop. (1980) *partido,* 446,587.

Quilon, town, administrative headquarters of Quilon district, southern Kerala state, southwestern India. Quilon has existed for many centuries and was called Elancon by early travellers, Kaulam Mall by the Arabs, and Coilum by the 13th-century Venetian traveller Marco Polo. Its location made it commercially important; the first Europeans there were the Portuguese, followed by the Dutch in 1662 and then by the British.

The town is a port on the Arabian Sea northwest of Trivandrum, the state capital. It lies next to Asthamudi Lake, an inlet of the sea, and is linked with Alleppey and Cochin to the north by a system of canals and lagoons. Quilon has an active export trade and numerous industries, including mineral processing, manufacturing, and processing of agricultural products, especially cashew nuts. Kundara, a suburb to the northeast, has chemical, ceramic, and aluminum plants. Quilon has five colleges affiliated with the University of Kerala. A railway links it with towns to the north, east, and south.

Quilon district is 1,785 sq mi (4,623 sq km) in area and is largely on the coastal plain between the Arabian Sea and the Western Ghāts range. Pop. (1981) town, 137,943; metropolitan area, 167,598; district, 2,813,650.

quilting, process of stitching together two layers of fabric, usually with a soft, thick substance placed between them. The layer of wool, cotton, or other stuffing provides insulation; the stitching keeps the stuffing evenly



"Cherry Trees and Robins," cotton quilt with an appliquéd pattern on a quilted ground, U.S., *c.* 1820; in the Art Institute of Chicago
By courtesy of the Art Institute of Chicago, gift of Mrs. Emma B. Hodge

distributed and also provides opportunity for artistic expression in both design and execution.

Quilting has long been used for clothing in many parts of the world, especially in China, India, Iran, the Middle East, and the Muslim regions of Africa. It was also used for military doublets worn under armour, and it sometimes provided a less expensive substitute for armour. In Europe quilting, particularly of bedcovers (quilts), attained the status of a minor art in the 14th century, reaching a high degree of popularity from the 17th through the 19th century. Quilting reached its fullest development in North America, where it was popularly used for petticoats and comforters. Those produced in the early 18th century imitated English and Dutch designs, but by the end of the century the American quilt had taken on many new and distinctive features. First from necessity and later from choice, the outer layers of quilts were made of coloured fabrics appliquéd to a white muslin ground or joined together as patchwork; in some instances the two techniques were combined in one quilt. The design was completed by the quilting itself, which often picked up and echoed the shape of the patchwork or appliqué pattern. Although a few examples can be found in other countries, this style is of American origin and was used more extensively there than elsewhere.

The work of quilting a large bedcover, possibly measuring as much as 10 feet (3 metres) square, was usually done on a frame, which could be as simple as two smooth poles or long bars of wood set on four chairs. Each sidebar of the quilting frame was covered with fabric to which the edges of the quilt lining were sewn, one side to each bar. The cotton or wool fibres used for the stuffing were spread smoothly and evenly on the stretched lining. Then the top was placed in position and its edge was pinned or basted to the edge of the lining, drawing it tightly over the fibre filling. The quilting pattern was marked on the top with either a tracing wheel and chalk, a pencil, or the pressure of the needle marking an indentation around a rigid pattern of wood. The running stitch was most commonly used for the quilting.

The invention of the sewing machine in mid-19th century was quickly followed by a series of attachments for machine-stitched quilting. Utilitarian items were quilted in this manner, but stitching by machine did not lend itself to artistic work.

Quimby, Phineas Parkhurst (b. Feb. 16, 1802, Lebanon, N.H., U.S.—d. Jan. 16, 1866, Belfast, Maine), U.S. exponent of mental healing who is generally regarded as the founder of the New Thought movement, a religio-metaphysical healing cult.

Quimby employed hypnosis as a means of healing but discovered that he could also heal by suggestion. He held that all illness is basically a matter of the mind and that it results from the patient's mistaken beliefs. Hence, cure lies in discovering the truth. Although not religious in the orthodox sense, he believed he had rediscovered the healing methods of Jesus. He became a controversial figure when Mary Baker Eddy, who had sought him out for treatment and had been for a time a disciple, denied that her discovery of Christian Science was influenced by him. *The Quimby Manuscripts* (1921, ed. by H.W. Dresser) include his philosophy. The first edition contains a number of Eddy's letters to Quimby and others not found in later editions.

Quimper, Breton KEMPER, town, capital of Finistère *département,* Bretagne region, France, and a port at the estuarine confluence of the Odet and Steir rivers. Once the ancient capital of the countship Cornouaille, it is associated with the legendary (5th century) king Gradlon, who came from Cornwall in Britain. The countship was united with the duchy of Brittany in the 11th century; but the town suffered in local wars of succession and, in 1344, was sacked by Charles de Blois. After the defeat of Charles at Auray (1364), the duchy passed to the House of Montfort.

The city's Gothic cathedral (13th–16th centuries) was named for the first bishop, St. Corentin of the 5th century. There are two museums, one of fine art, the other conserving local Breton tradition. At the Great Festival of Cornouaille held each July all the costumes of Bretagne are displayed.

Quimper, a commercial town and tourist centre, is known for its pottery, a faience that has been produced there since the 17th century. There are also some metal, dairying, clothing, and paper industries. Pop. (1982) 52,335.

Quimper faience, tin-enamelled earthenware produced by a factory at Loc Maria, a suburb of Quimper in Brittany, Fr. The factory was founded in 1690 by Jean-Baptiste Bosquet, a potter from Marseille who had settled there. Both Pierre Caussy, who took over in 1743, and de la Hubeaudière, who bought it in 1809, expanded production. Quimper ware never developed a truly distinct style of its own, however, but imitated in turn the pottery of Marseille, Nevers, and especially Rouen. In design and craftsmanship, Quimper ware was usually inferior to its models. The factory still exists.

Quin, James (b. Feb. 24, 1693, London—d. Jan. 21, 1766, Bath, Somerset, Eng.), English actor whose Falstaff was considered the finest of his time.

Quin made his first stage appearance at the Smock Alley Theatre, Dublin, in 1712. He was engaged for small parts at London's Drury Lane Theatre, where his remarkable memory enabled him to fill in at short notice as Bajazet in Rowe's *Tamerlane,* in which he had great success. In 1718 Quin went to Lincoln's Inn Fields Theatre and remained there for 14 years. A noted swordsman, he was convicted of manslaughter for killing another actor in a duel, and at Lincoln's Inn Fields he defended the stage with his sword against rioters.

Quin, detail from an engraving by W. Bromley, 1792, after a painting by T. Hudson
By courtesy of the Victoria and Albert Museum, London

He went to Covent Garden Theatre in 1732 and became a leader of the stage, returning to Drury Lane from 1734 to 1741. His style was declamatory, very slow but impressive, and he always wore the same costume. In 1746 his supremacy was challenged by David Garrick, who espoused a new type of acting; and when the two played together at Covent Garden, Garrick triumphed. Quin bore him no ill will; they became friends and acted together at Drury Lane. In 1751 he retired to Bath, where he was buried in the abbey church with an epitaph by Garrick.

quinacrine, also called MEPACRINE, synthetic drug introduced into medicine in the early 1930s as a substitute for quinine in treating malaria. Quinacrine is a more effective antimalarial than quinine. It inhibits the development of the malarial parasites (*Plasmodium* species) in the erythrocytic stage, in which they circulate in the bloodstream of the host, within the red blood cells.

When supplies of quinine from Southeast Asia became unavailable to many countries during World War II, quinacrine became the most important antimalarial drug. Since its introduction as an antimalarial, quinacrine also has become widely used as an anthelmintic drug (worming agent), especially in the treatment of tapeworm infections caused by the beef tapeworm (*Taenia saginata*), the pork tapeworm (*T. solium*), the dwarf tapeworm (*Hymenolepis nana*), and the fish tapeworm (*Diphyllobothrium latum*).

Quinacrine is administered orally in the form of its hydrochloride salt. It also can be given by intramuscular injection. Side effects include nausea, abdominal cramps, headache, and dizziness.

Quinará, region, southwestern Guinea-Bissau, West Africa, bordered by the regions of Tombali on the south and east, Bafatá on the northeast, Oio on the north, and Biombo on the northwest. Quinará fronts the Atlantic Ocean and the region of Bolama to the southwest. It has an area of 1,139 sq mi (2,920 sq km). The Rio Grande de Buba flows east–west through the centre of the region and empties into the Atlantic; most of the oil palms in the region are grown along the river. Rice is produced throughout Quinará, as are subsistence crops of millet, corn (maize), sorghum, and sweet potatoes. Some parts of the region are used for grazing cattle, sheep, and goats. Fulacunda, the regional capital, is linked by road southwest to São João and southeast to Buba. The Biafada peoples are the main ethnic group, together with the Balante and Malinke peoples. Pop. (1979) 35,360.

quince, fruit tree of the genus *Cydonia,* of the rose family (Rosaceae). The much-branched shrubs or small trees have entire leaves with small stipules and bear large, solitary, white or pink flowers like those of the pear or apple but with leafy calyx lobes and a many-celled ovary, in each cell of which are numerous horizontal ovules. The fruits may be round and flattened or somewhat pear-shaped, with a large, leafy calyx on the mature fruit.

The common quince is a native of Iran and Turkey and perhaps also of Greece and the Crimea. It is certain that the Greeks knew a common variety upon which they grafted scions of a better variety from Cydonia in Crete, from which its name was derived. The fragrance and astringency of the fruit of the quince are well known, and the mucilage from the seeds formerly was used medicinally. The fruit has a strong aroma and in the raw state is astringent; but it makes an excellent preserve and is often used to give flavour and sharpness to stewed or baked apples.

The Japanese quince has been widely used as an ornamental shrub in gardens, particularly because of the beauty of the flowers that appear on the stems before the leaves open fully in late winter and early spring. Some of the small shrubs bear large, green, fragrant fruits that are inedible in the fresh state but have been used in making preserves.

The quince was formerly grown in home fruit gardens and commercially in the northeastern United States but later lost favour. It thrives under the same systems of cultivation as do apples and pears, in regions having a distinct winter period, and does fairly well along fencerows, where it requires little care. The quince is susceptible to a bacterial disease called fire blight, which is also a serious hazard to pear growing. The trees are subject to the same scale insects that attack apples and pears and should receive the same dormant

Quince (*Cydonia oblonga*)
Walter Chandoha

spray treatment for the control of these pests. The fruits are golden yellow in colour, and the flesh takes on a pink colour when cooked, giving an attractive colour to jellies and conserves.

Quincy, city, seat (1825) of Adams county, western Illinois, U.S., on the Mississippi River, there bridged to Missouri. Settled in 1822 by John Wood (12th governor of Illinois, 1860–61), it was first known as Bluffs. It became the county seat on March 4, 1825, the day that President John Quincy Adams was inaugurated, and was renamed in his honour. As a river town, Quincy was an important stop for travelers. It became a part of the Underground Railroad (a system by which slaves were assisted in escaping to the North and to Canada), and during the winter of 1838–39 Mormons found refuge there before proceeding northward along the river to Nauvoo. The city declined with the passing of the steamboat era in the 1870s, but after 1920 industrial development stimulated its growth. An agricultural and manufacturing economy now prevails.

The city's Washington Park (originally John's Square) was the site of the sixth debate between Abraham Lincoln and Stephen A. Douglas (Oct. 13, 1858). Quincy College was established in 1860, Gem City College (business school) in 1870, John Wood Community College in 1974, and Blessing Hospital School of Nursing in 1891. Other institutions include Our Lady of Angels Franciscan Seminary, the Chaddock Boys School for the emotionally disturbed (Methodist, 1900), and Illinois Veterans Home (1887). Quinisippi Island Park, bordered by the Mississippi River and Quincy Bay, has been developed as a recreation area. Inc. village, 1834; city, 1840. Pop. (1988 est.) 39,236.

Quincy, city, Norfolk county, eastern Massachusetts, U.S., on Boston Harbor, just southeast of Boston. In 1625 the site was settled by Thomas Morton as Mount Wollaston, later known as Merry Mount; in 1627 Morton, an anti-Puritan, was exiled for celebrating May Day. Set off from Braintree and incorporated as a town (township) in 1792, it was renamed to honour Colonel John Quincy, a prominent local resident. Quincy is notable as the home of the celebrated Adams family, and the birthplaces of the two U.S. presidents John Adams and his son, John Quincy Adams, are preserved, as well as the Adams Mansion National Historic Site (built 1731). The crypts of the two presidents and their wives are in the United First Parish Church (1828). John Hancock, the Revolutionary patriot, was also born in that part of Braintree now in Quincy.

The city was once famed for its granite quarries, which supplied stone for King's Chapel and the Bunker Hill Monument in Boston. It was also a major shipbuilding centre, but the shipyards were closed in 1986. Now, Quincy has diversified manufactures including machinery, electronics, chemicals, plastics, and soap products. It is the seat of Eastern Nazarene College (1900) and Quincy Junior College (1958). Inc. city, 1888. Pop. (1988 est.) 83,864.

Quincy Plan, also called QUINCY METHOD, experimental, progressive, child-centred approach to education introduced in 1875 in Quincy, Mass., U.S., by superintendent of schools Francis W. Parker. Parker eliminated the rigid formalities of traditional school routine, arranged interrelated subjects around a central core, and emphasized socialized activities and creative self-expression. The curriculum included field trips, art, music, crafts, science, and physical training, with the purpose of developing each child's individual personality. In 1883, when Parker became principal of the Cook County Normal School in Chicago, he further elaborated on the Quincy Plan, actively campaigned against the methods of traditional schools, and trained teachers who introduced modern educational methods.

Quindío, *departamento,* west-central Colombia, on the western slopes of the Andean Cordillera Central. The smallest department

Coffee plantation in Quindío *departamento,* Colombia
Carl Frank

in the nation, it occupies an area of 712 square miles (1,845 square km) in one of Colombia's leading coffee-producing regions. Bananas, corn (maize), sugarcane, and beans are among the other crops, and livestock raising is widespread. Quindío has rich deposits of gold, silver, copper, and limestone. Armenia, the departmental capital, has long been important as a transportation centre because it is situated at the western end of the Quindío Pass. Pop. (1985) 377,860.

Quine, Willard Van Orman (b. June 25, 1908, Akron, Ohio, U.S.), American logician and philosopher advocating systematic constructivist analysis of philosophy. Although his early career emphasized technical aspects of logic as a basis for philosophy, his later work investigated more general philosophical issues within a systematic linguistic framework.

Initially trained in mathematics at Oberlin College and Harvard University before studying at Prague under Rudolf Carnap, he received an M.A. from Oxford and a Ph.D. from Harvard (1932) in philosophy. While at Harvard as lecturer and professor (1936–78), Quine was honoured as president of the American Philosophical Association (1951) and the Association for Symbolic Logic (1953–55) and received the Butler Gold Medal from Columbia University (1970). Among his publications are *A System of Logistic* (1934), *Mathematical Logic* (1940), *Elementary Logic* (1941), *From a Logical Point of View* (1953), *Word and Object* (1960), *Set Theory and Its Logic* (1963), *Philosophy of Logic* (1970), and *The Roots of Reference* (1973).

Quinet, Edgar (b. Feb. 17, 1803, Bourg-en-Bresse, Fr.—d. March 27, 1875, Versailles), French poet, historian, and political philosopher who made a significant contribution to the developing tradition of liberalism in France.

After moving to Paris in 1820, Quinet forsook the faith of his Protestant mother, became greatly attracted to German philosophy, and published in 1827–28, as his first major work, a translation of Herder's monumental philosophy of history, *Ideen zur Philosophie der Geschichte der Menschheit* (*Outlines of a Philosophy of the History of Man*). Soon, however, he became disillusioned with German philosophy and alarmed by the aggressive nature of Prussian nationalism. His literary reputation was increased by the publication of his epic prose poem *Ahasvérus* (1833), in which the legend of the Wandering Jew is used to symbolize the progress of humanity through the years. In *Le Génie des religions* (1842; "The Genius of Religions") he expressed sympathy for all religions while committing himself to none, but shortly afterward his increasingly radical views alienated him finally from Roman Catholicism.

It was not until 1842 that he obtained what he had really wanted—a professorship in Paris. His lectures at the Collège de France attacked Roman Catholicism, exalted the French Revolution, offered support for the oppressed nationalities of Europe, and promoted the theory that religions were the determining force in society. Because his treatment of these topics aroused heated controversy, the government intervened in 1846 and, to the satisfaction of the clergy and dismay of the students, he lost his chair.

Quinet hailed the revolution of February 1848, but with Louis-Napoleon's coup d'etat of December 1851 was forced to flee, first to Brussels (1851–58) and then to Veytaux, near Montreux, Switz., where he remained until 1870. His faith in humanity shaken, Quinet's optimism failed him for a while, and in *La Révolution religieuse au XIXe siècle* (1857; *The Religious Revolution of the 19th Century*) and *La Révolution* (1865) he sympathized with the use of force against an all-powerful church and even wistfully hoped that France might yet embrace Protestantism. In his last years the conquests of science fascinated him and restored his faith in the progress of humanity, as indicated in *La Création* (1870) and *L'Esprit nouveau* (1874; "The New Spirit"). He returned to Paris on the fall of the empire in 1870 and was elected to the National Assembly in the following year but exercised little influence over his fellow deputies.

His histories, political essays, and works on the history of religion are little read in the

Quinet, oil painting by Sébastien-Melchior Cornu, 1833; in the Musée Carnavalet, Paris
J.E. Bulloz

20th century. It is in the educational reforms of the Third Republic, including the banishing of religious instruction from the schools, that his most lasting influence is seen.

quinidine, alkaloid found in cinchona bark and used as a drug. It shares many of the pharmacological actions of quinine; *i.e.,* both have antimalarial and fever-reducing activity. The main use of quinidine, however, involves its activity as a myocardial depressant—that is, it depresses the excitability and conduction velocity of nerve impulses and the contractility of the heart muscle. Quinidine is thus used to treat a variety of disorders of cardiac rhythm—*e.g.,* atrial fibrillation, atrial flutter, and ventricular tachycardia. It can be a dangerous drug and is used less frequently than digitalis. Nausea, vomiting, and diarrhea are common reactions to the use of quinidine.

quinine, the most important alkaloid of cinchona bark, used chiefly in the treatment of malaria. During the 300 years between its introduction into Western medicine and World War I, quinine was the only effective remedy for malaria. As a specific treatment for this disease, quinine has benefitted more people than any other drug used thus far to combat infectious diseases. The treatment of malaria with quinine marked the first successful use of a chemical compound in combatting an infectious disease.

Like the other cinchona alkaloids, quinine is a large and complex molecule, and its total laboratory synthesis in 1944 is one of the classical achievements of synthetic organic chemistry, although commercial synthesis of quinine is not economically feasible.

Quinine acts by interfering with the growth and reproduction of the malarial parasites (*Plasmodium* species) inhabiting the red cells of the blood; it probably prevents the parasites from oxidizing glucose, their chief source of energy. Administration of quinine dramatically improves the condition of a person suffering from malaria; the parasites promptly disappear from the blood, and the symptoms of the disease are quickly alleviated. When quinine treatment is terminated, however, many recovered patients suffer another attack of malaria several weeks later. This recurrence stems from the failure of quinine to kill the malarial parasites in cells of the body other than the red blood cells. These parasites persist and, after a time, reinvade the red blood cells and precipitate the second malarial attack, or relapse.

Because quinine fails to produce a complete cure of malaria, better antimalarial drugs have long been sought. Research during World War II produced a number of antimalarial drugs that almost completely replaced quinine. Some of them, such as chloroquine and chloroguanide, are more effective than quinine in suppressing the growth of the blood forms of the malarial parasite; others, such as primaquine and pyrimethamine, act upon both the blood and tissue stages of the parasite, thus producing complete cures and preventing relapses. All of the newer antimalarials, unlike quinine, may be completely synthesized on a commercial scale.

During the 1960s several strains of the malarial parasite *Plasmodium falciparum* developed resistance to the synthetic drugs, particularly the highly valued chloroquine. The parasite remained sensitive, however, to quinine, which had to be reinstated in various parts of the world as the drug of choice despite the side effects that sometimes occur when the necessarily large doses of quinine are given.

In addition to its specific use in malaria, quinine is sometimes used as a nonspecific remedy for fever and pain. It reduces fever probably by dilating the small vessels of the skin; its analgesic (pain-relieving) effect may result from depression of certain centres in the central nervous system. Prolonged administration of quinine may produce toxic symptoms such as deafness, disturbances in vision, skin rashes, and digestive upsets. Some experts believe that patients who undergo quinine treatment may be predisposed to develop blackwater fever, a little understood complication of malaria marked by rapid and severe anemia and the appearance of hemoglobin (the oxygen-carrying blood pigment) in the urine.

Quinisext Council, also called COUNCIL IN TRULLO (after the palace hall in Constantinople where it met), council that was convened in 692 by the Byzantine emperor Justinian II to issue disciplinary decrees related to the second and third councils of Constantinople (held in 553 and 680–681). They were the fifth and sixth ecumenical councils—hence the name Quinisext. The two ecumenical councils had dealt only with doctrinal matters.

The Quinisext Council prepared 102 canons, many of which were directed against Western Church customs and legislation; they also showed the differences between the Eastern and Western churches (*e.g.*, clerical celibacy was rejected in the East). The Western Church and the Pope were not represented at the council. Justinian, however, wanted the Pope as well as the Eastern bishops to sign the canons. Pope Sergius I (687–701) refused to sign, and the canons were never fully accepted by the Western Church.

quinnat: *see* king salmon.

quinoline, any of a class of organic compounds of the aromatic heterocyclic series characterized by a double-ring structure composed of a benzene and a pyridine ring fused at two adjacent carbon atoms. The benzene ring contains six carbon atoms, while the pyridine ring contains five carbon atoms and a nitrogen atom. The simplest member of the quinoline family is quinoline itself, a compound with molecular structure C_9H_7N.

Quinoline is used principally for the manufacture of nicotinic acid, which prevents pellagra in humans, and other chemicals. Several methods are known for its preparation, and production of synthetic quinoline exceeds that from coal tar.

Several alkaloids (alkaline organic compounds produced in plants) are members of the quinoline family; these include quinine and other derivatives from the cinchona tree. The antimalarial drugs chloroquine and amodiaquin are synthetic quinoline compounds, as are dibucaine hydrochloride, a long-acting local anesthetic, and cyanine, the oldest of an important class of dyes.

quinone, any member of a class of cyclic organic compounds containing two carbonyl groups, $>C=O$, either adjacent or separated by a vinylene group, $-CH=CH-$, in a six-membered unsaturated ring. In a few quinones, the carbonyl groups are located in different rings. The term quinone also denotes the specific compound *para-* (*p*-)benzoquinone ($C_6H_4O_2$). The quinone structure plays an important role in theories concerning the relationship of chemical constitution to colour. Quinones occur as biological pigments (biochromes), for example, includ-

(Left) *para*-benzoquinone; (right) hydroquinone

ing the benzoquinones, naphthoquinones, anthraquinones, and polycyclic quinones. The quinones are found in bacteria, in certain fungi, and in various higher plant forms, but in only a few animals. Those animals in which they do occur—*e.g.*, sea urchins, aphids, lac insects, and certain scale insects—obtain their quinone compounds from the plants they eat. The K vitamins are naphthoquinones, as are some chemical indicators of acidity or alkalinity and various dyes used to colour certain types of fabrics.

Quinones usually are prepared by oxidation of aromatic amines, polyhydric phenols, and polynuclear hydrocarbons. The most important characteristic reaction of quinones is reduction to the corresponding dihydroxy form. In acidic solution, *p*-benzoquinone is reduced reversibly to hydroquinone ($C_6H_6O_2$); the reaction is marked by a measurable electrical potential of a magnitude that depends upon the hydrogen ion concentration of the reaction medium and the benzoquinone and hydroquinone concentrations. The so-called quinhydrone electrode, containing equivalent amounts of *p*-benzoquinone and hydroquinone, is used to determine hydrogen ion concentrations of unknown solutions. Hydroquinone is used principally as a photographic developing agent.

A bright yellow solid with a sharp odour, *p*-benzoquinone is slightly soluble in water and melts at about 115° C. Hydroquinone is a white, crystalline solid, soluble in water and alcohol. *See also* anthraquinone.

Quinque Ecclesiae (Hungary): *see* Pécs.

quinsy, also called PERITONSILLAR ABSCESS, pus-filled swelling in the throat that develops infrequently as a complication of acute tonsillitis. It extends through the tonsillar capsule into the loose connective tissue of the neck and displaces the involved tonsil toward the midline of the throat. Extreme pain accompanying the condition interferes with swallowing and talking. Often there is high fever and general prostration. Although acute tonsillitis is usually caused by streptococci, these organisms are not always present in the quinsy pus. Surgical incision and draining are sometimes needed if antibiotics are not given promptly.

Articles are alphabetized word by word, not letter by letter

Quintana, Manuel José (b. April 11, 1772, Madrid—d. March 11, 1857, Madrid), Spanish patriot and Neoclassical poet, esteemed by his countrymen for poems, pamphlets, and proclamations written during the War of Independence from Napoleon. Although he was once regarded as a great poet, Quintana's reputation has since steadily declined.

After studying law at the University of Salamanca, he went to Madrid to begin his practice. Active in the Napoleonic Wars, he was imprisoned, after the return to Spain of Ferdinand VII, from 1814 to 1820. Released by the revolutionary forces, he later served as tutor to the future queen Isabella II, as director of public instruction, and finally as a senator. In 1855 he was crowned as the national poet by Queen Isabella.

Quintana's poetry is extremely rhetorical and marked by patriotism and liberalism. The classic ode is his favourite form, and his work is completely untouched by the Romantic impulse. Quintana is also remembered for his Plutarchian portraits, *Vidas de españoles célebres,* 2 vol. (1807, 1830; "Lives of Famous Spaniards"), for his highly regarded literary criticism collected in the anthologies *Colección de poesías castellanas* ("Collected Castilian Poems") and *Musa épica* ("Epic Muse"), and also for his few tragedies.

Quintana Roo, state, Yucatán Peninsula, southeastern Mexico. Situated on the eastern side of the peninsula, it is bounded by the Caribbean Sea (east), by Belize (south), and by Campeche and Yucatán (west); its northern shore is on the Yucatán Channel between the Gulf of Mexico and the Caribbean. Quintana Roo, with an area of 19,397 sq mi (50,212 sq km), is a hot, humid, and heavily forested limestone plain. The area was named for Andrés Quintana Roo, writer and leader in the independence movement (1810–21).

In 1517 the first Spanish landing in Mexico was made at Cape Catoche, and in 1519 Hernán Cortés landed first on the offshore island of Cozumel. The region was for many years used as a place of exile for political prisoners. It was created as a territory in 1902 from parts of Yucatán and Campeche states and was made a state in 1974.

The population, except for the concentrations in Chetumal, the state capital, and a few towns, is dispersed in hamlets and villages. Most inhabitants are descendants of Maya Indians who rebelled in 1847 in Yucatán and were driven into Quintana Roo. The state contains important archaeological remains of the pre-Columbian Mayan Empire. Chicle and a small amount of copra, produced on the coast near Cozumel Island, are the state's main products. Valuable stands of mahogany and other hardwoods are largely unexploited, but sponge and turtle fishing are significant along the coast. The construction of highways, railroads, and airstrips has eased Quintana Roo's isolation. Pop. (1980) 226,000.

Quinte, Bay of, arm of Lake Ontario, southeastern Ontario, Canada, extending for 75 mi (121 km) from its entrance near Amherst Island to Murray Canal at the western end. It is a narrow bay, ranging from one to six miles in width. The bay is scenic, having many small inlets; and it receives several rivers from the north, including the Trent, Moira, Salmon, and Napanee. The head of the bay connects with Presqu'ile Bay and Lake Ontario through the Murray Canal; the Trent Canal runs northwestward to Georgian Bay. Major settlements around the bay include Trenton, Belleville, Deseronto, and Picton.

In 1615 the French explorers Étienne Brûlé and Samuel de Champlain became the first Europeans to enter the Bay of Quinte. From 1668 to 1680 French missionaries were based near Trenton. The bay's name was derived from Kenté, an Indian village that was situated at its west end. The Tyendinaga Indian Reserve lies along part of the northern shore.

Quintero, José (Benjamin) (b. Oct. 15, 1924, Panama City), Panamanian-born U.S. theatrical director who was a founder of New York City's Circle in the Square Theatre.

Quintero spent his youth in Panama but went to the United States to attend college in Los Angeles, after which he trained at the Goodman Theatre School in Chicago in 1948–49. He received his B.A. from the University of Southern California in 1948. In 1949 he directed his first play, Tennessee Williams' *The Glass Menagerie,* at the Woodstock Summer Theatre in Woodstock, N.Y. In 1950 he began to direct regularly at Circle in the Square. In 1952 he directed Williams' *Summer and Smoke,* a production that made a star of actress Geraldine Page and established Quintero's reputation.

Quintero was best known for his revivals of important 20th-century plays, particularly those of Tennessee Williams and Eugene O'Neill. His 1956 production of *The Iceman Cometh* was considered by some critics to be superior to the original Theatre Guild version of 1946. Later in 1956, Quintero was entrusted with the direction of the first American production of O'Neill's *Long Day's Journey Into Night,* a notable success that became a landmark in the history of the American theatre. In addition to directing for the stage, he directed a motion picture, *The Roman Spring of Mrs. Stone* (1961); television specials; and several operas.

Quintero, Serafín and Joaquín Álvarez (Spanish dramatists): *see* Álvarez Quintero, Serafín and Joaquín.

quintet, musical composition for five instruments or voices; also the group of musicians engaged in the performance of such a composition. The string quintet normally includes two violins, two violas, and a cello. Mozart's six works for this medium are usually considered his greatest achievement in chamber music. The composer and virtuoso cellist Luigi Boccherini favoured two cellos in place of two violas and composed 113 quintets for this combination as well as a dozen for the more conventional instrumentation. Only Franz Schubert followed his example, in the well-known *Quintet in C.*

The piano quintet—usually piano and string quartet—has been a popular medium with composers, with Boccherini having written a dozen of them, though Schubert's notable *Trout Quintet* is for piano, violin, viola, cello, and double bass. Flute, oboe, clarinet, etc., are also combined with four strings. Boccherini composed 18 quintets for flute or oboe and the normal complement of strings. Vocal quintets are usually for two sopranos, alto, tenor, and bass; much literature for five parts exists—16th-century madrigals, for example—but the name quintet is rarely used for it.

Quintilian, Latin in full MARCUS FABIUS QUINTILIANUS (b. *c.* AD 35, Calagurris Nassica, Hispania Tarraconensis—d. after 96, Rome), Latin teacher and writer whose work on rhetoric, *Institutio oratoria,* is a major contribution to educational theory and literary criticism.

Quintilian was born in northern Spain, but he was probably educated in Rome, where he afterward received some practical training from the leading orator of the day, Domitius Afer. He then practiced for a time as an advocate in the law courts. He left for his native Spain sometime after 57 but returned to Rome in 68 and began to teach rhetoric, combining this with advocacy in the law courts. Under the emperor Vespasian (ruled 69–79) he became the first teacher to receive a state salary for teaching Latin rhetoric, and he also held his position as Rome's leading teacher under the emperors Titus and Domitian, retiring probably in 88. Toward the end of Domitian's reign (81–96) he was entrusted with the education of the Emperor's two heirs (his grandnephews), and through the good agency of the boys' father, Flavius Clemens, he was given the honorary title of consul (*ornamenta consularia*). His own death, which probably took place soon after Domitian's assassination, was preceded by that of his young wife and two sons.

Quintilian's great work, the *Institutio oratoria,* in 12 books, was published shortly before the end of his life. He believed that the entire educational process, from infancy onward, was relevant to his major theme of training an orator. In Book I he therefore dealt with the stages of education before a boy entered the school of rhetoric itself, to which he came in Book II. These first two books contain his general observations on educational principles and are notable for their good sense and insight into human nature. Books III to XI are basically concerned with the five traditional "departments" of rhetoric: invention, arrangement, style, memory, and delivery. He also deals with the nature, value, origin, and function of rhetoric and with the different types of oratory, giving far more attention to forensic oratory (that used in legal proceedings) than to other types. During his general discussion of invention he also considers the successive, formal parts of a speech, including a lively chapter on the art of arousing laughter. Book X contains a well-known and much-praised survey of Greek and Latin authors, recommended to the young orator for study. Sometimes Quintilian agrees with the generally held estimate of a writer, but he is often independent in his judgments, especially when discussing Latin authors. Book XII deals with the ideal orator in action, after his training is completed: his character, the rules that he must follow in pleading a case, the style of his eloquence, and when he should retire.

The *Institutio* was the fruit of Quintilian's wide practical experience as a teacher. His purpose, he wrote, was not to invent new theories of rhetoric but to judge between existing ones, and this he did with great thoroughness and discrimination, rejecting anything he considered absurd and always remaining conscious of the fact that theoretical knowledge alone is of little use without experience and good judgment. The *Institutio* is further distinguished by its emphasis on morality, for Quintilian's aim was to mold the student's character as well as to develop his mind. His central idea was that a good orator must first and foremost be a good citizen; eloquence serves the public good and must therefore be fused with virtuous living. At the same time, he wished to produce a thoroughly professional, competent, and successful public speaker. His own experience of the law courts gave him a practical outlook that many other teachers lacked, and indeed he found much to criticize in contemporary teaching, which encouraged a superficial cleverness of style (in this connection he particularly regretted the influence of the early 1st-century writer and statesman Seneca the Younger). While admitting that stylish tricks gave an immediate effect, he felt they were of no great help to the orator in the realities of public advocacy at law. He attacked the "corrupt style," as he called it, and advocated a return to the more severe standards and older traditions upheld by Cicero (106–43 BC). Although he praised Cicero highly, he did not recommend students to slavishly imitate his style, recognizing that the needs of his own day were quite different. He did, however, appear to see a bright future for oratory, oblivious to the fact that his ideal—the orator-statesman of old who had influenced for good the policies of states and cities—was no longer relevant with the demise of the old republican form of Roman government.

Two collections of declamations attributed to Quintilian have also survived: the *Declamationes majores* (longer declamations) are generally considered to be spurious; the *Declamationes minores* (shorter declamations) may possibly be a version of Quintilian's oral teaching, recorded by one of his pupils. The text of his *Institutio* was rediscovered by a Florentine, Poggio Bracciolini, who, in 1416, came across a filthy but complete copy of it in an old tower at St. Gall, Switz., while he was on a diplomatic mission there. Its emphasis on the dual importance of moral and intellectual training was very appealing to the 15th and 16th centuries' humanist conception of education. Although its direct influence diminished after the 17th century, along with a general decline in respect for the authority of classical antiquity, the modern view of education as all-around character training to equip a student for life follows in a direct line from the theories of this 1st-century Roman.

Quintilian advises the teacher to apply different teaching methods according to the different characters and abilities of his pupils; he believes that the young should enjoy their studies and knows the value of play and recreation; he warns against the danger of discouraging a pupil by undue severity; he makes an effective criticism of the practice of corporal punishment; he depicts the schoolmaster as taking the place of a parent. "Pupils," he writes, "if rightly instructed regard their teacher with affection and respect. And it is scarcely possible to say how much more willingly we imitate those we like." (M.L.C.)

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Quintillus, Marcus Aurelius Claudius (d. 270), Roman emperor in AD 270, who died or was killed a few weeks after being proclaimed emperor.

quinto real (Spanish: "royal fifth"), in colonial Spanish America, a tax levied by the crown on mineral products; it was the principal source of profit derived by Spain from its colonies. The percentage was fixed at one-fifth in 1504, to be paid for 10 years, but the rate remained at generally that level until the 18th century. In 1723 the *quinto* was almost uniformly reduced to the *diezmo* (one-tenth); in 1777 the rate was everywhere reduced to 3 percent, with 2 percent added to metals on their actual importation into Spain. Although the *quinto* was officially levied on all mineral production, in practice it was collected only on precious metals and stones.

Quintus (ancient Roman personal name, or praenomen): *see under* gens or family name or honorific (*e.g.,* under Fabius for Quintus Fabius Maximus Cunctator), except as below.

Quintus SMYRNAEUS (fl. *c.* AD 375), Greek epic poet, the author of a hexameter poem in 14 books, narrating events at Troy from the funeral of Hector to the departure of the Achaeans after sacking the city (and hence called *Ta met' Homeron* or *Posthomerica*).

Quintus claimed that the Muses inspired him when, still a beardless lad, he kept sheep near the temple of Artemis. His style is monotonous, and his vocabulary and metrics are traditional, but his very unoriginality makes his work a valuable guide to the content of the lost epics (*Aethiopis, Little Iliad, Iliupersis*), which provided men of the classical period with their information about the last days of Troy.

Quionga, formerly KIONGA, village, Cabo (Cape) Delgado province, extreme northeastern Mozambique, East Africa, just south of the Rio Rovuma. In 1886 Germany and Portugal had agreed on the Rovuma as the boundary between then German East Africa (now Tanzania) and Portuguese Mozambique, but the Germans later claimed (1892) that Portugal had no rights north of Cabo Delgado, approximately 20 mi (32 km) south of the Rovuma's mouth. In 1894 the German navy took Quionga, and German forces occupied its hinterland, the "Kionga triangle" (approximately 245 sq mi [395 sq km]). In World War I the area was retaken by the Portuguese, and under the Treaty of Versailles it became Portugal's only territorial acquisition of the war. Pop. (latest census) village, 2,456.

Where the same name may denote a person, place, or thing, the articles will be found in that order

quipu, also spelled QUIPO, an Incan accounting apparatus consisting of a long rope from which hung 48 secondary cords and various tertiary cords attached to the secondary ones. Knots were made in the cords to represent units, tens, and hundreds; and, in imperial accounting, the cords were differently coloured to designate the different concerns of government—such as tribute, lands, economic productivity, ceremonies, and matters relating to war and peace. The quipus were created and maintained as historical records and were kept not only by high officials at the capital of Cuzco—judges, commanders, and important heads of extended families—but also by regional commanders and village headmen.

Quirino, landlocked province, north central Luzon, Philippines. It has an area of 1,180 sq mi (3,057 sq km) and until 1971 was the eastern part of Nueva Vizcaya province. It is a mountainous region, drained by the upper reaches of the Cagayan River, and parts of it remain little explored. The southern Sierra Madre runs along Quirino's eastern border, and the Caraballo Mountains are in the centre of the province; both contain major timber resources. Rice, corn (maize), and tobacco are grown; the northern part of the province has grasslands. Ifugao and Ilongot peoples live in the region. Cabarroquis is the provincial capital. Pop. (1980) 83,230.

Quirino, Elpidio (b. Nov. 16, 1890, Vigan, Phil.—d. Feb. 28, 1956, Novaliches), political leader and second president of the independent Republic of the Philippines.

After obtaining a law degree from the University of the Philippines, near Manila, in 1915,

Quirino
EB Inc.

Quirino practiced law until he was elected a member of the Philippine House of Representatives in 1919–25 and a senator in 1925–31. In 1934 he was a member of the Philippine independence mission to Washington, D.C., headed by Manuel Quezon, which secured the passage in Congress of the Tydings–McDuffie Act, setting the date for Philippine independence as July 4, 1946. He was also elected to the convention that drafted a constitution for the new Philippine Commonwealth. Subsequently he served as secretary of finance and secretary of the interior in the Commonwealth government.

After World War II, Quirino served as secretary of state and vice president under the first president of the independent Philippines, Manuel Roxas. When Roxas died on April 15, 1948, Quirino succeeded to the presidency. The following year, he was elected president for a four-year term on the Liberal Party ticket, defeating the Nacionalista candidate.

President Quirino's administration faced a serious threat in the form of the Communist-led Hukbalahap (Huk) movement. Though the Huks originally had been an anti-Japanese guerrilla army in Luzon, the Communists steadily gained control over the leadership, and, when Quirino's negotiations with Huk commander Luis Taruc broke down in 1948, Taruc openly declared himself a Communist and called for the overthrow of the government. By 1950 the Huks had gained control over a considerable portion of Luzon, and Quirino appointed the able Ramon Magsaysay as secretary of national defense to suppress the insurrection.

Quirino's six years as president were marked by notable postwar reconstruction, general economic gains, and increased economic aid from the United States. Basic social problems, however, particularly in the rural areas, remained unsolved; Quirino's administration was tainted by widespread graft and corruption. The 1949 elections, which he had won, were among the most dishonest in the country's history. Magsaysay, who had been largely successful in eliminating the threat of the Huk insurgents, broke with Quirino on the issue of corruption, campaigning for clean elections and defeating Quirino as the Nacionalista candidate in the presidential election of 1953. Subsequently, Quirino retired to private life.

Quirinus, major Roman deity ranking close to Jupiter and Mars (*qq.v.*); the *flamines* (*see* flamen) of these gods constituted the three major priests at Rome. Quirinus' name is in adjectival form and would seem to mean "he of the *quirium,*" a word generally taken to signify the very ancient Sabine settlement that united with the Palatine community to form the original Rome. It has also been derived, however, from *covirium,* meaning "assembly of men." That the Quirinal, traditional site of Sabine settlement, was the seat of his cult there is no doubt, and the Sabine origin of the god is reflected in Ovid (*Fasti* II, 475).

In spite of his importance, little is known about Quirinus. He bears a similarity to Mars, and some believe that he is only another form of that deity. By the late republic he is identified completely with Romulus. His was the name under which the immortalized Romulus was worshipped, and his festival fell on the same date that Romulus was said to have ascended to the gods, perhaps to assume the identity of Quirinus. He had a festival, the Quirinalia, on February 17; his temple on the Quirinal was one of the oldest in Rome. A cult partner, Hora, is spoken of, as are minor deities, the Virites Quirini, of whom nothing else is known. Janus (*q.v.*) appears with the epithet Quirinus, but the relationship between the two is a matter of conjecture.

Quiris, plural QUIRITES, a Roman citizen. In ancient Roman law it was the name by which a Roman called himself in a civil capacity, in contrast to the name Romanus, used in reference to his political and military capacity. The *jus Quiritium* in Roman law denoted the full body of rights for Roman citizenship.

It was an early name and was associated by ancient scholars with the Sabine element in Rome, the Sabine deity Quirinus, and the Quirina tribe. The word referred to citizens exclusively as civilians; it is said that Julius Caesar quelled a military mutiny by addressing the soldiers as "Quirites."

Quiroga, Horacio (b. Dec. 31, 1878, Salto, Uruguay—d. Feb. 19, 1937, Buenos Aires), Uruguayan-born short-story writer whose imaginative portrayal of the struggle of man and animal to survive in the tropical jungle earned him recognition as a master of the *cuento* ("tale") in Spanish.

After travels in Europe during his youth, Quiroga spent most of his life in Argentina, living in Buenos Aires and taking frequent trips to San Ignacio in the jungle province of Misiones, which provided the material for most of his stories. He was a journalist most of his life, briefly a teacher and a justice of the peace. Such early works as the collection of prose and verse *Los arrecifes de coral* (1901; "The Coral Reefs") show Quiroga's imitation of then-fashionable literary devices. Soon, however, he found his own direction in the short story, influenced at first by the macabre visions of the 19th-century U.S. short-story writer Edgar Allan Poe and the jungle settings of the 19th-century English short stories of Rudyard Kipling.

Exploring his view of life as an endless struggle for survival, Quiroga depicted the primitive and the savage with exotic imagery in such collections as *Cuentos de la selva* (1918; *Stories of the Jungle,* 1922) and *La gallina degollada y otras cuentos* (1925; *The Decapitated Chicken and Other Stories,* 1973). The work generally recognized as his masterpiece, *Anaconda* (1921), portrays on several levels—realistic, philosophical, and symbolic—the battles of the snakes in the tropical jungle, the nonpoisonous anaconda and the poisonous viper.

Quiroga suffered in his later years from illness and chronic depression; his later writings reflect the overwhelming sense of futility that eventually led to his suicide in a charity hospital.

Quiroga, Vasco de (b. 1470?, Madrigal, Castile—d. March 14, 1565, Uruapan, Mex.), founder of the Colegio de San Nicolás and a school for girls in colonial Mexico.

Quiroga was educated for the priesthood and trained as a lawyer at the University of Valladolid. He won early recognition for his erudition at a post in the chancery of Badajoz, where he found great favour with the Bishop. He was nominated for the first audiencia to New Spain and arrived in Mexico City in 1531. He was later appointed bishop of Michoacán, where he laboured diligently on behalf of the welfare of the natives, seeking their temporal as well as spiritual salvation. To the latter end, he translated religious works into the native language. In addition to the schools he founded, Quiroga left a literary legacy that included a volume of sermons.

Quisling, Vidkun (Abraham Lauritz Jonsson) (b. July 18, 1887, Fyresdal, Nor.—d. Oct. 24, 1945, Akershus Fortress, Oslo), Norwegian army officer whose collaboration with the Germans in their occupation of Norway during World War II established his name as a synonym for "traitor."

Quisling entered the army in 1911 and served as military attaché in Petrograd (now Leningrad; 1918–19) and in Helsinki (1919–21). He assisted in relief work in Russia under the famous Arctic explorer and humanitarian Fridtjof Nansen and later for the League of Nations. In the absence of diplomatic relations between Britain and Soviet Russia, he represented British interests at the Norwegian legation in Moscow (1927–29). As minister of defense in an agrarian government (1931–33), he gained notoriety for repressing a strike by hydroelectrical workers. He resigned from the government in 1933 to form the fascist Nasjonal Samling (National Union) Party, which stood for suppression of Communism and unionism, but he never gained a seat in the Storting (parliament).

Quisling
By courtesy of the Norwegian News Agency, Oslo

At a meeting with Adolf Hitler in December 1939, Quisling urged a German occupation of Norway; after the German invasion of April 1940, he proclaimed himself head of the government. Although his regime came under widespread bitter attack and collapsed within a week, he continued to serve in the occupation government and was named "minister president" in February 1942 under Reich commissioner Josef Terboven.

Quisling's attempts to convert the church, schools, and youth to National Socialism aroused fervent Norwegian opposition. He was held responsible for sending nearly 1,000 Jews to die in concentration camps. After the liberation of Norway in May 1945, he was arrested, found guilty of treason and other crimes, and executed.

Quito, in full VILLA DE SAN FRANCISCO DE QUITO, capital of Ecuador and of Pichincha province; it lies on the lower slopes of the Pichincha, a volcano that last erupted in 1666, in a narrow Andean valley at an altitude of 9,350 ft (2,850 m), just south of the Equator. It was anciently the seat of the Kingdom of Quitu, the largest unit of an Indian tribal confederation that left no recorded history. Between the 11th century and 1487, when it was united to the Inca Empire, it was ruled by the Shyris, sovereigns of the Cara Indians, who are said to have come "by way of the sea." Sebastián de Belalcázar, a lieutenant of the conquistador Francisco Pizarro, occupied the city on Dec. 6, 1534, and declared a municipal government (*cabildo*). Quito remained the focal point of national affairs—political, social, and economic—until the early 20th century, when economic dominance shifted to Guayaquil. A distinct rivalry between the two cities still exists, with Quito remaining the nation's political and cultural centre.

The oldest of all South American capitals, Quito preserves much of its colonial atmosphere, with the towers of many churches outlined against the circle of volcanoes surrounding the Quito Basin, and with peaceful squares, fountains, balconied houses, steep narrow streets, iron-grilled doorways, and secluded gardens. Unlike other Latin-American cities, Quito's poverty-fringe population lives in central city slums.

Cathedral of Quito on the Plaza Independencia, Ecuador
Carl Frank—Photo Researchers

In 1535 the Franciscans established in Quito an art school, the first of its kind in South America. This marked the foundation of a religious art movement that flourished throughout the Spanish colonial period, leaving a wealth of wooden polychrome sculpture and paintings unequalled in the New World. Many of Quito's churches, cloisters, and old mansions are veritable museums. Among the most admired of Quiteño churches and convents are La Compañía (Jesuit), with Baroque columns, ceilings, and massive altars covered with gold leaf; San Francisco, with its magnificent cloister; Carmen Alto, home of the native Santa Mariana de Jesús; San Agustin, famous for carved ceilings; Santo Domingo, noted for a handsome façade; the Sagrario, where Ecuadorian independence was declared in 1809; and the 17th-century cathedral, burial place of the hero of independence, Antonio José de Sucre. It is estimated that religious buildings occupy one-fourth of the city space.

Long an isolated highland centre, Quito was linked to the coast by the Guayaquil–Quito railway (1908). The city has an international airport and lies on the Pan-American Highway. The Central University (government-sponsored) dates from 1769, the National Polytechnic School from 1869, and the Pontifical Catholic University of Ecuador from 1946 (raised to pontifical status in 1963).

One of Ecuador's two major industrial centres (the other being Guayaquil), it produces textiles, light consumer goods, and objets d'art of leather, wood, gold, and silver. The Trans-Ecuadorian Pipeline from the oil fields in Napo province to the east runs through Quito to Esmeraldas; another oil pipeline connects Quito with Guayaquil to the southwest.

The weekly outdoor Indian markets, or fairs, and small shops selling native crafts are among the characteristic sights of Quito. Pop. (1982 prelim.) 881,414.

quiz show, also called GAME SHOW, broadcast show designed to test the memory, knowledge, agility, or luck of persons selected from studio or broadcast audience or to contrive a competition among these people for merchandise or cash awards. The quiz show first gained popularity on U.S. radio in the 1930s as an audience-participation program. One of its first successes featured a formidable Doctor I.Q. who hurled questions at individuals in a studio audience and rewarded them for correct answers with silver dollars. A later development was the quiz show style of *Information, Please,* which involved a panel answering questions on diverse subjects mailed in by listeners. This show was such a success that it had several imitators, the most popular of which was *The Quiz Kids,* which used precocious children on the studio panel.

U.S. television adopted the quiz show in the early 1950s and further increased its popularity. In place of the merchandise awards that outstanding radio contestants received, television used large cash awards. An indication of the quantum increase was the escalation of one radio program's highest prize, the *$64 Question*, to a *$64,000 Question* on television. The era of television's big-money quiz shows began in 1955.

Attempting to manipulate the outcome of the show so that dull and uninteresting contestants lost and the amiable underdog (or the contestant favoured most by the audience) won, quiz show producers began secretly briefing the contestants chosen to win and thereby increased the shows' popularity. In 1958 a defeated contestant accused the producers of *Twenty-One* of unfair practices. The accusation led to investigations by a New York grand jury and by a congressional subcommittee on legislative oversight, which proved the charges to be true. The scandal led to a quick demise of the big-money shows. In the mid-1960s the television networks revived the quiz show in game formats with lower stakes, and by the 1980s they were again extremely popular.

Qum (Iran): *see* Qom.

Qumrān, also spelled KUMRAN, region on the northwestern shore of the Dead Sea, notable since 1947 as the site of the caves where the Dead Sea Scrolls (*q.v.*) were first discovered. Excavations (since 1949) at a site called Khirbet Qumrān (Arabic: Qumrān Ruins), less than a mile from the sea and north of the waterway Wadi Qumrān, have revealed the ruins of buildings, believed to have been occupied by a community of Essenes, owners of the Scrolls; adjacent to the buildings is an extensive cemetery.

The Essenes separated from the rest of the Jewish community in the 2nd century BC, when Jonathan Maccabeus, and, later, Simon Maccabeus, usurped the office of high priest, which included secular power as well as religious authority. Simon found it necessary to persecute the Essenes, who opposed the usurpation. Hence, they fled into the wilderness with their leader, the Teacher of Righteousness.

These Essenes established a monastic community at Qumrān in the mid-2nd century BC, probably during the reign of Simon (143/142–135/134 BC) but no later than the time of John Hyrcanus (135/134–104 BC). After a brief interruption during the reign (37–4 BC) of Herod the Great, the community resumed its life at Qumrān until the centre was destroyed (AD 68) by Roman legions under Vespasian.

Living apart, like other Essenian communities in Judaea, the 4,000 or so members of the Qumrān community turned to apocalyptic visions of the overthrow of the wicked priests of Jerusalem and the ultimate establishment of their own community as the true priesthood and the true Israel. They devoted their time to study of the Scriptures, manual labour, worship, and prayer. Meals were taken in common as prophetic celebrations of the messianic banquet. The baptism they practiced symbolized repentance and entry into the company of the "Elect of God."

Excavations at Qumrān during the 1950s revealed a group of buildings covering an area approximately 80 metres (260 feet) square. The main building, rectangular and large, contained a scriptorium on the upper floor and had a massive two-story defensive tower of stone in its northwestern corner. Archaeologists further identified several pools and reservoirs, a forge, a grist mill, a cemetery of about 1,200 graves, and a room probably used for community meals.

Qunayṭirah, al-, also spelled EL-KUNEITRA, town and *muḥāfaẓah* (governorate), southwestern Syria. The town, capital of the governorate, is situated in a valley in the Golan Heights; it has ruins dating from Byzantine times. It served, until the 19th century, as a stopover for caravans; by the 20th century Muslim Circassians, a Caucasus Mountain people, had settled there and made al-Qunayṭirah their cultural centre. With the formation of modern Syria, the town grew more Arab in character and, by the mid-1960s, had become an important road junction, regional market centre, and Syrian military post of about 20,000 inhabitants. On June 10, 1967, however, the town was captured by Israeli forces during the Six-Day War. Al-Qunayṭirah was abandoned almost entirely, as most of its inhabitants fled to other parts of Syria. In the early 1970s all of the buildings, which had been standing vacant since the June 1967 war, were razed in preparation for new Israeli settlement.

The governorate, which before the war had an area of 660 sq mi (1,710 sq km), embraced the Golan Heights (*q.v.*) and the western fringe of the Ḥawrān (*q.v.*) region. After the Israeli occupation only the Ḥawrān, with less than half the area, remained under Syrian control; it is a productive wheat-growing region. Pop. (1981 prelim.) Syrian-held portion of the governorate, 26,148; (1982 est.) Israeli occupied, 18,200, of whom 5,700 are Israelis.

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

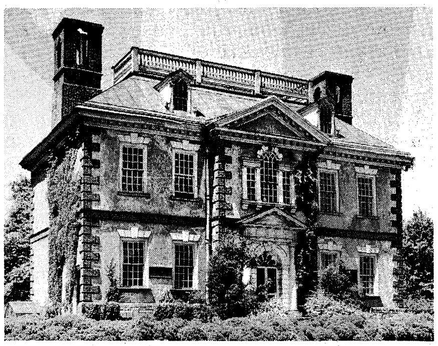
Quoc-ngu (Vietnamese: National Language), romanized writing system used with the Vietnamese language. Quoc-ngu was devised in the mid-17th century by a French Roman Catholic missionary who based his spelling system on the Roman alphabet, with additional signs and accents to denote distinctive Vietnamese sounds, or phonemes.

Quoc-ngu was the first orthographic system to recognize and systematically identify tone. Its use was made official by the French colonial government in 1910.

quodlibet (Latin: "what you will"), musical composition in which several well-known melodies are combined, either simultaneously or, less frequently, sequentially, for humorous effect. Quodlibet can also refer to an amalgamation of different song texts in a vocal composition.

While simultaneous combinations of two or more melodies go back to the 13th century (motets using, for example, a chant melody and a secular tune), quodlibets became popular only in the 15th and 16th centuries. In Germany numerous instances are found in manuscript collections of polyphonic (multipart) songs. An English example is the *Cries of London* by Orlando Gibbons. Perhaps the best known quodlibet is the finale of J.S. Bach's *Goldberg Variations for Harpsichord* (published 1742).

quoin, in Western architecture, both the external angle or corner of a building and, more often, one of the stones used to form that angle. These cornerstones are both decorative and structural, since they usually differ in



Quoins on Mount Pleasant, Philadelphia, 1761–62
Wayne Andrews

jointing, colour, texture, or size from the masonry of the adjoining walls.

Most frequently quoins are toothed, set in a regular pattern of alternating lengths. Such toothed construction was used at external corners of brick or stone buildings in ancient Rome. In 17th-century France, quoins were heavily rusticated, their surfaces roughened and their joints recessed. Similar treatment was used around wall openings (windows, doorways, and arches).

Occasionally quoins are dressed, smooth stones to contrast with walls of rough rubble masonry. They may also be of massive size, as in some Italian Renaissance palaces. Quoins in some brick buildings are covered with plaster, which accounts for the sharp contrast between the stark white quoins and dark brick walls of many manor houses built in the English Renaissance style.

quoits, game in which players toss rings at a stake, called the hob. A ring that encircles the hob scores two points for the thrower; a ring closer to the hob than an opponent's scores one. The rings are usually made of iron and weigh about three pounds, but rope or rubber rings are also used. Quoits was one of the five games in the ancient Greek pentathlon. The game may have been played by Roman soldiers of the 2nd century AD, who, like English peasants, often used horseshoes instead of quoits. In the United States America, horseshoe pitching became the more popular game.

quokka, marsupial mammal, a species of wallaby (*q.v.*).

quota, in international trade, government-imposed limit on the quantity, or in exceptional cases the value, of the goods or services that may be exported or imported over a specified period of time. Quotas are more effective in restricting trade than tariffs, particularly if domestic demand for a commodity is not sensitive to increases in price. Because the effects of quotas cannot be offset by depreciation of the foreign currency or by an export subsidy, quotas may be more disturbing to the international trade mechanism than tariffs. Applied selectively to various countries, quotas can also be a powerful weapon of discrimination among countries.

Tariff quotas may be distinguished from import quotas. A tariff quota permits the import of a certain quantity of a commodity duty free or at a lower duty rate, while quantities exceeding the quota are subject to a higher duty rate. An import quota, on the other hand, restricts imports absolutely.

If the quantity imported under a quota is less than would be imported in the absence of a quota, the domestic price of the commodity in question may rise. Unless the government maintains some system of licensing importers in order to capture as revenue the difference between the higher domestic price and the foreign price, the importing of such commodities can prove a lucrative source of private profit.

Quantitative trade restrictions were first imposed on a large scale during and immediately after World War I. During the 1920s quotas were progressively abolished and replaced by tariffs. The next great wave of quota protection came during the Great Depression in the early 1930s, with France leading the European countries in introducing a comprehensive quota system in 1931. After World War II, the western European countries began a gradual dismantling of quantitative import restrictions, but the United States tended to make more use of them.

qūpūz (musical instrument): *see* koboz.

Qur'ān, also spelled KORAN (Arabic: Recitation), the sacred scripture of Islām, regarded by Muslims as the infallible Word of God, a perfect transcription of an eternal tablet preserved in Heaven and revealed to the Prophet Muḥammad over a period of 20 years.

A brief treatment of the Qur'ān follows. For full treatment, *see* MACROPAEDIA: Islām, Muḥammad and the Religion of.

The intermittent revelations to Muḥammad were first memorized by followers and used in ritual prayers. Although verses were later written down during the Prophet's lifetime, they were first compiled in their present authoritative form during the reign of the third caliph (deputy or successor to the Prophet).

Qur'ānic recitation has always been an important aspect of Muslim piety. As the paramount authority for the Muslim community, the Qur'ān is the ultimate source and continual inspiration of Islām. Its injunctions have characterized the unique development of Islāmic civilization, and its various interpretations have influenced the direction of the multiple trends within this development.

The Qur'ān consists of 114 chapters (*sūrahs*) of unequal length. The earliest *sūrahs* of the Meccan period are generally shorter and written in dynamic rhymed prose. The *sūrahs* of the later Medinan period are longer and more prosaic in style. With the exception of the first *sūrah,* the *Fātiḥah* ("Opening"), the *sūrahs* are arranged roughly according to length, with the longer *sūrahs* preceding the shorter ones. Consequently, the present arrangement is, for the most part, an inversion of the text's chronological order.

The emphases of Qur'ānic teachings differ according to the periods of revelation. A single idea is seldom exhaustively discussed in one *sūrah.* Thus, a systematic rendering of Qur'ānic concepts requires the evaluation of doctrines in terms of both the Qur'ān as a whole and the particular historical circumstances in which the Prophet and community were addressed. The early *sūrahs* convey an emphatic call to moral and religious obedience in light of the coming Day of Judgment, while the late Medinan *sūrahs* provide directives for the creation of a social fabric supportive of the moral life called for by God.

Absolute monotheism governs all Qur'ānic ideas about God. The imperative to recognize no divinity besides God is reiterated throughout the scriptures. The God who revealed his Word to Muḥammad is identified with the God worshipped by both Jews and Christians, though these communities failed to hear and incorporate God's revelation to their prophets. The Qur'ān emphasizes God as the absolute creator and sustainer of an ordered universe, an order that reflects His infinite power, wisdom, and authority. Although God is completely unlike His creation, He is also recognized as omnipresent, "nearer to man than his jugular vein" (50:16). Through His revealed Word, God has provided guidance for mankind, and by the standard of that guidance He will judge mankind on the Day of Reckoning. Emphasis on the stern justice of God is tempered by recurrent references to His mercy and compassion.

The Qur'ān describes man both as "God's viceregent" within the created order as well as an "ignorant and foolhardy" creature. This paradox exemplifies the moral tension characterizing the human situation. While man is endowed with the greatest potential of any created being, he alone is susceptible to evil. The Qur'ān provides no basis for a doctrine of original sin or redemption; rather, it states explicitly that humanity is responsible, both individually and collectively, for its action. Though numerous passages refer to man's freedom to accept or reject the Qur'ānic teachings, other verses speak of God's control of history in terms more akin to predestination. This ambiguity has given rise to a variety of Muslim interpretations of human nature and destiny.

The moral principles to which man is responsible, however, are treated in the Qur'ān with utmost clarity. The scripture demands absolute submission (*islām*) to God and his word. This submission requires the implementation of moral principles both individually and within the sociopolitical order. With the end of history, each man will face judgment and account for the deeds unveiled before him. The Qur'ān provides detailed accounts of the consequences of God's judgment: the joys of the gardens of Paradise and the punishment and terror of Hell. Although the Qur'ān is the primary source of Islāmic law, it does not enumerate the detailed requirements of that law. Similarly, the scriptures provide merely fragmentary directives for the basic duties of the faithful, referred to as the Five Pillars of Islām.

Correct interpretation of the Qur'ān has been a central concern of all schools of Islāmic thought. A special branch of learning, called *tafsīr,* deals exclusively with Qur'ānic exegesis. Commentators use *tafsīr* to study Qur'ānic texts in terms of auxiliary branches of learning such as Arabic grammar, lexicography, and the Prophetic tradition. This development of exegesis, however, did not forestall doctrinal disputes; instead, various theological and legal schools used this discipline to support their respective systems of thought.

The Qur'ān, verbally received by Muḥammad in Arabic, is regarded as immutable in both form and content, and its translation has traditionally been forbidden. Muslims throughout the world thus continue to recite its *sūrahs* in Arabic, although they may not understand the language. Such translations as have been made are viewed as "paraphrases" to facilitate understanding of the actual scripture. A.J. Arberry's *The Koran Interpreted* (1955) is generally recognized as the superior English translation.

Quraysh, also spelled KURAISH, or KOREISH, the ruling tribe of Mecca at the time of the birth of the Prophet Muḥammad. There were 10 main clans, the names of some of which gained great lustre through their members' status in early Islām. These included Hāshim, the clan of the Prophet himself (*see* Hāshimite); Zuhra, that of his mother; and Taim and 'Adī, the clans of the first and second caliphs, Abū Bakr and 'Umar I, respectively; and Umayya, the clan of the third caliph, 'Uthmān, and his relatives, the dynasty of the Umayyad caliphs.

Qurayyāt, al-, *minṭaqah* (province), western Northern region, northwestern Saudi Arabia. It is bordered by the *manāṭiq* (provinces) of al-Hudūd ash-Shamālīyah to the northeast, al-Jawf to the east, and Tabūk to the south, and by Jordan on the north. Al-Qurayyāt fronts the Gulf of Aqaba on the west. The *minṭaqah* is mostly upland plateau with rock and gravel and is covered with grass and shrub that are used for grazing. The valley of the Wādī Sirhān is the main physical feature of the area; it formerly served as an important caravan route from the Mediterranean coast to the central and southern parts of the Arabian Peninsula. Al-Qurayyāt is sparsely populated; an-Nabk is its capital. Pop. (1974) 31,000.

qurrā' (Arabic: "reciters"), singular QĀRI', professional class of reciters of the text of the Muslim sacred scripture, the Qur'ān. In the early Islāmic community, Muḥammad's divine revelations had often been memorized by his Companions (disciples), a practice derived from the pre-Islāmic tradition of preserving poetry orally. It became common for pious Muslims to memorize the Qur'ān in its entirety, even after it had been assembled in written form. Such reciters were often called upon by scholars to elucidate points of pronunciation and meaning obscured by the early and deficient Arabic script, and thus they helped to define the rudiments of Arabic grammar and linguistics.

The sheer number of reciters—who by the 9th century formed an established, specialized class—produced such a variety of subtly differing interpretations that in the time of the 'Abbāsid caliph al-Qāhir (reigned 932–934) seven *qurrā'* were declared the sole orthodox interpreters of the Qur'ān and all other readings were banned. As early as the 7th century AD, in the confrontation at Ṣiffīn (657) between the fourth caliph, 'Alī, and Mu'āwiyah, a contender for the caliphate, the influence of the *qurrā'* was such that they forced 'Alī to submit to the arbitration that cost him the caliphate (*see* Ṣiffīn, Battle of). At the beginning of the 9th century, a union of *qurrā',* with its own elected head, the *shaykh al-qurrā',* is recorded in Baghdad.

The science of reciting the Qur'ān (*qirā'ah*) soon produced a corresponding art of intoning the Qur'ān (*tajwīd*), and this ritual chanting enabled large congregations of Muslims to follow the texts with relative ease. Religious figures employed in the mosques still memorize the Qur'ān to aid them in interpreting the revelations to the faithful. In some Arab countries the professional duties of reciting the Qur'ān at festivals and mosque services are generally reserved for blind men, who are trained in *qirā'ah* from childhood as a means of supporting themselves.

Qutaybah ibn Muslim (d. 715), Arab general under the caliphs 'Abd al-Malik and 'Abd al-Walīd I whose conquests in Afghanistan and Central Asia helped bring the Umayyad caliphate to the height of its power.

Qutaybah was granted the governorship of Khorāsān (now part of Iran) in 704 by 'Abd al-Malik and thus came into the command of a large standing army of about 50,000 Arab troops. From this time on, he used his military expertise in numerous campaigns to expand Umayyad dominion over the territories to the north and east. He began in 705 with the recovery of lower Tukharistan and its capital, Balkh (now part of northern Afghanistan). He then crossed the Oxus (now the Amu Darya) River and in a series of brilliant campaigns conquered Bukhara and its surrounding territories (706–709) in Sogdiana (now part of the Uzbek Soviet Socialist Republic). He then took Samarkand (710–712) and Khwārezm, with its capital, Khiva (all now part of the Uzbek S.S.R.). Qutaybah then led an expedition in 715 farther north into Central Asia, establishing nominal Arab rule over Farghānal (now part of the Uzbek and Kirgiz S.S.R.'s). He is even traditionally credited with reaching the borders of Chinese Turkistan, but this achievement remains historically undocumented. Qutaybah met his downfall from supporting a plan to prevent Sulaymān from inheriting the caliph's throne on the death of his brother, 'Abd al-Walīd. When al-Walīd died, Qutaybah was afraid to return and offer homage to Sulaymān, who did indeed succeed his brother. Qutaybah's troops thereupon mutinied and killed him.

Many of the territories Qutaybah conquered were incorporated into the province of Transoxiana ("that which lies beyond the Oxus"). Though Qutaybah himself was primarily concerned with the military administration of the conquered territories, his successors ultimately achieved the Islāmization of the heretofore primarily Buddhist peoples of those regions. The conquered cities of Samarkand and Bukhara became major centres for the dissemination of Islāmic culture and learning among the Mongoloid peoples of Central Asia.

Quṭb Shāhī DYNASTY (1518–1687), Muslim rulers of the kingdom of Golconda in the southeastern Deccan of India, one of the five successor states of the Bahmanī kingdom. The founder was Qulī Quṭb Shāh, a Turkish governor of the Bahmanī eastern region, which largely coincided with the preceding Hindu state of Warangal. Quṭb Shāh declared his independence in 1518 and moved his capital to Golconda. Toward the end of the century, Muḥammad Qulī Quṭb Shāh built a new capital at Hyderābād, a few miles away.

The kingdom was noted for its gold and diamonds. Its government was a Muslim military aristocracy; Persian influence was strong, and the sultans belonged to the Shī'ī sect of Islām. Relations of the dynasty with the Hindu Telugus were generally good. Golconda took part in the overthrow of Vijayanagar (1565) and thereafter was mainly concerned with expansion along the coastal Carnatic. In 1687 the Mughal emperor Aurangzeb annexed the kingdom.

Quṭb-ud-Dīn Aybak (d. 1210), a founder of Muslim rule in India and an able general of Muʿizz-ud-Dīn Muḥammad of Ghūr.

In childhood he was sold as a slave and raised at Nīshāpūr. He came into the possession of Muḥammad of Ghūr, who put him in charge of the royal stables. Eventually he was appointed to military command, and in 1193, after conquering Delhi, Muḥammad returned to Khorāsān and left the consolidation of the Ghūrid conquests in northwest India to Quṭb. With his headquarters at Delhi, Quṭb subjugated areas between the Ganges and Yamuna rivers, and he then turned his attention to the Rājputs who were still resisting Ghūrid domination. In 1195–1203 he mounted campaigns against their strongholds, while his lieutenant Bakhtiyār Khaljī conquered Bihār and Bengal.

When Muḥammad of Ghūr was assassinated (1206), Quṭb-ud-Dīn was his logical successor. He was still technically a slave, and he quickly obtained manumission. He married the daughter of Tāj-ud-Dīn Yildiz of Ghazna, one of the other principal claimants to succeed Muḥammad, and by other judiciously arranged marriages consolidated his rule. His son-in-law, ablest general, and successor, Iltutmish (reigned 1211–36), basing his power on the conquests of Quṭb, was able to establish the independence of the sultanate of Delhi.

Surviving inscriptions describe Quṭb as *malik* ("king"), and the Quṭb Mīnār in Delhi still stands to commemorate his victories. He died of injuries received in a polo match. *See also* Delhi Sultanate.

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

Quthing, village, southern Lesotho. The surrounding area, which borders South Africa and the black state of Transkei (southeast and west) and the Orange River (north), is predominantly agricultural, with subsistence farming of wheat, corn (maize), and sorghum, and pastoral. The area's main cash income comes from livestock (sheep, cattle, and goats), which produce wool and mohair for export. A large portion of the adult male population may be absent from the region at any given time, working in the mines and farms of South Africa. Quthing (or Moyeni) village has a hospital and is connected by road to Maseru, the national capital, 80 mi (130 km) north. Pop. (1976) village, 2,045.

QwaQwa, also called BASOTHO QWAQWA, formerly WITSIESHOEK, nonindependent black state, Orange Free State, South Africa, designated for the southern Sotho (often called Basuto) people. Located in a section of the Drakensberg, QwaQwa is a glen among mountains at elevations from 5,500 ft to more than 10,000 ft (1,675 m to more than 3,050 m). It is a headwaters area for several streams, including the upper Elands, an important source of water for the Vaal Dam complex. On the southwest, QwaQwa borders independent Lesotho, and to the southeast lies the province of Natal. With an area of 194 sq mi (502 sq km) in the early 1980s, QwaQwa was the smallest of South Africa's black states. Its name, meaning "whiter than white," is derived from a white sandstone hill dominating the area.

The area is divided between two groups of southern Sotho people, the Kwena and the Tlokwa. The Orange Free State's government settled these peoples at Witsieshoek and in the surrounding area in the 1870s by concluding peace with their leaders. In 1926, the Orange Free State government placed the Tlokwa under the authority of the Kwena but gave each group its own regional authority in 1930. In 1969 they were combined into a single territorial authority, which was replaced two years later by a legislative assembly. QwaQwa was granted self-government in 1974. The first election (1975) brought to power the Dikwank-wetla Party under the leadership of Kenneth T. Mopeli.

The economy is based on subsistence agriculture, and corn (maize), sorghum, potatoes, fruits, and other vegetables are grown. Industries include brickworks, gravel quarries, bakeries, and furniture factories. Clay and dolerite are mined. Most of QwaQwa's income is derived from migrant contract workers in South Africa. Phuthaditjhaba (formerly Witsieshoek), the capital and major town, has been selected as a site for industrial development. QwaQwa contains only a small minority of South Africa's southern Sotho people. Pop. (1980 prelim.) de facto, 155,077.

R. and A. (sports organization): *see* Royal and Ancient Golf Club of St. Andrews.

R Monocerotis (catalog number NGC 2261), stellar infrared source and nebula in the constellation Monoceros (Greek: Unicorn). The star, one of the class of dwarf stars called T Tauri variables, is immersed in a cloud of matter that changes in brightness erratically, reflecting or re-radiating energy from the star.

R4D (U.S. aircraft): *see* DC-3.

Ra (Egyptian god): *see* Re.

Ra, either of two papyrus boats with which the Norwegian scientist-explorer Thor Heyerdahl crossed the South Atlantic in 1969–70 to demonstrate the possibility of cultural contact between early peoples of Africa and Central and South America. The first was built in Egypt by boatbuilders Heyerdahl hired from Lake Chad, where reed boats are commonplace. Manned by seven men chosen from seven nations, "Ra" sailed from Safi, Mor., May 25, 1969, but defects in design and cargo loading, the result of inexperience, caused it slowly to founder in July after sailing 3,000 miles. With nearly the same crew, but with a boat ("Ra II") built by Aymaro Indians of Lake Titicaca, Heyerdahl repeated his adventure in 1970, completing the crossing of the Atlantic from Safi to Barbados, West Indies, in 57 days (May 17 to July 12).

Ra–Shalom, asteroid whose orbit is the smallest of any such object so far discovered; it takes only 278 days to circle the Sun. Ra–Shalom was detected in 1978 by Eleanor Helin, a U.S. planetary scientist, at a distance of 29,000,000 kilometres (18,000,000 miles) from the Earth in a region of the solar system that was previously thought to be swept clean of asteroids. It measures about 4 km (2.5 mi) in diameter and is the largest member of the Aten-type asteroids, a class of minor planets that have orbits largely inside that of the Earth. Ra–Shalom has a neutral gray colour and appears to be composed of rocks with water-bearing minerals and trace amounts of carbon.

Raab (Hungary): *see* Győr.

Raabe, Wilhelm, pseudonym JAKOB CORVINUS (b. Sept. 8, 1831, Eschershausen, near Hildesheim, Braunschweig—d. Nov. 15, 1910, Braunschweig, Ger.), German writer best known for realistic novels of middle-class life.

After leaving school in Wolfenbüttel in 1849, Raabe was apprenticed for four years to a Magdeburg book dealer, during which time he read widely. Although he attended lectures at Berlin University, the important product of his time in Berlin was his popular first novel, published under his pseudonym, *Die Chronik der Sperlingsgasse* (1857; "The Chronicle of Sperling Street"), which depicts episodes in the lives lived out on one small street. In 1856 Raabe returned to Wolfenbüttel, determined to make a living as a writer. He published a number of novels and story collections, none of which attracted much attention, and then set out to travel.

In 1862 he married and settled in Stuttgart, where he lived until 1870. During the Stuttgart years he wrote his then most successful novels, *Der Hungerpastor,* 3 vol. (1864; *The Hunger-pastor,* 1885), *Abu Telfan, oder Die Heimkehr vom Mondgebirge,* 3 vol. (1868; *Abu Telfan, Return from the Mountains of the Moon,* 1881), and *Der Schüdderump,* 3 vol. (1870; "The Rickety Cart"). These three novels are often viewed as a trilogy that is central to Raabe's generally pessimistic outlook, which views the difficulties of the individual in a world over which he has little control. Discouraged by a lack of public acclaim in Stuttgart, Raabe returned to Braunschweig, where he spent the last 40 years of his life. He specialized in short stories and involved shorter novels, which are now considered his most original, revealing a mature acceptance of compromise between the old order and the bewildering changes brought about by industrialization and urbanization. They are less pessimistic than his earlier books. Notable among them is *Stopfkuchen* (1891, "Stuffing Cake").

Raaff, Anton, Raaff also spelled RAAF (baptized May 6, 1714, Gelsdorf, near Bonn—d. May 28, 1797, Munich), German operatic tenor, one of the foremost of his day.

Raaff received some vocal experience while being trained for the priesthood as a young man, then in 1736 he began studying with Giovanni Battista Ferrandini in Munich and later with Antonio Bernacchi of Bologna. His career over the next several years took him to Florence, Venice, Bonn, Lisbon, and Madrid. In Madrid he performed in an opera directed by the renowned singer Farinelli, at whose invitation he moved to Naples in 1759. He spent the next decade as the foremost tenor in the opera houses there and in Florence.

In 1770 Raaff returned to Germany to the court of the elector Karl Theodor in Mannheim, where he premiered the title roles in two operas of Johann Christian Bach—*Temistocle* in 1772 and *Lucio Silla* in 1776. While in Mannheim in 1777 he was introduced to a young composer, Wolfgang Amadeus Mozart, who reset the aria "Se al labbro mio non credi" for him. Raaff was so pleased with the result that he arranged for Mozart to be given an opera commission by Karl Theodor. The result was *Idomeneo,* first performed in 1781 in Munich with Raaff in the title role.

Raamses (Egypt): *see* Per Ramessu.

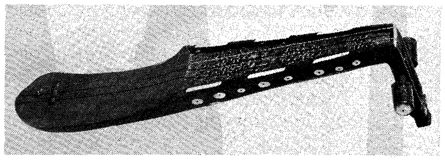
Rab, Italian ARBE, island in the Adriatic Sea forming the northernmost part of Dalmatia in the republic of Croatia, Yugoslavia. With an area of 35 sq mi (91 sq km), it reaches a maximum altitude of 1,339 ft (408 m) at Mt. Kamenjak and comprises three ridges of limestone. Over 300 freshwater springs provide a valuable water supply to the population of the island—which, in contrast to most of the Adriatic islands, is increasing, in part because of good communications with the mainland. Part of Yugoslavia since 1918, Rab had previously been Greek, Roman, Croatian, Venetian, Austrian, French, and Italian after its initial settlement as the colony of Arba by prehistoric Illyrians, reflecting the historic fluctuations of power in the Adriatic.

The principal town, Rab, is one of the most popular resorts of Yugoslavia, a walled town with three parallel main streets built on a steep promontory along the west coast. At the south end is a 13th-century Romanesque cathedral, whose campanile is considered the finest example of Romanesque architecture on the Adriatic littoral. It is the first in a line of four bell towers on a ridge dominating the old town. There are several historically interesting houses built by patrician Venetian families. Six hamlets are supported by fishing, agriculture, tourism, and a ready-made clothing enterprise. Pop. (1981 prelim.) 8,877.

Rabʿ al-Khālī, ar- (Saudi Arabia): *see* Rubʿ al-Khali.

rabāb, Arabic RABĀBAH, Arab fiddle, the earliest known bowed instrument and the parent of the medieval European rebec. It was first mentioned in the 10th century and was prominent in medieval and later Arab art music. In medieval times the word *rabāb* was also a generic term for any bowed instrument.

The *rabāb* has a membrane belly and, commonly, two or three strings. There is normally no fingerboard, the strings being stopped by the player's fingers. Body shapes vary. Pear- and boat-shaped *rabābs* were particularly common and influenced the rebec. Flat round, trapezoidal, and rectangular bodies are also found. Throughout the Middle East and Africa, as well as Central Asia, northern India, and Southeast Asia, the word *rabāb* or a



Algerian *rabāb;* in the Metropolitan Museum of Art, New York City

By courtesy of the Metropolitan Museum of Art, New York City, the Crosby Brown Collection of Musical Instruments, 1889

derivative name refers to a spike fiddle; *i.e.,* one that has a small, round or cylindrical body and appears skewered by a narrow neck.

The *rabāb* reached Europe by two routes. A pear-shaped variety was adopted in the Byzantine Empire in the 9th century as the lira, spreading westward and possibly giving rise to the medieval fiddle. A boat-shaped variety, still played in northern Africa, was introduced by the Arabs to Spain in the 11th century and was played alongside its newly developed European descendant, the rebec, until the 14th century. In parts of Central Asia the word *rabāb* refers to a variety of lute.

Rabad I: *see* ibn Daud, Abraham ben David Halevi.

Rabah (African Muslim leader): *see* Rābiḥ az-Zubayr.

Rabanus MAURUS, also called HRABANUS MAGNENTIUS (b. *c.* 780, Mainz, Franconia—d. Feb. 4, 856, Winkel), archbishop, Benedictine abbot, theologian, and scholar whose work so contributed to the development of German language and literature that he received the title Praeceptor Germaniae ("Teacher of Germany").

Rabanus was sent to Tours, Fr., in 802 to study under the noted scholar-monk Alcuin. In 803 he assumed the direction of the monastic school of Fulda, near modern Frankfurt-am-Main, and developed it into a leading European centre of learning. The manuscripts and works of art he amassed made Fulda one of the richest literary conservatories in western Europe.

Elected abbot of Fulda in 822, Rabanus expanded the help given by the monastery to the poor and enlarged the abbey structures, which were decorated by his own art students and monks. At the same time Fulda became the base for Christian missions throughout Germany.

Because of his role as political consultant to Emperor Lothair I in the Carolingian dynasty's struggle for the leadership of the Holy Roman Empire, Rabanus had to flee into exile when King Louis the German overcame Lothair's forces in 840. After a retirement occupied with literary work and asceticism at nearby Petersberg, Rabanus was reconciled with Louis and was named archbishop of Mainz in 847. In his pastoral work he gained a reputation for social concerns, and his contemporaries recorded that he prevented the starvation of hundreds during the famine of 850.

Conceiving the arts and sciences as necessary means to communicate Christian belief to the largely barbaric Germans east of the Rhine, Rabanus wrote a wealth of treatises and compendiums for the clergy and the laity. Although unoriginal in his thought and writings, he is important specifically for quoting and recapitulating the heritage of learning that he gathered from classical and early Christian authors. His most extensive work is the *De rerum naturis* (842–847; "On the Nature of Things"), also known as *De universo* ("On the Universe"), an encyclopaedia of knowledge in 22 books synthesizing intellectual history until the 9th century. Drawing from the Platonism of Augustine and from the noted Latin Church Father Pope Gregory the Great (6th century), Rabanus compiled a pedagogical treatise, *De institutione clericorum* (*c.* 810; "On the Formation of Clerics"), that constituted an apology for the Christian study of the liberal arts. His *De arte grammatica* ("On the Grammatical Art"), derived from the great 6th-century Latinist Priscian, Alcuin, and the 8th-century Anglo-Saxon monk, scholar, and historian Bede, contributed to the medieval development of logic. He also wrote commentaries on almost all the books of the Bible. Of special note are his annotations on the Old Testament Pentateuch (the five books of the Law) and on St. Matthew's Gospel.

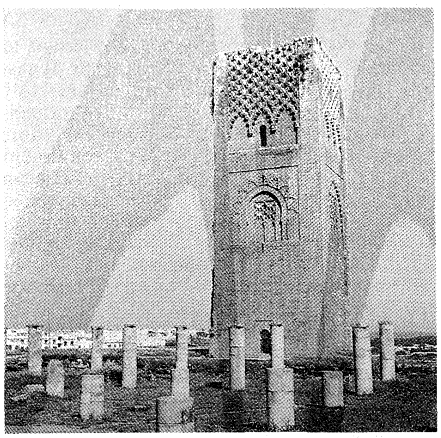
In the advancement of German literature Rabanus oversaw the Fulda translation from a Latin text of the *Diatessaron* ("From the Four"), Tatian's famous 2nd-century Greek and Syriac synthesis of the Gospels, and a translation of the Old Saxon epic poem *Heliand.*

Rabanus' writings have never been completely edited. An uncritical collection is contained in the series *Patrologia Latina,* J.-P. Migne (ed.), vols. 107–112 (1864). His important correspondence with monarchs, popes, and scholars was edited by Ernst Dümmeler (1898).

Rabat, town, west-central Malta, adjoining Mdina, west of Valletta. In Roman times the site of Mdina and Rabat was occupied by Melita, the island's capital. The modern names date from the Arab occupation of Malta, when Mdina was fortified and what remained outside the walls was called *rabat* ("suburb"). There are many Roman ruins, including a partially restored villa housing a museum. Extensive early Christian catacombs are beneath the town, and there are several cave churches and medieval churches and monasteries. The nearby Verdala Palace (1586) was built as a summer residence for the grand masters of the Hospitalers (Knights of St. John of Jerusalem) and was used by the governors of the islands.

Situated within an agricultural region, modern Rabat produces wine and a variety of handcrafted textiles. Pop. (1985 prelim.) 12,-920.

Rabat, Arabic RIBĀṬ, national capital and one of Morocco's four imperial cities, on the Atlantic coast at the mouth of the Bou Regreg River, opposite the town of Salé.



The tower of Hassan, amid ruins of the Hassan mosque of Abū Yūsuf Ya'qūb al-Manṣūr in Rabat, Mor.
Art Resource—EB Inc.

The history of Rabat is closely connected to that of neighbouring Salé, the site of which was first occupied by the Roman settlement of Sala (Shella). During the 10th century, Salé was established by the Zenata Berbers, who were orthodox Muslims, to house the heretical Berghouata Berbers.

Rabat itself was founded in the 12th century by ʿAbd al-Muʾmin, the first Almohad ruler, as a *ribāṭ* (camp) at which to quarter the troops for his jihad (holy war) against Spain. He later abandoned his efforts in Spain in order to concentrate his efforts on the conquest of North Africa. It was the third Almohad sultan, Abū Yūsuf Yaʿqūb al-Manṣūr, who named the place Ribāṭ al-Fath ("Camp of Victory"), from which the name of the present city is derived. He also erected the great fortified wall within which the modern town has developed, and he built the notable tower of Hassan (still standing). After 1609 the unified community of Rabat-Salé became the home of large numbers of Andalusian Moors who had been driven from Spain and, later, of the Sallee Corsairs, the most dreaded of Barbary pirates. Under the French, Rabat was made the administrative capital and, upon Moroccan independence, was designated, together with the city of Salé, an urban prefecture; it now embraces an area of 492 square miles (1,275 square km).

The old town, still surrounded by ramparts, lies near the coast. Within its fortifications are the medina (ancient Muslim town) and *millah* (Jewish quarter). To the north, on a cliff above the Bou Regreg, stands the 17th-century fortress of Casbah des Oudaïa, with a splendid 12th-century Almohad gateway, an Andalusian garden, and an adjoining *madrasah* (college) that houses a museum of Moroccan art. Southeast of the old town are a number of outstanding historical structures, including the 12th-century tower of Hassan, a magnificent minaret, and the ruins of the mosque of Abū Yūsuf Yaʿqūb al-Manṣūr (never completed); to the southwest of the old town are an archaeological museum and ar-Rouah city gate, also dating from the Almohad rule. The modern quarter of Rabat is partly enclosed by the fortified wall. Relatively modern structures, including a royal palace built in the 1950s, Muhammad V University (founded 1957), the national library, and various administrative buildings, are located in the city's southern outskirts.

No longer a port of any significance because of the silting up of the river mouth, the city is now the centre of an important textile industry and is noted for its carpets, blankets, and leather handicrafts. Other economic activities include fruit and fish processing and the manufacture of bricks and asbestos. Rabat is connected to Casablanca (57 miles [92 km] to the southwest) and Tangier (174 miles [280 km] to the northeast) by road and railway, and it has an international airport. Pop. (1982) 518,616.

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rabato, also spelled REBATO, wide, often lace-edged collar wired to stand up at the back of the head, worn by both men and women in the 16th and early 17th centuries. An example may be found in some of the portraits of Queen Elizabeth I, which often show her with a lace or gauze rabato rising up at the back of the neck in the shape of wings.

The turned-back rabato was sometimes used as the support or base for a ruff, the crimped or pleated frill fashionable during the same period. The rabat collar was much smaller than the rabato, and the rabatine collar fell over the shoulders much like a cape.

Man wearing a rabato, detail of "George Villiers, 1st Duke of Buckingham," oil painting by an unknown artist, *c.* late 16th century; in the National Portrait Gallery, London
By courtesy of the National Portrait Gallery, London

Rabaul, chief town of the island of New Britain, Papua New Guinea, in the southwestern Pacific. It is situated on Simpson Harbour, part of Blanche Bay, on the Gazelle Peninsula. Commercial activities in Rabaul centre on the harbour, through which such products as copra, cocoa, and coconut oil are exported. Rabaul also has some light manufactures, including furniture, cement pipes, prefabricated steel buildings, and bricks.

The town, founded in 1910 as a German colonial headquarters, was the capital (1921–41) of the Australian-administered Territory of New Guinea mandated by the League of Nations. It is surrounded by a number of volcanoes, including The Mother, North and South Daughters, Vulcan Crater (on Manam Island, now joined to the main coast, with a racecourse at its base), and Matupi Crater (Mount Tavurvur). Violent eruption of Vulcan and Matupi craters caused the evacuation of the town in 1937 and the transfer of the capital to Lae. Occupied by the Japanese from 1942 to 1945, Rabaul was destroyed by Allied bombing. It was rebuilt after 1950. Namanula Hill, behind the town, is the site of government buildings. Rabaul has good communications, including radio transmissions, and has an international airport. Pop. (1985 est.) 14,-300.

Rabaut, Paul (b. Jan. 29, 1718, Bédarieux, Fr.—d. Sept. 25, 1794, Nîmes), Protestant minister and Reformer who succeeded Antoine Court (1696–1760) as the leader of the Huguenots (French Protestants).

At age 16 Rabaut met Jean Bêtrine, an itinerant preacher of the French Reformed Church, who was highly unpopular with the Roman Catholic government. Rabaut's consequent theological training, which led to his certification as a preacher in 1738, was augmented by studies begun in Lausanne, Switz., in 1740 at the college founded there by Court. Four years later Rabaut became vice president of the synod of his church at Nîmes. In 1745 the government renewed its persecution of the Huguenots, and Rabaut went into hiding. During this period he sought to encourage the Protestants in his vast correspondence but, like Court, tried to prevent their armed rebellion. Following Court's death, Rabaut inherited his position as leader of the sect.

Failing to persuade Rabaut to leave France, the government slowly yielded to public opinion to reduce persecution. The outrage caused by the Calas affair (1762), an incident in which Jean Calas, a Huguenot cloth merchant, was condemned and executed on a false charge of having killed his son because the boy wished to become a Catholic, was a turning point in alleviating the Huguenots' suffering. In November 1787, Louis XVI signed an edict of toleration, and Rabaut celebrated the culmination of his work by dedicating the new church at Nîmes in 1792.

Rabbah (Jordan): *see* Amman.

Rabban bar Sauma (ecclesiastic): *see* bar Sauma, Rabban.

rabbi (Hebrew: "my teacher," or "my master"), in Judaism, a person qualified by academic studies of the Hebrew Bible and the Talmud to act as spiritual leader and religious teacher of a Jewish community or congregation. Ordination (certification as a rabbi) can be conferred by any rabbi, but one's teacher customarily performs this function by issuing a written statement. Ordination carries with it no special religious status. For many generations the education of a rabbi consisted almost exclusively of Talmudic studies, but since the 19th century the necessity and value of a well-rounded, general education has been recognized.

Differences among Orthodox, Conservative, and Reform Jewish groups are reflected, to some degree, in the functions of their respective rabbis. A rabbi associated with a Reform group, for example, will not be involved in overseeing the production of kosher foods, since his group does not observe Jewish dietary laws.

Whereas rabbis assist at all religious marriages, their presence at most other ceremonies is not required. Nonetheless, they generally conduct religious services, assist at Bar Mitzvah, and are present at funerals and sometimes circumcisions. In questions of divorce, a rabbi's role depends on an appointment to a special court of Jewish law.

A rabbi also preaches on occasion and counsels and consoles as needs arise. A rabbi has responsibility for the total religious education of the young, but the extent of his participation, beyond the realm of general supervision, is dictated by local circumstances. Modern rabbis are likewise involved in social and philanthropic works and are expected to lend support to any project sponsored by their congregations.

In some cases, rabbis function on a part-time basis, devoting the major portion of their energies to a secular profession. Because a rabbi does not have sacerdotal status, many functions that he normally performs may be assumed by other individuals who, although not ordained, are qualified to conduct the ceremonies with devotion and exactitude.

By AD 100 the term *rabbi* was in general use to denote a sage, an interpreter of the law, and in early literature it appears in various forms. Jesus, for example, was sometimes called *rabbi* (John 1:49, 9:2) or *rabboni* (John 20:16) by his followers, while presidents of the Sanhedrin were called *rabban* ("our master"). Similarly, the codifier of the Mishna (*c.* AD 200), Judah ha-Nasi, was called *rabbenu* ("our teacher").

Gradually, salaried rabbi-judges and unsalaried rabbi-teachers (interpreters of the Mosaic Law) came to perform routine services for their communities. From the 14th century, rabbi-teachers were receiving salaries (as rabbis generally do today) to free them from other obligations. Also in this period there began the tradition of submission of local scholars to their community's rabbi.

Chief rabbis came into prominence in medieval Europe but found little favour with the Jewish communities that they represented, because most of them held their posts as appointees of the civil government. Of the chief rabbinates that survive today, that in Israel has a rabbinic council with two chief rabbis, one representing the Sephardic (Spanish) rite, the other the Ashkenazi (German). There is no central rabbinate for Jewry as a whole.

Rabbinic Judaism, the normative form of Judaism that developed after the fall of the Temple of Jerusalem (AD 70). Originating in the work of the Pharisaic rabbis, it was based on the legal and commentative literature in the Talmud, and it set up a mode of worship and a life discipline that were to be practiced by Jews all over the world down to modern times.

Rabbinical Assembly, the International Association of Conservative Rabbis, organization of Conservative rabbis in the United States, Canada, Latin America, Europe, and Israel. It was founded in 1900 as the Alumni Association of the Jewish Theological Seminary and was reorganized in 1940 as the Rabbinical Assembly of America; in 1962 it acquired its present name and international scope.

The Rabbinical Assembly recommends rabbis for appointment to Conservative congregations and promotes the goals of Conservative Judaism. In 1985 the Rabbinical Assembly voted to allow the admittance of women as rabbis for the first time. Its publications include the quarterly *Conservative Judaism,* as well as the *Sabbath and Festival Prayer Book* (1946), *Weekday Prayer Book* (1961), *Maḥzor* (for the High Holy Days; 1972), *The Bond of Life* (for mourners; 1975), and *A Passover Haggadah* (1979).

Rabbinical Council of America, organization of Orthodox rabbis, almost all of whom have received their rabbinical training in the United States. The council's chief aims have been to promote the study and practice of Orthodox Judaism, to defend the basic rights of Jews in all parts of the world, and to support the State of Israel. It is the rabbinical arm of the Union of Orthodox Jewish Congregations of America, with which it supervises the manufacture of kosher foods.

Originally organized in 1923 as the Rabbinical Council of the Union of Orthodox Jewish Congregations, the council adopted its present name in the 1930s after merging (1936) with the Rabbinical Association of the Rabbi Isaac Elchanan Theological Seminary (now Yeshiva University), in New York City. The Alumni Association of Hebrew Theological College of Chicago (now in Skokie, Ill.) joined the council in 1943.

The council publishes two journals, the semiannual Hebrew-language *Hadorom* and the quarterly English-language *Tradition.* In 1960 it sponsored the publication of *The Traditional Prayer Book for Sabbath and Festivals.*

rabbit, any of numerous small gnawing mammals of the family Leporidae (rabbits and hares), order Lagomorpha. Rabbits are native to Europe, the New World, Asia, and Africa. They are placed in several genera, the best known being *Oryctolagus,* including only the Old World rabbit (*O. cuniculus*), and *Sylvilagus,* including about 13 species of cottontail rabbits.

As a group, rabbits and hares do not differ greatly in structure. The primary difference is that rabbits are naked, blind, and helpless at birth; newborn hares are well-haired and sufficiently advanced so that they can hop about shortly after birth. Rabbits may be gregarious, as is the Old World rabbit, but hares are generally solitary. Rabbits are also usually smaller than hares, although some, especially those of the many domestic breeds, may weigh as much as 7.25 kilograms (16 pounds). The small to medium-sized Old World and cottontail rabbits are about 25 to 45 centimetres (10 to 18 inches) long and weigh about 0.5 to 2 kg.

Rabbits are long-eared and short-tailed, with long hind legs and, usually, gray or brown fur. They are prolific animals, the females (does) bearing several litters of two to eight young each year. Gestation takes about one month. They live in grass nests (forms) or in burrows. The common names "rabbit" and "hare" are sometimes misleading; the popular breed known as the Belgian hare is actually a rabbit.

Rabbits are of considerable economic importance in many countries. They are widely hunted by man and form the bulk of the diet of many predators. They also carry and can transmit to man such diseases as tularemia, or rabbit fever. In some areas—Australia is a notable example—they become serious pests, destroying crops or grazing lands. Rabbits were introduced in Australia and soon overran the continent. In the 1950s their increase was slowed, although perhaps not permanently affected, by introduction of the rabbit disease myxomatosis.

Rabbit fur, sometimes called lapin, is used in the fur industry and is also a primary source of fibre for the manufacture of felt. Rabbit flesh, which is delicately flavoured, is often eaten by man. About 30 breeds and almost 80 varieties of domestic rabbits are recognized in America. Among the better known breeds are the Angora rabbit, a long-haired rabbit kept mainly for its fur and meat, and the New Zealand rabbit, a breed kept for its meat and fur and also for show, for laboratory use, and as a pet.

The cottontail rabbits of North America, named for the white on the underside of their tails, are common wild rabbits. They live in burrows and are usually found on open land, frequently near settled areas. The hair of cottontails, popular game and food animals, is used in felt production.

The Old World rabbit was originally found in central Europe but has been introduced into Australia, New Zealand, and the Americas. It is a social animal and lives in warrens

(Top) Old World rabbit (*Oryctolagus cuniculus*) and (bottom) Cottontail rabbit (*Sylvilagus*)

(Top) Jane Burton—Bruce Coleman Inc., (bottom) Alvin E. Staffan—The National Audubon Society Collection/Photo Researchers consisting of the burrows of many individual rabbits.

Rabbit, William: *see* Katay Don Sasorith.

rabbit hair, animal fibre obtained from the Angora rabbit and the various species of the common rabbit, all having coats consisting of both long, protective guard hairs and a fine insulating undercoat.

The fibre of the Angora rabbit, produced mainly in France and England, is a luxury fibre, prized for its fineness, soft texture, and lustre. Angora rabbits are domesticated and are usually sheared, clipped, or plucked four times yearly, allowing each growth of fibre to reach about 3 to 3.5 inches (8 to 9 centimetres). Each animal yields about 7 to 14 ounces (200 to 400 grams) of fibre annually. The diameter of the fine fibres ranges from 10 to 18 microns (a micron is about 0.00004 inch), and the percentage of coarse guard hair is low.

Common rabbit hair fibre includes that of domesticated white rabbits, and the less desirable fibre of gray rabbits. It is obtained chiefly from rabbits produced in Europe, especially in France, and from North and South America, China, Japan, and Australia. Some fibre is also obtained from hares raised in central and eastern Europe and South America. The lowest quality commercial fibre is that of the undomesticated gray rabbits of Australia, New Zealand, and Great Britain. Much common rabbit hair is supplied to the textile industry as a by-product of the manufacture of fur felt hats and fur garments. "Boiled fur" is obtained by boiling waste pieces of pelts in a sulfuric acid solution to free the fibre. Waste fibre is also made available from pelts that are sheared to simulate flat furs. Waste fibre is generally short, with the lowest grade of boiled fur about 0.5 inch long.

Like wool and most other animal fibres, rabbit hair is composed of the protein substance keratin and possesses properties much like these fibres. Both guard hairs and fur fibres have a scale covering and possess a thick central canal filled with air pockets, making the fibre fairly light in weight. Unlike wool, rabbit hair requires special processing for felt manufacture. Its ability to absorb and retain moisture is slightly less than that of wool. Alkalies and hot water tend to damage the fibres.

Both Angora and the fibre of common rabbits are often used in blends with other fibres, imparting warmth and softness, with guard hair often added for lustre and strength. The costly Angora rabbit fibre is used mainly for high-quality woven fabrics, knitted goods, and knitting yarns. Common rabbit hair is frequently used for felted fabrics and also for knitted goods.

rabbitfish, any of about 10 species of fishes in the family Siganidae (order Perciformes), found in shallow tropical marine waters from the Red Sea to Tahiti. They live in rocky areas near shore and derive their name from their habit of grazing on plants. Most rabbitfish are olive or brown in colour with poisonous spines; some species have spots. They seldom attain lengths greater than 30 centimetres (1 foot).

Besides members of the family Siganidae, the name rabbitfish has occasionally been applied to the smooth puffer (*Lagocephalus laevigatus*) in the family Tetraodontidae and to burrfish in the family Diodontidae (both, order Plectognathi). One shark of the chimaera (*q.v.*) group is also called a rabbitfish.

Rabbula (b. *c.* 350, Qenneshrin, near Aleppo, Syria—d. *c.* 435, Edessa), reforming bishop of Edessa and theologian who advocated the orthodox Alexandrian (Egypt) position in the 5th-century Christological controversy with the Antiochian (Syria) school of Nestorianism, a heretical teaching that denied that the person of Christ possessed both a divine and a human nature.

A Greek-educated civil servant, Rabbula became a monk after his acceptance of Christianity in Palestine, according to a contemporary biography. On being made bishop of Edessa *c.* 411, he embarked on a reform program with the composition of a "Rule," or directives for clerics and monks. Strenuously contesting pagan and Jewish influences, Rabbula, moreover, repressed Gnostic sects (esoteric, religious groups based on an Oriental dualistic philosophy of contending good and evil deities). At first supporting the Antiochian school, he later developed an admiration for the leading anti-Nestorian theologian, Cyril of Alexandria, and furthered the orthodox cause by translating from Greek into Syriac Cyril's treatises on the nature of Christ, notably "Concerning the Right Faith." The theological polemics pitted Rabbula against prominent Nestorian intellectuals in Edessa and Antioch, who harassed him through bishops sympathetic with their heterodox doctrines.

That he wrote a Syriac version of the Gospels, the Peshitta, to replace the rival *Diatessaron* by the 2nd-century heretic Tatian remains highly problematical on linguistic grounds. Rabbula's liturgical influence extended to the composition of hymns for the Syriac (Jacobite) ritual books as well as advocacy of prayer intercession for the dead.

Rabéarivelo, Jean-Joseph (b. March 4, 1901, Tananarive, Madagascar—d. 1937, Tananarive), Malagasy writer, one of the most important of African poets writing in French, considered to be the father of modern literature in his native land. The mythical world he creates in his poetry is an intensely personal one dominated by visions of death, catastrophe, and alienation, which are all mitigated only occasionally by hope of salvation or resurrection. The overall impression is one of a surrealistic other world in which natural objects such as birds, trees, stars, cows, and fish have human emotions and human figures seem cosmic or semidivine. He seldom touches upon themes of colonialism, revolution, or the quest for identity, themes that obsess later African writers. Rather, he remains immersed in his own dreams and his vision of a cosmic, universal death.

Rabéarivelo, a largely self-educated man who earned his living as a proofreader for the Imerina Printing Press, wrote seven volumes of poetry before his tragic death. *Presque-Songes* (1934; "Nearly Dreams") and *Traduit de la nuit* (1935; "Translation of the Night") are considered to be the most important. His early work (his first volume, *La Coupe de cendres,* "Cutting the Ashes," was published in 1924) is closely imitative of late 19th-century French poetry, especially that of Baudelaire and of a literary group known as the Fantaisites, who wrote melancholy verse expressing a sense of futility. His later work, however, is more remote and impersonal, retaining a Baudelarian sense of form but exhibiting a more mature, individual style. A final collection of poems, *Vieilles Chansons du pays Imérina* ("Old Songs of the Imerina Country"), published two years after his death, is based on poetic love dialogues (*hain-teny*) adapted from Malagasy vernacular tradition.

It is thought that disappointment at being unable to visit the France whose poets he so long admired, coupled with a melancholy temperament and drug addiction, were the causes of his suicide in 1937. Although not widely known outside of Madagascar during his lifetime, Rabéarivelo's best works were reissued for a broader reading public, and English translations of his poems are available in anthologies and journals.

Rabelais, François, pseudonym ALCOFRIBAS NASIER (b. *c.* 1483, Poitou, Fr.—d. probably April 9, 1553, Paris), French writer who for his contemporaries was an eminent physician and Humanist and for posterity is the author of the comic and satirical masterpieces *Pantagruel* (1532) and *Gargantua* (1534).

Rabelais, oil painting by an unknown artist, 17th century; in the Musée National de Versailles et des Trianons
Cliche Musees Nationaux, Paris

Early life. Details of Rabelais's life are sparse and difficult to interpret. He was the son of Antoine Rabelais, a rich Touraine landowner and a prominent lawyer who deputized for the *lieutenant-général* of Poitou in 1527. After apparently studying law, Rabelais became a Franciscan novice at La Baumette (1510?) and later moved to the Puy-Saint-Martin convent at Fontenay-le-Comte in Poitou. By 1521 (perhaps earlier) he had taken holy orders, a step that presupposes serious scholastic studies in the Franciscan tradition.

Rabelais was closely associated with Pierre Amy, a liberal Franciscan Humanist of international repute. In 1524 the Greek books of both scholars were temporarily confiscated by superiors of their convent, because Greek was suspect to the hyperorthodox as an "heretical" language: it opened up the original New Testament and encouraged the study of Greek Fathers of the Church, such as Origen and Clement of Alexandria. Both scholars may have been temporarily imprisoned in their convent. Rabelais then obtained an indult from Pope Clement VII and was removed to the Benedictine house of Saint-Pierre-de-Maillezais, the prior of which was his bishop, Geoffroy d'Estissac. He never liked his new order, however, and later satirized the Benedictines, though he passed lightly over Franciscan shortcomings.

Rabelais studied medicine, probably under the aegis of the Benedictines in their Hôtel Saint-Denis in Paris. In 1530 he broke his vows—though later in his *Supplicatio pro apostasia* ("Supplication for Apostasy") he claimed to have worn the habit of a secular priest and to have regularly celebrated mass. He studied medicine at Montpellier, probably with the support of his patron, Geoffroy d'Estissac. Graduating within weeks, he lectured on the works of distinguished ancient Greek physicians, publishing his own editions of Hippocrates' *Aphorisms* and Galen's *Ars parva* ("The Art of Raising Children") in 1532. As a doctor he placed great reliance on classical authority, siding with the Platonic school of Hippocrates but also following Galen and Avicenna. During this period an unknown widow bore him two children (François and Junie), who were given their father's name and were legitimated by Pope Paul IV in 1540. A third child, Théodule, was recognized by Rabelais but died in infancy.

First novels. After practicing medicine briefly in Narbonne, Rabelais was appointed physician to the hospital of Lyon, the Hôtel-Dieu, in 1532. In the same year he edited the medical letters of Giovanni Manardi, a contemporary Italian physician, as well as a Latin will that later proved to be a fabrication. On November 30 he wrote an enthusiastic letter to Erasmus, the leading Humanist of the time. It was during this period that he discovered his true talent. Fired by the success of an anonymous popular chapbook, *Les Grandes et inestimables cronicques du grant et énorme géant Gargantua,* he published, pseudonymously, his first novel, *Pantagruel.* The novel is slighter in length and intellectual depth than his later ones, but nothing of this quality had been seen before in French in any similar genre. Rabelais displayed his delight in words, his profound sense of the comedy of language itself, his mastery of comic situation, monologue, dialogue, and action, and his genius as a storyteller who was able to create a world of fantasy out of words alone. Within the framework of a mock-heroic, chivalrous romance, he laughed at many types of sophistry, including legal obscurantism and hermeticism, which he nevertheless preferred to the Scholasticism of the Sorbonne. One chapter stands out for its sustained seriousness, praising the divine gift of fertile matrimony, a compensation for death caused by Adam's fall. Rabelais maintains that the Christian father, having enjoyed the privilege to beget legitimate heirs, must educate his sons to become mirrors of his own body and soul conjoined. The work borrows openly from Sir Thomas More's *Utopia* in its reference to the war between Pantagruel's country, Utopia, and the Dipsodes but gaily preaches a semi-Lutheran doctrine—that nobody but God and his angels may spread the gospel by force. *Pantagruel* is memorable as the book in which Pantagruel's companion, Panurge, a cunning and witty rogue, first appears.

This successful novel was followed by the *Pantagrueline Prognostication,* a parody of the almanacs, astrological predictions that exercised a growing hold on the Renaissance mind, particularly after the great conjunction of planets in 1524. As a doctor, Rabelais could (and did) compose prognostications. He disbelieved in "judicial" (essentially fortune-telling) astrology, however, and joined forces with authors who, in the name of divine Providence, attacked it. His satirical form here owes much to German Latin models but surpasses them in quality. Suddenly, in 1534, Rabelais left the Hôtel-Dieu to travel to Rome with the bishop of Paris, Jean du Bellay. He returned to Lyon in May of that year and published an edition of Bartolomeo Marliani's description of Rome, *Topographia antiquae Romae.* He returned to the Hôtel-Dieu but left it precipitately in February 1535, perhaps because of the persecution following the Affaire des Placards (October 1534), an incident of the Reformation in which France was placarded with posters that openly attacked the "idolatry" of the mass. Even Catholic evangelicals, who sought truth in religion through recourse to scriptural authority, were accused of "Lutheranism" and forced to flee.

Gargantua belongs to this period. The second edition is dated 1535; the first edition lacks the title page in the only known copy. This masterpiece was, in part, designed to support royalist causes espoused by Jean du Bellay, who had been created cardinal, essentially by King Francis I, in May 1535. The King, the Cardinal, and his brother Guillaume du Bellay, seigneur de Langey, were in contact with the German theologian Philip Melanchthon, hoping to win his support for an ecumenical effort to end the Lutheran schism and to counter-reform the church in France. Meanwhile, diehard Scholastic theologians of the Sorbonne were kept in prison. *Gargantua* advances these causes, preaching steadfastness in face of persecution but condemning the persecution itself. The Sorbonne is mocked, evangelism propagated.

In *Gargantua,* Rabelais continues to exploit the romances mock-heroically, telling of the birth, education, and prowesses of the giant Gargantua, Pantagruel's father. Much of the satire—for example, mockery of the ignorant trivialization of the mystical cult of emblems and of erroneous theories of heraldry—is calculated to delight the court; much also aims at delighting the learned reader—for example, he sides with Humanist lawyers against legal traditionalists and doctors who accepted 11-month, or even 13-month, pregnancies. Old-fashioned Scholastic pedagogy is ridiculed and contrasted with the Humanist ideal of the Christian prince, widely learned in art, science, and crafts, and skilled in knightly warfare. In politics Rabelais champions appeasement against bellicosity, though he insists that the Christian prince should, as God's agent, follow unsuccessful appeasement with military might. The war between Gargantua and his neighbour, the "biliously choleric" Picrochole, is partly a private satire of an enemy of Rabelais's father, partly a mocking of Charles V, the Holy Roman emperor, and the imperial design of world conquest. Gargantua commands the operations, but some of the exploits are carried out by Frère Jean (the Benedictine). Lean, lecherous, dirty, and ignorant, Frère Jean is a "true monk if ever there was one," but he is redeemed by jollity and active virtue; for his fellow monks are timorous and idle, delighting in "vain repetitions" of prayers. Gargantua's last major episode centres around the erection of the Abbey of Thélème, a monastic institution that rejects poverty, celibacy, and obedience in the name of self-discipline. It welcomes wealth and the well-born, praises the aristocratic life, and rejoices in good marriages. Probably as an afterthought, it is also a refuge for persecuted evangelicals.

After *Gargantua,* Rabelais published nothing new for 11 years, though he prudently expurgated his two works of overbold religious opinions. He continued as physician to Cardinal Jean and his powerful brother Guillaume. After leaving the Hôtel-Dieu in February 1535, he eventually accompanied the Cardinal to Rome. There he regularized his position by making a "supplication" for his "apostasy" (*i.e.,* his unauthorized departure from the Benedictine monastery), arranging to enter the Cardinal's Benedictine convent at Saint-Maur-les-Fossés. The convent was secularized six months later, and he became a secular priest, authorized to exercise his medical profession.

In 1537 he joined Budé, Clément Marot, and others in a famous banquet celebrating the release from prison of a fellow Humanist, Étienne Dolet. Rabelais may later have quarrelled with Dolet, who pirated his works without the expurgations. In May of that year he was awarded the doctorate of medicine of Montpellier; and he delivered, with considerable success, a course of lectures on Hippocrates' *Prognostics.*

He was at Aigues-Mortes in July 1538 when Charles V met Francis I, but his movements are obscure until he followed Guillaume du Bellay to the Piedmont, visiting Turin and Ferrara. Late in 1542 Guillaume set out for Lyon but died in January 1543, in the presence of Rabelais and other doctors, before he reached his destination. Rabelais twice alludes in his works to this important event. He believed that God sent special portents and that Guillaume was granted on his deathbed the gift of prophecy. Guillaume's death meant the loss of a hero and the loss of a patron. That same year Geoffroy d'Estissac died as well and Rabelais's novels were condemned by the Sorbonne and the Parlement of Paris. Rabelais sought protection from the King's sister Margaret, queen of Navarre, dedicating to her his *Tiers Livre* (1546). Despite its royal *privilège* (*i.e.,* license to print), the book was immediately condemned for heresy by the Sorbonne, and Rabelais fled to Metz (an imperial city), remaining there until 1547.

Later work. The *Tiers Livre* is Rabelais's most profound work. Pantagruel has now deepened into a Stoico-Christian inerrant sage; Panurge, a lover of self and deluded by the devil, is now an adept at making black seem white. Panurge hesitates: Should he marry? Will he be cuckolded, beaten, robbed by his wife? He consults numerous prognostications, both good Platonic ones and less reputable ones—all to no effect because of his self-love. His ideas of human sexuality are "erroneous" Galenic ones, not "sound" Hippocratic ones. He consults a good theologian, a Platonic doctor, and a Skeptic philosopher approved of by the learned giants, but his problem is not treated by the "foolish" Bridoye, a judge who—like Roman law in cases of extreme perplexity—trusted in Providence and decided cases by casting lots. Panurge trusts in no one, least of all in himself. It is therefore decided to consult the oracle of the Dive Bouteille (Sacred Bottle), and the travellers set out for the temple. With Bridoye the novel deepens into a paradoxical defense of Christian "folly," owing something to Erasmus' *Praise of Folly* but more to St. Paul as Rabelais understood him. The *Tiers Livre* was condemned probably for its mockery of penance, its subordination of canon law to civil law in matrimonial matters—Rabelais denied the validity of marriages contracted without parental consent—and for its threat of civil intervention into monastic affairs. The work ends enigmatically with a mock eulogy in which hemp is eulogized for its myriad uses, thus artistically balancing Panurge's perverse eulogy on debts at the beginning of the book.

From 1547 onward, Rabelais found protection again as physician to Cardinal Jean and accompanied him to Rome via Turin, Ferrara, and Bologna. Passing through Lyon, he gave his printer his incomplete *Quart Livre,* which, as printed in 1548, finishes in the middle of a sentence. It contains some of his most delightful comic storytelling but also defends a "synergistic" theology (*i.e.,* men must "work together" with grace for salvation). in Rome he sent to the Cardinal de Guise a description of the "Sciomachie" ("Simulated Battle") organized by Cardinal Jean to celebrate the birth of Louis of Orléans, second son of Henry II of France.

In January 1551 Cardinal Jean presented him with two benefices at Meudon and Jambet, though Rabelais never officiated or resided there. In 1552, during the height of the Gallican crisis, when France nearly broke with Rome over the dispute on the monarch's jurisdictional rights within the French church, he published—with a new prologue—the full *Quart Livre,* his longest book. A wealth of both serious and comic writing, it propagates synergism against Calvinistic predestinationalism, mocks bloodthirsty bishops, dismisses the Council of Trent as a non-Catholic council of nitwits, and champions a "syncretistic" Christianity (a welding together of the best of ancient wisdom and scriptural Christianity.

This work, too, was designed to please a Gallican court and is proudly and aggressively dedicated to the liberal cardinal Odet de Châtillon. Despite its royal *privilège,* it, too, was condemned by the Sorbonne and banned by Parlement on March 1, 1552; the Gallican crisis had passed. On Jan. 9, 1553, Rabelais resigned his benefices. Rumour had it—probably without foundation—that he was in prison. He died shortly thereafter and was buried in Saint-Paul-des-Champs, Paris.

Influence and reputation. Rabelais's works are those of a man who had studied several subjects in depth, including scholastic and biblical theology, medicine, and, above all, the law. His reputation for profound humanist learning was a secure one in his lifetime. In spite of his religious irregularities, the Franciscans considered Rabelais as a writer of their order.

Rabelais's works were placed on the "Index of Forbidden Books" by the Council of Trent and tended to be interpreted in an increasingly Protestant sense when published—as for a long time they could only be—outside France. They have had an enormous influence not only on later French writers—such as Voltaire, Balzac, and Chateaubriand—but also on writers as diverse as Sterne, Swift, Trollope, and Kingsley. (M.A.S./Ed.)

MAJOR WORKS. *Gargantua and Pantagruel* comprises: *Pantagruel* (full title, *Pantagruel. Les horribles et espoventables faictz et prouesses du très renommé Pantagruel, roy des Dipsodes, filz du grand géant Gargantua, composez nouvellement par Maistre Alcofrybas Nasier;* published 1532, forms book ii); *Gargantua* (full title, *La vie inestimable du grand Gargantua, père de Pantagruel, jadis composée par l'abstracteur de quinte essence;* 1535, forms book i); *Tiers Livre* (full title, *Tiers Livre des faictz et dictz héroïques du noble Pantagruel; composez par M. Franç. Rabelais, docteur en medicine et calloïer des isles Hières;* 1546); *Quart Livre* (full title, *Le Quart Livre des faictz et dictz héroïques du noble Pantagruel;* complete, 1552); *Le Cinquiesme et dernier livre* (full title, *Le Cinquiesme et dernier livre des faicts et dicts héroïques du bon Pantagruel, composée par M. François Rabelais, docteur en medicine;* 1564). Also *Pantagrueline Prognostication* (1532).

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Rabemananjara, Jacques (b. June 23, 1913, Tananarive, Madagascar), Malagasy politician, playwright, and poet.

Rabemananjara began writing in the early 1940s and published his first volume of verse, *Sur les marches du soir* ("On the Edges of Evening"), in 1942. A death sentence imposed on him for his alleged participation in the 1947 revolt in Madagascar embittered him, despite a later reprieve, and the poems of *Antidote,* written while he was imprisoned in 1947–50 and published in 1961, reflect his anger at the injustice imposed on him and his political hopes for the future.

By the mid-1960s, when he was Madagascar's minister of economic affairs, Rabemananjara had published five volumes of verse and several plays, many of them glorifying the history and culture of his country. In his writing he defended and proclaimed the values of African culture, particularly its closeness to nature, contact with ancestral tradition, and ancient rhythm of life. His plays, *Les Dieux malgaches* (1947; "The Malagasy Gods"), *Les Boutriers de l'aurore* (1957; untranslatable), and *Les Agapes des dieux: Tritivatragédie malgache* (1962; "Love Feasts of the Gods"), and his somewhat rhetorical poems were well-received, and he remained one of Madagascar's most prominent writers.

Rabi, Isidor Isaac (b. July 29, 1898, Rymanów, Austria-Hungary [now in Poland]—d. Jan. 11, 1988, New York City), American physicist who was awarded the Nobel Prize for Physics in 1944 for his invention (in 1937) of the atomic and molecular beam magnetic resonance method of observing atomic spectra.

Rabi's parents settled in New York in 1899. After earning a bachelor's degree in chemistry at Cornell University in 1919, Rabi switched to physics and received his Ph.D. from Columbia University in 1927. He did postgraduate work in Europe and then joined the faculty of Columbia University in 1929, becoming professor of physics in 1937. From 1940 to 1945 Rabi was a leader of the group

Rabi
By courtesy of Columbia University

of scientists at the Massachusetts Institute of Technology, Cambridge, who helped in the development of radar. He was a member of the General Advisory Committee of the Atomic Energy Commission from 1946 to 1956 and succeeded J. Robert Oppenheimer as its chairman from 1952 to 1956. He originated the concept of the CERN international laboratory for high-energy physics in Geneva, Switz., and he was one of the founders of the Brookhaven National Laboratory, Upton, N.Y. He also built up one of the world's finest physics departments at Columbia University, one which was to produce several Nobel Prize-winning physicists.

Rabi's most important scientific work was his development (in the 1930s) of a method for measuring the magnetic properties of atoms, atomic nuclei, and molecules. The method is based on measuring the spin of the protons in the atom's core, a phenomenon known as nuclear magnetic moments. With the application of his magnetic resonance method, several mechanical and magnetic properties, as well as the shape, of an atomic nucleus can be deduced. The precise measurements yielded by this method made possible such subsequent applications as the atomic clock, the maser, and the laser, as well as the nuclear magnetic resonance imaging used in diagnostic medicine. Rabi's method provided the central technique for virtually all molecular and atomic beam experimentation.

Rábida Island, also called JERVIS ISLAND, one of the Galápagos Islands, in the eastern Pacific Ocean, about 600 miles (965 km) west of Ecuador. The island has an area of about 1 square mile (3 square km) and is studded with several small volcanic craters. Originally named for the 18th-century British admiral John Jervis, earl of St. Vincent, the island's official Ecuadorian name is Isla Rábida. Rábida has a lagoon and a flamingo rookery but no human population.

rabies, also called HYDROPHOBIA, or LYSSA, acute, ordinarily fatal, viral infectious disease of the central nervous system. The disease is usually spread among domestic dogs and wild carnivorous animals by a bite; all warm-blooded animals are susceptible to rabies infection. The virus is often present in the salivary glands of rabid animals and is excreted in the saliva; thus, the bite of the infected animal introduces the virus into a fresh wound. Under conditions favourable to it, the virus becomes established in the central nervous system by propagation along nerve tissue from the wound to the brain. When infection occurs, the disease develops most often between four and six weeks after exposure, but the incubation period may vary from 10 days to eight months.

The disease often begins with excitation of the central nervous system expressed as irritability and viciousness. During the early stages a rabid animal is most dangerous because it appears to be healthy and may seem friendly but will bite at the slightest provocation. Wild animals that appear to be tame and that approach people or human habitations in the daytime should be suspected of having rabies.

Dog rabies. Most infected dogs show a short excitation phase that is characterized by restlessness, nervousness, irritability, and viciousness and is followed by depression and paralysis. Sudden death from rabies, without recognizable signs of illness, is not uncommon. Dogs that develop the predominantly excited type of rabies invariably die of the infection, usually within three to five days after symptoms begin. Those with the paralytic type without any evidence of excitation or viciousness may (rarely) recover. The paralysis of the "voice" muscles in rabid dogs may produce a characteristic change in the sound of the bark.

Hydrophobia, or human rabies. Rabies in humans is similar to that in animals. The excitation phase may continue until death occurs during a convulsive seizure. More often, symptoms of depression of the central nervous system develop before death. The hydrophobia symptom consists of repeated episodes of painful contraction of the muscles of the throat upon attempting to swallow. This symptom may be elicited by the sight of water because of the association of water with the act of swallowing—hence the name hydrophobia ("fear of water"). Rabies in humans, when associated with excitation of the nervous system and the hydrophobia symptom, is almost always fatal, but in 1971 there was one instance of recovery.

Death ordinarily occurs within three to five days after the onset of symptoms. Abnormal sensations about the site of exposure are a common early symptom. Sometimes the disease is characterized by paralysis without any evidence of excitation of the nervous system. In such cases the course of the disease may be prolonged to a week or more, and recovery occurs rarely.

Serum treatment and vaccination. If administered soon after infection, serum or vaccine can be effective in combating the disease. Serum treatment for rabies was introduced in 1899. This is a type of passive immunization whereby animals are immunized with attenuated rabies virus, and the blood serum of these animals is injected into infected persons to give them temporary immunity to rabies. The treatment is effective if given within 24 hours after exposure but has little, if any, value if given three or more days after infection by rabies. Immediate treatment of animal bite wounds by cleansing with soap and water is extremely important because much, if not all, of the virus can be thus removed.

Vaccine prepared from rabies virus can be used to protect people whose occupations are likely to bring them into contact with infected animals. The best modern vaccine, called HDCV because it is grown on human diploid cells, may be effective in immunization with as few as two doses. When a person not protected by previous immunization is bitten by a rabid animal, treatment is a dose of serum followed by a series of vaccinations. With the older vaccines, at least 16 injections were required, whereas with HDCV four are usually sufficient. The older vaccines, which were often prepared with animal brain tissue, posed the hazard of encephalitis and caused considerable general reaction. With HDCV there is no danger of encephalitis and general reaction is minimal.

Rābiḥ az-Zubayr, in full RĀBIḤ AZ-ZUBAYR IBN FAḌL ALLĀH, French RABAH (d. 1900, West Africa), Muslim military leader who established a military hegemony in the districts immediately east of Lake Chad.

Rābiḥ was enslaved as a child and later enrolled in the military service of az-Zubayr Pasha, a Sudanese prince. Rābiḥ was loyal and capable, and he rose to a position of command. When in 1878 az-Zubayr rebelled against the Egyptian administration of the Sudan, Rābiḥ gave him loyal support. Az-Zubayr, however, was defeated, and rather than surrender, as did most of the rebels, Rābiḥ fled to central Africa with about 400 followers.

Rābiḥ developed a solid basis of military power. By raiding villages and tribes, his bands secured much booty. He exercised strict authority over his men and required that they surrender to him one-half of the slaves, horses, and cattle they captured. He increased his ranks by offering prisoners their lives and their freedom if they would join him. By the early 1890s he had built a force of some 5,000 men, acquired 44 pieces of light field artillery, and considered himself ready to move out of the relatively remote areas in which he had been operating.

In 1893 Rābiḥ occupied the district of Bornu, east of Lake Chad, with little difficulty. When resistance was offered at Kuka, the capital, he sacked it and thoroughly cowed the population. At Dikwa, south of Lake Chad, he established his capital and initiated a highly centralized administration. Rābiḥ launched several expeditions against the Fulani empire to the east, probably intending to occupy much of the Fulani lands.

Rābiḥ was never able to pursue his ambitions further, however, because France sought to establish a sphere of influence over the whole West African interior. In 1898 a French column moved northward from the Congo and reached the Shari River, where it was welcomed by the local ruler. Rābiḥ ceased his operations against the Fulanis and moved southward to face the new threat. His forces met the French at Kusseri on the Logan River in 1900, where Rābiḥ's army was routed and he himself was killed.

Rabin, Yitzhak (b. March 1, 1922, Jerusalem), prime minister of Israel (1974–77) and Israel's armed forces chief of staff during the Six-Day War (June 1967).

Rabin graduated from Kadourie Agricultural School in Kfar Tabor and joined the Palmach, the Jewish Defense Forces' commando unit, in 1941. He participated in actions against the Vichy French in Syria and Lebanon. During the Israeli war of independence (1948), he directed the defense of Jerusalem and also fought the Egyptians in the Negev. He graduated (1953) from the British staff college. He became chief of staff in January 1964 and conceived the strategies of swift mobilization of reserves and destruction of enemy aircraft on the ground that proved decisive in Israel's victory in the Six-Day War.

In 1968, on retirement from the army, Rabin became his country's ambassador to the United States, where he was often critical of the Nixon administration's peace initiatives as harmful to Israel's strategic interests. At the same, time he drew fire from Israeli hardliners because he advocated withdrawal from Arab territories occupied in the 1967 war as part of a general Middle East peace settlement.

Returning to Israel in March 1973, Rabin became active in Israeli politics. He was elected to the Knesset (Parliament) as a member of the Labour Party in December, joining Prime Minister Golda Meir's Cabinet as minister of labour in March 1974. When Meir resigned in April 1974, Rabin became Israel's fifth (and first native-born) prime minister in June. In 1975 he encouraged U.S. Secretary of State Henry Kissinger's "shuttle diplomacy" attempt to secure additional disengagement of Egyptian and Israeli forces in the Sinai desert, and he reached an agreement with Egyptian Pres. Anwar el-Sadat whereby Israel agreed to evacuate the Sinai oil fields and strategic passes in return for an increased American and United Nations presence in the Sinai as well as Egyptian concessions regarding passage of Israeli goods through the Suez Canal.

Rabin was forced to call a general election for May 1977, but in April of that year, during the electoral campaign, he relinquished the prime ministership and stepped down as leader of the Labour Party because of a controversy over technical irregularities in his finances. He was replaced as party leader by Shimon Peres.

rabob (musical instrument): *see* sarod.

Rabulist riots (1838), wave of popular demonstrations in Stockholm that led to a loosening of Swedish government press censorship and furthered the fortunes of parliamentary government.

The riots, named for a derogatory designation for Swedish radicals, occurred in the summer of 1838, following the conviction of M.J. Crusenstolpe, a liberal journalist, for libel against King Charles XIV. The intensity of the demonstrations, in which two demonstrators were killed, led the government to relax its harassment of the press, thus significantly advancing the position of liberal Swedish elements at the expense of monarchical and conservative forces.

Rabutin, Roger de: *see* Bussy-Rabutin, Roger de.

Racan, Honorat de Bueil, seigneur de (lord of) (b. Feb. 5, 1589, Champmarin, Fr.—d. Jan. 21, 1670, Paris), French poet, one of the earliest members (1635) of the Académie Française.

Racan's celebrated *Stances sur la retraite* (c. 1618) reflects his love of nature and his reluctance to adhere to the poetic discipline of his master, François de Malherbe, whose biography he wrote. Racan's best known work is a pastoral drama, *Les Bergeries*, sometimes called the finest example of the genre in French; it was performed at the Hôtel de Bourgogne in about 1620 and published in 1625. His other poems are mainly bucolic and religious, both preserving the elegiac lyricism of an earlier age and foreshadowing the gentle melancholy of Lamartine. His verse paraphrases of the Psalms, which he wrote during his retirement, are marked by sincerity and more feeling for the beauty of the original text than was usual at the time. Racan became a page at the court of Henry IV, served in the army, and in 1639 retired to his country seat in Touraine.

raccoon, also called RINGTAIL, any of several carnivores of the genus *Procyon* (two to seven species, depending on the authority), family Procyonidae. The typical North American raccoon, or "coon" (*Procyon lotor*), is a stout animal with short legs, a bushy tail, pointed muzzle, and small, erect ears. It is 75 to 90 centimetres (30 to 36 inches) long, including the 25-cm tail, and usually weighs about 10 kilograms (22 pounds), although a large male may weigh more than 20 kg.

North American raccoon (*Procyon lotor*)
Leonard Lee Rue III

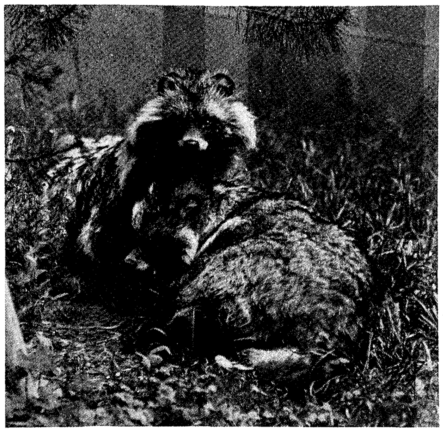
The raccoon's fur is shaggy and coarse, and its colour is iron gray to blackish with brown overtones; there is a conspicuous and well-known black "mask" across the eyes, and the tail is ringed with five to ten black bands. The feet are small, and the forefeet, especially, resemble slender human hands.

The raccoon prefers woods near water, but it adapts well to human presence and may even be found close to large cities. It ranges from northern Alberta, over most of the United States, and into South America. The raccoon is nocturnal and omnivorous, feeding on a variety of arthropods, rodents, frogs, berries, fruit, and other plant materials. Especially in captivity, it is prone to "wash" its food before eating if water is available. It climbs readily and usually chooses a den in a hollow tree. In very cold weather it sleeps for extended periods, but it does not hibernate in the sense of becoming torpid. A litter contains one to six (usually three or four) young, born after a gestation period of 60–73 days. The female is highly solicitous of her young and cares for them for about a year, even though the young begin hunting food and are weaned when about two months old.

Inquisitive, methodical, and intelligent, the raccoon makes a good pet when young, but tends to become irascible when older. Because of its fondness for eggs, nestlings, corn, and melons, it is a nuisance in some areas. It is hunted (most often with hounds) and trapped extensively for its fur and flesh. When cornered, full-grown raccoons are savage fighters, ripping and slashing with claws and teeth; few dogs can successfully attack an adult. In water, a raccoon may drown its adversary.

The large crab-eating raccoon (*P. cancrivorous*), a related species, inhabits South America as far south as northern Argentina. It resembles the North American species but has shorter, coarser fur.

raccoon dog (*Nyctereutes procyonoides*), member of the dog family (Canidae) native to eastern Asia and introduced into Europe. Some authorities place it in the raccoon family, Procyonidae. It resembles the raccoon in having dark facial markings that contrast with its yellowish brown coat, but it does not have a ringed tail. It has short, brown or blackish limbs, a heavy body, and rounded ears. Head



Raccoon dogs (*Nyctereutes procyonoides*)
Russ Kinne—Photo Researchers

and body length is 50–65 cm (20–26 inches); tail length, 13–18 cm (5–7 inches); and weight, about 7.5 kg (16.5 pounds). Most active at night, the raccoon dog is omnivorous and feeds on small animals, fish, vegetation, and carrion. Litters contain 5–12 young, born after a gestation period reported at 60–79 days. The long fur of the raccoon dog is sold commercially as "Ussuri raccoon" or "tanuki."

race, biological grouping within the human species, distinguished or classified according to genetically transmitted differences.

A brief treatment of races follows. For full treatment, *see* MACROPAEDIA: Evolution, Human.

The overwhelming majority of all human populations can be separated into 6 to 10 large groupings known as geographic races, which correspond to geographic areas of continental proportions. Smaller groups, known as local races, exist within most geographic races. Local races remain distinct through the influence of such factors as social custom, religious custom, geography, and population density. Even smaller groupings, known as microraces, can be discerned within local races. The origins and racial development of some peoples, such as the Ainu of Japan, however, are still unknown.

Many problems arise when attempting to distinguish one racial group from another on a nongenetic basis. While one racial group may differ significantly from another in its adaptation to the environment, individuals within the same racial group often differ widely among themselves. Furthermore, groups change over long periods of time.

Physical characteristics in which racial variations occur include body weight and proportions, skin pigmentation, hair texture and colour, blood composition, and fingerprints. Through the process of evolution by natural selection, those characteristics endure that best enable their owners to function in their environments. Thus, most racial traits have demonstrable adaptive usefulness in the climates and conditions in which they originated. For instance, the blood condition called sickle-cell anemia affects mainly people of African descent; in its carrier state it protects against malaria, which is endemic in the hot, damp regions of Africa. The narrow noses of desert-dwelling Arabs humidify the dry air they inhale better than would shorter or broader noses.

Bergmann's Rule and Allen's Rule specify two ways in which human physiology adapts to environmental conditions. Bergmann's Rule states that body weight tends to a minimum in warmer regions, increases to a certain threshold as temperature declines, and then falls off again as temperature falls further; Allen's Rule similarly describes relations between body proportions and climate.

Racial groups are differentiated today on the basis of inherited traits that can be measured and evaluated precisely. Traits often studied include differences in blood type, differences in the excretion of amino acids, and inherited enzyme deficiencies. Older methods of differentiation, like hair form and body measurement, are considered far less scientifically reliable, because of the great deal of individual variation and the influence of environmental factors.

Medical studies have discovered links between race and various physical disorders, blood types, and congenital defects. While sickle-cell anemia affects primarily people of African origin, cystic fibrosis affects mostly those of European origin. Blood type B, though relatively common in East Asia, India, and Africa, is absent in Australian Aborigines. Impacted wisdom teeth (third molars) are most prevalent among Asians and Europeans. Some genetically related disorders, however, appear to be linked directly to the environment. For example, diabetes may be less of a problem in populations that eat a higher percentage of meat and fish than foods rich in sugar and starch.

Human races are in a continual state of flux, with genes constantly flowing from one gene pool to another. This process is known as admixture (also called miscegenation or gene flow). Causes of admixture are numerous and include political disturbance, population pressure, and war. Another source of new genetic material in a gene pool is mutation, which occurs at a rate proportional to the level of penetrating radiation on a population. Through natural selection, mutant genes that are advantageous will be passed on to following generations and will increase in frequency over time.

Isolation, either geographic or cultural, preserves racial differences and allows isolated populations to maximally adapt to climatic and disease factors over long periods of time. For example, before Christopher Columbus' voyages to America, indigenous Americans had long been almost completely isolated from European, African, and Asian gene pools; they therefore lacked immunity to European diseases.

Small-sample effects, expressed as genetic drift and the founder effect, are another explanation for genetic differences among populations. Small populations are much more susceptible to genetic drift, the fluctuations in gene frequencies from generation to generation caused by random assortment. Thus, genes that may be lost in large populations may become established in smaller ones. As small populations enlarge and split into new groups, each new group develops a distinct gene pool that reflects the genetic makeup of the founders of the group. This phenomenon, called the founder effect, can also establish distinctive genetic traits. An example of this effect is in evidence on Pitcairn Island, where most inhabitants are descendants of an HMS *Bounty* mutineer.

Part of the process of evolutionary change is the dying out of some races and the birth of others. Some gene pools have been completely eradicated, but others are spreading through new populations through immigration and intermixture. New races are also springing up, as the result of history, geography, political alliances, military activities, and economics. In the Caribbean, for example, the Carib Indians, as a distinct racial group, have completely disappeared, but new races are forming in the region in which individuals possess genetic traits from Europe, Asia, and Africa.

There are no pure races; all racial groups currently existing are thoroughly mixed. Admixture does tend to favour new genetic combinations, thus increasing the rate of evolutionary change.

The designation "race" has been applied to language groups (the Aryan race), national groups (the Scottish race), religious groups (the Jewish race), and the entire species of humans (the human race), but these are biologically and scientifically meaningless. Nonetheless, throughout human history these types of distinctions have been made; in addition, contact between races has often caused conflict. The antagonism one group of people feels for another is called racism (*q.v.*). Racism is most likely to appear when the differences between groups are extremely obvious, as in differences of language or physical appearance. *See also* geographic race; local race; microrace.

race, milieu, and moment, according to the French critic Hippolyte Taine, the three principal motives or conditioning factors behind any work of art. Taine sought to establish a scientific approach to literature through the investigation of what created the individual who created the work of art.

By "race" he meant the inherited disposition or temperament that persists stubbornly over thousands of years. By "milieu" he meant the circumstances or environment that modify the inherited racial disposition. By "moment" Taine meant the momentum of past and present cultural traditions.

The literature of a culture, according to Taine, will show the most sensitive and unguarded displays of motive and the psychology of a people.

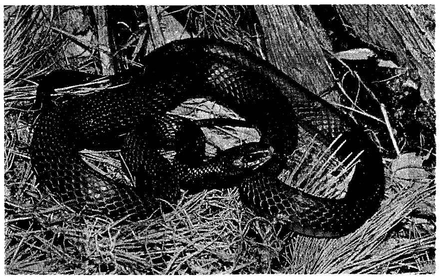
race walking (track and field): *see* walking.

racemate, a mixture of equal quantities of two enantiomorphs, or substances that have dissymmetric molecular structures that are mirror images of one another. Each enantiomorph rotates the plane of polarization of plane-polarized light through a characteristic angle, but, because the rotatory effect of each component exactly cancels that of the other, the racemic mixture is optically inactive (*see* optical activity). The name is derived from racemic acid, the first example of such a substance to be carefully studied. Racemic acid, or, more properly, racemic tartaric acid, is a mixture of equal amounts of dextrorotatory and levorotatory tartaric acids; it is customarily designated *dl*- or (±)-tartaric acid.

The process by which an optically active substance is transformed into the corresponding racemic modification is known as racemization; the converse process, by which a racemic modification is separated into the two enantiomorphs, is known as resolution. The ease with which an optically active compound can be racemized varies within wide limits. For example, racemization of an optically active paraffin hydrocarbon is extremely difficult, but that of lactic acid is easily accomplished. In all instances, however, it is presumed to occur as a result of a reversible transformation of the dissymmetric, optically active substance into an unstable, symmetric one incapable of optical activity; the reverse transformation back from this inactive intermediate is as likely to give one active enantiomorph as the other, so that an inactive mixture results. *See also* enantiomorph.

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

racer, any of several large, swift snakes belonging to the family Colubridae. Blue racers are central and western North American subspecies of *Coluber constrictor;* they are plain



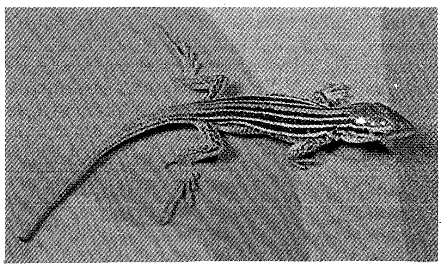
Racer (*Coluber constrictor*)

bluish, greenish blue, gray, or brownish, sometimes with yellow bellies. The eastern subspecies is called black snake; it is all black except for its whitish chin and throat. (For the similar pilot black snake, *see* rat snake.) The young of all subspecies are blotched or spotted.

C. constrictor ranges from southern Canada to Guatemala, and another *Coluber* subspecies is found in northeastern Asia. Despite its scientific name, *constrictor,* it does not kill by constriction; it holds down its prey—usually a small warm-blooded animal—by the weight of its coils, then swallows it.

Racers are slender and long-tailed, with big eyes and smooth scales. Some are 1.8 m (about 6 feet) long. They are active by day and are among the fastest of snakes, moving at a speed of about 5.6 km (3.5 miles) per hour on the ground and through bushes. If cornered they vibrate the tail and strike repeatedly with a sideways motion of the head that leaves a person's skin torn. In the western United States, colour phases of the coachwhip are called red racers and western black racers. *Compare* coachwhip.

racerunner, also called WHIPTAIL (*Cnemidophorus*), any of about 50 species of lizards belonging to the family Teiidae. The racerunner is the only genus of the family occurring in the United States, where it is common; its range extends southward to Argentina. The size varies from 20 to more than 40 cm (8 to 16 inches).



Spotted racerunner (*Cnemidophorus sacki*)
John H. Gerard

The racerunner may be diversely marked, even within a species, being yellow-striped, spotted, or both, on a brown or black background. The species in general prefer open country; some frequent deserts. Forest types are found in clearings and on open trails. The genus is of great interest because of the existence of sexual as well as parthenogenetic species and because of species that have three and four sets of chromosomes rather than the usual two.

Rach Gia, port city, northern Ca Mau Peninsula, southern Vietnam. It is at the head of Rach Gia Bay on the Gulf of Thailand at the north bank of the Cai Lon estuary, 120 miles (195 km) southwest of Ho Chi Minh City (formerly Saigon). Formerly Cambodian territory, in 1715 the flat, forest-covered swamp was placed under the protection of the Nguyen lords of Hue; its Kampuchean (Cambodian) name is Kramuon-Sa. It became widely known as a market for honey, beeswax, and the feathers of exotic birds. When the swamps were drained, Rach Gia became a centre for rice processing and exporting and for the manufacture of straw mats. It is served by the Rach Gia (a canal that predates the French colonial period and from which the city probably derives its present name), linking the port with the Hau Giang River (Bassac River), a major branch of the Mekong. It has a hospital and a commercial airport. Cultural features include a pagoda built under the emperor Gia Long and a Cambodian Buddhist pagoda 2 miles (3 km) north of the town. In a city park is a memorial recording an 1868 attack upon the French. Pop. (1971 est.) 104,161.

Rachel, Mademoiselle, original name ÉLISA FÉLIX (b. Feb. 28, 1820, Mumpf, Switz.—d. Jan. 3, 1858, Le Cannet, Fr.), French classical tragedienne who dominated the Comédie-Française for 17 years.

Mlle Rachel sang on the streets of Lyon and Paris, where her acting ability was quickly discovered by Isidore Samson, who taught her

Mlle Rachel as Phèdre, photograph by Mayer and Pierson
By courtesy of the Bibliotheque de l'Arsenal, Paris; photograph, J.E. Bulloz

the acting techniques he had learned from François-Joseph Talma. Mlle Rachel studied classical statuary for posture, practiced vocal intonations and gestures, performed in many academy plays, and at 17 made her debut at the Comédie-Française as Camille in Pierre Corneille's *Horace*. Press and public at once acclaimed the new star, who, although thin and less than 5 feet tall, dominated the stage with her regal bearing, fiery glances, and intense concentration.

Mlle Rachel was admired for her pantomime, the feverish excitement she brought to climactic scenes, and the evil fascination of some of her characterizations. She gradually came to dictate the policy and program of the Comédie-Française, bending its facilities and personnel to her will. Knowing that her genius and drawing power lay in classical plays, Mlle Rachel appeared in five by Corneille and seven by Jean Racine, finding her greatest triumph in Racine's *Phèdre*. She was persuaded to join the popular romantic movement and appeared in plays by Victor Hugo, Alexandre Dumas *père,* and Alfred de Musset, but of plays in this style only *Adrienne Lecouvreur* by Eugène Scribe and Ernest Legouvé was successfully received.

Mlle Rachel toured the provinces regularly and traveled to England, Austria, Russia, Italy, Germany, and Belgium. Her United States tour in 1855 failed. Weakened from the constant struggle to maintain her artistic and social eminence, the strenuous touring, and the vicissitudes of her notorious private life, Mlle Rachel died of tuberculosis and was buried at Père-Lachaise cemetery in Paris.

Rachidia, er-, formerly KSAR ES-SOUK, town, central Morocco. It lies on the Saharan side of the Atlas Mountains near an undemarcated and disputed frontier with Algeria. The town, occupied by the French from 1916 until the mid-1950s, is an irrigated oasis of date, olive, and fig trees and a road junction on the banks of the Wadi Ziz, a desert stream. It is the site of an agricultural experimental station.

The surrounding region is isolated and arid. Its inhabitants were dependent primarily upon subsistence farming and nomadic herding until the completion of a dam directly above er-Rachidia in 1972. Citrus fruits are grown, and lead and zinc are mined in the region. Pop. (1971) 16,775.

Rachmaninoff, Sergey (Vasilyevich), Rachmaninoff also spelled RAKHMANINOV, or RACHMANINOV (b. April 1 [March 20, Old Style], 1873, Oneg, near Semyonovo, Russia [now in Russian S.F.S.R.]—d. March 28, 1943, Beverly Hills, Calif., U.S.), composer who was the last great figure of the tradition of Russian Romanticism and a leading piano virtuoso of his time. He is especially known for his piano concerti and the piece for piano and orchestra *Rhapsody on a Theme of Paganini.*

Early life. Rachmaninoff was born on an estate belonging to his grandparents, situated near Lake Ilmen in the Novgorod district. His father was a retired army officer and his mother the daughter of a general. As a matter of family tradition, the boy was destined to become an army officer until his father lost the entire family fortune through risky financial ventures and then deserted the family. Young Sergey's cousin Aleksandr Siloti, a well-known concert pianist and conductor, sensed the boy's abilities and suggested sending him to the noted teacher and pianist Nikolay Zverev in Moscow for his piano studies. It is to Zverev's strict disciplinarian treatment of the boy that musical history owes one of the great piano virtuosos of this century. For his general education and theoretical subjects in music, Sergey became a pupil at the Moscow Conservatory.

At the age of 19 he was graduated from the conservatory, winning a gold medal for his one-act opera *Aleko* (after Aleksandr Pushkin's poem "The Gypsies"). His fame and popularity, both as composer and concert pianist, were launched by two compositions: the *Prelude in*

Rachmaninoff
Bassano and Vandyk, Elliott and Fry

C Sharp Minor, played for the first time in public on Sept. 26, 1892, and his *Concerto No. 2 in C Minor,* which had its first performance in Moscow on Oct. 27, 1901. The former piece, although it first brought Rachmaninoff to public attention, was to haunt him throughout his life: the prelude was constantly requested by his concert audiences. The concerto, his first major success, revived his hopes after a trying period of inactivity.

In his youth, Rachmaninoff's passionate nature was not sustained by the will and equilibrium he later developed, and he was subject to emotional crises over the success or failure of his works as well as in his personal relationships. Self-doubt and uncertainty carried him into deep depressions, one of the most severe of which followed the failure, on its first performance (March 1897), of his *Symphony No. 1 in D Minor.* The symphony was poorly performed, and the critics condemned it. (Ironically, this was the work that, following Rachmaninoff's death, was acclaimed by many musicologists as his greatest contribution to symphonic literature as well as his most original composition.) During this period, also brooding over an unhappy love affair, he was taken to a psychiatrist, Nikolay Dahl, who is often credited with having restored the young composer's self-confidence, thus enabling him to write the *Second Piano Concerto* (which is dedicated to Dahl).

The association with Dahl seemed to have an even greater influence on Rachmaninoff's personal life than on his music: about this time he married his own cousin Natalie Satin. The writing of the *Second Piano Concerto* marked the resumption of his creative activity, and it was soon followed by a number of shorter works. The concerto is studded with such melodic themes that it has become his most popular longer work.

Major creative activity. At the time of the Revolution of 1905, Rachmaninoff was a conductor at the Bolshoi Theatre. Although more of an observer than a person politically involved in the revolution, he went with his family, in November 1906, to live in Dresden. There he wrote three of his major scores: the *Symphony No. 2 in E Minor* (1907), the symphonic poem *The Isle of the Dead* (1909), and the *Concerto No. 3 in D Minor* (1909). The last was composed especially for his first concert tour of the United States, highlighting his much-acclaimed pianistic debut on Nov. 28, 1909, with the New York Symphony under Walter Damrosch. Probably the composer's best unified longer work, the *Third Piano Concerto* requires great virtuosity from the pianist; its last movement is a bravura section as dazzling as any in the literature. In Philadelphia and Chicago he appeared with equal success in the role of conductor, interpreting his own newest symphonic compositions. Of these, the *Second Symphony* is the most significant: although it displays Rachmaninoff's usual propensity for lapsing into familiar Romantic conventions, it is a work of deep emotion and haunting thematic material. While touring, he was invited to become permanent conductor of the Boston Symphony, but he declined the offer and returned to Russia in February 1910.

It was at that time and during musical feuds in Moscow between several divisions in the large family of Russian composers that Rachmaninoff's compositions were clearly classified and his place in Russian music defined. On the one hand there were the adherents to the St. Petersburg group of the "Mighty Five" (Balakirev, Borodin, Cui, Mussorgsky, and Rimsky-Korsakov), and on the other there were the more conservative followers of Tchaikovsky, Anton Rubinstein, and Taneyev. Another, smaller, group was composed of enthusiasts of Alexander Scriabin's music. Of these three factions, Rachmaninoff belonged unmistakably to the Tchaikovsky group. His lyricism, devoid of any particular innovation, is especially evident in the large number of songs he composed, even more than in his piano compositions.

Rachmaninoff's music, although mostly written in the 20th century, remains firmly entrenched in the 19th-century musical idiom. He was, in effect, the final expression of the tradition embodied by Tchaikovsky—a melodist of Romantic dimensions still writing in an era of explosive change and experimentation.

The one notable composition of Rachmaninoff's second period of residence in Moscow was his choral symphony *The Bells,* based on Konstantin Dmitriyevich Balmont's Russian translation of Poe's poem. Although it became a staple of the symphonic repertory, partly because of its scoring for chorus and soloists, the work displays considerable ingenuity in the coupling of choral and orchestral resources to produce striking imitative and textural effects.

After the Revolution of 1917, Rachmaninoff went into his second self-imposed exile—this time taking his family to the U.S., where he made his home for the rest of his life. For the next 25 years he lived in an English-speaking country, yet he never mastered its language nor thoroughly acclimatized himself. With his family and a small circle of friends, he lived a rather isolated life. He missed Russia and the Russian people—the sounding board for his music, as he said. And this alienation had a devastating effect on his formerly prolific creative ability. He produced little of real originality but rewrote some of his earlier work. Indeed, he devoted himself almost entirely to concertizing the U.S. and Europe, a field in which he had few peers. His only substantial works from this period are the *Symphony No. 3 in A Minor* (1936), another expression of sombre, Slavic melancholy, and the *Rhapsody on a Theme of Paganini* for piano and orchestra (1934), a set of variations on a Paganini violin caprice. The *Rhapsody* has vied with the *Second Concerto* as the composer's most often-played work.

Of his compositions, the *Second* and *Third Piano Concerti,* as well as the *Rhapsody,* still remain in the concert repertory and may continue to do so. His symphonies, his vocal works, and his solo piano pieces have declined somewhat in their appeal, yet the general charm of his work and his unique performances retain for him an honourable position in the history of music. (V.I.S.)

MAJOR WORKS. *Orchestral works.* Symphonies: *No. 1 in D Minor,* op. 13, 1895; *No. 2 in E Minor,* op. 27, 1907; *No. 3 in A Minor,* op. 44, 1936. Piano concerti: *No. 1 in F Sharp Minor,* op. 1, 1890–91, rev. 1917; *No. 2 in C Minor,* op. 18, 1901; *No. 3 in D Minor,* op. 30, 1909; *No. 4 in G Minor,* op. 40, 1927. Miscellaneous: *The Rock,* op. 7, 1893 (for orchestra); *Capriccio on Gypsy Themes,* op. 12, 1894 (for orchestra); *The Isle of the Dead,* op. 29, 1909 (symphonic poem based on picture of Böcklin); *Rhapsody on a Theme of Paganini,* op. 43, 1934 (for piano and orchestra); *Symphonic Dances, op. 45, 1941 (for full orchestra).*

Chamber music. Trio Elegiaque in D Minor, op. 9, 1893 (for piano, violin, and cello); *Sonata for Cello and Piano in C Minor,* op. 19, 1901.

Piano music. Solo piano: *Five Pieces for Piano,* op. 3, 1892 (including the *Prelude in C-Sharp Minor*), *Six Moments Musicaux,* op. 16, 1896; *Variations on a Theme of Chopin,* op. 22, 1903; *Nine Études-Tableaux,* op. 39, 1916–17; *Variations on a Theme of Corelli,* op. 42, 1932; preludes, études, and sonatas. Two pianos: *Suite No.1,* op. 5, 1893; *Suite No. 2,* op. 17, 1901.

Vocal music. Operas: *The Miser Knight,* op. 24, 1904; *Francesca da Rimini,* op. 25, 1904. Songs: Approximately 72 songs composed between 1893 and 1916. Miscellaneous: *Liturgy of St. John Chrysostomus,* op. 31, 1910 (for mixed choir); *The Bells,* op. 35, 1913 (choral symphony); *Vesper Mass,* op. 37, 1915; *Three Russian Folksongs,* op. 41, 1928.

BIBLIOGRAPHY. The central collection of Rachmaninoff papers, holograph scores, and autograph letters in the U.S. is the Rachmaninoff Archive at the Library of Congress. The Rachmaninoff Room at the State Central Museum of Musical Culture, Moscow, also holds autograph papers, letters, scores, and a complete catalog of works. Rachmaninoff's letters have been collected and published in Russian, *Pisma* ("Letters"), ed. by Z. Apetianz (1955). This collection includes all previously published letters and some newly published ones. *Rachmaninoff's Recollections Told to Oskar von Riesemann,* trans. from the German by D. Rutherford (1934), are reminiscences by the composer about his life and work. One of the few interviews with Rachmaninoff published in English, "Some Critical Moments in My Career," appears in the June 1, 1930, issue of *The Musical Times* (London). Sergei Bertensson and Jay Leyda, *Sergei Rachmaninoff: A Lifetime in Music* (1956), is a comprehensive biography whose preparation was assisted by Sophia Satin, the composer's cousin and sister-in-law. Other important biographical studies are Victor Seroff, *Rachmaninoff* (1950, reprinted 1970); Watson Lyle, *Rachmaninoff: A Biography* (1939, reprinted 1976); John Culshaw, *Sergei Rachmaninov* (1949); Geoffrey Norris, *Rakhmaninov* (1976); and Patrick Piggott, *Rachmaninov* (1978). A contemporary evaluation of Rachmaninoff may be found in M. Montagu-Nathan, *Contemporary Russian Composers* (1917).

Racial Equality, Congress of (CORE), U.S. interracial voluntary organization established in 1942 to undertake direct-action projects to improve race relations and end discriminatory policies. CORE projects have included voter registration drives in the South and actions to deal with a wide range of community issues in the North. One of CORE's most memorable projects was the sending of "Freedom Riders" through the South in May 1961 to test segregation laws and practices in interstate transportation.

By the late 20th century, CORE had more than 70,000 members in more than 180 local groups. The organization maintains its headquarters in New York City.

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racial segregation, practice of restricting people to certain limited areas of residence or to separate institutions (schools, churches) and facilities (parks, playgrounds, restaurants, restrooms) on the basis of race or alleged race. Always a means of maintaining the economic advantages and superior social status of the politically dominant group, racial segregation has been regarded in recent times primarily in terms of white populations maintaining ascendency over other groups by means of legal and social colour bars, but various conquerors—among them Asian Mongols, African Bantus, and American Aztecs—have historically practiced discrimination including segregation of subject races.

Racial segregation has appeared in all parts of the world where there are multiracial communities, except where racial amalgamation has occurred on a large scale, as in Hawaii and Brazil. In such countries there has been occasional social discrimination but not legal segregation. In the southern states of the U.S., on the other hand, legal segregation in public facilities was current from the late 19th century into the 1950s. The 1964 Civil Rights Act attempted to gain for blacks a share in economic and political power by barring job discrimination in federally assisted programs. It also contained provisions against discrimination and segregation in voting, education, and the use of public facilities.

The problem of racial segregation is present in the multiracial communities of central Africa and east Africa, but it has been most acute in South Africa, where apartheid (*q.v.*) is official government policy.

racialism: *see* racism.

Racibórz, German RATIBOR, town, southwestern Katowice *województwo* (province), south central Poland, on the upper Oder River. An industrial town and rail junction, it has electrotechnical, chemical, woodworking, and food-processing industries that have been developed largely since 1945.

According to tradition, Racibórz was founded by a Slavic tribal ruler, Prince Racibor, in the 9th century and was united with Poland in the 10th. It was granted municipal rights in the 13th century and became the seat of a trade fair and handicrafts industry. It passed to the Habsburgs in the 16th century and to Prussia in 1742 but was returned to Poland after World War II, in which it was badly damaged. A regional museum is located there. Pop. (1982 est.) 57,200.

Racine, city, seat (1836) of Racine County, southeastern Wisconsin, U.S., on Lake Michigan at the mouth of the Root River, just south of Milwaukee. Founded in 1834 as Port Gilbert by a lake captain, Gilbert Knapp, in 1837 it adopted its present name, which was derived either from the French word for "root" or from the Algonkian *pakwasewin,* meaning "a place where wild rice is gathered." The improvement of its harbour in the 1840s and the arrival of the railroad spurred its industrial growth, which received considerable impetus from World War II. It is a shipping point with a diversified economy, including publishing and the manufacture of wax products, farm machinery, automobile accessories, electrical equipment, and processed foods. The city is the site of the Johnson Wax administration and research complex, designed by Frank Lloyd Wright. Racine is the seat of Gateway Technical Institute–Racine Campus (1911). Inc. village, 1841; city, 1848. Pop. (1980) city, 85,725; (1982 est.) metropolitan area (SMSA) 173,500.

Racine, Jean(-Baptiste) (baptized Dec. 22, 1639, La Ferté-Milon, Fr.—d. April 21, 1699, Paris), French dramatic poet and master of French classical tragedy. His fame rests on his noble tragedies, *Britannicus* (1669), *Bérénice* (1670), *Bajazet* (1672), and *Phèdre* (1677).

Early life. Racine, born of a provincial family of modest excise or legal officials about 40 miles northeast of Paris, was left motherless at the age of one, fatherless and penniless at three. When he was nine his paternal grandmother became a widow and took him with

Racine, oil painting, 17th century; in the Musée National de Versailles et des Trianons
Giraudon—Art Resource/EB Inc.

her to the convent of Port-Royal des Champs in the Chevreuse Valley, near Paris. There she took vows, joining a daughter and a sister both of whom were nuns, and another sister, Mme Vitart, who lived with her family near the convent.

This was Racine's first stroke of fortune. Around this community lived a handful of distinguished scholars and enlightened teachers who had retired to live lives of austere seclusion under the influence of Jansenism, a theological tendency in Catholicism condemned by Rome in 1642 and 1656, of which they were the champions. Three of them, during a temporary dispersal, had found shelter at La Ferté with Mme Vitart. Their famous Petites Écoles were carefully taught groups of from 10 to 20 boys, never totalling more than 50 in all. Racine, admitted free in consideration of the Vitart connection, gained from them a knowledge of Latin, literary taste, and more Greek than any other pure man of letters of his day; he also learned something of their sombre theology of original sin and grace; and it was among aristocratic former pupils that he later found his first patrons. In 1653–54 he was in a college of similar spirit in Beauvais, after which he returned to Port-Royal for further study at the Petites Écoles. In 1656 the schools were closed by royal command, but Racine stayed, for this was his only home. He is said to have continued his Greek reading in the woods; he also imitated slightly outdated models of descriptive verse in the immature but interesting *Promenades de Port-Royal.*

After a year of law studies in Paris (1658), the young man found employment with his grandmother's nephew Nicolas Vitart, steward of Charles Honoré d'Albert, duc de Luynes. In 1661 Racine's mother's family took an interest in him again; they sent him down to the cathedral of Uzès, in Languedoc, where an uncle was vicar general and might get him an ecclesiastical living. He spent about two years there, studying and noting the violent temperaments and feuds of this still-Huguenot region, but his uncle's ambitions for him bore no immediate fruit.

Back in Paris he followed his own bent and plunged into a career of authorship. His only literary associate of merit at that time was the future fabulist Jean de La Fontaine.

Drama was then the best road to success, but this meant defying his Jansenist kinsfolk and teachers, who were ahead of general Catholic opinion in condemning the stage and all connected with it. He was told in 1663 to keep away from Port-Royal unless he reformed. In 1666, after his first dramatic success, he counterattacked bitterly with a brilliant anonymous open letter (*Lettre à l'auteur des 'Hérésies imaginaires'*) to his old master Pierre Nicole, who had recently written (with no reference to Racine) that a novelist or playwright was a public poisoner.

Mature life and works. Racine's career as an increasingly successful poet-playwright ran from 1664 to 1677, coinciding with the brilliant early years of Louis XIV's reign. Even before Uzès he had obtained a little notice by publishing an ode on the King's marriage (1660); another ode on a royal attack of measles (1663) brought him a small gratuity, the first of a great many. His letters of exile from the south speak of one rejected and one abandoned play (there may have been a third). On his return he somehow met Molière, the great comic poet and actor-manager, who accepted, perhaps even commissioned, his first tragedy, *La Thébaïde ou les frères ennemis* ("The Thebaide or the Enemy Brothers"), produced with mediocre success in 1664. *Alexandre,* the year after, was as superficial and fashionable in its use of the themes of love and glory as *La Thébaïde* had been archaic in its gloom and violence. *Alexandre* did well, but Racine, apparently dissatisfied with Molière's relatively natural acting style, surreptitiously took the script to the oldest of the three permanent theatres then in Paris, the Hôtel de Bourgogne, which actually put it on while it was having its sixth performance with Molière. The latter took offense and dropped Racine, who gave all the rest of his commercial plays to the Hôtel de Bourgogne. Molière's star actress, Du Parc, followed Racine and became his mistress. Hers was the title role in *Andromaque* (first performed 1667), in which Racine found what was to be his most appreciated (though not his only) theme: the tragic folly and blindness of passionate love. As poetry, the play was far superior to any competitor. In the neat efficiency of its dramatic mechanics it was a model and was, if anything, too clever. Its sometimes antiheroic moral realism disturbed some devotees of the idealistic tradition of romance, but in spite of critical cavils it was a sensational triumph.

There followed Racine's only comedy, the three-act *Les Plaideurs* (1668; *The Litigants*), a slight but witty adaptation of *The Wasps*—far removed from the original, but no one else in the century would have thought of borrowing from Aristophanes at all. Then came the sombre *Britannicus* and the touching *Bérénice,* both set in imperial Rome. The first was the occasion of an open breach with Pierre Corneille, the declining idol of an older generation of playgoers, who attended the first night and was openly hostile. *Bérénice* was based on the same historical episode as a play of Corneille produced almost simultaneously with it. (Such competitions were quite normal: Racine's *Thébaïde* seems to have been a counterblast to a tragedy put on by the Hôtel de Bourgogne, and *Iphigénie* and *Phèdre,* later on, both encountered rivals with the same titles and subjects.) One or both playwrights had some idea of what the other was writing, to judge by the texts. Corneille's play was not a failure, but Racine's was another triumph. He had shown up, by a deliberate contrast, his rival's weakness: the complexity of motives and interests that Corneille at this time was weaving into each of his plots. The point was pressed home in the prefaces to both *Britannicus* and *Bérénice.*

Not that this plea for "simplicity of action" was Racine's last word. Still trying new directions as he never ceased to do, he made his next subject, *Bajazet,* from almost contemporary Turkish history, full of intrigue and danger. *Mithridate* (1673) confronts an aging Asiatic despot with a Greek heroine. *Iphigénie,* first produced in 1674 in the outdoor setting of a royal fête at Versailles, is an adaptation of *Iphigenia at Aulis* by Euripides, but with a love plot and a happy ending; *Phèdre* was to use the same Greek poet even more successfully.

Iphigénie had a public run of extraordinary length and brought its author, at 35, to the apex of his first, literary, career. Racine was now head of his profession and powerfully patronized: official backing had won him membership in the Académie Française, the officially recognized body that arbitrated French literature and language, in 1672; in 1674 he obtained a sinecure conferring nobility, a treasurership of France. The man who had been in debt and without prospects in 1662 had been putting aside his savings in careful investments since 1669 and, for an author, was well off. The year 1676 saw a collective edition of all Racine's work to date, with the waspish polemical passages removed from the prefaces; the new or recast versions consciously built up the image of the scholar-poet.

Phèdre was the last, most profound, and most poetic of the tragedies for the Paris stage; the heroine suffers equally from her incestuous passion and her sense of degradation. Coming as it does before Racine's decisive break with the theatre, the play has often been thought to reflect the author's remorseful return to the principles of his youth.

Retirement from the theatre. Within eight months of the premiere of *Phèdre,* the great playwright had cut all links with the commercial stage, married a pious, unintellectual young woman of 24 or 25 (a connection by marriage of the Vitarts), and accepted—with his friend the critic and satirist Nicolas Boileau—the high honour of writing the official history of the reign.

There will always be debate about Racine's motives for this sudden retirement. It was said that his present mistress, the actress Champmeslé, had played him false (but she was notoriously promiscuous, anyway). It is true that *Phèdre* had been challenged for a short time by a rival play, and Racine, with Boileau, had been implicated in an ugly episode as supposed authors of scurrilous sonnets against Philippe Mancini, duc de Nevers, supporter of the other playwright, Jacques Pradon—but these were passing clouds. Racine spoke later of having turned away from a life of sinful dissipation, and the son who wrote his life gives a radical conversion as the sole cause of the retirement. Some modern scholars suggest that, with *Phèdre,* Racine had said all it was in him to say; or that he had shocked himself by this powerful picture of a world where the gods could be evil.

Most attribute at least some part to ambition and the desire for security. It must be remembered that, although he had made sacrifices to embrace a career in letters, he had always courted patronage, and that art had far less dignity in his society than it has since acquired. The new post, proffered through the influence of the King's favourite, Mme de Montesan, was an unexpected honour and a surprisingly well-paid one; socially and financially it would have been hard to refuse; humanly, perhaps impossible. The stage, too, was more and more frowned upon in religious circles, and the author of *Phèdre* himself was to express the same views in his last years.

He remained a man of letters; as such he was already a classic (and as irritably jealous as ever of his reputation). He went on revising new editions of his plays (1687 and 1697), which in book form seemed less blameworthy than on the stage. "The scandals of his past life," as his deathbed testament calls them, had resulted from his playwright's life, and ceased with it. His only known love affairs were with his two leading actresses, whom he coached in their roles. The first, with Du Parc, it is true, seems to have been a passionate one. The affair ended with her death, which may have been caused by an abortion; but accusations to this effect against Racine by a disreputable character, in the course of a criminal inquiry into poisonings and black masses in 1679–80, were never followed up. (One tradition says that she had earlier borne Racine a daughter, who died in childhood).

After 1677 his calling and way of life were irreproachably respectable. His wife presented him with two sons and five daughters, one of whom took the veil just before his death and one just after. He was a strict and solicitous father.

He renewed contact with Port-Royal and showed some courage in exerting his influence to help it. Not that he renounced the world: he had to be near the King, whose numerous campaigns he followed in order to report them; his pen was at the command of the King, Mme de Montespan, and later Mme de Maintenon, the King's morganatic wife. His social talents made him acceptable at court, so much that the envious accused him of hypocrisy. New honours arrived: he became a gentleman of the bedchamber in 1690, a second and more indubitable title of nobility than the treasurership, and one that was made hereditary by a new grant in 1693. All these had been—quite exceptionally—free gifts of the King; not so the secretaryship he purchased (for unknown reasons) in 1696. That post, and a tax levied on it in 1698, upset his hitherto flourishing finances and proved in the end that he could not afford the social eminence he had earned.

Racine's last two plays were commissioned by Mme de Maintenon for her school for daughters of impoverished nobles at Saint-Cyr. The preface of *Esther* (1689) explains that the plan for an improving dialogue with sung interludes was an unhoped-for chance to revive two features of Greek drama—the chorus and the religious inspiration. (Another model, not mentioned, was the opera.) *Esther* was a brilliant court occasion. The play's three acts, something of a nursery tale in comparison with the passion and subtlety of Racine's earlier dramatic actions, are redeemed by the poetry of the choruses. *Athalie* (1691), which for uncertain reasons never had a public performance in Racine's lifetime, has five acts with choruses, and, though different, equals most or all of the rest.

Racine died of an abscess (which may have been a cancer) on the liver, after 18 months of notably stricter austerity. He was buried at his own request in the Port-Royal graveyard. When Port-Royal was destroyed by royal decree (1710), his body was reinterred at Saint-Étienne-du-Mont.

Accomplishments. Racine gave supreme form to what has come to be called the "classical" French tragedy of the 17th century; he was among the greatest French poets in any genre, and in modern eyes he was the only French playwright ever to catch the authentic note (however it is defined) of tragedy. He was also the first French writer born without rank or money to die a courtier, a noble, and a man of means and influence. (R.C.K.)

MAJOR WORKS. *Plays. La Thébaïde ou les frères ennemis* (1664); *Alexandre le Grand* (1666); *Andromaque* (1668); *Les Plaideurs* (1669); *Britannicus* (1670); *Bérénice* (1670); *Bajazet* (1672); *Mithridate* (1673); *Iphigénie* (1675); *Phèdre* (1677); *Esther* (1689); *Athalie* (1691).

Verse. "Cantiques spirituels" (1694).

Prose. Abrégé de l'histoire de Port-Royal (1767).

Translations. The plays were rapidly translated into Dutch. Ten English stage versions appeared, 1675–1723, but differences of national taste made them grossly unfaithful: E. Smith, *Phaedra and Hippolytus* (1707) and A. Philips, *The Distrest Mother* (after *Andromaque,* 1712) had successes that now appear undeserved. Schiller's German *Phädra* (1805) is admired. The great obstacle in modern English is the absence of an accepted equivalent poetic style. Kenneth Muir has translated *Five Plays* (1960); J. Cairncross, *Phaedra and Other Plays* (1963) and *Andromache and Other Plays* (1967); S. Solomon, the *Complete Plays,* 2 vol. (1967–68). See also R.C. Knight, *Phèdre* (1971).

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The only critical edition complete with biographical material, still consulted though superseded in much of its detail, is the *Oeuvres,* ed. by P. Mesnard, 8 vol. (1865–73). The "Pléiade" edition, by R. Picard, 2 vol. (1950–52), gives accurate text, good critical introductions, and many of Racine's notes. The Garnier edition (1960) and "l'Intégrale" (ed. by P. Clarac, 1962—without variants), may be commended.

Racine's life has been treated by Agnes Mary Duclaux, *The Life of Racine* (1925, reprinted 1972), and more exhaustively and definitively in its external and material aspects by R. Picard, *La Carrière de Jean Racine* (1956). The *Mémoires* of L. Racine, who was not seven at his father's death (in Mesnard and Picard editions), are conscious whitewashing. See also G. Brereton, *Jean Racine: A Critical Biography* (1951), balanced and sympathetic; François Mauriac, *La Vie de Jean Racine* (1928), a religious interpretation; and R. Jasinski, *Vers le vrai Racine,* 2 vol. (1958).

For historically-based academic criticism, see O. de Mourgues, *Racine, or, The Triumph of Relevance* (1967); J.C. Lapp, *Aspects of Racinian Tragedy* (1955); and R.C. Knight (ed.), *Racine* (1969). Modern critical tendencies are represented, with moderation, by J.D. Hubert, *Essai d'exégèse racinienne: Les Secrets témoins* (1956); and much more extremely by French *néo-critiques*—L. Goldmann, *Le Dieu caché: Étude sur la vision tragique dans les Pensées de Pascal et dans le théâtre de Racine* (1955; *The Hidden God: A Study of Tragic Vision in the Pensées of Pascal and the Tragedies of Racine,* 1964); and *Racine* (Eng. trans. 1972); R. Barthes, *Sur Racine* (1963; *On Racine,* 1964); C. Mauron, *L'Inconscient dans l'œuvre et la vie de Racine* (1957); and Claude Kurt Abraham, *Jean Racine* (1977).

racism, also called RACIALISM, the theory or idea that there is a causal link between inherited physical traits and certain traits of personality, intellect, or culture and, combined with it, the notion that some races are inherently superior to others.

A brief treatment of racism follows. For full treatment, *see* MACROPAEDIA: Social Differentiation.

It is difficult to establish definitely the origins of racist thinking, but certainly one of the most influential of such thinkers was Joseph-Arthur, comte de Gobineau (*q.v.*), who published his four-volume *Essay on the Inequality of Human Races* in the middle of the 19th century. He taught the superiority of the white race over all others, and, among the whites, of the Aryans as having reached the heights of civilization. Gobineau's most important follower was Houston Stewart Chamberlain (*q.v.*), who published *The Foundations of the 19th Century* in German in 1899. An Englishman by birth, he spent most of his life in Germany, where he was active in the Gobineau Society, and was so popular with the ruling class that he became known as the kaiser's anthropologist. He, too, insisted on the superiority of the Teutons, whom he characterized physically as being for the most part tall, fair, and dolichocephalic (longheaded), that is to say, corresponding to the Nordic type. He regarded the Jews as alien in spirit to the favoured Teutons, although he admitted the difficulty of distinguishing Jews from Germans on the basis of physical characteristics alone.

Although there were many other writers who developed the racialist position, such as Ludwig Woltmann and H.F.K. Günther in Germany, and Lothrop Stoddard and Madison Grant in the United States, Gobineau and Chamberlain may be regarded as the intellectual forerunners of the racial theories of the German Nazis. Adolf Hitler himself acknowledged his indebtedness to these theorists, particularly to Chamberlain, for giving him the "scientific" basis for this aspect of his political philosophy. There were, of course, inner contradictions in the racist approach—the fact that so many Germans did not look like Nordics and so many Jews did, the alliance with the Japanese who had consequently to be exempted from the racial restrictions of the Third Reich, the difficulty of giving any clear meaning to the concepts of German "blood" or "soul"—so that facts had to be replaced by mysticism. In spite of these and other deficiencies, racialism was used as a technique which helped to unify the Germans by identifying the "enemy," gave the people a strong sense of ego enhancement and self-confidence, justified economic exploitation and slave labour, obtained support for the war, and convinced the Germans that they never could be defeated. Racism thus functioned as one of the most effective techniques of Nazi propaganda for achieving and maintaining power over the German people.

Although colonialism cannot be compared with Nazism in terms of the violence and virulence of the human destruction it involved, it also found in racialism a helpful rationalization for conquest and expansion. When the Spaniards first came to America, several of their apologists (particularly Francisco de Quevedo and Juan Ginés de Sepúlveda) supplied them with the proper excuses for taking the land away from the Indians and for treating them with complete lack of consideration. They developed the theory that the Indians had an entirely different origin from that of the Spaniards, that they were not human in the same sense, and that there was therefore no need to accord to them the same treatment as to one's fellow human beings. The familiar refrain of the "white man's burden," which was mainly of British manufacture and which found its literary expression in the writings of Thomas Carlyle, James A. Froude, and Charles Kingsley, and most strongly and clearly in those of Rudyard Kipling, made of imperialism a noble activity destined to bring civilization to the benighted members of other "races." Similarly, the French justified the maintenance of their colonial empire on the basis of their *mission civilisatrice,* their duty to bring civilization to the backward peoples of the world.

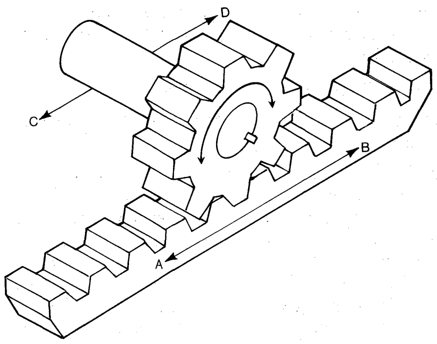
In all of these colonizing empires, there were undoubtedly many individuals honestly convinced of the nobility of their motives and their enterprise; at the same time, the feelings of racial superiority that accompanied colonialism played an important part in developing resentments among the colonized which even emancipation and independence have not always made it possible to overcome. There has developed in some parts of the world racialism in reverse, a degree of hostility of coloured peoples against whites as whites.

It remains true that in general, although with certain striking exceptions, the trend has been away from racism. The emergence of new nations, many of them former colonies, has meant that many more nations composed of "coloured peoples" have an independent voice in international affairs that commands a respectful hearing even from previous colonizers. The recognition that the treatment of ethnic minorities within a country may have important implications for international relations has focussed attention upon the need to improve intergroup relations in general. The work of scientists like Franz Boas in anthropology and Gunnar Myrdal and others in the social sciences helped to destroy much of the mythological thinking associated with race. The trend has been reversed in the Republic of South Africa, where separation of ethnic groups increased from 1948 on (*see* apartheid). In the United States, on the other hand, the movement was gradually and progressively in the direction of providing greater equality of opportunity for all ethnic groups. The first dramatic expression of this tendency was furnished by the unanimous decision of the U.S. Supreme Court on May 17, 1954, based in part on social-science research, that the enforced segregation of black schoolchildren in certain states and localities was contrary to the principles of the U.S. Constitution.

rack and pinion, mechanical device consisting of a bar of rectangular cross section (the rack), having teeth on one side that mesh with teeth on a small gear (the pinion). The pinion may have straight teeth, as in the figure, or helical (twisted) teeth that mesh with teeth on the rack that are inclined to the pinion-shaft axis.

If the pinion rotates about a fixed axis, the rack will translate; *i.e.,* move on a straight path, as shown by the arrow AB. Some automobiles have rack-and-pinion drives on their steering mechanisms that operate in this way.

If the rack is fixed and the pinion is carried



Rack and pinion

in bearings on a table guided on tracks parallel to the rack, rotation of the pinion shaft will move the table parallel to the rack as shown by the arrow CD in the Figure. On machine tools, rack-and-pinion mechanisms are used in this way to obtain rapid movements of worktables; the pinion shaft is usually rotated with a hand crank.

rackets, also spelled RACQUETS, game played with a ball and a strung racket in an enclosed court, all four walls of which are used in play. Rackets is played with a hard ball in a relatively large court, usually about 18 m (60 ft) long by 9 m wide—unlike the related game of squash rackets (*q.v.*), which is played with a soft ball on a smaller court.

History. It was once a common notion that rackets originated in the debtors' section of Fleet Prison in England early in the 19th century. Charles Dickens in his novel *The Pickwick Papers* (1836–37) describes a court in which the inmates whiled away their time. Most scholars now place the origin of rackets in real tennis, quoting J.R. Atkins' opinion in *The Book of Racquets* (1872) that "both games (rackets and real tennis) have so much in common that it is impossible to separate them historically; for practical purposes we must regard them as identical."

In its beginnings, rackets was played in rather formless fashion without set rules. In Fleet Prison the game was well established by the middle of the 18th century, and in the new Fleet of 1782 it achieved such popularity that its fame spread to taverns and other public houses. Robert Mackey, an inmate of Fleet, is listed as the first "world" champion or at least as the first claimant of the title in 1820.

It was with its introduction into Harrow School in 1822 that rackets achieved respectability and was enclosed within four walls. The first roofed-in structure is believed to have been a court built at Woolwich by the Royal Artillery in the 1840s. The building of old Prince's Club in London in 1853 is regarded as marking the beginning of a new era in which rackets became the game of the clubs, military services, and universities.

Rackets flourished in the 1860s and 1870s. Earlier than this it had been introduced into Canada and the United States, and it spread to India, Malta, and Argentina. Queen's Club was opened in London in 1887 and became the headquarters of the game. The next year the Amateur Championships were started there and the Amateur Doubles began in 1890. The rules of the game were drawn up for the first time in 1890 by tennis historian Julian Marshall and rackets authority Major Spens. The Tennis, Rackets and Fives Association was formed in 1907 to govern the sport. During and following World War I, private courts closed and rackets play declined. The expense of building courts and playing the game and the rising popularity of squash rackets brought about a great reduction in the number of rackets players, except in the public schools. Nevertheless, the game continued to be played. In 1928 a British team travelled to the United States to inaugurate the International Racquets Cup matches, which still continue from time to time.

The world rackets championship, which is decided by a challenge match, has been dominated by English players, although India and the United States have also produced outstanding players. Peter Latham, an English professional, is generally rated the greatest of rackets players. (Professionals, in rackets and squash rackets, are players who are paid to teach the games.) Latham was world champion from 1887 to 1902, when he resigned, and was also a great player of real tennis. The foremost English amateurs have included Sir William Hart-Dyke, the first amateur to hold the world championship (1862); and Geoffrey Atkins, world champion from 1954 to 1970, who excelled Latham's record of reigning for 15 years. Atkins is rated by some as the greatest of all amateurs.

The game. No dimensions are specified for the rackets themselves, which are made of ash and average 76 cm (27 in.) long and 255 g (9 oz) in weight. The head, strung with catgut, is usually 178–203 mm in diameter. The ball, which has a renewable covering of adhesive tape, is 2.54 cm in diameter and weighs 28.35 g.

Most courts are about 18 m long by 9 m wide and accommodate both the singles and doubles (four-handed) games. Courts have four walls. The roof, where skylights or other lighting is placed, is out-of-bounds for play; in India courts were left unroofed. The cement floor and walls must be perfectly smooth and very hard since the faster the ball travels the better the game. Front and side walls are about 9 m high, the back wall being about half that height with a spectators' gallery and marker's, or scorer's, box above it. The court is entered by a door in the centre of and flush with the back wall. On the front wall is fixed a wooden board, the upper edge of which, 0.68 m from the floor, constitutes the play line; 2.93 m from the floor a second line called the cut line or service line is marked. On the floor, 10.92 m from the front wall and parallel to it, the short line runs from wall to wall. From the centre of the short line to the centre of the back wall, the fault line divides the back court into two rectangular service courts. Against the side walls and separated from the service courts by the short line are the service boxes.

Rackets may be played by two persons (singles) or four persons playing two against two (doubles). The players must return the ball either before it reaches the ground or on its first bound so that it strikes the front wall above the play line (or service line in the case of a serve) and returns into the court and continue to do so alternately (either player of each in doubles) until one player fails to make a valid return and loses the stroke. The ball must not go out of court (into the gallery or roof of the court) or touch the players' clothing or person. Hard, low hitting close along the side wall is the essence of the game, with cutting, volleying, half-volleying, drop shots, and angled shots also in the repertory. In the four-handed game (doubles) one of each set of partners takes the right-hand side of the court and his partner the left. The game consists of 15 points, called aces. Points can be scored only by the hand-in (the player, or side, having the service), and the hand-out (side receiving service) must therefore win a stroke or strokes to obtain service before he or they can score an ace. In doubles each of the partners serves in turn, and both must be ousted before their opponents obtain the service. In the first exchange of each game, however, only one partner of each side has service.

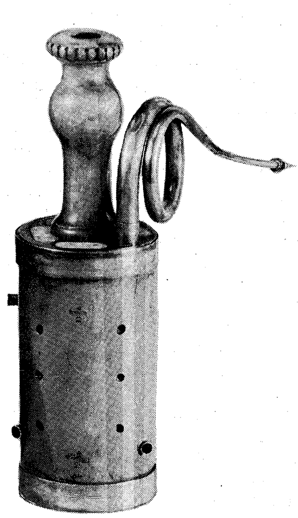
The server, with at least one foot inside the service box, serves the ball as in tennis, but directly to the front wall above the service line so that it rebounds and hits the floor within the service court on the opposite side, permissibly striking the side wall, back wall, or both before or after touching the floor. The serve is a fault if the ball (1) strikes the front wall below the service line; (2) touches the floor on the first bounce in front of the short line; or (3) first touches the floor in the wrong court. If the receiving player chooses to take a faulty first serve, play proceeds as if the serve had been good; otherwise the server must serve again; if he serves a second fault he loses his service to his partner or opponent, as the case may be. A serve that makes the ball strike the board or the floor before reaching the front wall or that sends it out of court counts the same as two consecutive faults: it costs the server his innings. In the United States and Canada only one serve is permitted.

If the player receiving service succeeds in returning the serve, the rally proceeds. If he fails in the rally (or in receiving service), the server scores a point and the side that first scores 15 points wins the game. When, however, the score reaches 13–all, the receiving side may, before the next serve is delivered, declare that he elects to set the game either to 5 or 3, making the game 18 or 16 points, whichever he prefers; and similarly when the score stands at 14–all, he may set the game to 3 (game 17).

It is the player's first duty to give the opponent full room for his stroke, but it is not always easy and sometimes, especially in doubles, absolutely impossible not to obstruct him. The rules, therefore, carefully provide for "lets." When in matches a let is claimed by any one of the players and allowed by the referee, the service or rally counts for nothing and the server serves again from the same service box.

The server in possession at the end of a game continues to serve in the new game, subject as before to the rule limiting the first innings of a doubles game to a single hand. The usual number of games in matches is five for singles and seven for doubles. In matches where there is a referee, there is an appeal to him from the marker's decision but no appeal is allowed if a foot fault is called.

rackett, also called RANKET (from German *Rank,* "bend"), in music, double-reed wind instrument of the 16th and 17th centuries. It consisted of a short wooden or ivory cylinder bored with six or seven extremely narrow channels connected in a series and emerging at the instrument top. The resulting long bore was cylindrical throughout.



Rackett by W. Wyme, *c.* 1700

By courtesy of Bildarchiv Preussischer Kulturbesitz BPK, Berlin

Finger holes were provided. The sound was reedy, low-pitched, and muffled. The compass was a 12th.

racquets (game): *see* rackets.

RADA (London): *see* Royal Academy of Dramatic Art.

raḍāʿ (Arabic: "to suckle"), in Islām, a legal relationship established between children when they are nursed by the same woman, the result being that they are forbidden to intermarry. Such a prohibition was prevalent in Arabian society even before Islām. Arabs equate such kinship with true blood relationship. In Mecca, the Arabs had a custom, still retained, of hiring professional nurses from among the Bedouins to suckle their children in the belief that a healthy Bedouin woman would raise healthier children. The Prophet Muḥammad himself was said to have been suckled by a famous Bedouin nurse named Ḥalīmah bint Abī Dhu'ayb.

To prove the existence of *raḍāʿ*, the testimony of a single individual is sufficient. Muslim jurists do not agree on the degree of suckling necessary to establish *raḍāʿ*. Whereas some consider any act of nursing as sufficient to prohibit marriage, others demand no less than seven acts of suckling to produce an impediment to marriage. Still others argue that the child must be fed entirely. It is illegal to use *raḍāʿ* purposely to establish an impediment to marriage.

Radak (Hebrew grammarian): *see* Kimhi, David.

radar (from "radio detecting and ranging"), electromagnetic device used to detect and locate objects at distances and under conditions of lighting or obscuration that would render the unaided eye useless. It also provides a means for measuring precisely the distance, or range, to an object and the speed at which the object is moving toward or away from the observing unit.

A brief treatment of radar follows. For full treatment, *see* MACROPAEDIA: Radar.

Radar systems operate by transmitting electromagnetic waves, most commonly of microwave frequency, toward an object and receiving the waves reflected from it. The properties of the received radio waves, or echoes, are amplified and analyzed by a signal processor. The processed signals are then converted into a form usable by a human operator or by a device (*e.g.,* antiaircraft gun) controlled by the radar unit. Information about the target object (*e.g.,* distance, direction, or altitude) is typically displayed on the screen of a cathode-ray tube, which may provide a maplike image of the area scanned by the radar beam, as, for example, in the case of the Plan Position Indicator (PPI).

There are several types of radar. Each variety involves different kinds of signals from the radar transmitter and makes use of different properties of the received echo.

By far the most widely used type of radar is pulse radar. It is so called because the transmitter is keyed to send out short, very intense bursts or pulses of electromagnetic energy, with a relatively long interval between pulses. The receiver picks up echoes from the closest objects soon after the transmission of a pulse, from objects at intermediate range later on, and from the most distant objects near the end of the interpulse interval. When sufficient time has elapsed to permit the reception of echoes from the most distant objects of interest, the transmitter sends another short pulse and the cycle repeats. The delay between the transmission of a pulse and the reception of an echo arises from the fact that the radar waves used travel at the exceedingly high (but finite) speed of light—namely, 300,000 km (186,000 miles) per second. In units convenient in radar applications, this speed equals 300 m (nearly 1,000 feet) per microsecond. Because the electromagnetic energy from the radar transmitter has to travel the distance from the radar set to the target twice—once out and once back as an echo—each microsecond of delay between the transmitting of the pulse and the receiving of an echo corresponds to 150 m (roughly 500 feet) of distance between the radar unit and the target. Extremely short intervals must be timed to achieve absolute precision in range. If an error in range of only 4.6 m (15 feet) can be tolerated, time intervals must be measured with an accuracy of $\frac{1}{30}$ of a microsecond. Electronic timing and display techniques permit such measurements to be made with considerable ease and reliability.

A second general type of radar is continuous-wave (CW) radar. In this technique radar signals are transmitted continuously, rather than in short bursts. Because the resultant continuous echo cannot be associated with a specific part of the transmitted wave, it is not possible to derive range information from simple continuous-wave radar. This technique, however, can be used to determine the speed of the target by measuring Doppler shift—*i.e.,* a change in observed frequency produced by motion. A signal transmitted at a particular frequency is coupled to the antenna through a duplexer (a device that permits the use of a single antenna for both transmission and reception) and is radiated into space. When the transmitted signal is interrupted by a radially moving target, the reflected signal will be altered in frequency.

Although simple continuous-wave radar cannot measure distance, a more sophisticated variation known as frequency-modulated radar is able to do so. This technique involves tagging each part of the transmitted radio signal, rendering it recognizable upon reception. The signal is tagged by altering the frequency continuously. When an echo is received, its frequency differs from that of the signal leaving the transmitter at that time. If the rate of frequency change is known, the difference in frequency can be interpreted as the distance from the target.

One other significant form of radar is laser radar, or lidar, in which very narrow signal beams of laser light are transmitted instead of radio radiation. Lidar operates at exceedingly high frequencies—roughly 100,000 times higher than radio frequencies. Most radio detection systems generate signals with frequencies ranging from several megahertz to 40 gigahertz.

The development of radar can be traced to the experimental work of the German physicist Heinrich Hertz. During the late 1880s Hertz proved the existence of radio waves and demonstrated that they behave much like light waves (*e.g.,* they can be reflected by objects, just as light is reflected by a mirror).

Christian Hülsmeyer, a German engineer, was one of the first to apply Hertz's findings. He developed a simple radio echo device for use in navigation and obtained a patent for it in 1904. His primitive radarlike system, however, failed to attract interest because of its severe technical limitations. The possibility of using the radio reflection phenomenon for detection purposes was further explored after the Italian engineer Guglielmo Marconi elaborated its principles in 1922. Soon afterwards, the United States Naval Research Laboratory tested his proposal, employing continuous-wave radiation to detect a ship passing between a radio transmitter and receiver. The operating principle of pulse ranging was developed in 1925 by two American physicists, Gregory Breit and Merle A. Tuve, while engaged in ionospheric research. They succeeded in measuring the height of the Earth's ionosphere by bouncing radio pulses off the ionized layer of air and determining the amount of time taken by the echoes to return.

During the 1930s several countries, including

Great Britain, France, the United States, Germany, and Japan, initiated research on radar systems capable of detecting aircraft and surface vessels at long range and under conditions of poor visibility. Before the outset of World War II, Britain had constructed a network of radar stations designed to provide early warning against approaching enemy aircraft. By late 1939 Germany had begun production of similar ground-based aircraft warning units called Freya. Within a few years the British developed an aircraft-intercept radar set small enough to be installed on fighters, and the United States introduced radar equipment that could be used to direct gunfire. Moreover, cooperative efforts by British and American researchers over the duration of the war resulted in the development of a reliable high-power microwave radar system particularly suited for automatic fire control and long-distance aircraft interception.

The main outlines of radar-system design were reasonably well defined at the close of World War II. Since the late 1940s radar development has included improvements of components and circuitry, with an increasing use of solid-state electronic devices from transistors to very-large-scale integrated (VLSI) circuits. The introduction of new scanning methods and the adoption of high-speed digital computers for signal processing have also contributed significantly to the efficiency and reliability of radar equipment.

These and other technological advances have given rise to a wide variety of new radar applications. In military uses, remarkable attainments in transmitters of ever higher power and in receivers of greater sensitivity have made possible networks of extremely long-range radars for early warning of intercontinental ballistic missiles. In the late 20th century the United States and Canada jointly operated a radar network known as Space Detection and Tracking System (SPADATS) for identifying and monitoring artificial satellites launched into Earth orbit. Other modern-day military applications include the use of radar for missile guidance and for surveillance (*e.g.*, mapping radar carried by reconnaissance planes).

Radar has found numerous and varied civilian applications as well. It has become an important navigational aid for commercial airplanes and marine vessels. Virtually all major airports have surveillance and precision-approach radar systems, which enable air-traffic controllers to monitor and direct the movements of approaching and departing aircraft so as to prevent collisions. With these systems, controllers also are able to help guide pilots to safe landings when visibility is poor. More and more ships, including small fishing and pleasure craft, are equipped with simple radar units suitable for coastline navigation. In many ports large radar surveillance sets have been installed ashore overlooking the harbour and approach waters in order to assist shipping. The radar operator observing ship movements in the confined waters advises pilots of harbour traffic conditions from moment to moment via radiotelephone.

Radar also serves as a valuable tool in astronomical studies. Radar techniques not only permit more accurate measurement of distances than optical methods do but also make possible the study of planetary and satellite surface features. So far, astronomers have employed radar to map the surfaces of the Moon, Mars, and Venus in considerable detail. (*See also* radio and radar astronomy.)

Another field of science that has benefited from radar is meteorology. Ground-based and airborne radars are used to aid weather forecasters in making short-range predictions. Such equipment can locate and track approaching storms for several hundred kilometres because strong radar echoes are reflected from cloud droplets, ice crystals, raindrops, and hailstones. Other kinds of meteorological observations, such as those of atmospheric aerosols, dust, and molecules, are commonly conducted with laser radar.

Continued miniaturization of circuitry and auxiliary equipment has enabled the designing of smaller portable radar units. The handheld continuous-wave radar gun employed by the police for detecting speeding vehicles is a notable example. An even smaller, lightweight unit is a laser-radar sensory device developed for use in canes for the blind.

Consult the INDEX *first*

Radbruch, Gustav (b. Nov. 21, 1878, Lubeck, Ger.—d. Nov. 23, 1949, Heidelberg), German jurist and legal philosopher, one of the foremost exponents of legal relativism and legal positivism. Radbruch served on the faculties of the universities at Königsberg, Kiel, and Heidelberg. He also served the Weimar government as a minister of justice (1921–22; 1923).

Radbruch's legal philosophy grew out of the neo-Kantian principle that law is defined by and depends upon moral values. In such a system, there are no absolutes; thus, the concepts of right and justice are not absolute but are relative to time and place and to the values of the parties in a given legal proceeding. As a result of Nazi rule in Germany, however, a radical change in Radbruch's outlook occurred in his later years. He abandoned relativism and turned toward a philosophy of natural law that recognized certain absolute, innate properties of law and justice. He was the author of numerous books on the theories and philosophy of law, including *Einführung in die Rechtswissenschaft* (1910; "Introduction to Jurisprudence"); *Grundzüge der Rechtsphilosophie* (1914; Eng. trans. by Kurt Wilk in *The Legal Philosophies of Lask, Radbruch, and Dabin*, 1950); *Der Geist des englischen Rechts* (1946; "The Spirit of English Law"); and *Vorschule der Rechtsphilosophie* (1948; "Primer on the Philosophy of Law").

Radcliffe, Ann, *née* WARD (b. July 9, 1764, London, Eng.—d. Feb. 7, 1823, London), the most representative of English Gothic novelists. She stands apart in her ability to infuse scenes of terror and suspense with an aura of romantic sensibility.

Radcliffe's father was in trade, and the family lived in well-to-do gentility. In 1787, at the age of 23, she married William Radcliffe, a journalist who encouraged her literary pursuits. Mrs. Radcliffe led a retired life and never visited the countries where the fearful happenings in her novels took place. Her only journey abroad, to Holland and Germany, was made in 1794 after most of her books were written. The journey was described in her *A Journey Made in the Summer of 1794* (1795).

Her first novels, *The Castles of Athlin and Dunbayne* (1789) and *A Sicilian Romance* (1790) were published anonymously. She achieved fame with her third novel, *The Romance of the Forest* (1791), a tale of 17th-century France. Her next work, *The Mysteries of Udolpho* (1794), by which she became the most popular novelist in England, tells how the orphaned Emily St. Aubert is subjected to cruelties by guardians, threatened with the loss of her fortune, and imprisoned in castles but is finally freed and united with her lover. Strange and fearful events take place in the haunted atmosphere of the solitary castle of Udolpho, set high in the dark and majestic Apennines.

With *The Italian* (1797), Mrs. Radcliffe realized her full stature as a writer. It shows not only improved dialogue and plot construction, but its villain, Schedoni, a monk of massive physique and sinister disposition, is treated with a psychological insight unusual in her work.

Mrs. Radcliffe's poems (1816) and her posthumous novel *Gaston de Blondeville* (1826) were comparatively unsuccessful.

There is little physical horror in Mrs. Radcliffe's "tales of terror," and elements that seem to be supernatural are usually found to have some rather disappointing natural explanation. Her characterization is usually weak, her historical insight is almost nonexistent, and her stories abound in anachronisms and impossibilities. But Mrs. Radcliffe's admirers cared as little for "realism" or accuracy as she did. They reveled in her romanticized views of nature, her intimations of evil, and her prolonged scenes of suspense.

Sir Walter Scott called her "the first poetess of romantic fiction," and her many admirers included Lord Byron, Samuel Taylor Coleridge, and Christina Rossetti. Writing in the tradition of the novel of sensibility, she boldly focused the themes of nascent Romanticism in her stories and paved the way for the greater talents of Scott and the Romantic poets.

Radcliffe, Thomas: *see* Sussex, Thomas Radcliffe, 3rd Earl of.

Radcliffe-Brown, A(lfred) R(eginald) (b. Jan. 17, 1881, Birmingham, Warwick, Eng.—d. Oct. 24, 1955, London), English social anthropologist of the 20th century who developed a systematic framework of concepts and generalizations relating to the social structures of relatively simple societies.

Radcliffe-Brown went to the Andaman Islands (1906–08), where his fieldwork won him a fellowship at Trinity College, Cambridge. On an expedition to Western Australia (1910–12), he concentrated on kinship and family organization. He became director of education for the kingdom of Tonga (1916) and served as professor of social anthropology at the University of Cape Town (1920–25), where he founded the School of African Life and Languages. His study *The Andaman Islanders* (1922; new ed. 1948) contained the essential formulation of his ideas and methods.

At the University of Sydney (1925–31) he developed a vigorous teaching program involving research in theoretical and applied anthropology. His theory had its classic formulation and application in *The Social Organisation of Australian Tribes* (1931). Treating all Aboriginal Australia known at the time, the work cataloged, classified, analyzed, and synthesized a vast amount of data on kinship, marriage, language, custom, occupancy and possession of land, sexual patterns, and cosmology. He attempted to explain social phenomena as enduring systems of adaptation, fusion, and integration of elements. He held that social structures are arrangements of persons and that organizations are the arrangements of activities; thus, the life of a society may be viewed as an active system of functionally consistent, interdependent elements.

At the University of Chicago (1931–37) Radcliffe-Brown was instrumental in introducing social anthropology to American scholars. Returning to England in 1937, he joined the faculty of the University of Oxford (1937–46). His later works include *Structure and Function in Primitive Society* (1952) and *Method in Social Anthropology* (1958).

Raddall, Thomas Head (b. Nov. 13, 1903, Hythe, Kent, Eng.), English-Canadian novelist who accurately depicted the history, manners, and idiom of Nova Scotians.

Raddall immigrated to Nova Scotia in 1913 and became a bookkeeper in a paper mill in 1922. He began writing as a hobby and by 1938 was writing full time. John Buchan, the British author and then governor-general of Canada, wrote a laudatory introduction to his first volume of short stories, *The Pied Piper of Dipper Creek* (1939). His first novel, *His Majesty's Yankees* (1942), set in Nova Scotia during the American Revolution, was followed by several other carefully researched historical romances. He also published *The Nymph and the Lamp* (1950), a story of contemporary life at a Canadian wireless station, and a historical work, *Halifax, Warden of the North* (1948). Other novels include *Hangman's Beach* (1966) and *Pride's Fancy* (1974). His autobiography *In My Time* appeared in 1976.

Radegunda, SAINT, also spelled RADEGUND, or RADEGUNDIS, French SAINTE RADEGONDE (d. Aug. 13, 587, Poitiers [now in France]; feast day August 13), queen of the Merovingian king Chlotar I, who left her husband to become a nun and later founded a monastery at Poitiers. She was one of the first of the Merovingian saints.

A Thuringian princess, Radegunda was captured in about 531 by Chlotar I during an expedition against the Thuringians. She was educated in letters at his court; and, although she is said to have hoped from an early age to be a martyr, she eventually married the king. Her piety and continence were such, however, that he complained of having a nun rather than a wife for his queen. Despite her rank, she displayed great humility, tending the poor and the sick.

Gregory of Tours reported in his *History of the Franks* that Chlotar "unjustly" killed Radegunda's brother; perhaps this was the occasion for her asking Médard, bishop of Noyon, to allow her to become a nun. Medard finally agreed, and she entered a convent; later she founded the nunnery of the Holy Cross at Poitiers. It was said that Radegunda performed numerous miracles and that Christ appeared to her a year before her death.

Radek, Karl (Bernhardovich), original name KARL SOBELSOHN (b. 1885, Lemberg, Galicia, Austria-Hungary [now Lvov, Ukrainian S.S.R.]—d. 1939?), Communist propagandist and early leader of the Communist International (Comintern), who fell victim to Joseph Stalin's Great Purge of the 1930s.

A member of a Galician Jewish family, he attended the universities of Krakôw and Bern. Having joined the Social Democratic Party of Poland and Lithuania in 1901, he participated in the Russian Revolution of 1905 and subsequently spent a year in a Russian prison. He then worked on the editorial staffs of left-wing Social Democratic newspapers in Poland and Germany, acquiring a reputation as an intelligent, witty political writer.

In 1915, while attending the Socialist Zimmerwald conference, Radek became acquainted with Lenin, who later invited Radek to return with him to Russia. Radek left Lenin in Sweden and remained there to publish a Bolshevik weekly bulletin. When the German revolution began in November 1918, he traveled there as a representative of the Central Committee of the Russian Communist Party, helped reorganize the German Communist Party, and worked on its Central Committee until his arrest in February 1919.

Released in December 1919, Radek returned to Russia, where he quickly assumed a prominent position in the Presidium of the Communist International. In 1923, representing the Comintern, he returned to Germany to help prepare a Communist revolution there. But the uprising (autumn 1923) proved abortive, and Radek's Soviet colleagues (particularly Stalin), who also opposed him for his strong support of Leon Trotsky, used his involvement in the German fiasco as an excuse to oust him from his post as secretary of the Comintern and from the party's central committee (May 1924). He was expelled from the party as a Trotskyite in 1927 and was banished to the Ural Mountains.

After recanting his oppositionist views (1929), Radek was readmitted to the party. He adopted a pro-Stalin position, praising the Communist leader profusely, and consequently was made a member of the editorial board of the state newspaper, *Izvestiya,* and allowed to become one of the nation's major commentators on foreign events (1931–36). In 1935 he was also appointed to the commission that prepared the 1936 Soviet constitution. Nevertheless, in October 1936 he was arrested and accused of participating in a Trotskyite conspiracy to dismember the Soviet Union. In January 1937, at the second show trial of the Great Purge, he confessed his guilt to the fabricated charge and, unlike his fellow defendants who were executed, was sentenced to 10 years in prison. Despite rumours, circulated in 1941, that he had been released to produce anti-German propaganda, there is strong evidence to suggest that he died in 1939 in prison or in a Soviet concentration camp.

In 1988 the Soviet Supreme Court found Radek not guilty of the crimes of which he had been convicted.

raden, Japanese decorative technique used for lacquer ware and woodenware, in which linings of mother-of-pearl or of abalone shells are cut into designs and either glued onto or inserted into the surface of the lacquer or wood. There are several varieties of *raden* lacquer ware. *Atsugai-hō,* a technique using thick shell, consists of two methods, one of which is inlay: the shell is inserted into the incised pattern after the surface has been given a first coat of lacquer; after a final coating, the surface is smoothed by burnishing. The second method involves gluing the shell onto the ground coating, applying a mixture of clay powder and raw lacquer (*sabi*), and burnishing the surface. In *usugai-hō,* a technique using thin shell, shell pieces are cut into designs by means of a knife or needle and are glued on after the surface has been given two coatings of lacquer. A third coating of lacquer is applied over the shell and then burnished. In both techniques, hairline engravings are often executed on the surface of the shell, and, in some cases, the back of the shell is coloured or lined with gold foil. *Warigai-hō* is a technique using thin shell material with cracks. A common method of creating such cracks is to paste the shells on rice paper and wrap the paper around a chopstick. In the *makigai-hō* technique, shells are crushed into particles and scattered over the background.

Japanese *raden* dates from the Nara period (645–794), when the method of *atsugai* was introduced from T'ang China. The application of *raden* to wood—especially red sandalwood—flourished during this period. In the Heian period (794–1185), *raden* lacquer ware developed a Japanese national style, and the technique was used together with *maki-e* (lacquer decorated with gold or silver). The technique was subtly refined during the Kamakura period (1192–1333), but it suddenly declined in the Muromachi period (1338–1573).

Rădescu, Nicolae (b. March 30, 1874, Bucharest—d. May 16, 1953, New York City), Romanian army officer and statesman and the last anti-Communist prime minister of Romania (December 1944–March 1945).

During World War I, Rădescu fought in the Romanian army and in the 1920s served as military attaché in London. He resigned from the army in 1933 to protest the dictatorial policies of King Carol II. Under the pro-Axis regime of General Ion Antonescu during World War II, he incurred German displeasure and was interned at Târgu-Jiu concentration camp (1941).

After the successful anti-Fascist coup of August 1944, Rădescu was appointed chief of the Romanian general staff. On Dec. 2, 1944, he was named premier and simultaneously assumed the ministry of the interior. His attempts to counter the growing dominance of Communist partisans in the government and external Soviet threats to Romanian sovereignty were unsuccessful mainly because his reliance upon U.S. support for his regime proved to be misplaced. After his forcible suppression of a mass political demonstration in Bucharest (Feb. 24, 1945), he was dismissed from office under Soviet pressure on March 3, 1945. He took refuge in Cyprus and later (1947) in New York City.

Radetzky, Joseph, Graf (Count), in full JOHANN JOSEPH WENZEL ANTON FRANZ KARL, GRAF RADETZKY VON RADETZ (b. Nov. 2, 1766, Trebnice, Bohemia Austrian Empire [now in Czechoslovakia]—d. Jan. 5, 1858, Milan), Austrian military reformer whose victorious campaigns covering more than half a century made him a national hero.

Radetzky joined the Austrian army in 1784 and served in the Turkish War of 1787–92 and in the Low Countries in the first years of the French Revolutionary Wars. From the first his courage and enterprise were conspicuous. During the Italian campaigns of 1796–97 he took part in operations against Napoleon. In 1805, with the rank of major general, he was given a command in Italy, and in 1809 he fought against the French at Wagram, Austria, with the rank of lieutenant field marshal. In 1809, as chief of the Austrian army general staff, he was involved in politics and military policy. His efforts to modernize the Austrian forces were frustrated by lack of funds, but nevertheless he carried out some reorganization. In 1813, as chief of staff to Karl Philipp zu Schwarzenberg, he had much influence in the councils of the Allies opposing Napoleon, particularly in planning the decisive battle of Leipzig. He entered Paris with the Allied sovereigns and notables in March 1814 and accompanied them to the Congress of Vienna. Returning to the army general staff, he tried unsuccessfully to reform the army further.

He was commander in chief of the Austrian imperial army in northern Italy from 1831 to 1857 and concurrently, from 1849 to 1857, governor-general of Austria's kingdom of Lombardy and Venetia. During the nationalist revolutions of 1848–49, troops under Radetzky's command crushed the Italian forces at Custozza in 1848 and Novara in 1849 and suppressed the revolution, again ruling the Lombardo-Venetian territories with an iron hand.

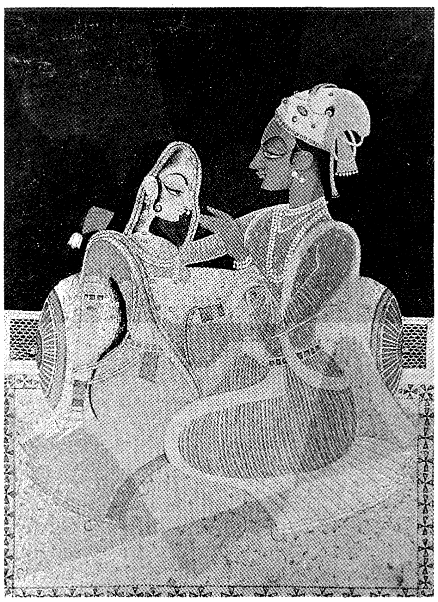
Johann Strauss the Elder wrote the popular *Radetzky March* (*Radetzkymarsch*) in his honour but later suffered the attacks of liberal critics for having done so.

Radewyns, Florentius, original name FLORENS RADEWIJNS (b. *c.* 1350, Leerdam, Bishopric of Utrecht [now in The Netherlands]—d. March 24, 1400, Deventer), Dutch Roman Catholic theologian, successor to Gerhard Groote as leader of the Brethren of the Common Life, a community of laymen dedicated to the care and education of the poor, and founder of the monastic Congregation of Windesheim.

Educated at the University of Prague, Radewyns returned to Leerdam and became Groote's friend and disciple (*c.* 1380) in the *devotio moderna* movement. He was ordained priest and became vicar of Deventer, where he and Groote formed the Brethren of the Common Life. In 1387 Radewyns founded the monastery of Windesheim, at the village of the same name, near Zwolle, Neth. It became a congregation of Augustinian Canons. Thomas à Kempis, a student who lived for a time with the Brethren, wrote a biography of Radewyns.

Rādhā, in Hindu mythology, the mistress of the god Krishna during that period of his life when he lived among the cowherds of Vṛndāvana. Rādhā was the wife of another *gopa* (cowherd) but was the most beloved of Krishna's consorts and his constant companion. In the bhakti (devotional) movement of Vaiṣṇavism, the woman, Rādhā, symbolizes the human soul and the male, Krishna, the divine.

The allegorical love of Rādhā has been given expression in the lyrical poetry of many Indian languages. In Bengal, many poets composed such poetry, including the supremely lyrical Govinda Dās. The Bengali saint Caitanya was said to be an incarnation of the two lovers; he was Krishna on the inside and Rādhā on the outside. Caitanya also composed many lyrics celebrating the divine love, which have not survived. The *Gītagovinda* by Jayadeva was a favourite source of inspiration for the later Rajasthani and Pahari miniature painters, in whose works Rādhā is seen waiting for Krishna to return with the cows in the twilight or sitting with him in a forest grove engaged in amorous play. The bronze images of Krishna playing the flute that are enshrined in temples are often accompanied, particularly in the northern and eastern parts of India, by images of his beloved Rādhā, and she is also worshiped.

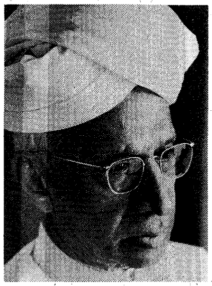


Rādhā and Krishna on the terrace, Indian miniature painting, Kishangarh style, *c.* 1760
By courtesy of the Victoria and Albert Museum, London

Rādhā Soāmi Satsaṅg, also called RADHASVAMI SATSANG, esoteric religious sect of India that has followers among both Hindus and Sikhs. The sect was founded in 1861 by Siva Dayal Saheb (also called Śivdayāl), a Hindu banker of Āgra, who believed that human beings could perfect their highest capabilities only through repetition of the *śabd* ("sound"), or *nām* ("name"), of the Lord. *Rādhā soāmi* signifies the union of the soul with God, the name of God, and the sound heard internally that emanates from God. Great emphasis is placed on the "congregation of truthful people," the *satsaṅg*.

On the death of Siva Dayal Saheb, the Rādhā Soāmi sect split into two factions. The main group remained at Āgra. The other branch was started by a Sikh disciple of Siva Dayal Saheb named Jaimal Singh. Members of this latter group are known as the Rādhā Soāmis of Beās, because they have their headquarters on the bank of the Beās River, near Amritsar.

Radhakrishnan, Sarvepalli (b. Sept. 5, 1888, Tiruttani, India—d. April 16, 1975, Madras), scholar and statesman who was president of India from 1962 to 1967. He served as professor of philosophy at Mysore (1918–21) and Calcutta (1921–31; 1937–41) universities and as vice chancellor of Andhra University (1931–36). He was professor of Eastern religions and ethics at the University of Oxford (1936–52) and vice chancellor of Benares Hindu University (1939–48), India. From 1953 to 1962 he was chancellor of the University of Delhi.



Radhakrishnan
Camera Press

Radhakrishnan led the Indian delegation to the United Nations Educational, Scientific and Cultural Organization (UNESCO; 1946–52) and was elected chairman of UNESCO's executive board (1948–49). From 1949 to 1952 he served as Indian ambassador to the Soviet Union. On his return to India in 1952 he was elected vice president, and on May 11, 1962, he was elected president, succeeding Rajendra Prasad, who was the first president of independent India. He retired from politics five years later.

Radhakrishnan's written works include *Indian Philosophy*, 2 vol. (1923–27), *The Philosophy of the Upanishads* (1924), *An Idealist View of Life* (1932), *Eastern Religions and Western Thought* (1939), and *East and West: Some Reflections* (1955). In his lectures and books he tried to interpret Indian thought for Westerners.

radial keratotomy, surgical procedure to correct myopia (nearsightedness) by reducing the radius of curvature of the cornea and astigmatism (asymmetrical curvature of the cornea). A series of 4 to 8 equally spaced deep cuts are made in the peripheral cornea, leaving the central cornea above the pupil clear. Intraocular pressure then pushes the weakened central cornea outward, flattening it and modifying its refractive power. Wound contraction during healing also affects corneal curvature by exerting radial tension on the uncut area.

Radial keratotomy improves visual acuity to a modest extent, enabling some people with low-level myopia to see well without the aid of spectacles or contact lenses. The procedure has been somewhat controversial, however, because the degree of improvement is unpredictable, depending in part on individual healing rate. Some people who have undergone surgery still require corrective lenses. The procedure is irreversible and may leave extensive scars on the cornea, causing glare in bright light and possibly interfering with the wearing of contact lenses (in cases of continued myopia).

Because repeated operations to correct residual defects may be effective in some cases and do not seem to increase the complications of the initial procedure, some surgeons have suggested that the operation be performed in stages until optimal visual correction can be achieved, but this view is not widely accepted. The improvement in vision that may occur with additional operations must be weighed against increased corneal scarring.

radiation, either the process by which energy is emitted from a source and propagated through the surrounding medium or the energy involved in this process. Familiar examples of radiant energy include light (a form of electromagnetic radiation) and sound (a form of acoustic radiation). Both electromagnetic and acoustic radiations are commonly described as waves that can vary over great ranges of either frequency or intensity. Electromagnetic radiation also is often treated as discrete packets of energy, called photons, or quanta. At very high frequencies, the energy of electromagnetic radiation becomes equivalent to appreciable quantities of mass, and the distinction between waves and particles becomes arbitrary. Much of the radiation emitted by radioactive elements takes the form of alpha rays, beta rays, and streams of other subatomic particles.

Radiation is treated in several articles in the MACROPAEDIA. For the origin, nature, and propagation of energy in the form of gamma rays, X rays, ultraviolet rays, visible light, heat, radio waves, and the like, *see* Electromagnetic Radiation. For corresponding treatment of acoustic radiations, *see* Sound. For the effects of the absorption of electromagnetic waves and subatomic particles in matter, living and nonliving, *see* Radiation.

For a description of the place of radiation in the circle of learning and for a list of both MACROPAEDIA and MICROPAEDIA articles on the subject, *see* PROPAEDIA: Part One, Divisions I and II.

radiation-damage dating, method of age determination that makes use of the damage to crystals and the radiation from radioactive substances caused by storage of energy in electron traps. In the mineral zircon, for example, radiation damage results in a change in colour, the storage of energy in electron traps, and a change in the crystallographic constants of the mineral. Extensive damage may result in a metamict mineral (that is, a mineral in which the crystal structure has been destroyed); the change in crystallographic constants is a function of the total radiation damage, which depends on the amount of radioactive substances and the age of the mineral. Thus, measurement of uranium and thorium content in the zircon, combined with measurement of its crystallographic constants, provides a measure of its age. *Compare* fission-track dating.

radiation injury, tissue damage or changes caused by exposure to ionizing radiation—namely, gamma rays, X rays, and such high-energy particles as neutrons, electrons, and positrons. Sources of ionizing radiation may be natural (*e.g.,* radioactive substances such as the element radium or the radioisotopes potassium-40 and carbon-14) or man-made (X-ray machines, nuclear reactors, particle accelerators, nuclear weapons, etc.).

A brief treatment of radiation injury follows. For full treatment, *see* MACROPAEDIA: Radiation.

Radiation injury occurs in various forms, with each type dependent on the ionizing radiation involved, its penetrating ability, the portion of the body exposed, the duration of exposure, and the total dose. Radiation injury occurs most readily in tissues and organs consisting of rapidly proliferating cells, as, for example, the skin, the lining of the gastrointestinal tract, and the bone marrow, where progenitor cells multiply continuously to replace the mature cells that are constantly being lost through normal aging. The effects of radiation on these organs result primarily from the destruction of the progenitor cells and the consequent interference with the replacement of the mature cells, which is so vital to the maintenance of tissue structure and function.

Symptoms resulting from the intensive irradiation of a large segment of the gastrointestinal tract or portion of the bone marrow constitute a condition called radiation sickness, or acute radiation syndrome. Early signs of this condition include loss of appetite, nausea, and vomiting within the first few hours after irradiation, followed by a symptom-free period that lasts until the main phase of the illness. In the intestinal form of radiation sickness, the main phase is characterized by abdominal pain, fever, and diarrhea, which lead within several days to dehydration, prostration, and a fatal shocklike state. The main phase of the hemopoietic form (that associated with bone marrow) of the illness begins later (about 2–3 weeks after irradiation), with typical symptoms including fever, weakness, loss of hair, infection, and hemorrhage. When damage to the bone marrow is severe, death may result from infection and uncontrollable bleeding.

Other manifestations of radiation injury are certain forms of cancer. The survivors of the atomic-bomb blasts at Hiroshima and Nagasaki, some patients subjected to multiple fluoroscopic chest examinations, and certain groups of radiation workers (*e.g.,* women who painted radium watch and clock dials) have exhibited dose-dependent increases in the incidence of cancer, most notably leukemia and breast cancer.

Radiation injury also includes abnormalities produced in the embryo. The tissues of the embryo, like others composed of rapidly proliferating cells, are extremely sensitive to ionizing radiation. Organs irradiated during the process of formation thus tend to be malformed. Many kinds of radiation-induced abnormalities have been observed in experimentally irradiated rodents. A large number of these are malformations of the nervous system, such as reduced brain size or the failure of the eyes to develop. Nervous-system abnormalities in human infants have been found with higher-than-normal frequency among children born to women who were pregnant and living in Hiroshima and Nagasaki at the time of the atomic-bomb explosions. The incidence of mental retardation and reduced head size in such children increased substantially when exposure occurred between the 8th and 15th weeks of gestation, which has been determined to be the age of greatest susceptibility to ionizing radiation.

radiation pressure, the pressure on a surface resulting from electromagnetic radiation that impinges on it, which results from the momentum carried by that radiation; radiation pressure is doubled if the radiation is reflected rather than absorbed.

Although the pressure of solar radiation is exceedingly small, a sufficiently large surface could produce a force that would be technologically useful. For example, it has been calculated that a "solar sail" could be designed large enough to propel a spacecraft.

radiation therapy, also called RADIOTHERAPY, or THERAPEUTIC RADIOLOGY, use of radiation sources in the treatment or relief of diseases. Radiation therapy almost always makes use of ionizing radiation, deep tissue-penetrating rays, which can physically and chemically react with diseased cells to destroy them. The other forms of radiation, infrared and ultraviolet, can be employed in heat lamps for neuritis and arthritis conditions to relieve the inflammation.

Radiation therapy is used for cancer and for blood disorders such as leukemia. Formerly it was used for overactive thyroids, acne, and benign tumours, but complications with more severe skin diseases and radiation-induced cancers caused almost complete abandonment of these procedures.

Radiation may be administered to the body by implanting radioactive substances into the tumours or by exposing the body to external sources of high-energy rays that penetrate internally. Both methods have met with fairly good results in the cure or arrest of cancerous growths; the type of treatment used depends largely on the size of the tumour, its location, the degree of radiation desired, and the most convenient method for the individual's circumstances. The purpose of such radiation therapy is to destroy cancerous cells with minimal damage to normal healthy tissue or systemic involvement. Ionizing radiation bombards the cells exposed to it and breaks the molecular bonds essential to cell growth. There is always the accompanying destruction of some normal tissue along with the tumour. Cancer growths that reproduce rapidly are generally more easily eradicated by radiation than slower-growing ones; some tumours are destroyed by irradiation treatment, while others are unaffected by it. The complications of radiation therapy may include vomiting, nausea, hair loss, weight loss, weakness, drop in blood levels, and skin disorders.

Easily accessible tumours of fairly small size are often treated by implantation of radioactive wires, threads, seeds, tubes, molds, or foams. The radiation sources can be radium and radon, or radioactive isotopes—radioactive forms of such metals as cesium, cobalt, gold, iridium, and tantalum. All of these isotopes emit gamma rays, which produce deep penetration and cause a minimum of surface-tissue irradiation. The elements are sealed in glass tubes, wires, or needles for easy tissue insertion and an even distribution of radiation. The implants can be permanent or temporary. The radiation dose by this method is usually slow and continuous, which gives the more resilient normal cells time to repair any damage that might be inflicted on them while the cancer cells are being destroyed. The advantages of implantation are that the tumour can be treated locally without involving other areas of the body; the radiation is continuous; the rays can be directed to conform to specific structural contours, as in the bladder, uterus, or mouth; and there is minimum deformity and interference with function. Tumours respond best to this therapy if they are small, rapidly growing, and discovered early.

External radiation must penetrate the outer body and reach the tumour. More normal tissue is affected this way, but larger growths are more readily cured. The treatments involve a series of about 10 to 20 radiation sessions over a period of several months. This type of therapy is frequently used in conjunction with surgical removal of the growth; it may serve, however, as the sole means of treatment when surgery is impossible. Its advantage over implantation is that higher doses can be administered to deep-seated tumours.

Radić, Stjepan (b. July 11, 1871, Trebarjevo, Croatia, Austria-Hungary [now in Yugoslavia]—d. Aug. 8, 1928, Zagreb, Kingdom of Serbs, Croats, and Slovenes), peasant leader and advocate of autonomy for Croatia (within a federalized Yugoslavia).

With his brother Ante, he organized the Croatian Peasant Party in 1904. In March 1918 Radić began to cooperate with the National Council in Zagreb for the establishment of a Yugoslav union with equal rights for Croats and Serbs and with the recognition of Croatia's traditional autonomy. Disagreement with the Belgrade regime led to his imprisonment in 1919–20. The elections of 1920 resulted in a period of sterile opposition for him. In July 1923 Radić went abroad to seek support for a Croatian peasant republic but returned disappointed to Zagreb in August 1924 and was imprisoned until July 1925. Accepting the 1921 centralist constitution, however, he entered the government in 1925 but returned to opposition in 1927. Then, unexpectedly collaborating with Svetozar Pribićević, a Serbian Democratic leader, he formed the peasant-democratic alliance that demanded a federalist reorganization of Yugoslavia. During a heated debate in the National Assembly on June 20, 1928, Radić was shot and mortally wounded.

radical, in politics, one who desires extreme change of part or all of the social order. The word was first used in a political sense in England, and its introduction is generally ascribed to Charles James Fox, who in 1797 declared for a "radical reform" consisting of a drastic expansion of the franchise to the point of universal manhood suffrage. The term radical thereafter began to be used as a general term covering all those who supported the movement for parliamentary reform. After the passage of the Reform Act of 1832, which extended the suffrage only to part of the middle class, a group of Radicals allied with the Whig faction in Parliament continued to press for an extension of the vote to include even the working class. When the Reform Act of 1867 further widened suffrage, the Radicals, notably in London and Birmingham, took the lead in organizing the new voters, helping to transform the Whig parliamentary faction into the Liberal Party of the later Victorian era. Because of their efforts on behalf of the working-class vote, the Radicals earned the loyalty of the trade unions; from 1874 to 1892 every trade unionist who sat in Parliament regarded himself as a Radical.

In France before 1848 the term radical designated a republican or supporter of universal manhood suffrage; open advocacy of republicanism being technically illegal, republicans usually called themselves radicals. After 1869 a self-styled Radical faction led by Georges Clemenceau began to drift away from the moderate democratic-republicanism of Léon Gambetta. These Radicals deemed themselves the true heirs of the French Revolutionary tradition. In 1881 at Montmartre they adopted a platform calling for broad social reforms, and at the turn of the century the Radical-Socialist Party was formed.

The English Radicals of the 19th century were influenced by philosophical ideas assuming that men are able to control their social environment by collective action, a position held by the so-called philosophical radicals. Because these assumptions also underlay Marxist theories of social reform, the label radical in time was affixed to Marxists and other advocates of violent social change, thus becoming inapplicable to the gradualist reformers.

In the United States, although the term is usually one of opprobrium, this was not always true in the post-Depression years of the 1930s; and it is generally not true in less stable Third World societies. In popular American usage, radicalism stands for political extremism of any variety, of the left or right; Communism serves as an example of the former, Fascism of the latter. The term has more commonly been applied to the left, but the expression "the radical right" came to be used commonly in the United States. Various youth movements in the United States, widely labeled as radical, were associated with denunciation of traditional social and political values.

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

radical, also called FREE RADICAL, in chemistry, molecule that contains at least one unpaired electron. Most molecules contain even numbers of electrons, and the covalent chemical bonds holding the atoms together within a molecule normally consist of pairs of electrons jointly shared by the atoms linked by the bond. Most radicals may be considered to have arisen by cleavage of normal electron-pair bonds, every cleavage having produced two separate entities, each of which contains a single, unpaired electron from the broken bond (in addition to all the rest of the normal, paired electrons of the atoms).

Although free radicals contain unpaired electrons, they may be electrically neutral. Because of their odd electrons, free radicals are usually highly reactive. They combine with one another, or with single atoms that also carry free electrons, to give ordinary molecules, all of whose electrons are paired; or they react with intact molecules, abstracting parts of the molecules to complete their own electron pairs and generating new free radicals in the process. In all these reactions, each simple free radical, because of its single unpaired electron, is able to combine with one other radical or atom containing a single unpaired electron. Under special circumstances, diradicals can be formed with unpaired electrons on each of two atoms (giving an overall *even* number of electrons), and these diradicals have a combining power of two.

Certain free radicals are stabilized by their peculiar structures; they exist for appreciable lengths of time, given the right conditions. Most free radicals, however, including such simple ones as the methyl ($\cdot CH_3$) and ethyl ($\cdot C_2H_5$) radicals, are capable of only the most fleeting independent existence.

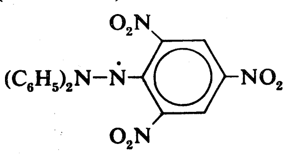
Stable radicals. The first relatively stable free radical, triphenylmethyl (structure I), was discovered by Moses Gomberg in 1900. In this compound the central carbon

$$(C_6H_5)_3C\cdot$$

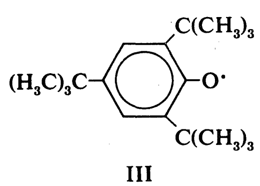
I

is trivalent since it is combined with three substituents instead of four, and its unshared electron is represented by a dot. Free radicals of the triphenylmethyl type are stable only in certain organic solvents; they are rapidly destroyed by irreversible reactions in the presence of air, water, or strong acids.

In a manner analogous to the above, free radicals are formed by the breaking of the nitrogen–nitrogen bond in aromatic hydrazines of the general structure $R_2N{-}NR_2$, or of the central nitrogen–nitrogen bond in aromatic tetrazanes, $R_2N{-}RN{-}NR{-}NR_2$. Thus, the radical 1,1-diphenyl-2-picrylhydrazyl (structure II) exists as a stable violet solid. Similar examples of free radicals, in which, however, the odd electron is on oxygen, are also known—*e.g.,* the 2,4,6-tri-*tert*-butylphenoxy radical (structure III).



II



III

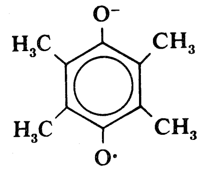
Still another type of stable radical ion, a metal ketyl, forms when a substance such as benzophenone,

$$(C_6H_5)_2C{=}O,$$

is treated with metallic sodium to give the coloured substance $(C_6H_5)_2C{-}O^-$. Similarly, sodium reacts with complex aromatic hydrocarbons such as naphthalene, converting them to highly coloured radical ions.

A final class of relatively stable organic free radicals are those containing the group $>NO$. An example is diphenylnitrogen oxide, $(C_6H_5)_2NO$, which is obtained by the oxidation of diphenylhydroxylamine, $(C_6H_5)_2NOH$.

Certain structural features appear to be required for the existence of stable free radicals. One condition of particular importance is shown by the semiquinone radical ion IV. As depicted, the upper oxygen atom has a negative charge and the lower one an odd electron. This assignment is arbitrary,



IV

however, and the same molecule would be represented if the charge and the odd electron were interchanged. When such a situation is encountered, the actual average distribution of electrons within the molecule is presumed not to be that of either of the structures just described but to be intermediate between the two. This circumstance is called delocalization, or resonance; according to quantum mechanics, the resonance considerably increases the stability of the substance and, as in this case, the probability of its existence. Similar arguments account for the stability of the other free radicals discussed earlier.

Unstable radicals. Simple free radicals such as methyl, $\cdot CH_3$, also exist and play key roles as transient intermediates in many chemical reactions. The existence of the methyl radical was first demonstrated by Friedrich A. Paneth and W. Hofeditz in 1929 by the following experiment. The vapours of tetramethyllead, $Pb(CH_3)_4$, mixed with gaseous hydrogen, H_2, were passed through a silica tube at low pressure. When a portion of the tube was heated to about 800° C, the tetramethyllead was decomposed and a mirror of metallic lead deposited on the internal surface of the tube. The gaseous products of the decomposition were found capable of causing the disappearance of a second lead mirror, deposited at a more distant cool point in the tube. Since none of the recognized stable products of the decomposition was able similarly to dissolve a lead mirror, the inference was drawn that methyl radicals formed in the high-temperature decomposition reacted with lead at the cool mirror to regenerate tetramethyllead. Methyl radicals obtained in this way proved to be highly reactive and short-lived. They not only reacted with lead and other metals but also disappeared rapidly and spontaneously, largely by dimerization to ethane, $H_3C{-}CH_3$. Techniques for producing reactive free radicals in the gas phase have been greatly extended by subsequent research. It has been found that various unstable species, such as ethyl, ($\cdot C_2H_5$), propyl, ($\cdot C_3H_7$), and hydroxyl, ($\cdot OH$), can be obtained by several methods including: (1) photochemical decomposition of a variety of organic and inorganic materials, (2) reaction between sodium vapour and an alkyl halide, and (3) discharge of electricity through a gas at low pressure. Atoms that arise from dissociation of a diatomic molecule (*e.g.,* the chlorine atom, $\cdot Cl$, from the dissociation of the chlorine molecule, Cl_2) can also be obtained and have the properties of short-lived radicals of this type.

The existence of the various known unstable free radicals is most commonly demonstrated by the reactions that they undergo. Thus, ethyl radicals, formed from tetraethyllead, $Pb(C_2H_5)_4$, dissolve zinc and antimony mirrors. The resulting ethyl derivatives of zinc and antimony, $Zn(C_2H_5)_2$ and $Sb(C_2H_5)_3$, have been isolated and chemically identified. In a few instances, unstable radicals also have been identified spectroscopically. Here the important technique of flash photolysis, the use of a single, intense flash of light to produce a momentary high concentration of free radicals, is used.

Transient, unstable free radicals also may be produced in solution by several means. A number of molecules, of which organic peroxides are typical, possess such weak chemical bonds that they decompose irreversibly into free radicals on warming in solution. Diacetyl peroxide, for example,

$$CH_3\overset{O}{\overset{\|}{C}}{-}O{-}O{-}\overset{O}{\overset{\|}{C}}CH_3$$

is considered to decompose, at least in large part, into carbon dioxide, CO_2, and methyl radicals. These, in turn, rapidly attack most organic solvents, often by abstracting hydrogen to given methane, CH_4, together with other products. Irradiation of solutions of many organic substances with ultraviolet light leads to the absorption of sufficient energy to disrupt chemical bonds and produce free radicals, and, in fact, most photochemical processes are at present thought to involve free-radical intermediates. The chemical changes that occur when solutions (and also gases) are exposed to high-energy radiation also appear to involve the transient formation of free radicals.

It is generally considered that free radicals are transient intermediates in many high-temperature reactions (such as combustion and the thermal cracking of hydrocarbons), in many photochemical processes, and in a number of other important reactions in organic chemistry, although the concentrations of the free radical intermediates are in general too low for direct detection. One class of free-radical reaction is of particular importance and is illustrated by the following example. Methane, CH_4, reacts with chlorine, Cl_2, by an overall process that gives chloromethane, CH_3Cl, and hydrogen chloride, HCl. The reaction is enormously accelerated by light and apparently involves the following steps:

$$Cl_2 \rightarrow 2Cl\cdot \qquad (1)$$
$$Cl\cdot + CH_4 \rightarrow \cdot CH_3 + HCl \qquad (2)$$
$$\cdot CH_3 + Cl_2 \rightarrow CH_3Cl + Cl\cdot \qquad (3)$$
$$2Cl\cdot \rightarrow Cl_2 \qquad (4)$$

Chlorine atoms are produced in (1) and destroyed in (4), while the products that are actually isolated arise from (2) and (3). Since chlorine atoms consumed in (2) are regenerated in (3), a single atom of chlorine can lead to the production of many molecules of chloromethane. Such processes, in which an intermediate is continually regenerated, are known as chain reactions, and their study constitutes an important branch of chemical kinetics. Similar chains involving transient free radicals are involved in the halogenation of many other organic molecules, in many of the polymerization reactions that are employed in the manufacture of plastics and synthetic rubber, and in the reaction of molecular oxygen, O_2, with a great number of organic molecules.

Magnetic properties of free radicals. The magnetic properties of free radicals provide a powerful tool for their detection and study. Molecules with even numbers of paired electrons are diamagnetic; *i.e.,* they are slightly repelled by a magnet. Free radicals, however, are paramagnetic (attracted by a magnet) because of the spin of the odd electron, the spins of the remaining paired electrons effectively canceling each other. The magnetic property of a substance most commonly studied is its magnetic susceptibility, effectively its behaviour in an inhomogeneous magnetic field, and the extent of paramagnetism of the substance is described in terms of its magnetic dipole moment. The magnitude of this dipole moment, which is the same for all free radicals containing single electrons, can be calculated, and the value obtained (1.73 Bohr magnetons) has been confirmed experimentally with free radicals in the solid state or at known concentrations in solution. Magnetic susceptibility measurements may be used to demonstrate the existence of free radicals and to measure the position of equilibrium between radicals and their dimers or disproportionation products. Diradicals, with even numbers of electrons, two of which, however, are not paired, are also paramagnetic, the oxygen molecule, O_2, being probably the simplest example of the kind.

The electron paramagnetic-resonance spectra of free radicals provide another technique for their detection and study. According to quantum mechanics, the spin of the odd electron of a free radical, when placed in a magnetic field, may have two, and only two, orientations, one with and the other against the field. These two orientations differ slightly in energy by an amount proportional to the strength of the magnetic field, and the majority of the electrons have the orientation of lower energy. If a system containing free radicals is placed in a magnetic field and exposed to electromagnetic radiation (*e.g.,* in the region of very short radio waves), molecules with the lower energy orientation absorb radiation of a frequency corresponding to an energy just sufficient to flip the odd electron into its higher energy state. This phenomenon gives rise in the simplest case to a paramagnetic-resonance absorption spectrum consisting of a single sharp absorption line. The technique is sensitive and will detect extremely small concentrations of free radicals, as little as one part in 10^7 having been reported detected. In many organic free radicals, interaction of the odd electron with the magnetic moments of the nuclei of different atoms in the molecule (most commonly with hydrogen nuclei) gives rise to a more complicated system of energy levels and an absorption spectrum consisting of a series of lines. The nature of the spectrum permits the identification of particular free radicals and also gives information about their electronic structure. (C.T.W./Ed.)

Radical, Philosophical: *see* Philosophical Radical.

radical empiricism, a theory of knowledge and a metaphysics (theory of Being) advanced by William James, an American pragmatist philosopher and psychologist, based on the pragmatic theory of truth and the principle of pure experience, which contends that the relations between things are at least as real as the things themselves, that their function is real, and that no hidden substrata are necessary to account for the various clashes and coherences of the world.

James summarized the theory as consisting of (1) a postulate: "The only things that shall be debatable among philosophers shall be things definable in terms drawn from experience"; (2) a factual statement: "The relations between things, conjunctive as well as disjunctive, are just as much matters of direct particular experience, neither more so nor less so, than the things themselves," which serves to distinguish radical empiricism from the empiricism of the Scottish philosopher David Hume; and (3) a generalized conclusion: "The parts of experience hold together from next to next by relations that are themselves parts of experience. The directly apprehended universe needs, in short, no extraneous transempirical connective support, but possesses in its own right a concatenated or continuous structure." The result of this theory of knowledge is a metaphysics that refutes the rationalist belief in a being that transcends experience, which gives unity to the world.

According to James there is no logical connection between radical empiricism and pragmatism. One may reject radical empiricism and continue to be a pragmatist. James's studies in radical empiricism were published posthumously as *Essays in Radical Empiricism* (1912).

Radical Republican, during and after the American Civil War, a member of the Republican Party committed to emancipation of the slaves and later to the equal treatment and enfranchisement of the freed blacks.

The Republican Party at its formation during the 1850s was a coalition of Northern altruists, industrialists, former Whigs, practical politicians, etc. While not publicly committed to abolition of slavery prior to the Civil War, the party nonetheless attracted the most zealous antislavery advocates. While Abraham Lincoln declared restoration of the Union to be his aim during the Civil War, the antislavery advocates in Congress pressed for emancipation as a stated war aim as well.

In December 1861, frustrated at the poor showing of the Union Army and the lack of progress toward emancipation, the Radicals formed the Joint Committee on the Conduct of the War. They agitated for the dismissal of General George B. McClellan, and they favoured the enlistment of black troops. Angry at Lincoln for his reluctance to move toward speedy abolition, they broke with him completely over Reconstruction policy.

As certain areas of the South fell under Federal military control in the course of the war, Lincoln embarked upon a process of lenient Reconstruction under presidential control. Only the most prominent Confederates were excluded from participating in the restored state governments under Lincoln's plan, and just 10 percent of a state's 1860 electorate was required to take a loyalty oath before Lincoln would recognize the state government they established as lawful. The Radicals countered Lincoln's "Ten Percent Plan" in 1864 with the Wade–Davis Bill, which required a majority of the electorate to take the loyalty oath and excluded far more former Confederates from participation in the restored governments. Lincoln pocket-vetoed the Wade–Davis Bill, which angered the Radicals and launched them on a short-lived drive to deny Lincoln renomination.

After Lincoln's assassination, the Radicals at first welcomed Andrew Johnson as president. But Johnson quickly indicated his intention to pursue Lincoln's lenient Reconstruction policies. The Radicals turned on him, formed the Joint Committee of Fifteen to assure congressional rather than presidential control of Reconstruction, and passed a number of measures for the protection of Southern blacks over Johnson's veto.

Johnson attempted to break the Radicals' power by uniting all moderates and by going on an extensive speaking tour during the 1866 congressional elections. But the strategy failed, and the Radicals won a resounding victory. They then showed their displeasure with Johnson by passing the Tenure of Office Act, restricting the president's ability to remove civil officers. When Johnson proceeded to remove his secretary of war in violation of the Tenure of Office Act, the House of Representatives voted to impeach him, and the Senate failed by just one vote to remove him from office.

The Radical Republicans' most important measures were contained in the Reconstruction Acts of 1867 and 1868, which placed the Southern states under military government and required universal manhood suffrage. Despite the Radical program, however, white control over Southern state governments was gradually restored. Such terrorist organizations as the Ku Klux Klan and Knights of the White Camelia were successful in frightening blacks away from the polls, and zeal for continued military occupation of the South waned in the North. By 1877 Reconstruction was at an end.

Radical Republicans never really existed as a cohesive group. They were united only by their common commitment to emancipation and racial justice. On other issues—such as hard/soft money, labour reform, and protectionism—they were often divided. Radical leaders included Henry Winter Davis, Thaddeus Stevens, and Benjamin Butler in the House; and Charles Sumner, Benjamin Wade, and Zachariah Chandler in the Senate.

Radical-Socialist Party, byname of RADICAL REPUBLICAN AND RADICAL-SOCIALIST PARTY, French PARTI RADICAL-SOCIALISTE, or PARTI REPUBLICAIN RADICAL ET RADICAL-SOCIALISTE, the oldest of the French political parties, officially founded in 1901 but tracing back to "radical" groups of the 19th century. Traditionally a centrist party without rigid ideology or structure, it was most prominent during the Third Republic (to 1940) and the Fourth Republic (1945–58) but continued to be influential during the Fifth Republic (from 1958).

The first French "radical" party was active in the Revolution of 1848. In the 1870s, the more reformist wing of the Republican Party, led by Georges Clemenceau among others, became known as the Radicals. The party played an important part in administrations of the late 19th and early 20th century. In the 1930s the Radicals began to lose ground. Although they won control of the government in the 1932 election, the Socialist Party won the popular vote. In 1936 the Radicals were reduced to participation in the Socialist Party's coalition government, Léon Blum's Popular Front.

After World War II the Radicals' popularity further declined. In the 1940s and early 1950s, they formed with other groups the Rassemblement des Gauches Républicaines (RGR; "Assembly of Republican Leftists"), which never won more than 11 percent of the vote in legislative elections. Until 1958, however, the Radicals played disproportionately important roles in the governments of the Fourth Republic, since party fragmentation in the National Assembly made the politically central Radical group important.

Under General Charles de Gaulle's Fifth Republic, founded in 1958, the Radicals continued both to lose votes and to hold key political positions. In 1965 the Radicals supported François Mitterrand, the unsuccessful presidential candidate of the all-left Fédération de la Gauche Démocrate et Socialiste ("Federation of the Democratic and Socialist Left"). Thereafter it participated in various centrist, centre-left, and centre-right coalitions.

Radiguet, Raymond (b. June 18, 1903, Saint-Maur, Fr.—d. Dec. 12, 1923, Paris), precocious French novelist and poet who wrote at 17 a masterpiece of astonishing insight and stylistic excellence, *Le Diable au corps* (1923; *The Devil in the Flesh*), which remains a unique expression of the poetry and perversity of an adolescent boy's love.

At 16 Radiguet took Paris by storm and joined the frenzied life of the leading post-World War I figures in the Dadaist and Cubist circles, including Guillaume Apollinaire, Max Jacob, Erik Satie, and, especially, Jean Cocteau, whose protégé he became.

His first literary attempts delighted his friends: poems, *Les Joues en feu* (1920; "The Burning Cheeks"); a short two-act play with music by Georges Auric, *Les Pélicans* (1921); and articles in avant-garde reviews. With *Le Diable au corps* the critics recognized the youth as a master of the Neoclassical tradition of simplicity and restraint in feeling, thought, and style. It is the wartime story of a schoolboy of 16 who seduces the wife of a soldier fighting on the front. She dies giving birth to their child. The story is told with a mixture of tenderness, cruelty, and indifference that characterizes its adolescent narrator. This book was followed by a second and last novel, *Le Bal du comte d'Orgel* (1924; *Count Orgel Opens the Ball,* 1952), an exercise in lucidity, subtlety, and measure. Radiguet died of typhoid, his body wasted by dissipation and alcoholism.

Radin, Paul (b. April 2, 1883, Łódź, Pol.—d. Feb. 21, 1959, New York City), U.S. anthropologist who was influential in advancing a historical model of primitive society based on a synthesis of economic and social structure, religion, philosophy, and psychology. He pioneered in such important fields of anthropology as culture-personality studies and the use of autobiographical documents. An accomplished linguist, he described a number of North American languages and advanced a classification scheme emphasizing their unity.

Radin's outlook was influenced by the skeptical humanism of U.S. historian James Harvey Robinson and the views of anthropologist Franz Boas. Radin took his Ph.D. at Columbia University in 1911. He made his first field study among the Winnebago Indians of Wisconsin (1908) and, starting with *The Winnebago Tribe* (1915–16), eventually treated nearly every aspect of their culture. *The Autobiography of a Winnebago Indian* (1920; retitled *Crashing Thunder,* 1926) exemplifies his use of autobiographical documents as do *The Road of Life and Death* (1945) and *The Culture of the Winnebago: As Described by Themselves* (1949). For many years a field anthropologist for the geological survey of Canada, Radin also taught at various times at several universities, including California (Berkeley), Chicago, Cambridge, and Brandeis (Waltham, Mass.).

Radin was basically interested in the folklore, religion, and language of primitive peoples, whose mentality he viewed as different in degree, but not in kind, from that of modern man. He considered primitive man's responses to life's main challenges to be profound, sophisticated, and comprehensible, and he was generally skeptical of notions of progress in moral awareness.

Over the years Radin wrote a number of significant works. His major linguistic contribution is *The Genetic Relationship of the North American Indian Languages* (1919). He contrasts two historical temperamental types in *Primitive Man as Philosopher* (1927) and *Primitive Religion* (1938). His principal critical-theoretical work is thought to be *Method and Theory of Ethnology* (1933). Radin's ideas attracted the interest of such diverse individuals as sociologist Lewis Mumford, psychoanalyst Carl Jung, poet John Crowe Ransom, and philosopher John Dewey.

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radio, transmission and detection of communication signals consisting of electromagnetic waves that travel through the air in a straight line or by reflection from the ionosphere or from a communications satellite.

A brief treatment of radio follows. For full treatment, *see* MACROPAEDIA: Broadcasting.

Two characteristics of electromagnetic-wave motion are most significant: the physical length of the wave and the number of times the wave cycle is repeated in a given period of time. The unit used to measure cycles per second is called the hertz (Hz); frequencies used in radio transmissions range up to 30 gigahertz (30,000,000,000 Hz). The higher the frequency, the smaller the wavelength, since all the waves travel at the speed of light (about 186,000 mi [300,000 km] per second).

For radio transmission, information is imparted to a carrier wave by varying its amplitude, frequency, or duration in a process called modulation. Amplitude modulation (AM) creates "side-band" frequencies at the upper and lower limits of a carrier wave, which register variations in the strength of the wave. Frequency modulation (FM) varies the number of cycles the wave goes through, instead of its amplitude. These changes in the otherwise constant frequency of the wave carry the desired information from transmitter to receiver. Duration modulation is a simpler system, in which a constant tone is transmitted for a certain period of time, shut off, and then transmitted again. Morse code utilizes this system.

Radio first became a possibility when the English physicist Michael Faraday demonstrated that an electrical current could produce a magnetic field. In 1864 James Clerk Maxwell, a professor of experimental physics at Cambridge, proved mathematically that these electrical disturbances could be detected at considerable distances. Maxwell predicted that this electromagnetic energy could move outward in waves travelling at the speed of light. In 1888 Heinrich Hertz demonstrated that Maxwell's prediction was true for transmissions over short distances. The Italian physicist Guglielmo Marconi then perfected a radio system that in 1901 transmitted Morse code over the Atlantic Ocean.

Next came the development of the vacuum tube, which amplified (strengthened) the radio signal that was received at an antenna; thus, much weaker signals could be transmitted and received than had previously been possible. It was next discovered that the electric current in a vacuum tube could be made to oscillate. An electronic-tube oscillator was thus able to generate very pure radio waves. Reception was also improved with the refinement of the tuning circuit. These and other components needed to produce radio receivers of acceptable quality underwent rapid improvement in the period before World War II.

Individual broadcasting stations were assigned a portion of an arbitrary frequency scale, so that the signal of one station would not conflict with another. Other frequency ranges have been reserved for the many additional uses of radio signals, which include navigational aids for ships and aircraft, two-way voice transmission, and space and satellite communications.

Innovations after the war, especially the replacement of tubes by transistors and of wires by printed circuits, drastically reduced the amount of power the receiver needed to operate and allowed its components to be miniaturized. Other advances included improvements in the sound fidelity of transmitting and receiving equipment and the perfection of FM stereo broadcasting.

radio and radar astronomy, study of celestial bodies by examination of the radio-frequency energy they emit or reflect.

In 1932 the U.S. radio engineer Karl Jansky, investigating radio disturbances interfering with transoceanic telephone service, found a source of cosmic "static" he attributed to interaction between electrons and ions (charged atoms) in interstellar space. He located this source in the direction of the centre of the Milky Way Galaxy. The amateur astronomer Grote Reber, also of the U.S., found in the 1930s and 1940s that radio-frequency radiation came from all along the plane of the Galaxy, with a strong maximum, secondary to that of the galactic centre, in the constellation Cygnus. During the 1940s, astronomers of several nations began to make radio observations. After 1945, large antennas (huge dish-shaped reflectors), improved receivers and data-processing methods, and the use of radio interferometers (devices in which the mutual interference or reinforcement of signals is made to yield information) enabled astronomers to study fainter sources and to obtain greater detail.

Radio waves penetrate much of the gas and dust in space as well as the clouds of planetary atmospheres. Radio astronomers can therefore obtain a much clearer picture of the central region of the Galaxy, behind clouds of small particles, than is possible by means of optical observation. A better understanding of the Milky Way has resulted from measurements of radio signals produced at the 21-centimetre wavelength by cold clouds of interstellar neutral hydrogen atoms distributed in its spiral arms. Radio astronomers have also discovered various hitherto unknown cosmic objects such as quasars (distant galaxies that release enormous amounts of energy primarily in the form of radio waves) and pulsars (neutron stars that emit highly rhythmic radio pulses). In recent years these and other related objects have been studied at extremely high resolution by means of very-long-baseline interferometry, a technique involving the synchronized observation of a cosmic radio source with multiple-dish interferometers located many kilometres apart.

It is possible to send radio signals to astronomical phenomena relatively close to the Earth—*e.g.,* meteor trails, the Moon, the nearby planets—and measure the reflections; this use and study of deliberately reflected radio signals constitutes the basis of radar astronomy. It provides one of the astronomer's few means of actively experimenting; unlike most other scientists, he must often simply watch and wait for natural events to observe. In 1946 astronomers in Hungary and the U.S. detected for the first time radar signals bounced off the Moon. Since the 1940s radar has been used to study meteors; a meteor leaves behind it in the upper air an ionized column of gas from which a signal can be reflected. Radar observations have revealed several daytime meteor streams that could never have been observed optically.

In 1958 astronomers in the U.S. obtained the first radar echoes from another planet, Venus. Radar reflections from planets provide an accurate measurement of their distances, from which other distances in the solar system can be calculated. Radar techniques made it possible to penetrate the dense cloud cover surrounding Venus and reveal valleys and enormous mountains on the planet's surface. Decisive evidence for the correct rotation period of Venus and of Mercury was also provided by radar.

Radio and radar studies of the Moon revealed the sandlike nature of its surface before landings were made. In addition, radio observations have contributed greatly to knowledge about the Sun. As the receiver is tuned to higher frequencies, the radiation received comes from increasing depths within the Sun's outer layers, which can thus be studied separately. Flares and spots on the Sun are strong radio sources.

Radio Corporation of America: *see* RCA Corporation.

radio direction finder, also called RADIO COMPASS, radio receiver and directional antenna system used to determine the direction of the source of a signal. It most often refers to a device used to check the position of a ship or aircraft, although it may also direct a craft's course or be used for military or investigative purposes.

The antenna, usually a loop antenna, rotates and pinpoints the direction from which a radio signal is strongest. This is the direction of the broadcasting station, the position of which is already known. Using the directions and positions of several radio stations, a navigator can use triangulation to determine the position of his craft. Corrections must, however, be made in the readings from the radio direction finder to account, for example, for the effect on radio transmissions of the craft's magnetic field.

radio-frequency heating, process of heating materials through the application of radio waves of high frequency—*i.e.*, above 70,000 hertz (cycles per second). Two methods of radio-frequency heating have been developed. One of these, induction heating, has proved highly effective for heating metals and other materials that are relatively good electric conductors. The other method, called dielectric heating, is used with materials that are poor conductors of electricity.

Induction heating. In this method the material to be heated is placed in a high-frequency electromagnetic field produced by a conductor or coil called an inductor, which is connected to a radio-frequency generator. The electromagnetic field causes electrical currents to be excited in regions of the material that lie within the field of the inductor. These currents heat the object. The precise amount of heat generated is dependent on three factors: (1) the magnitude of the induced currents, (2) the resistance of the material to the flow of the currents, and (3) the length of time the material is exposed to the field.

Induction heating is used extensively in the metalworking industry to heat metals for hardening, soldering, brazing, and tempering and annealing. The induction-heating process is also employed in the fusion of metals and the production of high-quality alloys. Since the late 1970s American physicists have applied this type of radio-frequency heating to some types of experimental fusion reactors. Their objective is to use the technique to heat plasmas in fusion reactors known as tokamaks. During one series of experiments, researchers found that radio waves will heat plasma provided that their frequency equals the cyclotron frequency of the plasma ions—*i.e.*, the rate at which the ions travel around the doughnut-shaped magnetic field of a cyclotron (*q.v.*). Approximately 600 kilowatts of radio-frequency energy were utilized to heat the plasma to roughly 23,000,000 K.

Dielectric heating. This method is designed to make use of the heat generated in poor electrical conductors, including insulators (*e.g.*, rubber, plastics, and wood), when such materials are placed in a varying, high-frequency electromagnetic field. The heat results from electrical losses that occur in a material located between two metal plates (electrodes) which form a kind of capacitor connected to a radio-frequency oscillator. Unlike induction heating, in which nonuniform heating may occur, dielectric heating makes it possible to heat an object evenly throughout.

Dielectric heating has many varied applications, particularly in industry. For example, it is used for drying lumber and gypsum wallboard, for the rapid heating of special glues in furniture making, and for preheating in molding plastics and glasslike materials. In addition, dielectric heating provides the basis for microwave ovens, which are widely used for cooking food.

radio interferometer, apparatus that is used to study heavenly bodies by receiving and analyzing electromagnetic radiation that these bodies emit or reflect in the radio wavelengths. A radio interferometer is a radio telescope (*q.v.*) consisting of two or more separate antennas receiving radio waves from the same source, joined to one receiver. The antennas may be placed close together or thousands of kilometres apart. The principle of a radio interferometer's operation is the same as for an optical interferometer (*q.v.*), but, because radio waves are much longer than light waves, the scale of the instrument is generally correspondingly greater. Parts of a radio wave reach the spaced antennas at different times. This time difference is compensated for by a variable-delay mechanism, and the waves can be made to interfere, much as in the optical interferometer. In another version, the spacing of the antennas can be changed in an attempt to make the waves interfere; the distance between them for interference depends on the wavelength and on the diameter of the source of the waves. The diameter can be calculated when the other quantities are known. If the diameter of the radio-wave source is not too small to be resolved by the interferometer, the radio signals will alternately reinforce and cancel each other in a manner analogous to the way fringes are produced in the optical interferometer.

radio range, in aerial navigation, a system of radio transmitting stations, each of which transmits a signal that not only carries identification but also is of intrinsic value to a navigator in fixing his position. The older "A–N" type, dating from 1927, operates at low and medium frequencies and is still in use, mainly by private light aircraft. The only equipment needed in the aircraft is an ordinary radio receiver. Each station transmits International code letters A (· —) and N (— ·) in alternate lobes of its radiation pattern. In the narrow radiants where adjacent lobes overlap, the dots and dashes of the different Morse signals blend into a continuous tone. A pilot following the steady tone knows he is flying directly toward the station or away from it; when he strays off course, he knows, by virtue of which letter he hears, which way to turn in order to get back on course.

Modern very-high-frequency omnidirectional radio range (VOR) has been developed in various forms since about 1930. It transmits two signals, simultaneously, in all directions. Operating in the very high frequencies (VHF), it is less subject than the lower-frequency radio range to disturbances by day–night alternation, weather, and other causes. The two simultaneously emitted signals have a difference in electrical phase that varies precisely with the direction from the station. Special receiving equipment in the aircraft detects the difference and displays it to the pilot in the form of a bearing. Used with distance-measuring equipment (DME), the VOR provides a basic guidance system for airliners.

radio source, in astronomy, any of various objects in the universe that emit relatively large amounts of radio waves. Nearly all types of astronomical objects give off some radio radiation, but the strongest sources of such emissions include pulsars, certain nebulas, quasars, and radio galaxies.

A brief treatment of radio sources follows. For full treatment, *see* MACROPAEDIA: Cosmos, The.

In 1931 Karl G. Jansky, an American radio engineer, detected radio waves from outer space. Several years later Grote Reber, an American electronics engineer, showed that the source of this cosmic radio radiation was the centre of the Milky Way Galaxy, the galactic system in which the Earth is located. In 1942 a group of British army radar operators detected for the first time bursts of radio energy from the Sun, and by the end of the decade astronomers had discovered about half a dozen discrete celestial radio sources. By the mid-1980s about 100,000 such radio sources had been cataloged. *See also* radio and radar astronomy.

Radio sources produce either continuum radiation or line radiation. Continuum radiation covers a very broad range of wavelengths; hence, continuum sources can be detected and studied with a radio telescope tuned to any convenient wavelength. Two different processes generate continuum radio radiation. One of these involves thermal radiation, the electromagnetic energy given off by hot, ionized interstellar gases of an emission nebula (*i.e.*, an HII region [*q.v.*]). Such radiation is composed of photons of many different wavelengths that are emitted by electrons when they are accelerated by nearby protons and change from their original orbits to other orbits. The second process is synchrotron emission, which involves the release of nonthermal radiation by electrons spiraling in magnetic fields at speeds near that of light. Synchrotron radiation is associated with a wide variety of radio-energy emitters, including supernova remnants such as the Crab Nebula and Cassiopeia A; and pulsars, rapidly spinning neutron stars that give off radiation in short, rhythmic pulses (*see* pulsar). The synchrotron mechanism is also operative in two other major radio sources, radio galaxies and certain quasars, which are discussed hereafter.

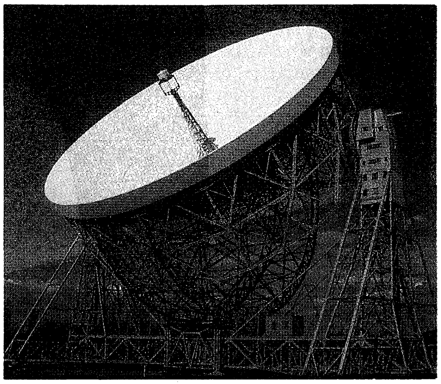
Line radiation is emitted at only one specific wavelength (like an optical spectral line), and so its detection requires that a radio telescope be set at precisely that given wavelength. The most important of these spectral lines is the 21-centimetre line emitted by neutral hydrogen atoms. The Dutch astronomer Hendrik C. van de Hulst predicted this line in 1944, and it was first detected in 1951. Molecules in the interstellar medium also manifest emissions and absorption lines at radio wavelengths. The 18-centimetre line of the hydroxyl (OH) radical was detected in 1963, and the lines from water (H_2O), ammonia (NH_3), formaldehyde (H_2CO), and carbon monoxide (CO) were identified in 1968–70. The total number of molecules and radicals so far detected stands at more than 50. Radio spectral lines from such molecules are associated with cold, dense interstellar clouds thought to be sites of star formation. A number of these clouds have been discovered near the centre of the Milky Way Galaxy.

The majority of the known discrete radio sources are extragalactic. Nearby spiral galaxies emit both continuous radiation at radio wavelengths and the 21-centimetre line of neutral hydrogen. These radio emissions, however, constitute only a relatively small percentage of their total energy output. The so-called radio galaxies, by contrast, give off extraordinarily large amounts of radio waves (*i.e.*, their radio emissions equal or exceed the amount of radiation released at optical wavelengths) and are typically 1,000,000 times more powerful than the spiral systems. The radio galaxy Cygnus A, one of the earliest radio sources discovered, is the second brightest radio-emitting object in the sky in spite of its great distance from the Earth—200,000,000 parsecs (1 parsec = 3.26 light-years). The synchrotron radiation from a radio galaxy comes from two large, lobe-shaped regions situated in a line on diametrically opposite sides of an optical galaxy—usually a giant elliptical system.

Radio galaxies were identified during the 1950s. Another, more compact kind of extragalactic radio source associated with synchrotron radiation was discovered in the early 1960s. Optically, such an object appears as a starlike point; hence the name quasi-stellar radio source, or quasar (*q.v.*). The earliest quasars to be discovered emitted as much radio energy as did the most powerful radio galaxies, but a number of those that were subsequently detected were found to release no radio radiation at all. Because of this, it has been proposed that quasars that give off radio waves merely represent an evolutionary stage of longer-lived quasars.

In 1965 two American researchers, Arno A. Penzias and Robert W. Wilson, discovered cosmic microwave background radiation. This faint thermal radiation emanating from all parts of the celestial sphere is thought to be the remnant of the primordial fireball predicted by the big-bang model (*q.v.*), a widely held cosmological theory according to which the universe began with a tremendous explosion about 10 billion years ago.

radio telescope, astronomical instrument consisting of a radio receiver and an antenna system that is used to detect radio-frequency radiation emitted by extraterrestrial sources. Because radio wavelengths are much longer than those of visible light, radio telescopes must be very large in order to attain the resolution of optical telescopes.



Lovell Telescope, a fully steerable radio telescope at Jodrell Bank, Macclesfield, Cheshire, Eng.
Jodrell Bank Science Centre

A brief treatment of radio telescopes follows. For full treatment, *see* MACROPAEDIA: Measurement and Observation, Principles, Methods, and Instruments of.

The first radio telescope, built in 1937 by Grote Reber of Wheaton, Ill., was a steerable paraboloid—*i.e.*, a device with a parabolically shaped reflector, dubbed the "dish," that focuses the incoming radio waves onto a small pickup antenna, or "feed." The radio telescope at Jodrell Bank, Cheshire, Eng., has a steerable paraboloid antenna 76 m (250 feet) in diameter. The reflecting surface of the telescope at Arecibo, P.R., fills a naturally occurring bowl-shaped depression 305 m (1,000 feet) in diameter. The Arecibo installation is equipped with a radar transmitter for the study of radar signals reflected from such celestial objects as planets and their satellites.

Radio interferometers consist of two or more widely separated antennas connected by transmission lines. With their greatly increased resolving power, they can be used to determine the position or diameter of a radio source or to separate two closely spaced sources. Phase-array telescopes consist of large numbers of relatively small antenna elements arranged in any of various configurations over a relatively large area, yielding the effective sensitivity and resolution of an antenna much larger than could practicably be built. An example of such a system is the 27-antenna Very Large Array near Socorro, N.M., which is one of the world's largest and most sensitive radio telescopes. *See also* telescope.

radioactive fallout, the deposition of radioactive materials on the Earth from the atmosphere. *See* fallout.

radioactive isotope, also called RADIOISOTOPE, any of several species of the same chemical element with different masses whose nuclei are unstable and dissipate excess energy by spontaneously emitting radiation in the form of alpha, beta, and gamma rays.

A brief treatment of radioactive isotopes follows. For full treatment, *see* MACROPAEDIA: Atoms: Their Structure, Properties, and Component Particles.

Every chemical element has one or more radioactive isotopes. For example, hydrogen, the lightest element, has three isotopes with mass numbers 1, 2, and 3. Only hydrogen-3 (tritium), however, is a radioactive isotope, the other two being stable. More than 1,000 radioactive isotopes of the various elements are known. Approximately 50 of these are found in nature; the rest are produced artificially as the direct products of nuclear reactions or indirectly as the radioactive descendants of these products.

Radioactive nuclides, or radionuclides, are species of unstable atomic nuclei without the restriction of being forms of the same element. Radioactive nuclides consist of all the sets of radioactive isotopes.

Radioactive isotopes have many useful applications. In medicine, for example, cobalt-60 is extensively employed as a radiation source to arrest the development of cancer. Other radioactive isotopes are utilized as tracers for diagnostic purposes, as well as in research on metabolic processes. When a radioactive isotope is added in small amounts to comparatively large quantities of the stable element, it behaves exactly the same as the ordinary isotope chemically; it can, however, be traced with a Geiger counter or other detection device. Iodine-131 has proved effective in locating brain tumours, measuring cardiac output, and determining liver and thyroid activity. Another medically important radioactive isotope is carbon-14, which is useful in studying abnormalities of metabolism that underlie diabetes, gout, anemia, and acromegaly. In industry, radioactive isotopes of various kinds are used for measuring the thickness of metal or plastic sheets; their precise thickness is indicated by the strength of the radiations that penetrate the material being inspected. They also may be employed in place of large X-ray machines to examine manufactured metal parts for structural defects. Other significant applications include the use of radioactive isotopes as compact sources of electrical power—*e.g.*, plutonium-238 in cardiac pacemakers and spacecraft. In such cases, the heat produced in the decay of the radioactive isotope is converted into electricity by means of thermoelectric junction circuits or related devices.

Some significant naturally occurring radioactive isotopes

isotope	half-life (years, unless noted)	isotope	half-life (years, unless noted)
^{3}H	12.32	^{149}Sm	10^{16}
^{14}C	5.715×10^{3}	^{176}Lu	3.8×10^{10}
^{50}V	$>3.9 \times 10^{17}$	^{187}Re	4.2×10^{10}
^{87}Rb	4.88×10^{10}	^{186}Os	2×10^{15}
^{90}Sr	29	^{222}Rn	3.823 days
^{115}In	4.4×10^{14}	^{226}Ra	1,599
^{123}Te	1.3×10^{13}	^{230}Th	7.54×10^{4}
^{130}Te	2.5×10^{21}	^{232}Th	1.4×10^{10}
^{131}I	8.040 days	^{232}U	68.9
^{137}Cs	30.17	^{234}U	2.45×10^{5}
^{138}La	1.06×10^{11}	^{235}U	7.04×10^{8}
^{144}Nd	2.1×10^{15}	^{236}U	2.34×10^{7}
^{147}Sm	1.06×10^{11}	^{237}U	6.75 days
^{148}Sm	7×10^{15}	^{238}U	4.46×10^{9}

Source: David R. Lide (ed.), *CRC Handbook of Chemistry and Physics*, 71st ed. (1990–91).

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radioactive series, any of four independent sets of unstable heavy atomic nuclei that decay through a sequence of alpha and beta decays until a stable nucleus is achieved. These four chains of consecutive parent and daughter nuclei (shown in the figure on page 892) begin and end among elements with atomic numbers higher than 81, which is the atomic weight of thallium; the members of each set are genetically related by alpha and beta decay. Three of the sets, the thorium series, uranium series, and actinium series, called natural or classical series, are headed by naturally occurring species of unstable nuclei that have half-lives comparable to the age of the elements. By 1935 these three radioactive series had been fully delineated. The fourth set, the neptunium series, is headed by neptunium-237, which has a half-life of 2,000,000 years. Its members are produced artificially by nuclear reactions and do not occur naturally; all their half-lives are short compared with the age of the elements.

Because the two pertinent decay processes result either in no change or in a change of four units in the mass number, the mass numbers of all the members of each series are divisible by four, with a constant remainder. Within each series, therefore, the mass number of the members may be expressed as four times an appropriate integer (n) plus the constant for that series; thus, the thorium series is sometimes called the $4n$ series; the neptunium series, $4n + 1$; the uranium series, $4n + 2$; and the actinium series, $4n + 3$.

The thorium series begins with thorium-232 and ends with the stable nuclide lead-208. The neptunium series is named for its longest-lived member, neptunium-237; it ends with bismuth-209. The uranium series begins with uranium-238 and ends with lead-206. The actinium series, named for its first-discovered member, actinium-227, begins with uranium-235 and ends with lead-207.

Alpha decay, symbolized by a larger arrow in the accompanying diagrams, involves the ejection from an unstable nucleus of a particle composed of two protons and two neutrons. Thus alpha emission lowers the atomic number (number of protons) by two units, the neutron number by two units, and the mass number (total of neutrons and protons) by four units. At the head of the thorium series, for example, thorium-232 undergoes alpha decay to radium-228.

Negative beta decay, symbolized by a smaller arrow, involves the ejection from an unstable nucleus of an electron and an antineutrino that are produced by the decay of a neutron into a proton. This process lowers the neutron number by one unit, raises the atomic number by one unit, and leaves the mass number unchanged. At the end of the neptunium series, for example, lead-209 undergoes negative beta decay to bismuth-209.

Branching (the decay of a given species in more than one way) occurs in all four of the radioactive series. For example, in the actinium series, bismuth-211 decays partially by negative beta emission to polonium-211 and partially by alpha emission to thallium-207.

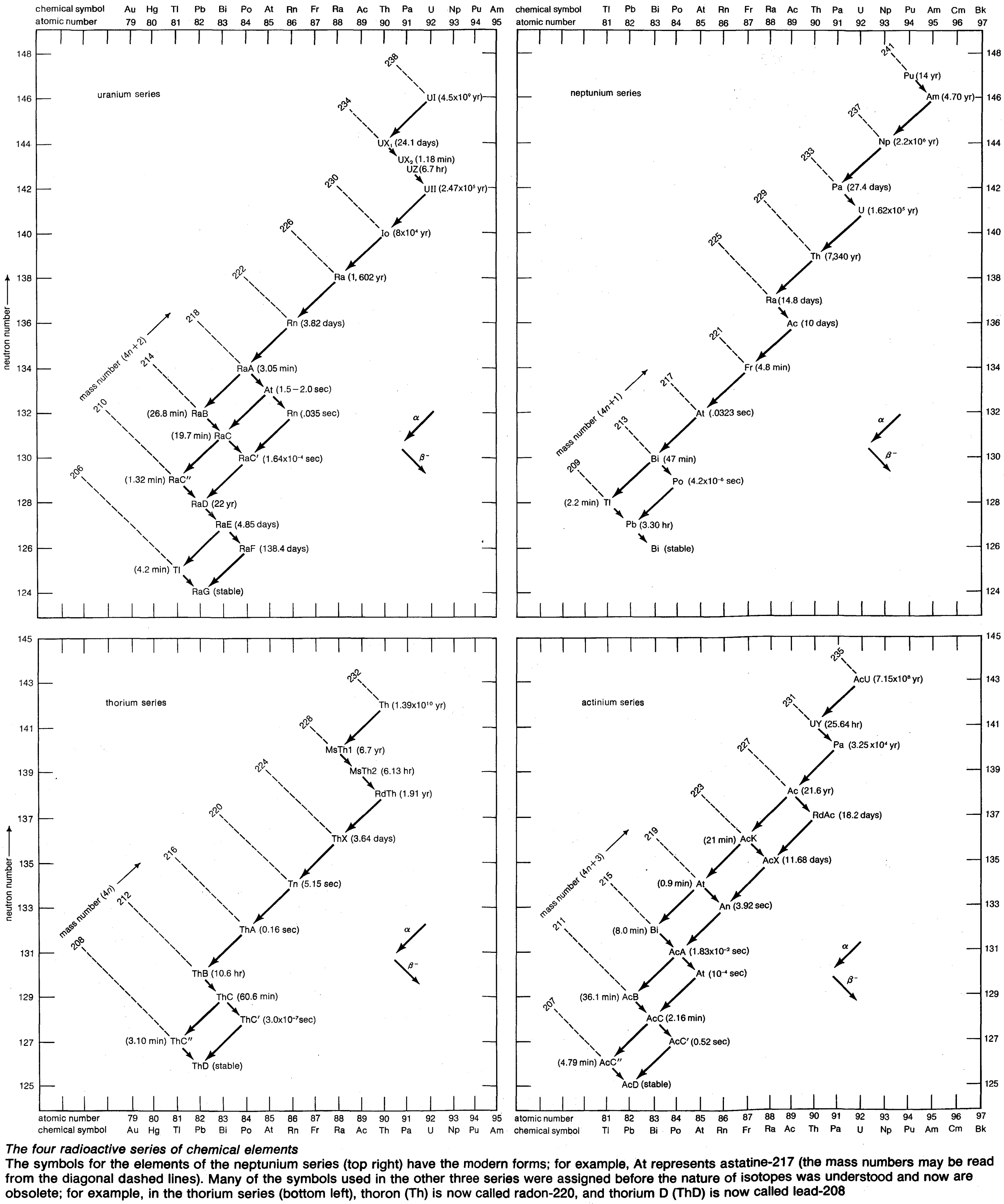
radioactivity, property exhibited by certain types of matter of emitting energy and subatomic particles spontaneously. It is, in essence, an attribute of individual atomic nuclei.

A brief treatment of radioactivity follows. For full treatment, *see* MACROPAEDIA: Atoms:

Their Structure, Properties, and Component Particles.

Radioactivity was first reported in 1896 by the French physicist Henri Becquerel for a double salt of uranium and potassium. Soon thereafter it was found that all uranium compounds and the metal itself were similarly radioactive. Intensity of activity was proportional to the amount of uranium present, chemical combination having no effect. In 1898 the noted French physicists Pierre and Marie Curie discovered two other strongly radioactive elements, radium and polonium, that occur in nature.

The early study of the radioactivity of the heavy elements led to revolutionary changes in ideas of the structure of matter. At the beginning of the 20th century the theory that matter consists of atoms was generally accepted by scientists; notions of the inner structure of atoms, however, were entirely speculative. By 1903 research on radioactive processes and radiations led to the realization that atoms are not of necessity permanently stable. The conclusion by 1911 was that nearly all of the mass of the atom is concentrated in a nucleus occupying only a minute portion of the total volume. Next came the important concept of isotopes (1913); and transmutation, the modification of an atomic nucleus, was achieved in a laboratory experiment six years later. Finally, in 1934, it was discovered that radioactivity could be induced in ordinary matter by transmutation in an artificially contrived arrangement. In these first experiments radioactive varieties of nitrogen, aluminum,



The four radioactive series of chemical elements

The symbols for the elements of the neptunium series (top right) have the modern forms; for example, At represents astatine-217 (the mass numbers may be read from the diagonal dashed lines). Many of the symbols used in the other three series were assigned before the nature of isotopes was understood and now are obsolete; for example, in the thorium series (bottom left), thoron (Th) is now called radon-220, and thorium D (ThD) is now called lead-208 and phosphorus were identified. Within a few months it had been shown that neutrons (uncharged nuclear particles) could effect transmutation, and the list of newly discovered radioactive isotopes covered the whole range of known elements from hydrogen to uranium. At this time there were indications that radioactive isotopes of transuranium elements (*i.e.,* those of atomic number greater than that of uranium) might be obtained through transmutation, but it was not until 1940 that the first clear identification of such an element—neptunium—was made.

Of the various processes resulting in the production of radioactive species, neutron-induced nuclear fission, achieved in 1939, has been the most fruitful. In 1941 it was learned that fission may also occur spontaneously. In this case, certain unstable nuclei of heavier elements split into nearly equal fragments without the introduction of outside energy. With such discoveries, modern theories of nuclear structure became possible, and the large-scale release of nuclear energy was achieved in 1942.

Radioactive substances emit energy in the form of ionizing radiations. Such radiations dissipate their energy in passing through matter by producing ionization and other effects. The radiated energy is either kinetic energy of particles or quantum energy of photons; these are eventually degraded into heat. If the radioactive source is a compact portion of matter, some of the energy of radiations is dissipated in the source itself. The source then tends to maintain a temperature higher than that of its surroundings. The emission is spontaneous, and its rate is uninfluenced by changes of pressure and temperature available to laboratory study. It is, however, not inexhaustible. For each source the rate of emission of energy continually decreases, as measured by its half-life. (Half-life is defined as the period in which the rate of radioactive emission by a pure sample falls by a factor of two.) Among known radioactive isotopes, half-lives range from about 10^{-7} seconds to 10^{16} years. *See also* nuclear fission.

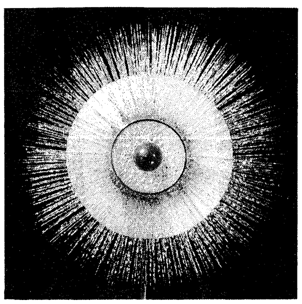
radiocarbon dating: *see* carbon-14 dating.

radioisotope: *see* radioactive isotope.

radiolarian, any protozoan of the subclass Radiolaria (class Actinopodea), found in the upper layers of all oceans. Radiolarians, which are mostly spherically symmetrical, are known for their complex and beautifully sculptured, though minute, skeletons, referred to as tests. Usually composed of silica, the test is elaborately perforated in a variety of patterns, forming a series either of lattice-like plates or of loose needle-shaped spicules. Pseudopodia extend through the perforated skeleton. A chitinous central capsule encloses the nuclei and divides the cytoplasm into two zones. The outer cytoplasm contains many vacuoles that control the organism's buoyancy.

Asexual reproduction is by budding, binary fission, or multiple fission. Generally, the skeleton divides, and each daughter cell regenerates the missing half. In some cases, however, one daughter cell escapes and develops an entirely new shell, the other daughter remaining within the parent skeleton.

The skeletal remains of radiolarians settle to the ocean floor and form radiolarian ooze. When the ocean bottom is lifted and transformed into land, the ooze becomes sedimentary rock. Silica deposits, such as flint, chert, and the abrasive tripoli, originate from radiolarian skeletons. Fossil radiolarians have been found that date back to the Precambrian Era (more than 570,000,000 years ago).



Radiolarian (glass model)

By courtesy of the American Museum of Natural History, New York City

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radiology, branch of medicine using radiation for the diagnosis and treatment of disease. Radiology originally involved the use of X rays in the diagnosis of disease and the use of X rays, gamma rays, and other forms of ionizing radiation in the treatment of disease. In more recent years radiology has come also to embrace diagnosis by a method of organ scanning with the use of radioactive isotopes and also with nonionizing radiation, such as ultrasound waves and nuclear magnetic resonance. Similarly, the scope of radiotherapy has extended to include, in the treatment of cancer, such agents as hormones and chemotherapeutic drugs.

Diagnosis. X rays were discovered by Wilhelm Conrad Röntgen, a German professor of physics, in his laboratory in the University of Würzburg on Nov. 8, 1895. Early on, in radiodiagnosis use was made of three of the properties of X rays—their ability to penetrate the tissues, their photographic effect, and their ability to cause certain substances to fluoresce. In penetrating the tissues, the radiation is absorbed differentially, depending on the densities of the tissues being penetrated. The radiation emerging from tissues thus produces on a photographic film or a fluorescent screen an image of the structures of differing densities within the body. The limiting factor in this method of diagnosis is the similarity between the densities of adjacent soft tissues within the body, with a resultant failure to produce a notable contrast between the images of adjacent structures or organs.

During the first two decades following their discovery, X rays were used largely for the diagnosis and control of treatment of fractures and for the localization of foreign bodies, such as bullets, during World War I. The physicians using these methods introduced artificial contrast agents, such as a paste consisting of barium sulfate, which is inert and nontoxic when taken by mouth. When it is taken by mouth or introduced by enema, the various parts of the alimentary tract can be demonstrated and examined. Refinements of this technique continue to the present day, and radiological examination of the alimentary tract is an elegant and precise aid to diagnosis. Eventually a number of other contrast media were produced that could be injected into blood vessels. The media could thus be used either to demonstrate those vessels (whether arteries or veins) or, after their selective concentration and excretion by the kidneys, to show the urinary tract.

Within the first few months after Röntgen's discovery, attempts were made to produce films of moving objects; thus, it was soon realized that radiology might be able to depict function and so demonstrate dynamic physiological functions rather than just static anatomy. Technical difficulties and the hazards of a high dose of radiation to the patient prevented the proper development of this technique.

In the 1950s an electronic method was devised to intensify the image, the so-called image intensifier, which made possible the overcoming of the technical difficulties, and cineradiography became routine. During the whole period of the development of radiology, photographic techniques were also continually being improved. Single-coated photographic plates were used at first, and then double-coated photographic films; photographic emulsions have now been developed to such a point that high speed can be provided with good definition and little intrusion of photographic grain into the image. Similarly, processing methods have been improved; automatic processors now can deliver a fully processed dry film in 90 seconds.

A new form of X-ray imaging, computerized axial tomography (CAT scanning) was devised by Godfrey Hounsfield of Great Britain and Allan Cormack of the United States during the 1970s. This method measures the attenuation of X rays entering the body from many different angles. From these measurements a computer reconstructs the organ under study in a series of cross-sections or planes. The technique allows soft tissues such as liver and kidney to be clearly differentiated in the images reconstructed by the computer. This procedure adds enormously to the diagnostic information that can be provided by conventional X rays. CAT scanners are now in use in many large hospitals and medical centres throughout the world.

A still more recently developed technique is nuclear magnetic resonance (NMR) scanning (also called magnetic resonance imaging, or MRI), in which radio waves are beamed into an individual who is subjected to a powerful magnetic field. Different atoms in the body absorb radio waves at different frequencies under the influence of the magnetic field. The way in which absorption takes place is measured and used by a computer to construct images of internal structures.

Another recent technique is positron emission tomography, or PET scanning, which involves the creation of particles of antimatter by compounds injected into the body being scanned. These particles, positrons, which are neutralized by their opposites, electrons, with the release of energy as matter and antimatter annihilate each other. Detectors arranged around the body pick up the energy released in the form of radiation and use it to follow the movements of the injected compound and its metabolism.

These relatively new radiological techniques provide much safer means of examining internal body structures. They also yield precise and clear images for the physician and diminish the margin of error in therapeutic measures.

Therapy. In radiotherapy, use is made of the biological effects of ionizing radiations. The early workers noted that large doses of radiation would cause, after some delay, reddening of the skin, which might lead to blistering and ulceration. Even small repeated doses, if occurring often enough, might produce serious skin lesions. It was argued, then, that a phenomenon producing such damage to normal tissues might be directed toward abnormal and undesirable tissues, such as cancer. Research into the fundamental nature of the biological action of radiation continues to the present day, and a new type of scientist, the radiobiologist, has emerged. About the same time as the uses of X rays were first being applied to medicine, radium was discovered, and also the importance of the time factor as a modifier of the reaction of tissue to radiation was established. Thus was born the art of radiotherapy, at first based entirely on an empirical approach. It was soon noted that ionizing radiations also have the effect of alleviating pain, and so in the period of development of this form of treatment it was used rather extensively in the treatment of painful forms of arthritis, swellings of the salivary glands, herpes zoster or shingles, overgrowth of adenoids in children, and several other benign conditions. As knowledge of the possible harmful effects of radiation has grown, many of these applications have been discarded, except in special circumstances and under strict supervision.

The vast bulk of the practice of radiotherapy has to do with cancer, and it is here that the great advances have been made. The first step was to establish a unit of measurement. Since the early days physicians practicing treatment with ionizing radiations have worked in close collaboration with physicists, and much of the fundamental research has been undertaken by radiation physicists working alongside their medical colleagues. The establishment of an internationally accepted unit of measurement at Stockholm in 1925, the roentgen unit, enabled physicists to undertake similar calibration in different centres and provided a means of devising a system of dosimetry.

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

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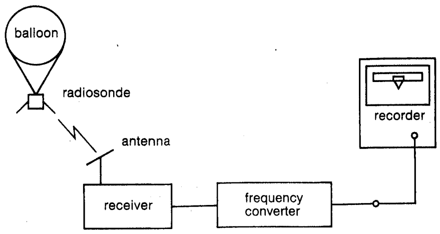
radiometer, instrument for detecting or measuring radiant energy. The term is applied in particular to devices used to measure infrared radiation. Radiometers are of various types that differ in their method of measurement or detection. Those that function by means of an increase in the temperature of the device, such as Herschel's thermometer, are called thermal detectors. Commonly used thermal detectors include the thermocouple, which produces a voltage when heated, and the bolometer, which undergoes a change in electrical resistance when heated. Devices that can, in principle, detect a singular quantum of radiant energy, such as Becquerel's photographic plate, are called quantum detectors. The photoelectric cell is the basis of many current quantum detectors.

The term radiometer is often used to refer specifically to a type of detector invented by Sir William Crookes in the late 1800s. It is rarely used as a scientific instrument, because it was found to be insensitive and not easily calibrated, but it paved the way for the more exact instruments in use today. A Crookes radiometer consists of a glass bulb from which most of the air has been removed, thereby creating a partial vacuum, and a rotor that is mounted on a vertical support inside the bulb. The rotor bears four light, horizontal arms mounted at right angles to one another on a central pivot; the rotor can turn freely in the horizontal plane. At the outer end of each arm is mounted a vertical metal vane. Each vane has one side polished and the other side blackened; the vanes are arranged so that the polished side of one faces the blackened side of the next. When radiant energy strikes the polished surfaces, most of it is reflected away, but when it strikes the blackened surface, most of it is absorbed, raising the temperature of those surfaces. The air near a blackened surface is thus heated and exerts a pressure on the blackened surface, causing the rotor to turn.

radiosonde, balloon-borne instrument for making atmospheric measurements, such as temperature, pressure, and humidity, and radioing the information back to a ground station. Special helium-filled meteorological balloons made of high-quality neoprene rubber are employed for elevating the radiosonde



Radiosonde system

From *Modern Dictionary of Electronics* by Rudolf F. Graf, copyright 1962, 1963, and 1968, by Howard W. Sams & Co., Inc., reprinted by permission of the publisher

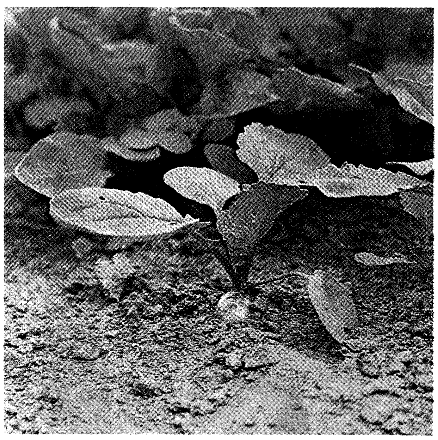
to very high altitudes of around 100,000 feet (30,000 metres); maximum altitude for balloon-borne radiosondes is about 150,000 feet.

Two basic systems are used for collecting data and coding it for transmittal. In the mechanical type, the thermometer is usually a bimetallic strip or a stretched wire, the humidity element a hair or goldbeater's skin hygrometer, and the pressure system an aneroid type of capsule. In the electrical change type system, a mechanical bellows, responsive to changes in atmospheric pressure, operates a switching arrangement to alternately transmit measurements of temperature and humidity; the temperature is indicated by a temperature-sensitive resistor and the humidity by a humidity-sensitive arrangement consisting of a strip of polystyrene coated with lithium chloride. Wind velocity can be determined by tracking the radiosonde with a theodolite or with an automatic tracking antenna.

radiotelegraphy, radio communication by means of Morse Code or other similarly coded signals. The radio carrier in amplitude-modulated (AM) systems is interrupted in accordance with the Morse dot-dash code. Automatic teleprinting operations function more efficiently with frequency-shift (frequency-modulation; FM) telegraphy, in which the code is transmitted by shifts in carrier frequency. *See also* modulation.

radiotherapy: *see* radiation therapy.

radish (*Raphanus sativus,* family Brassicaceae), annual or biennial grown for its large, succulent root. The edible part of the root, together with some of the seedling stem, forms a structure varying in shape, among varieties, from spherical, through oblong, to long cylindrical or tapered. The outside colour of the root varies from white, through pink, to red, purple, and black; the size of the edible part varies from a few grams in the most popular early American and European varieties up to 1 kilogram (2.2 pounds) in the late Japanese field type of radish, or *daikon.* Generally,



Radish (*Raphanus sativus* variety *radicula*)

Ingmar Holmasen

flower stalks form the first season, bearing white or lilac-veined flowers. The seeds are borne in a pod called a silicle. The small, quick-growing spring varieties have a mild, crisp, moderately firm flesh and are quite perishable. The large, slow-growing summer and winter types have pungent, firm flesh. Winter varieties can be stored through the winter.

The common radish is probably of Oriental origin. Radishes are low in calories and high in bulk. They are usually eaten raw and the young tops are sometimes shredded and added to salads. *See also* wild radish.

Radishchev, Aleksandr Nikolayevich (b. Aug. 31 [Aug. 20, old style], 1749, Moscow—d. Sept. 24 [Sept. 12, O.S.], 1802, St. Petersburg), writer who founded the revolutionary tradition in Russian literature and thought.

Radishchev, nobleman, was educated in Moscow (1757–62), at the St. Petersburg Corps of Pages (1763–66), and at Leipzig, where he studied law (1766–71). His career as a civil servant brought him into contact with people

Radishchev, engraving by Giovanni Vendramini

By courtesy of the State Historical Museum, Moscow

from all social strata. Under the influence of the cult of sentiment developed by such writers as Jean-Jacques Rousseau, he wrote his most important work, *Puteshestvie iz Peterburga v Moskvu* (1790; *A Journey from St. Petersburg to Moscow,* 1958), in which he collected, within the framework of an imaginary journey, all the examples of social injustice, wretchedness, and brutality he had seen. Though the book was an indictment of serfdom, autocracy, and censorship, Radishchev intended it for the enlightenment of Catherine the Great, who he assumed was unaware of such conditions. Its unfortunate timing (the year after the French Revolution) led to his immediate arrest and sentence to death. The sentence was commuted to 10 years' exile in Siberia, where he remained until 1797.

Radishchev's harsh treatment chilled liberal hopes for reform. In 1801 he was pardoned by Alexander I and employed by the government to draft legal reforms, but he committed suicide a year later. Though his work has slight claim to literary quality, his fame was great and his thought inspired later generations, especially the Dekabrists, an elite group of intellectuals and noblemen who staged an abortive rebellion against autocracy in 1825.

Radisson, Pierre Esprit (b. *c.* 1636, Paris—d. *c.* 1710, England?), French explorer and fur trader who served both France and England in Canada.

Radisson arrived in New France in 1651 and settled at Trois-Rivières. In 1652 he was captured and adopted by Iroquois Indians, with whom he chose to remain despite opportunities to escape. Later he left North America and sailed to France, landing at La Rochelle early in 1654.

He returned to Canada the same year with his brother-in-law, Médard Chouart des Groseilliers, and for six years they made trading expeditions to the West. In 1658 they set out for Lake Nipissing (then known as Lac des Castors), crossing what is now Wisconsin and the upper Mississippi River valley. Because they had failed to secure a government license, the French authorities in 1663 confiscated their furs and fined them. As a result Radisson and Groseilliers offered their services to the English at Port Royal (now Annapolis Royal, Nova Scotia).

They were later employed by New Englanders of Boston, for whom they sailed to Hudson Strait and discovered copper deposits near Lake Superior. Their report on the wealth in furs led to the formation of the Hudson's Bay Company in 1670. Financed by Prince Rupert, cousin to King Charles II, Radisson undertook another trading expedition in 1668 in search of a Northwest Passage. In 1671 he founded Moose Factory, a company trading post a few miles south of James Bay.

Three years later, Radisson and Groseilliers made their peace with France and served in the French fleet in Guinea and Tobago. Radisson became a resident of Quebec in 1681, and the following year he led an expedition against the English on Hudson Bay. After revisiting both France and England, he was again employed by the Hudson's Bay Company and was eventually pensioned by the company.

radium (Ra), radioactive chemical element, heaviest of the alkaline-earth metals of main Group IIa of the periodic table. Radium is a silvery white metal that does not occur free in nature.

Radium was discovered (1898) by Pierre Curie, Marie Curie, and an assistant, G. Bémont, after Mme Curie had observed that the radioactivity of pitchblende was four or five times greater than that of the uranium it contained and not fully explained on the basis of radioactive polonium, which she had just discovered in pitchblende residues. The new, powerfully radioactive substance followed the behaviour of barium, but because its chloride was slightly more insoluble it could be concentrated by fractional crystallization. By 1902, one-tenth gram of pure radium chloride was prepared by refining several tons of pitchblende residues, and by 1910 Mme Curie and André-Louis Debierne had isolated the metal itself.

Since all the isotopes of radium are radioactive and short-lived on the geological time scale, any primeval radium would have disappeared long ago. Therefore, radium occurs naturally only as a disintegration product in the three natural radioactive-decay series (thorium, uranium, and actinium series). The most stable isotope (1,620-year half-life) is a member of the uranium-decay series. Its parent is thorium-230 and its daughter radon-222. The further decay products, formerly called radium A, B, C, C′, C″, D, etc., are isotopes of polonium, lead, bismuth, and thallium.

Radium's uses all result from its radiations. The most important use of radium was formerly in medicine, principally for the treatment of cancer by subjecting tumours to the gamma radiation of its daughter isotopes. In many therapeutic applications radium has been superseded by the less costly and more powerful artificial radioisotopes cobalt-60 and cesium-137. An intimate mixture of radium and beryllium is a moderately intense source of neutrons, used for scientific research and for well logging in geophysical prospecting for petroleum. For these uses, however, substitutes have become available.

When concentrated, radium glows in the dark. Because of this property, it was once mixed with a paste of zinc sulfide to make a self-luminescent paint for watch, clock, and instrument dials. During the 1930s it was found, however, that exposure to radium posed a serious hazard to health: a number of the workers who routinely used the radium-containing luminescent paint developed anemia and, in some cases, bone cancer. The practice of employing radium in luminescent coatings was halted after the high toxicity of the material was recognized.

In the thorium-decay series of radioactive elements, two radium isotopes occur. They are found naturally in the mineral monazite: radium-228 (6.7-year half-life) and radium-224 (3.64-day half-life). One of their descendants, thallium-208, emits gamma radiation even more penetrating than that of bismuth-214; and, as a result of the complex sequence of half-lives, the gamma activity of freshly purified radium-228 increases for about four years and then steadily decreases. A fourth isotope, radium-223 (11.7-day half-life), occurs in the actinium-decay series.

Metallic radium has high chemical reactivity. It is attacked by water with vigorous evolution of hydrogen and by air with the formation of the nitride. Exclusively divalent, it occurs as the Ra^{2+} ion in all its compounds. The sulfate, $RaSO_4$, is the most insoluble sulfate known, and the hydroxide, $Ra(OH)_2$, is the most soluble of the alkaline-earth hydroxides. Its compounds are very similar to the corresponding barium compounds, making separation of the two elements difficult.

atomic number	88
stablest isotope	226
melting point	about 700° C
boiling point	about 1,737° C
specific gravity	about 5
valence	2
electronic config.	2-8-18-32-18-8-2 or $(Rn)7s^2$

radius, in anatomy, the outer of two bones of the forearm when viewed with the palm facing forward. All land vertebrates have this bone. In humans it is shorter than the other bone of the forearm, the ulna.

The head of the radius is disk-shaped; its upper concave surface articulates with the humerus (upper arm bone) above, and the side surface articulates with the ulna. On the upper part of the shaft is a rough projection, the radial tuberosity, which receives the biceps tendon. A ridge, the interosseous border, extends the length of the shaft and provides attachment for the interosseous membrane connecting the radius and ulna. The projection on the lower end of the radius, the styloid process, may be felt on the outside of the wrist where it joins the hand. The inside surface of this process presents the U-shaped ulnar notch in which the ulna articulates. Here the radius moves around and crosses the ulna as the hand is turned to cause the palm to face backward (pronation).

radius, atomic: *see* atomic radius.

radix (mathematics): *see* base.

Radlov, Vasily (Vasilyevich), German WILHELM RADLOFF (b. Jan. 17, 1837, Berlin—d. May 12, 1918, St. Petersburg [now Leningrad], Russia), German scholar and government adviser who made fundamental contributions to the knowledge of the ethnography, folklore, culture, ancient texts, and linguistics of the Turkic peoples of Southern Siberia and Central Asia.

Radlov engaged in Oriental studies at the University of Berlin during the 1850s, and after completing his education he taught in a secondary school at Barnaul in southwestern Siberia. During that period he had close contact with the Turkic people of the Sayan and Altai mountains and began his ethnographic, textual, and linguistic studies. The folkloric materials he collected appeared in part in *Proben der Volkslitteratur der türkischen Stämme,* 10 vol. (1866–1907; "Examples of the Folk Literature of the Turkic Tribes"). This and others of his works offered the first precise, systematic treatment of Central Asiatic ethnography and established the scientific study of the Turkic peoples.

Following his return to St. Petersburg, Radlov published a general ethnography of northern and Central Asia, *Aus Sibirien* (1884; "From Siberia"), which advanced a three-stage theory of cultural evolution for the region—hunting to pastoral to agricultural—with shamanism as the main religion. He also translated (1891–1910) *Kudatku Bilik,* a long medieval poem of the Uighur people.

Radlov wrote a comparative dictionary of Turkic languages, 4 vol. (1893–1911), and a lengthy work on Turkic inscriptions from Mongolia. As an adviser to the Russian government, he fostered enlightened treatment of Central Asians. He was also a principal developer of the Museum of Anthropology and Ethnography, Leningrad.

Radnor, district, Powys county, eastern Wales. Created in 1974 from the former county of Radnorshire, Radnor district covers 471 square miles (1,219 square km) of mountainous terrain and highlands, with a central valley formed by the River Wye. It borders the districts of Brecknock to the south, Ceredigion to the west, Montgomery to the north, and the English districts of South Shropshire, Leominster, and South Herefordshire to the east. There are ruins of a Roman villa outside the town of Knighton and the remains of a Roman fort, Castell Collen, near the town of Llandrindod Wells. The region was taken by the Normans in the late 1000s and became part of the Welsh Marches (border country between Wales and England). The 12th and 13th centuries saw almost continuous fighting in the area until Edward I of England defeated the Welsh in the 14th century. The region was almost entirely English-speaking by the 16th century, when Henry VIII of England formally created Radnorshire as a county within the principality of Wales.

Radnor today is primarily an agricultural district. Sheep raising is the predominant activity, and oats and hay are grown in the valleys. Numerous market centres are scattered throughout the district, including Presteigne, a small town on the River Lugg in western Radnor, and the larger town of Knighton to the north, with sawmills, woolen mills, and some agricultural engineering. The town of Llandrindod Wells, known for its 19th-century health spa, is the administrative seat for both the district and the county. A series of reservoirs in the valley of Elan supply water to Birmingham. Pop. (1986 est.) 21,700.

Radom, *województwo* (province), east-central Poland. Established in 1975, the province consists of an area of 2,816 square miles (7,294 square km). It is bordered by the provinces of Warsaw on the north, Siedlce and Lublin on the east, Tarnobrzeg and Kielce on the south, and Piotrków Trybunalski and Skierniewice on the west. It flourished since at least the 12th century as a fortified area and as a commercial centre.

The economy of the province today depends on the textile industry, glass and chemical works, food-processing factories, and agriculture (grains, sugar beets, and potatoes). The Vistula River, defining most of the eastern border of the province, has numerous health and resort spas along its banks; other rivers include the Radomka, the Pilica, and the Iłżanka. About 70 percent of the inhabitants of the province live in rural areas. Radom city is the provincial capital; other major cities are Pionki, Kozienice and Grójec. Pop. (1987 est.) 733,400.

Radom, city, capital of Radom *województwo* (province), east-central Poland. It is a rail junction and an administrative and industrial centre; the economy of the city relies predominantly on textile milling, glass and chemical works, munitions, footwear, and food processing. Radom has a museum and a theatre.

First mentioned in 1154 as a fortified settlement on the crossroads of two major trade routes, the town grew rapidly. It was walled and granted trading privileges in 1360 by King Casimir III the Great. During the 15th century, it became the seat of the diet (assembly) and the district council. It was seized by Austria in 1795, became a department capital under the Grand Duchy of Warsaw (1807–15), passed to Russian control, and was returned to Poland in 1918. Pop. (1987 est.) 219,100.

radon (Rn), chemical element, a heavy radioactive gas of Group 0 (noble gases) of the periodic table, generated by the radioactive decay of radium. Radon is a colourless, odourless, tasteless gas, 7.5 times heavier than air and more than 100 times heavier than hydrogen. The gas liquefies at −61.8° C (−80° F) and freezes at −71° C (−96° F). On further cooling, solid radon glows with a soft yellow light that becomes orange-red at the temperature of liquid air (−195° C [−319° F]).

Radon is rare in nature because its isotopes are all short-lived and because radium, its source, is a scarce element. The atmosphere contains traces of radon near the ground as a result of seepage from soil and rocks, all of which contain minute quantities of radium. (Radium occurs as a natural decay product of uranium present in various types of rocks.)

By the late 1980s, naturally occurring radon gas had come to be recognized as a potentially serious health hazard. The gas, arising from soil and rocks, seeps through the foundations, basements, or piping of buildings and can accumulate in the air of houses that are poorly ventilated. Exposure to high concentrations of this radon over the course of many years can greatly increase the risk of developing lung cancer. Indeed, radon is now thought to be the single most important cause of lung cancer among nonsmokers in the United States. Radon levels are highest in homes built over geological formations that contain uranium mineral deposits.

Concentrated samples of radon are prepared synthetically for medical and research purposes. Typically a supply of radium is kept in a glass vessel in aqueous solution or in the form of a porous solid from which the radon can readily flow. At intervals of a few days, the accumulated radon is pumped off, purified, and compressed into a small tube, which is then sealed and removed. The tube of gas is a source of penetrating gamma radiation, which comes mainly from one of radon's decay products, bismuth-214. Such tubes of radon have been used for radiotherapy and radiography.

Natural radon consists of three isotopes, one from each of the three natural radioactive-disintegration series (uranium, thorium, and actinium series). The longest-lived isotope, radon-222 (3.823-day half-life), discovered (1900) by the German chemist Friedrich E. Dorn, arises in the uranium series. The name radon is sometimes reserved for this isotope to distinguish it from the other two natural isotopes, called thoron and actinon because they originate in the thorium and the actinium series, respectively.

Radon-220 (thoron; 51.5-second half-life) was first observed (1899) by the British scientists R.B. Owens and Ernest Rutherford, who noticed that some of the radioactivity of thorium compounds could be blown away. Radon-219 (actinon; 3.92-second half-life) was found (1904), associated with actinium, independently by Friedrich O. Giesel and André-Louis Debierne. More than a dozen artificial radioactive isotopes of radon are known.

Radon atoms possess a particularly stable electronic configuration of eight electrons in their outer shell, which accounts for the characteristic chemical inactivity of the element. Radon, however, is not completely inert chemically. The existence of a compound, radon difluoride, apparently more stable chemically than compounds of the other reactive noble gases, krypton and xenon, was established in 1962. The short lifetime of radon and the energy of its radioactivity make difficult the experimental investigation of radon compounds.

atomic number	86
stablest isotope	(222)
melting point	−71° C (−96° F)
boiling point	−62° C (−80° F)
density (1 atm, 0° C)	9.73 g/litre
valence	0, +2(?)
electronic configuration	2-8-18-32-18-8 or $(Xe)4f^{14}5d^{10}6s^{2}6p^{6}$

Radowitz, Joseph Maria von (b. Feb. 6, 1797, Blankenburg, Harz, Braunschweig-Wolfenbüttel [Germany]—d. Dec. 25, 1853, Berlin), conservative Prussian diplomat and general who was the first statesman to attempt the unification of Germany under Prussian hegemony (from 1847), anticipating Otto von Bismarck's more successful efforts by almost 20 years.

Educated in military schools, Radowitz entered the Prussian army in 1823. He rose quickly through his intelligence and his friendship with the crown prince (the future Prussian king Frederick William IV), and by 1830 he was chief of the artillery general staff. Politically, Radowitz was a romantic conservative and became a member of the reactionary circle that had formed around the brothers Leopold and Ernst Ludwig von Gerlach. In 1836 he was appointed Prussian military plenipotentiary to the German Confederation. Radowitz soon became convinced that the confederation was so weak as to be almost useless, and he began to work for its reform, a process in which he felt Prussia should take the lead. Viewing France as the major enemy and threat, he regarded a strong Germany as indispensable.

The Revolution of 1848 gave Radowitz his chance. From March 1848 to April 1849 he served as a delegate to the Frankfurt National Assembly, where he headed the extreme right wing. His military knowledge and religious convictions soon earned him the title "the warlike monk." His proposal of a German union under Prussian leadership, which would be linked to Austria in a broader, looser confederation, was, however, rejected. After Frederick William IV's refusal of the imperial crown offered to him by the liberals at Frankfurt, Radowitz tried to achieve his goal by reaching agreement with the German princes rather than with the people's representatives. Though not a member of the Cabinet, he succeeded in almost single-handedly directing Prussia's foreign policy at this time, and formed a union of German states willing to accept Prussia's leadership. But when he attempted, as his country's representative to the 1850 Erfurt Parliament of that union, to gain acceptance for Prussia's leadership, he was opposed not only by Austria, Russia, and a number of other German states but also by the conservative Prussian Cabinet. Austria then revived the Diet of the Confederation at Frankfurt and, in the autumn of 1850, threatened to invade Hesse-Kassel, which had been swept by revolution. Radowitz, whose sole support was Frederick William, became Prussian prime minister (September 1850) and prepared for war, which was narrowly averted through the Prussian capitulation at Olmütz (Nov. 29, 1850) under pressure from Russia and Austria. Radowitz, who had resigned on November 3 and whose policy was then discarded, went to England, where he vainly tried to secure an alliance. He retired in 1851 but returned the next year as inspector general of military education. Though he retained his friendship with the king, he exercised no further influence on affairs of state.

radula, plural RADULAE, or RADULAS, horny, ribbonlike structure found in the mouths of all mollusks except the bivalves. The radula, part of the odontophore, may be protruded, and it is used in drilling or in rasping food particles from a surface. It is supported by a cartilage-like mass and is covered with rows of many small teeth (denticles). New sections are constantly produced to replace those worn away at the front.

Radziwiłł FAMILY, an important Polish–Lithuanian princely family that played a significant role in Polish–Lithuanian history.

Prince Mikołaj I (d. 1509) started a long line of Radziwiłł palatines of Wilno (Vilnius) when he was named to that post in 1492; he was chancellor of Lithuania at the same time. His son Mikołaj II (1470–1522) succeeded him in both offices; an advocate of closer ties between Lithuania and Poland, he was made a prince of the Holy Roman Empire by Maximilian I, who hoped to make him change his policy. Of Mikołaj II's three brothers, Jerzy (1480–1541) became hetman of Lithuania in 1531, Jan Mikołaj (d. 1522) was castellan of Troki, and Wojciech (1478–1519) was bishop of Wilno. Jerzy's daughter Barbara (1520–51) became mistress and then queen to King Sigismund II Augustus of Poland, thus greatly enhancing the family's position in Lithuania.

Mikołaj the Black (1515–65), son of Jan Mikołaj, was marshal of Lithuania from 1544, chancellor of Lithuania from 1550, and palatine of Wilno from 1551. An opponent of political union with Poland, he became the first of several Radziwiłł Calvinists to promote the Reformation in Poland and Lithuania, others being Mikołaj the Red (1512–84), who was Barbara's brother; Mikołaj the Red's sons; two of his grandsons; and their sons Janusz (1612–55) and Bogusław (1620–69), the last of the Radziwiłł Calvinists, who sought to realign Lithuania with Protestant Sweden. The descendants of Mikołaj the Black returned to Roman Catholicism and supported Poland's Counter-Reformation policies.

In the 18th century, Radziwiłł palatines, chancellors, and hetmany consistently supported the Saxon dynasty in its battles to keep or regain the Polish throne. Radziwiłłs continued to play important roles in Polish history into the 20th century. One of the best known was Janusz Radziwiłł (1880–1967), politician and chief of the Polish aristocracy.

Rae, John (b. June 1, 1796, Aberdeen, Aberdeenshire, Scot.—d. July 12, 1872, New York City), Scottish-born American economist, physician, and teacher.

Rae was educated in classics, mathematics, and medicine at the universities of Aberdeen and Edinburgh. He emigrated to Canada in 1822, where he pursued a career as a schoolteacher. Rae was an inventor and natural scientist as well as an economist; when he lost his teaching position in Canada (1848) because of a series of disputes over the provision of education, he recommenced his career as a doctor. He traveled to the California gold fields and the Hawaiian islands, finally returning to the United States in 1871.

But it is as an economist that he is famous. He advanced a theory of economic development that contained a number of elements which have brought him (largely posthumous) fame. Prominent among these is a theory of capital in which Rae analyzed the demand for machinery, characterized by positive but declining marginal productivity, and the supply of savings for transformation into capital goods. In the latter connection he used the concept of time-preference and analyzed the social and cultural factors which underlie the willingness to accumulate capital in different societies. His interest in capital goods and in natural science led to a detailed treatment of the process of invention, with Rae again providing an important and pioneering discussion. His work greatly influenced such diverse economists as John Stuart Mill and Joseph A. Schumpeter.

Rae, John (b. Sept. 30, 1813, near Stromness, Orkney Islands, Scot.—d. July 22, 1893, London), physician and explorer of the Canadian Arctic.

Rae studied medicine at the University of Edinburgh (1829–33). He was appointed (1833) surgeon to the Hudson's Bay Company ship that annually visited Moose Factory, a trading post on James Bay (now in Ontario). Two years later he was made resident surgeon of the post, and he remained there for 10 years.

In 1846–47, Rae set forth on the first of four expeditions into the Canadian Arctic; he surveyed Committee and Repulse bays and proved Boothia to be a peninsula. Returning to London, he was appointed second in command to Sir John Richardson on their overland search (1848–49) between the Mackenzie and Coppermine rivers for Sir John Franklin's lost Arctic expedition.

In 1849 the Hudson's Bay Company placed Rae in charge of the Mackenzie River district. For eight months of 1851 he led another party in search of Franklin, travelling about 5,300 miles (8,500 kilometres) and mapping 700 miles of the southern coast of Victoria Island. Rae returned to London but in 1853–54 again set out for the Canadian Arctic, surveying Boothia Peninsula and proving King William Land to be an island. It was on this journey that Rae received from Eskimos at Pelly Bay the first news that the members of the Franklin expedition had perished of exposure and starvation.

Rae retired from the Hudson's Bay Company in 1856 and lived thereafter mainly in London. In 1860 and 1864 he took part in land surveys for the establishment of a telegraph between England and America. Rae was known for his ability to live off the land and for his remarkable physical strength; during his Arctic travels he walked more than 23,000 miles. He was elected a fellow of the Royal Society in 1880. His writings include *Narrative of an Expedition to the Shores of the Arctic Sea, in 1846 and 1847* (1850).

Rae, detail from an oil painting by S. Pearce; in the National Portrait Gallery, London

BBC Hulton Picture Library

Rāe Bareli, town, administrative headquarters of Rāe Bareli district, Uttar Pradesh state, northern India, southeast of Lucknow, on the Sai River. Named for the Bhar people, it is a road and rail junction and an agricultural trade centre. Industries include the milling of agricultural products and handloom weaving. The town contains a 15th-century fort and other ancient buildings.

Rāe Bareli district, 1,777 sq mi (4,603 sq km) in area, is a stretch of fairly level plain drained principally by the Sai and Ganges rivers. There are extensive forests, with mango and mahua groves. Crops include rice, wheat, barley, and millet. Pop. (1981) town, 89,697; district, 1,886,940.

Raeburn, Sir Henry (b. March 4, 1756, Stockbridge, near Edinburgh—d. July 8, 1823, Edinburgh), leading Scottish portrait painter during the late 18th and early 19th centuries.

In about 1771 Raeburn was apprenticed to the goldsmith James Gilliland and is said to have studied with the Edinburgh portrait painter David Martin briefly in 1775. But for the most part Raeburn was self-taught, progressing from miniature painting to full-scale portraiture. A portrait of George Chalmers (1776; Dunfermline Town Hall) is Raeburn's earliest known portrait, and its faulty drawing and incorrect perspective suggest the artist's lack of formal training. By his marriage to a wealthy widow in 1778, he achieved financial security, and during the next four years he considerably improved his artistic skill. In London in 1785, while en route to a tour of Italy, he met Sir Joshua Reynolds, whose works were already familiar to him from Scottish collections and engravings.

"The MacNab"; oil painting by Sir Henry Raeburn, 1803–13; in the collection of John Dewar and Sons, Ltd.

By courtesy of John Dewar & Sons Ltd., Scotch Whisky Distillers; photograph, A.C. Cooper Ltd.

A man of many interests and a good conversationalist, Raeburn became a popular member of the new cultured Edinburgh society. By about 1790 he had painted the portrait of his wife (Countess Mountbatten Collection) and the double portrait of Sir John and Lady Clerk (Sir Alfred Beit Collection), in which the artist experimented with unusual lighting from behind the sitters' heads. During the following decade Raeburn produced some of his most brilliant portraits, such as "Sir John Sinclair" (*c.* 1794–95; Viscount Thurso), which foreshadowed "The MacNab" (*c.* 1803–13; John Dewar and Sons, Ltd., London), in which tonalities became darker and lighting more contrasted. In 1812 he was elected president of the Edinburgh Society of Artists, becoming a Royal Academician in 1815. He was knighted in 1822 and shortly thereafter was appointed His Majesty's Limner for Scotland.

Raeder, Erich (b. April 24, 1876, Wandsbek, Ger.—d. Nov. 6, 1960, Kiel, W.Ger.), commander in chief of the German Navy (1928–43) and proponent of an aggressive naval strategy, who was convicted as a war criminal for his role in World War II.

Raeder served as chief of staff to the commander of the German cruiser fleet in World War I and was promoted to rear admiral in 1922 and to vice admiral three years later. Appointed naval commander in chief in 1928, he advocated the construction of submarines—forbidden by the Versailles Treaty—and fast cruisers to satisfy German naval needs. Made grand admiral during World War II, he was the first to suggest a German invasion of Norway, and he supervised the subsequent planning and execution of the invasion of Denmark and Norway (1940). He also urged—without success—the transference of the major theatre of war to the Mediterranean as an alternative to invasions of Great Britain and the Soviet Union, strategies he considered ill-advised. His many strategic differences with Germany's Führer, Adolf Hitler, who generally undervalued the role of sea power, ultimately led to his removal from the supreme naval command (January 1943). In 1946 he was sentenced to life imprisonment by the International Military Tribunal at Nürnberg but was released because of ill health in 1955.

Raedwald, also spelled REDWALD (d. 616–627), king of the East Angles in England from the late 6th or early 7th century, son of Tytili.

Raedwald became a Christian during a stay in Kent, but on his return to East Anglia he sanctioned the worship of both the Christian and the heathen religions. For a time he recognized the overlordship of Aethelberht, king of Kent, but he seems to have shaken off the Kentish yoke and to have gained some superiority over the land south of the Humber with the exception of Kent. Raedwald protected the fugitive Edwin, afterwards king of Northumbria, and in his interests he fought a sanguinary battle with the reigning Northumbrian king, Aethelfrith, near Retford in Nottinghamshire, where Aethelfrith was defeated and killed in April 617.

Raemaekers, Louis (b. April 6, 1869, Roermond, Neth.—d. July 26, 1956, Scheveningen), Dutch cartoonist who gained international fame with his anti-German cartoons during World War I.

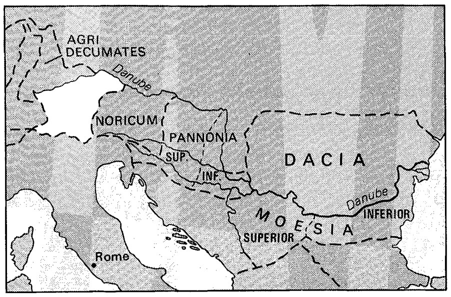
Raemaekers at first painted landscapes and portraits. His first political cartoons appeared

"The Last Throw" (showing the Kaiser and Crown Prince playing dice with Death), cartoon by Louis Raemaekers in the Amsterdam *Telegraaf*, April 2, 1916

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

in 1907, and he joined Amsterdam's *Telegraaf* in 1909. The sincerity and vigour of his wartime cartoons roused enthusiasm in England, France, and the United States, and after 1916 he lived for some years in England to supply the Allied press more easily. He was also a cartoonist during World War II.

Raetia, also spelled RHAETIA, ancient Roman province comprising Vorarlberg and



Raetia in the time of Augustus

Adapted from R. Treharne and H. Fullard (eds.), *Muir's Historical Atlas: Ancient, Medieval and Modern*, 9th ed. (1965); George Philip & Son Ltd., London

Tirol in present-day Austria, the eastern cantons of Switzerland, and parts of Bavaria and Baden-Württemberg in Germany. Its native stock was Illyrian and Celtic. The area was conquered by Rome in 15 BC, and became an important part of the empire, not for its economic value, which was small, but for its communications position in the network of highways between Italy and the Danube and between Gaul and the Balkans.

Because Raetia was a frontier province its boundaries shifted in response to pressures from the German tribes. The northern line was moved north of the Danube to the Neckar River in the 1st century AD, but in the 3rd century intrusions by German tribes forced the western and northern boundaries to be pulled back. By 450 Rome controlled only the Alpine regions of Raetia.

Raetian language, also spelled RAETIC, language spoken by the ancient Raetians in southern Germany and in the Alpine regions of Italy, Austria, and Switzerland in pre-Roman times. The language is known from a number of inscriptions.

Although some scholars formerly believed Raetian to hold an intermediate linguistic position between Celtic and Illyrian (a branch of the Indo-European language family spoken east of the Adriatic Sea), many scholars now believe the language to be non-Indo-European. Late Raetian inscriptions, especially those from northern Italy, seem to have been influenced somewhat by Etruscan.

Raeto-Romance dialects: *see* Rhaetian dialects.

RAF (United Kingdom): *see* Royal Air Force, The.

Raff, (Joseph) Joachim (b. May 27, 1822, Lachen, near Zürich—d. June 24/25, 1882, Frankfurt am Main), German composer and teacher, greatly celebrated in his lifetime but nearly forgotten in the late 20th century. After early compositional efforts influenced by Mendelssohn and Schumann, he joined ranks with the new German school of Liszt and Wagner, and from 1850 to 1856 he was Liszt's assistant in Weimar.

Composing in almost every genre, Raff was extremely prolific and was commonly regarded by his contemporaries as the peer of Brahms and Wagner. From 1877 until his death he was the highly esteemed director of the Hoch Conservatory in Frankfurt. He produced 11 symphonies, concerti for various instruments, operas, choral and chamber music, and piano works.

Raffi, pseudonym of HAKOB MELIQ-HAKOBIAN (b. 1835, Payajïk, Persia—d. 1888, Tiflis, Georgia, Russia), celebrated Armenian novelist.

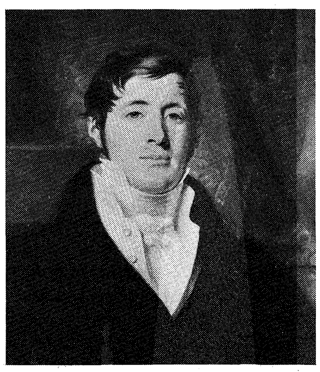
Raffi worked as a schoolmaster and a journalist, collaborating with the Russian-Armenian paper *Mshak* from 1872 to 1884. His principal novels are *Jalaleddin* (1878), *The Fool* (1880; Eng. trans., 1950), *David Bek* (1880), *The Golden Cockerel* (1882), *Sparks* (1883–90), and *Samuel* (1885). He also wrote a number of short stories and historical articles.

An ardent nationalist, he was preoccupied with the lot of his fellow Armenians in Persia and Turkey, and his interest in history was that of a writer of the Romantic school. He had a fertile imagination and narrative skill, but the psychology of his characters tends to be shallow and the construction and style of his work uneven.

Raffles, Sir (Thomas) Stamford (b. July 6, 1781, at sea, off Port Morant, Jam.—d. July 5, 1826, London), British East Indian administrator and founder of Singapore (1819), who was largely responsible for the creation of Britain's Far Eastern empire. He was knighted in 1816.

Early life. Born to an improvident merchant captain and his wife during a homeward voyage from the West Indies, Raffles grew up in an atmosphere of debt. Forced to cut short his schooling at the age of 14, he entered the service of the East India Company as a clerk in order to support his mother and four sisters. Although his formal education was inadequate, he studied the sciences and several languages at his own leisure and conceived an interest in natural history that was to earn him a distinguished reputation. Both in and out of office hours, his industry won him such notice that at the age of 23 he was appointed assistant secretary to the newly formed government of Penang, a hitherto inconspicuous island at the northern entrance to the Strait of Malacca.

Penang. In Penang, which had been established to give England a foothold in the Dutch-held East Indies, Raffles shaped his career by an intensive exploration into the language, history, and culture of the Malayan peoples scattered over the islands of the archipelago. This unique study caught the attention of Lord Minto, governor general of India, at a time of crisis, when Napoleon was using Java as a springboard for the destruction of England's slow and lumbering ships, the Indiamen, on the long haul to China. Deter-



Raffles, detail of an oil painting by G.F. Joseph, 1817; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

mined to remove Java from French influence, Minto appointed Raffles his agent to prepare the way for a naval invasion.

Java. Entrusted with an independent authority that aroused jealousy in Penang, Raffles established his headquarters in Malacca. Rewarded for his extraordinary work by an appointment to Minto's staff, Raffles sailed with him to Java, where the expeditionary force landed without mishap on Aug. 6, 1811, and, after a short and sharp engagement with the Dutch-French forces, occupied the island. Minto gave considerable credit for the success to Raffles. Having already described him as "a very clever, able, active and judicious man," he now recognized his intellectual and administrative ability and his humanism and concern for the Javanese, and on September 11 he proclaimed him lieutenant governor of Java. Shortly afterward Minto sailed for Calcutta, leaving Raffles at the age of 30 to rule not only Java but also an archipelagic empire of several million inhabitants.

Raffles inaugurated a mass of reforms aimed at transforming the Dutch colonial system and improving the condition of the native population. His reforms, however, proved too costly to a trading company primarily concerned with profit and were short-lived. After four and a half years in Java, suffering from increasing ill health and shattered by the death of his wife, he was recalled. Left vulnerable to personal attack by the death of Minto, he sailed for England on March 25, 1816, thoroughly out of favour with the court of directors of the East India Company.

He never regained their full confidence. Despite a dazzling London success in both fashionable and learned society that culminated in his election as a fellow of the Royal Society and the award of knighthood, he resumed his Eastern service in a situation of reduced and restricted authority, as lieutenant governor of the dilapidated, fever-ridden pepper port of Bengkulu on the west coast of Sumatra. Yet it was from Bengkulu, as he watched the Dutch regain possession of the archipelago and enforce a policy of complete commercial monopoly, that he made his next move to extend British influence in southeastern Asia.

Singapore. In a voyage to Calcutta, which all but ended in shipwreck, he employed his wide knowledge of Eastern affairs and his powers of persuasion to convince Lord Hastings, then governor general of India, that immediate and forceful action was essential to safeguard British trade. On Dec. 7, 1818, he sailed from Calcutta, bearing Hastings' qualified authority to establish a fortified post eastward of the Straits of Malacca and so placed as to wedge open the gateway to the China seas. On the morning of Jan. 29, 1819, he landed on the shore of a sparsely populated island off the southern tip of Malaya and, risking imminent collision with the Dutch, established by treaty the port of Singapore. Although he returned to his post at Bengkulu for three years, he went back to Singapore in October 1822, when he reorganized the various branches of the administration. His regulations of January 1823 stated,

> the Port of Singapore is a free Port, and the trade thereof is open to ships and vessels of every nation . . . equally and alike to all.

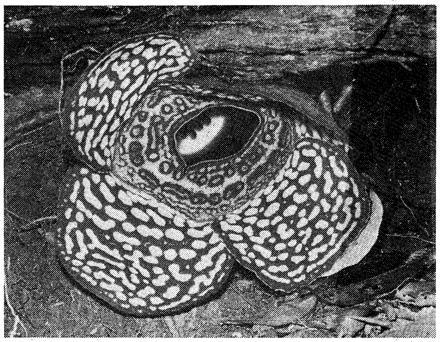
By a treaty of March 17, 1824, the Dutch relinquished all claim to Singapore. For Raffles, however, this was a time of rapidly deteriorating health, characterized by headaches of increasing ferocity, and he sailed for England, arriving there on Aug. 22, 1824. In London his vast collections illustrating natural history and Malayan lore won him acclaim as an Orientalist, and he assisted in founding the London Zoo, of which he was elected the first president. He died of a brain tumour in July 1826. (H.F.P.)

BIBLIOGRAPHY. C.E. Wurtzburg, *Raffles of the Eastern Isles* (1954), is a comprehensive work of great industry, excellently edited by Clifford Wit-

ting, and includes a comprehensive bibliography; Maurice Collis, *Raffles* (1966), is a later and briefer work presenting a clear picture of the man behind the facts.

To make the best use of the Britannica, consult the INDEX *first*

Rafflesiales, order of flowering plants constituting two families (Rafflesiaceae and Hydnoraceae) and 10 genera notable for being strictly parasitic upon the roots or stems of other plants and for the remarkable growth



Monster flower (*Rafflesia arnoldii*)
Edward F. Anderson

forms exhibited as adaptations to this mode of nutrition. The vegetative organs of most plants of the order are so reduced and modified that the plant body exists only as a network of threadlike cellular strands living almost wholly within the tissues of the host plant (in Rafflesiaceae), or as a thick, creeping, underground organ called a rhizomatoid (in Hydnoraceae). There are no green photosynthetic tissues, leaves, roots, or stems in the generally accepted sense, although vestiges of leaves exist in some species as scales.

The flowers are well developed, however, and range in size from minute to extremely large. The monster flower (*Rafflesia arnoldii*), with the largest known flower, is parasitic upon the roots of *Tetrastigma* species, large vines of the grape family (Vitaceae) found in the forested mountains of Malaysia. Its fully developed flower appears above ground as a thick, fleshy, five-lobed structure weighing up to 11 kilograms (24 pounds) and measuring almost one metre (about one yard) across. It remains open five to seven days, emitting a fetid odour that attracts carrion-feeding flies, which are believed to be the pollinating agents. The colour is reddish or purplish brown, sometimes in a mottled pattern, with the sex organs in a central cup. The fruit is a berry containing sticky seeds thought to be disseminated by fruit-eating rodents.

The family Rafflesiaceae includes the following genera, mostly in the Old World subtropics: *Pilostyles* (22 species), *Bdallophyton* (4 species), *Mitrastemon* (8 species), *Apodanthes* (5 species), *Rafflesia* (12 species), *Cytinus* (6 species), *Rhizanthes* (one or 2 species), and *Sapria* (one or 2 species).

In interesting contrast to the giant flower of *Rafflesia* is *Pilostyles thurberi* of southwestern North American deserts. A parasite on the stems of *Dalea* species and other shrubs of the pea family (Fabaceae), its total length outside the host plant, including the flower and its stalk, is only 5 or 6 millimetres (about 1/4 inch).

The family Hydnoraceae contains two genera: *Hydnora* (12 species), of tropical and southern Africa and Madagascar, and *Prosopanche* (6 species), of Paraguay and Argentina in South America. The family differs from the Rafflesiaceae in having bisexual flowers and no leaves whatever. *Hydnora* is parasitic on the roots of *Acacia* species and *Euphorbia* species. *Prosopanche* is parasitic on the roots of *Prosopis* species. Flowers of the Hydnoraceae are beetle-pollinated.

Rāfiḍah (Arabic: Rejectors), broadly, Shīʿī Muslims who reject (*rafḍ*) the caliphate of Muḥammad's two successors Abū Bakr and ʿUmar. Many Muslim scholars, however, have stated that the term Rāfiḍah cannot be applied to the Shīʿah in general but only to the extremists among them who believe in the divine right of ʿAlī to succeed Muḥammad and who condemn Abū Bakr and ʿUmar as unlawful rulers of the Muslim community. The Rāfiḍah were also considered by some to be one of three main groups that compose the Shīʿah, the other two being the Ghulāt and the Zaydīyah.

To the majority of the Shīʿah, who do not condemn Muḥammad's immediate successors and only assert ʿAlī's right to the caliphate over Muʿāwiyah (the first Umayyad caliph), the term Rāfiḍah is pejorative, coined by their opponents to cast the shadow of extremism on them.

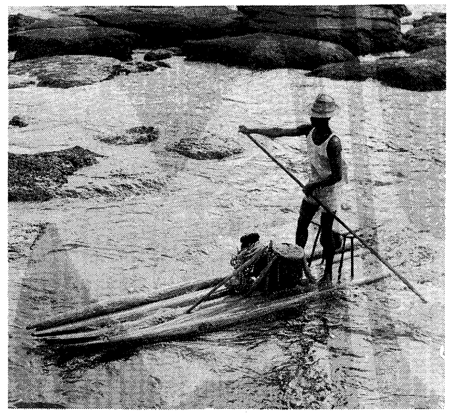
Rafinesque, Constantine Samuel (b. Oct. 22, 1783, Galata, Tur.—d. Sept. 18, 1840, Philadelphia), naturalist, traveller, and writer who made important and controversial contributions to botany and ichthyology.

Educated in Europe by private tutors, Rafinesque learned languages, read widely, and became deeply interested in natural history. His talents developed freely, but he did not acquire those traditional methods of study and attitudes of mind that are the usual products of more orderly training. Following a journey to the United States from 1802 to 1805, he lived as an exporter in Sicily, studying the natural history of plants and fish, until 1815. He then returned to the United States. In 1818 he was appointed professor of botany, natural history, and modern languages at Transylvania University, Lexington, Ky., where he soon established a reputation as a brilliant teacher, and in 1825 he founded a botanical garden. The following year he moved to Philadelphia, where he lectured at the Franklin Institute and continued his travels and field trips at every opportunity.

A remarkable student of natural history, Rafinesque believed that each variety of a species is a "deviant," which, through reproduction, may become a permanent species; thus, he anticipated, to some extent, part of Darwin's theory of evolution. He further showed his independent judgment by advocating in the United States the natural method of classifying plants, developed by Antoine Laurent de Jussieu, which differed markedly from the descriptive sexual system advanced by Carolus Linnaeus. Although Rafinesque's abilities were recognized in his lifetime, he was also severely criticized for sometimes doing careless work and for his tendency to establish new genera and species.

Throughout his life he travelled extensively, collected specimens wherever he went, met most of the noteworthy scientists in the United States, and wrote and published constantly. In addition to more than 950 publications on natural history, banking, economics, the Bible, and verse, he wrote his autobiography, *A Life of Travels and Researches in North America and South Europe* (1836). T.J. Fitzpatrick's *Rafinesque: A Sketch of his Life with Bibliography* appeared in 1911.

raft, simplest type of watercraft, made up of logs or planks fastened together to form a floating platform. The earliest were sometimes made of bundles of reeds. Most rafts have been designed simply to float with the current, but they can be equipped with oars or sails or both and can be navigated in the ocean over long distances, as was dramatically demonstrated by Norwegian scientist Thor Heyerdahl in 1947; to test his theory that the Pacific islands might have been settled by people from South America, he sailed a



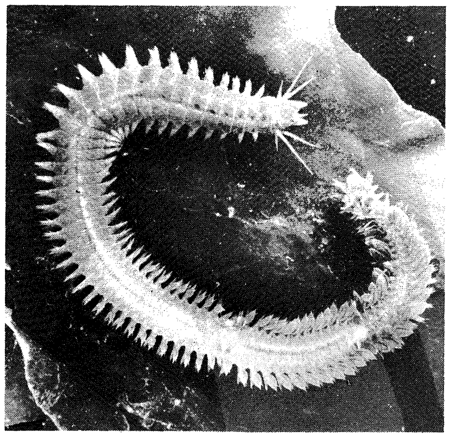
Brazilian fisherman on a balsa-wood raft (*jangada*)
Hans Mann

large balsa raft, the "Kon-Tiki," from Peru to islands near Tahiti in a voyage of three and a half months. The double-hulled catamarans of India are also seaworthy rafts.

Rigid or inflatable rafts have become common supplements to lifeboats on ships of all kinds; the inflatable kind can also be carried by aircraft for use in the event of a forced landing in the water or for dropping to aid victims of accidents at sea.

Raftor, Catherine: *see* Clive, Kitty.

rag worm, also called CLAM WORM (*Nereis*), any of a genus of mostly marine or shore



Rag worm (*Nereis*)
Walter Dawn

worms of the class Polychaeta (phylum Annelida). A few species live in fresh water. Other common names include mussel worm, pileworm, and sandworm. Rag worms vary in length from 2.5 to 90 centimetres (1 inch to 3 feet); they are commonly brown, bright red, or bright green. Rag worms are perhaps the most highly developed of the annelids. The head bears sharp retractable jaws. The first segment of the body has two short tentacles and four eyes; the second segment has four tentacle-like cirri. The number of body segments may exceed 200. All but the first two segments have a pair of parapodia—flat outgrowths bearing bristles—used for locomotion. Breathing is through gills. Principal foods are other worms and tiny sea animals.

Near mating time in most species the rear part of the body becomes swollen with sperm or eggs. The worm leaves its shallow burrow on the sea bottom and, usually at night, releases sex cells near the water surface. After fertilization a spherical larva emerges from the egg. In some species mating occurs in the burrow. The female dies soon after. She is eaten by the male, which then incubates the eggs.

Some species are hermaphroditic (*i.e.,* they have functional reproductive organs of both sexes) and reproduce by self-fertilization. The most common North American species is *Nereis limnicola,* found on the Atlantic and Pacific coasts. *N. virens,* which may be as long as 80 cm (31.5 inches), occurs on both sides of the North Atlantic.

Raga (island, Vanuatu): *see* Pentecôte.

raga, Sanskrit RĀGA ("colour," or "passion"), in the music of India and Pakistan, a melodic framework for improvisation based on a given set of notes (usually five to seven) and characteristic rhythmic patterns. The basic components of a raga can be written down in the form of a scale (in some cases differing in ascent and descent). By using only these notes, by emphasizing certain degrees of the scale, and by going from note to note in ways characteristic to the raga, the performer sets out to create a mood or atmosphere (*rasa*) that is unique to the raga in question. The contrast in emotional states evoked by different ragas might be compared to the difference the Western listener feels between pieces in major and minor modes. Among ragas, however, the spectrum of prescribed moods is vastly wider. There are several hundred ragas in present use, and thousands are possible in theory.

To the Indian musician, each raga is felt to be suitable only for a given time of day or night. An early morning raga such as *toṛī* induces a frame of mind that would be inappropriate for other times of the day. A performance of *toṛī* in the afternoon would create an incongruity not unlike that of playing a funeral march at a wedding.

A raga performance typically lasts for half an hour or more. It may be entirely improvised or combine improvisation with a memorized composition that also uses only the stipulated tones of the given raga. *See also* ālāpa; Carnatic music; Hindustani music.

ragfish (*Icosteus aenigmaticus*), marine fish, the single species in the family Icosteidae (order Perciformes). The ragfish is found throughout the North Pacific. The name refers to their floppy, limp bodies, which are as flexible as a rag.

Ragfishes have a cartilaginous skeleton that is almost completely lacking in true bone. The fins lack spines; scales and pelvic fins are absent in the adults. In shape, ragfishes are compressed laterally. Their colour ranges from brownish yellow in the juveniles to deep brown in the adults. Ragfishes attain a length of 2 m (6.5 feet). Their diet consists of other fishes and squid.

Raghunātha Śiromaṇi (b. *c.* 1475, Navadvīpa, Bengal, India—d. *c.* 1550), philosopher and logician who brought the New Nyāya school, representing the final development of Indian formal logic, to its zenith of analytic power.

Raghunātha's analysis of relations revealed the true nature of number, inseparable from the abstraction of natural phenomena, and his studies of metaphysics dealt with the negation or nonexistence of a complex reality. His most famous work in logic was the *Tattva-cintāmaṇi-dīdhiti,* a commentary on the works of Gaṅgeśa, founder of the New Nyāya school.

Raglan (of Raglan), FitzRoy James Henry Somerset, 1st Baron (b. Sept. 30, 1788, Badminton, Gloucestershire, Eng.—d. June 28, 1855, near Sevastopol, Crimea, Russia), field marshal, first British commander in chief during the Crimean War. His leadership in the war has usually been criticized.

During the Napoleonic Wars and afterward, Somerset served as the Duke of Wellington's military secretary. In 1852 he became master general of the ordnance and was created Baron Raglan. After Great Britain declared war on Russia (March 27, 1854), he led a force that was sent first to Turkey and then to the Crimea, where it landed (September 14) along with French and Turkish armies. The Allies won the Battle of the Alma River (September 20), but, forfeiting their advantage, they delayed their attack on Sevastopol until October and thus allowed the Russians to build up their defenses.

Raglan, detail of an oil painting by W. Salter; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

An ambiguous order by Raglan in the Battle of Balaklava (Oct. 25, 1854) led to the disastrous charge of the Light Cavalry Brigade under the 7th Earl of Cardigan. An inexperienced commander in chief in a difficult situation, Raglan was blamed (perhaps unjustly) for the campaign's lack of progress and for the suffering of his troops, who lacked adequate supplies and shelter during the winter of 1854–55. Gravely ill, he resumed the siege of Sevastopol in the spring but died shortly after a serious Allied defeat (June 18, 1855).

Raglan's name was applied to the raglan sleeve, which came into use in about 1855.

Ragnar Lothbrok, Ragnar also spelled REGNER, or REGNAR, Lodbrok also spelled LODBROG, or LODBROK (fl. 9th century), Viking hero in medieval European literature, who is largely legendary according to reliable historical sources.

In the Anglo-Saxon Chronicle, Ragnar was said to be the father of three sons, Halfdan, Inwaer (Ivar the Boneless), and Hubba (Ubbe), who led a Viking invasion of East Anglia in 865 seeking to avenge Ragnar's murder. The German historian Adam of Bremen (*c.* 1075) confirms the paternity of Inwaer, and the early 12th-century English *Annals of St. Noets* confirms that of Inwaer and Hubba. Modern authorities have added Sigefridus, a figure in continental annals from 873, to Ragnar's sons, and some have identified Ragnar with Reginherus, a Viking who invaded France in 845.

In the European literature of the several centuries following Ragnar's death, his name is surrounded with considerable legend. In the *Gesta Danorum* (*c.* 1185) of the Danish historian Saxo Grammaticus, he was a 9th-century Danish king whose campaigns included a battle with the Holy Roman emperor Charlemagne. According to Saxo's legendary history, Ragnar was eventually captured by the Anglo-Saxon king Aella of Northumbria and thrown into a snake pit to die. This story is also recounted in the later Icelandic works *Ragnars saga lodbrókar* and *Tháttr af Ragnarssonum.* The 12th-century Icelandic poem *Krákumál* provides a romanticized description of Ragnar's death and links him in marriage with a daughter of Sigurd (Siegfried) and Brynhild (Brunhild), figures from the heroic literature of the ancient Teutons. The actions of Ragnar and his sons are recounted in the Orkney Islands' poem *Háttalykill;* he may also be referred to in an Orkney runic inscription.

Ragnarök (Old Norse: "Doom of the Gods"), in Scandinavian mythology, the end of the world of gods and men. The Ragnarök is fully described only in the Icelandic poem *Völuspá* ("Sibyl's Prophecy"), probably of the late 10th century, and in the 13th-century *Prose Edda* of Snorri Sturluson (d. 1241), which largely follows the *Völuspá.* According to those two sources, the Ragnarök will be preceded by cruel winters and moral chaos. Giants and demons approaching from all points of the compass will attack the gods, who will meet them and face death like heroes. The sun will be darkened, the stars will vanish, and the earth will sink into the sea. Afterward, the earth will rise again, the innocent Balder will return from the dead, and the hosts of the just will live in a hall roofed with gold.

Disjointed allusions to the Ragnarök, found in many other sources, show that conceptions of it varied. According to one poem two human beings, Lif and Lifthrasir ("Life" and "Vitality"), will emerge from the world tree (which was not destroyed) and repeople the earth. The title of Richard Wagner's opera *Götterdämmerung* is a German equivalent of Ragnarök meaning "twilight of the gods."

ragtime, propulsively syncopated musical style, one forerunner of jazz and the predominant style of American popular music from about 1899 to 1917. Ragtime evolved in the playing of honky-tonk pianists along the Mississippi and Missouri rivers in the last decades of the 19th century. It was influenced by minstrel-show songs, blacks' banjo styles, and syncopated (off-beat) dance rhythms of the cakewalk, and also elements of European music. Ragtime found its characteristic expression in formally structured piano compositions. The regularly accented left-hand beat, in $\frac{4}{4}$ or $\frac{2}{4}$ time, was opposed in the right hand by a fast, bouncingly syncopated melody that gave the music its powerful forward impetus.

Scott Joplin, called "King of Ragtime," published the most successful of the early rags, "The Maple Leaf Rag," in 1899. Joplin, who considered ragtime a permanent and serious branch of classical music, composed hundreds of short pieces, a set of études, and operas in the style. Other important performers were, in St. Louis, Louis Chauvin and Thomas M. Turpin (father of St. Louis ragtime) and, in New Orleans, Tony Jackson.

BIBLIOGRAPHY. Terry Waldo, *This Is Ragtime* (1976), covers ragtime from the late 1800s to 1975. Other studies include Edward A. Berlin, *Ragtime: A Musical and Cultural History* (1980); and John Edward Hasse (ed.), *Ragtime: Its History, Composers, and Music* (1985).

Ragunan Zoological Gardens, also called JAKARTA ZOOLOGICAL GARDENS, Indonesian KEBUN BINATANG RAGUNAN, or KEBUN BINATANG JAKARTA, zoo in Jakarta, Indon., that is one of the world's notable collections of Southeast Asian flora and fauna. More than 3,500 specimens of approximately 450 animal species are exhibited on the 200-hectare (494-acre) park grounds. Among these are the orangutan, Sumatran serow, and various other rare animals of Indonesia. The zoo was founded in 1864 on a 4-hectare (11-acre) site and was moved to a new and much more spacious site in the late 1960s. It is operated by the Indonesian government.

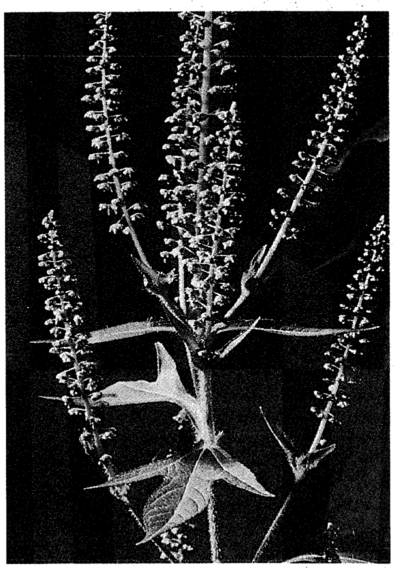
Ragusa, city, capital of Ragusa *provincia,* southeastern Sicily, Italy. The city lies in the Hyblaei Hills above the gorge of the Irminio River, west of Syracuse. The old lower town of Ragusa Ibla (on the site of the ancient Hybla Heraea) is separated from the upper (modern) town by a declivity.

The centre of an independent county from 1091 until it was united with that of Modica in 1296, the old town was destroyed by an earthquake of 1693, after which the new town was built to the west. The two were united in 1926. Handsome Baroque buildings include the cathedral (1706–60) and the basilica of San Giorgio (1738–75). Some 15th-century fragments survive in the church of Santa Maria delle Scale and the portal of San Giorgio Vecchio. There is a collection of paintings in its Palazzo Donnafugata. Ragusa is an episcopal see.

Already noted as an asphalt-mining centre, the Ragusa area also became a principal Italian oil-bearing zone by the 1970s. Cement and asphalt products are manufactured. The city is also an agricultural centre. Pop. (1987 est.) mun., 67,748; province, 287,927.

Ragusa (Yugoslavia): *see* Dubrovnik.

ragweed, any of several weedy plants of the genus *Ambrosia,* especially *A. artemisiifolia,* sometimes called American wormwood, and *A. trifida,* or great ragweed. The common ragweed is an herb of the family Asteraceae,



Great ragweed (*Ambrosia trifida*)
Louise K. Broman—Root Resources

native to North America but naturalized in Europe and other areas.

Ragweed has large, hairy, toothed leaves with three to five lobes, and many greenish yellow flowers in a slender, spikelike cluster at the top of the flower stalk. The small, drooping flower heads produce large amounts of pollen that stimulate allergic reactions in hay fever sufferers.

ragwort (plant): *see* groundsel.

Rahad River, Arabic NAHR AR-RAHAD, tributary of the Blue Nile, rising in the Ethiopian highlands, west of Lake Tana. It flows more than 300 miles (480 km) northwest into the eastern part of The Sudan to join the Blue Nile above Wadi Medanī. Although waterless during the dry season, it has a large flow during the flood season (June–September).

rahbānīyah (Arabic: "monasticism"), the monastic state, whose admissibility in Islām is much-disputed by Muslim theologians. The term appears but once in the Qur'ān: "And we set in the hearts of those who follow Jesus, tenderness and mercy. And monasticism they invented—we did not prescribe it for them—only seeking the good pleasure of God" (57:27). Although this verse has been interpreted in many ways, the general attitude of Muslims is that Islām encourages asceticism and devotion to piety and therefore sanctions *rahbānīyah.*

The Prophet Muḥammad, however, reputedly remarked: "No *rahbānīyah* in Islām." Tradition also attributes to him the saying: "Do not trouble yourselves and God will not trouble you. Some have troubled themselves and God has troubled them. Their likes are in the hermitages and monasteries." Such traditions were believed by many Muslim authorities on Ḥadīth (sayings of the Prophet) to have been coined by those who believed that Islām does not prohibit monasticism as a form of asceticism but condemns it only when it imitates Christian monasticism's traditional removal from the secular world.

Rahīmyār Khān, town, southern Punjab province, Pakistan. The town was founded in 1751 as Naushehra and received its present name in 1881. It is linked by road and rail with Bahāwalpur, Multān, and Sukkur and is a growing industrial centre (cotton ginning and cottonseed-oil pressing). It has a large sports stadium and government colleges affiliated with the University of the Punjab.

The surrounding region consists of an alluvial plain along the Panjnad and Indus rivers, a central barren soil depression, and the Rohi, or Cholistān, desert region in the south. Cotton, wheat, rice, and dates are the chief crops grown in the area. Pop. (1981) 119,036.

Rahman, Mujibur, also called SHEIKH MUJIB (b. March 17, 1920, Tungipara, India—d. Aug. 15, 1975, Dacca, Bangladesh), Bengali leader and first prime minister and later president of Bangladesh.

Mujib, the son of a middle-class landowner, studied law and political science at the universities of Calcutta and Dacca. Although jailed briefly as a teenager for agitating for Indian independence, he began his formal political career as a cofounder of the Awami League in 1949. His arrest in the late 1960s incited mob violence that eroded the Pakistani president's authority in East Pakistan. In the elections of December 1970, Mujib's Awami League secured a majority of the seats in the National Assembly, and Mujib demanded independence for East Pakistan. Troops from West Pakistan were sent to regain control of the eastern province but were defeated with the help of India. Bangladesh was proclaimed an independent republic with Mujib as the first prime minister in January 1975. With increasing problems, Mujib took tighter control and assumed the presidency in January 1975.

Sheikh Mujib
F.O.—Nancy Palmer Agency

He was killed, along with most of his family, in a coup d'état just seven months later.

Rahman, Tuanku Abdul (Malayan ruler): *see* Abdul Rahman, Tuanku.

Rahman, Tunku Abdul (prime minister of Malaysia): *see* Abdul Rahman Putra Alhaj, Tunku.

Rahner, Karl (b. March 5, 1904, Freiburg im Breisgau, Baden, Ger.—d. March 31, 1984, Innsbruck, Austria), German Jesuit priest who is widely considered to have been one of the foremost Roman Catholic theologians of the 20th century. He is best known for his work in Christology and for his integration of an Existential philosophy of personalism with Thomistic realism, by which human self-consciousness and self-transcendence are placed within a sphere in which the ultimate determinant is God.

Rahner was ordained in 1932. He studied at the University of Freiburg under Martin Heidegger before earning a doctorate at the University of Innsbruck. He taught at the universities of Innsbruck, Munich, and Münster. He was also an editor of *Lexikon für Theologie und Kirche,* 10 vol. (1957–68; "Lexicon for Theology and the Church"), and of *Sacramentum Mundi,* 6 vol. (1968–70; "Sacrament of the World"). He was known as well for his defense of Edward Schillebeeckx in 1968, when the Flemish theologian was under attack for heresy as a result of his calls for more freedom of theological research within the church and for theological pluralism.

Rahner's many books emphasize the continuity of modern and ancient interpretations of Catholic doctrine. His works include *Geist in Welt* (1939; *Spirit in the World*), *Hörer des Wortes* (1941; *Hearers of the Word*), *Sendung und Gnade,* 3 vol. (1966; *Mission and Grace*), *Grundkurs des Glaubens* (1976; *Foundations of Christian Faith*), and *Die siebenfältige Gabe: über die Sakramente der Kirche* (1974; *Meditations on the Sacraments*).

Articles are alphabetized word by word, not letter by letter

Rahr Plains, geographic region that composes part of the Lower Ganges Plains in northern West Bengal state, eastern India, with an area of about 12,400 square miles (32,000 square km). It was the extreme eastern territory known to the Aryans, was referred to as Vanga state in the Vedas, and was mentioned by the Chinese traveler Hsüan-tsang (7th century AD). From the late 12th century it was ruled by the Muslims until it came under British control after the battle of Plassey in 1757. Except in the northern mountainous area, the alluvial plains are essentially flat, though in places the honeycomb structures of underlying rocks are exposed. Moist deciduous forests of sal (*Shorea*), champac, and acacia are frequently found, together with bamboo, laurels, orchids, and giant creepers. The dense forests in the north provide sanctuary for the one-horned Indian rhinoceros (found particularly in the Jaldapāra Wild Life Sanctuary), elephant, and tiger. The Bhāgīrathi, Dāmodar, and Ajay rivers meander across the plains. The Dāmodar Valley Corporation and the Mayūrakshi Project coordinate irrigation, hydroelectric power, navigable waterways, and riverine fisheries.

The economy is mostly agricultural; cereals, pulse (legumes), oilseeds, fruits, vegetables, betel nut, date palm, and tea are grown. Poultry and livestock are raised. The Rānīganj coalfields, some of the largest in the country, and adjacent deposits of iron ore, copper, lead, and zinc are used by the major iron and steel industrial complexes near Asansol and Durgāpur. Other industries produce cotton and silk textiles, jute, paper, chemicals, fertilizers, gauges, bicycles, locomotives, steamboats, and motorboats. Durgāpur, Asansol, Burdwān, Bānkurā, Midnapore, and Sūri are the chief towns and are linked by roads and railways.

Rahv, Philip (b. March 10, 1908, Kupin, Ukraine, Russian Empire—d. Dec. 22, 1973, Cambridge, Mass., U.S.), Ukrainian-American critic who was cofounder (1933) with William Phillips of *The Partisan Review,* a journal of literature and social thought.

Rahv emigrated to the United States in 1922 and contributed to *The New Masses, The Nation, The New Republic,* and *The New Leader.* He wrote *Fourteen Essays on Literary Themes* (1949; enlarged, 1957, reprinted in *Image and Idea* and in *Literature and the Sixth Sense,* 1969). He edited many books, including *The Partisan Reader* (1946, with Phillips), *The Discovery of Europe: The Story of the American Experience in the Old World* (1947), *Literature in America* (1958), *Modern Occasions* (1966), and collections of short novels by Henry James, Leo Tolstoy, and modern Soviet and U.S. writers.

Rai, also called KHAMBU, tribe indigenous to northeastern Nepal, living west of the Arun River in the area drained by the Sun Kosi River, at altitudes of 5,500–7,700 ft (1,700–2,300 m) above sea level, and also in southwestern Bhutan. The most populous tribe of the Kiranti people, the Rai numbered about 232,300 in the 1970s. They are of Tibeto-Nepalese stock and speak Kiranti. With the Limbu and Magar peoples, they supplied the bulk of the Gurkha contingent to the British-Indian Armies.

The Rai are subsistence farmers and stock raisers, depending primarily on crops of rice, corn (maize), and millet. They terrace the mountains for wet rice paddies and build their stone houses in the dry rice fields. The Rai trade grains and buffalo hides for salt and produce with the Sherpas. Their basic economic and political unit is the kinship group, which contains several endogamous subdivisions. Descent is traced through the male line for seven generations, at which point clan intermarriage is sanctioned. A widow is expected to marry her husband's younger brother, and a widower marries his wife's younger sister. Although influenced by both Buddhism and Hinduism, the Rai retain their traditional religion, a worship of local deities and common ancestors. Considered in the next to lowest caste, the Rai are benefitting slowly from government programs.

Rai (Iran): *see* Rayy.

Raiatea, largest island of the Îles Sous le Vent (Leeward Group), Society Islands, French Polynesia, in the central South Pacific. It has a circumference of about 30 mi (50 km), an extreme width of 10 mi, and an area of 92 sq mi (238 sq km). Raiatea is volcanic and mountainous, culminating in Mt. Toomaru

Huts built on stilts, on Raiatea, French Polynesia
Photo Research International

(3,337 ft [1,017 m]). The neighbouring island to the north, Tahaa, geologically is part of the same volcanic complex, and both islands lie within the same fringing reef. The chief settlement is Uturoa, administrative seat of the Îles Sous le Vent; it is a regular port of call for ships passing between New Caledonia and Tahiti, and it has service facilities, light industry, and an electric power plant. Other villages are Opoa, Tevaitoa, Avera, Fetuna, and Vaiaau. Products are copra, mother-of-pearl, kapok, oranges, vanilla, and tobacco.

Hawaiki, Raiatea's earlier Polynesian name, together with Uporu (Upolu), Tahaa's earlier name, indicate that Samoans from Savai'i and Upolu settled on Raiatea and Tahaa. Subsequently, they feature in Maori legend in New Zealand. Hiro, leader of a Polynesian migratory expedition, supposedly left Hawaiki about AD 1300 in the "Aotea" canoe for New Zealand, and Raiatea is traditionally regarded by the Maoris as a seat of learning. Taputapuatea, the *marae* (place of worship), near Opoa, is well known in Polynesian lore. Pop. (1977) 6,376.

Raibolini, Francesco di Marco di Giacomo: *see* Francia.

Raichūr, town and district, eastern Karnātaka (formerly Mysore) state, southern India. The town, administrative headquarters of the district, contains a palace-citadel (1294) and fort (*c.* 1300) built on a hill 290 ft (88 m) above the surrounding plain. In 1489 Raichūr became the first capital of the independent kingdom of Bijāpur. The town is now a commercial centre on the Central Railway; products include oilseed, cotton, and soap. Its college of commerce and Laxmi Venkatesh Desai College are affiliated with Karnatak University in Dharwar.

Raichūr district (5,407 sq mi [14,005 sq km]) lies between the Krishna (north) and Tungabhadra (south) rivers. Its plateau is broken by isolated hills in the northwest. Mineral resources include gold, iron ore, limestone, and manganese. Cotton is the principal crop. The main population centres, apart from Raichūr town, are Lingsugūr, Koppal, and Gangāwati. Pop. (1981) town, 124,762; district, 1,783,822.

Raiganj, also spelled RAYGANJ, town, West Dinājpur district, West Bengal state, northeastern India, on the Kulik River. An important agricultural trade and jute exporting centre, it is connected by road with English Bāzār and with Dinājpur (in Bangladesh). Rice milling is an important industry. Raiganj was declared a municipality in 1951 and has a college affiliated with the University of North Bengal. Pop. (1981) town, 60,343; metropolitan area, 66,705.

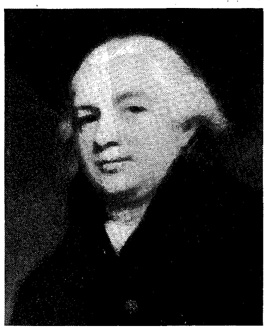
Raigarh, formerly KOLĀBA, district, Mahārāshtra state, western India, immediately south of Bombay. It has an area of 2,779 sq mi (7,198 sq km). Though part of the Konkan coastal plain, its terrain undulates with rugged transverse hills reaching from the steep scarp slopes of the Sahyādri Hills of the Western Ghāts (east) to bluffs on the Arabian Sea coast (west). The coastal bluffs are separated by seasonal river valleys that support most of the district's agriculture. Rice and coconuts are the major crops, and fishing and salt manufacture are important along the coast.

The Raigarh area of the Konkan coast had established foreign trading ports with Greece as early as the 3rd century BC. It contains several ancient Buddhist cave temples at Pal, Kol, Kuda, Kondāne, and Ambivli and the Śaivae caves on Elephanta Island. In the 17th century it became a Marāṭhā stronghold. During the 1970s there was considerable population migration to Bombay, and the northern parts of the district were rapidly industrialized. Paper pulp, chemical, and engineering works are the predominant industries. Khopoli and Panvel are the main industrial centres, and Alībāg is the district administrative headquarters. The noted resort of Matheran and the fort of Rayagad (King's Fort) are located in the district. Pop. (1981) 1,486,452.

Raigarh, town, administrative headquarters of Raigarh district, Madhya Pradesh state, central India, just west of the Kelo River, a tributary of the Mahānadi. The town was capital of the former Raigarh princely state. A major rail junction, it has industries such as jute milling and handloom weaving.

Raigarh district (4,985 sq mi [12,910 sq km]) was constituted in 1948 from the former Chhattīsgarh princely states of Raigarh, Jashpur, Saranggarh, and Udaipur. Divided by the Chauwardhal Range, it comprises a hill region in the north and the Raigarh plain in the south, drained by the Mānd and Kelo rivers. Rice, oilseeds, and pulses are the chief crops, and forestry and beekeeping are important. Coal, limestone, iron-ore, and bauxite deposits are worked. Pop. (1981) town, 68,060; metropolitan area, 69,791; district, 1,443,197.

Raikes, Robert (b. Sept. 4, 1736, Gloucester, Eng.—d. April 5, 1811, Gloucester), British



Raikes, detail of an oil painting by George Romney; in the National Portrait Gallery, London
By courtesy of the National Portrait Gallery, London

journalist, philanthropist, and pioneer of the Sunday-school movement. His philanthropic work began with a concern with prison reform.

Noting the unsupervised behaviour of Gloucester children on Sundays, Raikes engaged in 1780 a number of women to teach reading and the church catechism on Sundays. The experiment was so successful that he could record in his newspaper, the *Gloucester Journal* (Nov. 3, 1783), that the district had become "quite a heaven upon Sundays." The Sunday-school movement spread rapidly to all parts of the country. In 1785 the Sunday School Society was formed. The Sunday School Union (1803) was a direct result of Raikes's work.

Raikō (Japanese hero): *see* Yorimitsu.

rail, any of more than 100 species of slender marsh birds of the family Rallidae (order Gruiformes), somewhat chicken-shaped, with

Virginia rail (*Rallus limicola*)
John Gerard

short rounded wings, short tails, large feet, and long toes. The name is sometimes used to include coots and gallinules, which belong to the same family. Rails are distributed throughout the world, except in high latitudes. They vary in size from that of a sparrow, about 11 centimetres (4 inches) in length, to that of a small chicken, about 45 cm (18 in.). Their loud calls, especially at night, reveal their presence in dense vegetation. Many are excellent game birds; when flushed, they take wing reluctantly, flying a short distance and then dropping to the ground. Their slender build facilitates running through reeds and marsh grasses. They are mostly dull coloured in grays and browns. Many are barred in cryptic patterns. Short-billed species are often called crakes.

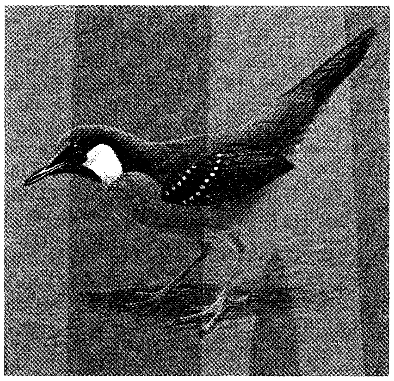
Rails hunted as game in the U.S. are the king rail (*Rallus elegans*), a reddish brown bird the size of a small chicken; the clapper rail (*R. longirostris*), a grayer form; the Virginia rail (*R. limicola*), reddish brown and about 25 cm (10 in.) in length; and the sora (*see* crake). The little yellow rail (*Coturnicops noveboracensis*) and the American black rail (*Laterallus jamaicensis*) are too scarce and small (about 15 cm) to be of interest to the hunter.

The land rail, or corncrake (*Crex crex*), is a widespread European crake. Less abundant but more widely distributed (extending to northern Africa) is the water rail (*Rallus aquaticus*), a slender bird with a long reddish bill.

Several flightless species occur on remote oceanic islands. The Inaccessible Island rail (*Atlantisia rogersi*) is a tiny bird found only on Inaccessible Island in the Tristan da Cunha group in the South Atlantic Ocean. The wekas, two *Gallirallus* species (considered by some authorities to be one species, *G. australis*), of New Zealand, are about the size of chickens.

For Bensch's rail, which is not a true rail, *see* mesite.

rail-babbler, any member of the songbird subfamily Orthonychinae (order Passeriformes), placed by some authorities with other babblers in the family Timaliidae and by others near the subfamily Timaliinae when the



Blue eupetes rail-babbler (*Eupetes leucostictus*)
Painting by John P. O'Neill

latter are placed in the Muscicapidae. It is also the particular name of species that look much like rails: small-headed, thin-necked, and long-legged, with tails carried cocked up.

Unlike rails (which are quite different birds), the rail-babblers have small feet and rather thrushlike bills. Their plumage is mostly black, blue, or reddish. They are found in thick forests from Malaysia to New Guinea.

railroad, mode of land transportation in which flange-wheeled vehicles move over two parallel steel rails, or tracks, either by self-propulsion or by the propulsion of a locomotive.

A brief treatment of railroads follows. For full treatment, *see* MACROPAEDIA: Transportation.

The principle of the railroad is that steel wheels on steel rails have an extremely low rolling friction and require relatively little motive force to move a heavy load. This free-rolling characteristic gives railroads a ratio of roughly one horsepower per gross ton. By contrast, highway semi-trailer trucks require about 10 horsepower per gross ton. Railroads also enjoy a 10 to 1 advantage in fuel economy and in employee productivity.

Railroads were first constructed in European mines in the 16th century, one of the earliest being that used in the mines at Leberthal, Alsace, in about 1550. Mining railroads in England date from about 1603 or 1604. From the inception of railroads cars have been built with flanged wheels, which keep them on the track and make them self-steering. Early railroad cars had flanges on either the inside or the outside, but in modern design flanges are on the inside of the wheels. Another primitive type of railroad, called a "plateway," had vertical flanges on the track and used cars with ordinary wheels. This allowed the vehicles to travel on either rails or ordinary roads, but the plateways presented great difficulties when it came to building switches; the last plateway was constructed in about 1815.

The earliest mining railroad cars were pulled by men or horses, and it was not until the first steam locomotive appeared in 1804 in Wales that the modern railroad emerged. Early locomotives were handicapped by the weakness of iron rails and the inefficiency and unreliability of their apparatus, but improvements in track materials and design and the technical advances made by such engineers as George Stephenson soon made railroads practical. The Stockton and Darlington Railway, which began operations in September 1825, was the first to carry both freight and passengers. It was followed by the Liverpool and Manchester Railway in 1830, which, with the introduction of Stephenson's locomotive "Rocket," can be considered the beginning of the railroad era. By 1841 there were more than 1,300 miles of track in Britain.

Railroads grew quickly in the 19th century, becoming a major force in the economic and social life of nations throughout the world. It was also responsible for many technical advances. Most continental European countries adhered to Great Britain's track width, or gauge, of 4 feet, 8.5 inches (1.435 metres) between the inside faces of the rails. In Russia and Finland, however, a gauge of 5 feet was used, while in Spain and Portugal it was 5 feet 6 inches. In the United States, which adopted Great Britain's "standard gauge," John Stephens built the first steam locomotive and demonstrated it on the lawn of his home in Hoboken, N.J., in 1825. The Baltimore and Ohio Railroad, the first railroad company in the United States, was chartered two years later.

At first all locomotives were steam powered, but by 1900 electric engines were being used in specialized service. By the middle of the 20th century diesel-electric locomotives had replaced steam on most railroads. A variety of railroad cars have been developed to transport freight and passengers. Freight cars (called goods wagons in Britain), include closed boxcars, open-top gondola and hopper cars, and flatcars. Cars designed to carry special freight include tank cars, livestock cars, closed hopper cars, and refrigerator cars. Passenger cars include coaches, which have individual seats or benches; dining cars that provide meal service on long-distance routes; and sleepers, couches that convert into beds for overnight travel. George Pullman, whose name became synonymous with sleepers (especially in the United States), leased his first car to the railroads in 1859.

Railroads reached their maturity in the early 20th century, as trains carried the bulk of land freight and passenger traffic in the industrialized countries of the world. By the mid-20th century, however, they had lost their preeminent position. The private automobile had replaced the railroad for short passenger trips, while the airplane had usurped it for long-distance travel, especially in the United States. Railroads remained effective, however, for transporting people in high-volume situations, such as commuting between the centres of large cities and their suburbs, and medium-distance travel of less than about 300 miles between urban centres.

Although railroads have lost much of the general-freight-carrying business to semi-trailer trucks, they remain the best means of transporting large volumes of such bulk commodities as coal, grain, chemicals, and ore over long distances. The development of containerization has made the railroads more effective in handling finished merchandise at relatively high speeds. In addition, the introduction of piggyback flatcars, in which truck trailers are transported long distances on specially-designed cars, has allowed railroads to regain some of the business lost to trucking.

For international statistical data on railroads, *see* BRITANNICA WORLD DATA in the current *Britannica Book of the Year*.

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

Railway Express Agency, Inc.: *see* REA Express, Inc.

Raimar, Freimund: *see* Rückert, Friedrich.

Raimond (French personal name): *see under* Raymond.

Raimondi, Marcantonio, byname MARCANTONIO (b. *c.* 1480, near Bologna, Italy—d. *c.* 1534, Bologna), Italian Renaissance master of engraving whose prints did much to disseminate the style of the High Renaissance throughout Europe.

Raimondi received his training in the workshop of the famous goldsmith and painter Francesco Raibolini, called Francia. The stiff, irregular hatching, as well as the figures, draperies, and composition of such early engravings as "Pyramus and Thisbe" (1505) reveal the influence of Francia, but the landscape backgrounds and his use of light and shade indicate that he was familiar with the engravings of Lucas van Leyden. Raimondi

"The Virgin Mourning Over the Body of Christ," engraving by Marcantonio Raimondi in the Clarence Buckingham Collection of the Art Institute of Chicago
By courtesy of the Art Institute of Chicago

also profited from studies of Dürer's energetic line and his use of crosshatching in modelling.

In about 1510 Marcantonio went to Rome.

There his activity was almost entirely limited to reproducing works of Raphael, Michelangelo, and their followers. He was very successful financially and attracted a large number of pupils, of whom the two most distinguished were Marco Dente, known as Marco da Ravenna, and Agostino de Musi, known as Agostino Veneziano.

Raimondi's best engravings, such as "Massacre of the Innocents," were done during the first years after he had attached himself to Raphael. In these he retains Raphael's idealized figures, but, in the parts where he was left to himself (the rounding and shading, the background and landscape), he managed his burin with all the skill and freedom he had gained by the imitation of northern models, while dispensing with the northern emphasis on detail. Raimondi's engravings after the works of Raphael's later years were characterized by a colder, harsher use of light and shade and by less-disciplined design.

Marcantonio was disgraced when he was arrested for engraving a series of obscene designs after Giulio Romano. He was finally ruined by having to pay a heavy ransom to the Spaniards who had taken Rome, after which he retired to obscurity in Bologna.

Consult the INDEX *first*

Raimundo, Don, English DON RAYMOND (b. France—d. 1152, Toledo, Castile [Spain]), archbishop and leading prelate of the 12th-century Spanish Christian church, whose patronage of the Toledan school of translators was an important contribution to the history of medieval learning.

Raimundo was one of the many French Cluniac monks who, under the leadership of Bernard of Périgord (archbishop of Toledo, 1086–1124), went to the Iberian Peninsula to reform the Spanish church during the era of King Alfonso VI of Leon (from 1065) and of Castile (from 1072). His vision and generalship at last established Christian hegemony in the peninsula.

In 1109 Raimundo was appointed bishop of Osma but was dispossessed and imprisoned in 1111 by Alfonso VI's successor, Alfonso I of Aragon, for opposing his marriage with Alfonso VI's daughter Urraca. This persecution commended him to King Alfonso VII of Leon and Castile, whose chancellor he became. On Bernard's death, Raimundo was appointed to succeed him as archbishop of Toledo and primate of Spain.

It was probably as a result of Raimundo's encouragement that the Toledan school of translators developed. Some effort to make available to Christians the learning of the Spanish Arabs had already begun, but Raimundo encouraged Spanish scholars to translate many important Arabic and Jewish works, unknown to Christians, into Latin. Soon foreign scholars arrived in Toledo to commission translators or to investigate the material at hand. Raimundo's personal patronage was especially reserved for philosophical translations, notably Neoplatonic works and the highly influential *Fons vitae* ("Fountain of Life") of the Jewish poet and philosopher Ibn Gabirol. The Toledan translators, subsequently associated with a great cathedral school, produced works for three centuries; and under Raimundo's reign there began the flourishing of Christian-Arabian-Jewish culture in Spain.

rain, precipitation of liquid drops that have diameters greater than 0.5 mm (0.02 inch). When the drops are smaller, the precipitation is usually called drizzle. *See also* precipitation.

Concentrations of raindrops typically range from 100 to 1,000 per cubic m (3 to 30 per cubic foot); drizzle droplets usually are more numerous. Raindrops seldom have diameters larger than 4 mm, because as they increase in size they break up. The concentration generally decreases as diameters increase. Except when the rain is heavy, it does not reduce visibility as much as does drizzle. Meteorologists classify rain according to its rate of fall. The hourly rates relating to light, moderate, and heavy rain are, respectively, less than 2.5 mm, 2.8 to 7.6 mm, and more than 7.6 mm.

Raindrops may form by the coalescence of small water droplets that collide or from the melting of snowflakes and other ice particles as they fall into warm air near the ground.

Mount Waialeale, Hawaii, with a 20-year annual average of 11,700 mm (460 inches) from tropical easterlies, is the wettest known point on the Earth. The nearest competitor is Cherrapunji, Assam, with an annual average of 11,430 mm from the moist tropical monsoon. Less than 250 mm and more than 1,500 mm per year represent approximate extremes of rainfall for all of the continents. Rainfall is slight in the central regions of the subtropical anticyclones, which are therefore the desert regions of the Earth. In parts of the desert no appreciable rain has ever been observed.

World extremes of recorded rainfall

Greatest amount in one year:
26,467 mm (1,042 inches) at Cherrapunji, Meghālaya, India, 1,313 m (4,307 feet) above sea level August 1860–July 1861

Greatest amount in one month:
9,300 mm (366 inches) at Cherrapunji July 1861

Greatest falls in one day:
1,870 mm (73.6 inches) at Cilaos, on Réunion Island (27° S, 55.5° E), 1,200 m (3,900 feet) above sea level on March 16, 1952
1,166 mm (45.9 inches) at Baguio, Luzon, Phil., 1,482 m (4,861 feet) above sea level on July 15, 1911

Greatest fall in one hour:
305 mm (12.0 inches) at Holt, Mo., on June 22, 1907

Greatest fall in five minutes:
63 mm (2.48 inches) at Portobelo, Pan., on Nov. 29, 1911

Greatest fall in one minute:
31 mm (1.23 inches) at Unionville, Md., on July 4, 1956

Over most of Europe, South America, eastern North America, and central Africa, the annual rainfall exceeds 500 mm (20 inches), while over most of Asia, excluding India, Tibet, and China, the annual rainfall is less than 500 mm, being less than 250 mm in a long tongue extending from Arabia across to northeast Mongolia. The central regions of Australia, most of northern and a part of southwest Africa, portions of the intermontane area of the United States, portions of the west-central coast and southern east coast of South America also have less than 250 mm of rain in the year. Portions of the western coast of Africa, between the equator and 10° N, a strip of the western coast of India, parts of Assam, a coastal strip of Myanmar (Burma), windward mountain slopes in the temperate latitudes of North and South America, and many isolated tropical stations average more than 2,500 mm of rain in the year. Rainfall intensities greater than 30 mm in five minutes, 150 mm in one hour, or 500 mm per day are quite rare, but these intensities on occasion have been more than doubled for the respective durations (*see* Table).

rain dance, ceremonial dance performed in many cultures, from the ancient Egyptian to 20th-century Balkan, to invoke rain, ensuring an abundant harvest. Because most primitive dances have the same goals—life, health, abundance, power—it is not uncommon for phallic and other fertility dances to be performed as rain dances. Thus, the Hopi Indian rain dance includes holding live venomous snakes in the mouth, an apparent phallic gesture.

Agrarian cultures, including the Mayan civilization and that of ancient Egypt, have most commonly employed rain dances; Egyptian tomb scenes depicted rain dancers as early as 2700 BC. Elements often found in rain dances include dancing in a circle, decoration with green vegetation, nudity, the pouring of water, phallic rites, the use of young girls, and whirling, meant to act as a wind charm. Thus, the South African Angoni carry tree branches, and Papuan mythology teaches that grass carried in such dances pierces the eye of the sun, causing it to weep and be covered with clouds. The Sioux Indians danced four times around a jug of water, threw themselves to the ground, and then drank from the jug. The Hopi snake dance, based on the belief that the snakes carry prayers to the Rainmakers beneath the earth, doubtless traces back to earlier snake cults in Mexico and Central America. In southeastern European ceremonies, a group of young girls proceed from house to house, their leader clothed only in leaves and grass and whirling in their midst while housewives pour water on her.

rain forest, luxurious forest, generally composed of tall, broad-leaved evergreen trees, usually found in wet tropical uplands and lowlands around the equator.

A brief treatment of rain forests follows. For full treatment, *see* MACROPAEDIA: Biosphere.

Rain forests occur in regions where there is a high annual rainfall of generally more than 1,800 mm (70 inches) and a hot and steamy climate. There are two basic kinds of rain forest, one tropical or equatorial and the other subtropical.

The equatorial rain forest occurs where the annual precipitation rate is between 1,500 and 3,500 mm (60 and 140 inches), so that there is a relatively high humidity at all times. There are no marked seasonal variations and temperatures remain high, usually about 30° C (86° F) during the day and 20° C (68° F) at night. Equatorial rain forests occur in the lowlands of the Amazon and the Congo, in Sumatra, and in several islands in the Pacific Ocean. Where altitude increases along the borders of equatorial rain forests, the vegetation is replaced by montane forests, as in the highlands of New Guinea, the Gotel Mountains of Cameroon, and in the Ruwenzori mass of Central Africa.

Subtropical rain forests occur on windward coasts, within latitudes of 10° north and south of the equator. There are seasons of pronounced rainfall as well as periods of drought. Seasonal variations in temperature and daylight periods produce a vegetation different from that found in equatorial rain forests, as evidenced by the subtropical forests of Vietnam, the Philippines, Central America, the Caribbean islands, parts of Brazil, and Madagascar. Here the forests are slightly more open with fewer species.

Other kinds of rain forests include the monsoon forests, most like the popular image of jungles, with a marked dry season and a vegetation dominated by deciduous trees such as teak, thickets of bamboo, and a dense undergrowth. Mangrove forests occur along estuaries and deltas on tropical coasts. Temperate rain forests filled with evergreen and laurel trees are lower and less dense than other kinds of rain forests, because the climate is more equable, with a moderate temperature range and well-distributed annual rainfall.

The topography of rain forests varies considerably, from flat lowland plains marked by small rock hills to highland valleys crisscrossed by streams. Volcanoes that produce rich soils are fairly common in the humid tropical forests.

Soil conditions vary with location and climate, although most rain forest soils tend to be permanently moist and soggy. The presence of iron gives the soils a reddish or yellowish colour and develops them into two types of soils—extremely porous tropical red loams which can be easily tilled, and lateritic soils which occur in well-marked layers, rich in different minerals. Chemical weathering of rock and soil in the equatorial forests is intense, and in rain forests weathering produces soil mantles that may be up to 330 feet (100 metres) deep. Although these soils are rich in aluminum, iron oxides, hydroxides, and kaolinite, other minerals are washed out of the soil by leaching and erosion. The soils are not very fertile, either, because the hot and humid weather causes organic matter to decompose rapidly and to be quickly absorbed by hungry tree roots and fungi.

Little erosion occurs in temperate rain forests, but in tropical rain forests, where there is minimal ground cover, erosion is a serious problem.

Rain forests exhibit a highly vertical stratification in plant and animal development. The highest plant layer, or tree canopy, extends to heights between 100 and 165 ft. Most of the trees are dicotyledons, with thick leathery leaves and shallow root systems. The nutritive, food-gathering roots are usually no more than a few centimetres deep. Rain falling on the forests drips down from the leaves and trickles down tree trunks to the ground, although a great deal of water is lost to leaf transpiration.

Most of the herbaceous food for animals is found among the leaves and branches of the canopy, where a variety of animals have developed swinging, climbing, gliding, and leaping movements to seek food and escape predators. Monkeys, flying squirrels, and sharp-clawed woodpeckers are some of the animals that inhabit the treetops. They rarely need to come down to ground level.

The next lowest layer of the rain forest is filled with small trees, lianas, and epiphytes, such as orchids, bromeliads, and ferns. Some of these are parastic, strangling their host's trunks, while others use the trees simply for support.

Above the ground surface the space is occupied by tree branches, twigs, and foliage. Many species of animals run, flutter, hop, and climb in the undergrowth. Most of these animals live on insects and fruit, although a few are carnivorous. They tend to communicate more by sound than by sight in this dense forest strata, and the large eyes of some creatures indicate that they have adapted to the environment.

Contrary to popular belief, the rain forest floor is not impassable at the ground level. Most of the surface is bare, except for a thin layer of humus and fallen leaves. The animals inhabiting this strata are adapted to walking and climbing short distances, like rhinoceroses, chimpanzees, gorillas, elephants, deer, leopards, and bears. Below the soil surface, burrowing animals, such as armadillos and caecilians, are found, as well as microorganisms that help to decompose and free much of the organic litter accumulated by other plants and animals from all strata.

The climate of the ground layer is unusually stable, because the upper stories of tree canopies and the lower branches filter sunlight and heat radiation, as well as reduce wind speeds, so that the temperatures remain fairly even throughout the day and night.

Virtually every group of animals except fishes is represented in the forest ecosystem. Many invertebrates tend toward gigantism, such as giant snails and butterflies. The breeding seasons for most animals tend to be coordinated with the availability of food, which, although generally abundant, does vary seasonally from region to region. The animals are unrestricted as to climatic variations, which are slight. Those animals that do not have highly developed modes of quick locomotion are concealed from predators by camouflage or become nocturnal feeders.

rain shadow, lee side of an orographic (mountainous) barrier, which receives considerably less precipitation than the windward side. *See* orographic precipitation.

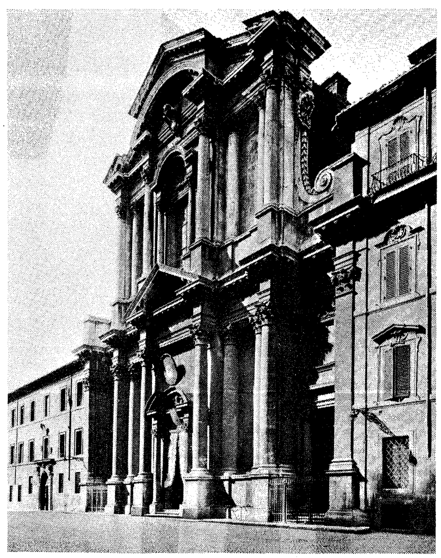
Rainald OF DASSEL, German RAINALD VON DASSEL (b. *c.* 1118/20—d. Aug. 14, 1167, Rome), German statesman, chancellor of the Holy Roman Empire, and archbishop of Cologne, the chief executor of the policies of the emperor Frederick I Barbarossa in Italy.

After studying at Hildesheim and Paris and serving as a church provost, he became (1153)

Rainald of Dassel; silver bust, in the Cologne Cathedral
By courtesy of Bildarchiv Preussischer Kulturbesitz BPK, West Berlin

a member of Emperor Frederick I's embassy to Pope Eugene III in Rome. In May 1156 he was appointed imperial chancellor. Between 1158 and 1164 Rainald led troops to Italy several times and negotiated with towns on Frederick's behalf. In 1159 he was elected archbishop of Cologne. After Pope Adrian IV's death the same year, Rainald championed the antipope Victor IV against Alexander III. Excommunicated by Pope Alexander III in 1163, Rainald ensured the continuance of the schism by swiftly moving to secure, on his own responsibility, the election of a new antipope, Paschal III, on the death of the antipope Victor IV (1164). In 1167 Rainald took part in Frederick's Italian campaign but, on reaching Rome, he was fatally stricken in a malaria epidemic.

Rainaldi, Carlo (b. 1611, Rome—d. 1691, Rome), Baroque architect, one of the leading architects of 17th-century Rome, noted particularly for the scenic grandeur of his designs. He collaborated with his father, Girolamo Rainaldi (*q.v.*), a distinguished architect who transplanted to Rome the north Italian Mannerist tradition of Pellegrino Tibaldi.



Church of Sta. Maria in Campitelli, Rome, by Carlo Rainaldi
Anderson—Alinari from Art Resource/EB Inc.

After his father's death Rainaldi evolved a monumental grand manner, without entirely discarding his paternal heritage. His major works, executed in the 1660s, include the facade of S. Andrea della Valle (1661–65) and the twin churches of Sta. Maria dei Miracoli and Sta. Maria in Monte Santo in the Piazza del Popolo (Bernini and Carlo Fontana also worked on them). Generally regarded as his masterpiece, Sta. Maria in Campitelli (1663–67) shows a northern Italian rather than Roman influence. The use in the facade of many freestanding columns, stressing verticality, also derives from north Italian tradition. Rainaldi's last important work was the grand facade uniting the old apse of Sta. Maria Maggiore with the chapels of Sixtus V and Paul V (1673).

Rainaldi, Girolamo, also called HIERONIMO RAINALDI (b. 1570—d. 1655, Rome), Italian architect in the north Italian Mannerist tradition, who became chief architect of Rome (in 1602) and of the papacy (1644). His most important church is the Carmelite church of S. Silvestro at Caprarola, near Rome. Pope Sixtus V was his patron, and Rainaldi succeeded Giacomo della Porta as the city's chief architect. Rainaldi designed the Palazzo Pamphili (*c.* 1650) in the Piazza Navona for Pope Innocent X and created the first design for S. Agnese in Agone (1652), also in the Piazza Navona, which was taken over by Francesco Borromini.

The Farnese family brought Rainaldi to Parma to build their town palaces. He also did the vaulting of SS. Annunziata, Parma. In Bologna he built the church of Sta. Lucia (1623), modelled on the Gesù in Rome, and the vaulting of the nave of S. Petronio, and in Modena he worked on a good part of the Palazzo Ducale (1631–34).

Girolamo's son, Carlo (*q.v.*), became an important architect of the new Baroque era.

Rainallucci, Pietro: *see* Nicholas (V) *under* Nicholas (Papacy).

Rainborow, Thomas, Rainborow also spelled RAINSBOROUGH (d. Oct. 29, 1648, Doncaster, Yorkshire, Eng.), English soldier and republican who fought for Parliament during the English Civil Wars.

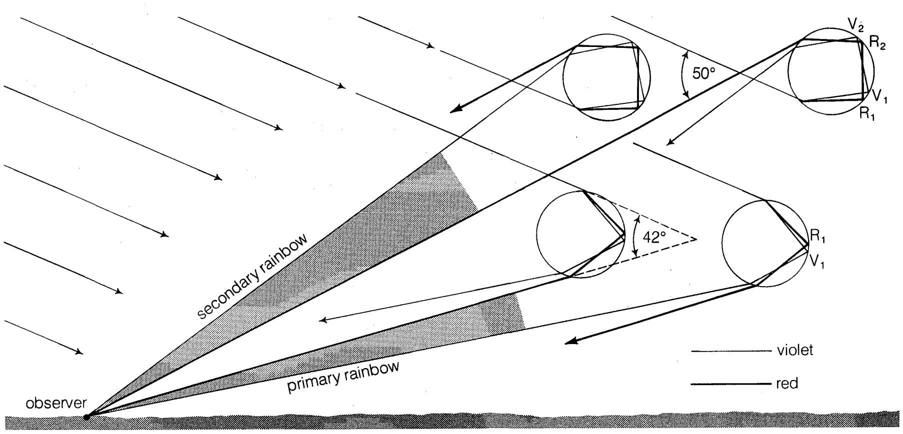
His father, Capt. William Rainborow, had been an officer in the royal navy. Thomas commanded the "Swallow" in the Parliamentary fleet in 1643. Transferred to the land forces, he became a colonel, and in 1645, in command of a regiment in the New Model Army, he fought at Naseby, Northamptonshire, and at the sieges of Bristol and Worcester. He became a member of Parliament for Droitwich, Worcestershire (1646), took a prominent part in the debates in the army council (1647) concerning the army's negotiations with Charles I, and was a leader of the republican officers and a supporter of the Leveller document, Agreement of the People, which called for manhood suffrage and religious toleration. This stand caused a division between Rainborow and the army commanders, but in December 1647 he was reconciled with Oliver Cromwell. Appointed commander for the siege of Pontefract Castle, he was mortally wounded on the battlefield at Doncaster.

rainbow, series of concentric coloured arcs that may be seen when light from a distant source falls upon a collection of water drops—as in rain, spray, or fog. It is most commonly observed when sunlight illuminates falling raindrops from a distant shower. The rainbow is observed in the direction opposite to the Sun.

The coloured rays of the rainbow are caused by the refraction and internal reflection of light rays that enter the raindrop, each colour being bent through a slightly different angle. Hence, the composite colours of the incident light will be separated upon emerging from the drop. The most brilliant and most common rainbow is the so-called primary bow, which results from light that emerges from the drop after one internal reflection. This rainbow has an angular radius of about 42°, with arcs (from inside to outside) of violet, indigo, blue, green, yellow, orange, and red.

Occasionally, a secondary bow may be observed, which is considerably less intense than the primary bow and has its colour sequence reversed. The secondary rainbow has an angular radius of about 50° and hence is seen outside of the primary bow. This bow results from light that has undergone two internal reflections within the water drop. Higher order rainbows, resulting from three or more internal reflections, are exceedingly weak and hence are rarely observed.

Occasionally, faintly coloured rings are seen just inside of the primary bow. These are called supernumerary rainbows; they owe their origin to interference effects on the light rays emerging from the water droplet after one internal reflection.



Dispersion of sunlight by refraction at the surfaces of individual droplets of water
The primary rainbow corresponds to one internal reflection of each component of the ray, the red component at R_1 and the violet at V_1; the secondary rainbow results from rays that have undergone a second internal reflection, as at R_2 and V_2

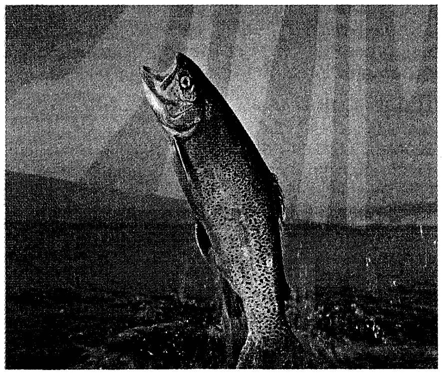
From Rhodes W. Fairbridge (ed.), *The Encyclopedia of Atmospheric Sciences and Astrogeology;* based on Neuberger, 1957.

Rainbow Bridge National Monument, national monument containing a rainbow-shaped bridge of pink sandstone spanning a canyon 290 ft (88 m) above a creek that winds toward the Colorado River, in southern Utah, U.S., on the Navajo Indian Reservation near the Utah-Arizona boundary. The site, established in 1910, occupies 160 ac (65 ha). The bridge is 278 ft long and is probably the largest natural bridge in the world.

Embedded among canyons carved by streams winding from the northern slopes of Navajo Mountain 5 mi (8 km) southeast, the monument is situated on a remote desert plateau and can be reached only on foot, by horseback, or by boat on Lake Powell. Plants, fed by water seeping from the canyon walls, grow in profusion nearby and include the wild orchid and maidenhair fern. Fire-blackened stones are an indication that Indians worshipped there at one time.

rainbow lizard (reptile): *see* Calotes.

rainbow trout (*Salmo gairdneri*), game fish of the family Salmonidae noted for its spectacular leaps and hard fighting when hooked.



Rainbow trout (*Salmo gairdneri*)
Appel Color Photography

It has been introduced from western North America to many other countries. A brightly coloured fish of lakes and swift streams, it is covered with small black spots and has a reddish band along either side.

The steelhead, an ocean-going form, is large and bluish and is also a prized game fish. Rainbow trout may weigh about 2.8 kilograms (6 pounds); steelhead (and rainbows in large lakes), from about 4.5 kilograms to more than twice that. Another form of rainbow, the Kamloops, or Kootenay, trout of Idaho, may exceed 13.6 kilograms.

Raine, Kathleen (Jessie) (b. June 14, 1908, London), poet and critic whose poetry is distinguished for its mystical and intuitive visionary qualities, which are sometimes expressed in terms of the landscape of the Scottish border country.

She studied the natural sciences at Cambridge University, and a gift for exactness of observation is evident in her first book of poems, *Stone and Flower* (1943). Other volumes of poems include *The Pythoness* (1949), *The Hollow Hill* (1965), *The Lost Country* (1971), *On a Deserted Shore* (1973), *The Oval Portrait* (1977), *The Oracle in the Heart* (1980), and *Collected Poems, 1935–1980* (1981). Among her critical works are *Blake and Tradition*, 2 vol. (1969), *Blake and Antiquity* (1974;) *From Blake to a Vision* (1978); and *True Human Face of God* (1982). Three volumes of autobiography are *Farewell Happy Fields* (1973), *The Land Unknown* (1975), and *The Lion's Mouth* (1977).

Rainey, Joseph Hayne (b. June 21, 1832, Georgetown, S.C., U.S.—d. Aug. 2, 1887, Georgetown), former U.S. slave, the first black to serve in the U.S. House of Representatives (1870–79).

The son of a barber who bought the family's freedom, Rainey received some private schooling and took up his father's trade in Charleston, S.C. During the Civil War he was forced to work on the fortifications in Charleston harbour but managed to escape to the West Indies, where he remained until the end of the war (1865). Upon his return to South Carolina, he was a delegate to the state constitutional convention (1868) and served briefly in the state senate before his election to the U.S. House of Representatives in 1870. He was reelected four times, the longest tenure in the House of any black during the Reconstruction era. While in office he dedicated himself to the passage of civil rights legislation, pressing the interests not only of blacks but of other minorities such as the Indians, and the Chinese in California. Upon leaving the House in 1879, he was appointed U.S. internal revenue agent of South Carolina. He resigned that post in 1881 to engage in banking and brokerage enterprises in Washington, D.C.

Rainey, Ma, byname of GERTRUDE MALISSA NIX RAINEY, *née* PRIDGETT (b. April 26, 1886, Columbus, Ga., U.S.—d. December 22, 1939, Rome, Ga.), "mother of the blues," the first great black professional blues vocalist. From 1904, she toured southern U.S. tent shows, levee camps, and cabarets in a song-and-dance team with her husband, William ("Pa") Rainey, a minstrel comic. She performed in the theatrical circuits of the South and Midwest through the 1920s, leading her own troupes, including at times Bessie Smith and Thomas A. ("Georgia Tom") Dorsey.

Rainey recorded more than 90 songs from 1923 through 1928 with country blues musicians and black jazz players. An outstanding, earthy stage presence, she retired in 1933, to own and operate two Georgia theatres and to join the Friendship Baptist Church in which her brother was a deacon.

Rainier III, PRINCE DE MONACO, original name RAINIER-LOUIS-HENRI-MAXENCE-BERTRAND DE GRIMALDI (b. May 31, 1923, Monaco), 31st hereditary ruler of the principality of Monaco, son of Prince Pierre, comte de Polignac, and Princesse Charlotte de Monaco, daughter of Louis II, prince de Monaco. Rainier became a Grimaldi (that is, received the name of his mother's family) in accord with a sovereign ordinance of March 18, 1920.

Rainier was educated in England, Switzerland, and the University of Montpellier in France. In 1944, during World War II, he served in the French Army and, after the war, studied at the University of Paris. His mother having renounced her rights to succession in 1944, Rainier succeeded to the throne on May 5, 1949, just before Louis II's death. On April 19, 1956, he married Grace Kelly (*q.v.*), who became Princesse Grace de Monaco; they had three children—Caroline, Albert, and Stéphanie.

Rainier, Mount, highest peak (14,410 ft [4,392 m]) in the state of Washington, U.S., and in the Cascade Range, 40 mi (64 km) southeast of the city of Tacoma. Covering 100 sq mi (260 sq km), the mountain is surrounded by the largest single-peak glacier system in the United States, with 26 glaciers radiating from the mile-square summit. An extinct volcano, which last erupted 2,000 years ago, it lies within the Mount Rainier National Park (created 1899). The mountain is noted for dense stands of coniferous trees on lower slopes, scenic Alpine meadows, waterfalls and lakes, and an abundance of wildlife and flowers.

The English explorer George Vancouver sighted the summit on May 8, 1792, and named it for a fellow navigator, Peter Rainier.

Mt. Rainier in Mount Rainier National Park, Washington

By courtesy of the National Park Service

The first successful ascent was completed by Hazard Stevens and P.B. Van Trump on Aug. 17, 1870. The mountain is a popular tourist and recreation area. It is sometimes referred to by its Indian name, Mt. Tacoma.

Rainis, pseudonym of JĀNIS PLIEKŠĀNS (b. Sept. 11, 1865, Varslavāni, Latvia, Russian Empire—d. Sept. 12, 1929, Majori, Latvia), Latvian poet and dramatist whose works were outstanding as literature and for their assertion of national freedom and social consciousness.

From 1891 to 1895 he edited the newspaper *Dienas Lapa,* aimed at promoting social and class consciousness in the peasantry. Inspired by Marxist theory and writings, Rainis began his literary career as a fighter for social justice and national freedom. His own philosophy, however, showed no trace of Marxist materialism—he regarded life as an incessant series of mutations of energy. Partly because of Russian censorship, he used symbols to express his ideal of political and personal freedom; but in 1897 he was banished to Pskov and, later, to Slobodsk for political activities. Returning in 1903, he took part in the unsuccessful revolution of 1905, after which he emigrated to Switzerland; he did not return until 1920, after Latvia had finally achieved independence. Enthusiastically welcomed, he was elected to the Saeima (Parliament) and was minister of education (December 1926–January 1928) and director of the national theatre (1921–25).

Rainis' first volume of poetry, *Tālas noskanas zilā vakarā* (1903; "Far-Off Reflections on a Blue Evening"), displays his wide experience and contains some subtle love lyrics. Other books express the revolutionary struggle through Symbolism. *Gals un sākums* (1912; "End and Beginning") is imbued with the spirit of Hegel's dialectical philosophy. In his plays Rainis used motifs from folklore as symbols for his political ideals.

Rainis also translated Shakespeare, Schiller, Heine, Pushkin, and Goethe's *Faust,* which enlarged the vocabulary of literary Latvian and also introduced the use of shorter word forms.

rainmaking, any process of increasing the amount of precipitation discharged from a cloud. Whereas primitive methods, such as rain dances or the throwing of pebbles into water, have not produced rain, modern techniques of seeding supercooled clouds with frozen carbon dioxide or silver iodide offer some possibility of increasing rainfall amounts substantially in the future. *See also* cloud seeding.

Rainsborough, Thomas: *see* Rainborow, Thomas.

rainwash: *see* sheet erosion.

Rainwater, (Leo) James (b. Dec. 9, 1917, Council, Idaho, U.S.—d. May 31, 1986, Yonkers, N.Y.), American physicist who won a Nobel Prize for Physics in 1975 for his part in determining the asymmetrical shapes of certain atomic nuclei.

Educated at the California Institute of Technology, Pasadena, and Columbia University, where he received his doctorate in 1946, Rainwater worked on the Manhattan Project to develop the atomic bomb during World War II. In 1949 he began formulating a theory that not all atomic nuclei are spherical, as was then generally believed. The theory was tested experimentally and confirmed by Danish physicists Aage N. Bohr and Ben R. Mottelson. For their work the three scientists were awarded jointly the 1975 Nobel Prize for Physics.

Professor of physics at Columbia from 1952 and Pupin professor of physics at Columbia from 1982, Rainwater also conducted valuable research on X rays and took part in Atomic Energy Commission and naval research projects. He was awarded the AEC's Ernest Orlando Lawrence Prize for Physics in 1963.

Rainy Lake, narrow lake astride the Canadian–U.S. border, between Minnesota, U.S., and the Rainy River district of southwestern Ontario, Can. It has an area of 360 sq mi (932 sq km), is about 50 mi (80 km) long, 35 mi of which form the international boundary, and has an average width of 5 mi with a maximum of 27 mi. Its shores are irregular and deeply indented, and it contains more than 500 islands. Drainage is westward through the 85-mi-long Rainy River into Lake of the Woods.

Rainy Lake was discovered in 1688 by a French explorer, Jacques de Noyon. A power station on Rainy River just downstream from the lake supplies electricity to the large lumber, pulp, and paper milling industries of Fort Frances (Ont.) and International Falls (Minn.). The region is the site of several Indian reservations and is popular for hunting, fishing, and canoeing.

Raipur, city, administrative headquarters of Raipur district, Madhya Pradesh state, central India. The town was founded in the 14th century by Rai Brahma Deo of the Ratanpur dynasty. It served as headquarters of the former Chhattīsgarh princely states division and was constituted a municipality in 1867. A food-processing and sawmilling centre, it is connected by rail with Vizianagaram and Vishākhapatnam port in Andhra Pradesh state. Raipur contains two musical academies, a museum, a tuberculosis clinic, and rice and sericulture experimental farms. It is the seat of Ravishankar University (1964).

Raipur district (8,205 sq mi [21,251 sq km]) comprises a forested hilly region (abounding in wild game) to the east and a portion of the Chhattīsgarh plain to the west. It is extensively irrigated by canals from the Mahānadi River, with a weir at Rudri. It is the leading rice-producing district of Madhya Pradesh. Wheat, cotton, and oilseeds are also grown, and there is extensive cattle raising. Sandstone, limestone, and lead deposits are worked. Pop. (1981) city, 338,245; district, 3,079,476.

Rais, Gilles de, Rais also spelled RETZ, or RAYS (b. September/October 1404, Champtocé, Fr.—d. Oct. 26, 1440, Nantes), Breton baron, marshal of France, and man of wealth whose distinguished career ended in a celebrated trial for satanism, abduction, and child murder. His name was later connected with the story of Bluebeard.

At an early age Rais distinguished himself militarily, fighting first in the wars of succession to the duchy of Brittany (1420) and then for the Duchess of Anjou against the English in 1427. He was assigned to Joan of Arc's guard and fought several battles at her side, including the relief of Orléans in 1429. He accompanied her to Reims for the consecration of Charles VII, who made him marshal of France. He continued to serve in Joan of Arc's special guard and was at her side when Paris was attacked. After her capture, he retired to his lands in Brittany.

Inheriting extensive domains from both his father and his maternal grandfather (Guy de Laval and Jean de Craon, respectively), Rais had also married a rich heiress, Catherine de Thouars (1420). He kept a more lavish court than the King, dissipating his wealth on the decoration of his châteaux and the maintenance of a large train of servants, heralds, and priests. He was a munificent patron of music, literature, and pageants, in one of which he figured (*The Mystery of Orléans*). When his family secured a decree from the King in July 1435, restraining him from selling or mortgaging the rest of his lands, he turned to alchemy. He also developed an interest in satanism, hoping to gain knowledge, power, and riches by invoking the devil. He was later accused of having abducted, tortured, and murdered more than 140 children.

Rais was arrested in September 1440 and brought to trial in Nantes, first before an ecclesiastical tribunal under the direction of the Bishop of Nantes and then before a civil court. At first he refused to plead to the charges, but, when threatened with excommunication, he recognized the court's authority and declared himself not guilty. He was condemned for heresy by the ecclesiastical court and sentenced to death for murder by the civil court. His confession and his repentance and the resignation with which he went to his hanging were acclaimed at the time as an example of Christian penitence. But skeptics have pointed to the numerous irregularities of the proceedings, the Duke of Brittany's financial interest in his ruin, and the fact that he confessed under threat of torture.

raised work, also called STUMP WORK, form of embroidery practiced in England in the 17th century, characterized by biblical and mythological scenes of padded plants, animals,

"The Queen of Sheba Before Solomon," raised work picture embroidered in coloured silks and gold thread, English, early 17th century; in the Art Institute of Chicago

By courtesy of the Art Institute of Chicago, gift of Mrs. Laurance H. Armour in memory of her mother, Mrs. Henry Malcolm Withers

birds, and the like in high relief. Panels, used as pictures or decorative coverings for mirror frames, caskets, and so on, were ornamented with padded flowers, fruit, and human figures, sometimes with details such as hands in wax.

The technique developed naturally from Elizabethan embroidery, in which petals or leaves, for example, were occasionally made to stand out by means of detached buttonhole stitches. It reached the epitome of exuberance before disappearing in about 1766.

Raisen, town, administrative headquarters of Raisen district, Madhya Pradesh state, central India. The town lies at the foot of a spur of the Vindhya Range, on which stands an ancient sandstone fort with several palaces and a mosque. A strategic town in the history of eastern Mālwa (*q.v.*), Raisen was the 16th-century stronghold of Silhari, a Rājput (warrior caste) chief, and was an important administrative centre under the Mughals. Annual festivals are held.

Raisen district (3,272 sq mi [8,396 sq km]), a portion of the former Bhopāl princely state, comprises Vindhyan spurs intersected by fertile basins of the Betwa, Bīna, and Tendoni rivers. Wheat, jowar (sorghum), and cotton are the major crops; sandstone deposits are worked. A Buddhist *stūpa* at Sānchi (*q.v.*) dates from *c.* 250 BC. Pop. (1981) town, 15,-914; district, 710,542.

raisin, dried fruit of certain varieties of grape. Raisin grapes were grown as early as 2000 BC in Persia and Egypt, and dried grapes are mentioned in the Bible (Num. 6:3) during the time of Moses. David was presented with "a hundred clusters of raisins" (I Sam. 25:18), probably sometime during the period 1110–1070 BC. Early Greeks and Romans adorned places of worship with raisins, and they were awarded as prizes in sporting events. Until the 20th century the chief raisin producers were Turkey, Iran, and Greece; by mid-century the United States had taken the lead in production, with Australia ranking second. The U.S. raisin industry is located entirely in California, where the first raisin grapes were planted in 1851.

The most important varieties of raisin grapes are the Thompson Seedless, a pale-yellow seedless grape, also known as Sultanina (California); Muscat, or Alexandria, a large-seeded variety also known as Gordo Blanco (Australia); White Hanepoot (South Africa); and the Black Corinth, a small, black, seedless type, also called Zante currant, Staphis (Greece), and panariti. Other varieties of raisin of local importance include the Round Kishmish, Rosaki, Dattier, Monukka, and Cape Currant.

Raisins also may be designated by the method of drying (natural, golden-bleached, lexia), the form in which marketed (seeded, loose, layers), the principal place of origin (Aíyion, Smyrna, Málaga), the size grades, or the quality grades. Natural raisins are dried in the sun in their natural condition; they are grayish black or grayish brown, with the natural bloom intact and a rather tough skin. Golden-bleached raisins are produced from Thompson Seedless grapes dipped in 0.5 percent lye, exposed to fumes of burning sulfur for two to four hours, and dried in a tunnel dehydrator. They are lemon yellow to golden yellow in colour, used chiefly in baked goods. Sulfur-bleached raisins are pretreated the same as golden-bleached, put on trays, and left in the sun for three to four hours. The trays are then stacked, and the drying is continued for several weeks in the shade. The finished product appears waxy and cream to faintly reddish yellow in colour.

Soda-dipped or soda-bleached raisins are from Thompson Seedless grapes hot-dipped in dilute lye but not sulfured, then dried in the sun or in a dehydrator. If dried rapidly they are light amber to medium brown, moderately tender, and mild flavoured. Oil-dipped and lexias are dipped in a dilute solution of lye upon which a thin film of olive oil is floated; they are dried on trays in direct sunlight and are medium to dark brown, tender, and mild in flavour. Raisins provide an excellent source of iron for the diet. *See also* grape.

raisin tree, also called HONEY TREE, or JAPANESE RAISIN TREE (*Hovenia dulcis*), shrub or tree, of the buckthorn family (Rhamnaceae), native to East Asia and sometimes cultivated in other regions. It is so-named because the fruit resembles a raisin in size and colour.

The plant grows to about 7.5 metres (about 25 feet) in height and has alternate, broadly oval leaves with long stalks. The small, greenish flowers grow in clusters from the branch tips or from the axils (upper angle at junc-

Raisin tree (*Hovenia dulcis*)
Douglas David Dawn

tion of leaf stem with branch). After the flower falls, the flower stalk swells into a red, sweet-tasting, edible mass.

Rāj-Nāndgaon, town, Rāj-Nāndgaon district, Madhya Pradesh state, central India, just north of the Seonāth River. The town was the capital of the former Rāj Nāndgaon princely state, which merged with Durg district in 1948. A major road and rail junction, it is an agricultural trade and cotton-textile centre. Rice and oilseed milling and chemical manufacturing are the major industries. There are two colleges (including a law college) affiliated with Ravishankar University.

Rāj-Nāndgaon district has an area of 4,248 sq mi (11,003 sq km). A plains region, it is drained by several small tributaries of the Seonāth River and is primarily agricultural. Pop. (1981) town, 86,367; district, 1,167,501.

Raja Ali Haji bin Raja Amhad: *see* Ali Haji bin Raja Amhad, Raja.

Rajagopalachari, Chakravarti (b. 1879, Hosūr, India—d. Dec. 25, 1972, Madras), the only Indian governor general of independent India; he became the founder and leader of the Swatantra (Independent) Party in 1959.

Leaving a lucrative law practice, Rajagopalachari edited Gandhi's paper *Young India* when Gandhi was in prison in the early 1920s. For 20 years (1922–42) he served on the Working Committee of the Indian National Congress and was prime minister of his home state of Madras (now Tamil Nadu) from 1937 to 1939.

In June 1948 Rajagopalachari took over as governor general of India's interim government, serving until January 1950. From 1952 to 1954 he was again chief minister of Madras.

In June 1959 Rajagopalachari helped found the Swatantra Party in Madras, representing a coalition of interests opposed to the Congress. The party was fundamentally conservative and anti-Communistic, supporting free enterprise and the reduction of the central government's control of the states.

Rājahmundry, town, East Godāvari district, Andhra Pradesh state, southern India, at the head of the Godāvari River Delta. In 1449 Rājahmundry was captured by Kapileśvara, the Orissa ruler. In 1757 it was ceded to the British. A railway bridge over the Godāvari, with 56 spans, is one of the longest railway bridges (9,036 ft [2,754 m]) in India.

The town is a centre for rice, salt, and lumber, which is floated down from the forested hills in the north. It is a manufacturing town and has a paper mill and a crucible factory. Four colleges, affiliated with Andhra University, and the Central Tobacco Research Institute are located there. Pop. (1981) town, 216,851; metropolitan area, 268,370.

rājākariya, traditional system of land tenure in Ceylon (now Sri Lanka) until the early 19th century in which land was granted in exchange for services rendered. The services expected were of two kinds: (1) public works, such as road and bridge building, or, in earlier days, the construction of irrigation works; and (2) special services elicited on the basis of a person's caste-related occupation.

Rājākariya was first abolished in 1802 by Frederick North, then British governor of Ceylon. A new tax, consisting of a share of land produce, was substituted for *rājākariya* but proved unpopular with the Ceylonese people, and North's successor reinstituted *rājākariya.* The practice then continued until 1832, when it was decisively abolished in a wave of administrative and economic reforms following recommendations of the Colebrook–Cameron Commission. While the Ceylonese people had been against abolition in 1802, the British colonial government had favoured it as a means both of encouraging the people to improve their landholdings—by granting them the land outright—and of encouraging population mobility by ending their obligatory bond to the land. By 1832 these positions had been reversed: the Ceylonese people favoured abolition, and the colonial government opposed it. The British colonial government was overruled, however, by the British home government, which for both economic and humanitarian reasons desired the abolition of *rājākariya.*

Rajang, Batang, river in Sarawak state, East Malaysia (northwest Borneo), rises in the Pegunungan Iran (Iran Mountains) and flows southwest to Kapit, where it turns westward to complete its 350-mi (563-km) course to the South China Sea. Its large, swampy delta includes Pulau Beruit (Beruit Island), with a lighthouse at Tanjung Sirik (Sirik Point). In a state almost totally dependent on riverine transport, the Batang Rajang ("sliced stream") is navigable for 80 mi to Sibu by oceangoing vessels and for another 100 mi by shallow draft craft; small canoes can penetrate even farther into the otherwise inaccessible Iban country interior.

The market towns of Sarikei, Binatang, Kanowit, and Kapit are along its banks. One of the state's few agricultural sectors parallels its course. Tributaries include the Kanowit, Ngemah, Iran, Baleh, and Pila rivers.

Rājapālaiyam, also spelled RĀJAPĀLAYAM, town, Rāmanāthapuram district, Tamil Nādu state, southeastern India, at the eastern foot of the Western Ghāts. It is named after its Rāju inhabitants, Telugu speakers who migrated during the Vijayanagar (1336–1565) conquest.

The town grew as a centre for cotton handlooming and weaving. It has cotton mills and a cement factory. Pop. (1981) 101,640.

Rajasanagara (ruler of Java): *see* Hayam Wuruk.

Rājasthān, constituent state of the Republic of India, located in the northwestern portion of the country. It is bounded on the west and northwest by Pakistan; on the north and northeast by the states of Punjab, Haryāna, and Uttar Pradesh; on the east and southeast by Uttar Pradesh and Madhya Pradesh; and on the southwest by Gujarāt.

The following article summarizes the administrative history, geography, demographic patterns, economy, and culture of modern Rājasthān; for additional treatment of its geography and history, *see* MACROPAEDIA: India.

Rājasthān means "the abode of the rajas," and it was formerly known as Rājputana, "the country of the Rājputs," or "sons of rajas." Archeological and historical evidence shows a continuous human habitation of the area dating back 100,000 years. Between the 7th and the 11th century AD, several Rājput dynasties arose, with Rājput strength reaching its peak at the beginning of the 16th century.

Defeated by and incorporated into the Mughal empire, the Rājput states were under Marāṭhā influence by the beginning of the 19th century. Later in that century the British gained domination over the Marāṭhās, but Rājasthān soon emerged as a centre of Indian nationalism and political activism. When the new constitution of India went into effect in 1950, Rājasthān became an integral part of India, the Rājput princes surrendering their powers to the central government.

The topography of Rājasthān is dominated by the Arāvalli Hills, which form a line across the state, running roughly from Mount Ābu at 5,650 feet (1,722 m) in the southwest to the town of Khetri in the northeast. The three-fifths of the state northwest of this line contains the Thar, or Great Indian, Desert and is mostly a sandy and unproductive region. The southeastern portion is higher in elevation, more fertile, and more diversified, containing hills, tableland, and the flat alluvial basin of the Yamuna River. The Chambal is the only large and perennial river. Sāmbhar is the largest salt lake in India.

There is a wide range of climate, varying from extremely arid to humid. Except in the hills, the heat in summer is great everywhere, with a mean daytime maximum temperature hovering at about 110° F (43° C) in many locations. Winter temperatures vary from 68° to 76° F (20° to 24° C). Hot winds and dust storms occur, especially in the desert tract, where rainfall averages 4 inches (100 mm) annually. In the southwest, rainfall is copious, in part owing to the summer monsoon winds off the Arabian Sea and Bay of Bengal.

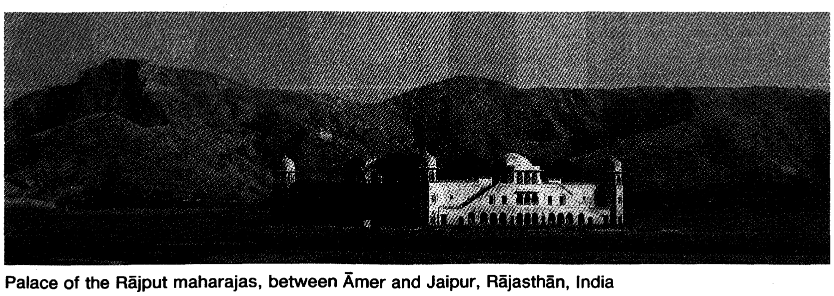
Numerous aboriginal tribal groups make up the Rājasthān population, including the Mīnās, the Meos, the Banjārās, and the Bhīls—one of the oldest tribes in India. Others include the Gadia Lohārs, the Grasias, and the Kathodis. Rājputs form a small percentage of the population, but they are the most prominent and take pride in their warlike reputation and ancestry. The principal language of the state is Rājasthānī, comprising a group of Indo-Aryan dialects derived from Dingal. The use of Rājasthānī is declining, however, being replaced by Hindī. Hinduism is the dominant religion, although Jainism is also important, and there are Muslim, Christian, and Sikh minorities in the state. Rājasthān is sparsely populated, with only a few towns having more than 100,000 inhabitants. The urban population, however, has been growing faster than the rural.

Rājasthān is predominately an agricultural and pastoral state where food production has been increasing since the 1950s with the increased use of irrigation. The state is one of the largest wool producers in India, and crops include millet, corn (maize), wheat, barley, edible seeds, rice, and oilseeds. Cotton is an important cash crop.

The state produces textiles, chemicals, nylon, precision instruments, calcium carbide, and caustic soda. Handicrafts earn foreign exchange. Oil has been found in Rājasthān, and other mineral deposits include gypsum, silver ore, asbestos, copper, zinc, limestone, salt, and marble. Rājasthān produces nearly all of India's output of lead and zinc concentrates, emeralds, and garnets and about nine-tenths of its gypsum and silver ore. Most supplies of electricity are obtained from neighbouring states, but a nuclear-energy plant is in operation at Rāwatbhāta near Kota. Road building has also increased, and there are air connections between Jaipur (the capital), Jodhpur, Kota, Udaipur, New Delhi, Bombay, and Āgra.

Hardly a month passes in Rājasthān without a religious festival, the Hindus and Muslims joining in each others' festivals. The most remarkable one is called Gangor, during which women worship clay images of Mahādevī and Pārvatī (representing the benevolent aspects of the Hindu mother goddess) for 15 days. Another important festival is held at Pushkar (near Ajmer), taking the form of a mixed religious celebration and livestock fair. It is visited by farmers from all over the state (bringing their camels and cattle) and by pilgrims seeking salvation.

The typical folk dance of Rājasthān is the *ghoomar,* performed only by women. The *geer* dance (performed by both sexes), the *panihārī* (a graceful dance for women), and the *kacchi ghori* (in which male dancers ride dummy horses) are also popular. The most famous song is the *Kurja,* which tells the story of a woman who wishes to send a message by the *kurja* (a bird), which is promised a priceless reward for his service. Rājasthān has a rich literary tradition, especially of bardic poetry, and the state abounds in objects of antiquarian interest—Jaina temples, mosques, and tombs. There are universities at Jaipur, Udaipur, and Jodhpur, and Pilanī has the Birla Institute of Technology and Science. Area 132,140 square miles (342,239 square km). Pop. (1981) 34,261,862.



Palace of the Rājput maharajas, between Āmer and Jaipur, Rājasthān, India

A.C. Lyon

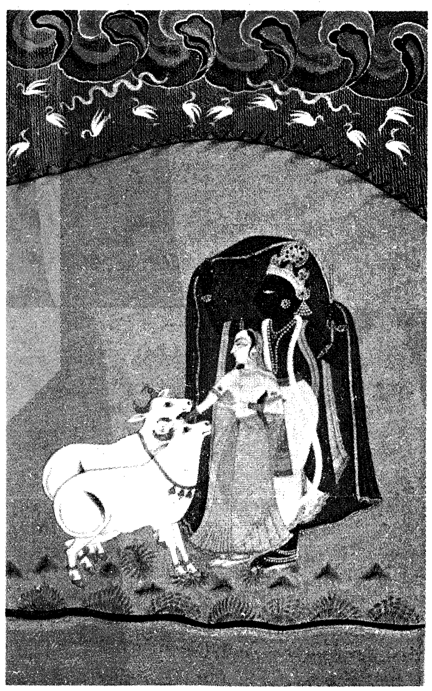
Rājasthān Steppe, desert in west-central Rājasthān state, northwestern India. It has an area of about 54,800 square miles (142,000 square km). The region was ruled successively in ancient times by the Mauryas, Guptas, and Gurjar Pratihāras. Later it was ruled by Rājput dynasties before coming under Mughal control.

Near Jodhpur is bedrock similar to that of the Vindhya Range; further south there are Malani volcanic and Jalore Siwana granitic rocks. The region slopes from the Arāvalli Range in the northeast to the Lūni River basin in the southeast, where rocks above the sandy surface bear evidence of wind erosion. Rājasthān Steppe has also been subject to extensive gullying. Large areas are covered with thorny scrub, acacia, and palm trees. The Lūni is the only major river; the inland drainage pattern has created a number of salt lakes, such as the Dīdwāna, Kuchman, Degna, and Sāmbhar. The desert soils contain a high percentage of soluble salts. Livestock (cattle, sheep, goats, and camels) raising and agriculture are economically important; cereals, pulses (legumes), oilseeds, cotton, and sugarcane are grown. The region suffers occasionally from severe droughts and swarms of locusts. It is rich in mineral resources (especially marble and salt), and gypsum, silver ore, and feldspar are mined; there is a sulfur plant at Sāmbhar Salt Lake. Rugs and woolen textiles, sugar, cement, pesticides, and dyes are produced. Jodhpur, Gangānagar, Churu, and Jhūnjhunu are the important towns.

Rājasthānī languages, group of Indo-Aryan languages and dialects spoken in the state of Rājasthān, India, and adjoining areas. There are four major groups: northeastern Mewātī, southern Mālvī, western Māṛwāṛī, and east-central Jaipurī.

Māṛwāṛī is the most extensive geographically. Rājasthān is a transition area between the Hindi areas on the east and the Gujarātī areas on the southwest; and Rājasthānī languages are not recognized as official media in the constitution of India. Instead, Hindi is used as the official language.

Rājasthānī painting, the style of miniature painting that developed mainly in the independent Hindu states of Rājasthān in western India in the 16th–19th century. It evolved from Western Indian manuscript illustrations, though Mughal influence became evident in the later years of its development.



Krishna sheltering Rādhā from the rain, Rājasthānī miniature painting, Mārwār school, late 18th century; in a private collection

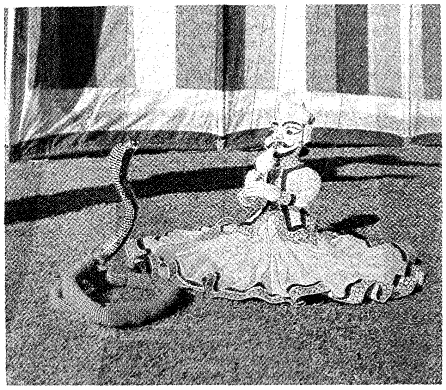
P. Chandra

Rājasthānī painting differs from the Mughal painting of the imperial ateliers at Delhi and the provincial courts in its bolder use of colour, an abstract and conventionalized conception of the human figure, and an ornamental treatment of landscape. In keeping with the new wave of popular devotionalism within Hinduism, the subjects principally depicted are the legends of the Hindu cowherd god Krishna and his favourite companion, Rādhā. To a lesser extent there are illustrated scenes from the two major epics of India, the musical modes (*rāgamālās*), and the types of heroines (*nāyikās*). In the 18th century, court portraits, court scenes, and hunting scenes became increasingly common.

Like Mughal art, Rājasthānī paintings were meant to be kept in boxes or albums and to be viewed by passing from hand to hand. The technique is similar to that of Mughal painting, though the materials are not as refined and sumptuous.

The study of Rājasthānī painting is comparatively young, and new material is continually being uncovered. Distinct schools have been separated out on the basis of style, such as Mewār painting, Būndi painting (*qq.v.*) and that of its neighbouring sister state of Kotah, Kishangarh painting (*q.v.*), Bīkaner, Jaipur, Mārwār, and, outside Rājasthān proper, Mālwa painting (*q.v.*), also referred to as Central Indian painting.

Rājasthānī puppet, string marionette found in the state of Rājasthān in northwestern India. It is controlled by one string that passes from the top of the puppet's head, over the manipulator's hand, and down to one shoulder and controls the body. The shrill voices characteristic of the Rājasthānī marionettes are produced by the head puppeteer, who speaks through a bamboo reed.



Snake and snake charmer, Rājasthānī puppets
Foto Features

The ceremony that marks the "death" of a puppet is some measure of puppetry's importance in Rājasthān. A marionette is handed down from generation to generation. When it is no longer usable, it is floated down a holy river with a prayer; the length of time that it remains afloat is an indication of how kindly the gods are judging it.

Rājataraṅgiṇī (Sanskrit: "River of Kings"), historical chronicle of early India, written in Sanskrit verse by the Kashmir Brahman Kalhaṇa in 1148; it is justifiably considered to be the best and most authentic work of its kind. It covers the entire span of Kashmir history, from the earliest times to the date of its composition.

Kalhaṇa was excellently equipped for the work. Uninvolved personally in the maelstrom of contemporary politics, he, nevertheless, was profoundly affected by it and stated the following to be his ideal: "That noble-minded poet alone merits praise whose word, like the sentence of a judge, keeps free from love or hatred in recording the past." His access to minute details of contemporary court intrigues was almost direct: his father and uncle were both in the Kashmir court. For the events of the past, Kalhaṇa's search for material was truly fastidious. He delved deep into such model works as the *Harṣacarita* and the *Bṛhat-saṃhitā* epics and used with commendable familiarity the local *rājakathās* (royal chronicles) and such previous works on Kashmir as *Nṛpāvali* of Kṣemendra, *Pārthivāvali* of Helārāja, and *Nīlamatapurāṇa*. He displayed surprisingly advanced technical expertise for his age in his concern for unconventional sources. He looked up a variety of epigraphic sources relating to royal eulogies, construction of temples, and land grants; he studied coins, monumental remains, family records, and local traditions. But his traditional conceptual framework, accommodating uncritical assumptions and belief in the role of the poet as an exponent of moral maxims, makes the idealizing content in his narrative, particularly for the early period, rather dominant.

Rājataraṅgiṇī, which consists, in all, of 7,826 verses, is divided into eight books. Book I attempts to weave imaginary tales of Kashmir kings into epic legends. Gonanda was the first king and a contemporary and enemy of Krishna. Traces of genuine history are also found, however, in references to Aśoka and Jālauka, the Buddhist Kushān kings Hushka (Huviṣka), Jushka (Vājheṣka), and Kanishka (Kaniṣka), and the Hūṇa Mihirakula. Book II introduces a new line of kings not mentioned in any other authentic source, starting with Pratāpāditya I and ending with Āryarāja. Book III starts with an account of the reign of Meghavāhana of the restored line of Gonanda and refers to the brief reign of Mātṛgupta, a supposed contemporary of Vikramāditya Harṣa of Mālwa. There too, legend is mixed with reality, and Toramāṇa Hūṇa is incorporated in the line of Meghavāhana. The book closes with the establishment of the Karkoṭa Nāga dynasty by Durlabhaka Pratāpāditya II, and it is from Book IV on that *Rājataraṅgiṇī* takes on the character of a dependable historical narrative. The Karkoṭa line came to a close with the usurpation of the throne by Avantivarman, who started the Utpala dynasty in 855. In Books V and VI the history of the dynasty continues down to 1003, when the kingdom of Kashmir passed on to a new dynasty, the Lohara. Book VII brings the narrative down to the death of King Harṣa (1101), and Book VIII deals, on the level of extremely dependable details, with the stormy events between the death of Harṣa and the stabilization of authority under Kalhaṇa's contemporary Jayasiṃha (reigned 1128–49).

In style the *Rājataraṅgiṇī* narrative is sometimes considered as versified prose on a massive scale, yet its strong structural appeal made it a model for later historians. In fact, the history of Kashmir was continued, along Kalhaṇa's line, down to some years after the annexation of Kashmir by Akbar (1586) in the following works: *Rājataraṅgiṇī* (by Jonarāja), *Jainataraṅgiṇī* (by Śrīvara), and *Rājāvalipatākā* (by Prājyabhaṭṭa and Śuka). Neither in style nor in authenticity do these works approximate the quality of Kalhaṇa's *Rājataraṅgiṇī*.

Rājauri, town, in northwestern Indian-administered Jammu and Kashmir state, in the northern part of the Indian subcontinent. It was referred to as Rājpuri in Kalhaṇa's *Rājataraṅgiṇī* (12th century AD). In the Pashtun intervention of 1947, almost the entire population of the town was massacred. Tattā Pāni, hot sulfur springs noted for their medicinal properties, and Shahdrā Sharif, a Muslim pilgrimage centre, are located near the town. Rājauri is located on the road connecting Pūnch in the Indian-held sector in the north and Jammu in the south.

The surrounding region is composed largely of the northwest–southeast-trending Pīr Panjāl Ranges (with an average elevation of 9,000 feet [2,745 m]) of the Middle Himalayas. The Chenāb is the principal river. Hill slopes are covered with temperate forests of pine, spruce, and fir. Agriculture, mining, and forestry form the basis of the region's economy. Rice, corn (maize), ragi, jowar (sorghum), and barley are grown on the terraced hill slopes and in the river valleys. Pop. (1981) 8,690.

Rājāvaliya, 17th-century historical chronicle of Sri Lanka, covering the history of the island from its legendary beginnings up to the accession of King Vimaladharmasūrya II in 1687. It is the only continuous history of the island written in the Sinhalese language prior to the British period.

Unlike many other Sri Lankan historical chronicles, the *Rājāvaliya* deals mainly with political rather than religious (Buddhist) events. Its style is a popular rather than a learned one, and historians believe it to have been the work of more than one hand. It is considered to be especially useful for the period after 1359.

Rājbanśī (people): *see* Koch.

Rājgarh, town, northwestern Madhya Pradesh state, central India, situated between the Newaj and Pārbati rivers. Founded in about 1640, it served as the capital of the former Rājgarh princely state, founded by Umat Rājputs (a warrior caste). The town is an agricultural market centre. There is a college affiliated with Vikram University. Pop. (1981) 14,944.

Rājgīr Hills, physical region, central Bihār state, northeastern India, extending for 40 miles (65 km) in two parallel ridges that enclose a narrow ravine. At one point the hills rise to 1,272 feet (388 m), but in general they seldom exceed 1,000 feet (300 m). The valley between the parallel ridges, south of the village of Rājgīr, contains the site of Rājagṛha ("Royal Residence"), said to have been the residence of the legendary Magadha emperor Jarāsandha of the Hindu epic *Mahābhārata*. The outer fortifications can be traced on the crests of the hills for more than 25 miles (40 km); they are 17½ feet (about 5 m) thick, built of massive undressed stones without mortar. These ruined walls are generally dated to the 6th century BC. The remains of New Rājagṛha, the reputed capital of Bimbisāra (*c.* 520–490 BC), lie north of the valley.

An important Buddhist and Jaina pilgrimage site, the Rājgīr Hills are associated with the life of Buddha Gautama, who often taught there. Chhatagiri is the former Gridhrakuta, or Vulture's Peak, which was one of his favourite resorts. One of the towers on Baibhar Hill (Vaibharagiri) has been identified as the Pippala stone house in which Buddha lived. Sattapanni cave, which has been identified with a number of sites on Baibhar Hill and with the Sonbhandar cave at its foot, was the site of the first Buddhist synod (543 BC) to record the tenets of the faith. The Sonbhandar cave is now believed to have been excavated by the Jains in the 3rd or 4th century AD. In the valley's centre, excavations at the Maṇiyār Math site have revealed a circular shrine associated with the worship of Maṇi-nāga, a serpent deity of the *Mahābhārata*. Several modern Jaina temples lie on the hills around the valley. There are also hot springs in the valleys, surrounded by Hindu shrines.

Rājkot, town, west-central Gujarāt state, west-central India, near the centre of the Kāthiāwār Peninsula. The capital of the former princely state of Rājkot and of the former Western India States Agency, it is now an important commercial and industrial centre. Manufacture of cotton and woolen textiles is the major activity. Educational institutions include Rajkumar College (1870) and several colleges affiliated with Saurāshtra University. The town is an important junction on the Western Railway, with connections to most major towns in the state. It is also served by major highways and an airport.

The terrain surrounding Rājkot is undulating, its stony soil watered by several streams. Principal crops are grains, sugarcane, and cotton; cotton and woolen textiles are the main manufactures. Pop. (1981) 445,076.

rajm (Arabic: "to stone," or "to curse"), in Islām, "casting of stones" at the devil during the pilgrimage (*ḥajj*) to Mecca, a pre-Islāmic Arabian religious custom retained by the Prophet Muḥammad. Historically, Muslim legalists did not agree on the number of stones to be cast or on the exact time for this rite among the other pilgrimage rites; Muḥammad himself reportedly stated that there was no harm in disregarding the traditional (pre-Islāmic) order of the pilgrimage ceremonies, probably to avoid reconciling differing tribal practices already in existence. Most Muslims, however, attempt to imitate the pilgrimage as completed by Muḥammad. On the 10th day of the Dhū al-Ḥijjah, the month of the *ḥajj,* they each throw seven small stones at a stone construction, *al-jamrat al-ʿaqabah,* which is identified by tradition as the site where the patriarch Ibrāhīm (Abraham) stoned Shayṭān (Satan). On the 11th, 12th, and 13th of the month, the ritual is repeated at all three *jamrah*s, these being stone towers located in the valley of Minā; each is pelted with seven stones every noon for the three days.

Stones for the *rajm* should be found in their natural state, rather than broken from larger rocks; precious stones and stones made of gold and silver are forbidden as wasteful and dangerous. The stones may not be thrown violently and should be not much larger than a lentil so that no harm is caused if someone is struck by accident. Any stones that are collected but not used on the pilgrimage must subsequently be buried, for once they reach the sacred shrine in Mecca, they assume a sacred character.

While the casting of stones at the devil symbolizes the expulsion of evil and the abandonment of worldly thoughts, it also serves to protect the pilgrim from evil when he returns to everyday life. Pious Muslims who encourage reciting religious formulas as each stone is thrown emphasize the spiritual meaning of *rajm.* They thus consider the practice not so much a symbolic cursing or punishing of the devil as a means of invoking the name of God.

Rajm also signifies ritual stoning as a punishment for fornication and is used for the stones placed on a tomb as flagstones or piled in a heap, practices condemned in Islām.

Rājmahāl, historic town, east-central Bihār state, northeastern India. It lies west of the Ganges River. The town is located in the Rājmahāl Hills, which run north–south for 120 miles (190 km) from the Ganges River almost to Dumka. They rise to 1,861 feet (567 m) and are inhabited by the Sauria Paharias. The valleys are cultivated by tribal Santāls.

Man Singh, a Mauryan governor of Bengal, chose the site for his capital in 1595–96 because of its strategic command of the Teliagarh Pass and Ganges River. The capital of Bengal was transferred to Dacca (now Dhākā) in 1608, but Rājmahāl temporarily regained its administrative position from 1639 to 1660. Buildings of historic interest in the town include the Akbar Masjid, or mosque (*c.* AD 1600), and the 18th-century palace of Mīr Qasīm, nawab of Bengal. Pop. (1981) 12,426.

Rājput (from Sanskrit *rāja-putra:* "son of a king"), any of about 12,000,000 landowners organized in patrilineal clans and located mainly in central and northern India, especially in former Rājputāna ("Land of the Rājputs"). The Rājputs regard themselves as descendants or members of the Kshattriya (warrior ruling) class, but they actually vary greatly in status, from princely lineages, such as the Guhilot and Kachwāhā, to simple cultivators. Most authorities agree that successful claims to Rājput status frequently were made by groups that attained secular power; probably central Asian invaders as well as patrician lines of indigenous tribal peoples were absorbed in this way. There are numbers of Muslim Rājputs in the northwest, and Rājputs generally have adopted the custom of purdah (seclusion of women). Their ethos includes an intense pride in ancestry and a mettlesome regard for personal honour. They seek hypergamous marriages (*i.e.,* the bride marrying into a social group higher than her own).

The Rājputs' origins seem to date from a great breakup of Indian society in northern and northwestern India under the impact of the Hephthalites (White Huns) and associated tribes from the mid-5th century onward. Following the breakup of the Gupta Empire (late 6th century), invading groups were probably integrated within the existing society, with the present pattern of northwestern Indian society being the result. Tribal leaders and nobles were accepted as Kshattriyas, the second order of the Hindus, while their followers entered the fourth (Śūdra, or cultivating) order to form the basis of tribal castes, such as the Jāṭs, the Gūjars, and the Ahīrs. Some of the invaders' priests became Brahmans (the highest ranking caste). Some indigenous tribes also attained Rājput status, such as the Rathors of Rājasthān, the Chandelās and the Bundelās of central India. The Rājputs are divided between the Solar and Lunar races and those claiming to come from the great fire pit near Ajmer. Rājput habits of eating meat (except beef) and other traits suggest both foreign and Aboriginal origins.

The Rājputs emerged into political importance in the 9th and 10th centuries. From *c.* 800 Rājput dynasties dominated northern India, and the many petty Rājput kingdoms there were among the main obstacles to the complete Muslim domination of Hindu India. After the Muslim conquest of the eastern Punjab and the Ganges Valley, the Rājputs maintained their independence in the fastnesses of Rājasthān and the forests of central India. Sultan ʿAlāʾ-ud-Dīn Khaljī of Delhi (reigned 1296–1316) took the two great Rājput forts of Chitor and Ranthambhor in east Rājasthān but could not hold them. The Rājput state of Mewār under Rānā Sāngā made a bid for supremacy but was defeated by the Mughal emperor Bābur at Khānua (1527). Bābur's grandson Akbar took the forts of Chitor and Ranthambhor (1568–69) and then made a settlement with all the Rājasthān princes except Mewār. Accepting Mughal overlordship, the princes were admitted to the court and the emperor's privy council and were given governorships and commands of armies. Although damaged by the emperor Aurangzeb's (reigned 1658–1707) intolerance, this arrangement continued until the Mughal Empire itself collapsed in the 18th century. The Rājputs then fell victims to the Marāthā chiefs until they accepted British suzerainty (1818) at the end of the last Marāthā war. After independence (1947) the Rājput states in Rājasthān were merged to form the state of Rājasthān within the Indian Union.

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

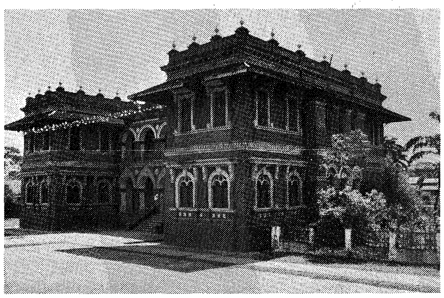
Rājput painting, the art of the independent Hindu feudal states in India, as distinguished from the court art of the Mughal emperors. Whereas Mughal painting was contemporary in style, Rājput was traditional and romantic.

It developed in the 16th and early 17th centuries, and its late period lasted through 1825. Rājput painting is further divided into Rājasthanī painting (*q.v.*), or the schools of the Rājasthān and central India, and Pahari painting (*q.v.*), or the art of the Himalayan kingdoms.

Rājputāna, also called RĀJWĀR, former group of princely states chiefly comprising what is now Rājasthān state, India. The name means "land of the Rājputs." The area, 132,559 square miles (343,328 square km), consisted of two geographic divisions: the area northwest of the Arāvalli Range, this being mostly sandy and unproductive and including part of the Great Indian (Thar) Desert; and the area southeast of the range, which is generally higher and more fertile. The whole area thus formed a compact block occupying the hill and plateau country between the north Indian plains and the main plateau of peninsular India.

Rājputāna consisted of 23 states, one chiefdom, one estate, and the British district of Ajmer-Merwārā. The majority of ruling princes were Rājputs, warrior rulers of the historic region of Rājputāna, who began to enter the area in the 7th century. The largest states were Jodhpur, Jaisalmer, Bīkaner, Jaipur, and Udaipur. In 1947 the consolidation of states began by stages, as a result of which the state of Rājasthān came into being. Some of Rājputāna's former territory in the southeast is now part of Madhya Pradesh, and some in the southwest is now part of Gujarāt.

Rājshāhi, formerly RAMPUR BOALIA, city, west-central Bangladesh. It lies just north of the Padma (Ganges) River. Selected by the



Government College, Rājshāhi, Bangladesh
Frederic Ohringer from the Nancy Palmer Agency—EB Inc.

Dutch in the early 18th century as the site of a factory (trading post), it was constituted a municipality in 1876. Now an industrial centre, it produces silk, matches, timber, and processed agricultural products. It has a hospital, the Varendra Research Museum, a sericulture institute, and the University of Rājshāhi (1953) and eight affiliated colleges.

To the northwest of Rājshāhi lies an elevated and undulating Bārind region; to the south is the high, well-drained Padma Valley; and a swampy depression carries off the drainage of the land in the immediate vicinity of the city. The chief crops in the area are rice, jute, pulses, and sugarcane. The region's sericulture accounts for almost the entire silk output of Bangladesh. Other cottage industries include weaving, metalworking and woodworking, and pottery. The region is believed to have formed part of the old Puṇḍra, or Pauṇḍravardhana kingdom, the country of the Poḍs, whose capital was at Mahāsthān. Pop. (1981) city, 171,600.

Rakaia River, river in east-central South Island, New Zealand. It rises in the Lyell and Ramsay glaciers of the Southern Alps near Whitcombe Pass. The river flows east and southeast for 90 miles (145 km) before entering Canterbury Bight of the Pacific Ocean through a delta just west of Banks Peninsula. Fed by its principal tributaries, the Mathias and Wilberforce, the river drains a basin 1,000 square miles (2,600 square km) in area. Its lower course crosses the Canterbury Plains, where the river flows in braided channels too shallow for navigation. The name Rakaia (Maori for "to arrange in ranks") may refer to an ancient method employed in fording the stream.

At the sawmilling town of Rakaia, 13 miles (21 km) upstream, the chief South Island rail and road lines cross the Rakaia River on mile-long bridges. Deposits of fine, windblown loess on the lowlands along the lower course yield grain crops, and salmon are taken from the stream. There are hydroelectric stations at Lake Coleridge, and a canal at Highbank brings water from the Rangitata River for hydroelectric generation and irrigation.

Rakhmaninov, Sergey (Vasilyevich) (composer): *see* Rachmaninoff, Sergey (Vasilyevich).

Rakka (Syria): *see* Raqqah, ar-.

Rákóczi, Ferenc, I (b. Feb. 24, 1645—d. July 8, 1676, Makovica, Hung.), scion of a noble Magyar family, and in 1670 a leader of an unsuccessful Hungarian-Croatian revolt against the Habsburgs.

Rákóczi, the son of György Rákóczi II, had been designated (1652) to become prince of Transylvania, but never did reign after his father's death (1660). Ferenc's mother, disregarding György's last wishes, in 1662 induced Ferenc to become a Roman Catholic (as she had been before she turned Calvinist on her marriage to György).

Ferenc Rákóczi I, detail of a painting by an unknown painter of the 17th century; in the Magyar Nemzeti Múzeum, Budapest
By courtesy of the Magyar Nemzeti Muzeum, Budapest

In March 1666 Rákóczi married Ilona, daughter of Péter Zrínyi (Zrinski), bán (governor) of Croatia, and four years later he joined Zrínyi in a conspiracy aimed at ending Habsburg rule in Hungary and Croatia. The insurrection was put down, and Zrínyi was beheaded in 1671. Rákóczi was spared on payment of a ransom, however, through his mother's influence with the Jesuits.

Rákóczi, Ferenc, II (b. March 27, 1676, Borsi, Hung.—d. April 8, 1735, Rodosto, Tur.), prince of Transylvania who headed a nearly successful national rising of all Hungary against the Habsburg empire.

He was born of an aristocratic Magyar family. Both his father and his stepfather had led insurrections against the Habsburgs, and Rákóczi grew up in an atmosphere of fervent Magyar patriotism. He was separated from his mother after the surrender of Munkács to the Austrians (1688) and taken to Vienna and placed in a Jesuit college in Bohemia to be brought up in Austrian ways.

Rákóczi returned to his Hungarian estates in 1694, having forgotten much of his heritage. Encouraged by other Hungarian nobles, however, he came to believe in the Hungarian cause, and, on the eve of the War of the Spanish Succession, he and his fellow magnates sought help from Louis XIV of France. Their intermediary betrayed his trust, and Rákóczi was arrested and imprisoned, escaping death with his wife's help by leaving his cell in disguise. After two years in Poland, he returned in 1703 to put himself at the head of the peasant revolt known as the Kuruc (or Kurucok) rising. He had considerable initial success, but the Anglo-Austrian victory at Blenheim in 1704 destroyed hopes of help from France and of eventual success, though fighting in Hungary continued until 1711.

Meanwhile, the Transylvanians were looking to Rákóczi to restore their independence, electing him prince on July 6, 1704, a major result of which was the destruction of any hopes for compromise with the emperor Leopold I, who was also king of Hungary. France sent no effective aid, Rákóczi's efforts to secure the Russian tsar Peter I's help against Austria failed, his peasant armies suffered further heavy defeats, and finally he left his country forever on Feb. 21, 1711, a few months before the signing of the Peace of Szatmár with Austria.

Ferenc Rákóczi II, detail of a painting by Ádám Mányoki; in the Budapest Museum of Fine Arts
By courtesy of the Budapest Museum of Fine Arts

After seeking refuge in Poland and France, Rákóczi went to Constantinople in 1717 on the invitation of the Sultan to help organize an army against the Austrians. Peace, however, was concluded before he arrived, the Sultan had no use for his services, and Rákóczi lived out his life in exile in Turkey.

Rákóczi, György, I (b. June 8, 1593—d. Oct. 11, 1648, Sárospatak, Hung.), prince of Transylvania from 1630, who, as a champion of Protestantism, fought for and won religious freedom in Hungary and made his principality virtually an independent state.

György was the youngest son of Zsigmond Rákóczi, prince of Transylvania (1607–08). György took a leading part in the campaigns of Transylvania's Prince Gábor Bethlen against the Habsburgs. After Bethlen's death he was elected prince (Nov. 26, 1630) and continued Transylvania's anti-Habsburg policy. In 1644, in alliance with Sweden, he declared war against the Habsburg emperor Ferdinand III and in the Peace of Linz (Dec. 16, 1645) won religious freedom for Protestants in Hungary and gained territory in western Hungary. Rákóczi's capital Gyulafehérvár (now Alba Iulia, Rom.) became a great Protestant centre.

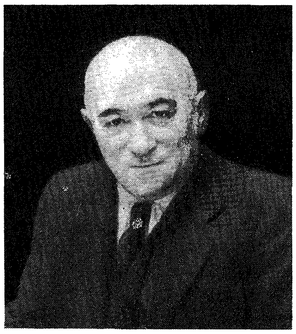
Rákóczi, György, II (b. Jan. 30, 1621, Sárospatak, Hung.—d. June 7, 1660, Nagyvárad, Transylvania, Hung.), prince of Transylvania from 1648, who had the laws of the principality codified, but whose foreign policy led to the restoration of Turkish hegemony over Transylvania.

György Rákóczi II, detail of an engraving by an unknown artist
By courtesy of the National Szechenyi Library, Budapest

György II succeeded his illustrious father György I as prince in 1648 and continued his policy of seeking alliances with the hospodars (lords) of Moldavia to the east and Walachia to the south. In 1656, however, he joined Charles X Gustavus of Sweden in attacking Poland, hoping to be elected Polish king, an act in defiance of the Ottoman Turks, who had suzerainty over Transylvania. The Turks ordered their vassals, the Crimean Tatars, to drive the Transylvanians out of Poland, and in 1657 Rákóczi's forces were forced to beat a hasty retreat. In the same year the Transylvanian diet, on Turkish orders, deposed Rákóczi. When he was reinstated in 1658, the Turks invaded Transylvania in force, and Rákóczi was mortally wounded at the Battle of Gyalu in May 1660.

Rákosi, Mátyás (b. March 14, 1892, Ada, Serbia—d. Feb. 5, 1971, Gorky, Russian S.F.S.R.), Hungarian Communist ruler of Hungary from 1945 to 1956.

An adherent of Social Democracy from his youth, Rákosi returned to Hungary a Communist in 1918, after a period as prisoner of war in Russia. He served as commissar for Socialist production in the short-lived Communist regime of Béla Kun (1919) but, with the triumph of counterrevolution in Hungary, was forced to flee to Moscow. Dispatched in 1924 to reorganize the Hungarian Communist Party, he was arrested by the Hungarian authorities the following year and in 1927 was sentenced to eight and a half years in prison from the date of his arrest. Upon the expiration of his term, he was rearrested and sentenced for life (1934) but in 1940 was allowed to go to Moscow. Returning to Hungary with Soviet troops in 1944, Rákosi became secretary of the Hungarian Workers (Communist) Party and, assisted by the newly organized State Security Police (AVO), soon consolidated political power in his hands. A confirmed Stalinist, he reigned supreme as party chief from 1949 to 1953 (from 1952 also as prime minister); but in July 1953, following Stalin's death, he was forced to relinquish the premiership to the reform-minded Imre Nagy. He remained party secretary, however, and in 1955 was able to effect the dismissal of Nagy, only to be removed himself by Moscow from all party offices the following year in order to placate the Yugoslav leader Marshal Tito, whom he had offended. Rákosi's enduring Stalinism and his subservience to Moscow had made him widely unpopular; and, when revolution broke out in Budapest in October 1956, he fled again to the U.S.S.R.



Rákosi, detail of an oil painting by Joseph M. Csaki, 1951; in the Magyar Munkásmozgalmi Múzeum, Budapest
By courtesy of the Magyar Munkasmozgalmi Muzeum, Budapest

Rakovski, Georgi Sava (b. 1821, Kotel, Rumelia—d. Oct. 20, 1867, Bucharest), revolutionary leader and writer, an early and influential partisan of Bulgarian liberation from Ottoman Turkish rule.

Already a national revolutionary by the age of 16, he participated in an insurrection against the Turks in 1841. Later, as an employee of the Turkish war ministry during the

Crimean War (1853–56), he secretly organized an armed revolt in Bulgaria. Arrested and sentenced to death, he escaped abroad to Serbia, Romania, and Russia, where he sought European support for Bulgarian liberation and published journals. Meeting with indifference, he addressed his revolutionary appeals to his Bulgarian countrymen. Though his radical, violent schemes cost him conservative support, his leadership gave the first real impetus to the Bulgarian independence movement, and his journalistic and literary work especially won young Bulgarians to the national cause.

Rakovsky, Khristian Georgiyevich (b. Aug. 13, 1873, Kotel, Bulg.—d. after 1938), Bulgarian revolutionary who conducted subversive activities in Romania before joining the Russian Bolshevik Party and becoming a leading political figure in Soviet Russia.

The grandson of the Bulgarian revolutionary Georgi Rakovski, he became involved in socialist activities and was forbidden to attend the university at Sofia (1890). At Montpellier, Fr., he earned a medical degree, and, under the pseudonym of Insarov, he contributed articles to *Iskra* and *Pravda,* the Russian revolutionary newspapers.

Upon his return to Romania, Rakovsky organized a socialist party and was twice arrested and imprisoned. After the Russians released him (May 1, 1917), Rakovsky became a member of V.I. Lenin's Bolshevik Party; when it seized power (October Revolution), he was elected to its central committee (1919) and also was made chairman of the Council of People's Commissars of the Ukraine (1919).

As he became more closely associated with the interests of the Ukraine, he became an advocate of real autonomy for the non-Russian nationality groups under Soviet rule. Consequently, he clashed with the increasingly powerful Joseph Stalin, who was organizing the Soviet Union into a tightly centralized, Russian-dominated state. After a sharp disagreement on this issue at the Twelfth Party Congress (1923), Rakovsky was removed from his position in the Ukraine and appointed the Soviet chargé d'affaires in London. In 1926 he became the Soviet ambassador to France.

In December 1927, however, Rakovsky was expelled from the Communist Party for his anti-Stalin, pro-Leon Trotsky views and banished first to Astrakhan, then to Kazakhstan. He formally renounced his views—the last member of the Trotskyite opposition to do so—only in 1934 after Adolf Hitler had risen to power in Germany.

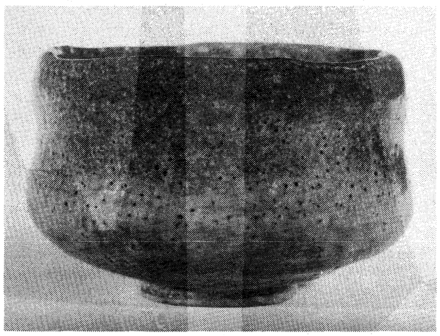
The following year he was reinstated in the party and given the post of a departmental chief in the Commissariat of Health. But he was soon dismissed (1937) and arrested (February 1938). Appearing with 20 other defendants at the third show trial of the Great Purge, Rakovsky was found guilty of fabricated charges and sentenced to 20 years' hard labour (March 1938). It is presumed that he died in a Soviet labour camp.

rakshasa, Sanskrit (male) RĀKṢASA, or (female) RĀKṢASĪ, in Hindu mythology, a type of demon or goblin. Rakshasas have the power to change their shape at will and appear as animals, as monsters, or in the case of the female demons, as beautiful women. They are most powerful in the evening, particularly during the dark period of the new moon, but they are dispelled by the rising sun. They especially detest sacrifices and prayer. Most powerful among them is their king, the 10-headed Rāvaṇa (*q.v.*). Pūtanā, a female demon, is well known for her attempt to kill the infant Krishna by offering him milk from her poisoned breast; she was, however, sucked to death by the god.

Not all rakshasas are equally evil; some are more akin to yakshas, or *yakṣas* (nature spirits), while others are similar to asuras, the traditional opponents of the gods. The term rakshasa, however, generally applies to those demons who haunt cemeteries, eat the flesh of men, and drink the milk of cows dry as if by magic.

They are vigorously depicted in Rajasthani paintings illustrating the *Rāmāyaṇa* ("Romance of Rāma"). The canons of sculpture instruct the artist to carve them with a terrifying appearance, complete with fearful side tusks, ugly eyes, curling awkward brows, and carrying a variety of horrible weapons.

raku ware, Japanese lead-glazed earthenware, originally invented expressly for the tea ceremony in 16th-century Kyōto. Quite distinct from wares that preceded it, raku represents an attempt to arrive at a new kind of beauty by deliberate repudiation of existing forms.



Raku tea bowl with pockmarked, crackled glaze, Edo-Meiji period, 19th century(?); in the Royal Ontario Museum, Toronto

By courtesy of the Royal Ontario Museum, Toronto, Canada

The shape of the vessels is extremely simple: a wide, straight-sided bowl set on a narrow base. Because raku wares are molded entirely by hand rather than thrown on a wheel, each piece clearly expresses the individuality of the maker's hand; and pieces tend to be unique creations. The glaze colours include dark brown, light orange-red, straw colour, green, and cream.

The most significant fact about raku pottery is the technique: instead of warming and maturing the pottery in a cold kiln, glazed ware is placed in a hot kiln for only about one hour, then removed and forced to cool rapidly at air temperature. The process subjects the pottery to extreme stress and creates unique effects throughout the glaze and, sometimes, in the pottery itself. Reduction firing, in which the hot pottery is placed in a flammable substance to deprive the surface of oxygen, increases the chance aspects and dramatic surface variation of the glaze. Chance and process are the key elements in the raku aesthetic.

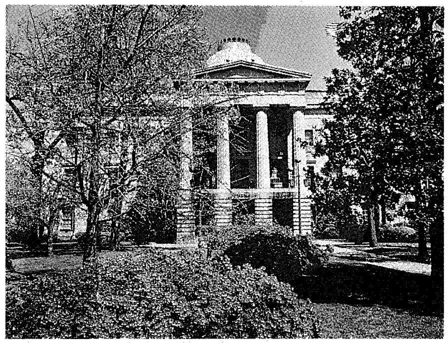
Rakushisha: *see* Mukai Kyorai.

Ralbag: *see* Levi ben Gershom.

Ralegh, Sir Walter: *see* Raleigh, Sir Walter.

Raleigh, city, capital of North Carolina, U.S., and seat (1771) of Wake county. The site was selected in 1788, and the city was laid off from a tract of forest in 1792, soon after the American Revolution, when North Carolina, like several other of the original states, moved its capital westward from the seaboard. It was named for Sir Walter Raleigh. The first capitol, completed in 1794, burned in 1831 and was replaced by the present building, completed in 1840. It stands in the middle of a 4-acre (1.6-hectare) square and is considered an outstanding example of Greek Revival architecture. Capitol Square is surrounded by various state buildings.

The city is an educational centre and is the site of North Carolina State University (1887), Shaw University (1865), and Meredith (1891), St. Augustine's (1867), St. Mary's (1842), and Peace (1857) colleges. The city is part of North Carolina's Research Triangle, a three-county area of cultural, scientific, and educational activities. Research Triangle Park, near Raleigh, embraces 4,000 acres (1,600 hectares) devoted entirely to research facilities. The North Carolina Museum of Art is also in Raleigh. The home in which Andrew Johnson, 17th president of the United States, was born in 1808, is preserved as a historic shrine.



The capitol building in Raleigh, N.C.

By courtesy of the North Carolina Department of Natural and Economic Resources

Raleigh is a major retail shipping point for eastern North Carolina, and it is a wholesale distributing point for food stores. After World War II the city attracted numerous factories manufacturing a wide variety of products, including electronic equipment and computers and processed foods, and it is a research and development centre for textiles and chemicals. A number of insurance companies have their home offices or regional headquarters there. Inc. 1795. Pop. (1988 est.) city, 188,308; Raleigh–Durham MSA, 683,500.

Raleigh, Sir Walter, Raleigh also spelled RALEGH (b. 1554?, Hayes Barton, near Budleigh Salterton, Devon, Eng.—d. Oct. 29, 1618, London), English adventurer and writer, a favourite of Queen Elizabeth I, who knighted him in 1585. Accused of treason by Elizabeth's successor, James I, he was imprisoned in the Tower of London and eventually put to death.

Raleigh was a younger son of Walter Raleigh (died 1581) of Fardell in Devon, by his third wife, Katherine Gilbert (*née* Champernowne). In 1569 he fought on the Huguenot (French Protestant) side in the Wars of Religion in France and later is known to have been at Oriel College, Oxford (1572), and at the Middle Temple law college (1575). In 1580 he

Sir Walter Raleigh, engraving by Simon Pass from the title page of the first edition of Raleigh's *History of the World,* 1614

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

fought against the Irish rebels in Munster, and his outspoken criticism of the way English policy was being handled in Ireland brought him to the attention of Queen Elizabeth. By 1582 he was the reigning favourite and began to acquire lucrative monopolies, properties, and influential positions. His Irish service was rewarded by vast estates in Munster. In 1583 the Queen secured him a lease of part of Durham House in the Strand, London, where he had a monopoly of wine licenses (1583) and of the export of broadcloth (1585), and he became warden of the stannaries (the Cornish tin mines), lieutenant of Cornwall, vice admiral of Devon and Cornwall, and frequently sat as a member of Parliament. In 1587, two years after he had been knighted, Raleigh became captain of the queen's guard. His last appointment under the crown was as governor of Jersey (one of the Channel Islands) in 1600.

In 1592 Raleigh acquired the manor of Sherborne in Dorset. He wanted to settle and found a family. His marriage to Elizabeth, daughter of Sir Nicholas Throckmorton, possibly as early as 1588, had been kept a secret from the jealous queen. In 1592 the birth of a son betrayed him, and he and his wife were both imprisoned in the Tower of London. Raleigh bought his release with profits from a privateering voyage in which he had invested, but he never regained his ascendancy at court. The child did not survive; a second son, Walter, was born in 1593 and a third son, Carew, in 1604 or 1605.

As a favourite, Raleigh was not popular. His pride and extravagant spending were notorious, and he was attacked for unorthodox thought. A Jesuit pamphlet in 1592 accused him of keeping a "School of Atheism," but he was not an atheist in the modern sense. He was a bold talker, interested in skeptical philosophy, and a serious student of mathematics as an aid to navigation. He also studied chemistry and compounded medical formulas. Some scholars have linked "School of Atheism" with a vaguely similar phrase, the "School of Night," which occurs in *Love's Labour's Lost,* and have read Shakespeare's play as a satire on Raleigh.

Raleigh's breach with the Queen widened his personal sphere of action. Between 1584 and 1589 he had tried to establish a colony near Roanoke Island (in present North Carolina), which he named Virginia; but he never set foot there himself. In 1595 he led an expedition to what is now Guyana, in South America, sailing up the Orinoco River in the heart of Spain's colonial empire. He described the expedition in his book *The Discoverie of Guiana* (1596). Spanish documents and stories told by Indians had convinced him of the existence of Eldorado, a fabulous city of gold in the interior of South America. He did locate some gold mines, but no one supported his project for colonizing the area. In 1596 he went with Robert Devereux, earl of Essex, on an unsuccessful expedition against the Spanish city of Cádiz, and he was Essex' rear admiral on the Islands voyage, in 1597, an expedition to the Azores.

Raleigh's aggressive policies toward Spain did not recommend him to the pacific king James I (reigned 1603–25). His enemies worked to bring about his ruin, and in 1603 he and others were accused of plotting to dethrone the King. Raleigh was convicted on the written evidence of Henry Brooke, Lord Cobham, and, after a last-minute reprieve from the death sentence, was consigned to the Tower. He fought to save Sherborne, which he had conveyed in trust for his son, but a clerical error invalidated the deed. In 1616 he was released but not pardoned. He still hoped to exploit the wealth of Guyana, arguing that the country had been ceded to England by its native chiefs in 1595. With the King's permission, he financed and led a second expedition there, promising to open a gold mine without offending Spain. A severe fever prevented his leading his men upriver. His lieutenant, Lawrence Kemys, burned a Spanish settlement but found no gold. Raleigh's son Walter died in the action. King James invoked the suspended sentence of 1603, and in 1618, after writing a spirited defense of his acts, Raleigh was executed.

Popular feeling had been on Raleigh's side ever since 1603. After 1618 his occasional writings were collected and published, often with little discrimination. The authenticity of some minor works attributed to him is still unsure. Some 560 lines of verse in his hand are preserved. They address the Queen as Cynthia and complain of her unkindness, probably with reference to his imprisonment of 1592. His best known prose works in addition to *The Discoverie of Guiana* are *A Report of the Truth of the fight about the Iles of Açores this last Sommer* (1591; generally known as *The Last Fight of the Revenge*) and *The History of the World* (1614). The last work, undertaken in the Tower, proceeds from the creation to the 2nd century BC. In the work history is shown as a record of God's providence, a doctrine that pleased contemporaries and counteracted the charge of atheism. King James was meant to note the many warnings that the injustice of kings is always punished.

Raleigh survives as an interesting and enigmatic personality rather than as a force in history. He can be presented either as a hero or as a scoundrel. His vaulting imagination, which could envisage both North and South America as English territory, was supported by considerable practical ability and a persuasive pen, but some discrepancy between the vision and the deed made him less effective than his gifts had promised. (A.M.C.L.)

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Biographies. William Oldys, *The Life of Sir Walter Ralegh* (1736, reprinted 1829), was the first reputable biography; Edward Edwards, *Life . . . ,* 2 vol. (1868), is well documented and includes a large collection of letters. See also William Stebbing, *Sir Walter Ralegh,* 2nd ed. (1899), a most valuable study; Philip Ahier, *The Governorship of Sir Walter Ralegh in Jersey, 1600–1603* (1971), a learned biographical study; and Robert Lacey, *Sir Walter Ralegh* (1974), a well-balanced, general account.

Raleigh, Sir Walter (Alexander) (b. Sept. 5, 1861, London—d. May 13, 1922, Oxford), Scottish man of letters and critic who was a prominent figure at the University of Oxford in his time.

He held the chair of modern literature at Liverpool (1889–1900) and of English at Glasgow and was appointed Oxford's first professor of English literature in 1904. Raleigh was a brilliant and stimulating talker and lecturer and became the centre of the Oxford English school, which had not been established until 1894. His books (*Style,* 1897; *Wordsworth,* 1903; *Shakespeare,* 1907; *Six Essays on Johnson,* 1910) are the essays not of an exact scholar but of an urbane critic, sensitive without eccentricity, synthetic rather than analytic. He was knighted in 1911.

Rallidae, the rail family, a bird family that includes the species known as rail, coot, crake, and gallinule (*qq.v.*).

rally driving, rally also spelled RALLYE, automobile racing over a specified public route with a driver and navigator attempting to keep to a predetermined schedule between checkpoints. The course is generally unknown to contestants until the start of the race. Such racing began in 1907 with a Peking-to-Paris race of about 12,000 km (7,500 mi). The Monte-Carlo rally, with various starting points, began in 1911 and continued thereafter except for wartime interruptions. Rallies became very popular after World War II in Europe and elsewhere, and international competitions were instituted. Weekend rallies came to be common worldwide, ranging from those held by local clubs to events sponsored by larger organizations. The longest rally held regularly, at up to 6,234 km (3,874 mi), is the East African Safari, first run in 1953. The longest rally was the London-to-Sydney rally in 1977, about 31,107 km (19,239 mi). For winners of various international rallies, *see* Sporting Record: *Automobile racing.*

Rally for the Republic, byname GAULLISTS, or GAULLISTES, French RASSEMBLEMENT POUR LA RÉPUBLIQUE (RPR), French political party formed by Jacques Chirac in 1976 and presuming to be heir to the traditions of Charles de Gaulle. It was the direct successor to the Gaullist coalitions, operating under various names over the years, that had dominated the political life of the Fifth Republic under presidents de Gaulle (1958–69) and Georges Pompidou (1969–74).

The antecedents of the party trace to 1947, when de Gaulle organized the Rally of the French People (Rassemblement du Peuple Français), originally conceived as a means by which de Gaulle might regain office without having to participate in party politics. It was thus at first organized as an extraparliamentary body in the hope that it might attract the support of sections of other parties and of the electorate by seeming to be above politics and partisan squabbling. In the 1951 general election, RPF candidates won more seats in the National Assembly than did any of the other five major groups. It remained only a faction, however, and in 1953 de Gaulle released his deputies.

From 1953 until 1958 the Gaullists were organized in numerous small groups. In the latter year de Gaulle came to power as the only figure capable of resolving the national crisis over Algeria; his victory did not result from party politicking. His supporters coalesced into three main groups, of which the Union for the New Republic (Union pour la Nouvelle République; UNR) emerged as the most important and electorally successful, gaining 26 percent of the vote in the 1958 election.

In 1962 the UNR formed an alliance with left-wing Gaullists of the Democratic Union of Labour (Union Démocratique du Travail), and in 1967 the two parties merged and drew in other splinter groups. After the 1968 elections, in which it won an absolute majority of parliamentary seats, this grouping assumed the name Union of Democrats for the Republic (Union des Démocrates pour la République), a name that prevailed until 1976.

The party's majority slipped to a plurality in the 1974 elections, in which its presidential candidate lost. Chirac, a Gaullist, became premier under the presidency of Valéry Giscard d'Estaing (of the Republicans) but resigned in 1976 in a clash of personalities. Chirac then reconstituted the Gaullists under the title Rally for the Republic, under his firm control.

Ralov, Kirsten, *née* GNATT (b. March 26, 1922, Baden bei Wien, Austria), Danish dancer, ballet teacher, and associate director of the Royal Danish Ballet.

Ralov began studying in Vienna but soon moved with her Danish parents to Copenhagen, where she was accepted (1928) into the Royal Danish Ballet School with her brother, Poul Gnatt. Ralov joined the company (1940) and was one of its leading dancers until 1962. While there, she restaged a number of the ballets of the company's one-time director, August Bournonville, for which she was made a Knight of the Order of Dannebrog (1952). After accepting an invitation from Ted Shawn to appear in the Jacob's Pillow Festival in 1955, she toured the world, spreading the Bournonville technique of dancing and mime.

Upon Flemming Flindt's resignation as director of the Royal Danish Ballet (1977), Ralov and Henning Kronstam became the company's associate directors. With their guidance the company flourished, visiting China in 1979 and the United States in 1980. Ralov released a record, *The Bournonville School*, and wrote a four-volume book of the same title (1979).

Ralph OF COGGESHALL (b. Cambridgeshire, Eng.—d. after 1227), English chronicler of the late 12th and early 13th centuries.

Ralph was a monk of the Cistercian abbey at Coggeshall, Essex, and abbot there from 1207 until 1218, when he resigned because of ill health. The abbey already possessed its own *Chronicon Anglicanum,* beginning at 1066, the year of the Norman conquest of England; Ralph continued this chronicle from 1187 to 1224. He also wrote some short annals covering the whole period from 1066 to 1223 and continued from 1162 to 1178 the chronicle of Ralph Niger (believed to have been archdeacon of Gloucester).

Ralph of Coggeshall's writings were published in *Radulphi Nigri chronicon ab initio mundi ad A.D. 1199* (ed. Robert Anstruther, 1851) and *Radulphi de Coggeshall chronicon Anglicanum* (ed. Joseph Stevenson, 1875).

Ralston Purina Company, American corporation, until 1986 the world's largest producer of pet foods and commercial feeds for livestock, poultry, and other animals. (The company sold its domestic feed business in 1986.) It has also produced soybean products and such foods as cereals, crackers, candy, mushrooms, and processed poultry. Its nonfood ventures include industrial parks. The company's chief trademark is the checkerboard symbol. Headquarters are on Checkerboard Square in St. Louis, Mo.

The company—initially called the Robinson-Danforth Commission Company—was founded in St. Louis in 1894 by William H. Danforth, George Robinson, and William Andrews and at first produced and sold horse and mule feeds. In 1898 Danforth, president of the company, launched a cracked-wheat cereal that became known as Ralston Whole Wheat Cereal (after Dr. Albert Wester Edgerly, known as "Dr. Ralston," a well-known health promoter of the 1890s). In 1902 the company's name was changed to Ralston Purina Company. Over the years, products were steadily diversified and sold throughout the United States and, from 1957, overseas.

ram, appurtenance fixed to the front end of a fighting vessel and designed to damage enemy ships when struck by it. It was possibly first developed by the Egyptians as early as 1200 BC, but its importance was most clearly emphasized in Phoenician, Greek, and Roman galleys (seagoing vessels propelled primarily by oars).

The ram enjoyed a brief revival in naval warfare in the mid-19th century, notably in the American Civil War and the Austro-Italian War of 1866. Rams were mounted on armoured, steam-propelled warships and used effectively against wooden sailing ships. Improvements in naval ordnance and the declining use of sails soon made the ram obsolete. *See also* battering ram.

Ram, Jagjivan (b. April 5, 1908, Chandwa, near Arrah, India—d. July 6, 1986, New Delhi), Indian politician and spokesman for the untouchables, the lowest caste in India.

Ram was born into an untouchable family and was among the first of his caste to receive a higher education. He attended Benares Hindu University and Calcutta University (B.Sc., 1931), becoming a member of Mohandas K. Gandhi's Congress Party in 1931. He helped to found (1935) the All-India Depressed Classes League, an organization dedicated to attaining equality for untouchables. During the late 1930s he also was elected to a position in the Bihar government and helped organize a rural labour movement. Jailed twice in the early 1940s for his political activities, Ram in 1946 became the youngest minister in Jawaharlal Nehru's provisional government. He held the Labour portfolio until 1952. Thereafter he held the posts of minister for communications (1952–56), for transport and railways (1956–62), and for transport and communications (1962–63). Ram supported Indira Gandhi's bid for office, and, when in 1966 she succeeded Lal Bahadur Shastri to the office of prime minister, Ram was appointed minister for labour, employment, and rehabilitation (1966–67). He served as minister for food and agriculture (1967–70), and in 1970 he was made minister of defense. During his tenure in that office, India helped to establish the independent state of Bangladesh. From 1974–77 Ram was minister for agriculture and irrigation. Although he initially supported Prime Minister Gandhi's declaration (1975) of a state of emergency, in 1977 Ram and five other politicians resigned from the Cabinet and formed a new political party. Disappointed that he was not chosen prime minister, Ram once again accepted the post of minister of defense (1977–79). He remained a member of Parliament until his death.

Rām Allāh, town, central Palestine, adjacent to the town of al-Bīrah (east) and north of Jerusalem. Previously in Jordan, Rām Allāh (Arabic: "Height of God") has since the Six-Day War of 1967 been under Israeli administration as part of the West Bank territory. An ancient settlement, it has buildings incorporating masonry from the time of Herod the Great (reigned 37–4 BC), but no complete structure antedates the Crusades of the 11th century AD.

Situated on the crest of the Judaean Hills, at an elevation of 2,861 feet (872 m) above sea level, Rām Allāh has fine summer breezes and has long been a popular Arab resort. The surrounding area is fertile; olives and viticulture are important. Birzeit University was founded at Rām Allāh in 1924.

Just south of the built-up area is the important *tall* (stratified mound with successive layers of ancient settlements) of Tel Mizpe (Hebrew: "Outlook Hill"; Arabic: Tall al-Nasbeh). It is the probable site of biblical Mizpah.

The demographic makeup of the town changed drastically between 1948 and 1967; formerly Rām Allāh was predominantly Christian and twice as large as al-Bīrah, a Muslim town. According to the special census of the West Bank taken by Israel in 1967, Rām Allāh's population was 12,134, only slightly more than half Christian, while al-Bīrah, including a large refugee camp, was 13,037. Pop. (1984 est.) Rām Allāh and al-Bīrah, 50,000.

Rām Dās, also called BHĀĪ JEṬHĀ (b. 1534, Lahore, Punjab, India—d. 1581, Goindwal), fourth Sikh Gurū and founder of the great Sikh centre of Amritsar, now headquarters or capital of the religion.

Rām Dās continued as Gurū (1574–81) the missionary endeavour begun by his predecessor, Amar Dās. On land given to him by the Mughal emperor Akbar, he built a holy tank or pool; then, wishing to build a community around it, he invited businessmen and traders to settle there. The town was first named Rāmdāspur and then Amritsar. Following the tradition of his saintly forerunners, Rām Dās urged Emperor Akbar to punish graft among his officials and to endow charitable undertakings of all kinds. He was noted for his humility, piety, and service to others. Shortly before the death of Rām Dās, his son Arjun succeeded him as Gurū.

Rām Rāiyā, member of a group of dissenters within Sikhism, a religion of India. The Rām Rāiyās are descendents of Rām Rāī, the eldest son of Gurū Har Rāī (1630–61), who was sent by his father as an emissary to the Mughal capital at Delhi. There he won the confidence of the emperor Aurangzeb but the displeasure of his own father, who when choosing the next Sikh Gurū passed over Rām Rāī in favour of his younger brother Hari Krishen. A few Rām Rāiyā *gurdwārās* (Sikh houses of worship) are maintained in Dehra Dūn (Uttar Pradesh state) on land given Rām Rāī by Aurangzeb.

Ram Singh (b. 1816, Bhaini, Punjab, India—d. 1885, Mergui, Burma), Sikh philosopher and reformer and the first Indian to use noncooperation and boycott of British merchandise and services as a political weapon.

Ram Singh was born into a respected small-farming family. As a boy, Ram Singh became a disciple of Balak Singh, the founder of the austere Nāmdhārī movement, from whom he learned of the great Sikh Gurūs and heroes and of the Khālsā (Sikh military brotherhood). Balak Singh appointed him leader of the Nāmdhārīs upon his death.

At the age of 20 Ram Singh entered the army of the Sikh maharaja Ranjit Singh. Three years later, on the death of Ranjit Singh, the mainstay of the Sikhs, his army and domain fell apart. Worried about British power and Sikh weakness, Ram Singh determined to help Sikhs regain their self-respect. He introduced new practices among the Nāmdhārīs, who came to be called Kūkās (from Punjabi *kūk,* "scream," or "cry") because of the shrieks they emitted after the frenzied chanting of hymns. His sect was more puritanical and fundamental than other Sikh sects were. Nāmdhārīs wore white, handwoven robes, bound their turbans in a distinctive way, carried wooden staves and rosaries of wood, and used special greetings and passwords. Their *gurdwārās* ("temples") were Spartan in their simplicity.

Ram Singh instilled a sense of worth and dignity into his disciples (nearly all of humble origin) by telling them they were the elite of God and that other sects were *mleccha* ("unclean"). His private army even had its own couriers, in order to boycott the British postal service and to prevent messages from falling into enemy hands.

In 1863 Ram Singh attempted a grand gesture; his followers were to meet him at Amritsar (the Sikh holy city), where he would proclaim himself the reincarnation of Gurū Gobind Singh and declare that he had come to form a new Kūkā Khālsā. The police intervened, however, and Ram Singh was restricted to his native village for an indefinite period. As the years passed and his prophecy of breaking British rule remained unfulfilled, internal trouble broke out. Realizing they were no match for British power, the Kūkās began to attack the Muslim community.

Following a particularly bloody incident, armed bands of Sikhs attacked Māler Kotla, a Muslim community, and a large number of the attackers were captured by the British. This attack was particularly heinous to other Sikhs because relations with Māler Kotla and its inhabitants had been friendly since 1705, when its leaders interceded with the Mughal emperor Aurangzeb in an attempt to save the sons of Gobind Singh from execution. The British, sensing that this was no mere bandit raid but the start of a revolt in the Punjab, dealt with the Kūkās in a barbarous way: the prisoners were bound over the mouths of cannons and blown to bits.

Thereafter, Ram Singh even appealed to Russia for aid in driving the British out of India, but Russia, not wishing to risk war with Great Britain, refused. Ram Singh spent the remainder of his days in prison and exile. After his release from prison, he was exiled to Rangoon, where he lived for almost 14 years as a state prisoner.

Where the same name may denote a person, place, or thing, the articles will be found in that order

Rāma, one of the most widely worshipped Hindu deities, the embodiment of chivalry and virtue. Although there are three Rāmas mentioned in Indian tradition (Paraśurāma, Balarāma, and Rāmacandra), the name is specifically associated with Rāmacandra, the seventh incarnation (*avatāra*) of Lord Vishnu (Viṣṇu). It is possible that Rāma was an actual historical figure, a tribal hero of ancient India who was later deified. His story is told briefly in the *Mahābhārata* ("Great Epic of the Bharata Dynasty") and at great length in the *Rāmāyaṇa* (*q.v.*; "Romance of Rāma").

References to Rāma as an incarnation of Vishnu appear in the early centuries AD; there was, however, probably no special worship of him before the 11th century, and it was not until the 14th and 15th centuries that distinct sects appeared venerating him as the supreme god (*see* Rāmānanda). Rāma's popularity was increased greatly by the retelling of the Sanskrit epics in the vernaculars, such as Tulsīdās' celebrated Hindi version, the *Rāmcaritmānas* ("Sacred Lake of the Acts of Rāma").

Rāma and Krishna (also an incarnation of Vishnu) were the two most popular recipients of adoration from the bhakti (devotional) cults that swept the country during that time. Whereas Krishna is adored for his mischievous pranks and amorous dalliances, Rāma is conceived as a model of reason, right action, and desirable virtues. Temples to Rāma faced by shrines to his monkey devotee Hanumān are widespread throughout India. Rāma's name is a popular form of greeting among friends ("Rām! Rām!"), and Rāma is the deity most invoked at death.

Rāma and Lakṣmaṇa attended by Hanumān in the forest, detail of relief inspired by the *Rāmāyana*, from Nācnā Kuṭhārā, Madhya Pradesh, 5th century AD

P. Chandra

In sculpture, Rāma is represented as a standing figure, holding an arrow in his right hand and a bow in his left. His image in a shrine or temple is almost invariably attended by figures of his wife Sītā, his favourite half-brother Lakṣmaṇa, and his monkey devotee Hanumān. In painting, he is depicted dark in colour (indicating his affinity with Lord Vishnu), with princely adornments and the *kirīṭa-makuṭa* (tall conical cap) on his head indicating his royal status. Rāma's exploits were depicted with great sympathy by Rajasthani and Pahari, both of whom were painters of the 17th and 18th centuries.

Rama, posthumous name of kings of Siam, grouped below chronologically and indicated by the symbol •.

• **Rama I,** also called PHRAPHUTTHAYOTFA CHULALOK (b. March 21, 1737, Ayutthaya, Siam—d. Sept. 7, 1809, Bangkok), Siamese king (1782–1809) and founder of the Chakkri dynasty (*q.v.*), which reigns in Thailand.

Rama I was the son of a high court official and his part-Chinese wife. At the time of the Burmese invasion of 1766–67, he was serving as chief judge in Rat Buri province. After the fall of Ayutthaya (1767), the Thai capital, he joined the service of Taksin and soon became the new king's minister of the northern provinces (Chao Phraya Chakkri) and most effective general. He spent most of the next decade leading Thai armies in the field that repelled the Burmese and established Siamese suzerainty over Laos, Cambodia, and the northern Malay states. Early in 1782 a rebellion in the capital brought him back from campaigns in Cambodia to assume the throne of Siam on April 6.

As king, Rama I moved the capital to Bangkok and undertook a thorough renovation of all the institutions of public life. He was particularly effective in strengthening the Buddhist monkhood, for whom he convened a general synod to define the orthodox Buddhist scriptures (1788–89); and he undertook the first complete codification of Thai law (1805). He strengthened the administrative system to control a newly extensive empire, and he established Thai military supremacy throughout the central portion of the Indochinese peninsula. Rama I was a lavish patron of literature and sponsored the first full Thai version of the Indian epic *Rāmāyaṇa* (Thai: *Ramakien*) and translations of literary works from Chinese, Mon, Persian, and Javanese.

The king's reign title was Phraphutthayotfa Chulalok: Rama I is the title posthumously conferred upon him by King Vajiravudh.

• **Rama II,** also called PHRAPHUTTHALOETLA NAPHALAI (b. Feb. 24, 1768, Rat Buri—d. July 21, 1824, Bangkok), the second ruler (1809–24) of the present Chakkri dynasty, under whose rule relations were reopened with the West and Siam began a forward policy on the Malay peninsula. A gifted poet and dramatist, Rama II wrote a famous version of *Inao*, dramatic version of a popular traditional story, as well as episodes of the *Ramakien* and popular dance dramas such as *Sang Thong*.

• **Rama III,** also called PHRANANGKLAO (b. March 31, 1788, Bangkok—d. April 2, 1851, Bangkok), king of Siam (1824–51) who made Siam's first tentative accommodations with the West, and under whom the country's boundaries reached their maximum extent.

Rama III was the eldest son of King Rama II by a royal concubine, and in his youth he was given responsibility for overseeing foreign trade and relations. On his father's death in 1824, Rama III was much older and more experienced than his younger brother Mongkut (*q.v.*; who because he was born of a queen had a stronger claim on the throne), and the accession council chose him to succeed to the throne. His earlier experience enabled him to withstand British demands presented by the Burney mission (1826) and conclude a treaty that established regular trade with the West but yielded none of Siam's independence.

In the 1830s and '40s Rama III was preoccupied mainly with Laos and Cambodia and intervened in the latter to forestall colonization by the Vietnamese. Recognizing the strong claims of Mongkut to the throne, Rama III refrained from naming an heir apparent, and Mongkut succeeded him in 1851, as the kingdom headed for a new confrontation with the West.

• **Rama IV:** *see* Mongkut.

• **Rama V:** *see* Chulalongkorn.

• **Rama VI:** *see* Vajiravudh.

• **Rama VII:** *see* Prajadhipok.

• **Rama VIII:** *see* Ananda Mahidol.

• **Rama IX:** *see* Bhumibol Adulyadej.

Ramaḍān, in Islām, the holy month of fasting, the ninth month of the Muslim year, in which "the Qur'ān was sent down as a guidance for the people" (Qur'ān 2:185).

In its religious function, the month is similar to the Jewish Yom Kippur inasmuch as both constitute a period of atonement; Ramaḍān, however, is seen less as atonement and more as an obedient response to a command from God. Muslim ordinance prescribes abstention from food, drink, and sexual intercourse from dawn until dusk throughout the month. The beginning and end of Ramaḍān are announced when one trustworthy witness testifies before the authorities that the new moon has been sighted; a cloudy sky may, therefore, delay or prolong the fast.

In the Qur'ān, the development of the Ramaḍān fast, which is one of the five Pillars, or basic institutions, of Islām, may be traced from the injunction to fast on 'Āshūrā' (*q.v.*), the 10th of Muḥarram, probably once identical with the Jewish Day of Atonement. This injunction was abrogated by a command to fast during Ramaḍān (2:184).

Rāmadatta (Hindu philosopher): *see* Rāmānanda.

Ramādī, ar-, capital of al-Anbār *muḥāfaẓah* (governorate), central Iraq. It lies on the Euphrates River just northwest of Hawr (Lake) al-Ḥabbānīyah. Ancient settlements existed in the vicinity, but ar-Ramādī was founded only in 1869 to encourage settlement by the nomadic Dulaym tribes, a goal that has been partially fulfilled. The town prospered after becoming the departure point of a trade route across the desert to Amman and Damascus. A military engagement occurred there in 1917, during World War I, when British forces defeated the Ottomans. A dam across the Euphrates there was completed in 1955. Pop. (1970 est.) 79,488.

Ramadier, Paul (b. March 17, 1888, La Rochelle, Fr.—d. Oct. 14, 1961, Rodez), first premier (January–November 1947) of the Fourth Republic of France.

After receiving his doctorate in law from the University of Paris, Ramadier became an advocate at the Paris Court of Appeals. He became mayor of Decazeville in 1919 and represented Villefranche-de-Rouergue in the Chamber of Deputies from 1928 to 1940. In 1936–37 Ramadier served in the public works ministry in Léon Blum's first Cabinet. During 1938–40, Ramadier served as minister of labour in the cabinets of Camille Chautemps and Édouard Daladier. Refusing to support the Vichy regime during World War II, Ramadier worked for the Résistance.

With the formation of the first government of the Fourth Republic under a new constitution in 1947, Ramadier was appointed premier, and he subsequently formed a left-of-centre coalition government. His government proved barely able to cope with a succession of postwar crises involving food shortages, labour unrest, native resistance to French colonialism in Indochina, and squabbles between the Communists and other coalition members. Ramadier resigned in response to the growing loss of support for his government.

From 1952 to 1955 he served as president of the International Labour Bureau, and for a short time in 1956 he held the post of minister of finance under Guy Mollet.

Ramakrishna, also called GADADHAR CHATTERJI, or GADADHAR CHATTOPADHYAYA (b. Feb. 18, 1836, Hooghly, Bengal state, India—d. Aug. 16, 1886, Calcutta), Hindu religious leader, perhaps the best known example in modern times of a man who demonstrated

Ramakrishna, photographed about 1881
By courtesy of the Information Service of India, London

by personal example the essential unity of all religions.

Son of a poor Brahman family, he had little formal schooling. All his life he spoke a coarse dialect of Bengali and knew neither English nor Sanskrit. At the age of 23 he was married to Sarada-devi, age five; the marriage was never consummated, because one of his principles was celibacy. Sarada-devi later was deified and is still considered a saint by the Ramakrishna sect, which calls her the Divine Mother.

When he was offered the opportunity for an education by his eldest brother, Ramkumar, a noted Sanskrit scholar, Ramakrishna declined. He wanted no "mere bread-winning education." Rather than learning about God from books, he wished to *realize* him through the way he lived and worshipped. Moderation was alien to his nature, and he oscillated between exaltation and deepest gloom. He became God-intoxicated at the age of seven, apparently falling into a mystical trance. So much legend surrounds him as a revered figure, however, that the true man is somewhat obscured. Only the essence of his philosophy is quite clear.

Ramakrishna fought against sexual passion and money. He believed that those twin evils caused men to fail in achieving spiritual enlightenment. Later in life, his objection to gold became so intense that it was said to have an allergic effect upon him, and finally he could not touch metal of any kind. He rejected the idea of caste, repudiating any kind of artificial social division.

He viewed Kālī, the Hindu goddess of creation and destruction, as the supreme manifestation of God. He called her the Divine Mother and worshipped her upon becoming a priest at a temple devoted to her near Calcutta. He wept for hours at a time and felt a burning sensation all over his body while imploring Kālī to reveal herself to him. Some attributed his condition to possession, madness, or a nervous disorder, but exorcism and available medical treatments had no effect. Eventual visions of Kālī or other deities brought ecstasy and peace; he once described Kālī as "a limitless, infinite, effulgent ocean of spirit."

His relatives had hoped that his marriage in 1859 would be a steadying influence, but the God-intoxication reappeared upon his return to the temple. He then began 12 years of ascetic exercises in various states of *samādhi* (self-induced spiritual trance). Under the guidance of a wandering Brahman woman, he became acquainted with Yoga and the practices of Tantrism. He also mastered the practice of Vaiṣṇava, which culminated in a vision of Sri Kṛishna. His initiation as a true *sannyāsin* (ascetic) came from Totapuri, a monk who taught him the philosophy of Advaita; Ramakrishna quickly achieved the *Nirvikalpa samādhi,* in which a person becomes one with the Eternal Brahman. It was at this time that he acquired the name Ramakrishna.

In 1866 Ramakrishna followed the path of Islām and is said to have had a vision of Muḥammad. Later, as he studied Christianity, he apparently also "saw" Jesus. From these studies and visions he came to the conclusion that all religions are in essence the same and all are true. His revelations became known throughout the world. Thousands crowded near his Calcutta home to hear him speak. Though famous he remained a basically simple man. He never wrote, but several volumes of his sayings were later published by disciples.

Ramakrishna saw God in everything and everyone. All paths, he believed, led to the same goal. "There are in a tank or pool," he said, "various *ghats* (steps to the water). The Hindus draw out the liquid and call it *jal.* The Muslims draw out the liquid and call it *pani.* The Christians draw out the liquid and call it water, but it is all the same substance, no essential difference."

The order bearing his name has its headquarters in Calcutta and sends missionaries throughout the world. His most noteworthy disciple, Vivekananda, represented Hinduism at the World's Parliament of Religions in Chicago in 1893.

Ramakrishna Mission, religious society that carries out extensive educational and philanthropic work in India and is also the foremost exponent in Western countries of a modern version of Advaita Vedānta—a school of orthodox Indian philosophy.

The society was founded in Calcutta by Vivekananda (*q.v.*) in 1897 with a twofold purpose: to spread the teachings of Vedānta as embodied in the life of the Hindu saint Ramakrishna (1836–86) and to improve the social conditions of the Indian people. Ramakrishna, as a direct result of his own spiritual experiences with various religious disciplines, including Christianity and Islām, fully realized the Hindu tenet that all religions are paths to the same goal. In his lifetime there grew about him a small but devoted band of disciples, among whom the young Narendranath Datta (who later took the name Vivekananda) was outstanding and was chosen by Ramakrishna as his successor. These disciples were the nucleus of the Ramakrishna *maṭh* ("monastery") established at Belūr, on the banks of the Ganges near Calcutta, and consecrated in 1898. The Shri Sarada Math, begun in Calcutta in 1953, was made a completely separate organization in 1959, following the earlier wishes of Vivekananda; it and its sister organization, the Ramakrishna Sarada Mission, now operate a number of centres in different parts of India. Several Ramakrishna Mission centres specifically serving women were turned over to the Ramakrishna Sarada Mission.

The Vedanta Society of the City of New York, incorporated in 1898, is the oldest branch of the mission in the U.S. It grew out of classes held by Vivekananda while on a visit to the U.S. to appear before the 1893 World's Parliament of Religions in Chicago. The activities of the order spread rapidly during the next half century. In the 1980s the order operated 13 branches in the United States and had centres in Bangladesh, Singapore, Fiji, Sri Lanka, Mauritius, France, Switzerland, Argentina, and the United Kingdom. The centres in Western countries do not carry on social service work but are devoted exclusively to promulgating Ramakrishna's teachings. In India nearly 90 *maṭh* and mission centres carry on various philanthropic activities, including medical service, educational work, publications, and relief work.

Ramalho Ortigão, José Duarte: *see* Ortigão, José Duarte Ramalho.

Raman, Sir Chandrasekhara Venkata (b. Nov. 7, 1888, Trichinopoly, India—d. Nov. 21, 1970, Bangalore), Indian physicist whose work was influential in the growth of science in India. He was the recipient of the Nobel Prize for Physics in 1930 for the discovery that when light traverses a transparent material, some of the light changes in wavelength.

Raman became professor of physics at the University of Calcutta in 1917. Studying the scattering of light in various substances, in 1928 he found that when a substance is illumi-

Raman
By courtesy of the Information Service of India, London

nated by a beam of light of one frequency, the beam emerging at right angles to the original direction contains other frequencies that are characteristic of the material. These so-called Raman frequencies are equal to the infrared frequencies for the material and are caused by the exchange of energy between the light and the material. Raman was knighted in 1929, and in 1933 he moved to the Indian Institute of Science, at Bangalore, as head of the department of physics. In 1947 he was named director of the Raman Research Institute there and in 1961 became a member of the Pontifical Academy of Science. He contributed to the building up of nearly every Indian research institution in his time, founded the *Indian Journal of Physics* and the Indian Academy of Sciences, and trained hundreds of students who found important posts in universities and government in India and Burma.

Raman effect, change in the wavelength of light that occurs when a light beam is deflected by molecules. The phenomenon is named for Sir Chandrasekhara Venkata Raman, who discovered it in 1928. When a beam of light traverses a dust-free, transparent sample of a chemical compound, a small fraction of the light emerges in directions other than that of the incident (incoming) beam. Most of this scattered light is of unchanged wavelength. A small part, however, has wavelengths different from that of the incident light; its presence is a result of the Raman effect.

Raman scattering is perhaps most easily understandable if the incident light is considered as consisting of particles, or photons (with energy proportional to frequency), that strike the molecules of the sample. Most of the encounters are elastic, and the photons are scattered with unchanged energy and frequency. On some occasions, however, the molecule takes up energy from or gives up energy to the photons, which are thereby scattered with diminished or increased energy, hence with lower or higher frequency. The frequency shifts are thus measures of the amounts of energy involved in the transition between initial and final states of the scattering molecule.

The Raman effect is feeble; for a liquid compound the intensity of the affected light may be only 1/100,000 of that incident beam. The pattern of the Raman lines is characteristic of the particular molecular species, and its intensity is proportional to the number of scattering molecules in the path of the light. Thus, Raman spectra are used in qualitative and quantitative analysis.

The energies corresponding to the Raman frequency shifts are found to be the energies associated with transitions between different rotational and vibrational states of the scattering molecule. Pure rotational shifts are small and difficult to observe, except for those of simple gaseous molecules. In liquids, rotational motions are hindered, and discrete rotational Raman lines are not found. Most Raman work is concerned with vibrational transitions, which give larger shifts observable for gases, liquids, and solids. Gases have low molecular concentration at ordinary pressures and therefore produce very faint Raman effects; thus liquids and solids are more frequently studied.

Ramana Maharshi, original name VENKATARAMAN AIYER (b. Dec. 30, 1879, Madurai, Madras states, India—d. April 14, 1950, Tiruvannāmalai), Hindu philosopher and yogi called "Great Master," "Bhagavan" (the Lord), and "the Sage of Aruṇāchala," whose position on monism (the identity of the individual soul and the creator of souls) and *māyā* (illusion) parallels that of Śaṅkara (*c.* AD 700–750). His original contribution to yogic philosophy is the technique of *vicāra* (self-"pondering" inquiry).

Born to a middle-class, southern Indian, Brahman family, Venkataraman read mystical and devotional literature, particularly the lives of South Indian Śaiva saints and the life of Kabīr, the medieval mystical poet. He was captivated by legends of the local pilgrimage place, Mt. Aruṇāchala, from which the god Śiva was supposed to have arisen in a spiral of fire at the creation of the world.

At the age of 17 Venkataraman had a spiritual experience from which he derived his *vicāra* technique: he suddenly felt a great fear of death, and, lying very still, imagined his body becoming a stiff, cold corpse. Following a traditional "not this, not that" (*neti-neti*) practice, he began self-inquiry, asking "Who am I?" and answering, "Not the body, because it is decaying; not the mind, because the brain will decay with the body; not the personality, nor the emotions, for these also will vanish with death." His intense desire to know the answer brought him into a state of consciousness beyond the mind, a state of bliss that Hindu philosophy calls *samādhi.* He immediately renounced his possessions, shaved his head, and fled from his village to Mt. Aruṇāchala to become a hermit and one of India's youngest gurus.

The publication of Paul Brunton's *My Search in Secret India* drew Western attention to the thought of Ramana Maharshi (the title used by Venkataraman's disciples) and attracted a number of notable students. Ramana Maharshi believed that death and evil were *māyā,* or illusion, which could be dissipated by the practice of *vicāra,* by which the true self and the unity of all things would be discovered. For liberation from rebirth it is sufficient, he believed, to practice only *vicāra* and bhakti (devotional surrender) either to Śiva Aruṇāchala or to Ramana Maharshi.

Rāmānanda, also called RĀMĀNAND, or RĀMADATTA (b. *c.* 1400—d. *c.* 1470), North Indian Brahman, fifth in succession in the lineage of the philosopher-mystic Rāmānuja and founder of the bhakti (devotional) cult of Rāma, the incarnation of Lord Vishnu known as the Rāmānandī, or Rāmavat, sect.

Rāmānanda left home as a youth and became a *sannyāsin* (ascetic) before settling in Vārānasi (Benares) to study Vedic texts, Rāmānuja's philosophy, and yogic techniques. His studies completed, he wandered about teaching and eating with his students, regardless of their caste. This disregard for caste caused his companions in Rāmānuja's lineage to ask him to eat alone rather than contaminate them. This so angered Rāmānanda that he left the lineage to found his own sect, the Rāmānandīs. His original disciples, 12 in number, included at least one woman, members of the lowest castes (including a leatherworker and a barber), and a Muslim (the mystic Kabīr). Rāmānanda's teachings were similar to Rāmānuja's except that he dropped the interdiction on intercaste dining and the strict rule that all teaching and all texts used must be in the Sanskrit language. At his centres in Āgra and Vārānasi, Rāmānanda taught in Hindi, the vernacular, in order to reach the masses, because Sanskrit was known only to the upper castes.

Today Rāmānandīs have numerous monasteries in North India.

Rāmanāthapuram, town, Rāmanāthapuram district, Tamil Nādu state, southeastern India. A former capital of the Maravan rajas, it produces textiles and jewelry and has two colleges affiliated with Madurai-Kamaraj University. Its name refers to the Hindu god Rāma.

Rāmanāthapuram district has an area of 4,856 sq mi (12,578 sq km) and occupies part of the flat southern coastal plain, including the island of Rāmeswaram (*q.v.*). Protected from the northeastern and southwestern monsoons by the Western Ghāts to the west and the mountains of Sri Lanka to the southeast, it has an unusually dry climate, but irrigation tanks (embanked earth reservoirs) enable the district to produce chilies and cotton for export. Large-scale industry such as cotton and cement milling has been introduced into its towns, the largest of which include Rājapālaiyam, Virudunagar, and Kāraikkudi. About 90 percent of India's fireworks are manufactured in Sivakāsi.

The district remained independent throughout much of its history, and the Maravan rajas frequently invaded Thanjāvūr in the 17th and 18th centuries. The British established a rail and ferry system to Ceylon (now Sri Lanka) through Rāmeswaram. Roads radiate from Madurai town in Madurai district to the north. The administrative headquarters of Rāmanāthapuram district are located in Madurai. Pop. (1981) town, 45,719; district, 3,335,437.

Rāmānuja, also called RĀMĀNUJĀCĀRYA, or IḶAIYA PERUMĀḶ (Tamil: Ageless Perumāḷ [God]) (b. *c.* 1017, Śrīperumbūdūr, India—d. 1137, Śrīraṅgam), South Indian Brahman theologian and philosopher, the single most influential thinker of devotional Hinduism. After a long pilgrimage, Rāmānuja settled in Śrīraṅgam, where he organized temple worship and founded centres to disseminate his doctrine of devotion to the god Vishnu and his consort Śrī. He provided an intellectual basis for the practice of bhakti (devotional worship) in three major commentaries: the *Vedārthasaṃgraha* (on the Veda), the *Śrī-bhāṣya* (on the *Brahma-sūtras*), and the *Bhagavadgītā-bhāṣya* (on the *Bhagavadgītā*).

Rāmānuja, bronze sculpture, 12th century; from a Viṣṇu temple in Tanjore district, India
By courtesy of the Institut Francais d'Indologie, Pondicherry

Life. Information on the life of Rāmānuja consists only of the accounts given in the legendary biographies about him, in which a pious imagination has embroidered historical details. According to tradition, he was born in southern India, in what is now Tamil Nadu (formerly Madras) state. He showed early signs of theological acumen and was sent to Kāñcī (Kānchipuram) for schooling, under the teacher Yādavaprakāśa, who was a follower of the monistic system of Vedānta of Śaṅkara, the famous 8th-century philosopher. Rāmānuja's profoundly religious nature was soon at odds with a doctrine that offered no room for a personal god. After falling out with his teacher he had a vision of the god Vishnu and his consort Śrī, or Lakṣmī, and instituted a daily worship ritual at the place where he beheld them.

He became a temple priest at the Varadarāja temple at Kāñcī, where he began to expound the doctrine that the goal of those who aspire to final release from transmigration is not the impersonal Brahman but rather Brahman as identified with the personal god Vishnu. In Kāñcī, as well as Śrīraṅgam, where he was to become associated with the Raṅganātha temple, he developed the teaching that the worship of a personal god and the soul's union with him is an essential part of the doctrines of the *Upaniṣads* (ancient speculative texts that are part of Hindu sacred scriptures) on which the system of Vedānta is built; therefore, the teachings of the Vaiṣṇavas and Bhāgavatas (worshippers and ardent devotees of Vishnu) are not heterodox. In this he continued the teachings of Yāmuna (Yāmunācārya; 10th century), his predecessor at Śrīraṅgam, to whom he was related on his mother's side. He set forth this doctrine in his three major commentaries.

Like many Hindu thinkers, he made an extended pilgrimage, circumambulating India from Rāmeswaram (part of Adams Bridge), along the west coast to Badrīnāth, the source of the holy river Ganges, and returning along the east coast. Tradition has it that later he suffered from the zeal of King Kulottuṅga of the Cōla dynasty, who adhered to the god Śiva, and withdrew to Mysore, in the west. There he converted numbers of Jainas (adherents of a dualistic, ascetic sect), as well as King Bittideva of the Hoyśala dynasty; this led to the founding in 1099 of the town Milukote (Melcote, present Karnataka state) and the dedication of a temple to Śelva Pillai (Sanskrit, Sampatkumāra, the name of a form of Vishnu). He returned after 20 years to Śrīraṅgam, where he organized the temple worship, and, reputedly, he founded 74 centres to disseminate his doctrine. After a life of 120 years, according to the tradition, he passed away in 1137.

Philosophy and influence. Rāmānuja's chief contribution to philosophy was his emphasis that discursive thought is necessary in man's search for the ultimate verities, that the phenomenal world is real and provides real knowledge, and that the exigencies of daily life are not detrimental or even contrary to the life of the spirit. In this emphasis he is the antithesis of Śaṅkara, of whom he was sharply critical and whose interpretation of the scriptures he disputed. Like other adherents of the Vedānta system, Rāmānuja accepted that any Vedānta system must base itself on the three "points of departure," viz., the *Upaniṣads*, the *Brahma-sūtras* (brief exposition of the major tenets of the *Upaniṣads*), and the *Bhagavadgītā*, the colloquy of the god Kṛṣṇa and his friend Arjuna. He wrote no commentary on any single *Upaniṣad* but explained in detail the method of understanding the *Upaniṣads* in his first major work, the *Vedārtha-saṃgraha* ("Summary of the Meaning of the Veda"). Much of this was incorporated in his commentary on the *Brahma-sūtras*, the *Śrī-bhāṣya*, which presents his fully developed views. His commentary on the *Bhagavadgītā*, the *Bhagavadgītā-bhāṣya*, dates from a later age.

Although Rāmānuja's contribution to Vedānta thought was highly significant, his influence on the course of Hinduism as a religion has been even greater. By allowing the urge for devotional worship (bhakti) into his doctrine of salvation, he aligned the popular religion with the pursuits of philosophy and gave bhakti an intellectual basis. Ever since, bhakti has remained the major force in the religions of Hinduism. His emphasis on the necessity of religious worship as a means of salvation continued in a more systematic context the devotional effusions of the Āḻvārs, the 7th–10th century poet-mystics of southern India, whose verse became incorporated into temple worship. This bhakti devotionalism, guided by Rāmānuja, made its way into northern India, where its influence on religious thought and practice has been profound.

Rāmānuja's world view accepts the ontological reality of three distinct orders: matter, soul, and God. Like Śaṅkara and earlier Vedānta, he admits that there is nonduality (*advaita*), an ultimate identity of the three orders, but this nonduality for him is asserted of God, who is modified (*viśiṣṭa*) by the orders of matter and soul; hence his doctrine is known as Viśiṣṭādvaita ("modified nonduality") as opposed to the unqualified nonduality of Śaṅkara. Central to his organic conception of the universe is the analogy of body and soul: just as the body modifies the soul, has no separate existence from it, and yet is different from it, just so the orders of matter and soul constitute God's "body," modifying it, yet having no separate existence from it. The goal of the human soul, therefore, is to serve God just as the body serves the soul. Anything different from God is but a *śeṣa* of him, a spilling from the plenitude of his being. All the phenomenal world is a manifestation of the glory of God (*vibhūti*), and to detract from its reality is to detract from his glory. Rāmānuja transformed the practice of ritual action into the practice of divine worship and the way of meditation into a continuous loving pondering of God's qualities; both in turn a subservient to bhakti, the fully realized devotion that finds God. Thus, release is not merely a shedding of the bonds of transmigration but a positive quest for the contemplation of God, who is pictured as enthroned in his heaven, called Vaikuṇṭha, with his consort and attendants.

Rāmānuja's doctrine, which was passed on and augmented by later generations, still identifies a caste of Brahmans in southern India, the Śrīvaiṣṇavas. They became divided into two subcastes, the northern, or Vaḍakalai, and the southern, or Teṇkalai. At issue between the two schools is the question of God's grace. According to the Vaḍakalai, who in this seem to follow Rāmānuja's intention more closely, God's grace is certainly active in man's quest for him but does not supplant the necessity of man's acting toward God. The Teṇkalai, on the other hand, hold that God's grace is paramount and that the only gesture needed from man is his total submission to God (*prapatti*).

The site of Rāmānuja's birthplace in Śrīperumbūdūr is now commemorated by a temple and an active Viśiṣṭādvaita school. The doctrines he promulgated still inspire a lively intellectual tradition, and the religious practices he emphasized are still carried on in the two most important Vaiṣṇava centres in southern India, the Raṅganātha temple in Śrīraṅgam, and the Veṅkateśvara temple in Tirupati, both in Tamil Nadu. (J.A.B.v.B.)

BIBLIOGRAPHY. There are several traditional accounts of Rāmānuja's life. The oldest, on which the others largely rest, is that by Anantacarya, entitled the *Prapannāmṛta*, which by some is dated to shortly after Rāmānuja's lifetime. Based on the *Prapannāmṛta* in large parts are the accounts by S.N. Das Gupta in his *History of Indian Philosophy*, vol. 3 (1940); and P.N. Srinivasachari in *Philosophy of Viśiṣṭādvaita*, 2nd ed. (1946).

Ramanujan, Srinivasa (b. Dec. 22, 1887, Erode, India—d. April 26, 1920, Kumbakonam), Indian mathematician whose contributions to the theory of numbers include pioneering discoveries of the properties of the partition function.

When he was 15 years old, he obtained a copy of George Shoobridge Carr's *Synopsis of Elementary Results in Pure and Applied Mathematics*, 2 vol. (1880–86). This collection of some 6,000 theorems (none of the material was newer than 1860) aroused his genius. Having verified the results in Carr's book, Ramanujan went beyond it, developing his own theorems and ideas. In 1903 he secured a scholarship to the University of Madras but lost it the following year because he neglected all other studies in pursuit of mathematics.

Ramanujan continued his work, without employment and living in the poorest circumstances. After marrying in 1909 he began a search for permanent employment that culminated in an interview with a government official, Ramachandra Rao. Impressed by Ramanujan's mathematical prowess, Rao supported his research for a time, but Ramanujan, unwilling to exist on charity, obtained a clerical post with the Madras Port Trust.

In 1911 Ramanujan published the first of his papers in the *Journal of the Indian Mathematical Society*. His genius slowly gained recognition, and in 1913 he began a correspondence with the British mathematician Godfrey H. Hardy that led to a special scholarship from the University of Madras and a grant from Trinity College, Cambridge. Overcoming his religious objections, Ramanujan travelled to England in 1914, where Hardy tutored him privately and collaborated with him in some research.

Ramanujan's knowledge of mathematics (most of which he had worked out for himself) was startling. Although almost completely ignorant of what had been developed, his mastery of continued fractions was unequalled by any living mathematician. He worked out the Riemann series, the elliptic integrals, hypergeometric series, the functional equations of the zeta function, and his own theory of divergent series. On the other hand, the gaps in his knowledge were equally startling. He knew nothing of doubly periodic functions, the classical theory of quadratic forms, or Cauchy's theorem, and had only the most nebulous idea of what constitutes a mathematical proof. Though brilliant, many of his theorems on the theory of prime numbers were completely wrong.

In England Ramanujan made further advances, especially in the partition of numbers. His papers were published in English and European journals, and in 1918 he became the first Indian to be elected to the Royal Society of London.

In 1917 Ramanujan contracted tuberculosis, but his condition improved sufficiently for him to return to India in 1919. He died the following year, generally unknown to the world at large but recognized by mathematicians as a phenomenal genius, without peer since Leonhard Euler (1707–83) and Karl Jacobi (1804–51).

Ramapithecus, fossil primate genus, dating from the late Miocene or early Pliocene epoch and thought to be the oldest direct ancestor of modern man. First discovered in fossil deposits in the Siwalik Hills of northern India by G.E. Lewis in 1932, *Ramapithecus* is represented only by fragments of jaws and teeth. Lewis' find was a right upper jaw fragment that more closely resembled that of a human than that of an ape. Since this jaw was the only such find, paleontologists withheld judgment on it. Then, in 1961, Louis and Mary Leakey found parts of an upper and lower jaw that closely resembled the Lewis find. Leakey's fossils were dated at 14,000,000 years ago. Other jaws and teeth found in Asia, Africa, and Europe indicate that *Ramapithecus* was the first direct ancestor of modern man, living from about 15,000,000 to 8,000,000 years ago.

The evidence on which the case was constructed lies in the nature of the teeth and jaws of *Ramapithecus*. They lie directly between those of apes and humans. While the human jaw is parabolic, or arch-shaped, the ape jaw is a rather squared U-shape. The jaw of *Ramapithecus* is somewhat rounded and does not jut out as strongly as an ape's. The most important difference is in the size and shape of the canine teeth. In the ape, these are long and project out and downward, capable of tearing, while in humans the canines tend to be flat and do not project beyond the other teeth and are more suitable for chewing and grinding. *Ramapithecus* canines, while still somewhat apelike in shape, do not project beyond the other teeth. The incisors of apes are broader than humans and there are gaps between the upper teeth to permit space for the larger incisors. The lower incisors of *Ramapithecus* are small and there are no spaces between the upper teeth. Furthermore, *Ramapithecus* has much thicker tooth enamel than the ape.

The changes in tooth structure that differentiate *Ramapithecus* from apes are associated with changes resulting from subsisting in a different environment. Evidence indicates that the apes and early forms of *Ramapithecus* lived largely in the forest, which contained soft, succulent food that merely needed to be torn. Later species of *Ramapithecus* lived mainly in open grasslands, which provided a diet of harder, tougher, and more fibrous foods that needed to be ground and chewed.

David Pilbeam advanced the hypothesis in the early 1980s that the reputed remains of *Ramapithecus punjabicus* actually belonged to an evolutionary ancestor of the orangutan.

Rama's Bridge (India and Sri Lanka): *see* Adams Bridge.

Ramat Gan, city, west central Israel, on the Plain of Sharon just east of Tel Aviv–Yafo. Founded in 1921, it is the largest satellite city in the Tel Aviv–Yafo metropolitan area, with fine residential quarters, extensive parks and gardens, including a national park, and the nation's principal athletic stadium, seating 50,000 persons. It is also the home of Bar-Ilan University, a religiously oriented institution founded by American Jews in 1953.

Light industries include the manufacture of chocolates, citrus preserves and concentrates, textiles, building materials, and cigarettes. Ramat Gan is also the home of Israel's Diamond Exchange. Inc. 1950. Pop. (1982 est.) 119,100.

Ramat ha-Golan (Syria): *see* Golan Heights.

Ramathibodi I (b. March 10, 1315—d. 1369, Ayutthaya), founder and first king (1351–69) of the Thai kingdom of Ayutthaya.

Little is known of Ramathibodi's early career, but he is thought to have been related to the ruling family of the principality of Lop Buri and to have married the daughter of the ruler of U Thong (now Suphan Buri) in central Siam. He succeeded to the throne of U Thong in about 1347 and moved his capital 50 miles east to an island in the Chao Phraya River, where he founded the city of Dvaravati Sri Ayudhya, more commonly known as Ayutthaya, which remained the capital of Siam for more than 400 years. On March 4, 1351, Ramathibodi became king of an extensive state in the Chao Phraya Valley based on Ayutthaya, Lop Buri, and Suphan Buri, and quickly established Siam as a power in the affairs of the region. Maintaining amicable relations with the Thai kingdom of Sukhothai to the north, he devoted his energies to securing the region's independence of the Cambodian kingdom of Angkor, against which he waged numerous campaigns. From the beginning of his reign he encouraged Persian and Chinese traders, and Ayutthaya's subsequent power and prosperity rested in part on its development as an international port.

One of Ramathibodi's most lasting achievements was to lay the foundations of the Siamese legal system, which was not changed significantly until the reign of Chulalongkorn in the 19th century. In 1350–59 he composed a legal text, which was a codification of the traditional law of the Tai state of Nanchao that had ruled in Southwest China from the 7th to the 13th centuries AD, before the Tai people migrated south to their present homeland.

Ramathibodi prepared his son Ramesuan to succeed him, but on his death in 1369 the throne was seized by his Suphan Buri brother-in-law, Borommaraja I, who reigned for nine years before Ramesuan could regain the throne and restore Ramathibodi's dynasty.

Ramatirtha, original name TIRATH RAMA (b. 1873, Muraluvala, Punjab Province, India—d. Oct. 17, 1906, Tehri, United Provinces of Āgra and Oudh), Hindu religious leader known for the highly personal and poetic manner in which he taught what he styled "Practical Vedānta," using common experiences to illustrate the divine nature of man. For Ramatirtha, any object whatever could be approached as a "mirror to God."

Educated at the Foreman Christian College and Government College, Lahore, in 1895 Tirath Rama was appointed a professor of mathematics at Foreman Christian College. A meeting with the Bengali ascetic Vivekananda strengthened his inclination toward religious study and the desire to spend his life in the propagation of the monotheistic system of Advaita Vedānta. He helped to found an Urdu journal, *Alif,* in which many of his articles on Vedānta appeared.

In 1901 Tirath Rama left his wife and children and went into seclusion in the Himalayas, returning to travel to Japan and to the United States. Ramatirtha (the name by which he then became known) advocated a "wholesale liberation of mankind, beginning with the personal liberation of the individual." His uniqueness was in the joy with which he propagated the otherwise traditional teachings of Vedānta. Often he would answer religious queries with prolonged laughter. His mystical leanings were coupled with an appreciation of Western science and technology as a means of solving India's social and economic problems, and he never failed to support public education in all forms. He died by drowning in the Ganges, whether by accident or design is still a matter of conjecture among his followers.

Rāmāyaṇa (Sanskrit: "Romance of Rāma"), shorter of the two great epic poems of India, the other being the *Mahābhārata* ("Great Epic of the Bharata Dynasty"). The *Rāmāyaṇa* was composed in Sanskrit, probably not before 300 BC by the poet Vālmīki, and in its present form consists of some 24,000 couplets divided into seven books.

The poem describes the royal birth of Rāma in the kingdom of Ayodhyā (Oudh), his tutelage under the sage Viśvāmitra, and his success in bending Śiva's (Shiva's) mighty bow at the bridegroom tournament of Sītā, the daughter of King Janaka, thus winning her for his wife. After he is banished from his position as heir by an intrigue, he retreats to the forest with his wife and his favourite half-brother, Lakṣmaṇa, to spend 14 years in exile. There Rāvaṇa, the demon-king of Laṅkā, carries off Sītā to his capital, while her two protectors are busy pursuing a golden deer sent to the forest to mislead them. Sītā resolutely rejects Rāvaṇa's attentions, and Rāma and his brother set about to rescue her. After numerous adventures they enter into alliance with Sugrīva, king of the monkeys; and with the assistance of the monkey-general Hanumān and Rāvaṇa's own brother, Vibhīṣana, they attack Laṅkā. Rāma slays Rāvaṇa and rescues Sītā, who in a later version undergoes an ordeal by fire in order to clear herself of the suspicions of infidelity. When they return to Ayodhyā, however, Rāma learns that the people still question the Queen's chastity, and he banishes her to the forest. There she meets the sage Vālmīki (the reputed author of the *Rāmāyaṇa*) and at his hermitage gives birth to Rāma's two sons. The family is reunited when the sons become of age, but Sītā, after again protesting her innocence, asks to be received by the earth, which swallows her up.

The poem enjoys immense popularity in India, where its recitation is considered an act of great merit. Many of its translations into the vernacular languages are themselves works of great literary merit, including the Tamil version of Kampaṉ, the Bengali version of Kṛttibās, and the Hindi version, *Rāmcaritmānas*, of Tulsīdās. Throughout North India the events of the poem are enacted in an annual pageant, the Rām-Līlā, and in South India the two epics, the *Rāmāyaṇa* and the *Mahābhārata*, even today make up the story repertoire of the kathakali dance-drama of Malabar. The *Rāmāyaṇa* was popular even during the Mughal period (16th century), and it was a favourite subject of Rajasthani and Pahari painters of the 17th and 18th centuries.

The story also spread in various forms throughout Southeast Asia (especially Kampuchea [Cambodia], Indonesia, and Thailand); and its heroes, together with the Pāṇḍava brothers of the *Mahābhārata*, were the heroes of traditional Javanese-Balinese theatre, dance, and shadow plays. Incidents from the *Rāmāyaṇa* are carved in bas-relief on many Indonesian monuments, as for example at Panataran, in eastern Java.

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Ramazan DYNASTY, Turkmen dynasty (*c.* 1352–*c.* 1610) that ruled in the Çukurova (Cilicia) region of southern Anatolia.

In 1352 Ramazan, founder of the dynasty, was recognized by the Mamlūk sultan of Egypt as the ruler of the Üçok branch of Oğuz Turkmen in Çukurova. After a period of attempts to overthrow Mamlūk suzerainty, the dynasty's principality in *c.* 1418 came under direct Mamlūk control and lost its significance.

With the extension of Ottoman territories to the Taurus Mountains and after an Ottoman–Mamlūk war in 1485–90, the Ramazan territory assumed strategic importance for the Ottomans. In 1514 the Ramazan ruler Mahmud was deposed by the Mamlūks and sought refuge with the Ottoman sultan Selim I, who the next year defeated the Mamlūks in Syria and restored the principality to Mahmud. Mahmud's successor Piri was appointed by the Ottomans; he assisted them in suppressing Turkmen revolts in central and southern Anatolia (1526) and enjoyed the favour of Sultan Süleyman I the Magnificent. Çukurova was incorporated into the Ottoman Empire (*c.* 1610), and thereafter members of the Ramazan dynasty continued to serve as governors of Ottoman provinces in Asia and in the Balkans.

Ramazzini, Bernardino (b. Nov. 3, 1633, Carpi, Italy—d. Nov. 5, 1714, Padua), Italian physician, considered a founder of industrial medicine, whose studies of occupational diseases and advocacy of protective measures for workers encouraged eventual passage of factory safety and workmen's compensation laws.

A professor of medicine at the University of Modena (1682–1700), and an early student of epidemiology, he described outbreaks of lathyrism (1690; chick-pea poisoning) and malaria (1690–95) in Italy. A strong proponent of the use of cinchona bark in the treatment of malaria, Ramazzini recognized the introduction of this medicament (from which the alkaloid quinine is derived) as a revolutionary event in the history of medicine, completing the downfall of the classic Greek physician Galen's medical theories advocating administration of purgatives in the treatment of disease.

Ramazzini, engraving by J.G. Seiller

Archiv fur Kunst und Geschichte, West Berlin

Ramazzini wrote *De Morbis Artificum Diatriba* (1713; *Diseases of Workers,* 1940), the first comprehensive work on occupational diseases, outlining the health hazards of irritating chemicals, dust, metals, and other abrasive agents encountered by workers in 52 occupations. He served as professor of medicine at the University of Padua from 1700 until his death.

Rambam (Jewish philosopher): *see* Maimonides, Moses.

Ramban (Jewish scholar): *see* Naḥmanides.

Rambert, Dame Marie, married name MARIE DUKES, original name CYVIA RAMBAM, also called MIRIAM RAMBACH, or RAMBERG (b. Feb. 20, 1888, Warsaw—d. June 12, 1982, London), ballet producer, director, and teacher who founded Ballet Rambert, the oldest English ballet company still performing.

A student of Émile Jaques-Dalcroze, the originator of eurhythmics, Rambert was invited in 1913 to teach this technique of rhythmic education to members of Sergey Diaghilev's

Marie Rambert, 1937
Houston Rogers

Ballets Russes; through her teaching she influenced Vaslav Nijinsky's controversial choreography for *L'Après-midi d'un faune* and *Le Sacre du printemps*. While with Diaghilev's company, Rambert studied with the eminent ballet teacher Enrico Cecchetti and later joined Diaghilev's corps de ballet. She continued her ballet training in London, staging her first ballet in 1917 and becoming a British citizen in 1918, following her marriage that year to the playwright Ashley Dukes.

Utilizing Cecchetti's teaching methods, she established a ballet school in 1920 and in 1926 produced the first ballet choreographed by her student Frederick Ashton, who became one of the world's most eminent choreographers. In 1930 she helped found the Camargo Society, which gave enormous impetus to English ballet, and established the Ballet Club, which in 1935 became Ballet Rambert. As Ballet Rambert's director she was characterized by a willingness to experiment and by a desire to develop fully the style of any particular dancer or ballet. She gave strong support to such young British choreographers as Ashton, Antony Tudor, Andrée Howard, Frank Staff, Walter Gore, and Norman Morrice and presented their works in London at the Mercury Theatre, owned by her husband. Dancers who began their careers with Ballet Rambert include Pearl Argyle, Maude Lloyd, Peggy van Praagh, Sally Gilmour, Celia Franca, and Hugh Laing, all of whom became noted for the individuality of their interpretations. Rambert also helped establish such designers as Sophie Fedorovitch, Hugh Stevenson, and William Chappell, formerly a dancer with Ballet Club.

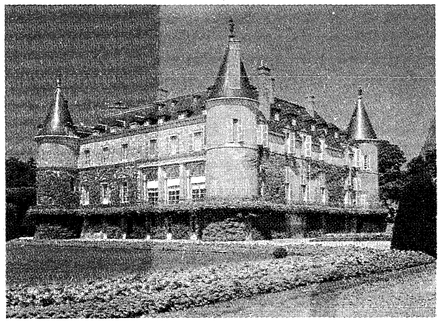
Rambert relied primarily on British dancers, choreographers, and designers, thus helping to eliminate the general English preference for foreign ballet artists. For her part in establishing English ballet, she was made Commander of the Order of the British Empire in 1954 and Dame of the Order of the British Empire in 1962. She was coauthor of *Dancers of Mercury: The Story of Ballet Rambert* (1960) and translator of *Ulànova: Her Childhood and Schooldays* (1962).

Rambler, The, a twopenny sheet issued twice weekly in London by the publisher John Payne between 1750 and 1752, each issue containing a single anonymous essay; 208 such periodical essays appeared, all but five written by Samuel Johnson. Johnson's intention in this project was that of a moralist aware of his duty to make the world better. This sense of responsibility determined the style of his *Rambler* essays, a majority of which deal with the disappointments inherent in life and with the setbacks to ambition. Many of the titles reflect this: "Happiness not Local"; "The Frequent Contemplation of Death Necessary to Moderate the Passions"; "The Luxury of Vain Imagination." *The Rambler*, in short, is of fundamental importance in any estimate of Johnson's approach to literature itself: it was not an entertainer but, rather, an instructor. For the most part Johnson was a detached and generalizing commentator, the essays bearing little relation to current events or current literature, even though they contain much acute literary criticism. They do, however, reflect the social and literary conditions of the time.

Johnson's immediate incentive in contributing *The Rambler* essays was to keep the wolf from the door ("No man but a blockhead ever wrote except for money"). *The Rambler* did not sell well as a periodical, however, though it was an immense success after being reissued, with the essays revised, in volume form in 1753. It also inspired other periodicals, notably John Hawkesworth's *The Adventurer* (1752–54), Edward Moore's lively *The World* (1753–56), George Colman's and Bonnell Thornton's *The Connoisseur* (1754–56), and Henry Mackenzie's Scottish periodical, *The Mirror* (1779–80).

Ramboldini, Vittorino: *see* Vittorino da Feltre.

Rambouillet, town, Yvelines *département*, Paris region, northern France, just southwest of Versailles. Flanked by its famous château and surrounded by an extensive forest, it is a favoured tourist spot for Parisians. The château, built in 1375 by a courtier of Charles V of France, passed into the hands of Jacques d'Angennes, captain of King Francis I's bodyguard. In 1547, Francis died there on a hunting visit. In 1783, Louis XVI bought the château from his cousin, had the gardens extended, and built a dairy for his wife, Marie-Antoinette. He established in the large park an experimental sheep farm, where the celebrated Rambouillet merinos are still bred. The park has now become the Bergerie Nationale (National Sheep Farm). The restored château, where Napoleon I and Charles X passed some of their last hours before going into exile, has become a summer residence for presidents of the French Republic. In Roman times the forest, which has an area of 50 sq mi (130 sq km), was part of the vast forest of Yvelines, extending south of Paris to Orléans. Manufactures include electrical machinery. Pop. (1982) 21,136.



The château at Rambouillet, Fr.
P. Salou—Shostal/EB Inc.

Rambouillet, breed of sheep, developed from selections of a few hundred of the best Merino sheep of Spain in 1786 and 1799 by the French government at its national sheepfold at Rambouillet, Fr. First imported to the United States in 1840, the breed was successfully molded through selective breeding to meet the needs of a large class of U.S. sheep producers. Rambouillets prevail on the western ranges, where two-thirds of the sheep of the United States are produced.

The Rambouillet is the largest of fine wool sheep. The breed has a white face and white legs. The face covering of wool is rather heavy, even to the extent of causing wool blindness in some specimens, but selective mating has alleviated this problem. Fleeces of Rambouillet sheep are relatively heavy. The lambs grow rapidly under good feeding conditions to produce satisfactory market weights at from six to nine months of age. Rambouillet ewes are crossbred extensively with medium-wool and long-coarse-wool rams to produce choice market lambs and rugged breeding ewes with heavy, attractive medium wool.

Rambouillet, Catherine de Vivonne, marquise de (marchioness of) (b. 1588—d. Dec. 27, 1665), aristocratic hostess who exerted a powerful influence on the development of French literature in the first half of the 17th century.

Mme de Rambouillet was of noble background and was married at the age of 12 to Charles d'Angennes, later marquis de Rambouillet. Revolted by the coarseness of the French court under Henry IV and distressed by the amount of political intrigue, she set out to establish at her townhouse, the Hôtel de Rambouillet, a salon devoted to literature and cultured conversation where nobles and men of letters could mingle on an equal footing. The remarkable homogeneity of French classical literature may be ascribed to the influence of her salon and of those of her imitators. With its emphasis on refinement and delicacy in thought and expression, the salon eventually bred the extravagances that Molière pilloried unmercifully in *Les Précieuses ridicules*. Nevertheless, her salon did set a standard for correct and elegant French, and its *habitués* learned the art of exploring human psychology that was to be the basis of French classical literature.

rambutan, also spelled RAMBOTAN, RAMBOETAN, RAMBOUTAN, or RAMBUSTAN (*Nephelium lappaceum*), tree of the soapberry family (Sapindaceae). It is native to Malaysia, where it is commonly cultivated for its tasty fruit, also called rambutan. The bright-red, oval fruit, about the size of a small hen's egg, is covered with long, soft spines and has a tasty acid pulp. The tree grows to about 10.5–12 metres (35–40 feet).

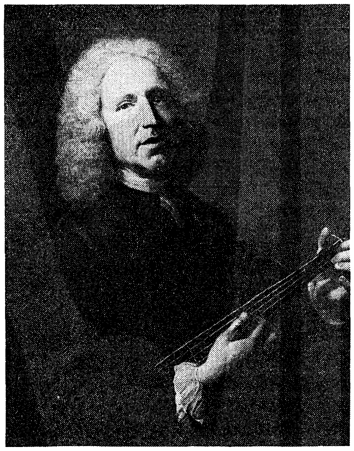
Rambutan (*Nephelium lappaceum*)
W.H. Hodge

Rāmcaritmānas ("Sacred Lake of the Acts of Rāma"), version, written in a dialect of Hindi, of the Sanskrit epic poem the *Rāmāyaṇa*, one of the masterpieces of medieval Hindu literature and a work with significant influence on modern Hinduism. Written in the 16th century by the poet Tulsīdās (*q.v.*), the poem is distinguished both by its great expression of love for a personal god and by its exemplification through its characters of the ideal conduct of a husband and ruler (Rāma), wife (Sītā), and brother (Lakṣmaṇa).

Ramé, Maria Louise: *see* Ouida.

Rameau, Jean-Philippe (baptized Sept. 25, 1683, Dijon, Fr.—d. Sept. 12, 1764, Paris), French composer of the late Baroque period, best known today for his harpsichord music but in his lifetime also famous as a musical theorist and a composer of operas.

Rameau's father, Jean, played the organ for 42 years in various churches in Dijon and



Rameau, detail of a portrait by Jacques-André-Joseph Aved; in the Musée des Beaux-Arts, Dijon, Fr.
Snark International

hoped one day to see his son on a lawyer's, rather than an organist's, bench. These hopes were dashed by the boy's deplorable performance in school. At the age of 17 he is said to have fallen in love with a young widow who laughed at the errors of grammar and spelling in his letters to her. He tried to refine his language, but, to judge by the prolixity of his later theoretical writings, his efforts resulted in no permanent improvement. At the age of 18, after deciding to pursue a musical career, he travelled to Italy but seems to have gotten no farther than Milan. The following year, he received the first of a series of appointments as organist in various cities of central France: Avignon, Clermont, Dijon, Lyon. There was a brief interlude in the capital, but apparently Paris did not take an immediate fancy to the provincial organist, in spite of his having published there a fine suite of harpsichord pieces in A minor, *Premier livre de pièces de clavecin* (1706). These works show the beneficial influence of Louis Marchand, a famous organist-harpsichordist of the day whose playing Rameau greatly admired.

Back in Clermont by 1715, he rashly signed a contract to be cathedral organist for 29 years. He then settled down to investigate, in an exhaustive and highly original manner, the foundations of musical harmony. He attacked traditional theory on the ground that "The Ancients," who to Rameau included such relatively recent writers as the 16th-century Italian Gioseffo Zarlino, ". . . based the rules of harmony on melody, instead of beginning with harmony, which comes first." Intuitively basing his studies on the natural overtone series, he arrived at a system of harmony that is the basis of most 20th-century harmony textbooks. Finally published in Paris in 1722, his impressive *Traité de l'harmonie* brought him fame at last and a yearning to return to the capital.

Authorities in Clermont were loath to let him go, and the story of his release reveals, as do his own writings and other evidence, something of his thorny personality, his persistence, and his single-mindedness. At an evening service he showed his displeasure with the church authorities by pulling out all the most unpleasing stops and by adding the most rending discords so that "connoisseurs confessed only Rameau could play so unpleasingly." But, after his release from the contract, he played with "so much delicacy, brilliance, force and harmony, that he aroused in the souls of the congregation all the sentiments he wished, thereby sharpening the regret with which all felt the loss they were about to sustain."

Upon his return to Paris, where he was to remain for the rest of his life, Rameau began a new and active life. A second volume of harpsichord pieces, *Pièces de clavecin avec une méthode pour la mécanique des doigts* (1724), met with considerably more success than the first, and he became a fashionable teacher of the instrument. A commission to write incidental music for the Fair theatres planted the seeds of his development as a dramatic composer, and the display of two Louisiana Indians at one of these theatres in 1725 inspired the composition of one of his best and most celebrated pieces, *Les Sauvages,* later used in his opéra ballet *Les Indes galantes* (first performed 1735). The following year, at the age of 42, he married a 19-year-old singer, who was to appear in several of his operas and who was to bear him four children.

His most influential contact at this time was Le Riche de la Pouplinière, one of the wealthiest men in France and one of the greatest musical patrons of all time. Rameau was put in charge of La Pouplinière's excellent private orchestra, a post he held for 22 years. He also taught the financier's brilliant and musical wife. The composer's family eventually moved into La Pouplinière's town mansion and spent summers at their château in Passy. This idyllic relationship between patron and composer gradually came to an end after La Pouplinière separated from his wife, and Rameau was replaced by the younger, avant-garde composer Karl Stamitz. In the meantime, however, admittance to La Pouplinière's circle had brought Rameau into contact with various literary lights. Abbé Pellegrin, whose biblical opera *Jephté* had been successfully set to music by Rameau's rival Michel Pinolet de Montéclair in 1732, was to become Rameau's librettist for his first and in many ways finest opera, *Hippolyte et Aricie.* It was first performed in the spring of 1733, at La Pouplinière's house, then, in the autumn, at the Opéra, and the following year it was performed at court. André Campra, perhaps the most celebrated French composer living at that time, remarked to the Prince de Conti: "My Lord, there is enough music in this opera to make ten of them; this man will eclipse us all."

To some ears there was, indeed, too much music. Those who had grown up with the operas of Jean-Baptiste Lully were baffled by the complexity of Rameau's orchestration, the intensity of his accompanied recitatives (speechlike sections), and the rich and often dissonant diversity of his harmonies. Rameau himself, however, professed his admiration for his predecessor in the preface to *Les Indes galantes,* in which he praised the "beautiful declamation and handsome turns of phrase in the recitative of the great Lully," and stated that he had sought to imitate it, though not as a "servile copyist." Indeed, almost everything in Rameau's operas has, at least technically, a precedent in Lully. Yet the content of his works, the rich dramatic contrasts, the brilliant orchestral sections, and, above all, the permeating sensuous melancholy and languorous pastoral sighings, put him in a different world: in short, the Rococo world of Louis XV.

Among those at the first performance of *Hippolyte* was the great Voltaire, who quipped that Rameau "is a man who has the misfortune to know more music than Lully." But he soon came around to Rameau's side and wrote for him a fine libretto, *Samson,* which was banned ostensibly for religious reasons but really because of a cabal against Voltaire; the music was lost. Their later collaboration on two frothy court entertainments is preserved, however: *La Princesse de Navarre* and *Le Temple de la Gloire* (both 1745). The former was condensed and revised as *Les Fêtes de Ramire* (1745) by Jean-Jacques Rousseau.

Rousseau, Jean Le Rond d'Alembert, and other writers associated with Denis Diderot's *Encyclopédie* began as ardent Rameau enthusiasts, but, by the mid-1750s, as they warmed more and more to Italian music, they gradually turned against him. Rameau appreciated the new Italian music as much as anyone, but the works he consciously composed in this style, such as the overtures to *Les Fêtes de Polymnie* (1745) and to his final work *Abaris ou les Boréades* (1764), are not very individual.

The zenith of Rameau's career may be said to have encompassed the brief span from 1748, when he tossed off the masterpiece *Pygmalion* in eight days and had six other operas on the boards, through 1754, when he wrote *La Naissance d'Osiris* for the birth of the future Louis XVI. Thereafter, his fame diminished, as the prevailing musical style became what is now generally called "Classical." The public preferred catchy tunes with simple harmonies to Rameau's profound emotion and rich, late-Baroque harmony. (A.S.Cu.)

MAJOR WORKS. *Dramatic works.* 35 including *Hippolyte et Aricie* (first performed 1733), *Les Indes galantes* (1735), *Castor et Pollux* (1737), *Dardanus* (1739), *Platée* (1745), and *Zoroastre* (1749).

Chamber music. Pièces de clavecin en concerts (published 1741).

Harpsichord. 3 volumes of pieces under varying titles. Most have either dance titles such as "Allemande" and "Gigue," or illustrative ones such as "Les Tendres Plaintes" and "La Poule."

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Ramée, Pierre de la (French philosopher): *see* Ramus, Petrus.

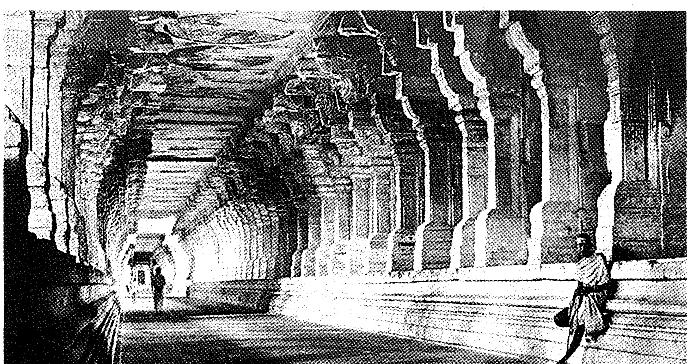
Ramenskoye, also spelled RAMENSKOJE, or RAMENSKOE, city and centre of a *rayon* (sector), Moscow *oblast* (province), western Russian Soviet Federated Socialist Republic. It lies southwest of Moscow, the nation's capital. In the 1820s it became the site of one of Russia's first cotton factories and soon developed as an industrial village. Incorporated in 1926, it is now a textile and engineering centre as well as a residential suburb of Moscow. It has a medical school and technical colleges. Pop. (1987 est.) 86,000.

Rameses, also spelled RAMESSES: *see* Ramses.

Ramesseum, funerary temple of Ramses II (1279–13 BC), erected on the west bank of the Nile at Thebes in Upper Egypt. The temple, famous for its 57-foot (17-metre) seated statue of Ramses II (of which only fragments are left), was dedicated to the god Amon and the deceased king. The walls of the Ramesseum, which is only about half preserved, are decorated with reliefs, including scenes depicting the Battle of Kadesh, the Syrian wars, and the Festival of Min. This temple is identified with the "Tomb of Osymandias" (a corruption of Ramses II's prenomen) described by the Augustan historian Diodorus Siculus, and the shattered colossus of Ramses was the subject of Percy Bysshe Shelley's poem "Ozymandias."

Relief showing Hittites fleeing before Ramses II at Kadesh, Ramesseum
Hirmer Fotoarchiv, Munchen

Rāmeswaram, island, southeastern Tamil Nādu state, southeastern India. It forms part of Adams Bridge, a series of coral reef islands connecting India and Sri Lanka. The island contains a temple that is one of the most venerated of all Hindu shrines. The great Temple of Rāmeswaram was built in the 17th century on the traditional site said to be sanctified by the god Rāma's footprints when he crossed the island on his journey to rescue his wife Sītā from the demon Rāvaṇa. The temple is built on rising ground above a small lake. It is quadrangular in shape and is about 1,000 feet (305 m) long and 650 feet (198 m) wide. It has a 100-foot- (30-metre-) high gopura, or tower gateway, but the temple's outstanding features are its 700-foot- (213-metre-) long pillared halls, which open into richly decorated transverse galleries. The temple is perhaps the finest example of Dravidian architecture. Sacred to both Vaishnavas and Śaivas, it is the most holy place for Hindus in India after Vārānasi (Benares).



Side corridor of the Temple of Rāmeswaram, Tamil Nādu, India
Syndication International Ltd.

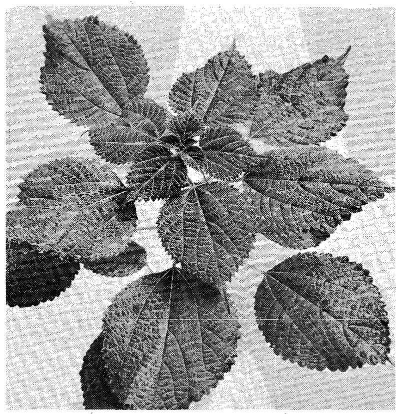
ramie, any of several fibre-yielding plants of the genus *Boehmeria,* belonging to the nettle family (Urticaceae), and their fibre, one of the bast fibre (*q.v.*) group. *B. nivea,* native to China, is the species usually cultivated for fibre, although *B. nivea* variety *tenacissima,* native to Malaysia and frequently called rhea, is also a fibre source.

The ramie plant has been cultivated in eastern Asia for fibre since prehistoric times. Ramie fabric was used in ancient Egypt and was known in Europe during the Middle Ages. Ramie fibre, also known as China grass, and ramie fabric, variously known as grass linen, grass cloth, or China linen, have been exported from East Asia to the Western Hemisphere since early in the 18th century, but commercial production of ramie products did not achieve importance in the West until the 1930s. Because of its desirable properties, including strength and durability, ramie has frequently been promoted as a textile fibre of great potential.

The plant is a perennial producing many stalks, each growing from 3 to 8 feet (1.9 to 2.4 m) high. The leaves, growing on the upper portion of the stalk, are somewhat heart-shaped with serrated edges. The leaves of *B. nivea* have bright green upper sides and undersides that are covered with white hairs; those of variety *tenacissima* are green on both sides. Greenish white flowers form drooping clusters growing from the angles between leafstalks and stems.

Crops, usually propagated with cuttings from underground stems (rhizomes), grow best in well-drained, sandy soil and in warm, moist climates with evenly distributed rainfall averaging at least 3 to 5 inches (7.5 to 13 cm) per month. Harvesting takes place when the lower portion of the stalk turns brown and the tips of new stalks appear. The stalks are usually cut by hand. Ramie fibres are obtained by decortication, a hand or mechanical process in which the bark and the adhering fibre are separated from the stalk and soaked in water, allowing the fibre to be scraped from the bark.

The individual fibre cells are quite long, averaging 5 to 6 inches (13 to 15 cm) in length. Ramie fibre is pure white in colour, lustrous, moisture absorbent, and readily dyed. The fibres are spun into yarn, which can then be woven into textiles. The fibre is stronger than flax, cotton, or wool. Fabric made from ramie fibre is easily laundered, increasing in strength when wet, and does not shrink or lose its shape. It dries quickly and becomes smoother and more lustrous with repeated washings. Ramie is resistant to mildew and other types of microorganism attack and does not change colour with prolonged exposure to sunlight.



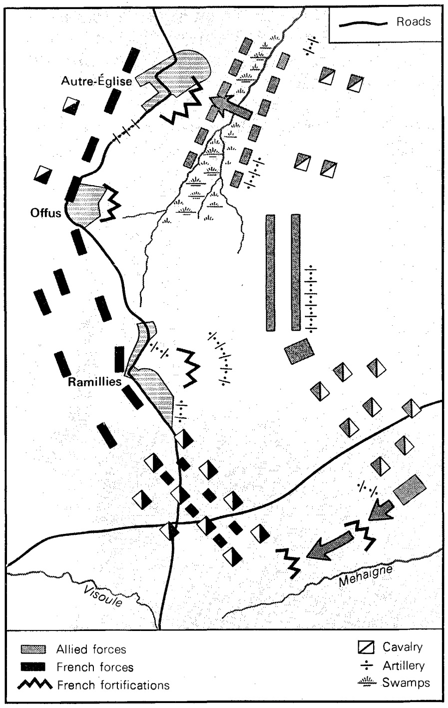
Ramie (*Boehmeria nivea*)
Walter Singer

Ramie has had limited acceptance for textile use, however. The fibre's extraction and cleaning are expensive, chiefly because several steps—involving scraping, pounding, heating, washing, or exposure to chemicals—are needed to separate the raw fibre from the adhesive gums or resins in which it is ensheathed. Spinning the fibre is made difficult by its brittle quality and low elasticity; and weaving is complicated by the hairy surface of the yarn, resulting from lack of cohesion between the fibres. The greater utilization of ramie depends upon the development of improved processing methods.

Ramie is used to make such products as industrial sewing thread, packing materials, fishing nets, and filter cloths. It is also made into fabrics for household furnishings and clothing, frequently in blends with other textile fibres. Shorter fibres and waste are used in paper manufacture. China leads in the production of ramie and exports mainly to Japan and Europe. Other producers include Japan, Taiwan, the Philippines, and Brazil.

Ramillies, Battle of (May 23, 1706), victory won by Allied (Anglo-Dutch) forces led by the Duke of Marlborough over the French during the War of the Spanish Succession. The victory led to the Allied capture of the whole north and east of the Spanish Netherlands.

The battle was fought at the village of Ramillies, 13 miles north of Namur (in modern Belgium), between a 62,000-man Allied army under Marlborough and a 60,000-man French army under François de Neufville, Duke de Villeroi. Under orders from Louis XIV to seek battle, the French reached the plain of Ramillies ahead of the Allies but deployed unwisely along the entire length of a 4-mile (6.5-kilometre) ridge, the centre of which was at the villages of Ramillies and Offus. A strong Allied attack on the French left forced Villeroi to shift reinforcements from his centre. Marlborough, however, called off this attack because the marshy ground would not permit cavalry support. Half of the battalions from this wing then marched, undetected by the French, to the centre to support the final concentrated Allied assault. This smashed the overextended French army. The French lost about 17,000 killed, wounded, or captured and by the next morning were thoroughly dispersed. Allied losses numbered about 5,000 killed and wounded. Although many towns fell to the



The Battle of Ramillies, initial attack

From David Chandler (ed.), *A Guide to the Battlefields of Europe*, vol. 1, copyright 1965 by Hugh Evelyn Ltd.; published by Dimension Books, Denville, New Jersey

Allies in the succeeding weeks, they were unable to coordinate their strategy against Louis XIV, and the seemingly decisive victory did not lead to a peace settlement.

Ramiro, name of rulers grouped below by country and indicated by the symbol •.

ARAGON

•**Ramiro I** (d. May 8, 1063), first king of Aragon, who reigned from 1035. He was the illegitimate son of King Sancho III of Navarre. During his father's lifetime he governed this territory and was made king of it by his father's will. In 1045 he annexed the territories belonging to his brother Gonzalo upon the latter's death. Ramiro later conquered some territory from the Moors and made the Moorish kings of Huesca, Saragossa, and Lérida his tributaries.

•**Ramiro II,** byname RAMIRO THE MONK, Spanish RAMIRO EL MONJE (d. 1154), king of Aragon from 1134 to 1137. He was the third son of Sancho V Ramirez. His elder brother, Alfonso I the Battler, left no issue and bequeathed his kingdom to the military orders. Ramiro, who had entered a monastery and was bishop-elect of Barbastro, renounced his vows, married, and received the crown. His daughter Petronila was betrothed to the son of Count Ramón Berenguer IV of Barcelona. Ramiro abdicated in 1137 in favour of his daughter and son-in-law, and later, in 1164, the crown of Aragon was united with the county of Barcelona, under their son, Alfonso II.

LEON AND ASTURIAS

•**Ramiro II** (d. 951, León, Leon), king of Leon and Asturias in Christian Spain from 931 to 951, an exceptional general who scored several major victories (*e.g.,* the Battle of Simancas, 939) over the caliphate of Córdoba in Muslim Spain. The second son of King Ordoño II, he became king on the abdication of his elder brother, Alfonso IV. In 944 he negotiated a five-year truce with the caliph ʿAbd ar-Raḥmān III. He failed, however, to suppress the Castilian separatist movement led by Fernán González, the first count of unified Castile, a region that came to dominate Spain militarily, politically, and linguistically.

ramjet, air-breathing jet engine that operates with no major moving parts. It relies on forward motion to draw in air and on a specially shaped intake passage to compress air for combustion. After fuel sprayed into the engine has been ignited, combustion is self-sustaining. As in other jet engines, forward thrust is obtained as a reaction to the rearward rush of hot exhaust gases.

Ramjets work best at speeds of Mach 2 (twice the speed of sound) and higher. Since ramjets develop no static thrust, some means for launching them at high velocity is required.

The first aircraft to fly solely on ramjet power, the Leduc 0.10, was built in France and was launched from another airplane April 21, 1949. *Compare* turbojet.

Ramkhamhaeng (b. 1239?—d. 1298?), third king of Sukhothai in north central Siam, who made his young and struggling kingdom into the first major Thai state in 13th-century Southeast Asia.

On the death of his brother, King Ban Muang, in about 1279, Ramkhamhaeng inherited his tiny kingdom of only a few hundred square miles. Over the next two decades—by careful diplomacy, shrewd alliances, and military campaigns—he extended his power and influence as far as Vientiane and Luang Prabang in what is now Laos, west to the Indian Ocean coast of Burma, and south on the Malay Peninsula to Nakhon Si Thammarat. It is likely that he did not directly rule all this area but rather gained the recognition by local rulers of his suzerainty. He united a region that shared a new faith in Therāvada Buddhism and a hostility toward the Cambodian kingdom of Angkor, which earlier had dominated the region. Missing from the Sukhothai empire was the eastern half of the lower Chao Phraya River valley, which in the 14th century was absorbed by Ramkhamhaeng's successors and became the core of a new Thai empire centred on Ayutthaya.

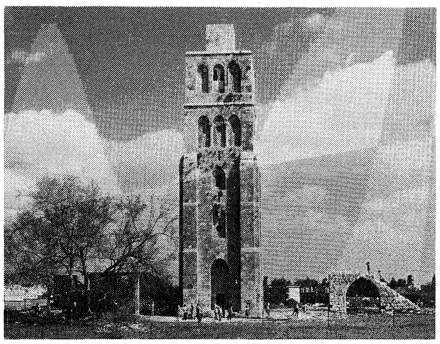
Most that is known of Ramkhamhaeng comes from his great inscription of 1292, the earliest extant inscription in the Thai language, in a script devised by the King himself. It portrays the King as a patriarchal ruler, father to his subjects, whose justice and liberality were available to all. He was an ardent and generous patron of Buddhism, a promoter of trade, and a friend to neighbouring rulers. Under Ramkhamhaeng, Sukhothai became the cradle of Siamese civilization. The arts developed distinctively Thai expressions, and Sukhothai bronze sculpture reached an especially high level. Ceramics, based on techniques borrowed from China, were produced at Sukhothai and Sawankhalok and became a major item of international trade.

Ramkhamhaeng's kingdom was built upon the personal power and magnetism of an exceptional ruler, and when the King died, his distant vassals soon broke away. The region, however, was left with a vision of unity and a sense of cultural integrity upon which Sukhothai's successor states, especially Ayutthaya, were to build in following centuries.

Save for colourful local legends, Ramkhamhaeng was all but forgotten until King Mongkut of Siam, then a Buddhist monk, rediscovered his 1292 inscription in 1834. Ramkhamhaeng since came to be regarded as a national hero in Thailand.

Ramla, city in Israel, on the coastal plain southeast of Tel Aviv–Yafo. Ramla is the only city founded by the Arabs in Palestine. It was established in 716 by the caliph Sulaymān ibn ʿAbd al-Malik (ruled 715–717), who made it the administrative capital of Palestine, replacing nearby Lod (Lydda). He built marketplaces, fortifications, and, above all, the Great Mosque. Only ruins of these remain, but the minaret of the Great Mosque, the so-called White Tower, 89 ft (27 m) tall, added by the Mamlūk sultan Baybars (ruled 1260–77), still stands. During the First Crusade (1096–99), the city was captured and fortified by the crusaders, who called it Rames. The fortifications were destroyed by Saladin when he took the city from the crusaders in 1187. From the 14th century on, Ramla developed as a trade centre; though an Arab city, it contained a Jewish community until the Arab–Jewish disturbances of 1936–39. Ramla was Napoleon's headquarters in 1799 in his unsuccessful attempt to take Palestine from the Turks.

The United Nations partition resolution of Nov. 29, 1947, placed Ramla in a projected Palestinian Arab state. When this state was not proclaimed, Ramla and environs were invaded by Transjordan's Arab Legion. Since Arab control of the area endangered the greater Tel Aviv area, the Legion was attacked by the Israelis, who took the city on July



White Tower of the Great Mosque, Ramla, Israel

William Greene—Photo Researchers

12, 1948. Most of the largely Christian Arab population fled; after the hostilities, they were replaced with Jewish immigrants. There are Arabs in the present population, and the city is unique in having a Jewish–Arab Friendship League. Ramla's industries include manufacture of cement, plywood, and electrical components and benefit from being located at a major highway and railway junction.

Interesting sites in the city, aside from the White Tower, are the Franciscan Hospice of St. Nicodemus and St. Joseph, where Napoleon's room is shown; the Great Mosque (al-Jāmiʿ al-Kabīr) built on the foundations of the 12th-century crusader cathedral of St. John; and the Pool of St. Helena, an 8th-century reservoir decorated with ornamental pillars and now used by small tourist boats. Pop. (1982 est.) 42,300.

rammed earth, building material made by compacting certain soils, used by many civilizations. The most durable of the earth-building forms, rammed earth may be used for making building blocks or for constructing whole walls in place, layer by layer. In making building blocks, the soil is rammed into a box-shaped mold. In building up whole walls, two wooden planks separated by a spacer bolt are used as a form, and the earth is rammed into this in layers; when the form is filled, it is removed and superimposed on the top of the wall and more earth is rammed in until the desired height is reached. Ironheaded rammers, roller-mounted forms, pneumatic rammers, and hydraulic, mass-production block presses have been used. The soil used must be high in sand and low in clay, 70 percent and 30 percent being the usual proportions. About 10 percent water is added in modern practice. Good compressive strength is characteristic of rammed earth.

Wall thicknesses are usually at least 12 inches (30 centimetres), a mass that results in a high thermal capacity, keeping the internal conditions uniform in climates having large variations in temperature from day to night. To give it increased resistance to weather, the wall surface is often treated with plaster, bitumen, or linseed oil. Stabilizers may be added to the soil to increase weather resistance and strength; portland cement and bitumen are commonly used.

Ramo, Simon (b. May 7, 1913, Salt Lake City, Utah, U.S.), U.S. engineer who made notable contributions to electronics and was chief scientist (1954–58) of the U.S. intercontinental ballistic missile (ICBM) program.

From 1936 to 1946 Ramo worked for the General Electric Company, Schenectady, N.Y., developing microwave transmission and detection equipment and General Electric's electron microscope. In 1946 he accepted a position with Hughes Aircraft Company, Culver City, Calif., where he developed fire-control, radar, navigation, computer, and other aircraft-electronics systems. He also directed the development of the Falcon family of air-to-air guided missiles, which were used in the Korean War and became the major weapon on many fighter aircraft.

Ramo and fellow engineer Dean E. Wooldridge left Hughes Aircraft in 1953 to form the Ramo-Wooldridge Corporation, obtaining financial support from Thompson Products, Inc. For the next four years, Ramo-Wooldridge had the primary responsibility for developing the Atlas, Titan, and Minuteman ICBM's as well as other missiles that were widely used in the late 1950s and 1960s for defense, research, and exploratory probes into space. In 1958 Ramo-Wooldridge merged with Thompson Products to form Thompson Ramo-Wooldridge, Inc., a name later shortened to TRW Inc. From 1978 Ramo served as chairman of TRW's science and technology committee, and from 1980 he served as chairman of TRW-Fujitsu Co.

In addition to technical works such as *Fields and Waves in Modern Radio* (1944), *Introduction to Microwaves* (1945), and *The Management of Innovative Technological Corporations* (1980), Ramo's writings include such studies of the relationship between science and society as *Cure for Chaos* (1969) and *America's Technology Slip* (1980).

Ramón (Spanish personal name): *see under* Raymond, except as below.

Ramon Berenguer (Catalan), Spanish RAMÓN BERENGUER, French RAIMOND BÉRENGER, English RAYMOND BERENGER, name of counts of Barcelona grouped below chronologically and indicated by the symbol •.

• Ramon Berenguer I, byname RAMON BERENGUER THE ELDER, Catalan RAMON BERENGUER EL VELL (b. 1023/24—d. May 26, 1076, Barcelona?), count of Barcelona from 1035 to 1076.

His father, Berenguer Ramon I (reigned 1018–35), divided and bequeathed his lands among his three sons; however, Sanç (or Sancho) in 1049 and Guillem (or William) in 1054 renounced their inheritances in their eldest brother's favour, thus reuniting the lands. Ramon Berenguer I also expanded his domain by securing control over the adjacent counties of Ampurias and Pallars. His most noted achievement was convoking the local Cortes (assembly) and having it deliberate on a choice of Roman and medieval laws for Catalonia. The result was the promulgation of the celebrated legal code known as the *Usatges de Barcelona* (1064–68).

• Ramon Berenguer II, byname RAMON BERENGUER THE TOWHEAD, Catalan RAMON BERENGUER CAP D'ESTOPES (b. *c.* 1053—d. Dec. 5, 1082, between Barcelona and Gerona, Catalonia), count of Barcelona who reigned jointly with his twin brother, Berenguer Ramon II, from 1076 to 1082.

Following up on the policies of their father, Ramon Berenguer I, they proceeded to build the defenses and repopulate the lands that he had conquered. In 1082, in a forest en route to Gerona, Ramon Berenguer II was murdered, probably by his brother, thereafter nicknamed "the Fratricide" ("el Fratricida"). Berenguer Ramon II, now sole master, took part in the civil wars of the Spanish Muslims and reconquered the Tarragona area (1091). He reigned until 1097, when, having lost a trial by combat that was intended to decide the question of his guilt in the crime attributed to him, he went on crusade to Jerusalem, where he died, probably in either 1097 or 1099.

• Ramon Berenguer III, byname RAMON BERENGUER THE GREAT, Catalan RAMON BERENGUER EL GRAN (b. 1082—d. 1131, Barcelona), count of Barcelona during whose reign, (1097–1131) independent Catalonia reached the summit of its historical greatness, spreading its ships over the western Mediterranean and acquiring new lands from the southern Pyrennees to Provence. He was also known as Ramon Berenguer I of Provence.

The son of Ramon Berenguer II, he took the throne on the departure of his uncle, Berenguer Ramon II, on crusade and spent his early years fighting off Almoravid Muslims, whose armies approached the very walls of Barcelona. Thereafter, his expansionist campaigns began. In 1111 he conquered the county of Besalú and, by his marriage to Douce (or Dolça) of Provence in 1112, acquired the county of Provence. In 1114–15 he undertook, with the Pisans, a joint expedition against the Balearic Islands, liberating thousands of Christian slaves and destroying the Moors' piratical bases. Commerce thereafter flourished between Barcelona, Marseille, Genoa, and Pisa. The following year (1116) he sailed to Rome to seek aid from the Italian states and to acquire a license from the Pope for his crusade in Spain, but the visit was largely unsuccessful. In 1117 he inherited the old county of Cerdaña in the Pyrenees.

On his death, Provence went to his younger son, Berenguer Ramon (as Berenguer Ramon I of Provence, reigning 1131–44); and the rest of the lands, the most important ones, went to the elder son, Ramon Berenguer IV.

• Ramon Berenguer IV, byname RAMON BERENGUER THE HOLY, Catalan RAMON BERENGUER EL SANT (b. *c.* 1113—d. Aug. 6, 1162, Borgo San Dalmazzo, Piedmont), count of Barcelona from 1131 to 1162, regent of Provence from 1144 to 1157, and ruling prince of Aragon from 1137 to 1162.

The elder son of Ramon Berenguer III, he continued his father's crusading wars against the Spanish Muslims. The Kingdom of Aragon soon sought Ramon Berenguer IV's aid against Castile. In the course of their negotiations, he was promised the hand of the Aragonese king Ramiro II's daughter and heir, Petronila (Peronella); they were married on Aug. 11, 1137, and a few months later (November 13), Ramiro II abdicated in favour of his daughter and son-in-law. Ramon Berenguer IV thus became the last count of Barcelona to take this as his principal title, for, from 1137, he was also ruler of Aragon (though he himself never assumed the title of king). From the reign of his son, who in 1162 succeeded him with the title of Alfonso II, the counts of Barcelona styled themselves, in the first place, kings of Aragon.

When Ramon Berenguer IV's father had died, he had left the county of Provence to a younger son. When this son died, his brother Ramon Berenguer IV acted as regent (conventionally with the title Ramon Berenguer II of Provence) until the legitimate heir, his young nephew, reached majority in 1157, as Ramon Berenguer III of Provence. When this count of Provence died in 1166 without a male heir, he was succeeded by Ramon Berenguer IV's son Alfonso II, king of Aragon. By his wars and conquests from the Moors—Tortosa (1148), Lerida, Mequinenza, and Fraga (1149), and Prades and Siurana (1153)—Ramon Berenguer IV definitively established the boundaries of the principality of Catalonia.

Ramón y Cajal, Santiago (b. May 1, 1852, Petilla de Aragón, Spain—d. Oct. 17, 1934, Madrid), Spanish histologist, who (with Camillo Golgi) received the 1906 Nobel Prize for Physiology or Medicine for establishing the neuron, or nerve cell, as the basic unit of nervous structure. This finding was instrumental in the recognition of the neuron's fundamental role in nervous function and in gaining a modern understanding of the nerve impulse.

Ramón y Cajal served as professor of descriptive anatomy at the University of Valencia (1884–87) and as professor of histology and pathological anatomy at the universities of Barcelona (1887–92) and Madrid (1892–1922). He improved Golgi's silver nitrate stain (1903) and developed a gold stain (1913) for the general study of the fine structure of nervous tissue in the brain, sensory centres, and the spinal cords of embryos and young animals. These nerve-specific stains not only enabled Ramón y Cajal to determine the fine structure of the retina of the eye and to trace the structure and connections of nerve cells in gray matter and the spinal cord but have also been of great value in the diagnosis of brain tumours.

In 1920 King Alfonso XIII of Spain commissioned the construction of the Institute Cajal in Madrid, where Ramón y Cajal worked until his death. Among his many books concerning nervous structure is *Estudios sobre la degeneración y regeneración del sistema nervioso*, 2 vol. (1913–14; *The Degeneration and Regeneration of the Nervous System,* 1928).

Ramos, Graciliano (b. Oct. 27, 1892, Quebrângulo, Braz.—d. March 20, 1953, Rio de Janeiro), Brazilian regional novelist whose works explore the lives of characters shaped by the rural misery of northeast Brazil.

Ramos spent most of his life in the backlands town of Palmeira dos Índios, where he was proprietor of a general store and mayor. His memoirs, *Infância* (1945; "Childhood"), describe the hazards of his family's fortunes in the drought-stricken area, his meagre schooling, and the education he pieced together for himself by reading Zola, Eça de Queiroz, Dostoyevski, and Gorky.

In 1934 he published his best known work, *São Bernardo* (Eng. trans., 1979), the reflections of Paulo Honório, who has risen by methods ranging from petty deceit to murder to become master of the plantation St. Bernard, where he was once a hired hand.

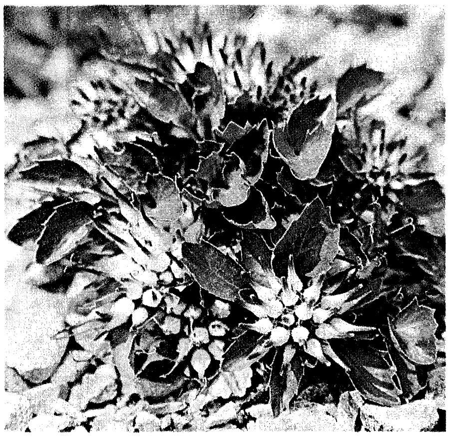
In 1936, before the Vargas coup d'etat of 1937, Ramos was arrested and imprisoned on a penal island. Though it was apparently because he was suspected of being a Communist, no explanation for his arrest was ever given him. (He later joined the Communist Party in 1945.) On his release from prison he settled in Rio de Janeiro, where he earned a marginal income as a federal inspector of education. In 1938 he wrote *Vidas Sêcas* (*Barren Lives,* 1965), a story of a family's flight from drought to a mysterious land of promise—the city.

Rampal, Jean-Pierre(-Louis) (b. Jan. 7, 1922, Marseille), French flutist who brought the flute to new prominence as a concert instrument.

Rampal studied with his father at the

Marseille conservatory, began the study of medicine, and then went to the Paris Conservatoire. Beginning his career as flutist in the Vichy Opéra orchestra (1947–51), he later was first flute at the Paris Opéra (1956–62), and in 1968 he joined the faculty of the Paris Conservatoire. His career combined international concert tours with teaching and with editing music by such composers as Antonio Vivaldi and Joseph Haydn. Particularly devoted to the 18th-century repertoire, he founded the French Wind Quintet in 1945 and the Baroque Ensemble of Paris in 1953. He gained admiration for his combination of technical command, smooth, cleanly articulated tone, and mastery of subtle tonal nuance. Works composed for him include ones by André Jolivet and Francis Poulenc.

rampion, any member of the genus *Phyteuma,* of the bellflower family (Campanulaceae), consisting of about 40 species of peren-



Horned rampion (*Phyteuma comosum*)
A to Z Botanical Collection—EB Inc.

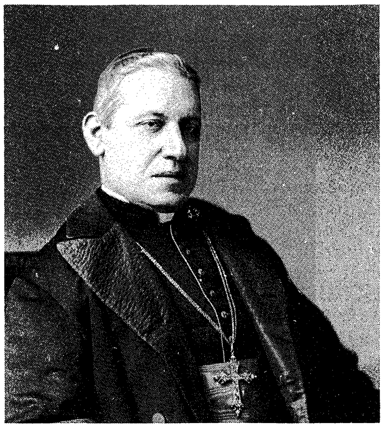
nial plants with long, clustered, hornlike buds and flowers native to sunny fields and meadows of the Mediterranean region. Rampion also refers to *Campanula rapunculus,* whose turnip-like roots and leaves are eaten in salads.

Round-headed rampion (*P. oribiculare*) produces deep-blue heads of 15 to 30 flowers that sit on a circle of bractlike leaves atop a stem about 45 centimetres (1½ feet) tall. Stem leaves are unstalked and narrow; basal leaves are long-stalked and oval and arise from a creeping rootstalk. Spike rampion (*P. spicatum*) has oblong spikes of yellowish-white flowers. Some species of rampion are grown as garden ornamentals.

Rampolla (del Tindaro), Mariano (b. Aug. 17, 1843, Polizzi, Sicily—d. Dec. 16, 1913, Rome), Italian prelate who played a notable role in the liberalization of the Vatican under Leo XIII.

On completing his studies at the Capranica College in Rome and taking orders, Rampolla trained for a diplomatic career in the church at the College of Ecclesiastical Nobles and, in 1875, was appointed counsellor to the papal nunciature in Madrid. After serving on the Congregation for the Propagation of the Faith in Rome in 1877, he returned to Madrid as nuncio (1882–87). On March 14, 1887, he was created cardinal and two months later was appointed by Leo XIII as papal secretary of state.

Alive to the political and social realities of his age, especially the currents of republicanism and Socialism, Cardinal Rampolla assembled the ideas for the encyclical *Rerum Novarum* ("New Things"), issued by Leo in 1891, emphasizing the obligations of governments and



Rampolla
Publifoto

employers to the working class. On Leo's death in 1903, it was widely anticipated that Cardinal Rampolla would succeed to the Holy See, but the Austrian emperor Francis Joseph threatened a veto; Pope Pius X, who subsequently abolished the princely right of veto, made Rampolla head of the Congregation of the Holy Office.

Rāmpur, town, administrative headquarters of Rāmpur district, Uttar Pradesh state, northern India, on the Kosi River, at a road and rail junction. A trade centre for agricultural products, its industry includes sugar processing, manufacturing, and cotton milling. Rāmpur is the site of Raza College and a state library.

Rāmpur district, 916 sq mi (2,372 sq km) in area, encompasses a tract of alluvial plain drained by the Rāmgangā River. Crops include grains, sugarcane, and cotton. The district was formerly a princely state, with Rāmpur town as its capital. It was incorporated into Uttar Pradesh in 1949. Pop. (1981) town, 204,610; district, 1,178,621.

Rampur Boalia (Bangladesh): *see* Rājshāhi.

Ramsay, Allan (b. Oct. 15, 1686, Leadhills, Lanarkshire, Scot.—d. Jan. 7, 1758, Edinburgh), Scottish poet and literary antiquary who maintained national poetic traditions by writing Scots poetry and by preserving the work of earlier Scottish poets at a time when most Scottish writers had been Anglicized. He was highly regarded by Robert Burns as a pioneer in the use of Scots in contemporary poetry.

Ramsay settled in Edinburgh *c.* 1700 and in 1701 became an apprentice wigmaker. Established in this respected craft, he married in 1712. In the same year he helped found the

Allan Ramsay, oil painting by John Smibert; in the Scottish National Portrait Gallery, Edinburgh
By courtesy of the Scottish National Portrait Gallery, Edinburgh

Easy Club, a Jacobite literary society. His pen names, first Isaac Bickerstaff and later Gawin Douglas, suggest both Augustan English and medieval Scottish influences. He soon established a reputation as a prolific composer of verse in both English and Scots, much of it modelled on classical styles and traditional metrical patterns, sometimes uneasily adapted to suit contemporary Edinburgh Neoclassical taste. He made considerable use of Scots in humorous and satirical verse; and, by collecting and publishing poems by Robert Henryson, William Dunbar, and other late medieval Scottish writers, Ramsay, though no scholarly respecter of texts, made certain of their survival and indirectly gave impetus to more accurate editing of Scottish poetry and song later in the century.

In 1721 Ramsay published a subscriber's edition of his own poems, including several in mock-elegy style, and renderings in Scots of Horace's *Odes;* a second volume appeared in 1728. An original pastoral comedy, *The Gentle Shepherd* (1725), gained much of its effect from the use of Scots; the appearance of John Gay's *Beggar's Opera* (1728) encouraged him to turn it into a ballad opera (1729). *The Tea-table Miscellany,* 3 vol. (1724–37), *The Ever Green,* 2 vol. (1724), and *Scots Proverbs* (1737) make up the bulk of his collection of old Scottish songs, poems, and wise sayings. *Fables and Tales* (1722–30) include versions of La Fontaine and La Motte in Scots.

After publication of the 1721 *Poems,* Ramsay changed from wigmaker to bookseller, and his shop became a meeting place for both townsmen and visitors. He founded Britain's first circulating library (1726); the Academy of St. Luke, for instruction in painting and drawing (1729); and a theatre (1736–39), eventually closed by extremists in the Church of Scotland presbytery, who found legal justification in the 1737 Licensing Act. He retired in 1740 but remained active until his death.

Ramsay, Allan (b. Oct. 13, 1713, Edinburgh—d. Aug. 10, 1784, Dover, Kent, Eng.), Scottish-born painter, one of the foremost 18th-century British portraitists.

The son of the poet and literary antiquary Allan Ramsay, he received rudimentary artistic training in Edinburgh and then went to London and worked with the Swedish portrait painter Hans Hysing (1734). His style was also influenced by Francesco Imperiali and Francesco Solimena during his studies in Italy during 1736–38. On settling in London in 1739 Ramsay soon became a popular portraitist, although he reached the height of his powers only after his return to London from his second visit to Italy (1754–57).

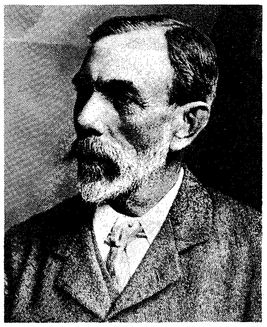
Though Ramsay painted many portraits of distinguished personages in a style anticipating Sir Joshua Reynolds' grand manner, his reputation now rests on his less formal and more intimate studies. His portraits of women are especially notable for the warmth, tenderness, and bloom of their presentation, as well as for the technical facility with which lace and ruffles are reproduced. The influence of French Rococo portraiture is strongly evident in the lightness and unpretentious elegance of these works.

In 1767 Ramsay was appointed painter to George III and executed little but royal images thenceforth. Most of this work, intended for government buildings, was done by assistants, and Ramsay devoted the rest of his life to political pamphleteering, classical studies, and conversation.

Ramsay, Fox Maule: *see* Dalhousie, Fox Maule Ramsay, 11th earl of.

Ramsay, James Andrew Broun: *see* Dalhousie, James Andrew Broun Ramsay, marquess and 10th earl of.

Ramsay, Sir William (b. Oct. 2, 1852, Glasgow—d. July 23, 1916, High Wycombe, Buck-



William Ramsay
BBC Hulton Picture Library

inghamshire, Eng.), British chemist whose discovery of four of the noble gases (neon, argon, krypton, and xenon) earned him the Nobel Prize for Chemistry in 1904.

A student of the German analytical chemist Robert Bunsen at the University of Heidelberg (1871), Ramsay became professor of chemistry at the University of Bristol, England (1880–87), and at the University of London (1887–1913). Among his early studies was the physiological action of alkaloids (complex chemical compounds derived from plants); he established their relationship to pyridine, a nitrogen-containing organic compound closely resembling benzene in chemical structure. With John Shields, he verified Roland Eötvös' law for the constancy of the rate of change of molecular surface energy with temperature.

When in 1892 the British physicist Lord Rayleigh asked chemists to explain the difference in the atomic weight of nitrogen found in chemical compounds and the heavier free nitrogen found in the atmosphere, Ramsay predicted that nitrogen isolated from the atmosphere was consistently contaminated with a hitherto undiscovered heavy gas. Devising a method that assured total removal of nitrogen and oxygen from air, Ramsay and Rayleigh found (1894) a chemically inert gaseous element, later called argon, making up nearly one percent of the atmosphere. The following year Ramsay liberated helium from the mineral cleveite and thus became the first person to isolate that element. He later (1903) demonstrated that helium, the lightest of the inert gases, is continually produced during the radioactive decay of radium, a discovery of crucial importance to a modern understanding of nuclear reactions.

The positions of helium and argon in the periodic table of elements (a systematic ordering of the elements according to their atomic weights and chemical properties) indicated that at least three more noble gases should exist, and in 1898 Ramsay and the British chemist M.W. Travers isolated these elements—called neon, krypton, and xenon—from air brought to a liquid state at low temperature and high pressure. In 1910 Ramsay detected the presence of the last of the noble-gas series, called niton (now known as radon), in the radioactive emissions of radium. Ramsay thus had the unique fame of discovering a whole family of elements.

Ramsay was elected fellow of the Royal Society in 1888 and was knighted in 1902. His writings include *A System of Inorganic Chemistry* (1891), *The Gases of the Atmosphere* (1896), *Modern Chemistry*, 2 vol. (1900), *Introduction to the Study of Physical Chemistry* (1904), and *Elements and Electrons* (1913).

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Ramsden, Jesse (b. Oct. 6, 1735, Halifax, Yorkshire, Eng.—d. Nov. 5, 1800, Brighton, Sussex), British pioneer in the design of precision tools.

Ramsden was apprenticed as a boy to a cloth worker, but in 1758 he apprenticed himself to a mathematical instrument maker. He went into business for himself in London in 1762. He designed dividing engines of great accuracy for both circles and straight lines and produced highly accurate sextants, theodolites, and vertical circles for astronomical observatories. He also built barometers, manometers, assay balances, and other instruments. He was elected to the Royal Society in 1786 and awarded the Copley Medal in 1795.

Ramses, also spelled RAMESES, or RAMESSES, name of kings of Egypt grouped below chronologically and indicated by the symbol •.

• **Ramses I** (fl. 14th century BC), king of Egypt (reigned 1292–90 BC), founder of the 19th dynasty of Egypt.

Probably descended from a nonroyal military family from the northeast Egyptian delta, Ramses found favour with Horemheb, the last king of the 18th dynasty, who was also a military man. As the elderly king had no son of his own, he made Ramses coregent not long before his own death. By then Ramses also was of advanced age, but his son, Seti I, was in the prime of life.

In 1292 Ramses I ascended the throne and shortly thereafter made Seti his coregent to help him assume some of the more rigorous royal duties. While his son planned campaigns against Syria in an attempt to regain Egypt's lost possessions there, Ramses completed the decoration of the second pylon and its vestibule in the great Karnak temple of the national god, Amon, at Thebes, which was built and partly decorated by his predecessor. He was also involved in the building of the great colonnaded hall in the temple at Karnak and had begun its decoration just before his death in 1290.

Inscriptions reveal that Ramses reigned about one year and four months. He was buried in a small, hastily prepared tomb in the Valley of the Tombs of the Kings at Thebes.

• **Ramses II,** byname RAMSES THE GREAT, also called USERMARE RAMSES (fl. 13th century BC), third king of the 19th dynasty of Egypt, whose reign (1279–13 BC) was the second longest in Egyptian history. In addition to his wars with the Hittites and Libyans, he is known for his extensive building programs and for the many colossal statues of him found all over Egypt.

Background and early years of reign. Ramses' family, of nonroyal origin, came to power some decades after the reign of the religious reformer, Akhenaton (Amenhotep IV, 1353–36 BC), and set about restoring Egyptian power in Asia, which had declined under Akhenaton and his successor, Tutankhamen. Ramses' father, Seti I, subdued a number of rebellious princes in Palestine and southern Syria and waged war on the Hittites of Anatolia in order to recover those provinces in the north that during the recent troubles had passed from Egyptian to Hittite control. Seti achieved some success against the Hittites at first, but his gains were only temporary, for at the end of his reign the enemy was firmly established at Kadesh, on the Orontes River, a strong fortress defended by the river, which became the key to their southern frontier.

Ramses II, upper portion of a granite figure from Thebes, 1250 BC; in the British Museum
Reproduced by courtesy of the trustees of the British Museum

During his reign Seti gave the crown prince Ramses, the future Ramses II, a special status as regent. Seti provided him with a kingly household and harem, and the young prince accompanied his father on his campaigns, so that when he came to sole rule he had already had experience of kingship and of war. It is noteworthy that Ramses was designated as successor at an unusually early age, as if to ensure that he would in fact succeed to the throne. He ranked as a captain of the army while still only 10 years old; at that age his rank must surely have been honorific, though he may well have been receiving military training.

Because his family's home was in the Nile delta and in order to have a convenient base for campaigns in Asia, Ramses built for himself a full-scale residence city called Pi-Ramesse (House of Ramses; biblical Raamses), which was famous for its beautiful layout, with gardens, orchards, and pleasant waters. Each of its four quarters had its own presiding deity: Amon in the west, Seth in the south, the royal cobra goddess, Buto (Wadjet), in the north, and, significantly, the Syrian goddess Astarte in the east. A vogue for Asian deities had grown up in Egypt, and Ramses himself had distinct leanings in that direction.

The first public act of Ramses after his accession to sole rule was to visit Thebes, the southern capital, for the great religious festival of Opet, when the god Amon of Karnak made a state visit in his ceremonial barge to the temple of Luxor. When returning to his home in the north, the king broke his journey at Abydos to worship Osiris and to arrange for the resumption of work on the great temple founded there by his father, which had been interrupted by the old king's death. He also took the opportunity to appoint as the new high priest of Amon at Thebes a man named Nebwenenef, high priest of Anhur at nearby Thinis.

Military exploits. It seems that, apart from his extensive building activities and his famous residence city, Ramses' reputation as a great king in the eyes of his subjects rested largely on his fame as a soldier.

In the fourth year of his reign, he led an army north to recover the lost provinces his father had been unable to conquer permanently. The first expedition was to subdue rebellious local dynasts in southern Syria, to ensure a secure springboard for further advances. He halted at the Nahr al-Kalb near Beirut, where he set up an inscription to record the events of the campaign; today nothing remains of it except his name and the date; all the rest has weathered away.

The next year the main expedition set out. Its objective was the Hittite stronghold at Kadesh. Following the coastal road through Palestine and Lebanon, the army halted on reaching the south of the land of Amor, perhaps in the neighbourhood of Tripolis. Here Ramses detached a special task force, the duty of which seems to have been to secure the seaport of Simyra and thence to march up the valley of the Eleutherus River (Nahr el-Kebir) to rejoin the main army at Kadesh. The main force then resumed its march to the River Orontes, the army being organized in four divisions of chariotry and infantry, each consisting of perhaps 5,000 men.

Crossing the river from east to west at the ford of Shabtuna, about eight miles from Kadesh, the army passed through a wood to emerge on the plain in front of the city. Two captured Hittite spies gave Ramses the false information that the main Hittite army was at Aleppo, some distance to the north, so that it appeared to the king as if he had only the garrison of Kadesh to deal with. It was not until the army had begun to arrive at the camping site before Kadesh that Ramses learned that the main Hittite army was in fact concealed behind the city. Ramses at once sent off messengers to hasten the remainder of his forces, but before any further action could be taken, the Hittites struck with a force of 2,500 chariots, with three men to a chariot as against the Egyptian two. The leading Egyptian divisions, taken entirely by surprise, broke and fled in disorder, leaving Ramses and his small corps of household chariotry entirely surrounded by the enemy and fighting desperately.

Fortunately for the king, at the crisis of the battle, the Simyra task force appeared on the scene to make its junction with the main army and thus saved the situation. The result of the battle was a tactical victory for the Egyptians, in that they remained masters of the stricken field, but a strategic defeat in that they did not and could not take Kadesh. Neither army was in a fit state to continue action the next day, so an armistice was agreed and the Egyptians returned home. This battle is one of the very few from pharaonic times of which there are real details, and that is because of the king's pride in his stand against great odds; pictures and accounts of the campaign, both an official record and a long poem on the subject, were carved on temple walls in Egypt and Nubia, and the poem is also extant on papyrus.

The failure to capture Kadesh had repercussions on Egyptian prestige abroad, and some of the petty states of South Syria and northern Palestine under Egyptian suzerainty rebelled, so that Ramses had to strengthen the northern edge of Egypt's Asiatic realm before again challenging the Hittites. In the eighth or ninth year of his reign, he took a number of towns in Galilee and Amor, and the next year he was again on the Nahr al-Kalb. It may have been in the 10th year that he broke through the Hittite defenses and conquered Katna and Tunip—where, in a surprise attack by the Hittites, he went into battle without his armour—and held them long enough for a statue of himself as overlord to be erected in Tunip. In a further advance he invaded Kode, perhaps the region between Alexandretta and Carchemish. Nevertheless, like his father before him, he found that he could not permanently hold territory so far from base against continual Hittite pressure, and, after 16 years of intermittent hostilities, a treaty of peace was concluded in 1258 BC, as between equal great powers, and its provisions were reciprocal.

The wars once over, the two nations established friendly ties. Letters on diplomatic matters were regularly exchanged; in 1245 Ramses contracted a marriage with the eldest daughter of the Hittite king, and it is possible that at a later date he married a second Hittite princess. Apart from the struggle against the Hittites, there were punitive expeditions against Edom, Moab, and Negeb and a more serious war against the Libyans, who were constantly trying to invade and settle in the delta; it is probable that Ramses took a personal part in the Libyan war but not in the minor expeditions. The latter part of the reign seems to have been free from wars.

Prosperity during his reign. One measure of Egypt's prosperity is the amount of temple building the kings could afford to carry out, and on that basis the reign of Ramses II is the most notable in Egyptian history, even making allowance for its great length. It was that, combined with his prowess in war as depicted in the temples, that led the Egyptologists of the 19th century to dub him "the Great," and that, in effect, is how his subjects and posterity viewed him; to them he was the king par excellence. Nine kings of the 20th dynasty called themselves by his name; even in the period of decline that followed, it was an honour to be able to claim descent from him, and his subjects called him by the affectionate abbreviation Sese.

In Egypt he completed the great hypostyle hall at Karnak (Thebes) and continued work on the temple built by Seti I at Abydos, both of which were left incomplete at the latter's death. Ramses also completed his father's funerary temple on the west bank of the Nile at Luxor (Thebes) and built one for himself, which is now known as the Ramesseum. At Abydos he built a temple of his own not far from that of his father; there were also the four major temples in his residence city, not to mention lesser shrines.

In Nubia (Nilotic Sudan) he constructed no fewer than six temples, of which the two carved out of a cliffside at Abu Simbel, with their four colossal statues of the king, are the most magnificent and the best known. The larger of the two was begun under Seti I but was largely executed by Ramses, while the other was entirely due to Ramses. In the Wadi Tumilat, one of the eastern entries into Egypt, he built the town of Per-Atum (biblical Pithom), which the Bible calls a store city (Exodus 1:11) but which probably was a fortified frontier town and customs station. In fact, there can have been few sites of any importance that originally did not exhibit at least the name of Ramses, for, apart from his own work, he did not hesitate to inscribe it on the monuments of his predecessors. In addition to the construction of Pi-Ramesse and Pithom, his most notable secular work, so far as is known, included the sinking of a well in the eastern desert on the route to the Nubian gold mines.

Of Ramses' personal life virtually nothing is known. His first and perhaps favourite queen was Nefertari; the fact that, at Abu Simbel, the smaller temple was dedicated to her and to the goddess of love points to real affection between them. She seems to have died comparatively early in the reign, and her fine tomb in the Valley of the Tombs of the Queens at Thebes is well known. Other queens whose names are preserved were Isinofre, who bore the king four sons, among whom was Ramses' eventual successor, Merneptah; Merytamun; and Matnefrure, the Hittite princess. In addition to the official queen or queens, the king, as was customary, possessed a large harem, and he took pride in his great family of well over 100 children. The best portrait of Ramses II is a fine statue of him as a young man, now in the Turin museum; his mummy, preserved in a mausoleum at Cairo, is that of a very old man with a long narrow face, prominent nose, and massive jaw.

The reign of Ramses II marks the last peak of Egypt's imperial power. After his death Egypt was forced on the defensive but managed to maintain its suzerainty over Palestine and the adjacent territories until the later part of the 20th dynasty, when, under the weak kings who followed Ramses III, internal decay ended its power beyond its borders. Ramses II must have been a good soldier, despite the fiasco of Kadesh, or else he would not have been able to penetrate so far into the Hittite Empire as he did in the following years; he appears to have been a competent administrator, since the country was prosperous, and he was certainly a popular king. Some of his fame, however, must surely be put down to his flair for publicity: his name and the record of his feats on the field of battle were found everywhere in Egypt and Nubia. It is easy to see why, in the eyes both of his subjects and of later generations, he was looked on as a model of what a king should be. (R.O.F.)

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• **Ramses III** (d. 1156 BC, Thebes, Egypt), king of Egypt (reigned 1187–56 BC), who defended his country against foreign invasion in three great wars, thus ensuring tranquillity during much of his reign. In his final years, however, he faced internal disturbances and an attempted coup d'état.

Ramses III, detail of the lid of a granite sarcophagus, about 1187–56 BC; in the Fitzwilliam Museum, Cambridge
By courtesy of the Fitzwilliam Museum, Cambridge

Son of Setnakht (reigned 1190–87 BC), founder of the 20th dynasty, Ramses found Egypt upon his accession only recently recovered from the civil wars that had plagued the land at the end of the previous dynasty. In the fifth year of his reign, a coalition of Libyan tribes invaded the western Nile delta on the pretext that the pharaoh had interfered in their chief's succession. The Libyans had, in fact, encroached upon Egyptian lands, a perennial problem during the 19th and 20th dynasties, and were soundly defeated in a battle in the western delta.

After two years of peace, another, more dangerous coalition, the Sea Peoples, a conglomeration of migrating peoples from Asia Minor and the Mediterranean islands, who had previously destroyed the powerful Hittite Empire in Asia Minor and devastated Syria, advanced against Egypt by land and by sea. Ramses' land army checked the enemy's advance in Palestine, and the hostile ships were trapped after being lured into the numerous and intricate waterways of the delta. Egypt averted conquest by the northerners, but two of the invading peoples settled on the coast of Palestine, between Gaza and Mount Carmel. The attempted invasion ended Egyptian pretensions to a Syro-Palestinian empire.

Two more years of peace ensued, but in Ramses' 11th year a new coalition of Libyan tribes infiltrated the western delta. Compelled to wage yet another war, he defeated the Libyans after capturing their chief.

After this final conflict, Ramses was able to reorganize Egyptian society into classes grouped by occupation and to finish his great funerary temple, palace, and town complex at Madīnat Habu, in western Thebes. He also built additions at Karnak, the great Theban temple complex.

Ramses encouraged trade and industry, dispatching a seaborne trading expedition to Punt, a land on the Somali coast of Africa, and exploiting the copper mines at Sinai and probably also the gold mines of Nubia, Egypt's province to the south.

After a prosperous middle reign, administrative difficulties and conspiracy troubled Ramses' last years. About the year 28 of the king's reign the vizier of Lower Egypt was ousted because of corruption. A year later the workers employed on the royal tombs at Thebes went on strike because of delay in the delivery of their monthly rations. Only the intervention of the Upper Egyptian vizier, who had assumed responsibility for the whole country, ended the work stoppage.

Toward the end of Ramses' reign, one of his secondary wives, seeking to place her son on the throne, plotted to assassinate the king. The plan was somehow betrayed and probably foiled, as the plotters were successfully brought to trial. The king may have died as a result of the plot, or soon afterward; but documents contain no information about the year of the conspiracy, and the king's mummy displays no wounds. Ramses died at Thebes in the 32nd year of his reign and was succeeded by the crown prince Ramses IV.

• **Ramses IV** (d. 1150 BC), king of Egypt (reigned 1156–50 BC) who strove through extensive building activity to maintain Egypt's prosperity in an era of deteriorating internal and external conditions.

Upon his accession, Ramses compiled a lengthy document recording his father's gifts to the gods, blessings for his son, and a survey of his reign (the Harris Papyrus). The unusual titulary and his overzealous devotion to the gods, however, suggest that Ramses IV's succession was irregular. Soon afterward the new king proclaimed a general amnesty and undertook a vast building program. In his first year, the graywacke (coarse sandstone) quarries in the Wadi Hammamat, east of Coptos in Upper Egypt, were surveyed and reopened to extract building stone. More quarrying occurred the next year, and cutting of the royal tomb began after the gang of workmen assigned to it was doubled. The greatest activity occurred in the third year of his reign, when three expeditions quarried stone in the Wadi Hammamat, including one consisting of 8,368 men, of whom 5,000 were soldiers, led by the high priest of Amon, Ramsesnakht. The king started two major temples at Dayr al-Bahrī in western Thebes and continued the decoration of a small temple built by his father at Karnak, the temple complex of Amon. He also built a small funerary temple near his father's great structure in western Thebes and left inscriptions at many places throughout Egypt. In return for these works, Ramses asked for a reign longer than that of his predecessor of the 19th dynasty, Ramses II.

A judicial papyrus of the following reign, however, reveals that problems existed in Egypt during Ramses IV's reign. At Elephantine, near modern Aswān, a group of officials began extensive criminal careers that went unpunished for 10 years. Also during Ramses' reign, Ramsesnakht, the high priest of Amon, arrogated unprecedented duties for himself after securing control of many key priestly offices for his family. Finally, in Palestine, only the Sinai copper mines remained in Egypt's possession.

Already middle-aged when he ascended the throne, Ramses IV died after six years of rule, leaving most of his projects uncompleted. He was succeeded by Ramses V, who was probably his son.

• **Ramses V** (fl. 12th century BC), king of Egypt (reigned 1150–45 BC) who died of smallpox, perhaps after his successor dethroned him.

Successor and probably the son of Ramses IV, Ramses V witnessed the growing power of the priesthood of Amon during his brief reign. As attested by the Wilbour Papyrus, a major land survey and tax assessment document dated the fourth year of Ramses V's reign, the high priest of Amon controlled much of Egypt's land that was held by the temples and directed the country's financial system through his son, who was chief tax master and also administered many estates.

The king continued to build Ramses IV's vast temple at Dayr al-Bahrī in western Thebes, which probably became his own funerary monument. At his death, however, Ramses was not buried until his successor's second year. As Egyptian burial rites normally lasted 70 days, the king either died after he was deposed or else his tomb was incomplete at his death, compelling his successor to delay his burial. Since the gang of royal tomb cutters still numbered 120 men under Ramses V, the former alternative is more probable. Further, references to internal warfare contained in a diary from western Thebes date either to Ramses V's or his successor's reign.

Ramses V's mummy indicates that the king died at an early age of smallpox, but his head also displays a major wound inflicted either before or shortly after death.

• **Ramses VI** (fl. 12th century BC), king of Egypt (reigned 1145–37 BC), who may have seized power after deposing his predecessor during a dynastic struggle.

Evidence indicates that Ramses VI was probably a grandson of Ramses III, the last outstanding ruler of the 20th dynasty. After taking the throne, perhaps in a coup motivated by dynastic rivalry, Ramses VI displayed hostility to his two immediate predecessors, who were of a different branch of the royal family, by usurping their monuments and even annexing the tomb of his predecessor, Ramses V. Despite the dynastic struggle, however, most important officials and the powerful high priest of Amon and his associates remained in power.

Reigning at least seven years, the king did very little building, and after he annexed his predecessor's tomb the size of the workmen's gang on the royal tomb was reduced. He was also the last Egyptian king to work the copper mines at Sinai; Nubia, Egypt's territory to the south, however, remained loyal. Ramses was followed by his son Ramses VII, formerly identified as Ramses VIII.

• **Ramses VII** (fl. 12th century BC), king of Egypt (reigned 1137–29 BC), whose reign is known chiefly from several important economics papyri.

Two documents, one a ship's log and the other an account concerning the shipment of grain taxes to Thebes, have been assigned to the reign of Ramses VII. One reveals that the vast estates of the god Amon, scattered throughout Egypt, collected a large sum in taxes that was forwarded to his temple at Thebes, while the other text indicates that during this reign prices of commodities rose over earlier 19th- and 20th-dynasty levels. Beginning in the fourth year of his reign, grain prices specifically climbed sharply to triple their former levels. At the same time, however, both documents illustrate that Nile River traffic was passing unimpeded between Upper and Lower Egypt.

Another fragmentary economics papyrus has been sufficiently reassembled to show that Ramses VII reigned seven years. It also confirms the inflation attested in the other documents. A tomb excavated for Ramses VII in the Valley of the Tombs of the Kings at Thebes still contains his empty sarcophagus.

• **Ramses VIII** (fl. 12th century BC), king of Egypt (reigned 1128–26 BC) whose ephemeral reign occurred immediately after that of Ramses VII and is poorly documented.

Some modern historians place this king before Ramses VII, following the list of princes—descendants of Ramses III, depicted in the temple of that pharaoh at Madīnat Habu in western Thebes—on which his name appears directly after that of Ramses VI, implying that he was Ramses VI's direct successor. However, close study of the economic documents of this period, and the fact that Ramses VII is known to be the son of Ramses VI, substantiate the older view that Ramses VIII's brief reign followed that of Ramses VII.

Other than the reference in the temple of his great-grandfather, Ramses VIII is known only by mention in a stela and a single scarab. His tomb, if indeed he ever owned one, has not yet been found in the Valley of the Tombs of the Kings at Thebes.

• **Ramses IX** (fl. 12th century BC), king of Egypt (reigned 1126–08 BC), during whose reign serious civil problems troubled Egypt.

Amenhotep, the high priest, exercised all religious and many governmental functions in Thebes, while Ramses IX remained almost continuously at his capital in the Nile delta. Libyan marauders from two tribes began disturbing the Theban region in the eighth year of his reign, and five years later they caused work stoppages in western Thebes; later they actually penetrated eastern Thebes. The government's failure in several years to pay several months' rations to the necropolis staff in western Thebes led the poorer workmen to plunder tombs, and the price of grain, though down slightly from its peak levels under Ramses IX's predecessor, remained high.

Through all these difficulties Ramses IX still controlled Nubia, despite maintaining his own residence apparently chiefly in the delta. Although a 19-year reign has been suggested for him, no incidents of his last two years have been recorded.

• **Ramses X** (fl. 12th century BC), king of Egypt (reigned 1108–04 BC), during whose poorly documented reign disorders that had become endemic under his predecessor continued.

Only one year of his reign is definitely attested, by a diary from his third year, found in western Thebes. It reveals that tomb cutters were idle for long periods, both because Libyans were roaming the area and because rations due the workmen were in arrears. According to one entry, workmen flatly refused to obey even an order given by the vizier himself. The high priest of Amon, often referred to in the diary, was probably Amenhotep, who survived into the next reign.

• **Ramses XI** (fl. 12th–11th century BC), king of Egypt (reigned 1104–1075? BC), last king of the 20th dynasty, whose reign was marked by civil wars involving the high priest of Amon and the viceroy of Nubia. At the end of his reign, new dynasties were founded in Upper and Lower Egypt.

During his reign much of the population of western Thebes stayed within the fortified temple of Ramses III at Madīnat Habu; and at various periods there was no high priest of Amon—even the high priest Amenhotep was suspended from office for eight months.

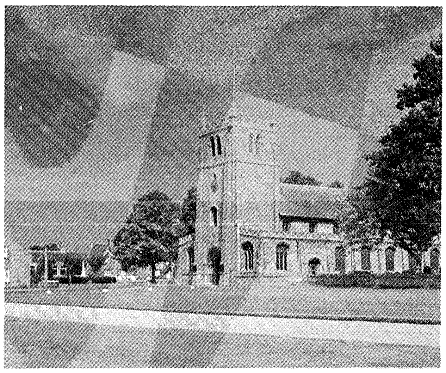
With the high priest's fall, Theban society disintegrated into near anarchy; tomb robbery became rife, penetrating even the Valley of the

Tombs of the Kings and involving scores of persons. Gangs crossed the river from eastern Thebes to participate in the looting. On the west bank the funerary temples of the 19th and 20th dynasties were plundered by the priests and necropolis staff. Out of the chaos, Herihor, a new leader, emerged from the military ranks. Beginning in the 19th year of the king's reign, Herihor restored order and became high priest of Amon.

Herihor soon arrogated the titles held earlier by Pinhasy, who had suppressed his superior, Amenhotep, and Herihor even added the vizier's title. In the temple of Khons at Thebes, he actually usurped the full royal titulary. When he died he was succeeded as high priest by Piankh (a general previously thought to be his son), without ever having quite secured the full kingship except in his Theban bailiwick. Piankh waged an unsuccessful war against Pinhasy in Nubia, losing the province for Egypt.

Thus, in obscurity, Ramses XI completed at least 27 years of rule; his Theban tomb lay unfinished and remained unoccupied, Egypt passing to two new separate dynasties.

Ramsey, town ("parish"), Huntingdonshire district, county of Cambridgeshire, England. The town serves an intensively cultivated hinterland on the southwest border of the Fens, a reclaimed region adjoining the North Sea.



Church of St. Thomas à Becket at Ramsey, Cambridgeshire
A.F. Kersting

Ramsey developed around a 10th-century Benedictine abbey, which was granted freedom from ecclesiastical and secular control before the Norman Conquest (1066). The abbey was an early English seat of learning, with a library of Hebrew books. After the dissolution of the monasteries (1536–39), its demesnes were granted to Sir Richard Cromwell, ancestor of Oliver Cromwell. A grammar school now occupies part of the site of the abbey. Pop. (1981) 5,858.

Ramsey, (Arthur) Michael, BARON RAMSEY OF CANTERBURY (b. Nov. 14, 1904, Cambridge, Cambridgeshire, Eng.—d. April 23, 1988, Oxford, Oxfordshire), archbishop of Canterbury (1961–74), theologian, educator, and advocate of Christian unity. His meeting with Pope Paul VI (March 1966) was the first encounter between the leaders of the Roman Catholic and Anglican churches since their separation in 1534.

Ramsey studied at Magdalene College, Cambridge, where he took first-class honours in theology and was president of the Cambridge Union. He attended Cuddesdon Theological College and was ordained in 1928. He held a number of lesser positions before becoming professor of divinity at the universities of Durham (1940–50) and Cambridge (1950–52), bishop of Durham (1952–56), and archbishop of York (1956–61). While archbishop of Canterbury he served as president of the World Council of Churches (1961–68). On his retirement in 1974 he was given a life peerage as Baron of Canterbury. His writings include *The Gospel and the Catholic Church* (1936), *God, Christ and the World* (1969), and (with Cardinal Suenens) *The Future of the Christian Church* (1971).

Ramsey, Norman Foster (b. Aug. 27, 1915, Washington, D.C., U.S.), American physicist who received one-half of the Nobel Prize for Physics in 1989 for his development of a technique to induce atoms to shift from one specific energy level to another. (The other half of the prize was awarded to Wolfgang Paul and Hans Georg Dehmelt.) Ramsey's innovation, called the separated oscillatory fields method, found application in the precise measurement of time and frequency.

Ramsey studied physics at Columbia University, N.Y., and received a Ph.D. degree there in 1940. He also earned a D.Sc. degree from the University of Cambridge in 1954. After teaching at various American universities in the 1940s, he taught at Harvard University from 1947, becoming Higgins professor of physics there in 1966.

In 1949 Ramsey perfected a method to study the structure of atoms by sending them through two separate oscillating electromagnetic fields. The rapid energy-level transitions thereby induced in a beam of atoms produced an interference pattern that could provide important data about the structure and behaviour of atoms. When synchronized with a microwave oscillator, the atoms' oscillations could also be used to measure the passage of time with extreme accuracy, thus providing the basis for the modern cesium atomic clock, which sets present time standards. In the 1950s Ramsey helped develop the hydrogen maser, a microwave-emitting relative of the laser.

Ramsgate, town, Thanet district, county of Kent, England. It lies on the east coast and is the reputed landing place of the invading Anglo-Saxon warriors Hengist and Horsa (AD 449) and of the Christian missionary St. Augustine (597). The fishing hamlet of Ramsgate developed as a port in the middle of the 18th century, and the opening of the Kent coalfield in the 20th century brought additional trade. Ramsgate also became noted as a popular seaside resort. Charter flights are available from the town's airport, and a regular Hovercraft service to France is operated from Pegwell Bay. Pop. (1981) 37,398.

Ramu River, formerly OTTILIEN, one of the longest rivers in Papua New Guinea, rising in the southeast on the Kratke Range and flowing northwest through the great Central Depression, where it receives numerous streams draining the Bismarck (south) and Finisterre and Adelbert (north) ranges. For the last 60 miles (100 km) of its approximately 400-mile- (640-kilometre-) long course, it flows directly north. This swampy portion receives the river's principal tributary, the Sogeram River. The Ramu, entering the Bismarck Sea just 20 miles (32 km) southeast of the mouth of the Sepik, experiences flooding, and changes of the channel are not infrequent. Dumpu, Bundi, and Atemble are the chief settlements along the generally unnavigable river. The upper Ramu River project supplies hydroelectricity to the highlands. The project includes a reservoir and a power-generating station that is located 700 feet (210 m) below ground near Kainantu.

Ramus, Petrus (Latin), French PIERRE DE LA RAMÉE (b. 1515, Cuts, Picardy, Fr.—d. Aug. 26, 1572, Paris), French philosopher, logician, and rhetorician.

Educated at Cuts and later at the Collège de Navarre, in Paris, Ramus became master of arts in 1536. He taught a reformed version of Aristotelian logic at the Collège du Mans, in Paris, and at the Collège de l'Ave Maria, where he worked with Audomarus Talaeus (Omer Talon). Talaeus, under Ramus' influence, reformed Ciceronian rhetoric upon the principles applied by Ramus to the rearrangement of Aristotle's *Organon.* These innovations so provoked the orthodox Aristotelian philosophers at the University of Paris that they induced Francis I in 1544 to suppress Ramus' works on the reformed logic and forbid him to teach that subject. Cardinal Charles de Lorraine used his influence with Henry II to have the ban against Ramus lifted (1547), and in 1551 Ramus was appointed regius professor of philosophy and eloquence at the Collège de France. About 1561 he was converted to Protestantism, and the last years of his life were marked by mounting persecution from his academic and ecclesiastical enemies. He was murdered by hired assassins two days after the outbreak of the Massacre of St. Bartholomew's Day.

Ramus, identifying logic with dialectic, neglected the traditional role that logic played as a method of inquiry and emphasized instead the equally traditional view that logic is the method of disputation, its two parts being invention, the process of discovering proofs in support of the thesis, and disposition, which taught how the materials of invention should be arranged.

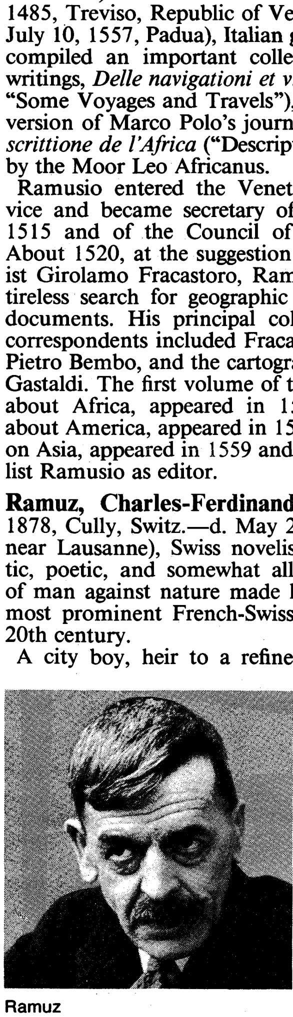
Ramus' logic had an enormous vogue in Europe during the 16th and 17th centuries. He was a prolific writer; among his most celebrated works are *Dialecticae partitiones* (1543), *Aristotelicae animadversiones* (1543), *Dialectique* (1555), and *Dialecticae libri duo* (1556).

Ramusio, Giovanni Battista (b. July 20, 1485, Treviso, Republic of Venice [Italy]—d. July 10, 1557, Padua), Italian geographer who compiled an important collection of travel writings, *Delle navigationi et viaggi* (1550–59; "Some Voyages and Travels"), containing his version of Marco Polo's journey and the *Descrittione de l'Africa* ("Description of Africa") by the Moor Leo Africanus.

Ramusio entered the Venetian public service and became secretary of the Senate in 1515 and of the Council of Ten in 1533. About 1520, at the suggestion of the humanist Girolamo Fracastoro, Ramusio began his tireless search for geographic narratives and documents. His principal collaborators and correspondents included Fracastoro, Cardinal Pietro Bembo, and the cartographer Giacomo Gastaldi. The first volume of the *Navigationi,* about Africa, appeared in 1550; the third, about America, appeared in 1557; the second, on Asia, appeared in 1559 and was the first to list Ramusio as editor.

Ramuz, Charles-Ferdinand (b. Sept. 24, 1878, Cully, Switz.—d. May 23, 1947, Pully, near Lausanne), Swiss novelist whose realistic, poetic, and somewhat allegorical stories of man against nature made him one of the most prominent French-Swiss writers of the 20th century.

A city boy, heir to a refined, middle-class



Ramuz
By courtesy of the Bibliotheque Nationale Suisse, Bern

culture, Ramuz nonetheless chose to write about rustic people in a language deliberately simple and earthy. Before World War I he spent a few years in Paris, associated with its painters and poets, and struck up a friendship with the composer Igor Stravinsky, for whom he wrote the text of *Histoire du soldat* (1918; *The Soldier's Tale*). But he was untouched by Parisian literary fashions when he returned to Switzerland.

Ramuz wrote his best-remembered works between his 40th and 60th years. His representative theme is of mountaineers, farmers, or villagers fighting heroically but often tragically against catastrophe or the force of myth. In *La Grande Peur dans la montagne* (1925; *Terror on the Mountain*), young villagers challenge fate by grazing their cattle on a mountain pasture despite a curse that hangs over it; and the reader shares their panic and final despair. Among his other works are *La Beauté sur la terre* (1927; *Beauty on Earth*) and *Derborence* (1934; *When the Mountain Fell*).

Rana, geographic region, Nordland *fylke* (county), northern Norway, surrounding the Rana channel and the Nordrana Fjord. It is centred on the industrial town of Mo (Mo i Rana) at the mouth of the Rana River, along which run the only road and rail line from southern to northern Norway. It includes several mining areas, and farming and fishing are also significant economic activities. Nesna and Hemnesberget are the main fishing ports. The area is mountainous, with many rivers, lakes, and unusual cave formations. Pop. (1989 est.) mun., 24,807.

Ranade, Mahadev Govind (b. Jan. 18, 1842, Niphad, India—d. Jan. 16, 1901, Poona), one of India's Citpāvan Brahmans of Mahārāshtra who was a judge of the High Court of Bombay, a noted historian, and an active participant in social and economic reform movements.

During his seven years as a judge in Bombay, Ranade worked for social reform in the areas of child marriage, widow remarriage, and woman's rights. After his appointment as instructor of history at Elphinstone College, Bombay (1866), he became interested in the history of the Marāthās, a militaristic Hindu ethnic group that established the independent kingdom of Mahārāshtra (1674–1818). The publication of his *Rise of the Maratha Power* followed in 1900.

Ranade has been called the father of Indian economics for urging (unsuccessfully) the British government to initiate industrialization and state welfare programs. He was an early member of the Prarthana Samaj (Prayer Society), which sought to reform the social customs of orthodox Hinduism. He regularly voiced views on social and economic reform at the annual sessions of the Indian National Social Conference, which he founded in 1887. Ranade inspired many other Indian social reformers, most notably the educator and legislator Gopal Krishna Gokhale, who carried on Ranade's reform work after his death.

Ranak: *see* Krochmal, Nachman.

Rancagua, capital of Cachapoal *provincia* and of O'Higgins *región,* northern central Chile. It lies in the Andean foothills along the Cachapoal River, south of Santiago. Founded as Villa Santa Cruz de Triana by José Antonio Manso de Velasco in 1743, the town was later renamed Rancagua. The Battle of Rancagua (Oct. 2, 1814), in which Bernardo O'Higgins' republican troops were defeated by Spanish royalist forces after a heroic defense of the city, was one of the major engagements of the Chilean struggle for independence.

Excellent railway connections sustain Rancagua's commerce and industries, which include beef processing, grain milling, fruit and vegetable canning, automobile assembling, and processing ores extracted from El Teniente (The Lieutenant), one of the world's largest copper mines, 25 miles (40 km) east. Pop. (1987 est.) mun., 172,489.

Rancé, Armand-Jean Le Bouthillier de (b. Jan. 9, 1626, Paris, Fr.—d. Oct. 27, 1700, Soligny-la-Trappe), French abbot who revived the Cistercian abbey of La Trappe, influenced the establishment of several important monasteries, and founded the reformed Cistercians, called Trappists, a community practicing extreme austerity of diet, penitential exercises, and, except for chanting, absolute silence.

Of noble birth, Rancé became commendatory abbot (a benefice granted to a secular clerk for life) of La Trappe. Between 1657 and 1660 he turned from a worldly to a spiritual life, giving up his possessions and benefices.

In 1664 he became regular abbot of La Trappe and devoted himself to reforming the Cistercian order. In 1678 Rancé obtained papal approval of his reform, which spread widely. His staunchness, the physical and psychological demands he made upon his followers (he regarded ugliness and squalor as integral to poverty), and his outspoken criticism of less austere religious orders, however, provoked hostility and led him into a heated controversy with the learned French Maurist (Benedictine scholar) Jean Mabillon.

In his *Traité de la sainteté et des devoirs de la vie monastique* (1683; "Treatise on the Holiness and the Duties of the Monastic Life") Rancé attacked learning—the central activity of the Maurists—as being contrary to the spirit of monastic life, which he believed should be confined to prayer and manual labour.

Rance River, river, rising in the Landes du Mené, a chain of hills in Côtes-du-Nord *département,* western France. It flows for 60 miles (97 km) past Dinan to form an estuary on the Brittany (Bretagne) coast of the English Channel at Saint-Malo, where the world's first large-scale tidal plant, using flood and ebb tides to generate electricity, was completed in 1967.

ranch, a farm, usually large, devoted to the breeding and raising of cattle, sheep, or horses on rangeland. Ranch farming, or ranching, originated in the imposition of European livestock-farming techniques onto the vast open grasslands of the New World. Spanish settlers introduced cattle and horses into the Argentine and Uruguayan pampas and the ranges of Mexico early in the colonial period, and the herding of these animals spread readily into what is now the southwestern United States.

By the early 19th century the ranch had become an economic mainstay of the North American ranges. Its importance in the territorial United States was augmented as the progressive clearing and cultivation of grazing lands in the East drove cowherders west in pursuit of new pasture. The cowboy (*q.v.*) emerged during this period as essentially a rancher on horseback, who moved from camp to camp, grazing cattle on unfenced public ranges. Biannual roundups were held for branding calves and separating steers to be driven north and east for fattening and slaughter.

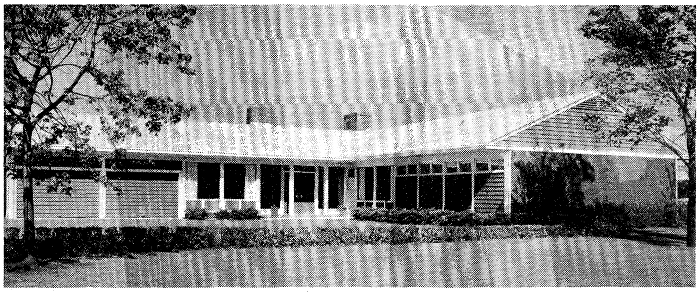
On the pampas of South America, where cattle and horses roamed freely for more than a century, the cowboy's southern counterpart, the gaucho (*q.v.*), first hunted huge semiwild herds independently and later worked for landowners, as the fenced estancia (estate) changed the face of the pampas.

The Homestead Act of 1862 in the United States generated the establishment of many grassland farms that were to expand into the huge western ranches of the late 19th century. Itinerant ranching reached its peak in the 1880s, when millions of cattle grazed the pastoral empire of the plains. Overstocking of ranges, the exceptionally hard winter of 1886–87, the passage of quarantine laws, increased railroad competition, and the encroachment of barbed-wire fencing all acted to check the northern cattle drives and diminish the glory of cattle country.

By the second quarter of the 20th century, nearly all livestock farming in the United States was sedentary. Huge ranches continued to exist, however, and, despite periods of fragmentation, the future of such enterprises seemed secure in the late 20th-century era of corporate agriculture. Open-range ranching has remained an important economic activity in Australia and New Zealand and in parts of Africa, where it was introduced in the late 19th century.

ranch house, type of residential building, characteristically built on one level, having a low roof and a rectangular open plan, with relatively little conventional demarcation of living areas.

When the settlers of the western United States abandoned their original log cabins, sod houses, and dugouts, they built small, wood-framed dwellings of one or two rooms without a basement; rooms were usually added as the family or settlers grew more numerous and more prosperous. This usually resulted in a series of large, open rooms laid end to end so that each would have an equal amount of sunlight, open to, and closely allied with, the surrounding terrain. From these old ranch houses of the western United States, a new type of American home developed during the 1920s, sometimes called the in-line house, built on what is known as the long plan. During the building boom after World War II, the style was particularly popular.



Suburban Chicago ranch house, 1957–58
Hedrich-Blessing Photo; architect, F.W. Cawley

Rānchi, town, south-central Bihār state, northeastern India. The town lies along the Subarnarekhā River and is the summer capital of the state. With major rail and road connections, it is the centre of the region's agricultural, cotton, and tea trade. Silk growing and the manufacture of shellac and heavy machine tools are the major industries. Rānchi, constituted a municipality in 1869, houses a military cantonment, radium and lac (shellac) research institutes, and two mental hospitals. It is the headquarters of the National Coal Development Corporation, the Heavy Engineering Corporation, and the

Hindustan Steel Company. Rānchi University, founded in 1960, includes affiliated colleges of law, medicine, and teacher training.

The area in which Rānchi is situated occupies the Rānchi plateau of the Choṭa Nāgpur Plateau system, with lofty flat-topped hills (*pats*) in the northwest. Rice is the principal crop in lands irrigated by the Subarnarekhā, Sankh, North Koel, and South Koel rivers. Bauxite, limestone, and china clay deposits are worked in the locality. Pop. (1981) town, 489,626; metropolitan area, 502,771.

Rancho Grande National Park (Venezuela): *see* Henri Pittier National Park.

Rancholabrean stage, major division of Pleistocene time and deposits in North America (the Pleistocene epoch began between about 2,500,000 and 1,700,000 years ago and ended about 10,000 years ago). The Rancholabrean stage follows the Irvingtonian and was named for the La Brea Tar Pits, Los Angeles, which are noted for their abundant remains of fossil animals. The Rancholabrean apparently includes the span of time covered by the Illinoian glacial stage, the following Sangamon interglacial stage, and the Wisconsin glacial stage, the last major glacial episode to affect North America.

The Rancholabrean fauna includes many modern forms, such as skunks, bats, bison, rodents, beavers (including a giant form), bear, antelope, and deer, as well as extinct animals: mammoths, mastodons and sabre-toothed cats. Farther south, tapirs, sloths, peccaries, and armadillos were found. Rancholabrean faunas are widely represented across the United States; many of the fossils found are in an excellent state of preservation.

At the end of Rancholabrean times the mammal fauna of North America underwent a drastic reduction in numbers and diversity. This reduction may have been connected with environmental changes. It has been suggested that the arrival of humans in North America was responsible for the widespread extinction. It seems unlikely, however, that humans were present in sufficient numbers or had the technology to cause the extinction of all the animals in question, but they may have dealt the final blow to forms already greatly reduced and vulnerable to his predation.

rancidity, condition produced by aerial oxidation of unsaturated fat present in foods and other products, marked by unpleasant odour or flavour. When a fatty substance is exposed to air, its unsaturated components are converted into hydroperoxides, which break down into volatile aldehydes, esters, alcohols, ketones, and hydrocarbons, some of which have disagreeable odours. Butter becomes rancid by the foregoing process and by hydrolysis, which liberates volatile and malodorous acids, particularly butyric acid. Saturated fats such as beef tallow are resistant to oxidation and seldom become rancid at ordinary temperatures.

Rand, Ayn (b. Feb. 2, 1905, St. Petersburg [now Leningrad], Russia—d. March 6, 1982, New York, N.Y., U.S.), Russian-born American writer who, in novels noted for their commercial success, presented her philosophy of objectivism, which held that all real achievement is the product of individual ability and effort, that laissez-faire capitalism is most congenial to the exercise of talent, and that selfishness is a virtue, altruism a vice. Her reversal of the traditional Judeo-Christian ethic won her a cult of followers.

After graduating from the University of Petrograd (1924), Rand went to the United States in 1926 and was a screenwriter in Hollywood. She became a naturalized U.S. citizen in 1931. *The Fountainhead* (1943), her first best-selling

Ayn Rand, 1957

By courtesy of Random House, Inc; photograph, The Ayn Rand Letter, Inc.

novel, depicts a highly romanticized architect-hero, a superior individual whose egoism and genius prevail over timid traditionalism and social conformism. The allegorical *Atlas Shrugged* (1957), another best-seller, combines science fiction and political message in telling of an anticollectivist strike called by the management of U.S. big industry, a company of attractive, self-made men. Rand also wrote a number of nonfiction works expounding her beliefs, such as *For the New Intellectual: The Philosophy of Ayn Rand* (1961), and she edited two journals propounding her ideas, *The Objectivist* (1962–71) and *The Ayn Rand Letter* (1971–76).

Rand, Sally, original name HELEN GOULD BECK (b. Jan. 2, 1904, Elkton, Mo., U.S.—d. Aug. 31, 1979, Glendora, Calif.), American actress and dancer who achieved fame as a fan dancer and bubble dancer.

She began in show business in her teens as a chorus girl in Kansas City and, during the 1920s, achieved only indifferent success in vaudeville, the Ringling Brothers circus, and motion pictures (playing bit parts, initially as a protégée of Cecil B. deMille). In the early 1930s in Chicago, performing in nightclubs, she fashioned some ostrich feathers into large fans and created her nude act. In 1933, at the Chicago World's Fair, she appeared as Lady Godiva in a publicity stunt and won a job as a dancer at the "Streets of Paris" attraction. There, performing a fan dance to such strains as Claude Debussy's *Clair de Lune* and Frédéric Chopin's *Waltz in C Sharp Minor,* she caused a sensation, launching a career that lasted for more than 30 years. She later created an alternative dance with large five-foot elastic bubbles.

Sally Rand, photographed at the Century of Progress Exposition in Chicago, 1933

The Granger Collection, New York City

Sally Rand continued to perform until age 74, maintaining a lovely face and trim figure that belied her age.

Rand Daily Mail, former English-language newspaper published in Johannesburg. It crusaded against South Africa's racial segregation but, because of financial losses, ceased publication in 1985.

The *Rand Daily Mail,* founded in 1902, pioneered in popular journalism, introducing illustrations and cartoons, entertainment features, and improved layout. In later years the paper became known for its generally antigovernment policy, reflecting the view of the small liberal-oriented Progressive Party. In the 1960s the *Rand Daily Mail* led newspaper attacks on conditions in prisons and on other aspects of South African life, despite increased restrictions placed on the paper by the government. By the time of its demise, it had a readership that was two-thirds black.

Rand McNally and Company, American publishers and printers of maps, atlases, globes, and tourist guidebooks; its headquarters are in Skokie, Ill. Founded in 1856 by William H. Rand and Andrew McNally and incorporated in 1873, it is the oldest firm of its kind in the country. The first publication issued was an annual report of a railroad company in 1868, and the first map was issued in 1872. The *Business Atlas,* now known as the *Commercial Atlas and Marketing Guide,* began publication in 1877. A textbook department opened in 1894 with the publication of the *Rand McNally Primary School Geography;* children's books were added to its publishing list in 1900. With the advent of automobiles about 1908, its first road guide was published. Rand McNally began publication of *Goode's School Atlas,* now *Goode's World Atlas,* a pioneer work in school geography, in the early 1920s. Its chief publications in the late 20th century were maps, atlases, geography and travel books, reference guides, children's books, adult nonfiction, and textbooks. The firm is also a noted commercial printer.

Randall, John Herman, Jr. (b. Feb. 14, 1899, Grand Rapids, Mich., U.S.—d. Dec. 1, 1980, New York, N.Y.), American historian and philosopher who wrote a series of highly respected works on the history of philosophy.

Randall studied under historians Charles A. Beard and James Harvey Robinson at Columbia University, where he began teaching in 1921 and earned his Ph.D. in 1922. In his first major work, *The Western Mind,* 2 vol. (1924), revised and reissued as *The Making of the Modern Mind* (1926), Randall reconstructed the times and conditions, as well as the historical experience and traditions, that gave rise to certain philosophical systems. His *Career of Philosophy in Modern Times,* 2 vol. (1962–65), is an analysis of the historical context surrounding the 17th- and 18th-century assimilation of science into traditional interpretive frameworks.

In his *Aristotle* (1960) Randall again placed Aristotle's thought into its own historical context and drew out its implications and relevance for modern man. His other works include *The School of Padua and the Emergence of Modern Science* (1961), *The Role of Knowledge in Western Religion* (1958), *Nature and Historical Experience* (1958), *How Philosophy Uses Its Past* (1963), *Plato* (1970), *Hellenistic Ways of Deliverance and the Making of the Christian Synthesis* (1970), and *Philosophy After Darwin* (1977).

Randall, Samuel J(ackson) (b. Oct. 10, 1828, Philadelphia, Pa., U.S.—d. April 13, 1890, Washington, D.C.), U.S. congressman who served for nearly 30 years and who, as speaker of the House of Representatives (1876–81), codified the rules of the House and strengthened the role of speaker.

Randall, a Democrat, served on the Philadelphia City Council (1852–56) and in the state senate (1858–59) before joining the Union Army during the Civil War. First elected to the U.S. House in 1862, he was successively reelected until his death. He became chairman of the House Appropriations Committee and, in 1875, leader of the Democratic Party in Pennsylvania.

As speaker of the House, Randall is remembered for consolidating the House rules. In so doing he strengthened the powers of the speaker, giving that office more control over House procedures, including the ability to assign bills to committees, to limit the length of time granted for debate over major bills, and to suspend temporarily the rules. He was also the first chairman of the permanent House Rules Committee. After the Republicans won a majority of seats in the House in the elections of 1880, Randall was removed as speaker and ultimately lost control of his party by opposing the majority position on the issue of a protective tariff.

Randall-MacIver, David (b. Oct. 31, 1873, London, Eng.—d. April 30, 1945, New York, N.Y., U.S.), British-born American archaeologist and anthropologist.

Randall-MacIver was educated at the University of Oxford and began his career at the excavation (1899–1901) of Abydos, Egypt, led by Sir Flinders Petrie. After conducting excavations of the Zimbabwe ruins in Southern Rhodesia (now Zimbabwe), Randall-MacIver wrote *Medieval Rhodesia* (1906), in which he contended that the ruins were of purely African origin and that they dated from the medieval period; his view was borne out by later archaeological study.

From 1907 to 1911 Randall-MacIver led an expedition into Egypt and the Sudan. He was librarian of the American Geographical Society from 1911 to 1914 and served as an intelligence officer during World War I. He settled in Rome in 1921 and concentrated on Italian archaeology; his publications on the subject include *Villanovans and Early Etruscans* (1924), *The Iron Age in Italy* (1927), and *Italy Before the Romans* (1928). During World War II he assisted the U.S. Department of War in efforts to preserve Italian monuments from destruction.

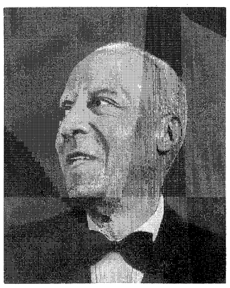
Randburg, residential town of Transvaal, South Africa, bordering Johannesburg on the north. It consists of numerous suburbs that were officially proclaimed a town in 1962. The town has no heavy industries, and the few light-industrial concerns include printing plants, organ-building workshops, and small engineering works. Randburg has been developed as a garden city and has numerous parks. The Kleinjukskei Vintage Car Museum has a collection of veteran cars. Pop. (1984 est.) mun., 115,511.

Randers, city, Århus *amtskommune* (county commune), eastern Jutland, Denmark. It lies at the mouth of the Gudenå River along Randers Fjord, northwest of Århus. First mentioned in 1086, it was chartered in 1302 and became an important market and ecclesiastical centre in the European Middle Ages. In 1340 the tyrant Count Gerhard of Holstein was assassinated there by the Danish national hero Niels Ebbesen. Despite successive fires in the 17th century, some medieval merchants' houses have survived, as have St. Morten Kirke (church; 1490) and the Helligånds Kloster (Holy Ghost Monastery; 1510). Randers manufactures railway rolling stock, gloves, beer, bacon, agricultural machinery, and dairy products. Pop. (1986 est.) city, 55,-563; (1988 est.) mun., 61,155.

Randfontein, town, Transvaal, South Africa. It lies west of Johannesburg and is centred on the gold mine first developed by Randfontein Estates Gold Mining Company in 1889. Originally a part of Krugersdorp, it became a separate municipality in 1929. It had undergone considerable industrial and residential expansion by the 1980s. Gold mining continues, and uranium is extracted from gold ores. Other industries include engineering, food processing, and textile manufacture. The population is predominantly black. Pop. (1985) 43,763.

Randolph, town (township), Norfolk county, eastern Massachusetts, U.S., part of the Boston metropolitan area. Settled in 1710 as Cochato (named for the Cochato Indians), it was part of Braintree until separately incorporated in 1793. The town was renamed for Peyton Randolph, first president of the Continental Congress. Randolph developed as a shoe-manufacturing centre but is now primarily residential with some light manufacturing. It was the birthplace of Mary Wilkins Freeman, who wrote many of her stories about New England village life there. The Boston School for the Deaf was established (1899) in the town. Pop. (1986 est.) 28,580.

Randolph, A(sa) Philip (b. April 15, 1889, Crescent City, Fla., U.S.—d. May 16, 1979, New York, N.Y.), trade unionist and civil-rights leader who was a dedicated and persistent leader in the struggle for justice and parity for the black American community.



A. Philip Randolph
By courtesy of the AFL-CIO News

The son of a Methodist minister, Randolph moved to the Harlem district of New York City in 1911. He attended City College at night and, with Chandler Owen, founded (1912) an employment agency and through it attempted to organize black workers. In 1917, following the entry of the United States in World War I, the two men founded a magazine, *The Messenger* (after 1929, *Black Worker*), that called for more positions in the war industry and the armed forces for blacks. After the war, Randolph lectured at New York's Rand School of Social Science and ran unsuccessfully for offices on the Socialist Party ticket.

In 1925, as founding president of the Brotherhood of Sleeping Car Porters, Randolph began organizing that group of black workers and, at a time when half the affiliates of the American Federation of Labor (AFL) barred blacks from membership, took his union into the AFL. Despite opposition, he built the first successful black trade union; the brotherhood won its first major contract with the Pullman Company in 1937. The following year, Randolph removed his union from the AFL in protest against its failure to fight discrimination in its ranks and took the brotherhood into the newly formed Congress of Industrial Organizations (CIO). He then returned to the question of black employment in the federal government and in industries with federal contracts. He warned President Franklin D. Roosevelt that he would lead thousands of blacks in a protest march on Washington, D.C.; Roosevelt, on June 25, 1941, issued Executive Order 8802, barring discrimination in defense industries and federal bureaus and creating the Fair Employment Practices Committee. After World War II, Randolph founded the League for Nonviolent Civil Disobedience Against Military Segregation, resulting in the issue by President Harry S. Truman on July 26, 1948, of Executive Order 9981, banning segregation in the armed forces.

When the AFL merged with the CIO in 1955, Randolph was made a vice president and member of the executive council of the combined organization. He was the first president (1960–66) of the Negro American Labor Council, formed by Randolph and others to fight discrimination within the AFL-CIO.

In an echo of his activities of 1941, Randolph was a director of the March on Washington for Jobs and Freedom, which brought more than 200,000 persons to the capital on Aug. 28, 1963 to demonstrate support for civil-rights policies for blacks. Two years later, he formed the A. Philip Randolph Institute for community leaders to study the causes of poverty. Suffering chronic illness, he resigned his presidency of the Brotherhood of Sleeping Car Porters in 1968 and retired from public life.

Randolph, Edmund Jennings (b. Aug. 10, 1753, Williamsburg, Va. [U.S.]—d. Sept. 12, 1813, Clark county, Va.), Virginia lawyer who played an important role in drafting and ratifying the U.S. Constitution and served as attorney general and later secretary of state in George Washington's Cabinet.

After attending William and Mary College, Randolph studied law in the office of his father, who was then the king's attorney in the Virginia colony. The approach of the American Revolution caused a split in the family: the father, with his wife and daughters, left for England in 1775, while Edmund threw in his lot with the rebellious colonists.

The young lawyer served briefly as an aide to General Washington in the siege (1776) of the British at Boston and then returned to Virginia to care for the estate of his uncle, Peyton Randolph. He was elected to the Virginia Constitutional Convention of 1776 and served on the committee that drew up a bill of rights and a state constitution. The Virginia Assembly elected him attorney general of the state, and he also served intermittently (1779–82) as a delegate to the Continental Congress.

In 1786 Randolph headed the Virginia delegation to the Annapolis Convention, and that same year he was elected governor of Virginia. As a delegate to the U.S. Constitutional Convention (1787), he presented the influential Virginia Plan and served on the Committee on Detail that prepared a first draft of the proposed constitution. He did not sign the final draft, however, because he wanted more protection of the rights of states and of individuals. Nevertheless, in the Virginia Convention of 1788 he used his influence to bring about that state's ratification of the Constitution.

After President Washington took office in

Edmund Randolph
By courtesy of the Virginia Historical Society

1789, he appointed Randolph—who had handled much of Washington's personal legal work—to the post of U.S. attorney general. Upon Thomas Jefferson's resignation as secretary of state in December 1793, Randolph was chosen to replace him. As England and France were then at war and there was strong support in the United States for both antagonists, Randolph's attempt to steer a middle course was difficult. While the Jay Treaty (1794) with England was under consideration, he performed the delicate task of maintaining friendly relations with France. He also paved the way for the signing (1795) of Pinckney's Treaty (or the Treaty of San Lorenzo) with Spain, which provided for free navigation of the Mississippi River.

Randolph's governmental service was brought to an end by an intercepted diplomatic dispatch from the French minister at Philadelphia, charging that he had shown a willingness to accept money from the French in return for influencing the U.S. government against Great Britain. Though the charges were not proved, Randolph resigned on Aug. 19, 1795. He returned to Virginia and resumed his law practice, acting in 1807 as senior counsel for Aaron Burr at his trial for treason.

BIBLIOGRAPHY. Studies of his life and influence include H.J. Eckenrode, *The Randolphs: The Story of a Virginia Family* (1946); and John J. Reardon, *Edmund Randolph* (1975).

Randolph, Edward (baptized July 9, 1632, Canterbury, Kent, Eng.—d. April 1703, Virginia [U.S.]), British royal agent, customs officer, and American colonial official.

Randolph worked in various governmental and private positions. In March 1676 the Lords of Trade appointed him to deliver royal instructions to Massachusetts requiring the colony government to send representatives to England to reply to complaints of the heirs of Sir Fernando Gorges and Captain John Mason, who sought compensation for their claims to Maine and New Hampshire. Randolph's relationship with Massachusetts officials was contentious, and he returned to England to file a report extremely critical of the Bay Colony's violations of imperial policy.

In 1678 he was appointed collector and surveyor of the customs for all New England. He established his headquarters in Boston, but widespread colonial opposition to his authority caused him to return to England on several occasions seeking revocation of the Massachusetts charter. After the charter was declared forfeit in 1684, Randolph was appointed to various high posts in the Dominion of New England. He served in the newly created royal government until it was overthrown in April 1689. Randolph was imprisoned for several months, but on orders of William III he was released from prison and sent to England.

He was appointed surveyor general of customs for all North America in 1691 and returned to the colonies. Randolph traveled throughout the mainland colonies, the West Indies, and the Bahamas, trying, with minimal success and considerable opposition, to enforce compliance to English trade laws. In 1700 he returned to England to support a movement in Parliament against the charter and proprietary colonies. The endeavour was unsuccessful, and he returned to Virginia in 1702.

Randolph, John (b. June 2, 1773, Prince George County, Va. [U.S.]—d. May 24, 1833, Philadelphia, Pa.), American political leader who was an important proponent of the doctrine of states' rights in opposition to a strong centralized government.

A descendant of notable colonial families of Virginia as well as of the Indian princess Pocahontas, Randolph distinguished himself from a distant relative by assuming the title John Randolph of Roanoke, where he established his home in 1810.

John Randolph, oil painting by Chester Harding, 1829–30; in the Corcoran Gallery of Art, Washington, D.C.
By courtesy of the Corcoran Gallery of Art, Washington, D.C.

In 1799 Randolph was elected to the U.S. House of Representatives, and he served in that legislative body almost continuously until 1829. His political rise was so rapid that by 1801 he was chairman of the House Ways and Means Committee and leader of the Jeffersonian Republicans in Congress. His debating skill and biting sarcasm made him a feared opponent through the years, and he anticipated the states'-rights theories of John C. Calhoun by passionately defending state sovereignty on every occasion. He thus opposed a national bank, protective tariffs, federally financed internal improvements (such as roads and canals), and federal interference with the institution of slavery—though he freed his own bondsmen in his will.

After his failure as manager of the impeachment trial of Supreme Court justice Samuel Chase in 1804–05, in addition to his opposition to President Thomas Jefferson's efforts to acquire Florida, Randolph drifted away from the Jeffersonian Republican Party. He returned to national prominence in 1820 when he represented Southern planters in resisting the Missouri Compromise, which outlawed slavery in new western territory north of the 36°30′ parallel. During those years, when party feelings ran high, Randolph's denunciation of Henry Clay's support of John Quincy Adams for the presidency in the disputed election of 1824–25 led him into a duel with Clay from which both emerged unscathed.

He served briefly in the Senate (1825–26) and three years later was a prominent member of the convention that drafted a new Virginia constitution. In 1830 President Andrew Jackson sent him on a special mission to Russia, but ill health forced him to return to the United States after only a few weeks at his post.

Randolph, Peyton (b. 1721, Williamsburg, Va. [U.S.]—d. Oct. 22, 1775, Philadelphia, Pa.), first president of the U.S. Continental Congress.

Randolph was educated at the College of William and Mary, Williamsburg, Va., and became a member of the Virginia bar in 1744. Four years later, in recognition of his stature as a lawyer, he was appointed king's attorney for Virginia. The same year, he was elected to Virginia's House of Burgesses, where he served almost continuously until the time of his death. A member of the colonial aristocracy, he regarded himself as a spokesman for both the crown and his fellow Virginians.

Randolph was opposed to the colonists' radical response to the Stamp Act. Looked to for leadership during the pre-Revolutionary disputes with England, he played a moderating and cautious role. But his patriotism was never in question, and he became more radical over time. By 1773 he was serving as chairman of the Virginia Committee of Correspondence.

In 1774 Randolph led the seven Virginia delegates to the first session of the Continental Congress. There he was elected president of the Congress, but in 1775 he suffered a stroke while in Philadelphia and died. John Hancock, whose views were far more radical, succeeded him as president.

Randolph, Thomas (military commander): *see* Moray, Thomas Randolph, 1st Earl of.

Randolph, Thomas (b. June 15, 1605, Newnham-cum-Badby, Northamptonshire, Eng.—d. March 1635, Blatherwycke, Northamptonshire), English poet and dramatist who used his knowledge of Aristotelian logic to create a unique kind of comedy.

Educated at Westminster School and at the University of Cambridge, Randolph earned at both schools a reputation for English and Latin verse, and Ben Jonson adopted him as one of his "sons."

Randolph's university plays, both comedies, *Aristippus, or The Joviall Philosopher* and *The Conceited Pedler,* were performed at Cambridge and were published in 1630. *Aristippus* was a debate about the relative virtues of ale and sack, full of the terms of Aristotelian logic and innumerable puns drawn from Randolph's classical learning. *The Jealous Lovers* (1634), performed at Cambridge for King Charles I, was well received. *The Muse's Looking-Glass,* performed about 1630, opens and closes with a masque and consists of 15 scenes presented before a comic puritan couple, with each scene devoted to an Aristotelian vice. *Hey for Honesty,* a comedy adapted from *The Plutus* of Aristophanes, was published in 1651. Randolph's untimely death at age 29 cut short a promising literary career.

Some of Randolph's poetry appeared in collections during his lifetime, notably three poems addressed to Jonson. A posthumous collection (1638) contained *The Muse's Looking-Glass* and *Amyntas.*

random walk, stochastic process based on the problem of determining the probable location of a point subject to random motions, given the probabilities (the same at each step) of moving some distance in some direction. A typical example is the drunkard's walk, in which a point beginning at the origin of the Euclidean plane moves a distance of one unit for each unit of time, the direction of motion, however, being random at each step. The problem is to find, after some fixed time, the probability distribution of the distance of the point from the origin.

Randstad, industrial and metropolitan conurbation occupying an area of peat and clay lowlands, west-central Netherlands. The Randstad ("Ring City") consists of major Dutch industrial cities extending in a crescent (open to the southeast) from Utrecht in the east to Dordrecht in the south and including Hilversum, Amsterdam, Haarlem, Leiden, The Hague, and Rotterdam. It encompasses portions of the *provincies* of Zuidholland, Noordholland, and Utrecht.

By AD 1300 there were settlements at Utrecht, Delft, Leiden, Amsterdam, Gouda, and Haarlem, and dikes had been built along the Zuiderzee, Haring River, Hollandsh Canal, and the rivers of Nieuwe Maas (Meuse) and Nieuwe Merwede. The area contained several lakes, many of which were dug by peat farmers who used the peat as fuel in their homes and for preserving herring. Industrialization grew during the 15th century, and the area that now constitutes the Randstad developed rapidly; excessive flooding of the lakes led to the prohibition of peat digging during the 16th century. Dordrecht, a major port, traded in wine and salt from France and herring from

Norway. Tiles, linen, vegetables, and madder (an herb used for dyeing) were exported. A large area of the shallow seas, including the Haarlemmermeer, that once existed between Amsterdam and Rotterdam was reclaimed by pumping between 1600 and 1900.

The cities of the modern Randstad manufacture motor vehicles, machinery, chemicals, electrical goods, and printed materials. Haarlem and Leiden are noted for their textile industries. Rotterdam Europoort is the world's largest port in volume of goods handled. The Hague is the seat of the national government, and Amsterdam, nominally the national capital, is also a financial and cultural centre. In addition, the cities are marketing centres for the flowers, cereals, and livestock that are raised in the surrounding area. Forests are found near The Hague, Amersfoort, and Hilversum. Railway connections and highways extend throughout the Randstad, and airports are located near Amsterdam, Rotterdam, and Hilversum.

Ranelagh, former resort by the River Thames in Chelsea, London. Land east of the Royal Hospital, Chelsea, was bought in 1690 by Richard Jones, 3rd Viscount Ranelagh, later 1st Earl of Ranelagh, who built a mansion and laid out gardens. Opened to the public in 1742, it became a fashionable resort, with its Rotunda laid out for concerts. The buildings were closed in 1805, and the site was repurchased by the Royal Hospital.

rangaku (Japanese: "Dutch learning"), concerted effort by Japanese scholars during the late Tokugawa period (late 18th–19th century) to learn the Dutch language so as to be able to learn Western technology; the term later became synonymous with Western scientific learning in general. With the exception of the Dutch trading post on the island of Deshima in Nagasaki Harbour, Japan remained inaccessible to all European nations for some 150 years after 1639, when the Tokugawa government adopted a policy of severely restricted economic and cultural contact with the West. The Dutch language was therefore the only medium by which the Japanese in the late 18th century could study European technology. The *rangaku* scholarly tradition heightened Japan's later, wide-ranging responses to the West in the late 19th and 20th centuries. Dutch-Japanese dictionaries were compiled, and Dutch books were published. *Rangaku* scholars studied European medicine, military science, geography, and politics.

Rāngāmāti, town, southeastern Bangladesh, situated in the Chittagong Hills region near the Karnaphuli River. Connected by road and river steamer with the city of Chittagong, the town is a rice-milling and cotton-weaving centre, and an agricultural market. It has a hospital and a government college affiliated with the University of Chittagong. Pop. (1981) 36,405.

Ranganathan, Shiyali Ramamrita (b. Aug. 9, 1892, Shiyali, Madras, India—d. Sept. 27, 1972, Bangalore, Mysore), Indian librarian and educator who was considered the father of library science in India and whose contributions had worldwide influence.

Ranganathan was educated at the Hindu High School in Shiyali, at Madras Christian College (where he took B.A. and M.A. degrees in mathematics in 1913 and 1916), and at Teachers College, Saidapet. In 1917 he joined the faculty of Government College, Mangalore. He subsequently taught at Government College, Coimbatore, in 1920 and at Presidency College, University of Madras, in 1921–23. In 1924 he was appointed first librarian of the University of Madras, and in order to fit himself for the post he traveled to England to study at University College, London. He took up the job at Madras in earnest in 1925 and held it until 1944. From 1945 to 1947 he served as librarian and as professor of library science at Hindu University in Vārānasi (Banaras), and from 1947 to 1954 he taught at the University of Delhi. During 1954–57 he was engaged in research and writing in Zürich. He returned to India in the latter year and served as visiting professor at Vikram University, Ujjain, until 1959. In 1962 he founded and became head of the Documentation Research and Training Centre in Bangalore, with which he remained associated for the rest of his life, and in 1965 he was honoured by the Indian government with the title of national research professor in library science.

Ranganathan's chief technical contributions to library science were in classification and indexing theory. His *Colon Classification* (1933) introduced a system that is widely used in research libraries around the world and that has affected the evolution of such older systems as the Dewey Decimal Classification. Later he devised the technique of "chain indexing" for deriving subject-index entries. Other works of his included *Classified Catalogue Code* (1934), *Prolegomena to Library Classification* (1937), *Theory of the Library Catalogue* (1938), *Elements of Library Classification* (1945), *Classification and International Documentation* (1948), *Classification and Communication* (1951), and *Headings and Canons* (1955). His *Five Laws of Library Science* (1931) was widely accepted as a definitive statement of the ideal of library service. He also drafted plans for a national and several state library systems, founded and edited several journals, and was active in numerous professional associations.

Rangao language: *see* Rengao language.

range, in radioactivity, the distance that a particle travels from its source through matter. The range depends upon the type of particle, its original energy of motion (kinetic energy), the medium through which it travels, and the particular way in which range is further defined. Range applies especially to charged particles, such as electrons and alpha particles. Charged particles are slowed down chiefly because their energy of motion is dissipated in forcing electrons out of the atoms of the absorbing medium (ionization) or in promoting these electrons to higher energy levels within the atoms (excitation).

Alpha particles, in particular, travel in nearly straight paths because they are thousands of times heavier than the atomic electrons to which they gradually lose energy. Their range is usually measured from the source in a straight line to the point at which ionization ceases to occur. The range of electrons (beta particles) is measured differently because radiated electrons are deflected into erratic paths by the electrons in the atoms of the absorbing medium. The range of electrons may be taken as the greatest distance of penetration in a given direction, or the minimum thickness of the medium required to stop all electrons. A slight spread of values in the range that given charged particles of the same initial energy travel in a given kind of matter is called straggling. The loss of energy of the particle, because it occurs in a series of discrete amounts, fluctuates statistically about a mean value, equivalent to a most probable range. Thus, alpha particles and other charged particles of the same initial energy show a slight random variation in their ranges.

In a given medium, electrons have a greater range than alpha particles of the same energy and are, therefore, more penetrating. The greater the original energy of the particle, the longer is its range.

range finder, any of several instruments used to measure the distance from the instrument to a selected point or object. One basic type is the optical range finder modeled after a ranging device developed by the English firm of Barr and Stroud in the 1880s. The optical range finder is usually classified into two kinds, coincidence and stereoscopic.

The coincidence range finder, used chiefly in cameras and for surveying, consists of an arrangement of lenses and prisms set at each end of a tube with a single eyepiece at its centre. This instrument enables the user to sight an object by correcting the parallax (*q.v.*) resulting from viewing simultaneously from two slightly separated points. The object's range is determined by measuring the angles formed by a line of sight at each end of the tube; the smaller the angles produced, the greater is the distance, and vice versa. The stereoscopic range finder operates on much the same principle and resembles the coincidence type except that it has two eyepieces instead of one. The design of the stereoscopic instrument makes it more effective for sighting moving objects. It was widely used for land-gunnery ranging during World War II.

Since the mid-1940s, radar has supplanted optical range finders for most military target-ranging operations. This nonoptical ranging device determines the distance to a target by measuring the time it takes radio pulses to reach the object, bounce off, and return.

Advances in laser technology led to the development in 1965 of another kind of ranging instrument known as the laser range finder. It has largely replaced coincidence range finders for surveying and radar in certain military applications. The laser range finder, like radar, measures distance by timing the interval between the transmission and reception of electromagnetic waves, but it employs visible or infrared light rather than radio pulses. Such a device can measure distances of up to 1 mile (0.62 km) to an accuracy of 0.2 inch (0.5 cm). It is especially useful in surveying rough terrain where remote points have to be located between rocks and brush.

rangeland, also called RANGE, any extensive area of land that is occupied by native herbaceous or shrubby vegetation which is grazed by domestic or wild herbivores. The vegetation of ranges may include tallgrass prairies, steppes (shortgrass prairies), desert shrublands, shrub woodlands, savannas, chaparrals, and tundras. Temperate and tropical forests that are used for grazing as well as timber production can also be considered rangeland. Rangelands thus occupy about 40–50 percent of the land area of the Earth.

Rangelands are distinguished from pastureland by the presence on them of native vegetation, rather than of plants established by human societies, and by their management principally through the control of the number of animals grazing on them, as opposed to the more intensive agricultural practices of seeding, irrigation, and the use of fertilizers. The tallgrass prairies of the North American Great Plains, the Ukraine, and parts of Argentina and Hungary formerly made ideal rangelands but were too well-suited to cultivated crops to be left for grazing purposes. Rangelands are thus more generally confined to areas of marginal or submarginal agricultural land or to areas that are entirely unsuited to permanent cultivation.

Fire is an important regulator of range vegetation, whether set by humans or arising from lightning. Fires tend to burn or kill off trees, shrubs, and brush and to permit the more quickly recovering grasses to flourish without excessive competition from the former. The artificial elimination of periodic fires from desert shrublands, savannas, or woodlands frequently invites the dominance of trees and shrubs to the near exclusion of the grass.

Range management is a professional field whose aim is to ensure a sustained yield of rangeland products while protecting and improving the basic range resources of soil, water, and plant and animal life. Besides producing forage for domestic and wild animals, a range can provide timber, minerals, natural beauty, and recreational opportunities. Modern range management utilizes the concept of multiple use, which requires that all the resources of a rangeland be managed simultaneously, using constant monitoring and adjustments to provide a mix of material products and intangible assets that best satisfy the needs of both landowners and the general public. Range management depends for its effectiveness on range science, which is a body of knowledge drawn from the botanical and zoological sciences as well as from ecology, climatology, pedology (soil science), hydrology, and so on. The responses of rangeland to grazing and other uses are predicted from range science's accumulated knowledge of the functioning of rangeland ecosystems, which in turn has been aided by computer-simulated mathematical models.

In concrete terms, range-management practices centre on the regulation of the number of animals allowed to graze on a given range, along with the duration and season of their grazing. The stocking of a range must be carefully regulated so that the existing grasses are not depleted or exhausted from overgrazing. Indeed, the most pernicious and chronic problem in the management of ranges is overgrazing. Overgrazing of the vegetation reduces the production of forage; exposes the soil to sealing, baking, and erosion; reduces the infiltration of water into the soil; increases water runoff and flooding; and induces unfavourable changes in the botanical composition of the vegetation. Overgrazing has practically denuded vast areas of rangeland in nearly every continent, and in the Sahel region of sub-Saharan Africa, for instance, overgrazing has led directly to the southward expansion of the Sahara ("Desert") over distances of many miles. The degeneration of range condition has become one of the most serious problems in the agriculture of many developing countries. *See also* grassland.

ranger, in U.S. military usage, a soldier specially trained to act in small groups that make rapid surprise raids on enemy territory. Ranger has also been the designation for the Texas state constabulary and for national-park supervisors and forest wardens.

Ranger units originated during the French and Indian War (1756–63), when the British formed special units of expert woodsmen and marksmen to range the forests on scouting, screening, and harassing missions. During the American Revolution, both British and American forces employed rangers, who formed entire regiments of light infantry. In 1832 the force authorized for the Black Hawk War included 600 mounted rangers. This was the first suggestion of combining the functions of rangers and cavalry.

During the Mexican War (1846–48), companies of Texas Rangers were formed into regiments and mustered into federal service. They operated both as conventional cavalry and as rangers on scouting, patrolling, and raiding duty. After the Mexican War they served as a state constabulary organized along military lines, maintaining law and order against the Indians and against bandits and other lawless elements. In 1901 they were organized into a permanent law-enforcement agency. The Texas Rangers were merged in 1935 with the State Highway Patrol under the Department of Public Safety.

Rangers operated on both sides during the American Civil War but were a more significant factor in Confederate operations. The United States had six ranger battalions during World War II. They made sudden hard-hitting raids behind enemy lines, carrying out demolition and intelligence missions. The success of these ranger missions led to formation in 1950 of airborne ranger infantry as an integral part of each U.S. infantry division.

In the National Park Service, the U.S. Department of the Interior established in 1916 a force of national-park rangers whose functions were protection and conservation of forests and wildlife, enforcement of park regulations (for which they have police power), and assistance to visitors. Similar functions with respect to the national forests were assigned to the rangers of the Forest Service, established in 1905 as an agency of the U.S. Department of Agriculture. Forest rangers are particularly noted for their activities in the prevention and fighting of forest fires.

Ranger, any of a series of nine unmanned probes launched from 1961 to 1965 by the United States National Aeronautics and Space Administration (NASA). Project Ranger represented NASA's earliest attempt at lunar exploration. Ranger 4 (1962) became the first U.S. spacecraft to hit the moon, crash-landing on its surface as designed. The last three probes in the series, Ranger 7, 8, and 9 (1964–65), transmitted more than 17,000 high-resolution photographs of the Moon, including many from as close as 300 m (1,000 feet) above the lunar surface, before crashing.

Rangi Hiroa, Te: *see* Buck, Sir Peter (Henry).

Rangitata River, river in east-central South Island, New Zealand. It is formed by the confluence of the Clyde and Havelock rivers, which rise in the Southern Alps. The river's name is of Maori derivation and means "low sky." The river passes through the Rangitata Gorge, in the Alpine foothills, and flows southeast for 75 miles (121 km), entering Canterbury Bight of the Pacific Ocean, 40 miles (64 km) northeast of Timaru. In the stream's lower reaches, crossing the Canterbury Plains, it flows in braided channels that are usually too shallow for navigation but may unite in time of flood.

At the mouth of the Rangitata Gorge, a diversion canal carries water northeast to Highbank on the Rakaia River, where it is used for the generation of hydroelectric power and irrigation.

Rangitikei River, river in southwestern North Island, New Zealand. Rising on the east slopes of the Kaimanawa Mountains, it flows south and southwest for 150 miles (240 km) to enter South Taranaki Bight of the Tasman Sea, 60 miles (97 km) south of Wanganui. The river—with its principal tributaries, the Moawhango and Hautapu—drains a basin 1,230 square miles (3,190 square km) in area. Its upper course flows steeply through a gorge as far as Marton, below which the valley broadens to form part of the Manawatu plains. Chief settlements of the valley, which supports fat-lamb and dairy farming, are Utiku, Mangaweka, Ohingaita, and Bulls.

Rangoon (Myanmar): *see* Yangôn.

Rangoon River (Myanmar): *see* Yangôn River.

Rangpur, city, northwestern Bangladesh, on the Ghāghāt River. It is an industrial centre noted for the manufacture of dhurries (cotton carpets), bidis (cigarettes), and cigars. Constituted a municipality in 1869, it contains eight government colleges affiliated with the University of Rājshāhi; technical, agricultural, and primary teacher-training institutes; two parks; and two libraries. Rangpur ("Abode of Bliss") is said to be the site where Rāja Bhagadatta, who took part in the war recorded in the *Mahābhārata* (*c.* 400 BC–AD 200), had a country residence.

The surrounding area is composed of a vast alluvial plain. Most of the area is under continuous cultivation (tobacco, rice, jute, and oilseeds). An extensive rail network distributes the products of Rangpur's jute, rice, and sugar mills and cotton- and silk-weaving cottage industries. Pop. (1981) 153,174.

Ranidae, family of wide-ranging frogs of the order Anura, containing more than 400 species. Representatives occur on every continent except Antarctica. Members of the group are referred to as the true frogs because of their generalized body form and life history.

The eggs of most species are laid in water and develop into typical tadpoles prior to metamorphosis. The most common genus is *Rana,* which includes the large bullfrog of North America. *See also* bullfrog; common frog; green frog; leopard frog; marsh frog; pickerel frog; wood frog.

Raniero, Latin RANIERUS (pope): *see* Paschal II.

Ranjit Singh, also spelled RUNJIT SINGH, byname LION OF THE PUNJAB (b. Nov. 13, 1780, Budrukhan, or Gujrānwāla, India—d. June 27, 1839, Lahore [now in Pakistan]), founder and maharaja (1801–39) of the Sikh kingdom of the Punjab.

Ranjit Singh was the only child of Maha Singh, on whose death in 1792 he became chief of the Śukerchakīās, a Sikh group. His inheritance included Gujrānwāla town and the surrounding villages, now in Pakistan. At 15 he married the daughter of a chieftain of the Kanhayas, and for many years his affairs were directed by his ambitious mother-in-law, the widow Sada Kaur. A second marriage, to a girl of the Nakkais, made Ranjit Singh preeminent among the clans of the Sikh confederacy.

In July 1799 he seized Lahore, the capital of the Punjab. The Afghan king, Shāh Zamān, confirmed Ranjit Singh as governor of the city; in 1801, however, Ranjit Singh proclaimed himself maharaja of the Punjab. He had coins struck in the name of the Sikh Gurūs, the revered line of Sikh leaders, and proceeded to administer the state in the name of the Sikh commonwealth. A year later he captured Amritsar, the most important commercial entrepôt in northern India and sacred city of the Sikhs. Thereafter he proceeded to subdue the smaller Sikh and Pashtun (Afghan) principalities that were scattered over the Punjab. But his later forays east were checked by the English, with whom he signed the Treaty of Amritsar (1809) fixing the Sutlej River as the eastern boundary of his territories.

Ranjit Singh then turned his ambitions toward the north and west, against the Pashtuns. In the summer of 1818 his troops captured the city of Multān and six months later entered the Pashtun citadel, Peshāwar. In July 1819 he finally expelled the Pashtuns from the Vale of Kashmir. By 1820 he had consolidated his rule over the whole Punjab between the Sutlej and the Indus rivers.

All of Ranjit Singh's conquests were achieved by Punjabi armies composed of Sikhs, Muslims, and Hindus. His commanders were also drawn from different religious communities, as were his Cabinet ministers. In 1820 Ranjit Singh began to modernize his army, using European officers to train the infantry and artillery. The modernized Punjabi army fought well in campaigns in the North-West Frontier (on the Afghanistan border). Ranjit Singh added Ladākh (a region of eastern Kashmir) to his kingdom in 1834, and his forces repulsed an Afghan counterattack on Peshāwar in 1837.

In 1838 he agreed to a treaty with the British viceroy Lord Auckland to restore Shāh Shojāʿ to the Afghan throne at Kābul. In pursuance of this agreement, the British Army of the Indus entered Afghanistan from the south, while

Ranjit Singh's troops went through the Khyber Pass and took part in the victory parade in Kābul.

Shortly afterward Ranjit Singh was taken ill, and he died at Lahore in June 1839, exactly 40 years after he had entered the city as a conqueror. In little more than six years after his death, the Sikh state he had created collapsed because of the internecine strife of rival chiefs.

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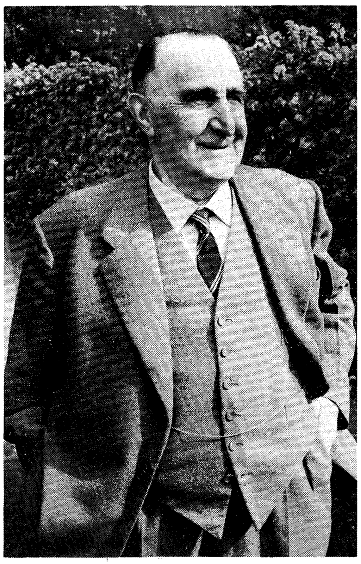
Ranjitsinhji Vibhaji, Sir, Maharaja Jam Saheb of Nawānagar (cricketer): *see* Nawānagar, Sir Ranjitsinhji Vibhaji, Maharaja Jam Saheb of.

Rank (of Sutton Scotney), J(oseph) Arthur Rank, Baron (b. Dec. 22 or 23, 1888, Hull, Yorkshire, Eng.—d. March 29, 1972, Winchester, Hampshire), British industrialist who became Great Britain's chief distributor (and one of the world's major producers) of motion pictures.

The youngest son of Joseph Rank, a flour miller and Methodist philanthropist, he served (1952–69) as chairman of his family business, Ranks Hovis McDougall, Ltd. Earlier, in the 1930s, he turned to making religious films as instructional aids for Methodist Sunday school classes. In 1935 his British National Film Company made its first commercial picture, *The Turn of the Tide,* about a Yorkshire fishing village. In the same year he and Charles M. Woolf established General Film Distributors, Ltd., which handled the distribution of Universal Pictures films in Britain. The company grew rapidly, and by 1941 Rank controlled two of the three largest movie theatre chains in Great Britain. In 1946 the J. Arthur Rank Organisation was incorporated, and this company dominated British film production during that industry's most productive period, the late 1940s and the '50s. Rank was chairman (1946–62) and president (1962–72) of the Rank Organisation, but his company withdrew from motion-picture activities in favour of hotel ownership and other more profitable enterprises in the late 1960s. He was raised to the peerage in 1957 (the barony becoming extinct upon his death). *Mr. Rank,* a biography by Alan Wood, appeared in 1952.



Lord Rank, 1968
By courtesy of the Rank Organisation Ltd.

Rank, Otto, original name OTTO ROSENFELD (b. April 22, 1884, Vienna—d. Oct. 31, 1939, New York City), Austrian psychologist who extended psychoanalytic theory to the study of legend, myth, art, and creativity and who suggested that the basis of anxiety neurosis is a psychological trauma occurring during the birth of the individual.

Rank came from a poor family and attended trade school, working in a machine shop while trying to write at night. His reading of Sigmund Freud's *The Interpretation of Dreams* inspired him to write *Der Künstler* (1907; "The Artist"), an attempt to explain art by using psychoanalytic principles. This work brought him to the attention of Freud, who helped arrange his entry to the University of Vienna, from which he received his doctorate in philosophy in 1912. While studying at the university, he legally adopted his pen name of Otto Rank and published two more works, *Der Mythus von der Geburt des Helden* (1909; *The Myth of the Birth of the Hero*) and *Das Inzest-Motiv in Dichtung und Sage* (1912; "The Incest Motif in Poetry and Saga"), in which he attempted to show how the Oedipus complex supplies abundant themes for poetry and myth.

Rank served as secretary to the Vienna Psychoanalytic Society and as editor of its minutes, and from 1912 to 1924 he edited the *Internationale Zeitschrift für Psychoanalyse* ("International Journal of Psychoanalysis"). In 1919 he founded a publishing house devoted to the publication of psychoanalytic works and directed it until 1924.

Publication of *Das Trauma der Geburt und seine Bedeutung für die Psychoanalyse* (1924; *The Trauma of Birth*) caused Rank's break with Freud and other members of the Vienna Psychoanalytic Society, which expelled him from its membership. The book, which argued that the transition from the womb to the outside world causes tremendous anxiety in the infant that may persist as anxiety neurosis into adulthood, was seen by many members of the Viennese society as conflicting with the concepts of psychoanalysis. Following the break, which became complete in the mid-1920s, Rank taught and practiced in the United States and Europe (chiefly Paris) for about 10 years, settling in New York City in 1936.

During the 1930s Rank developed a concept of the will as the guiding force in personality development. The will could be a positive force for controlling and using a person's instinctual drives, which were seen by Freud as the motivating factors in human behaviour. Thus, in Rank's view, resistance by a patient during psychoanalysis was a manifestation of this will and not inherently a negative factor; instead of wearing down such resistance, as a Freudian analyst would attempt, Rank would use it to direct self-discovery and development.

Rank's attempt to reduce all of psychology to a monolithic system based on the birth trauma is viewed as a serious departure from a scientific orientation. But his emphasis on personal growth and self-actualization and his application of psychoanalytic theory to the interpretation of art and myth have remained influential.

Ranke, Leopold von (b. Dec. 21, 1795, Wiehe, Thuringia, Saxony [Germany]—d. May 23, 1886, Berlin), leading German historian of the 19th century, whose scholarly method and way of teaching (he was the first to establish a historical seminar) had a great influence on Western historiography. He was ennobled (with the addition of *von* to his name) in 1865.

Education. Ranke was born into a devout family of Lutheran pastors and lawyers. After attending the renowned Protestant boarding school of Schulpforta, he entered the University of Leipzig. He studied theology and the classics, concentrating on philological work and the translation and exposition of texts. This approach he later developed into a highly influential technique of philological and historical textual criticism. His predilection for history arose from his studies of the ancient writers, his indifference to the rationalistic theology still in vogue in Leipzig, and his intense interest in Luther as a historical character. But he decided in favour of history only in Frankfurt an der Oder, where he was a secondary school teacher from 1818 to 1825. Apart from the contemporary patriotic enthusiasm for German history, his decision was influenced by Barthold Georg Niebuhr's Roman history (which inaugurated the modern scientific historical method), the historiographers of the Middle Ages, and Sir Walter Scott's historical novels, as well as by the German Romantic poet and philosopher Johann Gottfried von Herder, who regarded history as a chronicle of human progress. Yet Ranke's strongest motive was a religious one: influenced by the philosophy of Friedrich Schelling, he sought to comprehend God's actions in history. Attempting to establish that God's omnipresence revealed itself in the "context of great historical events," Ranke the historian became both priest and teacher.

Early career. The typical features of Ranke's historiographical work were his concern for universality and his research into particular limited periods. In 1824 he produced his maiden work, the *Geschichte der romanischen und germanischen Völker von 1494 bis 1514* (*History of the Latin and Teutonic Nations from 1494 to 1514*), which treats the struggle waged between the French and the Habsburgs for Italy as the phase that ushered in the new era. The appended treatise, *Zur Kritik neuerer Geschichtsschreiber,* in which he showed that the critical analysis of tradition is the historian's basic task, is the more important work. As a result of these publications, he was appointed associate professor in 1825 at the University of Berlin, where he taught as full professor from 1834 to 1871. Many of the students in his famous seminars were to become prominent historians, continuing his method of research and training in other universities. In his next book, Ranke, utilizing the extremely important reports of the Venetian ambassadors, dealt with the rivalry between the Ottoman Empire and Spain in the Mediterranean (*Fürsten und Völker von Süd-Europa im sechzehnten und siebzehnten Jahrhundert*); from 1834 to 1836, he published *Die römischen Päpste, ihre Kirche und ihr Staat im sechzehnten und siebzehnten Jahrhundert* (changed to *Die römischen Päpste in den let-*

Ranke, detail of an oil painting by J. Schrader, 1868; in the National-Galerie, Berlin
By courtesy of the Staatliche Museen zu Berlin, Ger.

zen vier Jahrhunderten in later editions)—a book that ranks even today as a masterpiece of narrative history. Rising above religious partisanship, Ranke in this work depicts the papacy not just as an ecclesiastical institution but above all as a worldly power.

Before this work appeared, Ranke the historian had been drawn briefly into contemporary history and politics. A disillusioning experience, it produced, however, a few short writings in which he expressed his scholarly and political convictions more directly than in his major works. Disregarding his real talents and misjudging the contemporaneous political dissensions, which in 1830 were intensified by the liberal July revolution in France, he undertook to edit a periodical defending Prussian policy and its rejection of liberal and democratic thinking. Only two volumes of the *Historisch-politische Zeitschrift* were published from 1832 to 1836, most of the articles being written by Ranke himself. While he tried to explain the conflicts of the times from a historical—and for him that meant nonpartisan—viewpoint, in essence he sought to prove that the French revolutionary development could not and should not be repeated in Germany. Ranke believed that history evolves in the separate development of individual men, peoples, and states, which together constitute the process of culture. The history of Europe from the late 15th century onward—in which each people, though sharing one cultural tradition, was free to develop its own concept of the state—seemed to him to confirm his thesis. Ranke dismissed abstract, universally valid principles as requirements for the establishment of social and national order; he felt that social and political principles must vary according to the characteristics of different peoples. To him the individual entities of greatest historical importance were states, the "spiritual entities, original creations of the human mind—even 'thoughts of God.' " Their essential task was to evolve independently and, in the process, to create institutions and constitutions adapted to their times.

In this respect Ranke's thinking is related to the philosopher G.W.F. Hegel's theory that what is real is also rational; yet, in Ranke's view, it is not reason that justifies what is real but historical continuity. This continuity is the prerequisite for the development of a culture and also for understanding historical reality. Hence, it is the historian's duty to understand the essence of "historicism": that history determines each event but does not justify it. In practice, however, Ranke endorsed the social and political order of his time—the European system of states, the German Federation with its numerous monarchies, and Prussia before the 1848 revolution, with its highly developed monarchy and bureaucracy, its highly developed educational system, and its rejection of liberal and democratic trends—as resulting from the European cultural process, a process that, according to him, would be demolished by democratic revolution.

The search for objectivity. But Ranke pleased no one; too devoted to the state for the liberals, he was not sufficiently dogmatic for the conservatives. He therefore returned to his historiographical work in which he thought he could more successfully attain his ideal of objectivity. From 1839 to 1847 the *Deutsche Geschichte im Zeitalter der Reformation* (*History of the Reformation in Germany,* 1845–47) appeared, the first scholarly treatment of that age. In 1847–48 there followed *Neun Bücher preussischer Geschichte* (*Memoirs of the House of Brandenburg and History of Prussia, During the Seventeenth and Eighteenth Centuries,* 1849), later expanded to 12 volumes; in 1852–61 the *Französische Geschichte, vornehmlich im sechzehnten und siebzehnten Jahrhundert* (*Civil Wars and Monarchy in France, in the Sixteenth and Seventeeth Centuries: A History of France Principally During That Period,* 1852); and, in 1859–69, the *Englische Geschichte, vornehmlich im sechzehnten und siebzehnten Jahrhundert* (*A History of England Principally in the Seventeenth Century,* 1875)—each consisting of several volumes that, although partly rendered obsolete by later research, are still worth reading today for their great narrative skill. In these works, too, Ranke deals with the leading European states at decisive stages of their development within the European system. Ranke typically restricts himself to the Latin and Germanic nations as the protagonists of cultural development, among whom—from the 16th century on—the Protestant states had increasingly assumed leadership; and just as typically, he focusses on political history; *i.e.,* the foreign relations of states and their systems of government and administration. Because economic and social factors were barely reflected in the sources he used, appearing only dimly in the background as "forces" and "tendencies," Ranke found it increasingly difficult to understand the modern age of incipient social change.

His books on the late 18th and early 19th centuries (*Die deutschen Mächte und der Fürstenbund,* 1871–72; *Ursprung und Beginn der Revolutionskriege 1791 und 1792,* 1875; *Hardenberg und die Geschichte des preussischen Staates von 1793 bis 1813,* 1877) are subtle accounts of complex political events but address themselves only indirectly to the central problems of a changing age. Like the *Englische Geschichte,* these books exhibit a certain bias against political and social change, especially the appearance of radical movements. In his lectures Ranke often dealt with the history of his time; they did not, apparently, differ in concept or emphasis from his books. History is regarded as a complex process of "historical life," which assumes its most effective "real spiritual" form in the great states and their tensions. The historian, as objectively as possible, must describe "how it really was," keeping the whole picture in mind while extracting the essence. Ranke was thus not an analyst but a "visual" historiographer. Aware of the limitations imposed by time and place on every historian, he attempted to achieve maximum objectivity principally by identifying himself not with a "party" but with the state. Yet his work demonstrates that his intellectual credo influenced his political views.

Ranke reached the peak of his fame as the most important living historian in the second half of the century. In 1865 he was ennobled and in 1882 made a privy counsellor. When Frederick William IV became mentally ill in 1857, Ranke finally withdrew from political life and, after his wife's death (1871), from social life also. Rejecting liberal democratic nationalism and distrusting Chancellor Otto von Bismarck's policy because he believed that it jeopardized the continuity of German history and embraced cooperation with popular movements, Ranke nevertheless welcomed the foundation of the empire in 1871.

In the meantime, failing eyesight had turned him into a lonely scholar who depended on the help of assistants. Yet, despite this handicap, at the age of 82 he began what he claimed to be his greatest work, a "world history" (9 vol., 1881–88) leading up to the 15th century. Ranke thus fulfilled the task he had set himself as a young man: to tell the "story of universal history." Not a work of critical research or of historical and philosophical speculation but a wide-ranging account of the evolution of culture from the Greeks to the Latin-Germanic nations, it is actually a history of Europe in which the non-European world appears at best only marginally. He wrote it in the conviction that the peaceful evolution of culture was definitively protected against the danger of revolution and that the conflict between popular sovereignty and the monarchy had been settled once and for all in favour of the latter.

Assessment. Ranke's concept and writing of history predominated in German historiography up to World War I and even after; it also influenced a great many distinguished foreign historians who studied in Germany. Unfortunately, many of Ranke's disciples simply continued, canonized, and debased Ranke's concepts, retaining all of their limitations without the universality of view that gave them meaning. Ranke's own achievements, however, remain unquestioned. He contributed greatly to the progress of historiography: it became more self-assured in its method and proved itself capable of transforming the widely felt need for a historical understanding of the world ("historicism") into an interpretation of the past based on scientific research. (Ru.V.)

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ranket (musical instrument): *see* rackett.

Rankin, Jeannette (b. June 11, 1880, near Missoula, Mont., U.S.—d. May 18, 1973, Carmel, Calif.), first woman member of the U.S. Congress (1917–19, 1941–43), a vigorous feminist and a lifetime pacifist and crusader for social and electoral reform.

Jeannette Rankin, 1918

By courtesy of the Library of Congress, Washington, D.C.

After varied university studies, Rankin began social work in Seattle, Wash., in 1909. Attracted to the cause of woman suffrage, for the next five years she campaigned actively on its behalf in Washington, California, and Montana, eventually becoming legislative secretary of the National American Woman Suffrage Association. In 1916 she was elected to the U.S. House of Representatives, thus becoming the first woman to hold a seat in either chamber. In office she introduced the first bill that would have allowed women citizenship independent of their husbands and also supported government-sponsored hygiene instruction in maternity and infancy. Reflecting a deep-seated pacifism, she became an outspoken isolationist and was one of 49 members of Congress to vote against declaring war on Germany in 1917. This unpopular stand cost her the Republican Senate nomination in 1918; she ran as an independent and lost. After the war she became a lobbyist and later returned to social work.

Running on an antiwar platform in 1940, Rankin once again won election to the House. She created a furor as the only legislator to vote against the declaration of war on Japan after the raid on Pearl Harbor (Dec. 7, 1941), effectively terminating her political career with this vote. She did not seek reelection, but continued to lecture on various aspects of social reform. Her militant feminism remained unabated as late as the 1960s, when she founded a self-sufficient women's "cooperative homestead" in Georgia. She also became active again in the peace movement, urging women to demand a halt to the U.S. intervention in Vietnam. On Jan. 15, 1968, at the age of 87, she led 5,000 women, calling themselves the "Jeannette Rankin Brigade," to the foot of Capitol Hill to demonstrate opposition to the hostilities in Indochina. A biography by Hannah Josephson was published in 1974.

Rankine, William John Macquorn (b. July 5, 1820, Edinburgh—d. Dec. 24, 1872, Glasgow), Scottish engineer and physicist and one of the founders of the science of thermodynamics, particularly in reference to steam-engine theory.

Trained as a civil engineer under Sir John Benjamin MacNeill, Rankine was appointed to the Queen Victoria chair of civil engineering and mechanics at the University of Glasgow (1855). One of Rankine's first scientific works, a paper on fatigue in metals of railway axles (1843), led to new methods of construction. His *Manual of Applied Mechanics* (1858) was of considerable help to designing engineers and architects. His classic *Manual of the Steam Engine and Other Prime Movers* (1859) was the first attempt at a systematic treatment of steam-engine theory. Rankine worked out a thermodynamic cycle of events (the so-called Rankine cycle) used as a standard for the performance of steam-power installations where a condensable vapour provides the working fluid.

In soil mechanics his work on earth pressures and the stability of retaining walls was a notable advance, particularly his paper "On the Thermodynamic Theory of Waves of Finite Longitudinal Disturbance."

Rankine cycle, in heat engines, ideal cyclical sequence of changes of pressure and temperature of a fluid, such as water, used in an engine, such as a steam engine. It is used as a thermodynamic standard for rating the performance of steam power plants. The cycle was described in 1859 by the Scottish engineer William J.M. Rankine.

In the Rankine cycle the working substance of the engine undergoes four successive changes: heating at constant pressure, converting the liquid to vapour; reversible adiabatic expansion, performing work (as by driving a turbine); cooling at constant pressure, condensing the vapour to liquid; and reversible adiabatic compression, pumping the liquid back to the boiler.

Ranks, Table of, Russian TABLICHA RANGOV (Jan. 24, 1722), classification of grades in the Russian military, naval, and civil services into a hierarchy of 14 categories and the foundation of a system of promotion based on personal ability and performance rather than on birth and genealogy. This system, introduced by Peter I the Great, granted anyone who attained the eighth rank the status of a hereditary noble. It thus caused dissatisfaction among the old aristocracy, which lost its exclusiveness as well as its hereditary right to high office. The Table of Ranks, with minor changes, was used until 1917.

Rann of Kutch (India and Pakistan): *see* Kutch, Rann of.

Rannoch, geographic region, in The Grampians of Scotland, composed mainly of moorland and lochs. The region includes Loch Rannoch, part of the Tummel-Ericht hydroelectric scheme, and, south of the loch, Rannoch Moor, a bleak windswept area of 20 sq mi (52 sq km) of heather and peat bog with a few surviving pines, relics of the original Caledonian Forest of Scotland. The northeast section of the moor is a nature reserve.

Ranong, town and *changwat* (province) in the Southern region of Thailand, on the west coast of the Malay Peninsula. Ranong town, the provincial capital, is a fishing port in the Pakchan River estuary.

The province has an area of 1,273 sq mi (3,298 sq km), with a coastline on the Indian Ocean. It borders Burma on the northwest and there are highlands in the east. It is a tin-mining and fishing region. Pop. (1980) town, 13,309; (1983 est.) province, 90,137.

Ransier, Alonzo J(acob) (b. Jan. 3, 1834, Charleston, S.C., U.S.—d. Aug. 17, 1882, Charleston), black member of the U.S. House of Representatives from South Carolina during Reconstruction.

Ransier was born a free black and received a rudimentary education. His career in public life began immediately after the Civil War when, in 1865, he served as registrar of elections. The following year he attended South Carolina's first Republican convention, and in 1868 he was a South Carolina presidential elector for the Grant–Colfax ticket. As Republican candidate for lieutenant governor in 1870, Ransier won by 33,000 votes, and in 1872 he was selected a delegate to the Republican National Convention.

A recognized spokesman for the black community in Charleston, Ransier was elected to Congress in 1872. In the House he fought for a full and complete civil rights bill, backed a high tariff, opposed a salary increase for federal officials, advocated a six-year presidential term, and sought funds for the improvement of Charleston harbour.

Defeated in his bid for a second term, Ransier settled once again in Charleston. He spent his final years there working as a day labourer for the municipal government.

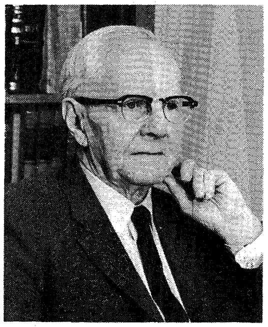
Articles are alphabetized word by word, not letter by letter

Ransom, John Crowe (b. April 30, 1888, Pulaski, Tenn., U.S.—d. July 4, 1974, Gambier, Ohio), U.S. poet and critic, leading theorist of the Southern literary renascence that began after World War I. Ransom's *The New Criticism* (1941) provided the name of the influential mid-20th-century school of criticism (*see* New Criticism).

Ransom was educated at Vanderbilt University, Nashville, Tenn., and from 1914 to 1937 he taught English there, where he was the leader of the Fugitives (*q.v.*), a group of poets that published the influential literary magazine *The Fugitive* (1922–25) and shared a belief in the South and its regional traditions.

Ransom was also among those Fugitives who became known as the Agrarians. Their *I'll Take My Stand* (1930) criticized the idea that industrialization was the answer to the needs of the South.

Ransom taught from 1937 until his retirement in 1958 at Kenyon College, Gambier, Ohio, where he founded and edited (1939–59) the literary magazine *The Kenyon Review.* Ransom's literary studies include *God Without Thunder* (1930); *The World's Body* (1938), in which he takes the position that poetry and science furnish different but equally valid knowledge about the world; *Poems and Essays* (1955); and *Beating the Bushes: Selected Essays, 1941–1970* (1972). Ransom's poetry is collected in *Chills and Fever* (1924) and *Two Gentlemen in Bonds* (1927). Thereafter he published only five poems, his *Selected Poems* (1945; rev. ed., 1969) composed of excerpts from the previous two volumes. T.D. Young edited his critical essays (1968) and wrote a biography (1977).



Ransom, 1968

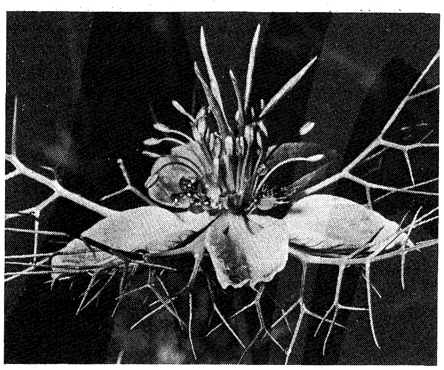
By courtesy of Kenyon College, Gambier, Ohio

Ransome, Arthur (Michell) (b. Jan. 18, 1884, Leeds, Yorkshire, Eng.—d. June 3, 1967, Manchester), writer of children's adventure novels noted for their high literary standards and their detailed and colourful accounts of the perception and imagination of children.

Educated at Rugby School, Ransome worked in a publishing house, then became a war correspondent in World War I, and in the course of his work made several trips to Russia before and after the Revolution. He also travelled in China, Egypt, and the Sudan, and his experiences provided the inspiration for, especially, *Old Peter's Russian Tales* (1916) and *Racundra's First Cruise* (1923), about sailing on the Baltic Sea. Ransome's many other works include *Swallows and Amazons* (1931), *Pigeon Post* (1936), *We Didn't Mean to Go to Sea* (1937), *Missee Lee* (1941), and *Mainly About Fishing* (1959). *The Autobiography of Arthur Ransome* was published in 1976.

Rantoul, village, Champaign County, east central Illinois, U.S. Settled with the coming of the Illinois Central Railroad in 1854, it was named for Robert Rantoul, a director of the railroad. The economy, once agricultural, now depends almost entirely on Chanute Air Force Base adjacent to Rantoul. Built in 1917 and named for Octave Chanute (1832–1910), a pioneer in aviation engineering, it is one of the oldest and one of the largest technical training centres of the U.S. Air Force. Inc. 1869. Pop. (1980) village, 20,161; (1982 est.) Champaign–Urbana–Rantoul metropolitan area (SMSA), 172,000.

Ranunculaceae, the buttercup family (order Ranunculales), comprising about 1,900 species in some 50 genera of flowering plants,



Nigella sativa, an herb of the family Ranunculaceae known as black cumin and fennel flower

George Whiteley—Photo Researchers

mostly herbs, which are widely distributed in all temperate and subtropical regions. In the tropics they occur mostly at high elevations.

The leaves are usually alternate and stalkless and may be simple or much divided, often with sheathing bases. The flowers usually have two to five free sepals and may be radially symmetrical or irregular. The petals are free and sometimes numerous but usually number five or fewer. The male and female parts (stamens and pistils) are usually numerous and are always separate from each other.

The family includes many popular wild flowers as well as ornamentals, including anemone, buttercup, larkspur, marsh marigold, *Clematis*, and *Hepatica* (*qq.v.*).

Ranunculales, the buttercup order of flowering plants, belonging to the class known as dicotyledon (*q.v.*; characterized by two seed leaves) and containing 10 families, about 140 genera, and approximately 3,000 species. The order is somewhat diverse, encompassing herbaceous (nonwoody) plants, woody climbers, and shrubs. Included are familiar ornamental plants, such as buttercups, columbines, and larkspurs, and also several common weeds. Alkaloids poisonous to humans and animals are present in many species.

A brief treatment of Ranunculales follows. For full treatment, *see* MACROPAEDIA: Angiosperms.

The Ranunculales order contains short-lived annuals, perennial herbs of longer or shorter duration, and long-lasting woody shrubs and climbers. Its members occupy a wide range of habitats, including fresh water, marshes, grasslands, forests, and mountain pastures. Most species are adapted to partly moist or wet environments, but they are widely distributed and, except in desert areas, grow abundantly. Only the Menispermaceae family is chiefly tropical; other families prefer cooler climates. Many species are cultivated as garden ornamentals. Some of the alkaloid compounds found throughout the order are major ingredients of folk medicines.

The buttercup family, Ranunculaceae, is the largest family in the order. Consisting mostly of herbaceous plants, its members grow in temperate and subtropical areas. Many well-known wild and cultivated flowers belong to this group. Wild buttercups (*Ranunculus*), with their bright yellow blossoms, are distributed over a wide range; marsh marigolds (*Caltha*), also known as cowslips or kingcups, grow in wet places on both sides of the Atlantic; and columbines (*Aquilegia*) are among the most beautiful wildflowers of North America. The *Anemone* genus includes wild anemones native to the North Temperate Zone as well as cultivated varieties. *Clematis*, a genus containing both herbs and semiwoody climbers, includes large-flowered vines that are grown as garden ornamentals.

Many plants in the Ranunculaceae family are poisonous as well as beautiful. The larkspurs (*Delphinium*) include annuals and perennials cultivated for their strikingly showy flowers. All larkspur species contain several toxic alkaloids, and *D. geyeri* is notorious in the Rocky Mountains as a cattle poisoner. The hellebores (*Helleborus*), which contain extremely poisonous juice, include the Christmas rose (*H. niger*), a southern European native planted in northern gardens for its midwinter blooms. Aconite, or monkshood (*Aconitum*), a hardy perennial of northern mountains, is also called wolfsbane because of its toxic nature; the species *A. ferox* contains one of the deadliest poisons known.

The barberry family, Berberidaceae, includes herbs and shrubs that grow in most temperate parts of the world. A majority of species belong to the shrubby *Berberis* genus. Many cultivated barberry shrubs are handsome, spiny evergreens, with yellow flowers followed by red berries. Alkaloids contained in the roots of some species are used in folk remedies.

Most species of Menispermaceae, the moonseed family, are woody climbers in tropical forests, although some genera extend into temperate regions in North America and Japan. The common moonseed (*Menispermum canadense*) and other members of the family have characteristic half-moon-shaped seeds. A few species are cultivated as foliage ornamentals.

Members of the Ranunculales order vary widely in structure, but they share several features: they are either herbaceous or softly woody; their leaves are usually alternately arranged and without stipules (leaflike appendages at the bases of the leaf stalks); flower petals and sepals are usually arranged spirally, as are the characteristically numerous stamens (male); several free carpels (female) are arranged spirally or in a circular whorl; and alkaloids are regularly present. In most families the flowers are bisexual, with both male and female reproductive organs.

Several means of pollination exist among the Ranunculales, and this variation is reflected in the range of floral types. Insect pollination is the prevailing method, and pollinators are attracted by coloured petals and sepals. Some genera have flowers with well-developed nectaries, and insects visit them to obtain nectar, touching the stamens and spreading pollen to other plants in the process. Flowers of other genera produce no nectar, and the insects seek the pollen itself. Among the Berberidaceae sensitive stamens sometimes aid in pollination by springing up when touched and shaking pollen onto the visiting insect. Cross-pollination is made more certain in the Menispermaceae by the location of the sexual organs in separate female and male flowers.

Seed dispersal is accomplished in a variety of ways, depending on the nature of the fruit. In plants with fleshy berries, foraging animals and birds gather the fruits and distribute the seeds. The majority of fruits in the order, however, are dry, and seeds must be dispersed more passively. Some have spiny projections that stick to animal fur; others are winged or plumed to be blown through the air. Some genera have podlike fruits that gradually spill out their seeds when agitated by the wind. In one species of hellebore the seeds from the pod are attached to a ribbon of placenta that ants feed on and drag about.

Ranvier, Louis-Antoine (b. Oct. 2, 1835, Lyon—d. March 22, 1922, Thélys, Fr.), French histologist and pathologist whose dynamic approach to the study of minute anatomy made his laboratories a world centre for students of histology and contributed especially to knowledge of nervous structure and function.

Assistant to the eminent French physiologist Claude Bernard (1867), Ranvier became director of the histology laboratory (1875) at the Collège de France, Paris, where he later was appointed professor of general anatomy (1886). Ranvier is credited with transforming histology from a descriptive discipline into an experimental science that could serve as a basis for physiological observations. He devoted most of his research to elaborating detailed nerve and skin structure. In 1878 he described constrictions seen in certain nerve fibres, now known as the nodes of Ranvier, where discontinuities occur in the nerve's myelin coating and discovered nerve terminals between the epithelial cells of the tongue that are now known as Ranvier's tactile disks. With the French bacteriologist André-Victor Cornil he wrote *Manuel d'histologie pathologique* (1869), considered a landmark of 19th-century medicine.

Raoul (French personal name): *see under* Rudolf, except as below.

Raoul DE HOUDENC, Houdenc also spelled HOUDAN (fl. *c.* 1200–30), trouvère poet-musician of courtly romances and author credited with writing one of the first French romances in an ornate, allegorical style.

Little is known of his life. His name could have originated from a dozen cities. Certain passages in his writings suggest that he may have been a monk, and it is known that he was trained as a clerk. He was familiar with Paris and seems to have lived as a minstrel, singing sometimes in the street and sometimes at the courts of the minor nobility. His greatest work, an Arthurian romance, *Méraugis de Portlesguez,* was constructed on a single theme, developed through myriad enveloping allegorical details. Delicate in its psychology and subtle in its expression, the work was an influence on the courtly tradition. His *Songe d'enfer* ("Dream of Hell") may have influenced Dante (1265–1321) in writing his *Divina commedia.* Houdenc also wrote the *Roman des ailes* ("The Romance of the Wings"), in which he enumerates the qualities necessary for courtly love. An imitator or competitor of the poet Chrétien de Troyes (fl. 12th century), he may also have been the author of an allegorical poem, *La Voie de Paradis* ("The Way of Paradise"), and a romance, *Vengeance de Raguidel.*

Raoult, François-Marie (b. May 10, 1830, Fournes-en-Weppes, Fr.—d. April 1, 1901, Grenoble), French chemist who formulated a law on solutions (called Raoult's law) that made it possible to determine the molecular weights of dissolved substances.

Raoult taught at the University of Grenoble from 1867 and was professor from 1870 until his death. In about 1886 he discovered that the freezing point of an aqueous solution is lowered in proportion to the amount of a nonelectrolytic substance dissolved.

This observation led to the expression of Raoult's law, which states that the changes in certain related properties of a liquid (*e.g.,* vapour pressure, boiling point, or freezing point) that occur when a substance is dissolved in the liquid are proportional to the number of molecules of dissolved substance (solute) present for a given quantity of solvent molecules. The relationship has been of fundamental importance in the development of the theory of solutions, although few real solutions behave strictly in accordance with it. A solution that conforms to Raoult's law is called an ideal solution.

Rapacki, Adam (b. Dec. 24, 1909, Lwów, Galicia, Austria-Hungary—d. Oct. 10, 1970, Warsaw), Polish Socialist and economist who joined the Communist Party after World War II and who, as minister of foreign affairs, was noted for his "Rapacki Plan" for an atom-bomb-free zone in Europe.

Son of Marian Rapacki, founder of the cooperative movement in Poland, Rapacki studied in France and Italy and became active in organizing Socialist youth groups. He fought with the Polish Army against the invading Germans and spent 1939–45 in prisoner-of-war camps. In 1948 he joined the Polish United Workers (Communist) Party. After holding the post of minister for higher education (1950–56), he was appointed to the foreign affairs post. While he supported Soviet policies in the United Nations and backed the positions of other Communist countries, Rapacki also tried to keep relations with the West open, diplomatically and culturally as well as for trade.

Rapacki gained prominence in 1957, when on October 2 he presented the so-called Rapacki Plan to the UN General Assembly. It would have established a denuclearized zone in Europe. On Dec. 20, 1968, Rapacki was removed as foreign minister for his refusal to support anti-Semitic measures that followed earlier outbreaks of student unrest.

Rapallo, city, Genova *provincia,* Liguria *regione,* northwestern Italy, on the Levante Riviera at the head of Rapallo Gulf, southeast of Genoa.

First mentioned in 964, Rapallo was sacked successively by the Lombards, Normans, and Swiss. It was the site of the Allied Conference of Rapallo in 1917, and treaties establishing friendly relations between Italy and Yugoslavia (1920) and the Soviet Union and Germany (1922) were signed there. It became a city in 1956.

There is a 15th-century castle and a 12th-century church, and the nearby sanctuary of Montallegro (1557) is notable. Rapallo is a thriving resort known for its mild climate and fine hotels. Although tourism is the principal economic activity, pillow lace, olive oil, textiles, cement, and special steels are manufactured. Pop. (1988 est.) mun., 29,559.

rape, also called COLZA (species *Brassica napus*), plant of the mustard family (Brassicaceae), native to Europe. Rape is an annual, 30 cm (1 foot) or more tall, with a long, usually thin taproot. The foliage is smooth, bluish green, and deeply scalloped. The bases of the upper leaves clasp the stem. Rape bears clusters of four-petaled, yellow flowers. Each round pod has a short beak and contains many seeds. These seeds are a source of colza oil, used for fuel, in cooking, as a lubricant, and in soaps and synthetic rubber. The seeds are also used as bird feed. The seed residue is used for fodder.

Rape (*Brassica napus*)
Ingmar Holmasen

rape, a violation of person and of humane and legal codes of behaviour. It most often refers to an act by a man of sexual intercourse with a woman without her consent, through force or the threat of force or, in some countries, through fraud. The term rape may also refer to forcible sodomy, and the victim also may be another man or a child. In psychological terms, rape is considered to be an act of anger and a pathological assertion of power. Although it is a sexual assault, it is more an act of aggression than of sexual desire.

In most societies, rape is considered to be a serious crime, although not always for the same reason. In many African tribes, rape is heavily fined because it is considered a violation of property rights, the woman belonging either to a father or a husband.

In patriarchal societies of the past and present, situations of socially acceptable rape exist. A number of ancient peoples customarily ravished the women of conquered tribes. Among some American Indian tribes, forcible rape by 20 or more men was prescribed punishment organized by an offended husband against an adulterous wife.

In England rape is considered a felony at common law and was a capital offense until the Offences Against the Person Act (1861) made it punishable with imprisonment for life. In the United States, the elements of the crime under statute are similar to those at common law. The age when effective consent can be given by the woman has commonly been set by the various states between 14 and 18 years.

The term statutory rape refers to the legal proscription, existing in most countries, against a man's taking sexual advantage of a child or any other person presumed to lack comprehension of the physical and other consequences of sexual intercourse. The definition of this lack of comprehension, however, is often overreaching, for, as noted above, a child may be designated as someone as old as 18 years. Consent is not relevant, and statutory rape may vary drastically from the type of violent aggression described earlier. Charges against the perpetrator are not usually brought by the victim, but by the victim's parents or guardians. The term statutory rape may also refer to those laws, as in France, against taking sexual advantage of a person in a subservient position, such as an employee or ward.

Homosexual rape—involving the forcible sodomy of males—is a common problem in jails and prisons. It extends beyond the occasional reports of inmates being brutally mass raped and includes the habitual submission of weaker inmates to stronger inmates, under implicit or explicit threats of violence. However, because male prisoners are kept from contact with females and thus may engage in homosexual acts more readily than they might otherwise (random estimates are that from 20 to 60 percent of prison populations habitually engage in homosexual acts), it is often difficult to distinguish this kind of rape from intercourse by consent.

Psychological reactions to rape vary but usually include degrees of shame, humiliation, confusion, fear, and rage. Victims have reported a feeling of perpetual defilement, an inability to feel clean, an overwhelming sense of vulnerability, and a paralyzing feeling of lack of control over their lives. Many are haunted by fear of the neighbourhood in which the crime occurred, or of being followed, or of all sexual relationships. Others experience long-term disruption of sleep or eating patterns or an inability to function at work. The duration of the psychological trauma varies from individual to individual; most feel the effects for years, even with considerable supportive therapy.

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

Raphael, in the Bible and the Qur'ān, one of the archangels. In the Old Testament apocryphal Book of Tobit, he is the one who in human disguise and under the name of Azarias ("Yahweh helps") accompanied Tobias in his adventurous journey and conquered the demon Asmodeus. He is said (Tobit 12:15) to be "one of the seven holy angels [archangels] who present the prayers of the saints and enter into the presence of the glory of the Holy One." In the pseudepigraphal Book of Enoch, Raphael is "the angel of the spirits of men," and it is his business to "heal the earth which the angels [*i.e.,* the fallen angels] have defiled." Though the archangels are referred to as numbering seven (*e.g.,* Revelation 8:2 and Tobit 7:15), only four are named (in the Book of Enoch): Michael, Uriel, Suriel (Raphael), and Gabriel. Raphael is reckoned among the saints in both Eastern and Western churches, his feast day being October 24.

Raphael, Italian in full RAFFAELLO SANZIO (b. April 6, 1483, Urbino, Duchy of Urbino [Italy]—d. April 6, 1520, Rome), master painter and architect of the Italian High Renaissance. His work is admired for its suppleness of form and ease of composition and for its visual achievement of the Neoplatonic ideal of human grandeur.

Early years at Urbino. Raphael was the son of Giovanni Santi and Magia di Battista Ciarla; his mother died in 1491. His father was, according to the 16th-century artist and biographer Giorgio Vasari, a painter "of no great merit." He was, however, a man of culture who was in constant contact with the advanced artistic ideas current at the court of Urbino. He gave his son his first instruction in painting, and, before his death in 1494, when Raphael was 11, he had introduced the boy to humanistic philosophy at the court, where the cultural achievements of the past and new ideas looking forward to the 16th century could be learned.

Urbino had become a centre of culture during the rule of Duke Federico da Montefeltro, who died seven months before Raphael was born. Duke Federico, the embodiment of the Renaissance ideal of the cultured prince, had greatly encouraged all the arts and had attracted the visits of men of outstanding talent, including Donato Bramante, Piero della Francesca, and Leon Battista Alberti, to the court he kept in the beautiful ducal palace he had had reconstructed.

Although in Perugia and in Florence Raphael would be influenced by other major artists, Urbino constituted the basis for all his subsequent learning. Furthermore, the cultural vitality of the city probably accounted for the exceptional precociousness of the young artist, who, even at the beginning of the 16th century, when he was scarcely 17 years old, already displayed an extraordinary talent.

Apprenticeship at Perugia with Perugino. Vasari's statement that Giovanni Santi accompanied his son to Perugia and apprenticed him there to the great Umbrian painter Pietro Perugino cannot be accepted, for Raphael was hardly 11 at the time of his father's death. Nevertheless, the date of Raphael's arrival in Perugia cannot be long postponed, and several scholars place it definitely in 1495. What is certain, as attested by a notary's deed, is that

Plato (left) and Aristotle, detail from the "School of Athens," fresco by Raphael, 1508–11; in the Stanza della Segnatura, the Vatican
SCALA—Art Resource/EB Inc.

he was no longer in Urbino on May 13, 1500. Furthermore, another document of Dec. 10, 1500, declares that the young painter, by then called a "master," was commissioned to paint, together with a pupil of his father, an altarpiece to be completed by Sept. 13, 1502. It is clear from this that Raphael's apprenticeship to Perugino was already under way and that he had given immediate proof of his mastery, so much so that between 1501 and 1503 he received a rather important commission—to paint the "Coronation of the Virgin" for the Cappella Oddi in S. Francesco, Perugia, where it remained until 1797, when it was stolen by Napoleonic troops. It was returned to the Vatican in 1815. Perugino was executing the frescoes in the Collegio del Cambio at Perugia between 1498 and 1500, enabling Raphael, as a member of his workshop, to acquire extensive professional knowledge.

In addition to this practical instruction, Perugino's calmly exquisite style also influenced Raphael. The "Giving of the Keys to St. Peter," painted in 1481–82 by Perugino for the Sistine Chapel of the Vatican Palace in Rome, inspired Raphael's first major work, "The Marriage of the Virgin" (1504). Perugino's influence is seen in the emphasis on perspectives, in the graded relationships between the figures and the architecture, and in the lyrical sweetness of the figures. Nevertheless, even in this early painting, it is clear that Raphael's sensibility was different from his teacher's. The disposition of the figures is less rigidly related to the architecture, and the disposition of each figure in relation to the others is more informal and animated.

Three small paintings done by Raphael shortly after "The Marriage of the Virgin"—"Vision of a Knight," "Three Graces," and "St. Michael"—are masterful examples of narrative painting, showing, as well as youthful freshness, a maturing ability to control the elements of his own style. Although he had learned much from Perugino, Raphael by late 1504 needed other models to work from; it is clear that his desire for knowledge was driving him to look beyond Perugia.

Move to Florence. Vasari vaguely recounts that Raphael followed the Perugian painter Bernardino Pinturicchio to Siena and then went on to Florence, drawn there by accounts of the work that Leonardo and Michelangelo were undertaking in that city (their respective designs of the battles of Anghiari and Cascina for paintings in the Palazza della Signoria). By the autumn of 1504 Raphael had certainly arrived in Florence. It is not known if this was his first visit to Florence, but, as his works attest, it was about 1504 that he first came into substantial contact with this artistic civilization, which reinforced all the ideas he had already acquired and also opened to him new and broader horizons. He took in all that he saw, not passively but, as usual, to reaffirm his understanding of the canons of Renaissance culture. Giorgio Vasari records that he studied not only the works of Leonardo, Michelangelo, and Fra Bartolomeo, a Florentine proponent of the generalized idealism of the High Renaissance, but also "the old things of Masaccio," a pioneer of the naturalism that marked the departure of the early Renaissance from the Gothic. Some of his designs show that he also looked back to the sculptors Donatello and Verrocchio and the engraver Antonio Pollaiuolo, all of whom were avid students of ways of rendering movement in the human form.

Still, his principal teachers in Florence were Leonardo and Michelangelo. Many of the works that Raphael executed in the years between 1505 and 1507, most notably the Madonnas, such as "The Madonna of the Goldfinch," the "Madonna del Prato," the "Esterházy Madonna," and "La Belle Jardinière," are marked by the influence of Leonardo, who since 1480 had been making great innovations in painting. These paintings were influenced by Leonardo's compositions, figure placement, and gestures, all of which are marked by an intimacy and simplicity of setting uncommon in 15th-century art. Raphael also owed much to Leonardo's lighting techniques; he made moderate use of Leonardo's chiaroscuro (*i.e.,* strong contrast between light and dark, seemingly resulting from a natural or fixed light source), and he was especially influenced by his sfumato (*i.e.,* use of extremely fine, soft shading instead of line to delineate forms and features). Raphael went beyond Leonardo in creating new figure types whose round, gentle faces reveal uncomplicated and typically human sentiments but raised to a sublime perfection and serenity.

Between 1504 and 1508 Raphael did not reside continuously in Florence but moved about, even returning to Urbino and, naturally, to Perugia. And it was a Perugian noblewoman who commissioned him, in 1507, to paint the "Deposition" that is now in the Borghese Gallery in Rome; in this work, the obvious influences of Michelangelo and Leonardo, both painters of dark intensity and excitement, are transformed by the freshness and calm of Raphael's own vision.

Last years in Rome. Raphael was called to Rome toward the end of 1508 by Pope Julius II at the suggestion of Bramante, who wanted to bring his fellow townsmen into the papal court. At this time Raphael was little known in Rome, but the young man soon made a deep impression on the volatile Julius and the papal court, and his authority as a master grew day by day. Identifying himself with Rome and the spirit of its aristocracy, he became so popular that he was called "the prince of painters." The Humanist Celio Calcagnini later said of him in a Latin epigram:

> It took many ancient heroes and a long age to build Rome, and many enemies and centuries to destroy it. Now Raphael has sought and discovered Rome in Rome: it takes a great man to seek, but discovery comes of God Himself.

The epigram is testimony to the success of the style by which the artist gained the respect of the whole city. The Roman aristocracy considered him one of its own; Cardinal Bibbiena in 1514 wished to give his niece in marriage to him; according to Vasari, Pope Leo X, the successor of Julius II and the cultured son of the Medici Lorenzo the Magnificent, had had the intention of making him a cardinal.

Raphael spent the last 12 years of his short life in Rome. They were years of feverish activity and successive masterpieces. No test frightened him; he faced every task with modesty and deep studiousness, but he aimed at new heights each time and triumphed. Begun at the end of 1508 and completed in less than three years, the decoration of the Stanza della Segnatura in the Vatican Palace was perhaps his greatest work, reflecting the ideology and culture of Julius' pontificate and glorifying the Roman Church in history. The Stanza della Segnatura is one of the rooms in the Vatican papal apartments in which Julius II, who commissioned the decoration, was to live and work.

Julius II was a highly cultured man who surrounded himself with the most illustrious personalities of the Renaissance. He entrusted Bramante with the construction of a new basilica of St. Peter to replace the original 4th-century church; he called upon Michelangelo to execute his tomb and compelled him against his will to decorate the ceiling of the Sistine Chapel; and, sensing the genius of Raphael, he committed into his hands the interpretation of the philosophical scheme of the frescoes in the Stanza della Segnatura, the theme of which he had discussed with the Humanists of his court. This theme was the historical justification of the power of the Roman Church through Neoplatonic philosophy.

The two most important of these frescoes are called the "Disputa" and the "School of Athens." The "Disputa," showing a celestial vision of God and his prophets and apostles above a gathering of representatives, past and present, of the Roman Church, equates through its iconography the triumph of the church and the triumph of truth. The "School of Athens" is a complex allegory of secular knowledge, or philosophy, showing Plato and Aristotle surrounded by philosophers, past and present, in a modern architectural setting; it illustrates the historical continuity of Platonic thought.

The decoration of the apartments continued after the death of Julius in 1513 and into the succeeding pontificate of Leo X until 1517. In spite of this great undertaking, the last sections of which were left almost completely to his pupils, Raphael undertook at the same time a variety of other ambitious tasks—sacred and secular decorations in other buildings, portraits, altarpieces (in which his gentle saints and madonnas introduce a new typology), cartoons for tapestries, designs for dishes, and the painting of stage scenery. While he was at work in the Stanza della Segnatura, he also did his first architectural work, designing the church of S. Eligio degli Orefici. In 1513 the banker Agostino Chigi, whose Villa Farnesina Raphael had already decorated, commissioned him to design and decorate his funerary chapel in the church of Sta. Maria del Popolo. In 1514 Leo X chose him to work on the basilica of St. Peter's alongside Bramante; and when Bramante died later that year, Raphael assumed the direction of the work, transforming the plans of the church from a Greek, or radial, to a Latin, or longitudinal, design. He also succeeded Bramante in the decoration of the Vatican loggias, or galleries. The sweet simplicity of this lyrical decoration seemed to counterbalance the terrifying grandeur of the Sistine Chapel of Michelangelo.

As a result of the philosophical depth of many of Raphael's Roman works, his reputation as a Humanist and Neoplatonist spread through Rome. He counted among his friends there several men of letters—among them, Castiglione, Cardinal Bembo, the satirist Pietro Aretino, and Bibbiena—as well as many artists. In 1519 he designed the sets for the comedy *I suppositi,* by Italy's epic poet Ludovico Ariosto. Raphael was a competent scholar, particularly interested in classical antiquity. In August 1515 Pope Leo put him in charge of the supervision of the preservation of marbles with valuable Latin inscriptions; two years later he was appointed commissioner of antiquities for the city, and he drew up an archaeological map of Rome.

The ancient past, however, did not preoccupy the end of Raphael's career. Simultaneously with the overseeing of the antiquities project, he was creating designs that looked beyond the High Renaissance to a new mode of expression. His plans for the Villa Madama in Rome, the construction of which was begun after 1516, exemplified a new architectural conception of enormous importance to the subsequent development of Italian architecture. Similarly prophetic in his painting, he revealed in his last work, the "Transfiguration" (commissioned in 1517), a new sensibility that is like the prevision of a new world, turbulent and agitated; in its composition it tends toward an expression that is already Baroque.

Raphael died on his 37th birthday. A mythical halo had surrounded him during the last years of his life, and the whole papal court mourned him. His funeral mass was celebrated at the Vatican, his "Transfiguration" was placed at the head of the bier, and his body was buried in the Pantheon in Rome.

MAJOR WORKS. *Paintings.* "Altarpiece: the Crucified Christ with the Virgin Mary, Saints and Angels" ("Mond Crucifixion," *c.* 1501; National Gallery, London); "An Allegory" ("Vision of a Knight," *c.* 1501; National Gallery, London); "Three Graces" (*c.* 1501; Musée Condé, Chantilly, Fr.); "St. Michael" (*c.* 1501; Louvre, Paris); "Coronation of the Virgin" (*c.* 1501–03; Vatican Museum, Rome); "The Marriage of the Virgin" (1504; Brera, Milan); "Portrait of Agnolo Doni" (*c.* 1505; Pitti Palace, Florence); "Portrait of Maddalena Doni" (*c.* 1505; Pitti Palace); "The Madonna of the Goldfinch" (*c.* 1505; Uffizi, Florence); "The Madonna and Child with St. John" ("Madonna del Prato," *c.* 1505; Kunsthistorisches Museum, Vienna); "Esterházy Madonna" (*c.* 1505–07; Museum of Fine Arts, Budapest); "The Ansidei Madonna" (*c.* 1506; National Gallery, London); "The Deposition of Christ" (1507; Borghese Gallery, Rome); "La Belle Jardinière" (1507; Louvre); "The Niccolini-Cowper Madonna" (1508; National Gallery of Art, Washington, D.C.); "Stanza della Segnatura" (1508–11; Vatican); "Stanza d'Eliodoro" (1512–14; Vatican); "Triumph of Galatea" (1511–13; Villa Farnesina, Rome); "Sistine Madonna" (1513?; Gemäldegalerie, Dresden); "Stanza dell'Incendio" (1514–17; Vatican); Tapestry cartoons for Leo X (*c.* 1516; Victoria and Albert Museum, London); "Portrait of Balthasar Castiglione" (1516; Louvre); "Transfiguration" (1517–*c.* 1520; Vatican Museum); "The Holy Family of Francis I" (1518; Louvre); "St. Michael Vanquishing Satan" (1518; Louvre).

Architecture. Chigi Chapel (*c.* 1513–14; Sta. Maria del Popolo, Rome); S. Eligio degli Orefici (*c.* 1516; Rome); Palazzo Pandolfini (*c.* 1516; Florence).

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Rapid City, city, seat of Pennington county, southwestern South Dakota, U.S., at the eastern edge of the Black Hills on Rapid Creek, from which it derived its name. It was settled in 1876 during the Black Hills gold rush.

Incorporated in 1882, the city has become a tourist and trade centre. Industries are based on mining (gold, silver, feldspar, gypsum, mica, uranium), lumbering, and agriculture. Manufactures include cement, electronic equipment, pottery, and jewelry. The South Dakota School of Mines and Technology was founded there in 1885 and the National College of Business in 1940. Geological, Sioux (Dakota) Indian, transportation, and historical museums are within the city, which is also the site of Ellsworth Air Force Base and the federal Sioux Indian Sanitorium. Nearby are Mount Rushmore National Memorial, Dinosaur Park, Crazy Horse Memorial, Custer State Park, and Rockerville Gold Town, a reconstructed ghost town. Range Days, with a rodeo and carnival, is held annually in August. Stratosphere Bowl at the nearby Black Hills National Forest entrance was a balloon-testing site in the 1930s. A cloudburst over the Black Hills in June 1972 triggered runoff floods that roared down Rapid Creek, killing at least 235 persons. Pop. (1986 est.) 49,300.

rapid transit, system of railways, usually electric, used for local transit in a metropolitan area. A rapid transit line may run underground (subway), above street level (elevated transit line), or at street level. Rapid transit is distinguished from other forms of mass transit by its operation on exclusive right-of-way, with no access for other vehicles or for pedestrians. *See* elevated transit line; mass transit; subway.

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Rapier, James T(homas) (b. Nov. 13, 1837, Florence, Ala., U.S.—d. May 31, 1883, Montgomery, Ala.), black planter and labour organizer who was a member of the U.S. House of Representatives from Alabama during Reconstruction.

Born in affluence—his father was a wealthy planter—Rapier was educated by private tutors and later studied at Montreal College (Canada), the University of Glasgow (Scotland), and Franklin College (Nashville, Tenn.). Although he was admitted to the bar in Canada, he never practiced.

Rapier returned to Alabama after the Civil War and became a successful cotton planter. He began his career in public life by serving as a delegate to Alabama's first Republican state convention; he was a member of the platform committee. In 1867 he participated in the convention called to rewrite the state constitution, and after losing a campaign in 1870 to become Alabama's secretary of state, he won a congressional seat in 1872. In Washington he worked for the passage of the Civil Rights Act of 1875, although he was defeated for reelection in 1874.

Except for service as collector of internal revenue in Alabama's second district, Rapier did not again hold public office. But he continued as an active labour organizer, seeking to unite poor urban workers and rural sharecroppers. He wrote prolabour editorials for the *Montgomery Sentinel,* of which he was the publisher, and he played a key role in bringing about Alabama's first black labour convention.

rapier loom, a shuttleless weaving loom in which the filling yarn is carried through the shed of warp yarns to the other side of the loom by fingerlike carriers called rapiers. One type has a single long rapier that reaches across the loom's width to carry the filling to the other side.

Another type has two small rapiers, one on each side. One rapier carries the filling yarn halfway through the shed, where it is met by the other rapier, which carries the filling the rest of the way across the loom.

RAPP, abbreviation of ROSSIYSKAYA ASSOTSIATSIYA PROLETARSKIKH PISATELEY, English RUSSIAN ASSOCIATION OF PROLETARIAN WRITERS, association formed in the Soviet Union in 1928 out of various groups of proletarian writers who were dedicated to defining a truly proletarian literature and to eliminating writers whose works were not thoroughly imbued with Communist ideology. Under the leadership of Leopold Leonardovich Averbakh, RAPP managed to get control of the literary scene in 1929, when it received official sanction for its program of establishing the Soviet First Five-Year Plan as the sole theme of Soviet literature. The mechanical literature written on assignment that resulted from RAPP's dictatorship led to an official about-face in 1932, when RAPP was liquidated and an all-inclusive Union of Soviet Writers was founded. *See also* Proletkult; Soviet Writers, Union of.

Rapp, George, original name JOHANN GEORG RAPP (b. Nov. 1, 1757, Iptingen, Württemberg—d. Aug. 7, 1847, Economy, Pa., U.S.), German-born American ascetic who founded the Rappites (Harmonists), a Pietist sect that formed communes in the United States.

A linen weaver and a lay preacher, "Father" Rapp, accompanied by his son, emigrated to the United States in 1803 in protest against Lutheran rationalism and to escape persecution. They were joined by about 600 disciples. By 1805 they established their first "Community of Equality" in Harmony, Pa., but the land was not suitable to vine and fruit culture, the main economic activity of the community. In search of land suitable for vineyards and orchards, the Rappites moved to southern Indiana (1814), where they established Harmony (or Harmonie), with 800 members. Here Rapp built a labyrinth of vines and shrubs near the village, symbolizing the difficulty of approaching a state of true "harmony."

Rapp ran the community with a strong paternal hand. He heard the confessions of all who joined, and anyone who sinned confessed to him before the day ended. All quarrels were settled the same day they occurred. Shortly after coming to the United States, the Rappites renounced marriage, and eventually all persons lived in celibacy.

After 10 years in Indiana, Rapp decided that the colony should move again. Harmony was sold in 1825 to the British utopian Robert Owen, who established a Socialist community there and called it New Harmony. The Rappites moved to a site 18 miles from Pittsburgh and established a new village called Economy (now Ambridge), Pa.

In 1831 a new member from Germany, who called himself Count de Leon, began encouraging marriage and the enjoyment of luxury. He persuaded about 200 members to secede and demand their share from the common fund. For the next several years the colony was involved in court suits.

After Rapp's death in 1847 the colony's membership dwindled, resulting from the preference for celibacy and the lack of converts. In 1866 about 250 members survived, and by 1900 only a few remained. The community's affairs were finally settled in 1905 by the U.S. Supreme Court, and the Rappites disbanded in 1906.

Rappahannock River, river in Virginia, U.S., rising near Chester Gap in the Blue Ridge Mountains east of Front Royal and flowing southeastward past Fredericksburg (head of navigation and of tidewater) to enter Chesapeake Bay after a course of 184 miles (296 km). Its chief tributary is the Rapidan, which joins it above Fredericksburg. A number of Civil War battles took place along the Rappahannock, and it is otherwise historically important for its evidence of early Indian and colonial settlements, mill sites, and navigation canals and locks.

rapparee, any of the Irish nationalists who employed guerrilla methods to resist the English after the regular Irish Army had surrendered in the war (1689–91) in Ireland. They were termed rapparees after their weapons, short pikes (Irish *rápaire*). The elusiveness of the rapparees confounded the British for a time, but superior forces, plus Britain's ability to insulate Ireland from foreign, particularly French, support, ended the insurgency.

Rappoport, Solomon Zanvel (Jewish writer): *see* Ansky, S.

rapporteur (French: "reporter"), in French civil law, a judge who furnishes a written report on the case at hand to other judges of the court, in which he sets forth the arguments of the parties, specifies the questions of fact and of law raised in the dispute, and lists the evidence on the issue.

The position originated in the ecclesiastical courts in the Middle Ages and was adopted by the Parlement of Paris in the late 13th century. Originally *rapporteurs* were not members of the court, but by 1336 they were given full rights to participate in the decision-making process as judges.

The *rapporteur*'s functions emerged when investigators were sent by the Parlement to interview witnesses and collect documents. Since so much material was collected, it became necessary to analyze it before it could be presented to the other judges. The *rapporteur* acted alone in making this analysis, but the position rotated among the judges of the court. In later times the *rapporteur* gained a good deal of power. The proceedings under which these deliberations took place were secret, and the decrees gave no reason for the decision; it was only in the 16th century that even the testimony collected by the investigators was released to the parties in the case.

The Revolution brought legislation to do away with these inequities. The *rapporteur* had to present his analysis in open court, and it was later published in law reports. When the Cour de Cassation (now the supreme court of France) was established during the Revolution, the *rapporteur* became a member of the court. He was placed in charge of examining the record of the case, determining issues and means of settlement, and making a recommendation for disposition to the remainder of the court. By the mid-19th century the *rapporteurs* had begun to cite previous decisions in their presentations to the court.

In Germany the *referent* in the Reichskammergericht, the supreme court of the Holy Roman Empire, had similar responsibilities. He analyzed evidence and legal issues and made his recommendations to the whole court; in important cases two *referents* were appointed. The reports and discussions were kept secret, and the decisions made no mention of the grounds upon which they were based. By the 17th century, however, the first in a series of law reports on the decisions was published, giving the legal arguments and the *referents*' conclusions in addition to the votes and opinions of the individual judges.

raptor, in general, any bird of prey; the term raptor is sometimes restricted to birds of the order Falconiformes (hawks, eagles, falcons, and their allies). *See* bird of prey.

raptures of the deep (medicine): *see* nitrogen narcosis.

Raqqah, ar-, also spelled RAQQA, or RAKKA, town and *muḥāfaẓah* (governorate), northern Syria. The town, capital of the governorate, is situated on the Euphrates River just east of its confluence with the Balīkh River; it occupies the site of an ancient Greek city, Nicephorium, and a later Roman fortress and important market town, Callinicus. It flourished again in early Arab times when the ʿAbbāsid caliph Hārūn ar-Rashīd built several palatial residences there and established it as his headquarters against the Byzantines. For a time the town was known as ar-Rashīd. The Arab astronomer al-Battānī (Albatenius) made his observations there in the 9th and 10th centuries. Mongol invasions in the 13th century destroyed much of the settlement. Gradually the town fell into decay and was replaced in importance by its suburb, ar-Rafiqah, which took over its name. After the Ṭabaqah Dam, just up the Euphrates from ar-Raqqah, began to be built in 1968, ar-Raqqah grew. It became a supply centre for the community at the dam site, where jobs were provided on the dam. Local cultivation increased, and ar-Raqqah again became an increasingly important market centre. The town has a small museum exhibiting finds from excavations in the area; a team of archaeologists from the Syrian Department of Antiquities is excavating and restoring buildings of the ʿAbbāsid period.

Ar-Raqqah governorate, which has an area of 7,473 sq mi (19,354 sq km), occupies a semi-arid portion of the upper Euphrates River Valley along the Turkish frontier. Dry farming was practiced, and irrigation in the Euphrates floodplain, until the 1973 completion of the Ṭabaqah Dam. The dam and Lake Assad behind it lie entirely in the *muḥāfaẓah* and have fostered an irrigation program not expected to be completed until 2000, when the various studies concerning soil salinity, gypsum underlying the topsoil, and the economic potential of the land have been completed. Dry farming is still practiced in parts of the region not accessible to lake or river water, but with the electrification of the villages with hydroelectric power provided by the dam, electric pumps are increasingly used to pump subterranean water for use in irrigation. Pop. (1981 prelim.) town, 87,138; governorate, 348,372.

Raqqah ware, Islāmic earthenware produced at ar-Raqqah, Syria, between the 9th and 14th centuries. The body of the ware, which is white tending to buff, is coated with a siliceous glaze. Designs, sometimes in relief, tend to be bold. Decoration includes brown lustre and blue and black underglaze paint. Glazes, which may be either opaque or transparent, are usually in shades of blue, bluish green, or turquoise; however, clear glazes, as well as glazes stained purple with manganese, were also used. Perfect excavated specimens are rare.

Rarámuri (people): *see* Tarahumara.

rare-earth metal, any of a large family of chemical elements consisting of scandium (atomic number 21), yttrium (atomic number 39), and the 15 elements from lanthanum to lutetium (atomic numbers 57–71). The rare earths themselves are the oxides of these metals, originally thought to be quite scarce, or mixtures of these oxides, commonly occurring together, such as the first rare earths to be discovered, yttria (1794) and ceria (1803).

A brief treatment of the rare-earth metals follows. For full treatment, *see* MACROPAEDIA: Chemical Elements. *See also* MICROPAEDIA for entries on each member of this element family.

Not all of the rare-earth metals are as scarce as early estimates indicated. Cerium, the most plentiful, is nearly three times more abundant than lead in the Earth's crust. Thulium, the least plentiful (except for artificially produced promethium), is more abundant than silver, gold, or platinum. Moreover, many of the rare-earth metals are found in meteorites, on the Moon, and in the Sun. The spectra of numerous other stars suggest that they have substantially larger quantities of the rare-earth metals than does the solar system.

The rare-earth elements are never found as free metals in the Earth's crust. Pure minerals of the individual elements do not exist in nature; all their minerals consist of mixtures of various rare-earth elements and nonmetals. Monazite and bastnaesite are the principal mineral sources of the rare-earth metals.

In terms of physical properties, the rare-earth elements do not resemble each other as closely as was once believed. The melting point of lutetium (1,663° C), for example, differs greatly from that of lanthanum (920° C), and the vapour pressures of ytterbium and europium at 1,000° C are millions of times as great as those of lanthanum and cerium. Nevertheless, the rare-earth metals, particularly those with atomic numbers from 58 to 71 (collectively called the lanthanide series), do share certain common characteristics. Cerium, praseodymium, europium, and neodymium all readily corrode in air. Characteristically, small amounts of nonmetallic impurities tend to intensify such properties (*e.g.*, the light lanthanide metals corrode much more rapidly if calcium or magnesium is present).

The rare-earth elements are very similar chemically because of their general similarity in atomic structure. All of them have three electrons in the outermost shells of their atoms and are therefore trivalent in their compounds. They combine directly with nonmetallic elements, giving rise to extremely stable borides, carbides, oxides, and various other binary compounds.

Rare-earth elements

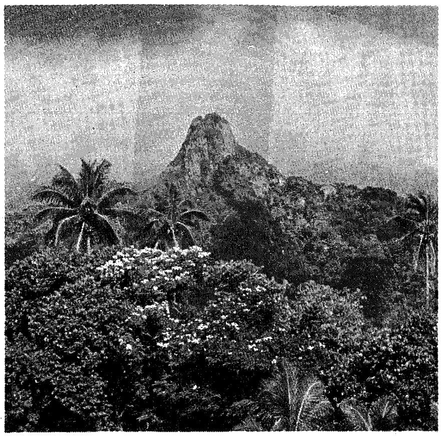
	symbol	atomic number
scandium	Sc	21
yttrium	Y	39
lanthanum	La	57
cerium	Ce	58
praseodymium	Pr	59
neodymium	Nd	60
promethium	Pm	61
samarium	Sm	62
europium	Eu	63
gadolinium	Gd	64
terbium	Tb	65
dysprosium	Dy	66
holmium	Ho	67
erbium	Er	68
thulium	Tm	69
ytterbium	Yb	70
lutetium	Lu	71

rarefaction, in the physics of sound, segment of one cycle of a longitudinal wave during its travel or motion, the other segment being compression. If the prong of a tuning fork vibrates in the air, for example, the layer of air adjacent to the prong undergoes compression (or condensation) upon the initial motion of the fork. When the prong springs back in the opposite direction, however, it leaves an area of reduced air pressure. This is rarefaction. A succession of rarefactions and compressions comprise the longitudinal wave motion that emanates from an acoustic source.

Raritan River, largest stream lying wholly within New Jersey, U.S., formed by the confluence of the North Branch and the South Branch in western Somerset County. It flows about 75 mi (120 km) generally southeast past Somerville, Bound Brook, and New Brunswick into Raritan Bay of the Atlantic Ocean. Navigable to New Brunswick, it supplies (via pumping) the Spruce Run (1963) and Round Valley (1965) reservoirs. The name was probably derived from an Algonkian word meaning "stream overflows."

Rarotonga, largest (26 sq mi [67 sq km]) of the lower Cook Islands, in the South Pacific Ocean, 2,100 mi (3,400 km) northeast of New Zealand. Volcanic in origin, it has a rugged interior rising to Mt. Te (2,142 ft [653 m] Manga (2,140 ft [652 m]). Surrounding its mountainous core is a plain, an ancient raised coral fringing reef that that has since been covered with sediment. The island is fringed by a coral reef. Visited in 1789 by mutineers from the British ship "Bounty," Rarotonga bears marks of a long habitation, including *marae,* or temple platforms, in the Tupapa Valley. The Ara Metua, an ancient pathway, circles the island parallel to a modern road. Rarotonga was the base from which John Williams of the London Missionary Society (who arrived in 1823) Christianized the islands.

Avarua, its main port, is the seat of administration for the Cook Islands. Absence of a suitable lagoon forces oceangoing ships to lie off the reef and move cargoes ashore via lighters. Rarotonga's economy is based on citrus fruits, pineapples, coconuts, bananas, and



Mount Te Manga on Rarotonga, Cook Islands
Douglass Baglin

light industry. The tourist industry has grown slowly since the introduction of international air service in 1973. The island has a hospital, Tereora College (a postprimary school), and a teacher-training college at Nikao. Pop. (1981) 9,530.

Ra's al-Khaymah, also spelled RAS AL-KHAIMAH, constituent emirate of the United Arab Emirates (formerly Trucial States, or Trucial Oman). It consists of two irregularly shaped tracts on the Oman Promontory, oriented north–south. The northern section shares the Ru'ūs al-Jibāl peninsula with the sultanate of Oman and has a coastline of about 35 miles (56 km) on the Persian Gulf. A southern inland tract is separated from the northern by a projection of al-Fujayrah emirate. Political fragmentation in the region is so extreme that Ra's al-Khaymah's two parts have borders with 10 political units; eight belong to five of the six other emirates in the federation, and the other two are with Oman and its exclave on the Ru'ūs al-Jibāl. Ra's al-Khaymah's estimated total area is 660 square miles (1,700 square km); the capital and only settlement of urban pretensions is Ra's al-Khaymah town.

Ra's al-Khaymah was not one of the original Trucial States but was part of ash-Shāriqah emirate for most of its history. Its rulers were the Qawāsim pirate sheikhs, and Ra's al-Khaymah town was long their most important base. In the late 16th century, Portugal had a fort, called Julfa, or Julfar, on or near the site; the Persians expelled the Portuguese in 1622. The Dutch had begun their commercial penetration of the region, but they withdrew in the mid-18th century. By the 19th century, Britain had become the chief Western power in the Gulf. Pirates based in Ra's al-Khaymah town became increasingly daring and captured British ships; they sometimes put the crews to death and often held them for ransom. Sulṭān ibn Ṣaqr (ruled 1803–66) was the chief pirate leader. In 1819 Ra's al-Khaymah town was besieged and captured, after several ineffectual punitive expeditions, by a British force; in 1820 the British made Sulṭān, as sheikh of ash-Shāriqah, sign the General Treaty of Peace. Together with the other Gulf rulers, he also signed the later Trucial agreements. In 1869 Ra's al-Khaymah became a separate state under Hamayd ibn 'Abd Allāh, a grandson of Sulṭān, but upon his death (1900) it reverted to ash-Shāriqah and was not finally recognized by Britain as a separate Trucial state until 1919.

When Britain finally left the Persian Gulf in late 1971, a dispute arose over the small islands of Greater and Lesser Ṭunb, in the Gulf about 50 miles (80 km) northwest of Ra's al-Khaymah town; these islands had long been claimed by both Ra's al-Khaymah and Iran. On Nov. 30, 1971, Iranian troops landed on Greater Ṭunb and met armed resistance from Ra's al-Khaymah police. Iran, however, remained in possession of the islands.

Ra's al-Khaymah emirate is unique in the region in that agriculture is extensively practiced, employing about one-half of the labour force. Truck crops (cabbages, onions, tomatoes), dates, tobacco, and fruits, especially bananas and citrus fruits, are grown along the coast around Ra's al-Khaymah town for local consumption and for export to other states of the federation, mainly Dubayy. Elsewhere along the coast, employment opportunities declined with the decline of the pearling industry, and much depopulation has occurred. The Shiḥūh people of the Ru'ūs al-Jibāl sell surpluses of dates and raise goats. Petroleum exploration both onshore and offshore has produced no results. The emirate has received aid from Saudi Arabia and Kuwait as well as from its sister states Abu Dhabi and Dubayy. From 1964 to 1972 much of Ra's al-Khaymah's revenue came from commemorative stamps, printed for sale to philatelists.

Ra's al-Khaymah town's name means "the tent point," after a large tent erected as an aid to navigation by an early chief. The town, a port from ancient times, has developed only recently in the 20th century; it now has a hotel with a casino. Industries include cement factories, a lime factory, and an explosives plant. Ra's al-Khaymah town is connected by a paved road to Dubayy town and ash-Shāriqah town and has an international airport. Pop. (1985) 116,470.

Ras Algethi, also called ALPHA HERCULIS, red supergiant star, whose diameter is probably larger than the orbit of the Earth. It lies in the constellation Hercules and is of about third magnitude, its brightness varying. The name comes from an Arabic phrase meaning "the kneeler's head," referring to the Arabic name of the constellation.

Ra's Musandam (Oman): *see* Musandam Peninsula.

Ra's Naṣrānī, formerly (until 1982) SHARM ASH SHAYKH, also spelled SHARM EL-SHEIKH, Hebrew MIFRAẒ SHELOMO, English SOLOMON'S BAY, small inlet and cape on the southeastern coast of the Sinai Peninsula. Located in Sīnā' al-Janūbīyah (Southern Sinai) *muḥāfaẓah* (governorate), Egypt, Ra's Naṣrānī was occupied by the Israelis from 1967 to 1982. The Hebrew name is an allusion to King Solomon's fleets, which presumably passed through the adjacent Strait of Tiran on their way from the port of Ezion-geber, at the head of the Gulf of Aqaba, to the land of Ophir (I Kings 9), variously identified as India, Arabia, or Ethiopia.

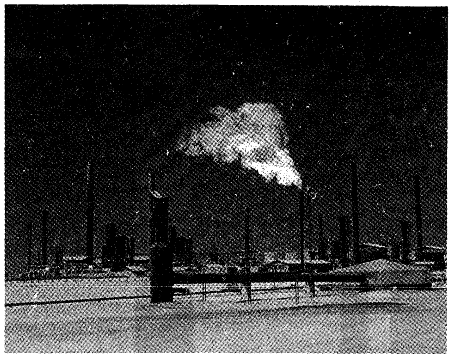
Uninhabited throughout most of historic times, Ra's Naṣrānī's modern importance is due to its strategic situation commanding the narrow entrance to the Gulf of Aqaba. The entrance is 14 miles (23 km) northeast of Ra's Naṣrānī's bay, at the Strait of Tiran. The strait, which is blocked by islets and coral reefs, is hemmed in by Ra's Naṣrānī's cape on the west and by Tīrān Island on the east. After Israel's War of Independence (1948–49), Egyptian guns were installed in the area to prevent shipping from reaching Elat, Israel's only port on the Gulf of Aqaba. The installations were captured by Israelis in the Sinai Campaign of 1956, and the bay and strait were guarded by a United Nations Emergency Force from 1957 to 1967. Egypt's withdrawal of the UN force and its closure of the straits in May 1967 helped precipitate the Six-Day War of June 1967. Following that war, Israel again occupied Ra's Naṣrānī and its environs until Israeli forces withdrew from the Sinai Peninsula in the early 1980s.

Ra's Naṣrānī was developed as a recreational and tourist site by the Israeli administration, and Egypt has continued this program, converting the airport located nearby to civilian use. A highway has been built from Elat to Ra's Naṣrānī (1971). In 1972 Ophira, a new town, was built in the area.

Ras Shamra (archaeological site, Syria): *see* Ugarit.

Ras Tafarian: *see* Rastafarian.

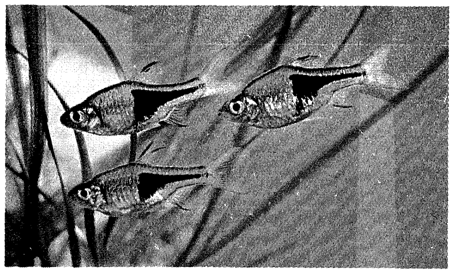
Ras Tanura, also spelled RAS TANNURA, Arabic RA'S AT-TANNŪRAH, port on the Persian Gulf, in eastern Saudi Arabia, at the tip of a small peninsula. Developed by the Arabian American Oil Company (Aramco) after the



Petroleum refinery at Ras Tanura, Saudi Arabia
Herbert Lanks—Shostal/EB Inc.

discovery of nearby petroleum deposits in the 1930s, it is now a principal Persian Gulf terminal of the pipelines; it is a modern port capable of accommodating the largest tankers. The town also has a refinery and storage tanks as well as hydroformers, producing high-octane gasoline. Aramco operates an industrial-training school and a modern hospital. Pop. (latest est.) 6,300.

rasbora, any of about 45 species of schooling, freshwater tropical fishes of the genus *Rasbora,* in the carp family, Cyprinidae. Most species are found in southeastern Asia, but a few are native to Africa. The fishes are active,



Harlequin fish (*Rasbora heteromorpha*)
Gene Wolfsheimer

generally slender, and have a protruding lower jaw. Several species are kept as pets, one of the most popular being the harlequin fish, or rasbora (*R. heteromorpha*), a reddish fish 4–5 cm (1.5–2 inches) long with a wedge-shaped, black spot on each side.

Rasch, Albertina (b. 1896, Vienna—d. Oct. 2, 1967, Hollywood), Austrian-born American dancer, choreographer, and teacher whose troupes became well known during the 1920s and '30s for their appearances in Broadway musicals and Hollywood films.

Rasch, a student of the Vienna Opera ballet school, became leading ballerina at the Hippodrome Theatre in New York City in 1911. In 1923 she opened a ballet school and in 1924 formed the first of several troupes known as the Albertina Rasch Girls. After staging the dances for several of Florenz Ziegfeld's revues and for George White's *Scandals,* she choreographed numerous Broadway musicals, including *Three's a Crowd* (1930) and Moss Hart's *Lady in the Dark* (1941), as well as a number of motion pictures.

Before Rasch's influence, dancing in musical plays and films had provided primarily a background for the leading performers; routines were usually simple, with emphasis on spectacular costumes and uniform ensemble dancing. Rasch's choreography was more closely allied to the dramatic narrative, and, although she continued to use precision dancing, she was among the first on Broadway to include variations for individual ensemble dancers. She incorporated classical ballet technique into precision dancing and helped raise technical standards of stage and film dancing by requiring a ballet background of her dancers.

Rasgrad (Bulgaria): *see* Razgrad.

Rashba: *see* Adret, Solomon ben Abraham.

Rashbaz: *see* Duran, Simeon ben Zemah.

Rashi, acronym of RABBI SHLOMO YITZḤAQI (b. 1040, Troyes, Champagne—d. July 13, 1105, Troyes), renowned medieval French commentator on the Bible and Talmud (the authoritative Jewish compendium of law, lore, and commentary). Rashi combined the two basic methods of interpretation, literal and nonliteral, in his influential Bible commentary. His commentary on the Talmud was a landmark in Talmudic exegesis, and his work still serves among Jews as the most substantive introduction to biblical and postbiblical Judaism. Rashi also composed some penitential hymns (*seliḥot*), which revolve around twin themes: the harsh reality of exile and the comforting belief in redemption.

Shlomo (Solomon) Yitzḥaqi (son of Isaac) studied in the schools of Worms and Mainz, the old Rhenish centres of Jewish learning, where he absorbed the methods, teachings, and traditions associated with Rabbi Gershom ben Judah (*c.* 960–1028/1040), called the "Light of the Exile" because of his preeminence as the first great scholar of northern European Judaism. Rashi then transferred his scholarly legacy to the valley of the Seine (*c.* 1065), where he was the de facto but unofficial head of the small Jewish community (about 100–200 people) in Troyes.

Rashi's Bible commentary illustrates vividly the coexistence and, to some extent, the successful reconciliation of the two basic methods of interpretation: the literal and the nonliteral. Rashi seeks the literal meaning, deftly using rules of grammar and syntax and carefully analyzing both text and context, but does not hesitate to mount Midrashic explanations, utilizing allegory, parable, and symbolism, upon the underlying literal interpretation. As a result, some of his successors are critical of his searching literalism and deviation from traditional Midrashic exegesis, while others find his excessive fondness for nonliteral homilies uncongenial. Yet it is precisely the versatility and mixture, the blend of creative eclecticism and originality, that account for the genius, the animation, and the unrivaled popularity of his commentary, which, symbolically, was the first book printed in Hebrew (1475). The commentary had a significant influence on Christian Bible study from the 12th-century Victorines to the Franciscan scholar Nicholas of Lyra (*c.* 1270–1349), who, in turn, was a major source of Martin Luther's Bible work. Its influence continues in contemporary exegesis and revised translations. Rashi's customary use of a vernacular gloss to clarify the exact meaning of an obscure or technical term—there are more than 3,000 of them in his works—also makes his commentary an important source for the study of Old French.

Rashi's commentary on the Talmud, based on the collective achievements of the previous generations of Franco-German scholars, reflects its genesis in the oral classroom instruction that Rashi gave in Troyes for several decades. The commentary, sometimes referred to as *kuntros* (literally, "notebook"), resembles a living tutor; it explains the text in its entirety, guides the student in methodological and substantive matters, resolves linguistic difficulties, and indicates the normative conclusions of the discussion. Unlike Maimonides' commentary on the Mishna (the authoritative compendium of Jewish Oral Law), which may be read independently of the underlying text, Rashi's commentary is interwoven with the underlying text. Indeed, text and commentary form a unified mosaic.

Rashi's work was literally epochal, and the agreement of subsequent scholars that the basic needs of text commentary had been fulfilled stimulated the rise of a new school of writers known as *tosafists*, who composed *tosafot* (glosses), refining, criticizing, expanding, or qualifying Rashi's interpretations and conclusions. Skillfully and honestly combining stricture and supplement, they were able to perpetuate and augment the achievement of the great Rashi. (I.T./Ed.)

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Rashīd (Egypt): *see* Rosetta.

Rashīd, ar- (d. 1672, Marrakech, Mor.), founder (1666) of the reigning ʿAlawī (Filālī) dynasty of Morocco. By force of arms he filled a power vacuum that, with the collapse of the Saʿdi dynasty, had allowed half a century of provincial and religious warfare among rival Ṣūfī marabouts, or holy men, and the rulers of various sheikhdoms.

In 1664 Mawlāy (Lord) ar-Rashīd succeeded his brother Muḥammad, who for 30 years had tried to carve out a principality in northeastern Morocco. Obtaining funds through the murder of a wealthy Jew, ar-Rashīd gathered a force of Arab and Berber mercenaries and imposed his rule in the east. He set up a provisional capital at Taza, in a gap in the Rif Mountains overlooking the Atlantic plain. In 1666 ar-Rashīd's army spilled down the gap and seized Fès, the capital of the powerful religious brotherhood of Dila. Ar-Rashīd proclaimed himself sultan, thus formally establishing the ʿAlawī dynasty. From Fès he proceeded to conquer the north, plundered and razed the Dila monastery, and seized control of Morocco's Atlantic seaboard from its ruling marabouts. Turning his attention southwest, he occupied Marrakech in 1669 and conquered the Sous region and the Anti-Atlas Mountains.

By ruthlessly crushing the power of the religious brotherhoods and forcibly uniting most of the country's warring tribes under one dynasty. Mawlāy ar-Rashīd set the political configuration for what became modern Morocco. He died suddenly of an accident, however, before he could consolidate his rule. He bequeathed to his brother Ismāʿīl (*q.v.*) the problems of subjugating the hostile Berbers of the Atlas Mountains and wresting control of vital seaports from European powers.

Rashīd ad-Dīn, in full RASHĪD AD-DĪN AS-SINĀN (d. 1192), leader of the Syrian branch of the Assassins (an Ismāʿīlī Shīʿī Muslim sect) at the time of the Third Crusade. He had his headquarters at a fortress in Maṣyāf, in northern Syria, and was known to Westerners as the Old Man of the Mountain. Feared for his practice of sending his followers to murder his enemies, he made several attempts on the life of the Ayyūbid leader Saladin, who opposed the Ismāʿīlī Shīʿī sect.

Rashīd ad-Dīn (b. 1247—d. 1318), Persian statesman and historian who was the author of a universal history, *Jāmiʿ at-tawārīkh.*

He belonged to a Jewish family of Hamadan but was converted to Islām and as a physician joined the court of the Mongol ruler of Persia, Abagha (1265–82). He became vizier to Ghāzān in 1298 and served under his successor Öljeitü. Accused by his rivals of having poisoned his sovereign, he was put to death by Öljeitü's son Abū Saʿīd.

Rashīd ad-Dīn's history covers a vast field even outside the Muslim world. His sources of information for Mongolia and China were high officials of the Mongol empire and the Mongol records, for India a Buddhist from Kashmir, for the popes and emperors a Catholic monk. There are important chapters describing the social and economic conditions of the Islāmic countries under Ghāzān (1295–1304) and the reforms introduced by this ruler on the advice of the author himself. Rashīd ad-Dīn uses a great number of Mongol and Turkish terms, but his style is lucid and matter-of-fact.

Rashīd Riḍā, (Muḥammad) (b. 1865, Syria—d. 1935, Syria), Syrian scholar who helped Muslims formulate an intellectual response to the problem of reconciling their Islāmic heritage to the modern world.

Rashīd Riḍā was educated according to traditional forms of Muslim learning—the sciences of the Islāmic religion and the Arabic language. He was profoundly influenced in his early years by the writings of Muḥammad ʿAbduh and Jamāl ad-Dīn al-Afghānī, Muslim reformist and nationalist thinkers, and he became ʿAbduh's biographer and the leading exponent and defender of his ideas. Rashīd Riḍā founded the newspaper *al-Manār* in 1898 and published it throughout his life. To a limited extent, he also participated in the political affairs of Syria and Egypt.

He was concerned with the backwardness of the Muslim countries, which he believed resulted from a neglect of the true principles of Islām. He believed that these principles could be found in the teachings of the Prophet Muḥammad and in the practices of the first generation of Muslims, before corruptions began to spread among the religious practices of the faithful (*c.* 655). He was convinced that Islām, as a body of teachings correctly understood, contained all the principles necessary for happiness in this world and the hereafter, and that positive effort to improve the material basis of the community was of the essence of Islām.

Rashīd Riḍā urged Arabs to emulate the scientific and technological progress made by the West. In the political affairs of the Muslim community, he wanted rulers to respect the authority of the men of religion and to consult with them in the formulation of governmental policies. Here he showed his tendency to assimilate practices of traditional Islām into the forms of modern societies. Consultation had never been institutionalized in traditional Islām, but he equated it with modern parliamentary government. He sanctioned the bending of Islām to fit the demands of modern times in other important respects; for example, the Prophet had forbidden the taking of interest, but Rashīd Riḍā believed that, to combat effectively the penetration of Western capitalism, Muslims had to accept the policy of taking interest.

To realize a political and cultural revival, Rashīd Riḍā saw the need to unify the Muslim community. He advocated the establishment of a true caliph, who would be the supreme interpreter of Islām and whose prestige would enable him to guide Muslim governments in the directions demanded by an Islām adapted to the needs of modern society.

rāshidūn, ar- (Arabic: "rightly guided," or "perfect"), the first four caliphs of the Islāmic community, known in Muslim history as the orthodox or patriarchal caliphs: Abū Bakr (reigned 632–634), ʿUmar (reigned 634–644), ʿUthmān (reigned 644–656), and ʿAlī (reigned 656–661).

The 29-year rule of the *rāshidūn* was Islām's first experience without the leadership of the Prophet Muḥammad. His example, however, in both private and public life, came to be regarded as the norm (*sunnah*) for his successors, and a large and influential body of *anṣār* (companions of the Prophet) kept close watch on the caliphs to insure their strict adherence to divine revelation (the Qurʾān) and the *sunnah.* The *rāshidūn* thus assumed all of Muḥammad's duties except the prophetic: as imams, they led the congregation in prayer at the mosque; as *khaṭīb*s, they delivered the Friday sermons; and as *umarāʾ al-muʾminīn* ("commanders of the faithful"), they commanded the army.

The caliphate of the *rāshidūn,* in which virtually all actions had religious import, began with the wars of the *riddah* ("apostasy"; 632–633), tribal uprisings in Arabia, and ended with the first Muslim civil war (*fitnah;* 656–661). It effected the expansion of the Islāmic state beyond Arabia into Iraq, Syria, Palestine, Egypt, Iran, and Armenia and, with it, the development of an elite class of Arab soldiers. The *rāshidūn* were also responsible for the adoption of an Islāmic calendar, dating from Muḥammad's emigration (*hijrah*) from Mecca to Medina (622), and the establishment of an authoritative reading of the Qurʾān, which strengthened the Muslim community and encouraged religious scholarship. It was also a controversy over ʿAlī's succession that irrevocably split Islām into two sects, the Sunnī (traditionalists) and the Shīʿī (*shīʿat ʿAlī,* "party of ʿAlī"), which have survived to modern times.

The religious and very traditionalist strictures on the *khulafāʾ ar-rāshidūn* were somewhat relaxed as Muḥammad's contemporaries, especially the *anṣār,* began to die off, and the conquered territories became too vast to rule along theocratic lines; thus the Umayyads, who followed the *rāshidūn* as caliphs, were able to secularize the operations of the state.

Rashnu, in Zoroastrianism, the deity of justice, who together with Mithra, the god of truth, and Sraosha, the god of religious obedience, determines the fates of the souls of the dead. Rashnu is praised in a *yasht,* or hymn, of the Avesta, the sacred book of Zoroastrianism; the 18th day of the month is sacred to Rashnu.

The name Rashnu originally may have referred to Ahura Mazdā, the supreme Iranian god, and to Mithra, in their capacities as judges. Rashnu eventually took over their functions and now stands on the Bridge of the Requiter (Rashnu himself), where, assisted by Mithra and Sraosha, he weighs on his golden scales the deeds of the souls that wish to pass in order to determine their futures. The divine triad may attempt to intercede for souls and obtain forgiveness for their sins.

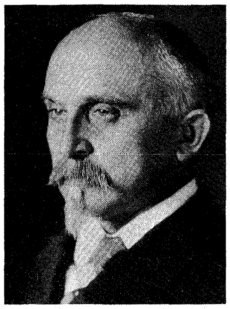
Rasht, also spelled RESHT, city and capital, Gīlān *ostān* (province), Iran, on a branch of the Safīd Rūd (river), where the higher ground merges into the marshlands fringing the Mordāb, or Pahlavī, lagoon. Rasht's importance as capital of Gīlān dates from Russia's southward expansion in the 17th century. The city suffered severely during World Wars I and II from Russian occupation and afterward from economic decline.

The city is surrounded by rice fields and areas of half-cleared jungle. The mostly two-storied houses have much woodwork, such as broad verandas and overhanging eaves; roofs are red-tiled, and the houses often are raised from the ground. Modernization is confined to the main streets.

Besides being an administrative and cultural centre, Rasht is an important market and processing centre for rice, tea, peanuts (groundnuts), and silk; soap, glass, razor blades, and jute bags also are manufactured. In 1962 a large dam on the Safīd Rūd was completed. Rasht is connected by road with the port of Bandar-e Anzalī (formerly Bandar-e Pahlavī), Tehrān, Māzandarān *ostān,* and Tabriz; it also has an airport. Pop. (1985 est.) 266,300.

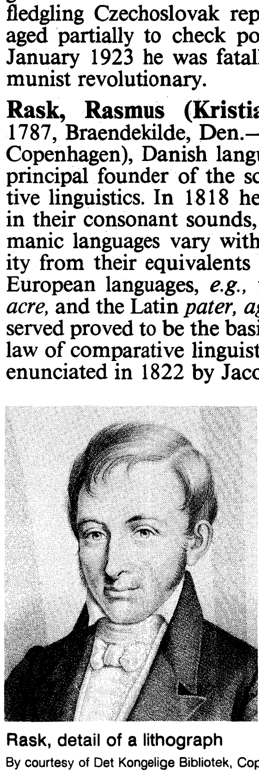
Rašín, Alois (b. Oct. 18, 1867, Nechanice, Bohemia, Austria-Hungary—d. Feb. 18, 1923, Prague), Czech statesman, one of the founders and first finance minister of the Republic of Czechoslovakia.

A leader of the Czech revolutionary organization Omladina, Rašín was arrested and imprisoned for conspiring against the Austrian authorities after nationalistic rioting in Prague in 1893. Granted amnesty in 1895, he joined the Young Czech Party and then founded a


Rašín
Czechoslovak News Agency, Prague

new Radical-Progressive Party (1899); later, however, Rǎsín rejoined the Young Czechs and became a close associate of the party's leader, Karel Kramář. Rašín was elected to the Austrian Reichsrat (lower house of parliament) in 1911; but, following the outbreak of World War I, he was arrested (July 1915) and was sentenced to death for treason (June 1916). Given amnesty a year later, he was one of the home defense leaders who effected the bloodless revolution at Prague (Oct. 28, 1918) that established a national republican government. As first finance minister of the fledgling Czechoslovak republic, Rǎsín managed partially to check postwar inflation. In January 1923 he was fatally shot by a Communist revolutionary.

Rask, Rasmus (Kristian) (b. Nov. 22, 1787, Braendekilde, Den.—d. Nov. 14, 1832, Copenhagen), Danish language scholar and a principal founder of the science of comparative linguistics. In 1818 he first showed that, in their consonant sounds, words in the Germanic languages vary with a certain regularity from their equivalents in the other Indo-European languages, *e.g.,* the English *father, acre,* and the Latin *pater, ager.* What Rask observed proved to be the basis of a fundamental law of comparative linguistics (Grimm's law), enunciated in 1822 by Jacob Grimm.


Rask, detail of a lithograph
By courtesy of Det Kongelige Bibliotek, Copenhagen

Rask began his long association with the University of Copenhagen as assistant keeper of the library in 1808, and in 1811 he published the first systematic grammar of Old Norse, published in an English translation in 1979. During a stay in Iceland that he spent in mastering the language and studying the literature, manners, and customs (1813–15), he wrote the work on which his fame rests, *Undersøgelse om det gamle Nordiske eller Islandske Sprogs Oprindelse* (1818; "Investigation on the Origin of the Old Norse or Icelandic Language"). It was primarily an examination and comparison of the Scandinavian languages with Latin and Greek. Rask was the first to indicate that the Celtic languages, which include Breton, Welsh, and Irish, belong to the Indo-European family and also stated that Basque and Finno-Ugric do not. He established the relationship of Old Norse to Gothic and of Lithuanian to Slavic, Greek, and Latin.

Although he turned his attention mainly to Indic languages around 1816, he published the first Anglo-Saxon grammar in 1817 and edited two major works of Icelandic literature, the *Poetic Edda* and the *Prose Edda* (1818). In 1816 he began travels that took him to Stockholm, St. Petersburg, and finally Iran. The Persian manuscripts he collected remain among the national treasures of Denmark. In 1820 he continued on to India and Ceylon. When he returned to Copenhagen in May 1823, he brought with him many manuscripts in Pāli, Sinhalese, and other languages. Subsequently, Rask was appointed professor of literary history (1825), university librarian (1829), and professor of Oriental languages (1831). His later works include grammars of Spanish (1824), Frisian (1825), and other languages. Over his lifetime Rask had mastered 25 languages and dialects and is reputed to have studied twice as many.

Raskob, John Jakob (b. March 19, 1879, Lockport, N.Y., U.S.—d. Oct. 15, 1950, Centreville, Md.), American financier who played a major role in the early 20th-century expansion of E.I. du Pont de Nemours & Co. and of General Motors Corporation.

From 1898 to 1900, Raskob served as secretary in three firms, ending up serving Pierre Samuel du Pont, president of Johnson Company, which was involved in real estate and Ohio interurban railways. When du Pont became treasurer of E.I. du Pont de Nemours in 1902, Raskob continued as his assistant. Twelve years later, Raskob assumed his mentor's position as treasurer and was then made a vice president. He and du Pont had taken an interest in the General Motors Corporation, begun in 1908 and by 1915 the two owned enough stock to make du Pont chairman of the board and Raskob a board member. In 1918 he became chairman of the firm's finance committee.

Under Raskob's financial leadership, General Motors enjoyed greatly increased sales and earnings. He encouraged a widened stock ownership base in the belief that as more people bought the company's stock, more would buy its products. He further stimulated sales by establishing the General Motors Acceptance Corporation (GMAC), which allowed dealers to finance their inventory of cars and offer credit and long-term financing to their customers. Raskob's influence in the company declined, however, after the recession crisis of 1920 and the appointment that year of du Pont as president.

In 1928 Raskob left General Motors to become chairman of the Democratic National Committee, in which capacity he ran Alfred E. Smith's unsuccessful campaign for president. After the election Smith and Raskob became directors of the Empire State Building

Corporation, overseeing the construction and management of what was the world's tallest building to date.

Raskol (Russian: "Schism"), division in the Russian Orthodox Church in the 17th century over reforms in liturgy and forms of worship. Over the centuries, many features of Russian religious practice had been inadvertently altered by unlettered priests and laity, removing Russian Orthodoxy ever further from its Greek Orthodox parent faith. Reforms intended to remove these idiosyncracies were instituted under the direction of the autocratic Russian patriarch Nikon between 1652 and 1667. The large group of traditionalists who resisted these changes, denouncing them as the work of the Antichrist, came to be known as Raskolniki ("Schismatics"), or Old Believers. *See* Old Believer.

rāslīlā, folk dance drama of northern India, mainly Uttar Pradesh, based on scenes from the life of Krishna. Solo and group dancing are combined with singing, chanted recitation, and instrumental accompaniment.

The audience joins in singing refrains and marks the beat by clapping hands. The interaction of performers, chanters, and audience determines the length of each performance.

Rasmussen, Halfdan (b. Jan. 29, 1915, Copenhagen), Danish poet of social protest, as well as an excellent writer of nonsense verse.

He belonged to the generation of the 1940s. In his early poetry, *Soldat eller menneske* (1941; "Soldier or Human Being") and *Digte under Besaettelsen* (1945; "Poems During the Occupation"), a collection of his poems of protest published illegally during the German occupation of Denmark, he documents his various experiences from the war years with simplicity and sincerity. His poetry from the late 1940s reflects the feelings of pessimism and despair symptomatic of the Cold War years. In *På knae for livet* (1948; "Kneeling to Life") and *Den som har set september* (1949; "The One who Experienced September") the poet rejects all political systems and ideologies and speaks out for the right and the necessity of the individual to dissent and doubt. Rasmussen's final conviction is one of reverence for life and commitment to the weak and suffering. In a didactic poem on his time, "Generation," from his collection *Forventning* (1951; "Expectation"), Rasmussen characterizes the despair and anxiety that followed upon the atomic bombing of Hiroshima. His poetic manner is traditional, simple, and rhymed, with a suggestive rhythm of its own.

Some of his later collections have motifs from his travels; *Torso* (1957) is set in Greece. Later he wrote *Mørke over Akropolis* (1967; "Darkness over the Acropolis"). Rasmussen also composed children's verse and nonsense verse, two genres that made him very popular.

Rasmussen, Knud Johan Victor (b. June 7, 1879, Jakobshavn, Greenland—d. Dec. 21, 1933, Gentofte, Den.), Danish-Eskimo explorer and ethnologist who, in the course of completing the longest dog-sledge journey to that time, across the American Arctic, made a scientific study of virtually every Eskimo tribe in that vast region.

Partly of Eskimo descent himself, and equipped with a thorough mastery of the Eskimo language, Rasmussen wintered among the most northerly tribe in the world, the Polar Eskimo of northwestern Greenland (1902–04). He studied the possibility of introducing reindeer husbandry to western Greenland (1905), spent the next two years again among the Polar Eskimo, and founded a permanent station at Thule, Greenland, in 1910. Its purpose was to provide a trading centre for the population and a base for expeditions. With three companions he crossed the Greenland ice sheet, in 1912, from Thule to the northeast coast. His expedition of 1916–18 surveyed the north coast of Greenland. In 1919 he went to Angmagssalik in eastern Greenland to collect Eskimo tales.

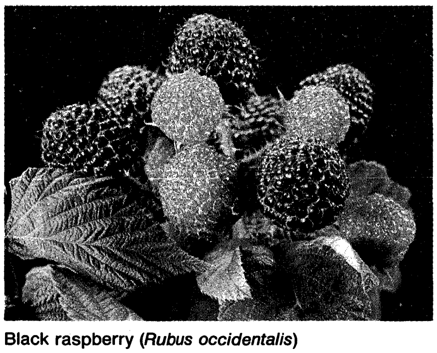
Knud Rasmussen
Nordisk Pressefoto

On Sept. 7, 1921, at Upernavik, he began the great expedition during which he planned to visit every Eskimo tribe from Greenland to the Bering Strait. After investigations in northeastern Canada, on March 4, 1923, he set off on his trek across the continent and reached Point Barrow, Alaska, on May 23, 1924. Along the way he traced Eskimo migration routes and observed the basic unity of Eskimo cultures. He described this expedition in *Across Arctic America* (1927).

On subsequent expeditions from Thule, Rasmussen made cartographic, archaeological, and ethnographical studies in southeastern Greenland. His rich literary production includes travel descriptions and translations of Eskimo mythology and songs as well as scientific works, such as *Grønland, Langs Polhavet* (1919; *Greenland by the Polar Sea*).

rasorite: *see* kernite.

raspberry, fruit-bearing bush of the genus *Rubus* (family Rosaceae), mentioned by Pliny the Elder as a wild fruit. John Parkinson (*Paradisus* [1629]) speaks of red, white, and thornless varieties of raspberries; their culture began about this time. Raspberry bushes bear juicy red, purple, or black (rarely orange, amber, or pale-yellow) berries that separate from the core that remains on the plant; in the related blackberry, the core is a part of the fruit. The raspberry section of *Rubus* probably evolved in eastern Asia, where more than 200 species are known.



Black raspberry (*Rubus occidentalis*)
Grant Heilman—EB Inc.

In Great Britain about 10,000 acres of red raspberries are cultivated. The Blairgowrie district is the centre of production in Scotland; Kent, the eastern counties, and the county of Hereford and Worcester are centres in England. Raspberries are sometimes grown in mixed plantings with other fruit, the plants being set at 450-millimetre (18-inch) intervals in rows 2 or 2.5 metres (6 or 8 feet) apart. American raspberry acreage is about 11,000. Black raspberries are nearly as important as red; the acreage of purple varieties is small. Important raspberry areas are found in Maryland, New Jersey, New York, Michigan, Minnesota, Washington, and Oregon. Few plantings in the United States are mixed with other fruits.

Red raspberries are propagated by suckers from the roots of the parent plant. Root cuttings about 75 mm long are also used for rapid increase of new varieties. Black and purple varieties have arched canes and are propagated by tip layers, the tips of the shoots being buried about 50 mm deep in late summer and the rooted tips being dug in early spring. Leaf-bud cuttings may be used for rapid propagation of new black varieties. The stouter the canes of both black and red varieties, the more productive they are. Stakes or trellises are commonly used to support the canes of the red raspberry.

Raspberries contain iron and vitamin C. They are eaten fresh, often with cream or ice cream, as a dessert fruit. Raspberry jam and jelly are extremely popular. The fruit is also used as a pastry filling and as a flavouring for certain liqueurs.

Raspe, Henry: *see* Henry Raspe.

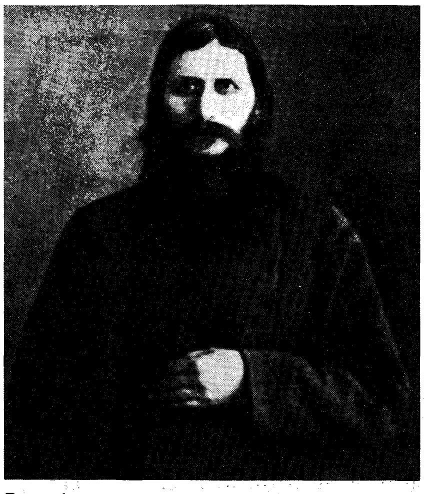
Raspe, Rudolf Erich (b. 1737, Hannover, Hanover—d. 1794, Muckross, County Kerry, Ire.), German scholar and adventurer best remembered as the author of the popular tall tales *The Adventures of Baron Munchhausen.*

After having studied natural sciences and philology at Göttingen and Leipzig, Raspe worked in several university libraries before being appointed librarian and custodian of the Landgraf's collection of gems and coins at Kassel in 1767. One of the first to interest himself in Ossian, the supposed author of epic poetry "discovered" in Scotland, and in Percy's *Reliques of Ancient English Poetry,* a collection of old ballads and poems first published in England in 1765, he acquired a scholarly reputation and was elected to the Royal Society in 1769. In 1775, however, he began stealing from the Landgraf's gem collection and had to flee to England to escape arrest. While living there as a fugitive and in need of money, Raspe succeeded in publishing anonymously a collection of humorous and highly coloured stories as related by the braggart Münchhausen on his travels to Russia. Raspe had known the Baron in Göttingen, but few of the tales were actually derived from him.

In 1786 and again in 1788, the poet G.A. Bürger translated into German and considerably enlarged Raspe's tales. Bürger's translations served to introduce Münchhausen to world literature, and Raspe's authorship of the original was not revealed until 1847 by Heinrich Döring in his biography of Bürger. Becoming involved in a swindle concerned with mining in Scotland, Raspe fled to Ireland in 1791, where he died.

Rasputin, Grigory Yefimovich, original name GRIGORY YEFIMOVICH NOVYKH (b. 1872?, Pokrovskoye, near Tyumen, Siberia, Russian Empire—d. December 30 [December 17, Old Style], 1916, Petrograd [now Leningrad]), Siberian peasant and mystic whose ability to improve the condition of Aleksey Nikolayevich, the hemophiliac heir to the Russian throne, made him an influential favourite at the court of Emperor Nicholas II and Empress Alexandra.

Although he attended school, the peasant Grigory Yefimovich Novykh remained illiterate, and his reputation for licentiousness earned him the surname Rasputin, Russian for "debauched one." He evidently underwent a religious conversion at age 18, and eventually he went to the monastery at Verkhoture, where he was introduced to the Khlysty (Flagellants) sect. Rasputin perverted Khlysty beliefs into the doctrine that one was nearest God when feeling "holy passionlessness" and that the best way to reach such a state was through the sexual exhaustion that came after



Rasputin
Photo Harlingue—H. Roger-Viollet

prolonged debauchery. Rasputin did not become a monk, returned to Pokrovskoye, and at age 19 married Proskovia Fyodorovna, who later bore him four children. Marriage did not settle Rasputin; he left home and wandered to Mount Athos, Greece, and Jerusalem, living off the peasants' donations and gaining a reputation as a starets (self-proclaimed holy man) with the ability to heal the sick and predict the future.

Rasputin's wanderings took him to St. Petersburg (1903), where he was welcomed by Theophan, inspector of the religious Academy of St. Petersburg, and Hermogen, bishop of Saratov. The court circles of St. Petersburg at that time were entertaining themselves by delving into mysticism and the occult, so Rasputin—a filthy, unkempt wanderer with brilliant eyes and allegedly extraordinary healing talents—was warmly welcomed. In 1905 Rasputin was introduced to the royal family, and in 1908 he was summoned to the palace of Nicholas and Alexandra during one of their hemophiliac son's bleeding episodes. Rasputin succeeded in easing the boy's suffering (probably by his hypnotic powers) and, upon leaving the palace, warned the parents that the destiny of both the child and the dynasty were irrevocably linked to him, thereby setting in motion a decade of Rasputin's powerful influence on the imperial family and affairs of state.

In the presence of the royal family, Rasputin consistently maintained the posture of a humble and holy peasant. Outside court, however, he soon fell into his former licentious habits. Preaching that physical contact with his own person had a purifying and healing effect, he acquired mistresses and attempted to seduce many other women. When accounts of Rasputin's conduct reached the ears of Nicholas, the tsar refused to believe that he was anything other than a holy man, and Rasputin's accusers found themselves transferred to remote regions of the empire or entirely removed from their positions of influence.

By 1911 Rasputin's behaviour had become a general scandal. The prime minister, P.A. Stolypin, sent the tsar a report on Rasputin's misdeeds. As a result, the tsar expelled Rasputin, but Alexandra had him returned within a matter of months. Nicholas, anxious not to displease his wife or endanger his son, upon whom Rasputin had an obviously beneficial effect, chose to ignore further allegations of wrongdoing.

Rasputin reached the pinnacle of his power at the Russian court after 1915. During World War I, Nicholas II took personal command of his forces (September 1915) and went to the troops on the front, leaving Alexandra in charge of Russia's internal affairs, while Rasputin served as her personal advisor. Rasputin's influence ranged from the appointment of church officials to the selection of cabinet ministers (often incompetent opportunists), and he occasionally intervened in military matters to Russia's detriment. Though supporting no particular political group, Rasputin was a strong opponent of anyone opposing the autocracy or himself.

Several attempts were made to take the life of Rasputin and save Russia from further calamity, but none were successful until 1916. Then a group of extreme conservatives, including Prince Feliks Yusupov (husband of the tsar's niece), Vladimir Mitrofanovich Purishkevich (a member of the Duma), and Grand Duke Dmitry Pavlovich (the tsar's cousin), formed a conspiracy to eliminate Rasputin and save the monarchy from further scandal. On the night of December 29–30 (December 16–17, Old Style), Rasputin was invited to visit Yusupov's home and, once there, was given poisoned wine and tea cakes. When he did not die, the frantic Yusupov shot him. Rasputin collapsed but was able to run out into the courtyard, where Purishkevich shot him again. The conspirators then bound him and threw him through a hole in the ice into the Neva River, where he finally died by drowning.

The murder merely strengthened Alexandra's resolve to uphold the principle of autocracy, but a few weeks later the whole imperial regime was swept away by revolution.

Rassam, Hormuzd (b. 1826, Mosul, Ottoman Mesopotamia [now in Iraq]—d. 1910), Assyriologist who excavated some of the finest Assyrian and Babylonian antiquities that are now in the possession of the British Museum and found vast numbers of cuneiform tablets at Nineveh (Nīnawā, Iraq) and Sippar (Abū Ḥabbah, Iraq), including the earliest known record of archaeological activity.

He first served as an assistant (1845–47) to the famed British Assyriologist Austen Henry Layard and participated in the excavation of Nimrūd (Khorsabad, Iraq). After studying at the University of Oxford, he again accompanied Layard (1849–51) and took part in the excavation of Nineveh. Layard entered political life shortly thereafter, and in 1852 Rassam was retained to continue excavating antiquities for the British Museum. At Nineveh, Nimrūd, and elsewhere he unearthed notable sculptures, stelae (carved slabs), and inscriptions. In 1853 he discovered at Nineveh the well-known lion-hunt relief of King Ashurbanipal. Shortly thereafter he found the remainder of the royal library, including much of the ancient *Epic of Gilgamesh* and a terra-cotta prism inscribed with the annals of Ashurbanipal's reign. Subsequently, he held British political appointments in Aden and Ethiopia for a number of years.

In 1876 he again became the British Museum's supervisor of Mesopotamian excavations. His final efforts (1878–82) yielded important results. About 15 miles (24 km) from Mosul, at a mound known as Tell Balawat, he excavated the palace of Shalmaneser II and found a pair of great bronze gates that are now one of the glories of the British Museum. Possibly his most valuable contribution to Mesopotamian studies was his discovery in 1880 of a tablet of King Nabu-apal-iddin, which identified the site as the temple of the sun god Shamash in the city of Sippar. In the following 18 months Rassam excavated about 170 chambers surrounding the temple and found 40,000 to 50,000 inscribed cylinders and tablets. One cylinder recounted how Nabonidus (reigned 555–539 BC), the father of Belshazzar and the last king of Babylon, had excavated the temple to its original cornerstone, laid 4,200 years earlier by Naram-Sin, the son of King Sargon of Akkad. Rassam recounted much of his work in *Asshur and the Land of Nimrod* (1897).

rasse, small Asiatic mammal, a species of civet (*q.v.*).

Rassemblement pour la République: *see* Rally for the Republic.

Rastafarian, also spelled RAS TAFARIAN, member of a politico-religious movement among elements of the black population of Jamaica and several other countries. Rastafarians worship Haile Selassie I, former emperor of Ethiopia, under his precoronation name, Ras (Prince) Tafari. They consider the Ethiopian emperor to have been a divine being, the Messiah, and the champion of the black race. According to the Rastafarians, blacks are the Israelites reincarnated and have been subjected to the evil and inferior white race in divine punishment for their sins; they will eventually be redeemed by repatriation to Africa, their true home and heaven on earth, and will compel the whites to serve them.

These beliefs, first enunciated in 1953, can be traced to several independent prophets and particularly to the Back to Africa movement led by Marcus Garvey in the early 20th century. The various groups that make up the Rastafarians rejected Jamaican-European-oriented culture and Christian revivalist religion and developed their own identity while awaiting the exodus. Since the early 1950s the Rastafarian movement has grown in numbers and complexity. The identification with Africa remained, but the repatriation concept received less emphasis and the Rastafarians began to lean toward either political black militancy or a religious mysticism supported by the Old Testament and incorporating African forms. Rastafarian lifestyle may include dietary rules (often vegetarianism), the wearing of uncombed locks and beards, and the smoking of ganja (marijuana).

Rastatt and Baden, treaties of (March 6 and Sept. 7, 1714), peace treaties between the Holy Roman emperor Charles VI and France that ended the emperor's attempt to continue the War of the Spanish Succession (1700–14) after the other states had made peace in the Treaties of Utrecht (beginning in 1713).

Charles VI made peace in his own name at Rastatt and in the name of the states of the Holy Roman Empire half a year later at Baden in Switzerland. In these treaties Charles renounced his claims to the Spanish throne but did not actually make peace with Spain and did not recognize the Bourbon Philip V as king of Spain. A technical state of war with Spain existed until 1720.

The emperor was recognized by France as the ruler of the former Spanish possessions of Milan, Tuscany, Naples, the Southern Netherlands, and Sardinia. The emperor recovered Breisach, Kehl, and Freiburg east of the Rhine; in return he ceded Strasbourg and Alsace to France and agreed to allow France's allies, the electors of Bavaria and Cologne, to recover their possessions. This settlement, like the final treaties of the general settlement of Utrecht, became part of the foundation of international relations in Europe for the next generation.

Rastell, William (b. 1508, Coventry, Warwickshire, Eng.—d. Aug. 27, 1565, Louvain, duchy of Brabant [now in Belgium]), English printer, lawyer, and man of letters. He edited and published the works of his uncle, Thomas More. He also printed the only surviving plays of John Heywood, who married Rastell's sister, Eliza.

The son of John Rastell, a playwright and, like him, a lawyer and printer, he went to Oxford in 1525 but received no degree. He worked in his father's office as a scribe and printer and then set up his own press in 1529. After More's execution in 1535 Rastell and

More's daughter, Margaret Roper, rescued the manuscript letters and treatises that More had written in the Tower of London.

Rastell began the study of law at Lincoln's Inn in 1532 and was called to the bar in 1539, rising to the position of treasurer at the Inn in 1549. In that year the Protestant policies of Edward VI caused Rastell, a staunch Catholic, to go into exile at Louvain. He returned after the accession of Queen Mary (July 1553) and in 1557 had More's English *Works* printed. He also published important law books of his own: *A Collection of All the Statutes* (1557) and *A Collection of Entrees* (1566). Of his large biography of More, only a fragment survives. In 1558 he became a justice of the queen's bench, and five years later, during the reign of Queen Elizabeth I, he went into exile again at Louvain, where he published More's Latin works in 1565.

Rastenburg Assassination Plot: *see* July Plot.

Rāṣṭrakūṭa DYNASTY, Hindu dynasty that ruled the Deccan and neighbouring areas of India from *c.* 755 to 975.

Probably originally Dravidian farmers, they were the royal family of Lattalur (Lātūr, near Osmānābād). They spoke Kannada but also knew the northern Deccan language. Under Rāṣṭrakūṭa, who defeated a rival dynasty, the Cālukyas (*see* Cālukya), the Deccan Empire became the second greatest political unit in India, covering the area from Mālwa to Kānchi. The importance of the Rāṣṭrakūṭas during this era is indicated by the fact that a Muslim traveller wrote of the King as being one of the four great rulers of the world (the others being the Caliph and the emperors of Byzantium and China).

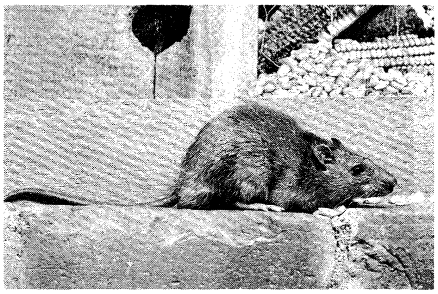
Several Rāṣṭrakūṭa monarchs were devoted to learning and the arts. The second king, Kṛṣṇa I (*c.* 756–773), built the rock temple of Kailāsa at Ellora; another king, Amoghavarṣa I, who reigned from *c.* 814 to 878, was the author of part of the *Kavirājamārga,* the earliest known Kannada poem. Other kings were skilled in the art of war. Dhruva I subdued the Gaṅgas of Gaṅgavāḍi (Mysore), contained the Pallava of Kānchi (Kānchipuram), and defeated the king of Bengal and the Pratihāra king, who were contending for Kannauj. Kṛṣṇa II, who succeeded in 878, reacquired Gujarāt, which Amoghavarsa I had lost, but failed to retake Veṅgi. His grandson, Indra III, who came to the throne in 914, took Kannauj and brought Rāṣṭrakūṭa power to its peak. Kṛṣṇa III outdid him in northern campaigns (*c.* 940) and in a spectacular occupation of Kānchi and much of the Tamil plains (948–966/67). Khottiga Amoghavarṣa IV (968–972) failed to protect the capital, and its sack destroyed faith in the dynasty. The Emperor fled to the Western Ghāts, where his line lingered ignominiously, supported by brave Gaṅga and Kadamba feudatories, until Taila I Cālukya won the succession *c.* 975.

Rasūlid DYNASTY, Muslim dynasty that ruled Yemen and Ḥaḍramawt (1229–1454) after the Ayyūbids of Egypt abandoned the southern provinces of the Arabian Peninsula.

Although the family claimed descent from Qaḥṭān, the legendary patriarch of the southern Arabs, the Rasūlids were of Oğuz (Turkmen) origin, Rasūl having been a messenger (Arabic *rasūl*) for an ʿAbbāsid caliph. His son ʿAlī was governor of Mecca under the last Ayyūbid ruler of Yemen and succeeded him in the government of the whole country. ʿUmar I ibn ʿAlī (reigned 1229–50), Rasūl's grandson, first established himself at Zabīd (Yemen), then moved into the mountainous interior, making Ṣanʿāʾ the Rasūlid capital. Though the Hejaz (west coast of Arabia) itself was a tributary of the Egyptian Mamlūks from 1252, ʿUmar also ruled the holy city Mecca.

For the next two centuries Yemen was an important and prosperous Muslim state; the Rasūlid ruler assumed the title of caliph in 1258. Political and trade relations were maintained with China, India, and Ceylon, and the opening of the port of Aden encouraged a lively international trade. Disturbances in Mecca around the middle of the 14th century, however, offered the Mamlūks an opportunity to intervene in Rasūlid affairs. Aḥmad ibn Ismāʿīl (reigned 1400–24) regained temporary control and offered Mamlūk trade in the Red Sea keen competition, but, soon after his death, internal unrest, revolts of slaves, and the plague hastened the fall of the dynasty. Yemen then passed into the hands of the Ṭāhirid dynasty until the Ottoman conquest of the 16th century.

rat, any of the more than 500 named forms of the genus *Rattus,* family Muridae (order Rodentia). Rats are commonly thought of as dark animals with pointed noses and naked feet and tails; they are similar to, but generally larger than, mice. The name rat is also applied indiscriminately to many moderate-sized rodents belonging to several families, such as the bamboo rat (Rhizomyidae), cane rat (Thryonomyidae), kangaroo rat (Heteromyidae), and rice rat (Cricetidae).



Norway rat (*Rattus norvegicus*)
John H. Gerard

Ordinarily, "rat" refers to either the black rat (*Rattus rattus*) or the Norway rat (*R. norvegicus*). These are aggressive, active, omnivorous, adaptable, and fecund animals that live with man and have accompanied him almost throughout the world. The senses of these rats are highly developed, and their ability to climb, jump, burrow, or gnaw gains them entry to places inaccessible to many other small mammals. They are able to breed at three to four months and can produce up to seven litters a year, each containing 6 to 22 young. Black and Norway rats have destroyed quantities of valuable poultry, game, crops, and stored grain and have been implicated in harbouring or transmitting, directly or indirectly, more than 20 diseases.

The black rat, also called roof, Alexandrine, climbing, or gray rat, has a head and body about 20 centimetres (8 inches) long and a tail somewhat longer. It has a pointed nose and ears about one-half the length of the head. Dark gray or brownish above and gray or whitish below, it is an excellent climber and jumper.

The Norway rat, also known as barn, brown, sewer, or wharf rat, differs from the black rat in having proportionately smaller ears, a more robust body, and a tail shorter than the combined head and body length of 18 to 25 cm. Its colour is usually brown but may be gray, white, black, or pied. Laboratory rats are domesticated albino strains of the Norway rat.

In contrast to the black rat, the Norway rat digs burrows and is an adept swimmer. It is larger and more adaptable than the black rat. When both species live in the same area, they occupy different habitats; in a building, for example, the Norway rat tends to occupy the lower levels, while the black rat lives on the upper floors.

The most effective methods of rat control are adequate sanitation and ratproof construction; other methods include trapping, poisoning, and fumigation.

rat-bite fever, also called SPIRILLARY RAT-BITE FEVER, or SODOKU, a relapsing type of infection caused by *Spirillum minus* and transmitted to man by the bite of an infected rat; it is characterized by infection at the site of inoculation, inflammation of the regional lymph nodes, relapsing fever, chills, and skin rash. The rat-bite wound usually first heals promptly, but after an incubation period of 5 to 28 days there is a sudden flare-up of the characteristic symptoms, and the wound becomes swollen, hard, painful, and may ulcerate; both local and generalized symptoms subside, only to reappear again in a few days. Periods of fever may then alternate with afebrile periods. False positive serological tests for syphilis occur in a large proportion of the cases; confirmation of the diagnosis is made by demonstration of *Spirillum minus* in the lesion or regional lymph node. Treatment consists of the use of antimicrobial drugs such as penicillin and streptomycin; chlorotetracycline and oxytetracycline have also proved effective. The condition was first described in Japan (Japanese *so:* "rat" plus *doku:* "poisoning"). *See also* streptobacillary fever.

Rat Buri (Thailand): *see* Ratchaburi.

rat kangaroo, any of the nine species of Australian and Tasmanian marsupials constituting a subfamily Potoroinae, of the kangaroo family, Macropodidae (*see* kangaroo). Some authorities recognize a separate family, Potoroidae. They differ from other kangaroos in skull and urogenital anatomy and in having large canine teeth. All are rabbit-sized or smaller. Rat kangaroos live in undergrowth.

Rufous rat kangaroo (*Aepyprymnus rufescens*)
Graham Pizzey—Bruce Coleman Inc.

At night they forage for grass, tubers, and underground fungi; some also eat grubs and worms.

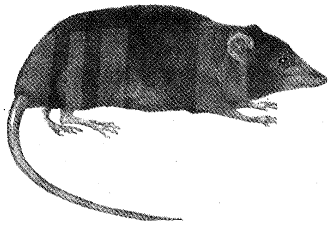
The four species of short-nosed rat kangaroos (genus *Bettongia*), also called boodies, have pinkish noses and short ears. The two long-nosed rat kangaroos, or potoroos (*Potorous*), have shorter tails and more pointed faces.

The rufous rat kangaroo (*Aepyprymnus rufescens*) is the largest of the rat kangaroos and has a whitish but not distinct hip stripe. The tail attains a length of 35 centimetres (14 inches) or more.

The musky rat kangaroo (*Hypsiprymnodon moschatus*) is the only member of the Macropodidae that has a naked tail and retains the first digit of the hind foot. It is therefore classified by some taxonomists as a separate subfamily, Hypsiprymnodontinae.

rat opossum, also called SELVA, any of several South American marsupial mammals of the family Caenolestidae. The seven species, together with opossums (Didelphidae), form the New World section of the superorder

Marsupialia. Rat opossums, named for their general appearance and size, have 46 to 48 teeth and long epipubic bones associated with



Rat opossum (Caenolestidae)
Painting by Don Meighan

the pelvis. The marsupial pouch is lacking in adults. The thick, soft fur is gray-brown. Rat opossums live in cloud forests and high valleys of Ecuador and Bolivia (the five species of the genus *Caenolestes*) and of Peru (*Lestoros,* or *Orolestes, inca*) and in coastal forests of Chile (*Rhyncholestes raphanurus*). Their habits are little known.

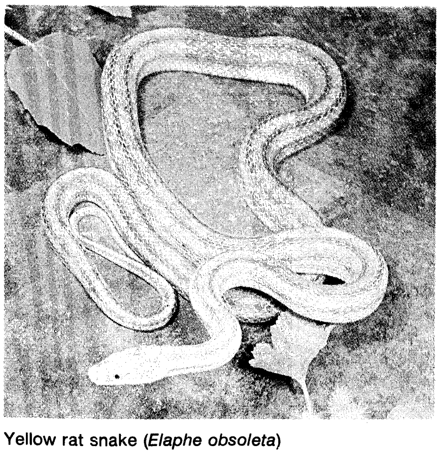
rat snake, any of between 40 and 55 species of the genus *Elaphe,* of the family Colubridae and similar forms. They occur in North America, Europe, and Asia east to the Philippines. Most are found in woodlands and around farm buildings. They hunt rats and mice and kill them by constriction. They also eat eggs, and some species raid poultry yards and are sometimes called chicken snakes. Some hunt birds in trees and have the ventral scales keeled (ridged), for climbing. These rather large, nonvenomous, egg-laying snakes are normally slow and docile, but in self-defense they vibrate the tail, discharge a foul liquid from the anal gland, and strike from an upreared position.

The black rat snake, or pilot black snake (*Elaphe obsoleta obsoleta*), of the eastern United States usually is about 1.2 metres (about 4 feet) long but may exceed 2.5 m (8 ft). It is black, with whitish chin and throat—like the true black snake (*see* racer)—but has slightly keeled dorsal scales. Other races of *E. obsoleta* are tan, gray, yellow, reddish or brown, and some are blotched or striped.

The corn snake (*E. guttata*) ranges from New Jersey and Florida to Utah and northeastern Mexico. In the east it is yellow or gray, with black-edged red blotches and is often referred to as the red rat snake. In the west it usually is pale gray, with black-edged brownish or dark-gray blotches.

The fox snake (*E. vulpina*), chiefly of farmlands of Wisconsin to Missouri, is yellowish or pale brown above, with strong dark blotches, and yellow below, with black checkering. Its head may be quite reddish.

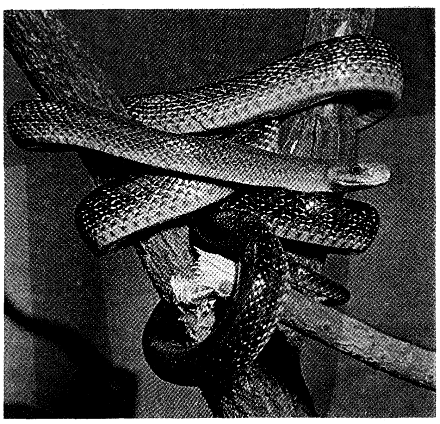
One of Europe's largest serpents is the four-lined snake (*E. quatuorlineata*), which may be 1.8 m (about 6 ft) long. It ranges from



Yellow rat snake (*Elaphe obsoleta*)
John H. Gerard

Italy to the Caucasus and Turkey and is grayish, with two dorsal and two lateral stripes. The Aesculapian snake (*E. longissima*), plain and dark-coloured, is native to southeastern Europe and Asia Minor. In ancient times it was sacred to Aesclepius, god of medicine; the present isolated populations in Germany and Switzerland are descended from specimens conveyed to health resorts there by the Romans. The leopard snake (*E. situla*) of the eastern Mediterranean region to the Caucasus has large round red markings.

Chicken snake is the usual name in southeastern Asia for two slender greenish species, *E. prasina* and *E. oxycephala;* both are strongly arboreal. The copperhead of India is *E. radiata.* The Oriental rat snake (*Zaocys carinatus*) of southeastern Asia may be the largest member of the family Colubridae; one specimen



Aesculapian snake (*Elaphe longissima*)
Anton Thau—Bavaria Verlag

measured 3.7 m (12 ft). The Indian, or greater, rat snake (*Ptyas mucosus*) may be more than 2.5 m (8 ft) long.

rat-tail (fish): *see* grenadier.

Ratana Church, 20th-century religious awakening among the New Zealand Maoris and a national political influence, especially during the period 1943–63, when its members held all four Maori parliamentary seats.

The Ratana Church was founded by Tahupotiki Wiremu Ratana, a Methodist farmer who acquired a reputation as a visionary and faith healer. News of his extraordinary gifts drew Maoris from all parts of New Zealand, who came to hear him preach his doctrine of moral reform under the one God of the Bible. In 1920 he established an interdenominational church at the village of Ratana Pa.

Ratana's movement gave new hope and a transtribal unity to the Maoris, who had many grievances against the government. By 1920 they had lost most of their lands and had been devastated by disease and by the adverse moral and economic effects of World War I. A subject of particular bitterness was the failure of the government to fulfill its promises to the Maoris of the Waitangi Treaty (*q.v.*; 1840).

The association of Ratana's movement with other Christian denominations ended in 1925. The self-proclaimed Ratana Church had developed a syncretic Maori Christianity, marked by heterodox rituals and an elaborate hierarchy of religious officials; hymns and prayers glorified Ratana as God's *mangai* ("mouthpiece"). Displeased by these developments, several of New Zealand's Anglican bishops denounced the new religion. Furthermore, the doctrine of faith healing discouraged the taking of medicines, a fact that alienated religious and secular authorities alike.

Combining political activism with its religious beliefs, the Ratana Church began to sponsor political candidates in 1922. Although it was not until 1931 that a Ratana candidate was elected, the church—allying itself with the country's Labour Party—eventually established a position of political power.

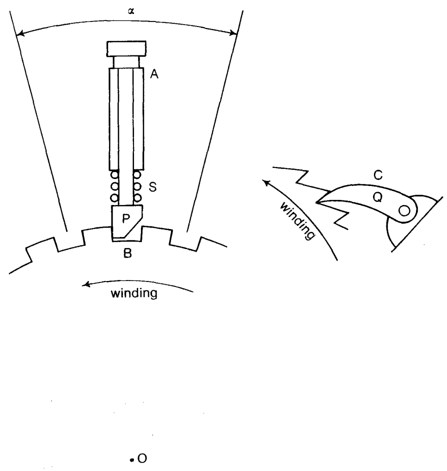
In the 1960s the church renewed relationships with other Christian churches in New Zealand and reemphasized the original biblical principles of Ratana; according to the 1976 census, it had a membership of 35,000.

Ratanakiri (Kampuchea): *see* Rôtânôkiri.

Ratchaburi, also spelled RATBURI, or RAT BURI, town and *changwat* (province) in the Western region of Thailand, west of Bangkok. Prehistoric relics, cave drawings, and old Buddhist temples indicate that the site of Ratchaburi town, on the Mae Nam (river) Mae Klong, has been inhabited from early times. The town is now the provincial capital, a river port, a station of the Bangkok–Singapore railway, and a commercial and service centre for the surrounding region.

The province has an area of 2,006 sq mi (5,196 sq km) and shares its mountainous western border with Burma. It is noted for the production of handmade glazed pottery. Fluorite and tin are mined, rice and vegetables are grown, and freshwater fish are caught, dried, and smoked. Ban Pong and Photharam are towns on the railway north of Ratchaburi town. Pop. (1980) town, 40,404; province, 635,289.

ratchet, mechanical device that transmits intermittent rotary motion or permits a shaft to rotate in one direction but not in the opposite one. In the Figure the arm A and the ratchet wheel B are both pivoted at O. The stem of the pawl P can slide in the arm and is kept in its lowest position by the spring S. If the



Ratchet mechanisms

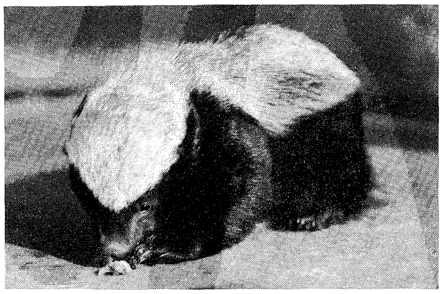
arm oscillates through the angle a (alpha), the pawl rotates the wheel intermittently in a counterclockwise direction; if the arm rotates clockwise the sloping side of the pawl rides over the teeth and has no turning effect on the wheel. If the pawl is rotated half a turn so that its sloping side is on the left, oscillation of the arm rotates the wheel in a clockwise direction only. Reversing ratchets of the type described are used on socket wrench handles and are convenient for tightening or loosening bolts in positions where a complete revolution of a wrench handle is impossible. They are also used to obtain an intermittent feeding motion (workpiece movement) on machine-tool work tables; the ratchet wheel is attached to the screw that moves the table, and the arm is driven by a crank, the throw of which can be varied to change a.

On mechanisms that receive their power from a wound spring, such as watches and clocks, ratchets such as that shown at C in the Figure are used. The pawl Q pivots on a fixed axis and rides over the pointed teeth when the spring is being wound but prevents rotation of the wheel in a clockwise direction.

Although ratchets with pawls and toothed wheels are the most common, other types are used. In one such type, an oscillating member works through a one-way clutch to rotate a wheel intermittently.

Ratclyffe, Thomas: *see* Sussex, Thomas Radcliffe, 3rd Earl of.

ratel, also called HONEY BADGER (*Mellivora capensis*), badgerlike member of the weasel family (Mustelidae) noted for its fondness for honey. Ratels live in covered and forested regions of Africa and southern Asia. The adult stands 25–30 cm (10–12 inches) at the shoulder and has a heavily built, thick-skinned body about 60–77 cm (24–30 inches) long, plus a tail length of 20–30 cm. The ears are rudimentary; the upper body parts are whitish, but the lower parts, face, and legs are black—the two colours sharply separated.

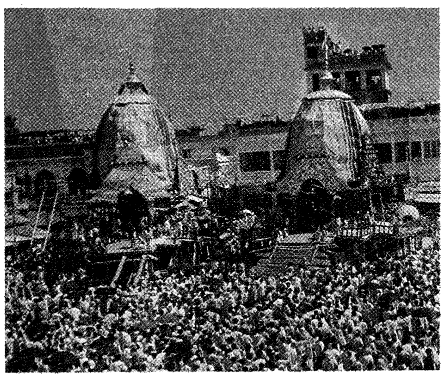


Ratel (*Mellivora capensis*)
Paul Popper Ltd.

Ratels are nocturnal and live in burrows dug with their strong, incurved front claws. They feed on small animals and fruit and on honey, which they find by following the calls of a bird, the greater, or black-throated, honey guide (*Indicator indicator*); the ratels break open the bees' nests to feed on the honey, and the birds in return obtain the remains of the nest. Ratels are strong, fearless fighters but in captivity can become tame and playful. A litter usually consists of two cubs.

ratfish, any of certain sharks of the chimaera (*q.v.*) group.

Rathayātrā, car festival of India, observed by taking an image of the deity in a procession through the streets, thus affording darshan (auspicious viewing) of the deity to worshipers who, because of caste or sectarian restrictions, are not admitted to the sanctuary. The most famous Rathayātrā festival is that of Krishna worshiped as Jagannātha, which takes place at Puri in Orissa and at Shrīrāmpur in West Bengal, but similar festivals for other deities are observed in many parts of south and east India and Nepal. The images are taken out in procession in elaborately carved wooden chariots, which are often extremely large and heavy, requiring hundreds of worshipers to pull them. *See also* Jagannātha.



Rathayātrā at Puri, India
Vidyavrata

Rathbun, Mary Jane (b. June 11, 1860, Buffalo, N.Y., U.S.—d. April 4, 1943, Washington, D.C.), American marine zoologist known for establishing the basic taxonomic information on Crustacea.

In 1881, at the urging of her brother, Richard Rathbun, of the U.S. Fish Commission, she volunteered to work at the Woods Hole Marine Research Center in Massachusetts. Her interest in marine life grew rapidly, and in 1884 she was hired by the U.S. Fish Commission to help organize and catalog its collections. In 1886 she was transferred to the Division of Marine Invertebrates of the National Museum in Washington, D.C. She remained there for 53 years, becoming assistant curator in 1907.

By 1891 Rathbun began to write scientific articles, primarily concerning crustacean faunas, and she subsequently published more than 158 studies. Most were taxonomic works describing and classifying groups of both recent and fossil marine life. Rathbun has been credited with amassing new taxonomic information on and determining the zoological nomenclature of much of the decapod Crustacea (such as crabs and shrimps). Ecologists and other zoologists have also long relied on her extensive records at the National Museum.

Her best-known works are four monographs on the grapsoid, spider, cancroid, and oxystomatous crabs, published by the National Museum between 1918 and 1937.

Rathenau, Emil (b. Dec. 11, 1838, Berlin—d. June 20, 1915, Berlin), German industrialist and a leading figure in the early European electrical industry.

In 1883 he founded the Deutsche Edison-Gesellschaft to manufacture products based on Thomas A. Edison's patents, for which he had purchased the European rights. The firm was renamed Allgemeine-Elektrizitäts-Gesellschaft in 1887. Rathenau and the noted German engineer Werner von Siemens established the Telefunken Gesellschaft in 1903. Rathenau was the first to produce aluminum in Germany for industrial use.

Emil Rathenau, about 1900
Archiv fur Kunst und Geschichte, West Berlin

Rathenau, Walther (b. Sept. 29, 1867, Berlin—d. June 24, 1922, Berlin), statesman, industrialist, and philosopher who organized Germany's economy on a war footing during World War I and, after the war, as minister of reconstruction and foreign minister, was instrumental in beginning reparations payments under the Treaty of Versailles obligations and in breaking Germany's diplomatic isolation.

Rathenau was the son of Emil Rathenau, the founder of the immense Allgemeine-Elektrizitäts-Gesellschaft (AEG) combine. He studied philosophy, physics, chemistry, and engineering at Berlin and Strassburg (Strasbourg) and received his doctorate in 1889. He subsequently held a number of executive positions in German industry and, at the outbreak of World War I, headed the AEG. One of the few German industrialists who realized that governmental direction of the nation's economic resources would be necessary for victory, Rathenau convinced the government of the need for a War Raw Materials Department in the War Ministry. As its head from August 1914 to the spring of 1915, he ensured the conservation and distribution of raw materials essential to the war effort. He thus played a crucial part in Germany's efforts to maintain its economic production in the face of the tightening British naval blockade. He then returned to business and writing, but, when the collapse of the Western front became imminent in the autumn of 1918, he proposed a desperate *levée en masse* ("call to arms") to turn defeat into victory.

After the war, Rathenau helped found the middle-class German Democratic Party and advocated a policy of cooperation with the German Social Democratic Party. Convinced that the days of unrestricted capitalism were over, he advocated in his *Die neue Wirtschaft* (1918; "The New Economy") industrial self-government combined with employee participation and effective state control rather than the wholesale nationalization of industry by the state.

Rathenau combined democratic convictions and a strong belief in international cooperation with economic experience and a knowledge of foreign countries. He entered the government of Karl Joseph Wirth in May 1921 as minister of reconstruction, and in that post he initially advocated a policy of fulfillment of Germany's obligations under the Treaty of Versailles as part of a general European reconstruction scheme. On Jan. 31, 1922, he became foreign minister. Though Western-oriented, he negotiated the Treaty of Rapallo with the Soviet Union (April 16, 1922), which reestablished normal relations and strengthened economic ties between the two nations that had been outcasts from the concert of European powers. This far-reaching settlement affronted the Western Allies, since it marked the first time since the war's end that Germany had asserted its position as an independent agent in international affairs.

Despite this diplomatic success, which was hailed by many Germans, Rathenau was increasingly reviled at home. To the extreme right, he represented the whole German postwar system, which they hated, and he was also, as author of the Treaty of Rapallo, the promoter of "creeping Communism." His being a Jew intensified the extreme nationalists' hatred of him. Rathenau was assassinated on the way to his office by right-wing fanatics. His collected works were published in 1918.

Rathke, Martin H(einrich) (b. Aug. 25, 1793, Danzig, Prussia [now Gdańsk, Pol.]—d. Sept. 3, 1860, Königsberg [now Kaliningrad, Russian S.F.S.R.]), German anatomist who first described the gill slits and gill arches in the embryos of mammals and birds. He also first described in 1839 the embryonic structure, now known as Rathke's pouch, from which the anterior lobe of the pituitary gland develops.

Rathke ended a 10-year medical practice in his hometown when he became professor of physiology at the University of Dorpat and, later (1835), professor of zoology and anatomy in Königsberg. An outstanding embryologist, Rathke thought the gill arches were vestiges of ancestral gills, but he also recognized their significance in the later development of the associated blood vessels. Rathke also did pioneering research in marine zoology. He was elected a fellow of the Royal Society in 1855.

Ratibor (Poland): *see* Racibórz.

Ratich, Wolfgang, also spelled RATICHIUS (educational reformer): *see* Ratke, Wolfgang.

rating rule, in yacht racing, rule used to classify sailing yachts of different designs to enable them to compete on relatively equal terms. The competition may be either among yachts in a particular rating class or on a handicap basis, with the highest-rated boat giving up time allowances to all lower-rated craft in a contest. Such rules are based on measurement formulas that take into account a yacht's length, beam, displacement, sail area, and other design factors that affect its potential speed.

Early rating rules emphasized a yacht's sail area and waterline length. To take advantage of these rules, flat-bodied hulls were developed with long overhangs and light displacement; the resulting skimming-dish type was exemplified in the defender of the America's Cup of 1903, the *Reliance,* which had overhangs totaling more than 50 feet (15 m) on a waterline length of about 90 feet (27 m). The Universal Rule, adopted in 1905 in the United States and later internationally, retained length and sail area as chief factors but also imposed penalties on overhangs, draft, freeboard, and other dimensions. It established letter classes, such as the J-Class that was used in the America's Cup competition in the 1930s.

Metric classes were created by the International Rule, adopted in 1906, which was more complex than the Universal Rule but retained many of its factors. In the late 1920s the 6-, 8-, and 12-Metre International Rule classes became popular. The 12-Metre-class yachts were used in a revival of the America's Cup competition beginning in 1958, but most other rating classes were inactive after World War II, having been superseded by the smaller, more economical one-design classes (in which all competing boats are built to the same measurements).

Long-distance ocean races continued to be conducted on a handicap basis, primarily under the Cruising Club of America (CCA) and the Royal Ocean Racing Club (RORC) measurement rules after the 1930s. The major international races of 1970 were the first run under a new International Offshore Racing Rule that combined aspects of both CCA and RORC rules.

rationalism, in philosophy, a method of inquiry that regards reason as the chief source and test of knowledge and, in contrast to empiricism, tends to discountenance sensory experience. It holds that, because reality itself has an inherently rational structure, there are truths—especially in logic and mathematics but also in ethics and metaphysics—that the intellect can grasp directly. In ethics, rationalism relies on a "natural light," and in theology it replaces supernatural revelation with reason.

A brief treatment of rationalism follows. For full treatment, *see* MACROPAEDIA: Philosophical Schools and Doctrines, Western.

The inspiration of rationalism has always been mathematics, and rationalists have stressed the superiority of the deductive over all other methods in point of certainty. According to the extreme rationalist doctrine, all the truths of physical science and even history could in principle be discovered by pure thinking and set forth as the consequences of self-evident premises. This view is opposed to the various systems which regard the mind as a tabula rasa (blank tablet) in which the outside world, as it were, imprints itself through the senses.

The opposition between rationalism and empiricism is, however, rarely so simple and direct, inasmuch as many thinkers have admitted both sensation and reflection. Locke, for example, is a rationalist in the weakest sense, holding that the materials of human knowledge (ideas) are supplied by sense experience or introspection, but that knowledge consists in seeing necessary connections between them, which is the function of reason (*Essay Concerning Human Understanding*).

Most philosophers who are called rationalists have maintained that the materials of knowledge are derived not from experience but deductively from fundamental elementary concepts. This attitude may be studied in René Descartes, Gottfried Wilhelm Leibniz, and Christian von Wolff. It is based on Descartes's fundamental principle that knowledge must be clear, and seeks to give to philosophy the certainty and demonstrative character of mathematics, from the a priori principle of which all its claims are derived. The attack made by David Hume on the causal relation led directly to the new rationalism of Kant, who argued that it was wrong to regard thought as mere analysis. In Kant's views, a priori concepts do exist, but if they are to lead to the amplification of knowledge, they must be brought into relation with empirical data.

Ethical rationalism is the application of epistemological rationalism to the field of morals. The primary moral ideas (good, duty) are held to be innate, and the first principles of morals (*e.g.,* the Golden Rule) are deemed self-evident. It is further claimed that the possession of reason provides an adequate motive for moral conduct. In ethical rationalism, reason is generally contrasted with feeling or moral sense.

Religious rationalism asserts the claims of reason against those of revelation or authority. The fundamental principles of religion are held to be innate or self-evident and revelation unnecessary. Religious rationalism thus stresses the importance of natural as opposed to revealed religion.

rationing, government policy consisting of the planned and restrictive allocation of scarce resources and consumer goods, usually practiced during times of war, famine, or some other national emergency.

Rationing may be of several types. Informal rationing, which precedes the imposition of formal controls, may consist of admonitions to consumers to reduce their consumption or of independent action taken by suppliers in allocating scarce supplies. Rationing according to use prohibits the less important uses of a commodity. Rationing by quantity may limit the hours during which the commodity is available or may assign quotas of a commodity to all known and approved claimants. Rationing by value limits the amount consumers may spend on commodities that cannot be standardized, the consumer being allowed to make his own selections within the value limits imposed. Point rationing assigns a point value to each commodity and allocates a certain number of points to each consumer; this system is employed during periods of critical and increasing shortages when individuals begin substituting unrationed for rationed items, thereby spreading shortages.

Consumers in a rationed economy are usually exhorted to save by purchasing government bonds or by increasing their deposits in savings banks so that unspent money will not be used for increased purchases of unrationed items or for purchases on the black market.

Ratisbon (Germany): *see* Regensburg.

Rätische Alpen (Europe): *see* Rhaetian Alps.

ratite, any bird whose sternum (breastbone) is smooth, or raftlike, for lack of a keel to which flight muscles could be anchored. All species of ratites are thus unable to fly. They are a peculiar and puzzling group, with anatomic anomalies. The group includes some of the largest birds of all time, such as the elephant bird and the moa (*q.v.*). Extant ratites include the ostrich, emu, cassowary, rhea, and kiwi (*qq.v.*).

Ratke, Wolfgang, Ratke also spelled RATICH, or RATICHIUS (b. Oct. 18, 1571, Wilster, Holstein, Ger.—d. April 27, 1635, Erfurt, Saxony), German educational reformer, especially in the teaching of languages, whose pioneering achievements laid the groundwork for the work of Comenius.

Ratke was educated in Hamburg, and he studied theology (without obtaining a degree) at the University of Rostock. Having abandoned a possible career in the clergy because of his inadequacy at public speaking, Ratke returned to Wilster, where from 1600 to 1603 he studied languages, especially Hebrew. The next eight years he spent as a private teacher in Amsterdam, where he began to develop his new teaching system, based largely on Francis Bacon's concepts of inductive reasoning from the particular to the general.

Failing to win official backing for his ideas in the Netherlands, Ratke returned to Germany. At the Imperial Diet at Frankfurt in 1612 he urged replacing Latin with the vernacular as the language of higher education. From 1614 to 1622 he tried to establish his pedagogical system successively at Augsburg, Köthen, and Magdeburg. All of these experiments were failures, owing in part to the unprecedented nature of Ratke's concepts, in part to his limitations as an organizer and administrator, and in part to the hostility of the Roman Catholic Church, which wanted to mantain control over education.

Though unable to put his ideas into successful practice, Ratke made major contributions to education by formulating a number of important reform principles, all of which were successfully applied by various successors. These principles were: learning through experience and experiment rather than by rote, proceeding from the concrete to the abstract, mastering one concept before moving to another, learning through repetition, and perfecting knowledge of the native language before attempting to learn foreign tongues.

Ratke suffered a paralytic stroke in 1633 and died two years later. His teaching methods survived him, however, greatly influencing Comenius and subsequent educational reformers.

Ratlām, also spelled RUTLĀM, town, western Madhya Pradesh state, central India. Ratlām is a major rail junction, an agricultural trade centre, and a major industrial town. It is heavily engaged in cotton, silk, sugar, and oilseed milling, handloom weaving, and the manufacture of pottery, trunks, umbrellas, and snuff. The town served as capital of the former Ratlām princely state, and buildings of historical interest include the maharaja's palace and several Jaina temples. There are a zoological garden, a musical academy, and two colleges affiliated with Vikram University.

The surrounding area lies on the Mālwa Plateau, has fertile black soil that supports cotton, and is drained by the Mahi and Chambal rivers and their tributaries. Wheat, corn (maize), and sugarcane are also cultivated, and Vindhyan sandstone deposits are worked. Pop. (1981) town, 142,319; metropolitan area, 155,578.

ratline hitch (knot): *see* clove hitch.

Ratnāgiri, town, southwestern Mahārāshtra state, western India, on the Arabian Sea coast. The town became an administrative capital under the Bijāpur rulers. In 1731 it came under the control of Sātāra kings, and in 1818 it was surrendered to the British. A fort, built during the Bijāpur dynasty and strengthened in 1670 by the Marāṭhā king Śivajī, is located on a headland near the harbour. The town has a marine biology research station and is one of the ports of the Konkan Coast. The town is a popular resort; it has a palace where Thibaw, the last king of Burma, and, later, Savarkar were confined.

The surrounding area is bordered on the east by the Sahyādri Hills of the Western Ghāts. The hills receive heavy annual rainfall, which runs off in rapid streams that have dissected the landscape, creating infertile plateaus separated by fertile alluvial valleys. The main crops are rice and coconuts; cultivation of various fruits and cashew nuts was developed in the 1970s. Fishing is predominant in coastal areas, particularly at Ratnāgiri town, and forestry yields quality teak. Iron ore and bauxite are mined; iron is exported through the port of Reddi. The region has become dependent for its nonagricultural needs on Bombay, which attracts much of Ratnāgiri's working population. Pop. (1981) town, 47,036.

Ratnapura, town, southwestern Sri Lanka (Ceylon). It is situated southeast of Colombo, on the Kalu Ganga (river). Dominating the town is a hill on which the Portuguese built a fort. Ratnapura (Sinhalese: "city of gems") is Sri Lanka's chief source of precious and semi-

Panning for gems, Ratnapura, Sri Lanka
Ed Lark—Artstreet

precious stones (including rubies, sapphires, and cat's-eyes), which are found in the valleys around the town and are prepared by Muslim gem cutters; examples are on display in the town's gem museum. Graphite is also mined in the area. The town is connected with Colombo by rail and with other parts of Sri Lanka by road. Pop. (1982 est.) 40,000.

Ratnasambhava, in Mahāyāna Buddhism, one of the five "self-born" Buddhas. *See* Dhyāni-Buddha.

Raton, city, seat (1897) of Colfax County, northeastern New Mexico, U.S. It lies at the southern end of Raton Pass (7,834 feet [2,388 m] above sea level), in the Sangre de Cristo Range near the Colorado border. Located on the old Santa Fe Trail and settled in 1871, it was used as a watering place by cattlemen. The town was laid out in 1880 after the arrival of the Santa Fe Railroad and was named Raton (Spanish: "rat") for a nearby lava-capped mountain that was inhabited by many small rodents. It developed as a shipping point for coal and livestock. The Capulin Mountain National Monument (a symmetrical volcanic cone rising 1,500 feet [460 m] from a plain) and the site where prehistoric artifacts of the Folsom complex were found are about 30 miles (48 km) east. Inc. 1891. Pop. (1984 est.) 7,923.

Ratramnus (d. *c.* 868, Corbie, West Frankish Kingdom), theologian, priest, and monk at the Benedictine abbey of Corbie whose important 9th-century work provoked the eucharistic controversy and was posthumously condemned.

It was at the request (*c.* 850) of the West Frankish king Charles II the Bald that Ratramnus began to write two major books: *De corpore et sanguine Domini* ("Concerning the Body and Blood of the Lord") and *De praedestinatione.* Showing remarkable originality, *De corpore* is partially a reply to *De corpore et sanguine Christi* ("Concerning Christ's Body and Blood"), written by his abbot, Paschasius Radbertus. Ratramnus proposed that the bread and wine of the Eucharist are mystic symbols commemorative of Christ's body and blood, becoming such through sacerdotal consecration but retaining their outward appearance; within the bread and wine, however, resides a power perceived only by the faith that makes them effective. In short, they are not converted into the substance of Christ's body and blood in actuality but only symbolically.

These views contrast sharply with those of Paschasius, but *De corpore* apparently was not attacked until it was ordered destroyed at the Council of Vercelli (1050) and condemned at the Lateran Synod (1059); in both cases, *De corpore* was incorrectly attributed to the Irish philosopher and theologian John Scotus Erigena. Surviving copies of *De corpore* influenced Protestant theologians, thereby contributing to the Reformation. It was widely translated despite its being listed in the *Index of Forbidden Books* from 1559 until 1900. Opinions of its orthodoxy are still unsettled.

Rejecting predestination to sin and upholding predestination to salvation, Ratramnus in *De praedestinatione* opposed Archbishop Hincmar of Reims and defended Bishop St. Augustine of Hippo. In his *Contra Graecorum opposita* ("Against Greek Opposition"), Ratramnus defends the Western Church from attacks by Patriarch Photius of Constantinople during the controversy on the *Filioque* clause ("and from the Son") in the Nicene Creed and pleads for unity between the Western and Eastern churches. *De nativitate Christi* ("On the Birth of Christ") argues that Christ's birth was natural, a belief challenged by Paschasius.

English translations of his works by G.E. McCracken are in "Library of Christian Classics," vol. 9 (1957). J. Fahey's *Eucharistic Teaching of Ratramn of Corbie* appeared in 1951.

rattan vine, woody climbing plant of the buckthorn family, also known as supplejack (*q.v.*).

Rattazzi, Urbano (b. June 20, 1808, Alessandria, Kingdom of Italy—d. June 5, 1873, Frosinone, Italy), Piedmontese lawyer and statesman who held many important cabinet positions in the early years of the Italian Republic, including that of prime minister; his ambiguous policies brought him into conflict with the Italian hero Giuseppe Garibaldi and ultimately caused his downfall.

In 1848 Rattazzi was elected deputy to the Sardinian Parliament. For the next decade he held various ministerial positions and became associated with the brilliant premier Count Cavour. Violently anticlerical and considered devoid of principle, Rattazzi nevertheless became premier after Cavour's death. At this time Garibaldi offered to capture Rome, then occupied by the French. Rattazzi at first sanctioned this venture and then changed his mind and sent troops to intercept Garibaldi, who was wounded in the ensuing Battle of Aspromonte (1862). Public opinion condemning this action forced Rattazzi's resignation.

In 1867 Rattazzi was again asked to be premier, and again Garibaldi marched on Rome, with Rattazzi's tacit consent. Rattazzi once more changed his mind, and he ordered Garibaldi arrested. Faced with the choice of arresting Garibaldi's volunteers or invading Rome himself, Rattazzi resigned.

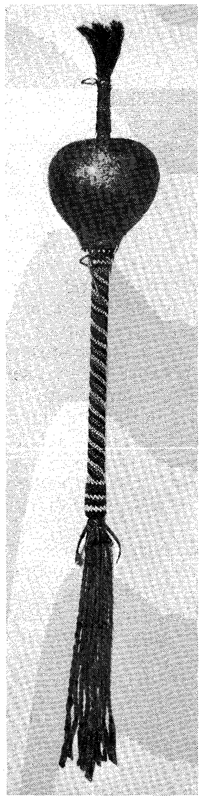
Ratti, Ambrogio Damiano Achille (pope): *see* Pius XI.

Rattigan, Sir Terence (Mervyn) (b. June 10, 1911, London—d. Nov. 30, 1977, Hamilton, Bermuda), English playwright, a master of the well-made play.

Educated at Harrow and Trinity College, Oxford, Rattigan had early success with two farces, *French Without Tears* (performed 1936) and *While the Sun Shines* (performed 1943). *The Winslow Boy* (performed 1946), a drama based on a real-life case in which a young boy at the Royal Naval College was unjustly accused of theft, won a New York Critics award. *Separate Tables* (performed 1945), perhaps his best known work, took as its theme the isolation and frustration that result from rigidly imposed social conventions. *Ross* (performed 1960) explored the life of T.E. Lawrence (of Arabia) and was less traditional in its structure. *A Bequest to the Nation* (performed 1970) reviewed the intimate, personal aspects of Lord Nelson's life. His last play was *Cause Celebre* (performed 1977).

Rattigan's works were treated coldly by some critics who saw them as unadventurous and catering to undemanding, middle-class taste. Several of his plays do seriously explore social or psychological themes, however, and his plays consistently demonstrate solid craftsmanship. Rattigan was knighted in 1971 for his services to the theatre. He had many screenplays to his credit, including the film versions of *The Winslow Boy* (1948) and *Separate Tables* (1958), among others, and *The Yellow Rolls Royce* (1965) and *Goodbye Mr. Chips* (1968).

rattle, percussion instrument consisting of resonant objects strung together and set in a sliding frame or enclosed in a container such that when it is shaken the parts strike against each other, producing sounds. In many societies, rattles are associated with the supernatural and accompany religious rites. Slung rattles (shells, bones, hooves, or similar ob-



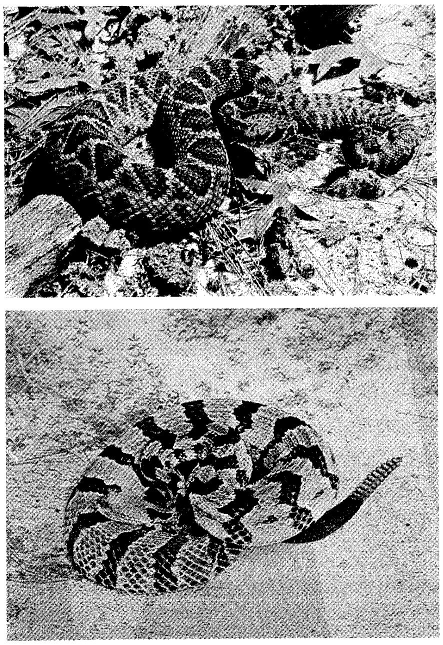
Cheyenne Indian gourd rattle with beaded handle and buckskin fringe, 19th century
By courtesy of U.S. Department of the Interior, Indian Arts and Crafts Board, Southern Plains Indian Museum and Crafts Center

jects strung on a cord or tied in bunches and attached to a dancer's body) are among the earliest musical instruments, appearing, along with gourd and tube rattles, in prehistoric times. Gourd rattles are particularly prominent as ritual instruments. Where gourds are uncommon, similar rattles are made of basketry, wood, clay, or other material. Gourd rattles known from their use in popular Latin-American dance bands are the *cabaça* (Portuguese for "calabash"), a gourd enclosed in a beaded mesh, and maracas, which as folk instruments in Central and South America frequently have magical attributes.

Pellet bells—a familiar variety is the metal jingle bell—are hollow vessels enclosing a single rattling object. In ancient or folk cultures they have frequently been considered to be protective and, as such, have been worn by priests and dancers, especially in ritual dance, and placed on animals. Their use as jewelry reflects their ancient role as protective amulets.

Other varieties of rattle include the sistrum, having sliding bars set in a frame, and the Javanese *angklung,* tuned bamboo tubes set in a bamboo frame. The word jingle refers to various types of rattles—*e.g.,* slung rattles, pellet bells, and the sliding metal disks on many tambourines.

rattlesnake, any of about 30 species of venomous New World snakes of the viper family (Viperidae), characterized by a tail rattle that produces a buzzing sound when vibrated. Rattlesnakes are pit vipers (subfamily Crotalinae)—*i.e.,* they have a small heat-sensing pit between each eye and nostril that aids in hunting. The rattle, their outstanding feature, is composed of horny, loosely connected segments, added one at a time, with each skin shedding. Presumably a warning device, the rattle usually contains six to ten segments in an adult.



(Top) Eastern diamondback rattlesnake (*Crotalus adamanteus*); (bottom) timber rattlesnake (*Crotalus horridus*)
Jack Dermid

There are two genera of rattlesnakes: *Sistrurus,* including the massasauga and the pygmy rattler (*S. miliarius*), and *Crotalus,* including the sidewinder and all others. The massasauga and pygmy rattler are small and have nine large scales on the tops of their heads. Members of the genus *Crotalus* may be large or small, depending on the species, but all have mostly small scales on their heads. Among the best known species in North America are the timber, or banded, rattlesnake (*C. horridus*) of the eastern and central United States, the prairie rattlesnake (*C. viridis*) of the western states, and the eastern and western diamondback rattlesnakes (*C. adamanteus* and *C. atrox*), which are the largest of all rattlesnakes.

Rattlesnakes are found from Canada to South America, usually in arid regions. They vary in length from about 30 centimetres (one foot) in several small Mexican species to about 2.5 metres (8 feet) in the eastern diamondback. A few species are marked with transverse bands, but most rattlesnakes are blotched with dark diamonds, hexagons, or spots on a lighter background, usually gray or light brown; some are various shades of orange, pink, red, or green. Identification is sometimes difficult.

Most species of rattlesnakes eat small animals, primarily rodents; small or juvenile rattlesnakes depend largely on lizards. All species bear live young, usually in broods of about a dozen. Like other snakes, rattlesnakes cannot tolerate extreme heat or cold. In hot areas they become nocturnal, avoiding the heat of day in protected shelters. In winter they congregate in rockslides or crevices to hibernate.

All rattlesnakes are venomous and dangerous. With improved methods of treatment and the abandonment of folk cures (many of which presented more danger than benefit to the victim), a rattlesnake bite is no longer the threat to life that it once was. It is still, however, a serious and painful accident. The most dangerous rattlesnakes are the Mexican West Coast rattlesnake (*C. basiliscus*) and the tropical or South American rattlesnake, or cascabel (*C. durissus*); both have a venom that attacks the nervous system more strongly than that of other rattlesnakes. The most dangerous species in the United States are the diamondbacks.

Ratzel, Friedrich (b. Aug. 30, 1844, Karlsruhe, Baden—d. Aug. 9, 1904, Ammerland, Ger.), German geographer and ethnographer and a principal influence in the modern development of both disciplines. He originated the concept of *Lebensraum,* or "living space," which relates human groups to the spatial units where they develop. Though Ratzel pointed out the propensity of a state to expand or contract its boundaries according to rational capabilities, the subsequent misuse of the *Lebensraum* concept by the Nazi regime in Germany was largely based on the interpretation of Ratzel's concept by the Swedish political scientist Rudolf Kjellén.

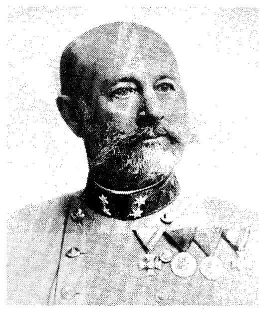
Ratzel studied zoology and in 1869 published a commentary on the work of Darwin. He subsequently became familiar with theories relating to the migration of species. His extended tour of North and Central America (1874–75) as a correspondent for the *Kölnische Zeitung* ("Cologne Journal") made a profound impression on him and provided a basis for many of his ideas. For the rest of his life he taught at the technical university of Munich (1875–86) and at the University of Leipzig (1886–1904).

Ratzel's chief interests lay in human migration, cultural borrowing, and the relation between man and the many factors of his physical environment. Though influenced by the evolutionary theories of Darwin and of the German zoologist Ernst Heinrich Haeckel, Ratzel became critical of the mechanistic quality of their views. Philosophy, rather than biology, came to dominate his later thought.

Ratzel, etching by Johann Lindner, *c.* 1892
Archiv fur Kunst und Geschichte, West Berlin

His principal work on ethnography was *Völkerkunde,* 3 vol. (1885–88; *The History of Mankind,* 1896–98). In *Anthropogeographie* (vol. 1, 1882, and vol. 2, 1891) he considered population distribution, its relation to migration and environment, and also the effects of environment on individuals and societies. His other works included *Die Erde und das Leben: Eine vergleichende Erdkunde* (1901–02; "Earth and Life: A Comparative Geography"), *Politische Geographie* (1897; "Political-Geography"), and a political-geographical study of the United States (1893). His essay "Lebensraum" (1901), often cited as a starting point in geopolitics, was a study in biogeography.

Ratzenhofer, Gustav (b. July 4, 1842, Vienna—d. Oct. 8, 1904, at sea en route to Europe), Austrian soldier, military jurist, and sociologist, a Social Darwinist who conceived of society as a universe of conflicting ethnic groups and who thought that sociology could guide the human species into higher forms of association.



Ratzenhofer
By courtesy of the Bild-Archiv, Osterreichische Nationalbibliothek, Vienna

Ratzenhofer's formal education ended after a short time in secondary school. He rose in the Austrian Army from cadet (1859) to field marshal and president of the supreme military court of Vienna (1898–1901), where he developed his interest in the social sciences. After his successful army career he wrote six books on philosophy, sociology, and political science. Professionally and intellectually a tough, self-made man, he was naturally inclined to join Herbert Spencer and others in applying Charles Darwin's biological theory of the struggle for existence and survival of the fittest to human society.

His political and sociological writings are concerned with the development of types of human associations. He reduced social phenomena to chemical, physical, and biological concerns, finding man's basic drives in his biological nature, applying Darwin's theory of survival of the fittest. Every human being, he felt, tended to act according to such basic drives and similar basic interests, which establishes a state of "absolute hostility" in human interaction. His particular concern with the evolution of the types of human associations caused him to feel that the continual evolution of large groups are formed gradually from less complex social units in conflict. His choice of a variety of racial groups as the units for analysis led him to believe that the source of group conflict in an "absolute hostility" was fundamental to human interaction.

His writings include: *Wesen und Zweck der*

Politik, 3 vol. (1893; "The Essense and Objective of Politics"), *Die sociologische Erkenntnis: Positive Philosophie des socialen Lebens* (1898; "Sociological Perception: An Exact Philosophy of Social Life"), *Der positive Monismus und das einheitliche Princip aller Erscheinungen* (1899; "Positive Monism and the Uniform Principle of All Phenomenons"), *Positive Ethik: Die Verwirklichung des Sittlich-Seinsollenden* (1901; "The Positive Ethic: The Complexity of Maintaining a State of Morality"), *Die Kritik des Intellects* (1902; "Critique of the Intellect"), and *Soziologie: Positive Lehre von den menschlichen Wechselbeziehungen* (1907; "Sociology: Exact Models of Correlation").

Rau, Sir Benegal Narsing (b. Feb. 26, 1887, Karkala or Mangalore, Mysore state, India—d. Nov. 29, 1953, Zürich), one of the foremost Indian jurists of his time. He helped to draft the constitutions of Burma (1947) and India (1950). As India's representative on the United Nations Security Council (1950–52), he was serving as president of the council when it recommended armed assistance to South Korea (June 1950). Later he was a member of the Korean War cease-fire commission.

A graduate of Madras and Cambridge universities, Rau entered the Indian civil service in 1910. After revising the entire Indian statutory code (1935–37), he was knighted (1938) and made judge of the Bengal High Court, Calcutta (1939). His writings on Indian law include a noted study on constitutional precedents as well as articles on human rights in India. He served briefly (1944–45) as prime minister of Jammu and Kashmir state. From February 1952 until his death, he was a judge of the Permanent Court of International Justice, The Hague. Before his election to the court, he was regarded as a candidate for secretary-general of the UN.

Raub, town, central West Malaysia (Malaya). It is situated in the eastern foothills of the Main Range and began in the 1880s as a gold-mining settlement. Raub is the Malay word for "scoop with one's hands," and at one time the ore was reputedly so abundant that this was a common method of working. The Australian Gold Mining Company began production in 1889 at nearby Koman Hill. Although that major mine closed in 1962, small-scale mining continues. Small quantities of the ore occur in limestone rock at a depth of 1,200 feet (366 m). The inhabitants of the surrounding area are now primarily engaged in paddy (rice) farming and vegetable farming. Raub is one of the few interior Malayan towns that has preserved buildings of the colonial era. Residential areas are clustered on nearby hillsides. The *golok,* a Malay knife, is made at Kampung Dong to the north. Pop. (1980) 22,907.

Raukumara Series, major division of Cretaceous rocks and time in New Zealand (the Cretaceous Period began about 136,000,000 years ago and lasted about 71,000,000 years). Rocks of the Raukumara Series overlie those of the Clarence Series and underlie those of the Mata Series; they consist of siltstones, sandstones, shales, conglomerates, and freshwater deposits. The Raukumara Series has been divided into three stages, representing shorter spans of time. The oldest stage is the Arowhanan, about 300 m (1,000 feet) of shales and mudstones. It is overlain by the Mangaotanean Stage, about 200 m (650 feet) of shales, which in turn is overlain by the Teratan Stage, about 600 m (2,000 feet) of shales, mudstones, sandstones, and conglomerates. The Raukumara Series is characterized by several species of the pelecypod (mollusk) genus *Inoceramus,* which enable the stages to be further subdivided into zones, much shorter spans of time.

Rauma, Swedish RAUMO, city, Turun ja Porin *lääni* (Turku ja Pori province), southwestern Finland. It lies along the Gulf of Bothnia north-northwest of Turku. Rauma was first noted in official records in 1442. In 1550, King Gustav I Vasa ordered the inhabitants to move to newly founded Helsinki, and Rauma was virtually abandoned for a number of years. In 1855, during the Crimean War, the town was attacked by the British. By the end of the 19th century, Rauma had developed Finland's largest fleet of sailing vessels to export timber. Notable buildings in Rauma include the church of the Holy Cross, which was part of a 15th-century Franciscan monastery, and the old town hall (1776), now a museum displaying Rauma lace, for which the city has been famous since the Middle Ages, and an impressive maritime collection. A major seaport, Rauma still exports large quantities of timber and wood products. It has one of the largest drydocks in Finland. Rauma is also a rail terminus, with connections to Pori and Tampere. Other industry includes tanneries and factories manufacturing shoes, cellulose, and munitions. Pop. (1985 est.) mun., 30,964.

Rauschenberg, Robert, original name MILTON RAUSCHENBERG (b. Oct. 22, 1925, Port Arthur, Texas, U.S.), American painter and graphic artist whose early works anticipated the Pop art movement.

Rauschenberg knew little about art until he visited an art museum in 1942 while serving in the U.S. Navy. He first studied painting at the Kansas City Art Institute in 1946, and the following year he entered the Académie Julian in Paris. During 1948–50 he studied at Black Mountain College, North Carolina, under Josef Albers and at the Art Students' League in New York City.

Rauschenberg's first exhibitions of paintings in the early 1950s comprised a series of all-white and all-black surfaces underlaid with wrinkled newspaper. In subsequent works he began to explore the possibilities of making art from the objects in his immediate surroundings. Influenced in part by the Dadaist and Cubist movements, he mastered the techniques of collage and assemblage, incorporating such three-dimensional objects as Coca-Cola bottles, traffic barricades, and stuffed birds into what he called combine paintings. One of his most famous works from this period, "The Bed" (1955), consists of the artist's own bed quilt and pillow covered with numerous layers of dribbled paint. Another, entitled "Monogram" (1959), features a stuffed Angora goat with a tire around its midsection.

In 1955 Rauschenberg became associated with the Merce Cunningham Dance Company, first as a designer of costumes and sets and later as a technical director. He also produced theatrical pieces in collaboration with composer John Cage.

From the late 1950s Rauschenberg experimented with the use of newspaper and magazine photographs in his paintings, devising a process using solvent to transfer images directly onto the canvas. Around 1962 he borrowed from Andy Warhol the silk-screen stencil technique for applying photographic images to large expanses of canvas, reinforcing the images and unifying them compositionally with broad strokes of paint reminiscent of Abstract Expressionist brushwork. These works draw on themes from modern American history and popular culture and are notable for their sophisticated compositions and the spatial relations of the objects depicted in them. During this period his painting became more purely graphic (*e.g.,* "Bicycle," 1963) than the earlier combines. In 1964 he was awarded first prize at the Venice Biennale art exhibition.

Rauschenberg's work in the 1970s and '80s showed a preoccupation with lithography and other printmaking techniques. He continued to incorporate imagery from the commercial print media but began to rely more heavily on his own photography. His book *Rauschenberg Photographs* was published in 1981.

Rauschenbusch, Walter (b. Oct. 4, 1861, Rochester, N.Y., U.S.—d. July 25, 1918, Rochester), clergyman and theology professor who led the Social Gospel movement in the United States.

The son of a Lutheran missionary to German immigrants in the United States, Rauschenbusch graduated from the Rochester Free Academy and then studied for four years in Germany, returning in 1883 to simultaneously finish at the University of Rochester and begin seminary training. On June 1, 1886, he was ordained a minister of the Second German Baptist Church in New York City, where he became aware of social problems from the personal distress he encountered in a depressed neighbourhood and from the mayoral campaign based on a social welfare platform by the economist Henry George. Even more influential were two young Baptist preachers, Leighton Williams and Nathaniel Schmidt. With Rauschenbusch they formed a Society of Jesus, later expanded into the Brotherhood of the Kingdom. *For the Right,* a monthly periodical "in the interests of the working people," was launched in November 1889 in an effort to reach the labouring classes and to aid in the formulation of a Christian Socialist program. Publication ceased in March 1891 when Rauschenbusch left for a year of study in Germany and a visit to England, where he became interested in Fabian Socialism. In 1897 he joined the faculty of Rochester Theological Seminary and in 1902 became professor of church history.

Upon the publication of *Christianity and the Social Crisis* (1907), Rauschenbusch gained recognition as the major spokesman of the Social Gospel movement in the United States. Considered both dynamic and compassionate, he always regarded himself as an evangelist seeking to win men to a "new birth" in Christ. At the same time, he believed that the Kingdom of God required social as well as individual salvation, and he demanded "a new order that would rest on the Christian principles of equal rights and democratic distribution of economic power." Among Rauschenbusch's other writings are *Prayers of the Social Awakening* (1910), *Christianizing the Social Order* (1912), and *A Theology for the Social Gospel* (1917).

Rauwolfia, also spelled RAUVOLFIA, genus of plants in the dogbane family (Apocynaceae), with about 85 species of shrubs and trees native to tropical areas of the world. The flowers are small and usually white or greenish white in colour.

Rauwolfia caffra
L.J. Watcham

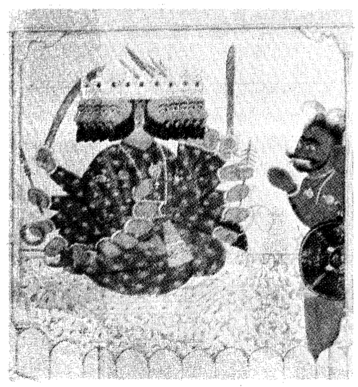
The roots of many species contain an alkaloid called reserpine, first found in the Indian species *R. serpentina* and used in the treatment of high blood pressure and as a tranquilizer. Some are grown as ornamentals.

Ravaisson-Mollien, Jean-Gaspard-Félix Lacher (b. Oct. 23, 1813, Namur, Fr.—d. May 18, 1900, Paris), French philosopher whose writings had an extensive influence in the Roman Catholic world during the 19th century. He was appointed inspector general

Ravaisson-Mollien, self-portrait, 1892; in the Louvre, Paris
Cliche Musees Nationaux, Paris

of public libraries (1839–46, 1846–53) and later served as inspector general of higher education, a post he held until 1880. His major philosophical works are: *Essai sur la métaphysique d'Aristote,* 2 vol. (1837–46; "Essay on the Metaphysics of Aristotle"), *De l'habitude* (1839; "On Customs"), and *La Philosophie en France au XIX^e^ siècle* (1868; "Philosophy in France During the 19th Century").

Rāvaṇa, in Hindu mythology, the 10-headed king of the demons (*rākṣasas*). His abduction of Sītā and eventual defeat by her husband Rāma are the central incidents of the popular epic the *Rāmāyaṇa* ("Romance of Rāma"). Rāvaṇa ruled in the kingdom of Laṅkā, believed by some to be modern Sri Lanka, from which he had expelled his brother Kubera. The Rām Līlā festival, an annual pageant popular particularly in northern India, is climaxed



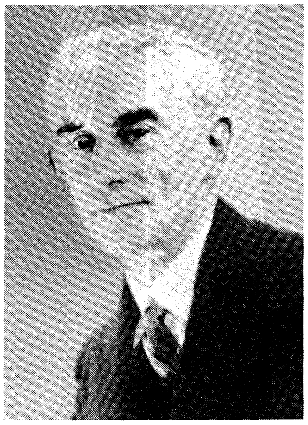
Rāvaṇa, the many-headed demon-king, detail from a Guler painting of the *Rāmāyaṇa*, *c.* 1720; in the Cleveland Museum of Art
By courtesy of the Cleveland Museum of Art, Ohio, gift of George P. Bickford

with the defeat of Rāvaṇa and the burning of huge effigies of the demons.

Rāvaṇa is described as having 10 heads and 20 arms and is vividly portrayed in Rajasthani painting of incidents of the *Rāmāyaṇa*, flying away with Sītā, fighting with Rāma, and sitting with his demon councillors. In sculpture, a favourite incident depicted is his shaking of Mt. Kailāsa. Śiva (Shiva) stopped him by pressing the mountain down with his toe and kept him imprisoned beneath for 1,000 years. Notable examples of this representation can be seen at Ellora in Mahārāshtra state, India. Glorification of Rāvaṇa is not unknown. According to a minor tradition, the demons of Vishnu are successive reincarnations of his attendants, who take this form in order to be near him.

In modern times, Tamil groups who oppose what they believe to be the political domination of southern India by the north view the story of Rāma as an example of the Aryan invasion of the south and express their sympathies for Rāvaṇa and against Rāma.

Ravel, (Joseph-)Maurice (b. March 7, 1875, Ciboure, Fr.—d. Dec. 28, 1937, Paris), French composer of Swiss-Basque descent, noted for his musical craftsmanship and perfection of form and style in such works as *Boléro* (1928),



Ravel
By courtesy of the French Embassy, Press and Information Division, New York

Pavane pour une infante défunte (1899; *Pavane for a Dead Princess*), *Rapsodie espagnole* (1907), the ballet *Daphnis et Chloé* (first performed 1912), and the opera *L'Enfant et les sortilèges* (1925; *The Child and the Enchantments*).

Ravel was born in a village near Saint-Jean-de-Luz, Fr., of a Swiss father and a Basque mother. His family background was an artistic and cultivated one, and the young Maurice received every encouragement from his father when his talent for music became apparent at an early age. In 1889, at 14, he entered the Paris Conservatoire, where he remained until 1905. During this period he composed some of his best known works, including the *Pavane pour une infante défunte* (*Pavane for a Dead Princess*), the *Sonatine* for piano, and the *String Quartet*. All these works, especially the two latter, show the astonishing early perfection of style and craftsmanship that are the hallmarks of Ravel's entire oeuvre. He is one of the rare composers whose early works seem scarcely less mature than those of his maturity. Indeed, his failure at the Conservatoire, after three attempts, to win the coveted Prix de Rome for composition (the works he submitted were judged too "advanced" by ultraconservative members of the jury) caused something of a scandal. Indignant protests were published, and liberal-minded musicians and writers, including the musicologist and novelist Romain Rolland, supported Ravel. As a result, the director of the Conservatoire, Théodore Dubois, was forced to resign, and his place was taken by the composer Gabriel Fauré, with whom Ravel had studied composition.

Ravel was in no sense a revolutionary musician. He was for the most part content to work within the established formal and harmonic conventions of his day, still firmly rooted in tonality—*i.e.,* the organization of music around focal tones. Yet, so very personal and individual was his adaptation and manipulation of the traditional musical idiom that it would be true to say he forged for himself a language of his own that bears the stamp of his personality as unmistakably as any work of Bach or Chopin. While his melodies are almost always modal (*i.e.,* based not on the conventional Western diatonic scale but on the old Greek Phrygian and Dorian modes), his harmonies derive their often somewhat acid flavour from his fondness for "added" notes and unresolved appoggiaturas, or notes extraneous to the chord that are allowed to remain harmonically unresolved. He enriched the literature of the piano by a series of masterworks, ranging from the early *Jeux d'eau* (completed 1901) and the *Miroirs* of 1905 to the formidable *Gaspard de la nuit* (1908), *Le Tombeau de Couperin* (1917), and the two piano concerti (1931). Of his purely orchestral works, the *Rapsodie espagnole* and *Boléro* are the best known and reveal his consummate mastery of the art of instrumentation. But perhaps the highlights of his career were his collaboration with the Russian impresario Sergey Diaghilev, for whose Ballets Russes he composed the masterpiece *Daphnis et Chloé,* and with the French writer Colette, who was the librettist of his best known opera, *L'Enfant et les sortilèges.* The latter work gave Ravel an opportunity of doing ingenious and amusing things with the animals and inanimate objects that come to life in this tale of bewitchment and magic in which a naughty child is involved. His only other operatic venture had been his brilliantly satirical *L'Heure espagnole* (first performed 1911). As a songwriter Ravel achieved great distinction with his imaginative *Histoires naturelles, Trois poèmes de Stéphane Mallarmé,* and *Chansons madécasses.*

Ravel's life was in the main uneventful. He never married, and, though he enjoyed the society of a few chosen friends, he lived the life of a semirecluse at his country retreat at Montfort-L'Amaury, in the forest of Rambouillet, near Paris. He served in World War I for a short time as a truck driver at the front, but the strain was too great for his fragile constitution, and he was discharged from the army in 1917.

In 1928 Ravel embarked on a four months' tour of Canada and the United States and in the same year visited England to receive an honorary degree of doctor of music from Oxford. That year also saw the creation of *Boléro* in its original form as a ballet, with Ida Rubinstein in the principal role.

The last five years of Ravel's life were clouded by aphasia, which not only prevented him from writing another note of music but also deprived him of the power of speech and made it impossible for him even to sign his name. Perhaps the real tragedy of his condition was that his musical imagination remained as active as ever. An operation to relieve the obstruction of a blood vessel that supplies the brain was unsuccessful. Ravel was buried in the cemetery of Levallois, a Paris suburb in which he had lived, in the presence of Stravinsky and other distinguished musicians and composers.

For Ravel, music was a kind of ritual, having its own laws, to be conducted behind high walls, sealed off from the outside world, and impenetrable to unauthorized intruders. When his Russian contemporary Igor Stravinsky compared Ravel to "the most perfect of Swiss watchmakers," he was in fact extolling those qualities of intricacy and precision to which he himself attached so much importance. (R.My.)

MAJOR WORKS. *Stage works.* Ballet: *Daphnis et Chloé* (first performed 1912; also two suites for orchestra); *La Valse* (1920); *Boléro* (1928; also arranged for piano and piano, four hands). Opera: *L'Heure espagnole* (1911); *L'Enfant et les sortilèges* (1925).

Orchestral works. Orchestra alone: *Shéhérazade,* overture (1898); *Pavane pour une infante défunte* (completed 1899); *Rapsodie espagnole* (1907). Solo instrument and orchestra: *Tzigane,* for violin and piano or orchestra (1924); *Piano Concerto in G Major* (1931); *Piano Concerto in D Major for Left Hand* (1931).

Chamber music. *String Quartet* (1903); *Introduction et allegro,* for solo harp, string quartet, flute, and clarinet (1905); *Trio for Violin, Cello and Piano* (1914); *Sonata for Violin and Cello* (1922); *Sonata for Violin and Piano* (1927). Piano music: *Jeux d'eau,* for piano solo (1901); *Miroirs* (1905, basis for a later ballet); *Sonatine* (1905); *Ma mère l'Oye,* piano, four hands (1908, later orchestrated and made into a ballet); *Gaspard de la nuit* (1908); *Le Tombeau de Couperin* (1917, later orchestrated); *Valses, nobles et sentimentales* (1911, later orchestrated and made into a ballet).

Vocal music. Song cycles: *Shéhérazade,* for voice and piano or orchestra (1903); *Histoires naturelles,* for voice and piano (1906); *Trois poèmes de Stéphane Mallarmé,* for voice, piano, string quartet, two flutes, and two clarinets (1913); *Chansons madécasses,* for voice, piano, cello, and flute (1926); *Don Quichotte à Dulcinée,* for voice and piano (1932).

Orchestrations of works by other composers. *Menuet pompeux* (1918), from *Dix pièces pittoresques* (1880) by Emmanuel Chabrier; *Pictures from an Exhibition* (1922), a piano suite by Modest Mussorgsky.

BIBLIOGRAPHY. Biographical works, most of which also contain lists of Ravel's compositions, include Rollo H. Myers, *Ravel: Life and Works* (1960, reprinted 1973); Vladimir Jankélévitch, *Ravel* (1959, reprinted 1976); Norman Demuth, *Ravel* (1947, reprinted 1979); Victor I. Seroff, *Maurice Ravel* (1953, reprinted 1970); and Roger Nichols, *Ravel* (1977), and *Ravel Remembered* (1987). Arbie Orenstein (ed.), *A Ravel Reader: Correspondence, Articles, Interviews* (1989), is an informative collection. Burnett James, *Ravel, His Life and Times* (1983), explores the works and social background of the composer. Other analyses of Ravel's music include H.H. Stuckenschmidt, *Maurice Ravel: Variations of His Life and Work* (1968); Laurence Davies, *Ravel Orchestral Music* (1970); Marguerite Long, *At the Piano with Ravel* (1973); Vlado Perlemuter and Hélène Jourdan-Morhange, *Ravel According to Ravel* (1988); and Arbie Orenstein, *Ravel: Man and Musician* (1975).

Consult the INDEX *first*

raven, any of several species of heavy-billed, dark birds, larger than crows, of the genus

Common raven (*Corvus corax*)
E. Breeze-Jones—Bruce Coleman Ltd.

Corvus, family Corvidae (*q.v.*). The common raven (*C. corax*) is the biggest passerine (member of the order Passeriformes) bird: it reaches a length of as much as 66 cm (26 inches) and has a wingspan of more than 1.3 m (4 feet). (Some magpies and the lyrebird exceed the raven in length but are smaller bodied.) Although like the crow in appearance, the raven has a much heavier bill and shaggier plumage, especially around the throat. The raven's lustrous feathers have a blue or purplish iridescence. In the white-necked raven (*C. cryptoleucus*) of western North America, the bases of the neck feathers are white. Other species of ravens—some with white or brown markings—occur in Africa, southern Asia, and North America.

Formerly abundant throughout the Northern Hemisphere, the raven is now restricted to the wilder, undisturbed parts of its range. It is among the hardiest of birds, inhabiting the northern tundra and coniferous forests as well as barren mountains and desert. It is keen-sighted and notably wary. Long before it was immortalized in Edgar Allen Poe's poem "The Raven," the common raven was a near-universal symbol of dark prophecy—of death, pestilence, and disease, though its cleverness and fearless habits also won it a degree of admiration, as evidenced in its noble heraldic roles in the mythology of some peoples.

Like other corvids, the raven is a noisy, aggressive omnivore whose diet includes rodents, insects, grain, and birds' eggs. In winter, especially, it is a scavenger and feeds on carrion, dead fish, and refuse. The raven has a large and varied vocabulary, including guttural croaks, gurglings, and a sharp metallic "tok." The common raven usually is solitary but may feed in small flocks. The raven's spectacular courtship flight involves soaring and all kinds of aerial acrobatics. The birds' crudely made nest of coarse sticks, usually lined with hair or shredded bark, is a bulky structure up to 1.5 m (5 feet) in diameter that may be built on a cliff or the top of a large tree. The young remain in the nest for about a month. If captured while a nestling, a raven may make an interesting pet capable of learning to mimic a few words. One captive bird on record lived 69 years.

Raven, Simon (Arthur Noël) (b. Dec. 28, 1927, Leicester, Leicestershire, Eng.), English novelist, playwright, and journalist, known particularly for his portrayal of the mid-20th-century upper classes of English society in *Alms for Oblivion* and for television dramatizations of works by Aldous Huxley and Anthony Trollope.

Raven's most important work is the novel sequence *Alms for Oblivion,* which consists of *The Rich Pay Late* (1964), *Friends in Low Places* (1965), *The Sabre Squadron* (1966), *Fielding Gray* (1967), *The Judas Boy* (1968), *Places Where They Sing* (1970), *Sound the Retreat* (1971), *Come Like Shadows* (1972), *Bring Forth the Body* (1974), *The Survivors* (1976), *The Roses of Picardie* (1980), and *An Inch of Fortune* (1980). His television dramatizations of the 20th-century novelist Aldous Huxley's *Point Counter Point* (shown 1968) and the 19th-century English novelist Anthony Trollope's *The Way We Live Now* (shown 1969) and *The Pallisers* (shown 1974), and *Edward and Mrs. Simpson,* based on Frances Donaldson's *Edward VIII* (shown 1978), also reached wide audiences.

Raven was educated at Charterhouse, Surrey, and King's College, Cambridge. Among his other writings is a long essay, *The English Gentleman* (1961), and an autobiography, *Shadows on the Grass* (1982).

Raven cycle, collection of oral trickster-transformer tales popular mainly among the Indians of the Northwest Pacific Coast from Alaska to British Columbia. The tales feature Raven as a culture hero, an alternately clever and stupid bird-human whose voracious appetite and eroticism give rise to violent and amorous adventures.

The cycle begins with a boy's birth and relates early adventures that include the seduction of his aunt (sometimes replaced by the daughter of the Sky Chief) and his flight to the sky to escape the ensuing flood. Raven, his child, falls to earth, where he is adopted by a chief; as an adult he transforms the earth from a dark and arid land inhabited by a variety of ferocious monsters into a land of rivers, lakes, and mountains inhabited by animals and human beings. He later travels about, changing aspects of the physical environment into their present form, often through deception. The dozens of tales that result include Raven's impersonation of a woman to embarrass a man; his killing of a monster by putting hot stones down his throat; and his role as the "bungling host," a common motif of a guest who is fed by an animal wizard, then tries to imitate him in producing food, but, lacking his magic, fails ignominiously. In other geographic areas, Mink, Blue Jay, or Fox replace Raven as the hero of similar tales.

Ravenna, capital of the *provincia* of Ravenna, Emilia-Romagna *regione,* northeastern Italy. The city is on a low-lying plain near the confluence of the Ronco and Montone rivers, 6 miles (10 km) inland from the Adriatic Sea, with which it is connected by a canal. Ravenna was important in history as the capital of the Western Roman Empire in the 5th century AD and later (6th–8th century) of Ostrogothic and Byzantine Italy.

In ancient times the Adriatic lay nearer Ravenna, which rested on coastal lagoons that later silted up. The earliest inhabitants

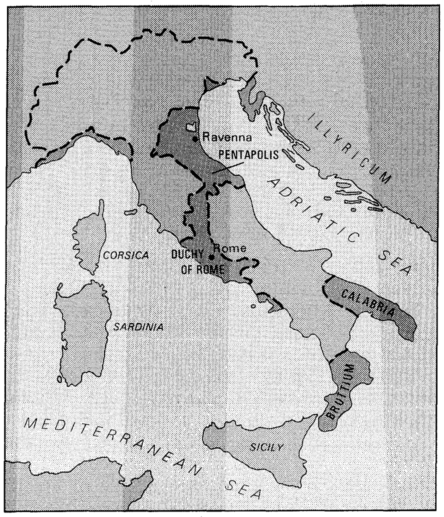
Mausoleum of Theodoric, *c.* 520, at Ravenna, Italy
SCALA—Art Resource, New York City

of Ravenna were probably Italic peoples who moved southward from Aquileia about 1400 BC. According to tradition, it was occupied by the Etruscans and later by the Gauls. It came under Roman control in 191 BC and soon became important because it possessed one of the few good port sites on the northeastern coast of Italy. The Roman emperor Augustus built the port of Classis, about 3 miles (5 km) from the city, and by the 1st century BC Ravenna had become the base for Rome's naval fleet in the Adriatic Sea.

In AD 402 the danger of barbarian invasions compelled the Western Roman emperor Honorius to move his court from Rome to Ravenna. Ravenna was henceforth the capital of the Western Roman Empire until its dissolution in 476. As such, Ravenna was embellished with magnificent monuments. The city was also raised to the status of an archbishopric in 438. With the fall of the Western Empire in 476, it became the capital of the first barbarian ruler of Italy, Odoacer (reigned 476–493), who in turn surrendered it to the Ostrogothic king Theodoric (reigned 493–526) in 493. Theodoric made Ravenna the capital of the Ostrogothic kingdom, but in 540 Ravenna was occupied by the great Byzantine general Belisarius and was subsequently made an imperial exarchate.

As the capital of the Exarchate of Ravenna, the city was the administrative centre of Byzantine government in Italy. In the early 7th century the area administered included a diagonal strip of territory extending from the area north of Ravenna to south of Rome, the southern extremities of the peninsula, and various coastal enclaves. The exarchate was broken up by revolts and invasions after 726. About 751 Ravenna itself fell to the Lombards, who in turn lost it to the Franks in 754 under the leadership of Pepin III the Short. He gave Ravenna to the pope in 757; the local archbishops, however, retained almost princely powers.

A short-lived bid for independence on Ravenna's part in the mid-12th century was followed in the 14th and early 15th centuries by the rule of the da Polenta family, a noble house of the Romagna region. In 1441 Venice was able to establish direct rule over Ravenna, but in 1509 the city was returned to the Papal States. In 1512, following the Battle of Ravenna, the city was seized by the French but was soon recaptured. Thereafter it was subject to papal rule with only minor interruptions. In 1859 Ravenna proclaimed its union with the kingdom of Sardinia, which became the kingdom of Italy in 1861.



The Exarchate of Ravenna in the 7th century AD
Adapted from *Enciclopedia Italiana di Scienze, Lettere ed Arti*, vol. 19

Ravenna is now an agricultural and industrial city. Its principal enterprises include petroleum and natural-gas refining, the production of fertilizers and synthetic rubber, and the processing of oilseeds.

Nothing remains of the ancient Roman structures in Ravenna or of its harbour at Classis. The fame of Ravenna rests instead on the quality and quantity of its 5th–8th-century Christian monuments. As the capital city of the Western Roman Empire for 250 years and a major port of entry for the Eastern (Byzantine) Empire, Ravenna reflects in its art and architecture a fusion of Roman architectural forms with Byzantine mosaics and other decoration.

One of the earliest of Ravenna's extant monuments is the mausoleum of Galla Placidia, built in the 5th century AD by Galla Placidia, the sister of the emperor Honorius. Its building technique is Western, but its Latin cross layout, with barrel vaults and a central dome, has Eastern prototypes. The entire upper surface of the mausoleum's interior is covered with mosaics on a blue ground.

Of the monuments dating from the rule of the Arian Ostrogothic king Theodoric (d. 526), the most impressive is his mausoleum. This two-storied structure is capped by a single-slab limestone dome that is 36 feet (11 m) in diameter. The Basilica of Sant'Apollinare Nuovo was also erected by Theodoric. It was originally an Arian cathedral but became a Catholic church in 570. This church contains magnificent mosaics depicting the teachings, miracles, Passion, and Resurrection of Christ; these are among the oldest such representations in existence and are of considerable scholarly interest. The church also has finely executed mosaics depicting processions of male and female saints.

The Church of San Vitale, the masterpiece of Byzantine art in Ravenna, was completed during the reign of the emperor Justinian. The church was begun by Bishop Ecclesius under the Ostrogothic queen Amalasuntha (d. 535) and was consecrated in 547. This octagonal church, built of marble and capped by a lofty terra-cotta dome, is one of the finest examples of Byzantine architecture and decoration in western Europe. The celebrated mosaics in the church's presbytery are strongly influenced by similar work at Constantinople. They depict Old and New Testament figures, as well as contemporary Byzantine rulers and Catholic ecclesiastics.

Ravenna's other surviving monuments include the following. The Basilica of Sant'Apollinare in Classe, begun in 535 and consecrated in 549, has a distinctive round campanile (870–878) that is the earliest example in Italy of the decorative use of maiolica. This church also has impressive capitals in its nave and a fine apse mosaic depicting the Transfiguration of Christ. The Church of St. Francis (San Francesco) has a small annex containing the tomb of the Italian poet Dante Alighieri. The Church of St. John the Evangelist (San Giovanni Evangelista) was almost totally destroyed in World War II and has since been heavily restored. The oldest church in Ravenna, the cathedral, was originally built in 370–390 but was destroyed in 1733 and immediately rebuilt. Adjoining the cathedral is an octagonal baptistery containing fine Byzantine mosaics from the 5th century.

Ravenna's National Museum of Antiquities, housed in the cloisters of the Church of San Vitale, has an important collection of classical and Early Christian antiquities, including inscriptions, icons, ceramics, ivories and other sculptures, and sarcophagi. The Church of Santa Maria in Porto Fuori, built after 1069, was, until its destruction in World War II, the only important surviving building of the later European Middle Ages in Ravenna. From the era of Venetian dominion there remain various palaces and a fortress, the Rocca Brancaleona. Pop. (1988 est.) mun., 136,324.

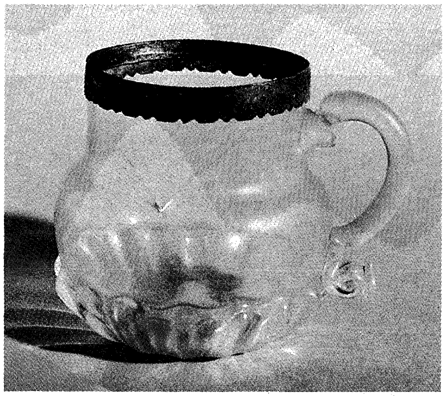
Ravensbrück, German Nazi concentration camp for women (*Frauenlager*), located in the midst of swampland close by the village of Ravensbrück near the resort town of Fürstenberg, 50 miles (80 km) north of Berlin. Set up in 1938, it was designed to accommodate 6,000 inmates but, by the end of World War II, was housing more than 36,000. About 50,000 women died at Ravensbrück, from overwork at slave labour and from harsh, crowded living conditions. Some inmates were used in medical experiments: *e.g.,* in 1942–43, selected inmates were infected with gas gangrene or bacterial inflammations and given a series of "cures" that often resulted in deaths or crippling; in 1944 inmates were subjected to experimental bone transplants and amputations.

Ravensburg, city, Baden-Württemberg *Land* (state), southwestern Germany. It lies along the Schussen River, just north of Lake Constance (Bodensee). Founded and chartered in the 12th century near the Guelphs' ancestral castle (where Henry the Lion was born) on the Veitsburg, it passed to the Hohenstaufens in 1180. A free city of the Holy Roman Empire from 1276 to 1802, it had a flourishing trading company in the 14th and 15th centuries. Parts of the city's old fortifications remain, including the wall tower Mehlsack (1350). The city's medieval buildings include the town hall, the weighing house, the parish church, and St. Jodok's Church. Textiles, paper, timber, and machinery are produced, and there is machine and textile manufacturing. Pop. (1989 est.) 44,146.

Ravenscroft, George (b. 1618—d. 1681), English glassmaker, developer of flint glass, a heavy, blown type (shaped by blowing when in a plastic state) characterized by both brilliance and dark shadow.

Ravenscroft was commissioned by the Worshipful Company of Glass Sellers to experiment with native raw materials for glass manufacture, because the members, dissatisfied with the quality of the glassware available, hoped to make England independent of foreign sources for both raw materials and finished glass.

In 1674 Ravenscroft obtained a patent for a glass with the desirable quality of a resemblance to rock crystal; this glass was made from a formula including transparent, black flint (a hard mineral of the quartz family), which he called "flint crystalline." Finding that his pieces tended to lose transparency within several months after manufacture, he added lead, usually in the form of red lead, producing a heavier, denser glass with darker colour and greatly increased refractive power, distinguished by the resonant ring produced when hollow glassware was flicked with the thumb and forefinger. He marked pieces made by the later method with a small glass seal impressed with the raven's head borne on his family coat of arms.



Glass mug by George Ravenscroft, *c.* 1674–80; in the Victoria and Albert Museum, London
By courtesy of the Victoria and Albert Museum, London

The new, solid, durable glass gradually achieved a greater market than the more fragile Venetian type, and new techniques, more suitable to the new glass, began to replace methods developed for Venetian glass. Ravenscroft died within a few days after the expiration of his seven-year patent, and other glassmakers immediately began to manufacture flint glass.

Ravenscroft, Thomas (b. *c.* 1583, Sussex?, Eng.—d. *c.* 1633, London?), composer remembered for his social songs and his collection of psalm settings.

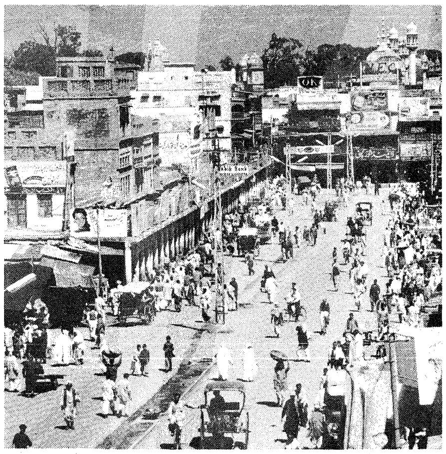
In 1607 he took his bachelor of music degree at the University of Cambridge. From 1618 to 1622 he was music master at Christ's Hospital. Ravenscroft's *Whole Booke of Psalmes* (1621), comprising more than 100 metrical psalm tunes, proved extremely popular. He harmonized about half the melodies, commissioning or compiling the rest. Several of his versions are still in use.

His secular collections are full of interest for the historian of popular music. *Pammelia* (1609), containing 100 catches and rounds, was the first anthology of its kind; *Deuteromelia* (1609) has 31 items, including "Three blind mice"; *Melismata* (1611) has 23 songs for the "court, city, and country humours"; and his theoretical work, the *Brief Discourse* (1614), appends further characteristic pieces. Ravenscroft aimed to please a middle-class lay public very different from the educated elite who enjoyed the madrigal or the air, or ayre.

Rāvi River, in northwestern India and northeastern Pakistan, one of the rivers that give the Punjab (meaning "five rivers") its name. It rises in the Himalayas in Himāchal Pradesh state, India, and flows west-northwest past Chamba, turning southwest at the boundary of Jammu and Kashmir. The river then flows to the Pakistani border and along it for more than 50 miles (80 km) before entering Pakistani Punjab. It flows past Lahore for a considerable distance and turns west near Kamālia, emptying into the Chenāb River south of Ahmadpur Siāl after a course of about 450 miles (725 km).

The Rāvi's waters are used for irrigating large areas of land along its course. The Upper Bāri Doāb Canal, with headworks at Mādhopur at the northern tip of Indian Punjab, was completed in 1878–79; it irrigates a large area east of the Rāvi, and its distributary canals extend into Pakistan. The two nations had frequent disputes over the water before reaching an agreement in 1960. The Lower Bāri Doāb Canal, completed in 1917, lies entirely in Pakistan.

Rāwalpindi, city, Punjab province, northern Pakistan. It was the capital of Pakistan from 1959 to 1969. The city lies on the Potwar Plateau and is situated 9 miles (14 km) southwest of Islāmābād, the national capital.



A business district of Rāwalpindi, Pak.
Art Resource—EB Inc.

Rāwalpindi ("Village of Rāwals") occupies the site of an old village inhabited by the Rāwals, a group of yogis (ascetics). Certain ruins on the site are identified with the ancient city Gājipur, or Gajnīpur, the capital of the Bhatti tribe during the pre-Christian era. Destroyed during the Mongol invasion (14th century AD), the town was restored by the Gakhar chief Jhanda Khān, who gave it its present name. It grew rapidly in importance when Milka Singh, a Sikh adventurer, occupied it in 1765 and invited settlers from the Jhelum and Shāhpur areas to settle there. It was annexed by the British in 1849.

The Leh Watercourse separates the city from the cantonment (permanent military station), and a satellite town has been built on the Murree Road. Rāwalpindi is an important administrative, commercial, and industrial centre. Its industries include locomotive works, gasworks, an oil refinery, sawmills, an iron foundry, a brewery, and cotton, hosiery, and textile mills; it also produces shoes, leather goods, pottery, newsprint, and tents. An annual horse fair is held in April. Rāwalpindi was incorporated as a municipality in 1867 and contains Ayub National Park, Liaqat Gardens, a polytechnic school, a police-training institute, an armed forces medical college, and several colleges affiliated with the University of the Punjab. It is also the Pakistan army headquarters.

Rāwalpindi is the starting point of the route into Kashmir and is connected by the Grand Trunk Road, rail, and air with the cities of Peshāwar and Lahore and by rail and air with Karāchi.

Wheat, barley, corn (maize), and millet are the chief crops grown in the surrounding area. The nearby Rāwal Dam, on the Kurang River, completed in 1961–62, provides Rāwalpindi and Islāmābād with water.

In ancient times the locality formed part of Gandhāra and was included in the Achaemenid Persian Empire. The ancient city of Taxila has been identified with ruins located near Shāhderi, northwest of Rāwalpindi. Mānkiāl, south of Rāwalpindi, is a Buddhist stupa site (3rd century BC). Pop. (1981) city, 794,843; (1981 prelim.) metropolitan area, 1,299,000.

Rawdon-Hastings, Francis: *see* Hastings, Francis Rawdon-Hastings, 1st Marquess of.

rāwī (English: "reciter"), in Arabic literature, professional reciter of poetry. The *rāwīs* preserved pre-Islāmic poetry in oral tradition until it was written down in the 8th century.

One or more *rāwīs* attached themselves to a particular poet and learned his works by heart. They then recited and explained the poet's verse before a wider audience. Such an attachment often became an apprenticeship, and, after mastering the poetic technique, some *rāwīs* became poets in their own right. The *rāwīs*, with reputations for phenomenal memories, eventually came to form an independent class. When the great philological schools of Basra and al-Kūfah in Iraq were formed in the 8th century, the *rāwīs* were sought out by scholars as preservers of an ancient language and poetic style that was falling into disuse.

The method of preserving poetry through *rāwīs*, relying as it did on memory, however, was imperfect, and the poetry of the pre-Islāmic period was subject to mutations, omissions, unauthorized additions, and the transposition of lines and verses. Early poems recorded in more than one version show great textual divergences, and parts of different poems are often found pieced together.

Some of the most famous *rāwīs*, especially two who first wrote down poems, Ḥammād ar-Rāwiyah and Khalaf al-Aḥmar, are thought to have dealt freely with their originals and have even been called clever forgers. It is thus necessary to consider carefully the evidence for authenticity of any verse attributed to a particular pre-Islāmic poet.

Rawlings, Jerry J(ohn) (b. June 22, 1947, Accra, Ghana), military and political leader in Ghana who twice (1979, 1981) overthrew the government and seized power. His second period of rule (from 1981) afforded Ghana political stability and competent economic management.

Rawlings was the son of a Scottish father and a Ghanaian mother. He was educated at Achimoto College and the military academy at Teshie. He was commissioned a second lieutenant in the Ghanaian Air Force in 1969 and became a flight lieutenant and expert pilot, skilled in aerobatics. In June 1979 Rawlings and other junior officers led a successful military coup with the purported aim of purging the military and public life of widespread corruption. He and his Armed Forces Revolutionary Council ruled for 112 days, during which time the former heads of state, General Ignatius Kutu Acheampong and General Fred W.K. Akuffo, were tried and executed. Rawlings then yielded power to a freely elected civilian president, Hilla Limann, who promptly retired Rawlings from the army.

Rawlings continued to be a popular figure, however, drawing big crowds at public rallies. After two years of weak civilian rule which saw the further deterioration of Ghana's economy, Rawlings on Dec. 31, 1981, overthrew Limann's government, accusing it of leading the nation "down to total economic ruin." Rawlings established a Provisional National Defense Council as the new government and imprisoned Limann and some 200 other politicians. "Peoples' Defense Committees" were set up in neighbourhoods, as were workers' councils to monitor production in factories. When the failure of these and other populist measures had become clear by 1983, Rawlings reversed course and adopted conservative economic policies, including the dropping of subsidies and price controls in order to reduce inflation, the privatization of many state-owned companies, and currency devaluations in order to stimulate exports. These free-market measures sharply revived Ghana's economy, which by the early 1990s had one of the highest growth rates in Africa.

Rawlings, Marjorie Kinnan (b. Aug. 8, 1896, Washington, D.C., U.S.—d. Dec. 14, 1953, St. Augustine, Fla.), American short-story writer and novelist who founded a regional literature of backwoods Florida.

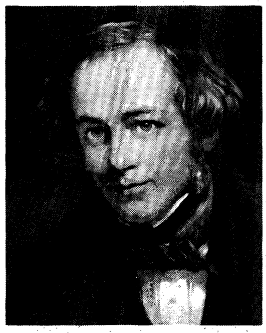
After graduating from the University of Wisconsin in 1918, Rawlings sought writing experience as a reporter and worked successively for the Louisville *Courier-Journal,* the *Rochester Journal,* and the United Feature Syndicate. She worked as a journalist for 10 years, meanwhile trying, unsuccessfully, to write stories that would sell. While visiting Florida in 1926, she was enchanted by the landscape, and in 1928 she moved to Cross Creek, Hawthorn, Fla., where she devoted herself to writing fiction. She finally succeeded in selling her writing, and her story "Gal Young Un" received the O. Henry Memorial Award in 1933. Her first novel was *South Moon Under* (1933), followed by *Golden Apples* (1935) and the book for which she is best known, *The Yearling* (1938), which won the Pulitzer Prize for fiction in 1939.

Rawlings took her material from the people and land around her, and her books are less fiction than vivid factual reporting. Rich in atmosphere, her work describes the Florida natives and their lack of despair in the face of perpetual disappointment. Rawlings' books have been widely acclaimed for their magical description of the landscape, a quality that is evident in the minor classic *The Yearling.*

Other works include *Cross Creek* (1942), a mystical, autobiographical book describing her discovery of her Florida home, and *The Sojourner* (1953).

Rawlins, city, seat of Carbon county, south-central Wyoming, U.S. It lies just east of the Continental Divide at an elevation of 6,755 feet (2,059 m). Founded in 1868 when the Union Pacific Railroad arrived, it was first named Rawlins Springs for General John A. Rawlins, who discovered a freshwater spring there. In 1874 "Rawlins Red" pigment from the local paint mines was sent 2,000 miles (3220 km) to be used on the Brooklyn Bridge. Rawlins has since become a railroad division point, a supply centre for a ranching, lumbering, and coal-mining area, and a tourist rest stop for nearby national forests. In the 1950s it became an important shipping point for uranium from the Gas Hills area to the north. The state penitentiary is there and an oil refinery is 6 miles (10 km) east at Sinclair. Inc. 1886. Pop. (1986 est.) 10,680.

Rawlinson, Sir Henry Creswicke (b. April 11, 1810, Chadlington, Oxfordshire, Eng.—d. March 5, 1895, London), British army officer and Orientalist who deciphered the Old Persian portion of the trilingual cuneiform inscription of Darius I the Great at Bīsitūn, Iran. His success provided the key to the deciphering, by himself and others, of Mesopotamian cuneiform script, a feat that greatly expanded knowledge of the ancient Middle East.



Rawlinson, detail of an engraving by Samuel Cousins after a painting by Henry Wyndham Phillips, 1850

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

In 1827 Rawlinson went to India as a British East India Company cadet, and in 1833 he and other British officers were sent to Iran to reorganize the shah's army. There he became keenly interested in Persian antiquities, and deciphering the cuneiform inscriptions at Bīsitūn became his goal. After two years of work, Rawlinson published his translations of the first two paragraphs of the inscription (1837). Required to leave the country because of friction between Iran and Britain, Rawlinson was nevertheless able to return in 1844 to obtain impressions of the Babylonian script. As a result, his *Persian Cuneiform Inscription at Behistun* appeared (1846–51); it contained a complete translation, analysis of the grammar, and notes—altogether an achievement yielding valuable information on the history of ancient Persia and its rulers. With other scholars he succeeded in deciphering the Mesopotamian cuneiform script by 1857. The way to understanding ancient Babylonia and Assyria and much of biblical history now lay open.

Meanwhile Rawlinson had become British consul at Baghdad (1843) and had given his collection of antiquities to the British Museum (1849–51). He became consul general at Baghdad (1851) and succeeded the archaeologist Henry Austen Layard in the work of obtaining ancient sculptures for the museum. On resigning his post with the British East India Company (1855), he was knighted and made a crown director of the company. He sat in Parliament (1858 and 1865–68) and was minister to the Iranian court at Tehrān (1859). His other writings include *A Commentary on the Cuneiform Inscriptions of Babylonia and Assyria* (1850) and *Outline of the History of Assyria* (1852).

Rawls, Betsy, byname of ELIZABETH EARLE RAWLS (b. May 4, 1928, Spartanburg, S.C., U.S.), American golfer who set a record by winning the U.S. Women's Open four times (tied by Mickey Wright in 1964).

Rawls began playing golf at 17, capping her amateur career by placing second in the 1950 U.S. Women's Open behind the all-time great Babe Zaharias. Turning professional in 1951, Rawls won that year's Open, repeating her victory in 1953, 1957, and 1960. Other major professional achievements included winning the Eastern and Western Women's Open twice each, the Ladies' Professional Golfers' Association (LPGA) tournament twice, and the Tampa Women's Open four times.

Her 55 LPGA tournament wins were the third highest at the time of her retirement from active play. Rawls served as LPGA president from 1961 to 1962 and as tournament director in 1975. In 1952 and 1959 she won the most money on the LPGA tour, with her earnings in the latter year setting a record at that time.

Rawson, town, capital of Chubut province, southern Argentina. It lies along the Chubut River near the latter's mouth, about 5 miles (8 km) upriver from the Atlantic coast. It was founded in 1865 by Welsh settlers and named after Guillermo Rawson (1821–90), then Argentine minister of the interior. Although the port has declined in importance, there are small installations for fisheries. A beach is located nearby. Pop. (1980) 12,981.

Where the same name may denote a person, place, or thing, the articles will be found in that order

Rawsthorne, Alan (b. May 2, 1905, Haslingden, Lancashire, Eng.—d. July 24, 1971, Cambridge, Cambridgeshire), English composer best known for his finely structured orchestral and chamber music written in a restrained, unostentatious style.

Rawsthorne studied at the Royal Manchester College of Music (1926–30) and in Berlin (1930–31) with Egon Petri. His early music with its pervasive linear counterpoint shows the influence of Paul Hindemith, and his style retained a consistent contrapuntal basis combined with incisive rhythms, melodic fluidity, and a strong feeling for tonal centres. Rawsthorne's works include three symphonies, eight concerti, and the vocal *Medieval Diptych* (1962) and *Carmen vitale* (1963).

Ray (Iran): *see* Rayy.

ray, any of the cartilaginous fishes of the order Batoidei, related to sharks and placed with them in the class Chondrichthyes (or Selachii). The order includes 300 to 350 species.

Rays are distinguished from sharks by a flattened, disklike body, with the five gill openings and the mouth generally located on the underside. Rays are further distinguished from sharks by their greatly enlarged, winglike pectoral fins, which extend forward along the sides of the head above the gill openings. Many rays swim and breathe differently from sharks, propelling themselves with their pectoral fins and taking in water for respiration through large openings (spiracles) on the upper surface of the head, rather than through the mouth. The ray's tail is generally long and slender and in many species bears one or more sharp, saw-edged, venomous spines that can be used to inflict painful wounds.

Rays are predominantly marine and are found in all oceans. Many are slow-moving bottom dwellers. Devil rays feed on plankton and small animals; others take various fishes and invertebrates, sometimes damaging commercially valuable shellfish beds. Other than skates, most or possibly all rays bear living young. Fertilization is internal, the male introducing sperm into the female by means of special copulatory organs (claspers) that are the modified edges of the pelvic fins.

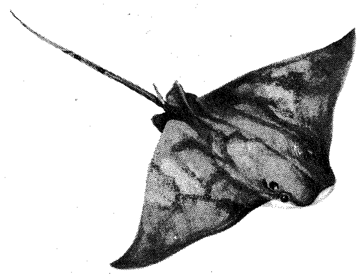
Rays can be classified into the following groups: electric rays, sawfishes, skates, and various families of rays that have slender, whiplike tails equipped with spines and that are all-inclusively called stingrays, or whip-tailed rays.

The electric rays (suborder Torpedinoidei) are distinguished by large paired electric organs between the pectoral fins and the head, with which they can give powerful shocks either for defensive purposes or to kill prey. The electric rays have a smooth and naked skin; the head and trunk with the pectoral fins form a circular disk, and the tail is short and stout. About 20 species are known to inhabit warm seas, with some reaching a weight of 200 pounds (90 kg).

All other types of rays, which lack electric organs, generally have a rough skin, often bearing strong spines. The sawfishes (family Pristidae) have a snout that is modified into a long blade possessing a series of strong teeth on each side. About six species are known from warm seas, frequenting sandy shores and estuaries.

In the skates (suborder Rajoidei), the large pectoral fins extend to the snout and backward, stopping abruptly at the base of a slender tail. In contrast to other rays, skates produce eggs; these are large and oblong in shape with dark, leathery shells having a tendril at each corner by which they become fastened to seaweed or other objects. Skates lack the long, slender barbed spine that distinguishes stingrays. The most widespread skates belong to the genus *Raja* of the family Rajidae.

The remaining rays comprise the suborder Myliobatoidei and consist of whip-tailed rays (family Dasyatidae), butterfly rays (Gymnuridae), stingrays (Urolophidae), eagle rays (Myliobatidae), devil rays (or mantas; Mobulidae), and cow-nosed rays (Rhinopteridae). Common to the rays of all these families is a long, slender, whiplike tail that usually has a barbed spine connected with a poison gland; this spine is capable of inflicting serious wounds and is a dangerous weapon when the tail is lashed. Almost all of these rays are inhabitants of warm seas, except for a few species of stingray that live in the rivers of South America.



Cow-nosed ray (*Rhinoptera bonasus*), a stingray

Painting by Richard Ellis

The guitarfishes are a group of fishes that are closely related to the rays and are either classified as a separate order (Rhinobatiformes) or as a suborder (Rhinobatoidei) of the ray order (Batoidei).

For more information on species and groups of rays, *see* devil ray; electric ray; guitarfish; sawfish; skate; stingray.

Ray, Charlotte E., married name FRAIM (b. Jan. 13, 1850, New York, N.Y., U.S.—d. Jan. 4, 1911, Woodside, N.Y.), teacher and the first black female lawyer in the United States.

Ray studied at the Institution for the Education of Colored Youth in Washington, D.C., and by 1869 she was teaching at Howard University. There she studied law, receiving her degree in 1872. Her admission that year to the District of Columbia bar made her the first woman admitted to practice in the District of Columbia and the first black woman certified as a lawyer in the United States.

Ray opened a law office in Washington, D.C., but racial prejudices proved too strong, and she could not obtain enough legal business to maintain an active practice. By 1879 she had returned to New York City, where she taught in the public schools. In the late 1880s she married a man with the surname of Fraim; little is known of her later life.

Ray, James Earl (b. March 10, 1928, Alton, Ill., U.S.), American assassin of Martin Luther King, Jr.

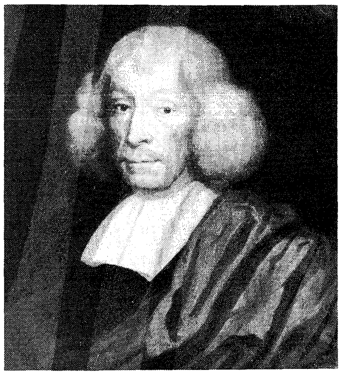
Ray had been a small-time crook, a robber of gas stations and stores, who had served time in prison, once in Illinois and twice in Missouri, and received a suspended sentence in Los Angeles. He escaped from Missouri State Penitentiary on April 23, 1967; and in Memphis, Tenn., nearly a year later, on April 4, 1968, from a window of a neighbouring rooming house, he shot King, who was emerging from a motel room.

Ray fled to Toronto, secured a Canadian passport through a travel agency, flew to London (May 5), then to Lisbon (May 7?), where he secured a second Canadian passport (May 16), and back to London (May 17?). On June 8 he was apprehended by London police at Heathrow Airport as he was about to embark for Brussels; the FBI had established him as the prime suspect almost immediately after the assassination. Back in Memphis, Ray pleaded guilty and was sentenced to 99 years in prison. Months later, he recanted his confession, without effect.

In June 1977 Ray escaped from Brushy Mountain (Tenn.) Prison and remained at large for 54 hours before being recaptured in a massive manhunt.

Ray, John, Ray also spelled (until 1670) WRAY (b. Nov. 29, 1627, Black Notley, Essex, Eng.—d. Jan. 17, 1705, Black Notley), leading 17th-century English naturalist and botanist who contributed significantly to progress in taxonomy. He joined his fellow naturalist Francis Willughby (1635–72) in an expedition to Wales and Cornwall and later to the European continent to study the natural history of living things. His enduring legacy to botany was the establishment of species as the ultimate unit of taxonomy.

Life. Ray was the son of the village blacksmith in Black Notley. He attended the grammar school in nearby Braintree. Ray was fortunate in growing up at a time and place in which a fund had been left in trust to support needy scholars at the University of Cambridge. In 1644 he matriculated at one of the colleges there, St. Catherine's Hall, and moved to Trinity College in 1646. Fortune again was with Ray. He had come to Cambridge at the



John Ray, detail of an oil painting; in the National Portrait Gallery, London
By courtesy of the National Portrait Gallery, London

right time for one with his talents, for he found a circle of friends with whom he pursued anatomical and chemical studies. He also progressed well in the prescribed curriculum, taking his bachelor's degree in 1648 and being elected to a fellowship at Trinity the following year; during the next 13 years he lived quietly in his collegiate cloister.

Ray's string of fortunate circumstances ended with the Restoration. Although he was never an excited partisan, he was thoroughly Puritan in spirit and refused to take the oath that was prescribed by the Act of Uniformity. In 1662 he lost his fellowship. Prosperous friends, mostly students he had tutored at Trinity College, supported him during the subsequent 43 years while he pursued his career as a naturalist.

That career had already begun with the publication of his first work in 1660, a catalog of plants growing around Cambridge; he had worked on the catalog for nine years, during which he trained himself, without benefit of preceptor, in natural history. After he had exhausted the Cambridge area as a subject for his studies, Ray began to explore the rest of Britain. An expedition in 1662 to Wales and Cornwall with Francis Willughby, when Ray's dismissal from Trinity was imminent, was a turning point in his life. Willughby, of a prosperous Warwickshire family, had been fired by Ray's enthusiasm for natural history while a student at Trinity. They now agreed to undertake a study of the complete natural history of living things, with Ray responsible for the plant kingdom and Willughby the animal. Implicit was Willughby's material support of Ray.

The first fruit of the agreement, a tour of the European continent lasting from 1663 to 1666, greatly extended Ray's first-hand knowledge of flora and fauna. Back in England, the two friends set to work on their appointed task, with Ray established more or less permanently in Willughby's home, Middleton. In 1670 Ray produced a *Catalogus Plantarum Angliae* ("Catalog of English Plants"). Then in 1672 Willughby suddenly died. Ray took up the completion of their project as a sacred duty owed to him; he was aided by an annuity of £60 left to him by Willughby and by his position as tutor to the Willughby children. In 1676 Ray published *F. Willughbeii . . . Ornithologia* (Eng. trans., *The Ornithology of F. Willughby . . . ,* 1678) under Willughby's name, even though Ray had contributed at least as much as Willughby. Ray was already at work on *F. Willughbeii . . . de Historia Piscium* (1685; "History of Fish") when Willughby's mother, his remaining support in the household, died. Willughby's widow, who had never liked Ray or his work, immediately forced him from the house. After he completed the "History of Fish," also with Willughby's name, she refused to aid in its publication. Eventually the Royal Society, of which Ray was a fellow, financed the publication.

Meanwhile, Ray returned to his native village of Black Notley. In 1673 he had married a young governess in the Willughby household, Margaret Oakley, and, after 11 childless years, they produced four daughters. The girls collected caterpillars and butterflies, which they brought to their father to identify and classify. Among the younger generation of scientists, Ray formed a new circle of friends. From the cottage in which he lived, perhaps not in poverty but certainly not in plenty, Ray, now more than 60 years old, far removed from an adequate library, and tormented by sores on his legs, poured out an incredible volume of scientific work.

Important publications. Ray had never interrupted his research in botany. In 1682 he had published a *Methodus Plantarum Nova* (revised in 1703 as the *Methodus Plantarum Emendata . . .*), his contribution to classification, which insisted on the taxonomic importance of the distinction between monocotyledons and dicotyledons, plants whose seeds germinate with one leaf and those with two, respectively. Ray's enduring legacy to botany was the establishment of species as the ultimate unit of taxonomy. On the basis of the *Methodus,* he constructed his masterwork, the *Historia Plantarum,* three huge volumes that appeared between 1686 and 1704. After the first two volumes, he was urged to compose a complete system of nature. To this end he compiled brief synopses of British and European plants, a *Synopsis Methodica Avium et Piscium* (published posthumously, 1713; "Synopsis of Birds and Fish"), and a *Synopsis Methodica Animalium Quadrupedum et Serpentini Generis* (1693; "Synopsis of Quadrupeds"). Much of his final decade was spent on a pioneering investigation of insects, published posthumously as *Historia Insectorum.*

In all this work, Ray contributed to the ordering of taxonomy. Instead of a single feature, he attempted to base his systems of classification on all the structural characteristics, including internal anatomy. By insisting on the importance of lungs and cardiac structure, he effectively established the class of mammals, and he divided insects according to the presence or absence of metamorphoses. Although a truly natural system of taxonomy could not be realized before the age of Darwin, Ray's system approached that goal more than the frankly artificial systems of his contemporaries. He was one of the great predecessors who made possible Linnaeus' contributions in the following century.

Nor was this the sum of his work. Ray had always asserted that "Divinity is my profession," and in the 1690s he also published three volumes on religion. *The Wisdom of God Manifested in the Works of the Creation* (1691), an essay in natural religion that called on the full range of his biological learning, was his most popular and influential book. It argued that the correlation of form and function in organic nature demonstrates the necessity of an omniscient creator. This argument from design, common to all the leading scientists of the 17th century, implied a static view of nature that impeded the development of evolutionary ideas even throughout the 19th century. Still working on his *Historia Insectorum,* John Ray died at the age of 77.

(R.S.W.)

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Ray, Man, original name EMANUEL RABINOVITCH (b. Aug. 27, 1890, Philadelphia, Pa., U.S.—d. Nov. 18, 1976, Paris, Fr.), American photographer, painter, and filmmaker of the Dada and Surrealist movements, important for his numerous technical innovations in various media.

The son of an artist and photographer, Ray grew up in New York City, where he studied architecture, engineering, and art and became a painter. In 1915 Ray met the French artist Marcel Duchamp, and together they collaborated on many inventions and formed the New York group of Dada. Like Duchamp, Ray began to produce "ready-mades," commercially manufactured objects that he designated as works of art. Among his best-known readymades is "Le Cadeau" (1921; "The Gift"), a flatiron with a row of tacks glued to the bottom. In addition, he experimented with such techniques as painting on glass with an airbrush.

In 1921 Ray moved to Paris and became associated with the group of Surrealist artists and writers headed by André Breton. To finance his painting Ray took up photography. He experimented with the medium endlessly, rediscovering how to make "cameraless" pictures, or photograms, which he called rayographs. He made them by placing flat and three-dimensional objects of various opacities on light-sensitive paper, which he exposed to light and developed. In 1922 a book of his collected rayographs, *Les Champs délicieux* ("The Delightful Fields"), was published. He also rediscovered in 1929 the technique called solarization, which renders part of the photographic image negative and part positive by exposing a print or negative to a flash of light during development. Ray was the first to use the process, known since the 1840s, for aesthetic purposes.

Ray turned to fashion and portrait photography and made a virtually complete record of the celebrities of Parisian cultural life during the 1920s and '30s. His fame soon became so great that his major paintings, such as "Observatory Time—The Lovers" (1932–34), were ignored. Even in his portrait photographs, however, he continued to experiment: he gave one sitter three pairs of eyes, and in "Violon d'Ingres" (1924) he photographically superimposed f-shaped holes onto the photograph of the back of a female nude so that the woman resembled a violin. Meanwhile he continued to produce ready-mades. One, a metronome with a photograph of an eye fixed to the pendulum, was called "Object to be Destroyed" (1923)—which it was by anti-Dada rioters in 1957. He also made the films *Anemic Cinema* (1924; in collaboration with Duchamp) and *L'Étoile de mer* (1928–29; "Star of the Sea"). In another short film, *Le Retour à la raison* (1923; "The Return to Reason"), he applied the rayograph technique to motion-picture film, making patterns with salt, pepper, tacks, and pins.

In 1940 Ray escaped the German occupation of Paris by moving to Los Angeles. Returning to Paris in 1946, he continued to paint and experiment until his death.

Ray, Nicholas, original name RAYMOND NICHOLAS KIENZLE (b. Aug. 7, 1911, La Crosse, Wis., U.S.—d. June 16, 1979, New York, N.Y.), American motion-picture writer and director who showed great promise with such early low-budget films as *They Live by Night* (1948–49), *Knock on Any Door* (1949), and *Johnny Guitar* (1954).

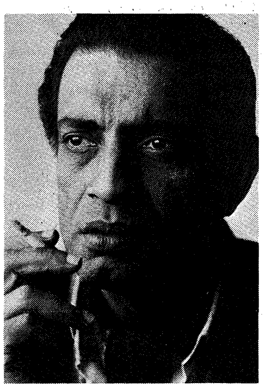
Ray studied architecture and theatre at the University of Chicago and was directing plays by the mid-1930s. He worked with John Houseman and Elia Kazan in New York City and was taken to Hollywood by Kazan to work as an assistant director on the film *A Tree Grows in Brooklyn* in 1944. In 1947 Houseman, who had become involved in film production at RKO Radio Pictures, enabled Ray to direct his first feature film, *They Live By Night,* which was typical of his early work in its exploration of the themes of violence and youthful rebellion. Ray's film *In a Lonely Place* (1950) was an acclaimed commentary on Hollywood society, while *Rebel Without a Cause* (1955) is an account of middle-class juvenile delinquency. The latter film starred James Dean, and critics praised Ray for his compassionate portrait of a teenager ignored by his parents. Ray's film *The True Story of Jesse James* (1957) brought him into conflict with the Hollywood studios, and his subsequent films, notably *The Savage Innocents* (1959), *King of Kings* (1961), and *55 Days at Peking* (1963), were shot partly in Europe and Canada.

After that Ray tried directing in Yugoslavia, taught at the State University of New York, and worked for a number of years on the film *We Can't Go Home Again.* He was the subject of a feature-length documentary, *I'm A Stranger Here Myself* (1974), and collaborated with the German filmmaker Wim Wenders on *Lightning over Water* (1980), a semidocumentary of Ray's last days and death.

Ray, Satyajit (b. May 2, 1922, Calcutta, India), Indian motion-picture director who modernized traditional Bengali literary and graphic conventions in such films as the trilogy *Pather Panchali* (1955; *On the Road*), *Aparajito* (1956; *The Unvanquished*), and *Apu Sansar* (1959; *The World of Apu*).

Ray was born into a family of artists—his grandfather was a well-known painter, and his father, who died in 1923, was the author of works that are now Bengali classics. The future director completed his secondary schooling at Presidency College in Calcutta. He was then destined for scientific research, but, through the influence of the Bengali poet Rabindranath Tagore, a family friend, he turned to artistic studies. He took courses given by the poet at Visva-Bharati in Santiniketan.

After Tagore's death in 1941, Satyajit Ray returned to Calcutta. Hoping to make a career in illustrating, he joined a publicity firm and soon became artistic director (the world of advertising was to provide the setting for his film *Company Limited* in 1971). In 1945, while illustrating the works of the Bengali writer Bibhuti Bhusan Bandyopadhyay, the idea of becoming a filmmaker occurred to him. His interest was heightened by his contact with the great French director Jean Renoir, who made his film *The River* (1951) in India. But Ray's plans to adapt Bandyopadhyay's work to the screen met with many obstacles. Producers hesitated to entrust so much responsibility to a beginner, especially as Ray wanted to employ nonprofessionals and to show the life and customs of the Bengali peasants without anecdotes of the sort that were common in Indian films. Seven years later, in 1952,



Satyajit Ray
Camera Press

thanks to the help of friends, he succeeded in raising the capital to start the film. Except for the camera operator, Subrata Mitra, none of the people who plunged into this adventure had ever worked in films. At the end of three months their small capital was exhausted. But after long talks, the West Bengal government agreed to provide the needed finances for the first film of the anticipated trilogy.

The film, *Pather Panchali,* was completed in 1955 and was a great success. Acclaiming its significance, the Asian public was enthusiastic, and the next year it won a prize at the highly prestigious film festival at Cannes, Fr. This success assured Ray the financial backing he needed to make the other two films of the trilogy: *Aparajito,* which earned the "Golden Lion" award of the 1957 Venice Film Festival, and *Apu Sansar,* made in 1959. In these films, Ray, in the style of an Oriental Dickens, relates the story of a Bengali child, Apu, from youth to maturity. The slow rhythm of the narrative creates a timeless poetic climate, halfway between dream and reality.

Between *Aparajito* and *Apu Sansar,* Ray produced two films of an entirely different sort: *Paras Pathar,* a satirical film adapted from a novel by Parasuram, and *Jalsaghar* (1958; *The Music Room*), an amusing comedy of manners.

As soon as the Apu trilogy was completed, he undertook a long documentary illustrating the life and work of Tagore, which was released in 1960. To celebrate the centennial of the poet's birth, in 1961, he brought to the screen three of Tagore's novels grouped under the title of *Teen Kanya* ("Three Girls"). Its Western version (called *Two Daughters*) includes only two stories: *The Postmaster,* which tells the adventures of a village postman, his love affair with a young orphan, and their final separation; and *The Conclusion,* a comedy of manners illustrating the disastrous consequences of the marriage of a student to an eccentric girl. The humorous characters and the portrayal of small details of daily life lend charm to these minor sketches.

Devi (1960; *The Goddess*), a powerful portrayal of lingering superstition in a changing world, was followed in 1962 by *Kanchenjunga* and *Abhijan* (*The Country*). He made *Mahanagar* (*The Big City*) in 1963 and *Charulata* (*The Lonely Wife*) in 1964. Of Ray's later films, *Asani Sanket* (1973; *Distant Thunder*), an epic treatment of the great Bengali famine of 1943, and *Shatranj Ke Khilari* (1977; *The Chess Players*), his first film in the Hindi language, are especially notable. *The Kingdom of Diamonds,* an allegorical sequel to *The Adventures of Goopy and Bagha* (1969), appeared in 1980.

Ray usually rehearsed his actors very little, especially when they were nonprofessionals, and he usually preferred the first film of a scene, because of its spontaneity, rather than a "retake." In response to criticisms of the slow pace of his work, he defended its rhythm as a reflection of the style of the life he is trying to interpret. He cited as the greatest influences on his work the documentaries *Nanook of the North* (1920–21) and *Louisiana Story* (1948) by the American Robert Flaherty and *Earth* (1930), set on a collective farm, by the Soviet director Aleksandr Dovzhenko.

(Je.M./Ed.)

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A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

ray spider, any spider belonging to the family Theridiosomatidae (order Araneida). Most are less than 3 mm (0.125 inch) in body length and are usually found near streams or in damp areas. The strands of the ray spider's web extend outward in raylike groups of three or four. The web is pulled into a cone shape by a strand attached from the web centre to a nearby twig. This strand, held taut by the spider, is released when an insect becomes caught in the web; the web snaps back, further ensnaring the insect.

Rayburn, Sam(uel Taliaferro) (b. Jan. 6, 1882, Roane County, Tenn., U.S.—d. Nov. 16, 1961, Bonham, Texas), U.S. Democratic

Rayburn
From the Records of the Office of War Information in the National Archives, Washington, D.C.

Party leader who served for more than 48 years in the U.S. House of Representatives (1913–61), including 17 years as speaker; his public longevity, combined with broad political influence behind the scenes, caused him to be known as "Mr. Democrat."

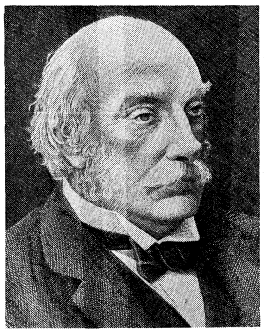
Reared on a farm after his family moved to Texas, young Rayburn taught school and became a lawyer at Bonham. Politics soon dominated his interests, and he began public life as a state legislator (1907–13), being chosen speaker of the Texas House of Representatives in 1911. Elected to the U.S. House of Representatives in 1912, he was reelected 25 consecutive times. Energetic, studious, ambitious, and affable, he became influential in government circles and in closed-door party councils. As chairman of the powerful congressional Committee on Interstate and Foreign Commerce (1931–37), he was a major architect of Pres. Franklin D. Roosevelt's New Deal program. He was coauthor of six important laws: the Railroad Holding Company Act, "Truth-in-Securities" Act, Securities Exchange Act, Federal Communications Act, Rural Electrification Act, and the most bitterly contested of all New Deal legislation, the Public Utility Holding Company Act.

Rayburn was elected Democratic leader of the House in 1937 and became speaker in September 1940. Noted for his tart common sense, honesty, and unflagging patriotism, he was a trusted adviser to President Roosevelt and to three succeeding presidents. He was a dedicated party man who described himself as a Democrat "without prefix, without suffix, and without apology."

After winning a battle in 1961 to enlarge the House Rules Committee—the hardest internal House struggle in 50 years—Rayburn's health failed, and he returned home before Congress adjourned that year. A biography by Alfred Steinberg, *Sam Rayburn*, was published in 1975.

Rayganj (India): *see* Raiganj.

Rayleigh (of Terling Place), John William Strutt, 3rd Baron (b. Nov. 12, 1842, Langford Grove, Maldon, Essex, Eng.—d. June 30, 1919, Terling Place, Witham, Essex), English physical scientist who made fundamental discoveries in the fields of acoustics and optics that are basic to the theory of wave propagation in fluids. He received the Nobel Prize for Physics in 1904 for his successful isolation of argon, an inert atmospheric gas.



Rayleigh, engraving by R. Cottot

By courtesy of the International Telecommunication Union, Geneva

Strutt suffered from poor health throughout his childhood and youth, and it was necessary for him to be withdrawn from both Eton and Harrow. In 1857 he began four years of private study under a tutor. In 1861 Strutt entered Trinity College, Cambridge, from which he was graduated with a B.A. as Senior Wrangler (highest honour) in the Mathematical Tripos in 1865, a distinction that foreshadowed his future success. He early developed an absorbing interest in both the experimental and mathematical sides of physical science, and in 1868 he purchased an outfit of scientific apparatus for independent research. In his first paper, published in 1869, he gave a lucid exposition of some aspects of the electromagnetic theory of James Clerk Maxwell, the Scottish physicist, in terms of analogies that the average man would understand.

An attack of rheumatic fever shortly after his marriage in 1871 threatened his life for a time. A recuperative trip to Egypt was suggested, and Strutt took his bride, Evelyn Balfour, the sister of Arthur James Balfour, the well-known politician and statesman, on a houseboat journey up the Nile for an extended winter holiday. On this excursion he began work on his great book, *The Theory of Sound,* in which he examined questions of vibrations and the resonance of elastic solids and gases. The first volume appeared in 1877, followed by a second in 1878, concentrating on acoustical propagation in material media. After some revision during his lifetime and successive reprintings after his death, the work has remained the foremost monument of acoustical literature.

Shortly after returning to England he succeeded to the title of Baron Rayleigh in 1873, on the death of his father. Rayleigh then took up residence at Terling Place, where he built a laboratory adjacent to the manor house. His early papers deal with such subjects as electromagnetism, colour, acoustics, and diffraction gratings. Perhaps his most significant early work was his theory explaining the blue colour of the sky as the result of scattering of sunlight by small particles in the atmosphere. The Rayleigh scattering law, which evolved from this theory, has since become classic in the study of all kinds of wave propagation.

Rayleigh's one excursion into academic life came in the period 1879–84, when he agreed to serve as the second Cavendish professor of experimental physics at Cambridge, in succession to James Clerk Maxwell. Rayleigh took his university duties very seriously with respect both to the instruction of students and to the carrying out of a vigorous research program on the precision determination of electrical standards. A classical series of papers, published by the Royal Society, resulted from this ambitious work. After a tenure of five years he returned to his laboratory at Terling Place, where he carried out practically all of his scientific investigations.

A few months after resigning from Cambridge, Rayleigh became secretary of the Royal Society, an administrative post that, during the next 11 years, allowed considerable freedom for research.

Rayleigh's greatest single contribution to science is generally considered to have been his discovery and isolation of argon, one of the rare gases of the atmosphere. Precision measurements of the density of gases conducted by him in the 1880s led to the interesting discovery that the density of nitrogen obtained from the atmosphere is greater by a small though definite amount than is the density of nitrogen obtained from one of its chemical compounds, such as ammonia. Excited by this anomaly and stimulated by some earlier observations of the ingenious but eccentric 18th-century scientist Henry Cavendish on the oxidation of atmospheric nitrogen, Rayleigh decided to explore the possibility that the discrepancy he had discovered resulted from the presence in the atmosphere of a hitherto undetected constituent. After a long and arduous experimental program, he finally succeeded in 1895 in isolating the gas, which was appropriately named argon, from the Greek word meaning "inactive." Rayleigh shared the priority of the discovery with the chemist William Ramsay, who also isolated the new gas, though he began his work after Rayleigh's publication of the original density discrepancy. In 1904 Rayleigh was awarded the Nobel Prize for Physics; Ramsay received the award in chemistry for his work on argon and other inert elements. The next year Rayleigh was elected president of the Royal Society.

A decided catholicity of taste characterized Rayleigh's choices in research. It was not his habit to devote his exclusive attention to one problem over a long interval but to divert it frequently to a wide variety of topics, such as optics, acoustics, electricity, or fluid mechanics. He preferred to work on several research projects at once, but he was by no means erratic; his work was consistently of high quality throughout his career, both in the brilliance and thoroughness of experimental execution and in the lucidity and precision of his writings. He not only expanded and consolidated existing knowledge in important branches of the physical sciences, but he also opened up important new research frontiers, especially in acoustics and fluid dynamics.

In his later years, when he was the foremost leader in British physics, Rayleigh gave freely of his time and helpful counsel by serving in influential advisory capacities in education and government. In 1908 he accepted the post of chancellor of Cambridge University, retaining this position until his death. He was also associated with the National Physical Laboratory and government committees on aviation and the treasury.

Retaining his mental powers until the end, he worked on scientific papers until five days before his death, on June 30, 1919.

(R.B.L.)

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Rayleigh scattering, dispersion of electromagnetic radiation by particles that have a radius less than approximately 1/10 the wavelength of the radiation. The process has been named in honour of Lord Rayleigh, who in 1871 published a paper describing this phenomenon.

The angle through which sunlight in the atmosphere is scattered by molecules of the constituent gases varies inversely as the fourth power of the wavelength; hence, blue light, which is at the short wavelength end of the visible spectrum, will be scattered much more strongly than will the long wavelength red light. This results in the blue colour of the sunlit sky, since, in directions other than toward the Sun, the observer sees only scattered light. The Rayleigh laws also predict the variation of the intensity of scattered light with direction, one of the results being that there is complete symmetry in the patterns of forward scattering and backward scattering from single particles. They additionally predict the polarization of the scattered light.

Raymond, French RAIMOND, name of rulers grouped below by country and indicated by the symbol •.

ANTIOCH

• Raymond, byname RAYMOND OF POITIERS, French RAIMOND DE POITIERS (b. 1099—d. June 28, 1149), prince of Antioch (1136–49) who successfully resisted the attempts of the Byzantine emperor John II to establish control over the principality.

Raymond was the younger son of William VII, count of Poitiers, in west central France. In 1135 King Fulk of the Latin Kingdom of Jerusalem, regent for the heiress Constance of Antioch, sent envoys to offer her in marriage to Raymond, who was then at the court of Henry I of England. Raymond arrived in Antioch in April 1136 and married the nine-year-old Constance, thereby becoming ruler of Antioch.

The Byzantine Empire had claimed Antioch ever since the First Crusade (1095–99), when the crusaders had promised to hand over the city to the empire but instead had kept it themselves. In August 1137 Emperor John II Comnenus arrived at Antioch and forced Raymond to agree to cede Antioch to him in exchange for territory around Aleppo—provided it could be captured from the Muslims. In April and May 1138 Raymond and John battled the Muslims without success. John then made a solemn entry into Antioch, but Raymond managed to evade John's request for control of the citadel, and John soon left.

In September 1142, John, who was campaigning in Syria, again demanded that Antioch be handed over to him in exchange for a yet-to-be-conquered principality. Raymond barred the Byzantines from the city, and they then prepared to invade Antioch. John died, however, in April 1143, and Raymond, attempting to take advantage of John's death, invaded Cilicia to the north, but was repulsed and driven back to Antioch. The Byzantines then ravaged the country north of the city, while their fleet raided the coast of the principality. The following year Edessa fell to the Muslims, exposing Antioch to attack from the northeast. In 1145, therefore, Raymond visited Constantinople to conciliate John's successor, Manuel I.

In the spring of 1148, when Louis VII of France and his wife, Eleanor of Aquitaine, who were participating in the Second Crusade, visited Antioch, Raymond wisely urged Louis to attack Aleppo, the northern Syrian base of the Muslim leader Nureddin. For religious reasons, however, Louis decided to campaign closer to Jerusalem and the Holy Sepulchre. Raymond's relations with Eleanor, his niece, gave rise to scandalous rumours. Outraged, Louis procured an annulment of the marriage when he and Eleanor returned to France in 1148. The next year Raymond was slain in a battle against Nureddin.

Toulouse

• **Raymond IV,** byname RAYMOND OF SAINT-GILLES, French RAIMOND DE SAINT-GILLES (b. 1041 or 1042, Toulouse, County of Toulouse—d. Feb. 28, 1105, near Tripoli), count of Toulouse (1093–1105) and marquis of Provence (1066–1105), who was the first, and one of the most effective, of the western European rulers who joined the First Crusade. He is reckoned as Raymond I of Tripoli, which he conquered and ruled from 1102 to 1105.

In the early years of his countship, Raymond was a pious lay leader of the papacy's reform movement. Before preaching the First Crusade (1095), Pope Urban II probably secured assurance of Raymond's participation. Although he disliked the Byzantine emperor Alexius I Comnenus, Raymond became the most faithful partisan of the Emperor's territorial interest in the crusade, sometimes to his own disadvantage. Alone among leaders of the crusade, he conquered no Middle Eastern principality for himself. (He is, however, considered the founder of the Latin countship of Tripoli, established by his heirs.)

After helping to capture Antioch from the Turks (June 3, 1098), Raymond unsuccessfully tried to induce Bohemond I, Frankish crusader prince of the city, to restore it to Alexius. He then organized a march on Jerusalem and took part in its capture (July 15, 1099). Apparently he refused the crusaders' crown of Jerusalem, which was then given to Godfrey of Bouillon, duke of Lower Lorraine. Although he quarrelled with Godfrey, together they repulsed an attack on Jerusalem by the Egyptian Fāṭimids. From 1100, Raymond, on behalf of Alexius, blocked the southward expansion of Bohemond's principality of Antioch. He built near Tripoli the castle of Mons Peregrinus (Mont-Pèlerin), in which he died.

Raymond IV de Saint Gilles (1959), by John Hugh Hill and Laurita Lyttleton Hill, was translated into English as *Raymond IV, Count of Toulouse* (1962).

• **Raymond VI** (b. Oct. 27, 1156—d. August 1222, Toulouse, Fr.), count of Toulouse from 1194, who at first tolerated the heretical Cathari in Languedoc, then (1209) joined the Albigensian Crusade against them and afterward fought the crusaders to save his own dominions.

The son of Count Raymond V, Raymond VI was a nephew of King Louis VII of France and brother-in-law of King Richard I of England. Tolerant toward the many heretics among his subjects, Raymond VI was thought to have been an accessory to the murder of a papal legate, Peter of Castelnau, who had been urging him to act against the Cathari. After the Legate's death (Jan. 15, 1208), Pope Innocent III proclaimed the crusade, which Raymond joined, perhaps as penance. The other crusaders, most of whom were North Frenchmen seeking lands in the South, were led by Simon de Montfort (father of Simon de Montfort, earl of Leicester, famous in English history), and Raymond found himself obliged to defend his lands against their ambitions. In the Battle of Muret, near Toulouse (Sept. 12, 1213), Raymond and King Peter II of Aragon (his brother-in-law by a later marriage) were defeated by Simon, who was awarded Raymond's countship by the fourth Lateran Council (1215).

With Aragonese help, however, Raymond reoccupied the city of Toulouse (September 1217). He then withstood a siege by Simon (who was killed near the city, June 25, 1218) and regained most of his lands before his sudden death. Twice excommunicated by the church, he was refused Christian burial.

• **Raymond VII** (b. July 1197, Beaucaire, Fr.—d. Sept. 27, 1249, Millau), count of Toulouse from 1222, who succeeded his father, Raymond VI, not only in the countship but also in having to face problems raised by the Albigensian Crusade against the heretical Cathari. Under his rule, the de facto independence of Toulouse from the French kingdom was permanently curtailed.

Raymond VII, seal, 13th century; in the Archives Nationales, Paris
Giraudon—Art Resource/EB Inc.

After helping to recover lands of which his father had been dispossessed by the fourth Lateran Council (1215), Raymond became count and then negotiated a truce (1223) with the land-hungry crusaders from the North of France. For failing to suppress the Cathari, however, he was excommunicated (1226), was declared forfeit of his lands, and was subjected to an invasion by King Louis VIII of France. Although the death of Louis (Nov. 8, 1226) weakened this campaign, Raymond eventually was compelled (Treaty of Meaux, 1229) to cede territory to France and to permit the crusade against the Cathari to continue in Languedoc. His daughter Joan was to marry Alphonse, brother of Louis IX of France; the failure of this marriage to produce an heir led to the reversion of Toulouse to the crown in 1271.

In 1242, in alliance with King Henry III of England, Raymond rebelled against Louis. Henry's defeat at Saintes (October 1242) obliged Raymond to yield, and by the Treaty of Lorris (January 1243) the authority of France over Toulouse was greatly strengthened. In his later years, Raymond was a notable builder of *bastides* (fortified new towns).

Tripoli

• **Raymond I:** *see* Raymond IV (Toulouse).

• **Raymond III** (b. *c.* 1140—d. July 1187, County of Tripoli), count of the crusaders' state of Tripoli (1152–87) and twice regent of the Latin Kingdom of Jerusalem (1174–77, 1184–85).

Raymond succeeded to the countship after the assassination of his father, Raymond II, in 1152. In his campaigns against the Muslims he was taken prisoner by their leader Nureddin in 1164 but was released in 1172. When the new king of Jerusalem, Baldwin IV, took the throne in 1174, Raymond successfully claimed the regency as the first cousin once removed of Baldwin, a minor and a leper. The regency ended when Baldwin came of age (1177), but Raymond continued to take an active part in the kingdom's affairs.

Raymond's rivals soon induced Baldwin to exile him for two years (1180–82). The growing threat from the Muslim leader Saladin, however, finally led to the designation of Raymond (early in 1184) as regent again for the dying Baldwin's infant nephew, who had been crowned king (1183). There was a proviso, however, that if the new king, Baldwin V, should die prematurely, the succession should be determined by the pope, the Holy Roman emperor, and the kings of England and France. When Baldwin IV died in March 1185, Raymond immediately concluded a four-year truce with Saladin.

When Baldwin V died in the summer of 1186, his mother Sibyl and her husband Guy of Lusignan took the throne in violation of the proviso of the regency. Refusing to acknowledge Guy, Raymond withdrew to Tiberias (on the sea of Galilee), a stronghold belonging to his wife Eschiva of Bures, princess of Galilee. When Saladin resumed war against the kingdom, Raymond at first maintained a separate truce. Finally, however, the slaughter of some of Guy's supporters in the Galilee area by Muslims to whom Raymond had granted a safe conduct impelled Raymond to a reconciliation with Guy. Raymond was wounded in the Battle of the Horns of Ḥaṭṭin (July 4, 1187), after which he retired to Tripoli and died shortly thereafter.

Raymond OF PEÑAFORT, SAINT, Catalan SANT RAMON DE PENYAFORT (b. *c.* 1185, Peñafort, near Barcelona—d. Jan. 6, 1275, Barcelona; canonized 1601; feast day January 23), Catalan Dominican friar who compiled the *Decretals* of Gregory IX, a body of medieval legislation that remained part of church law until the Code of Canon Law was promulgated in 1917.

He studied canon law at Bologna and taught there from 1218 to 1221. Among his works of this period were unpublished annotations of the *Decretum* of Gratian (flourished *c.* 1140; the father of the science of canon law) and an uncompleted treatise on canon law, *Summa juris canonici.*

After his return to Barcelona in 1222, he joined the Dominican Order and wrote a manual of canon law for confessors, *Summa de casibus poenitentiae* ("Concerning the Cases of Penance"), one of the most widely used books of its kind during the later Middle Ages.

In 1230 Pope Gregory IX called Raymond to Rome to serve as a papal chaplain to examine cases of conscience. Gregory also commissioned him to codify the papal statutes and rulings on points of canon law that had been issued since the appearance of Gratian's *Decretum*. Raymond's compilation of Gregory's *Decretals* was formally promulgated in 1234. The following year he revised and reissued his *Summa de casibus*, with an added part on the law of matrimony.

He returned to Spain (1236) and in 1238 was elected master general of the Dominican Order. Although he resigned after only two years, he revised the constitutions of the order. The remainder of his life was devoted to various papal commissions and to missionary interests. Later he organized schools of Arabic and Hebrew studies for missionaries in Tunis and in Murcia (*c.* 1255), an independent Muslim kingdom in Spain. It was at his request that St. Thomas Aquinas wrote the *Summa contra gentiles*, a theological exposition against the heathens. Thomas M. Schwertner's *Saint Raymond of Pennafort of the Order of Friars Preachers* appeared in 1935.

Raymond OF POITIERS: *see* Raymond *under* Raymond (Antioch).

Raymond OF SAINT-GILLES: *see* Raymond IV *under* Raymond (Toulouse).

Raymond, Alex(ander Gillespie) (b. Oct. 2, 1909, New Rochelle, N.Y., U.S.—d. Sept. 6, 1956, near Westport, Conn.), U.S. comic-strip artist notable for his creation of a number of outstanding and successful adventure comic strips.

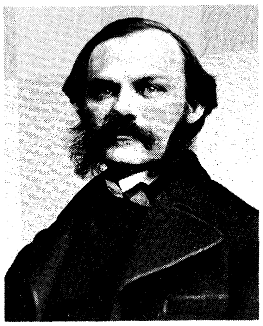
At 18 Raymond went to work in a brokerage office on New York City's Wall Street, but the stock market crash of 1929 ended his career in finance. He then worked briefly as an assistant to Russ Westover on his strip "Tillie the Toiler." In 1930 he joined the King Features Syndicate, creating, with the mystery writer Dashiell Hammett, the strip "Secret Agent X-9." In 1934 he was assigned to draw "Flash Gordon," a new strip dealing with interplanetary adventures, and at about the same time he created "Jungle Jim," another adventure strip.

During World War II Raymond served with the U.S. Marine Corps as a public information officer and combat cartoonist. In 1946 he introduced still another strip, "Rip Kirby," dealing with the adventures of a suave, intellectual private detective. Raymond's strips were notable for outstanding drawing, particularly for the skillful use of shadow.

Raymond, Don: *see* Raimundo, Don.

Raymond, Henry Jarvis (b. Jan. 24, 1820, near Lima, N.Y., U.S.—d. June 18, 1869, New York City), U.S. journalist and politician who, as first editor and chief proprietor of *The New York Times* (from 1851), did much to elevate the style and tone of contemporary newspapers and who was prominent in forming the Republican Party.

Raymond worked for Horace Greeley on the weekly *New Yorker* in 1840 and then from 1841 to 1848 on the daily New York *Tribune*. As early as 1843 he and George Jones had planned their own newspaper, but lack of capital forced postponement of the project until Sept. 18, 1851, when the first issue of the New York *Daily Times* (renamed *The New York Times* in 1857) was published. The paper was largely free from the hyper-emotional writing



Henry Jarvis Raymond

By courtesy of the Library of Congress, Washington, D.C.

and the emphasis on extremist personalities that was common in the 1850s, a period of factional and sectional hatreds that were exploited by many journalists and helped bring on the American Civil War (1861–65). During that conflict, as in the war of France and Piedmont against Austria in 1859, Raymond served as a war correspondent.

Although Raymond had been a valued employee of Greeley for several years, they were temperamentally incompatible and became political enemies. Raymond's nomination over Greeley on the Whig ticket for lieutenant governor of New York and his election in 1854 led to the dissolution of the political alliance of Greeley, Thurlow Weed, and William H. Seward and contributed to the demise of the Whig Party. For the new Republican Party's convention in Pittsburgh, in February 1856, Raymond wrote a statement of party principles known as the "Address to the People." He prepared most of Pres. Abraham Lincoln's platform in 1864 and from that year until 1866 was chairman of the Republican National Committee. Elected to the U.S. House of Representatives for the 1865–67 term, he was criticized for failing to oppose the radical Reconstruction plan of Thaddeus Stevens, the leading foe of Pres. Andrew Johnson. Denied renomination by his party, Raymond returned to active newspaper work.

Raymond Berenger (counts of Barcelona): *see under* Ramon Berenguer.

Raymond Terrace, town, eastern New South Wales, Australia, on the east bank of the Hunter River (near its junction with the Williams), just north of Newcastle. Founded in the 1830s, the town was named after a member of an exploring expedition in 1812 led by Gov. Lachlan Macquarie. An important wool river port in the 1840s, Raymond Terrace was proclaimed a municipality and in 1937 merged into the Shire of Port Stephens. In a district of citrus and vegetable growing, dairying, and lumbering, the town is accessible (via the Pacific Highway) from Sydney, 88 mi (142 km) south-southwest, and has developing light industries, including rayon and fibreboard factories. An aluminum smelter operates at nearby Tomago. The 50-sq-mi (130-sq-km) Tomago Sandbeds, part of the Newcastle water supply system, are also nearby. Pop. (1981) 7,548.

Raynal, Guillaume-Thomas, abbé de (b. April 12, 1713, Saint-Geniez, Fr.—d. March 6, 1796, Chaillot), French writer and propagandist who helped set the intellectual climate for the French Revolution.

Raynal was educated by the Jesuits and as a young man joined the order, but after going to Paris to work for the church he gave up religious life in favour of writing. He established himself as a writer with two historical works, one on the Netherlands (1747) and the other on the English Parliament (1748), both of them hackwork but popular and widely read. From 1750 to 1754 he edited the government-supported literary periodical *Mercure de France*, winning literary respectability and a place in society.

Raynal's most important work was a six-volume history of the European colonies in India and America, published in 1770. It was both anticlerical and antiroyalist in tone. The philosopher and encyclopaedist Denis Diderot is credited with writing many of the better passages, as well as the more radical historical interpretations. The work was extremely popular, going through 30 editions between 1772 and 1789, its radical tone becoming more pronounced in the later editions.

In 1774 the history was placed on the Catholic Church's Index of Forbidden Books, and in 1781 the authorities ordered Raynal into exile and decreed that his history be burned. He was allowed to return to France, but not to Paris, in 1784. His banishment from Paris was finally rescinded in 1790.

Although he had been elected to the States General in 1789, early in the French Revolution Raynal refused to serve because he

Raynal, detail of an engraving by N. Delaunay, 1780, after a drawing by C.N. Cochin

By courtesy of the Bibliotheque Nationale, Paris

opposed violence. He later renounced radicalism and prepared a message that was read to the National Assembly (successor to the States General) in May 1791, calling for a constitutional monarchy modelled on the English system. His property was later confiscated by the National Assembly, and he died in poverty.

Raynald OF CHÂTILLON (French crusader): *see* Reginald of Châtillon.

Raynaud's disease, disease, occurring primarily in young women, in which spasms in the arteries to the fingers cause the fingertips of both hands to become first pale and then cyanotic—bluish—upon exposure to cold or in response to emotion. Often the fingertips become cold and numb and perspire. The fingers may ache and move awkwardly. If the attack is prolonged, the rest of the hands and the feet may be affected. The disorder, when it occurs as a complication of another disease, is termed Raynaud's phenomenon; this ordinarily affects only one hand or one or two fingers. Treatment of Raynaud's disease includes protection of the fingers from cold. Complications include ulcerations and atrophy of the fat and skin of the fingers. *See also* acrocyanosis.

Raynouard, François-Juste-Marie (b. Sept. 18, 1761, Brignoles, Fr.—d. Oct. 27, 1836, Passy), French dramatist and Romance philologist who also played a part in the politics of the Revolutionary and Napoleonic periods.

Trained as a lawyer, Raynouard was elected to the Legislative Assembly in 1791. In 1793 he was imprisoned on political grounds but was released in 1794 after the fall of Robespierre. His first play, *Caton d'Utique*, was published in 1794.

After practicing law in his native Provence, he returned to Paris in 1803. In 1805 his second play, *Les Templiers*, was a great success, but his *Les États de Blois, ou la mort du duc*

Raynouard, detail of an engraving
Harlingue—H. Roger-Viollet

de Guise (1810) offended Napoleon, and it was banned. Following the defeat of Napoleon at Waterloo in 1815, Raynouard left politics to devote himself to the study of the medieval troubadour poets of France. His writing in this field proved to be his most important and lasting accomplishment. He wrote *Choix des poésies originales des troubadours,* 6 vol. (1816–21; "Selected Poetry of the Troubadours"). He also wrote a six-volume dictionary, *Lexique roman,* which was published posthumously (1839–44).

rayon, any man-made textile fibre produced from the plant substance cellulose. Developed in an attempt to produce silk chemically, the fibre was originally known by such terms as artificial silk and wood silk, but in 1924 it was given the coined name rayon. An anitrocellulose type of rayon, first produced commercially in France in 1891 in the form of a nitrocellulose fibre, was later discontinued because of its high flammability.

Rayon is described as a regenerated fibre because the cellulose is converted to a liquid compound and then back to cellulose in the form of fibre. The cellulose, obtained from soft woods or from the short fibres adhering to cotton seeds (linters), is chemically treated to form a solution that is forced through tiny holes in a nozzle (spinnerets). This process of forcing a solution through spinneret holes is called spinning; the same name is applied to the production of yarn by twisting together fibres that may be of natural or man-made origin. Rayon emerges in the form of filament, a fibre of great length, and is hardened by drying in air or by chemical means. The filament is sometimes cut into shorter pieces having uniform length, called staple, and twisted together to make yarn.

Viscose rayon, the most widely used type, was developed in 1892. The raw material is formed into thin sheets and subjected to various treatments that produce a viscous spinning solution resembling honey in consistency and colour. Colour is frequently incorporated at the solution stage (spun-dyed), although the fibre has good affinity for dyes. Substances may also be added to the solution to decrease the normal high lustre. Most viscose rayons have strengths approaching the regular grades of nylon and have similar stretch characteristics, but they are low in elasticity except when wet. Readily penetrated by water, the fibre absorbs up to 13 percent of its weight in moisture. It swells when wet and also loses strength. Viscose decomposes at about 185° to 205° C (365° to 400° F) and is readily ignited. Exposure to sunlight gradually reduces strength but does not affect colour. Viscose can be washed in mild alkaline solutions but loses strength if subjected to harsh alkalies. Common dry-cleaning solvents are not harmful. Viscose can be produced in a variety of forms adaptable to numerous uses. Its ability to absorb moisture contributes to the comfort of the wearer of viscose clothing, and it is widely used in both outer apparel and underwear. It is also used in carpets and other home furnishings and for such industrial applications as tire cords and surgical materials. High-tenacity viscose rayons, known by such trade names as Tenasco and Cordura, have improved strength imparted by application of a high degree of stretch immediately after spinning.

Cuprammonium rayon, widely known by the trademarked name Bemberg, was developed in 1890 and is made with a spinning solution produced by dissolving cellulose in an ammoniacal copper solution. The fibre, of about the same strength and performing much like viscose rayon, has a fine diameter and is the rayon most resembling silk. It can be stretched 10 to 17 percent beyond its original length when dry and 17 to 33 percent when wet. Depending upon the amount and duration of stretching, its elastic recovery ranges from 20 to 75 percent. The fibre can absorb about 12.5 percent of its weight in moisture. It burns readily and begins to decompose at about 150° C (300° F). It is somewhat more costly than viscose and is lustrous, with soft hand (properties perceived by handling) and good draping properties. It is frequently used for lightweight, sheer fabrics and for satins.

Rayong, town, southern Thailand. It lies southeast of Bangkok, on the northeastern coast of the Gulf of Thailand. Rayong is a fishing port and produces tapioca from locally grown cassava. Cassava, fruits, and rubber are the major products of the adjacent hinterland. Nearby beaches attract a growing number of tourists. Pop. (1985 est.) 41,222.

Rayonism, Russian LUCHISM (Ray-ism), Russian art movement founded by Mikhail F. Larionov, representing one of the first steps toward the development of abstract art in Russia. Larionov painted the first Rayonist work, "Glass," in 1909 and wrote the movement's manifesto in 1912 (though it was not published until the following year). Explaining the new style, which was a synthesis of Cubism, Futurism, and Orphism, Larionov said that it "is concerned with spatial forms which are obtained through the crossing of reflected rays from various objects."

The raylike lines appearing in the works of Larionov and Nathalie Goncharova bear strong similarities to the lines of force in Futurist paintings. Rayonism apparently ended after 1914, when Larionov and Goncharova departed for Paris.

Rays, Gilles de: *see* Rais, Gilles de.

Raytheon Company, major American supplier of electronic systems and subsystems for government (chiefly military) and commercial use and manufacturer of home appliances. Headquarters are in Lexington, Mass.

Raytheon was founded in 1922 as American Appliance Company to make electrical parts. It soon changed its name to Raytheon, Inc. In 1928 a successor company, Raytheon Manufacturing Company, was formed to merge Raytheon and Q.R.S. Company, an Illinois manufacturer of rectifier tubes, mercury switches, and neon signs. The company assumed its present name in 1959. In 1956 Raytheon sold its radio and television operations to Admiral Corporation, and in 1971 it consolidated its communications, computer, and display functions under a unified business division.

The major customer for Raytheon's electronic products and its research abilities in aerospace and defense is the U.S. government. In addition to air-defense missile systems, Raytheon produces radar systems for intelligence, fire, weather, and air-traffic control; communications systems; and electronic weaponry. The company also has developed electronic data-processing and minicomputer systems.

Raytheon markets home appliances through its Amana Refrigeration, Inc., subsidiary and its Caloric division. Products include kitchen and laundry appliances, heaters, and air conditioners. In 1980 it acquired Beech Aircraft Company, which produces single- and twin-engine planes for the general aviation market. The company also supplies energy services, heavy construction equipment, and textbooks.

Rayy, also spelled RAY, REY, or RAI, Old Persian RAGHA, Latin RHAGAE, formerly one of the great cities of Iran. The remains of the ancient city lie on the eastern outskirts of the modern city of Shahr-e-Rey, which itself is located just a few miles southeast of Tehrān.

A settlement at the site dates from the 3rd millennium BC. Rayy is featured in the Avesta (the original document of Zoroastrianism, an Iranian religion) as a sacred place, and it is also mentioned in the book of Tobit, of the biblical Apocrypha, and by classical authors. Rayy was captured by the Muslim Arabs in AD 641. During the reign of the Muslim caliph al-Mahdī in the 8th century, the city grew in importance until it was rivaled in western Asia only by Damascus and Baghdad. Islamic writers described it as a city of extraordinary beauty, built largely of fired brick and brilliantly ornamented with blue faience (glazed earthenware). It continued to be an important city under the rule of the Seljuqs, but in the 12th century it was weakened by the fierce quarrels of rival religious sects. In 1220 the city was almost entirely destroyed by the Mongols, and its inhabitants were massacred. Most of the survivors of the massacre moved to nearby Tehrān, and the deserted remnants of Rayy soon fell into complete ruin.

Rayy was famous for its decorated silks, of unsurpassed artistic perfection, and for ceramics. Only two architectural monuments survive: the tower of Toghrïl (1139) and a partially ruined tower.

Rayy ware, in Islāmic ceramics, style of pottery found at Rayy near Tehrān and dating from the 12th century. Particularly characteristic is a fine *minai* (a kind of enamel) painting. Fine pottery with bold carving, occasional piercing, and translucent glaze is typical, as is a range of matte colours and silhouette decoration.

Razak bin Hussein, Tun Abdul (Malaysian prime minister): *see* Abdul Razak bin Hussein, Tun Haji.

Razgrad, also spelled RASGRAD, town, northeastern Bulgaria, on the Beli Lom River. It is the largest producer of antibiotics in Bulgaria and also manufactures concrete, porcelain, and glass and is an agricultural centre for grain, vegetables, and timber. Between the 15th and the 19th century, Razgrad was Turkish. Historical monuments in the town include the İbrahim Paşa Mosque (built 1614) and the ruins of the massive Roman fortress of Abritus, select findings from which are in the local museum. Pop. (1987 est.) 51,277.

Rāzī, ar-, in full ABŪ BAKR MUḤAMMAD IBN ZAKARĪYĀʾ AR-RĀZĪ, Latin RHAZES (b. *c.* 865, Rayy, Persia [now in Iran]—d. 923/932, Rayy), celebrated alchemist and Muslim philosopher who is also considered to have been the greatest physician of the Islāmic world.

One tradition holds that ar-Rāzī was already an alchemist before he gained his medical knowledge. After serving as chief physician in a Rayy hospital, he held a similar position in Baghdad for some time. Like many intellectuals in his day, he lived at various small courts under the patronage of minor rulers. With references to his Greek predecessors, ar-Rāzī viewed himself as the Islāmic version of Socrates in philosophy and of Hippocrates in medicine.

Ar-Rāzī's two most significant medical works are the *Kitāb al-Manṣūrī,* which he composed for the Rayy ruler Manṣūr ibn Isḥaq and which became well known in the West in Gerard of Cremona's 12th-century Latin translation; and *Kitāb al-ḥāwī,* the "Comprehensive Book," in which he surveyed Greek, Syrian, and early Arabic medicine, as well as some Indian medical knowledge. Throughout his works he added his own considered judgment and his own medical experience as commentary. Among his numerous minor medical treatises is the famed *Treatise on the Small Pox and Measles,* which was translated into Latin, Byzantine Greek, and various modern languages.

The philosophical writings of ar-Rāzī were neglected for centuries, and renewed appreciation of their importance did not occur until the 20th century. Although he claimed to be a follower of Plato, he consistently disagreed with such Arabic interpreters of Plato as al-Fārābī, Avicenna, and Averroës. He was probably acquainted with Arabic translations of the Greek atomist philosopher Democritus and pursued a similar tendency in his own atomic theory of the composition of matter. Among his other works, *The Spiritual Physick of Rhazes* is a popular ethical treatise and a major alchemical study.

Rāzī, ar- (Muslim theologian): *see* Fakhr ad-Dīn ar-Rāzī.

Razin, Stenka, byname of STEPAN TIMOFEYEVICH RAZIN (b. *c.* 1630, Zimoveyskaya-na-Donu, Russia—d. June 16 [June 6, Old Style], 1671, Moscow), leader of a major Cossack and peasant rebellion on Russia's southeastern frontier (1670–71).

Born into a well-to-do Don Cossack family, Stenka Razin grew up amid the tension caused by the inability of runaway serfs, who were continually escaping from Poland and Russia to the Don Cossack area, to find land and comfortably settle in the prosperous Cossack communities.

In 1667 Razin made himself the head (hetman) of a small band of landless newcomers and adventurers and established a new Cossack outpost on the upper Don, near the course of the Volga River. For the next three years he carried out daring raids on Russian and Persian settlements, seizing a large Volga River flotilla that was carrying goods owned by the Tsar, capturing (1668) the town of Yaik on the Yaik (now Ural) River, attacking by sea and destroying the Muslim settlements of Derbent, Baku, and Rasht on the Caspian Sea in Persia, and defeating a fleet sent against him by the shah of Persia (1669).

Stenka Razin, detail of an engraving from "A Relation Concerning the Particulars of the Rebellion Lately Raised in Muscovy by Stenka Razin" (London, 1672)

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

Having acquired great fame and wealth, Razin returned to the Don and in 1670 launched a new campaign against the tsar's fortress cities on the Volga. With a force of about 7,000 Cossacks, he seized Tsaritsyn (now Volgograd) and Astrakhan. In both towns Razin and his men had engaged in drunken orgies and perpetrated savage atrocities against the nobles and military officers; he also replaced the local governments with Cossack institutions of self-rule. Encouraged by his success, he decided to continue his advance up the Volga, and along the way he incited the peasantry and urban lower classes to join his rebellion against the nobility and bureaucracy (but not against the tsar). He captured Saratov and, with a force that had swollen to 20,000, proceeded to Simbirsk (now Ulyanovsk), while his insurrection spread throughout the Volga region into the lands adjoining the Don and Donets rivers and even into some of the central provinces of the Russian state.

Alarmed at Stenka Razin's success, Tsar Alexis (ruled 1645–76) sent an army under the command of Prince Yury Baryatinsky to relieve Simbirsk. The Prince's force, trained in western European military techniques, inflicted a decisive defeat on Razin's largely raw, undisciplined, and badly equipped troops (October 1670). Razin fled to the Don; but on April 24 (April 14), 1671, he was captured by loyalist Cossacks and turned over to the tsarist authorities. Brought to Moscow and tortured, Razin was executed by quartering in Red Square. Tsarist forces burned the rebels' villages and executed their leaders in suppressing the revolt, and Astrakhan, the last rebel stronghold, surrendered in December 1671.

The Razin uprising combined two distinct forces, Cossacks and peasants. The former were inspired by what can only be called anarchist ideals, the latter by hatred of serfdom, which had been finally legalized in 1649. While the element of social protest was present in the rebellion, the tone was set by the anarchic element whose aim was simple loot and destruction. For this reason, most Russian and Soviet historians have tended to relegate Razin to a minor place in their narratives of Russian history. In Russian folklore, however, Razin is a popular hero, the incarnation of a free man who triumphs alike over society and nature. His exploits have been immortalized in numerous folk songs and legends.

razor, keen-edged cutting implement for shaving or cutting hair. Prehistoric cave drawings show that clam shells, shark's teeth, and sharpened flints were used as shaving implements, and flints are still in use by certain primitive tribes. Solid gold and copper razors have been found in Egyptian tombs of the 4th millennium BC. According to the Roman historian Livy, the razor was introduced in Rome in the 6th century BC by Lucius Tarquinius Priscus, legendary king of Rome; but shaving did not become customary until the 5th century BC.

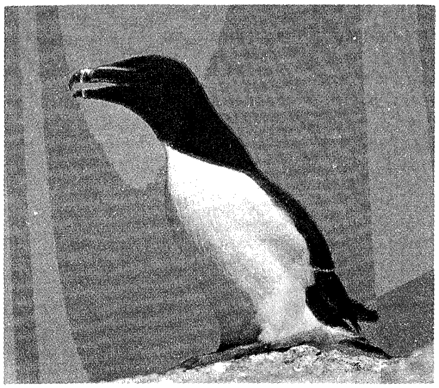
Steel razors with ornamented handles and individually hollow-ground blades were crafted in Sheffield, Eng., the centre of the cutlery industry, in the 18th and 19th centuries. The hard crucible steel produced there by Benjamin Huntsman in 1740 was first rejected and then, later, after its adoption in France, deemed superior by the local manufacturers.

The forerunner of the modern safety razor, a steel blade with a guard along one edge, was made in Sheffield in 1828. In the United States a hoe-shaped safety razor was produced at about the same time, and, at the beginning of the 20th century, King Camp Gillette combined the hoe shape with the double-edged replaceable blade. In the early 1960s several countries began to manufacture stainless steel blades for safety razors, with the advantage of longer use.

The popularity of the long-wearing double-edged blade was greatly eclipsed by the development of inexpensive cartridge-style injector blades, designed to fit into disposable plastic handles. The cartridge had only one cutting edge, but many manufacturers produce a "double-edged" instrument by placing two blades on one side.

Electric razors were patented as early as 1900 in the United States, but the first to be successfully manufactured was that on which Jacob Schick, a retired U.S. Army colonel, applied for a patent in 1928 and that he placed on the market in 1931. Competitive models soon appeared. In the electric razor a shearing head, driven by a small motor, is divided into two sections: the outer consists of a series of slots to grip the hairs and the inner of a series of saw blades. Models vary in the number and design of the blades, in the shape of the shearing head (round or flat), and in auxiliary devices such as clippers for sideburns.

razor-billed auk, also called RAZORBILL (*Alca torda*), black and white seabird of the North Atlantic, bearing a sharp, heavy, compressed beak. About 40 cm (16 inches) long, it is the largest living member of the auk family, Alci-



Razor-billed auk (*Alca torda*)

Wolfgang Lummer

dae (order Charadriiformes), and the nearest kin to the extinct great auk (*q.v.*). Razor-billed auks are deep divers, feeding on fish (including shellfish). They breed along North Atlantic coasts; some migrate as far south as the Mediterranean Sea.

razor clam, any of the species of marine bivalve mollusks of the family Solenidae. In England the species of the genera *Ensis* and *Solen* are called razor shells. The Solenidae are common in intertidal sands and muds, particularly of temperate seas. These bivalves have narrow and elongated razor-like shells up to about 20 cm (8 inches) long. They have a large active foot that enables them to move rapidly up and down within their burrows and retreat very quickly when disturbed. With their short siphons, they feed on particulate material in seawater. Some species are able to swim for short distances by jetting water through the siphons.

razor fish: *see* shrimpfish.

razorback whale: *see* fin whale.

RCA Corporation, formerly (1919–69) RADIO CORPORATION OF AMERICA, major American electronics and broadcasting conglomerate that is a unit of General Electric Company. Among its subsidiaries is the National Broadcasting Company (NBC). Headquarters are in New York City.

RCA was founded as Radio Corporation of America by the General Electric Company in 1919 to acquire Marconi Wireless Telegraph Company of America (incorporated in 1899). A subsidiary of a British-owned company, Marconi Wireless at that time was the only company capable of handling commercial transatlantic radio communciations, and General Electric took it over with the assistance of the U.S. Navy Department, which was eager to keep the technology in American hands. For the following 50 years the company was led by David Sarnoff, who built the company into a modern communications conglomerate.

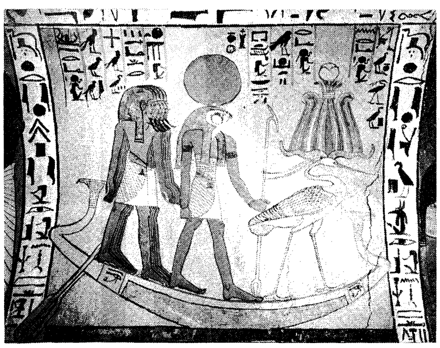
Westinghouse beat RCA to the first commercial radio broadcast in 1920, but Sarnoff followed in 1921 with the first sports broadcast. In 1926 the National Broadcasting Company was set up to carry on the company's radio activities. In 1929 the company acquired the Victor Talking Machine Company and in 1939 developed the first experimental television set. The first black-and-white sets went on sale in 1946, and colour became available four years later. Meanwhile, NBC had divested itself of one of its two networks (the "Blue" network), and this became the American Broadcasting Company (ABC). General Electric Company acquired RCA in 1986 for more than $6,000,000,000 in what was the largest non-oil company merger up to that time. In addition to radio and television broadcasting, RCA also is active in military and space electronics and satellite communications. General Electric sold RCA's consumer-electronics manufacturing operations to the French corporation Thomson-Brandt, SA, in 1987.

RCMP: *see* Royal Canadian Mounted Police.

RDX, abbreviation of RESEARCH DEPARTMENT EXPLOSIVE, formally CYCLOTRIMETHYLENETRINITRAMINE, also called CYCLONITE, HEXOGEN, or T_4, powerful explosive, discovered by Hans Henning of Germany in 1899 but not used until World War II, when most of the warring powers introduced it. Relatively safe and inexpensive to manufacture, RDX was produced on a large scale in the United States by a secret process developed in the United States and Canada. The name RDX was coined by the British, and this name was accepted in the United States. The Germans called it hexogen, and the Italians called it T_4.

RDX is a hard, white crystalline solid, insoluble in water and only slightly soluble in some other solvents. Sensitive to percussion, its principal nonmilitary use is in blasting caps. It is often mixed with other substances to decrease its sensitivity.

Re, also spelled PHRA, or RA, in ancient Egyptian religion, god of the sun and of creation, one of the most important figures in the pantheon. He was thought to travel across the sky in his solar boat each day and, during the night, to make his passage in another



Re, or Re-Horakhte (centre), and a bird-god in a boat, wall painting, 19th dynasty; in the tomb of Sennedjem, Dayr al-Madīnah, Egypt

Andre Held

boat through the underworld, where, in order to be born again for the new day, he had to vanquish the evil serpent Apepi (Apophis). He was represented as rising from the ocean of chaos on the primeval hill, creating himself and then in turn eight other gods.

Originally he was but one of many solar deities. Eventually, however, his worship came to pervade that of all other solar gods and also that of many of the animal-headed deities. Thus there are found such syncretisms as Re-Horakhte, Amon-Re, Sebek-Re, and Min-Re, among others. In turn, aspects of other gods influenced Re himself; *e.g.,* his falcon-headed appearance may have originated from an association with Horus, the falcon-headed god of Lower Egypt associated with the kings. Re's influence was spread by his active and powerful priesthood at On (Heliopolis), the centre of his worship. By the 5th dynasty (*c.* 2465–*c.* 2325 BC), Re had become the official god of the pharaohs, and every king claimed to be both the son of Re and even Re himself incarnate. "Re" became part of the royal name. As the father of Maʿat, he was the ultimate source of right and justice in Egypt.

With the advent of the 12th dynasty (1938–1756 BC), Re was associated with Amon of Thebes as Amon-Re, a god closely connected with the rulers. Even the revolutionary worship of the sun disk Aton during the abortive Amarna period in the 18th dynasty is considered to be only an offshoot of Re worship.

Ré Island, French ÎLE DE RÉ, island in the Bay of Biscay, Charente-Maritime *département,* off the west coast of France, opposite La Pallice and La Rochelle (to which it is connected by ferry). It was for long separated from the mainland by the shallow water of Pertuis Breton, 2 miles (3.2 km) wide at the narrowest point, but a 2.1-mile bridge was constructed in the late 1970s. The island is 18 miles (29 km) long and 2 to 3 miles wide; it has an area of 33 square miles (85 square km). On the island's north coast an indentation, the Fier d'Ars, nearly divides it, leaving an isthmus only 240 feet (73 m) across. The island is low-lying and fertile, specializing in the cultivation of early vegetables, notably asparagus, and there are vineyards. There are salt fields and oyster beds along the shores, which have long stretches of sand. The chief resort communities are Saint-Martin, a port on the north coast, and La Flotte, a fishing port. There are ruins of a medieval abbey of Saint-Laurent. Pop. (1982) 11,396.

REA Express, Inc., formerly (1918–29) AMERICAN RAILWAY EXPRESS COMPANY, or (1929–70) RAILWAY EXPRESS AGENCY, INC., American company founded in 1918 and liquidated in 1975, which operated the nation's largest ground and air express services, transporting parcels, money, and goods, with pickup and delivery.

American Railway Express Company was established by the U.S. government in 1918, during World War I, at the same time that the government took over the nation's railroads. The domestic express businesses and property of the nation's major express carriers—Adams & Company (founded 1842), American Express Company (founded 1850), Wells, Fargo & Company (founded 1852), and Southern Express Company (founded 1861)—were expropriated and merged into a public corporation. After the war the domestic express businesses were not returned to their original owners (unlike the return of the railroads) but remained with the American Railway Express Company.

On Dec. 7, 1928, however, 86 of the nation's railroads joined in setting up Railway Express Agency, Inc., which in 1929 bought out the American Railway Express Company and proceeded to operate the express business under private ownership. Forty years later, a group of the company's officials secured controlling interest in the company, and in 1970 the company's name was changed to REA Express, Inc. Faulty management, strikes by the Brotherhood of Railway & Airline Clerks, and competition from the U.S. Postal Service and United Parcel Service led to drastic financial losses, and on Feb. 18, 1975, REA filed for bankruptcy and was adjudicated bankrupt the following November.

reactance, in electricity, measure of the opposition that a circuit or a part of a circuit presents to electric current insofar as the current is varying or alternating. Steady electric currents flowing along conductors in one direction undergo opposition called electrical resistance, but no reactance. Reactance is present in addition to resistance when conductors carry alternating current. Reactance also occurs for short intervals when direct current is changing as it approaches or departs from steady flow, for example, when switches are closed or opened.

Reactance is of two types: inductive and capacitive. Inductive reactance is associated with the magnetic field that surrounds a wire or a coil carrying a current. An alternating current in such a conductor, or inductor, sets up an alternating magnetic field that in turn affects the current in, and the voltage (potential difference) across, that part of the circuit. An inductor essentially opposes changes in current, making changes in the current lag behind those in the voltage. The current builds up as the driving voltage is already decreasing, tends to continue on at maximum value when the voltage is reversing its direction, falls off to zero as the voltage is increasing to maximum in the opposite direction, and reverses itself and builds up in the same direction as the voltage even as the voltage is falling off again. Inductive reactance, a measure of this opposition to the current, is proportional to both the frequency f of the alternating current and a property of the inductor called inductance (symbolized by L and depending in turn on the inductor's dimensions, arrangement, and surrounding medium). Inductive reactance X_L equals 2π times the product of the frequency of the current and the inductance of the conductor, simply $X_L = 2\pi fL$. Inductive reactance is expressed in ohms. (The unit of frequency is hertz, and that of inductance is henry.)

Capacitive reactance, on the other hand, is associated with the changing electric field between two conducting surfaces (plates) separated from each other by an insulating medium. Such a set of conductors, a capacitor, essentially opposes changes in voltage, or potential difference, across its plates. A capacitor in a circuit retards current flow by causing the alternating voltage to lag behind the alternating current, a relationship in contrast to that caused by an inductor. The capacitive reactance, a measure of this opposition, is inversely proportional to the frequency f of the alternating current and to a property of the capacitor called capacitance (symbolized by C and depending on the capacitor's dimensions, arrangement, and insulating medium). The capacitive reactance X_C equals the reciprocal of the product of 2π, the frequency of the current, and the capacitance of that part of the circuit, simply $X_C = 1/(2\pi fC)$. Capacitive reactance has units of ohms. (The unit of capacitance is farad.)

Because inductive reactance X_L causes the voltage to lead the current and capacitive reactance X_C causes the voltage to lag behind the current, total reactance X is their difference—that is, $X = X_L - X_C$. The reciprocal of the reactance, $1/X$, is called the susceptance and is expressed in units of reciprocal ohm, called mho (*ohm* spelled backward).

reaction, heat of, the amount of heat that must be added or removed during a chemical reaction in order to keep all of the substances present at the same temperature. If the pressure in the vessel containing the reacting system is kept at a constant value, the measured heat of reaction also represents the change in the thermodynamic quantity called enthalpy, or heat content, accompanying the process—*i.e.,* the difference between the enthalpy of the substances present at the end of the reaction and the enthalpy of the substances present at the start of the reaction. Thus, the heat of reaction determined at constant pressure is also designated the enthalpy of reaction, represented by the symbol ΔH. If the heat of reaction is positive, the reaction is said to be endothermic; if negative, exothermic.

The prediction and measurement of the heat effects that accompany chemical changes are important to the understanding and use of chemical reactions. If the vessel containing the reacting system is so insulated that no heat flows into or out of the system (adiabatic condition), the heat effect that accompanies the transformation may be manifested by an increase or a decrease in temperature, as the case may be, of the substances present. Accurate values of heats of reactions are necessary for the proper design of equipment for use in chemical processes.

Because it is not practical to make a heat measurement for every reaction that occurs and because for certain reactions such a measurement may not even be feasible, it is customary to estimate heats of reactions from suitable combinations of compiled standard thermal data. These data usually take the form of standard heats of formation and heats of combustion. The standard heat of formation is defined as the amount of heat absorbed or evolved at 25° C (77° F) and one atmosphere pressure when one mole of a compound is formed from its constituent elements, each substance being in its normal physical state (gas, liquid, or solid). The heat of formation of an element is arbitrarily assigned a value of zero. The standard heat of combustion is similarly defined as the amount of heat evolved at 25° C and at one atmosphere pressure when one mole of a substance is burned in excess oxygen. The method of calculating heats of reactions from measured values of heats of formation and combustion is based on the principle known as Hess's law of heat summation.

reaction rate, the speed, or velocity, at which a chemical reaction proceeds, expressed in terms of the amount of a product formed per unit time or the amount of a reactant used per unit time. Thus, for the reaction of two compounds X and Y that form a product Z, the equation is $X + Y \rightarrow Z$, and the reaction rate may be given by the rate of increase of the concentration of Z or by the rate of decrease of the concentration of X or Y. Mathematically, the reaction rate is given by dC_Z/dt, $-dC_X/dt$, or $-dC_Y/dt$, in which C represents the concentration (*e.g.,* moles per litre) of the species denoted by the subscript, and the symbol d/dt is the mathematical expression for the rate of change of some quantity with respect to time (the derivative with respect to time).

Chemical reactions proceed at different speeds depending on the nature of the reacting substances and the type of chemical transformation. In general, reactions in which ions (electrically charged particles) combine or separate occur very rapidly, while those in which covalent bonds are formed or broken are much slower. For a given set of reactants, the speed of the reaction will vary with the temperature or pressure imposed on the reacting system and the amounts of reactants used. Ordinarily the reaction will gradually slow down as the reactants become depleted. In some cases the addition of a substance not itself a reactant, called a catalyst, accelerates a reaction that normally takes place at a very low rate.

The reaction-rate constant, or the specific rate constant, is the proportionality constant in the equation that describes the relationship between the rate of a chemical reaction and the concentrations of the reacting substances. If r represents reaction rate, k is the symbol customarily used for the reaction rate constant, and $f(C)$ is an expression for the concentrations of the reactants, then the equation for these values is $r = kf(C)$. If the reaction rate, or velocity, is visualized as being determined by two factors, one representing the amount of molecules present and the other the type and the condition of those molecules, the rate constant is a quantity that represents the latter. The prediction, measurement, and interpretation of reaction rates are subjects of the branch of chemistry known as chemical kinetics.

reactive dye, any of a class of highly coloured organic substances, primarily used for tinting textiles, that attach themselves to their substrates by a chemical reaction that forms a covalent bond between the molecule of dye and that of the fibre. The dyestuff thus becomes a part of the fibre and is much less likely to be removed by washing than are dyestuffs that adhere by adsorption.

reactor, in chemical engineering, device or vessel within which chemical processes are carried out for experimental or manufacturing purposes.

Reactors range in size and complexity from small, open kettles fitted with simple stirrers and heaters to large, elaborate vessels equipped with jackets or internal coils for heating or cooling, nozzles or ports for adding and removing materials, sources of ultraviolet radiation or electrical energy, specially designed agitators or scrapers, and strong walls and tight seals to permit operation at high or low pressures. In many cases, these reactors are provided with instruments that measure temperature, pressure, pH, or other properties of the contents. They are constructed of materials selected for strength and resistance to attack by the substances being processed.

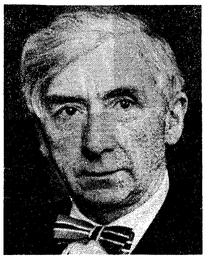
For certain processes that are particularly adaptable to continuous operation, reactors are devised so that the chemical reaction may continue for weeks or months while starting materials are introduced continuously or intermittently and the finished product is removed in a steady stream or in periodic discharges. Modern petroleum refineries have reactors of the steady-stream type; steel mills rely on blast furnaces, which are continuous reactors charged and discharged intermittently.

Read, Sir Herbert (b. Dec. 4, 1893, Muscoates Grange, Kirbymorside, Yorkshire, Eng.—d. June 12, 1968, Malton, Yorkshire), poet and critic who was the chief advocate and interpreter of modern art movements in Great Britain from the 1930s. His critical scrutiny embraced society, art, and literature from the point of view of a philosophic anarchist.

Read grew up on a farm, and he described his childhood in *The Innocent Eye* (1933), incorporated with other autobiographical writings in *The Contrary Experiences* (1963). After working in a bank, he went to the University of Leeds. He served for three years as an infantry officer during World War I. War and his lost childhood appear often as themes in his several volumes of poetry, beginning with *Naked Warriors* (1919); his first *Collected Poems* was published in 1926, his last in 1966. He was an important influence among a group of poets of the 1940s known as the "new apocalypse," who reacted against the political and cerebral poetry of the 1930s.

Read became an assistant keeper at the Victoria and Albert Museum, London, after the war, taught at the University of Edinburgh (1931–32), and edited the *Burlington Magazine* (1933–39). He lived in London in the 1930s near the artists and sculptors Henry Moore, Barbara Hepworth, and Ben Nicholson, and his interest helped establish their work. Writing, teaching, and work in publishing occupied his later years. He was knighted in 1953.

Important to Read's theories of art and literature is the distinction he first made in *Form in Modern Poetry* (1932) between organic and abstract form. He favoured the organic, which takes shape to meet the needs of a particular expression, rather than abstract form, superimposed on a given content.

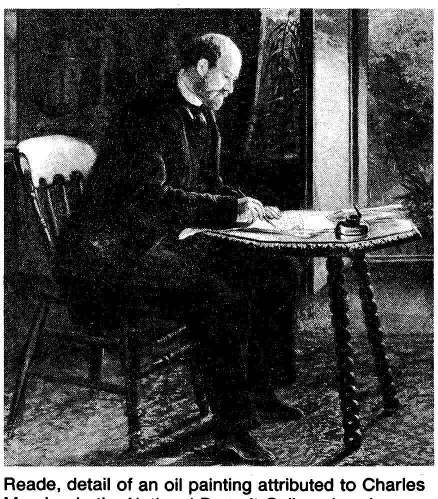


Sir Herbert Read
BBC Hulton Picture Library

Read's many critical works include *Art Now* (1933, rev. 1936, 1948), *Art and Industry* (1934), *Art and Society* (1936), *Education Through Art* (1943), and *The Philosophy of Modern Art* (1952). His *The True Voice of Feeling: Studies in English Romantic Poetry* (1953) revived the reputation of the Romantic poets. Read's emphasis on the importance of art in learning influenced British education, and his support of functionalism left its impress on British design. *The Contrary Experience: The Autobiography of Herbert Read* was published in 1974.

Read, Opie (Percival) (b. Dec. 22, 1852, Nashville, Tenn., U.S.—d. Nov. 2, 1939, Chicago), U.S. journalist, humorist, novelist, and lecturer. Read specialized in the homespun humour of life in Kentucky, Tennessee, and Arkansas; Southern colonels, blacks, and drunken printers are frequently found in his writing. Inspired by Benjamin Franklin's autobiography, Read became a printer, reporter, and editor, ultimately editing the Little Rock, Ark., *Gazette* (1878–81) and the *Arkansas Traveler* (1882), a weekly humour and literary journal, which he moved to Chicago in 1887. His books included *Len Gansett* (a tale of the South, 1888); *Jucklins* (1895), which sold over 1,000,000 copies; *My Young Masters* (1896), about the U.S. Civil War; and many others. His autobiography, *I Remember*, was published in 1930.

Reade, Charles (b. June 8, 1814, near Ipsden, Oxfordshire, Eng.—d. April 11, 1884, London), English author whose novels expose, with passionate indignation, the social injustices of his times. His greatest work, however, *The Cloister and the Hearth* (1861), a brilliant historical romance, relates the adventures of the father of Erasmus.



Reade, detail of an oil painting attributed to Charles Mercier; in the National Portrait Gallery, London
By courtesy of the National Portrait Gallery, London

As a young man Reade was an active partner in a Soho violin business and was himself a fair performer on that instrument. In 1843 he was called to the bar but never practiced law. In 1851 Reade became vice president of Magdalen College, Oxford, but treated the position as a sinecure. A loyal friend of Reade's, Laura Seymour, an actress, became his housekeeper from 1856 until her death in 1879.

Although Reade spent a great deal of time and money in writing and staging plays (he wrote 40), they are crippled by crude characterizations and melodrama.

Reade's 14 novels reveal his humanitarianism and concern with social issues. *It Is Never Too Late to Mend* (1856) attacked conditions in prisons, and *Hard Cash* (1863) exposed the ill-treatment of mental patients, especially in private asylums; *Put Yourself in His Place* (1870) dealt with the terrorist activities of trade unionists; and the melodramatic *Foul Play* (1868), written with Dion Boucicault, revealed the frauds of "coffin ships" and helped to sway public opinion in favour of the safety measures proposed later by Samuel Plimsoll.

reader: *see* lector.

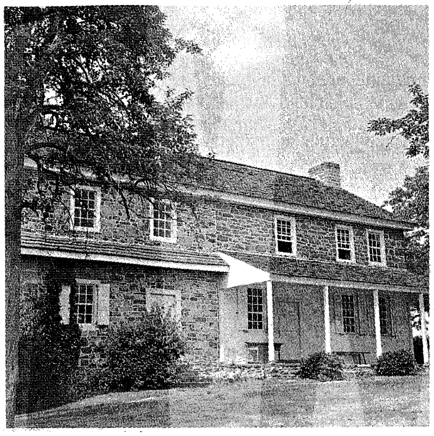
Reader's Digest, U.S. monthly magazine, probably the most popular and influential in the United States, long having the largest circulation of any periodical in the world. It was first published in 1922 as a digest of condensed articles of topical interest and entertainment value taken from other periodicals. Founded on a low budget by DeWitt Wallace and his wife, Lila Acheson, after numerous magazine publishers had rejected the idea, the pocket-size magazine appealed from the start to popular tastes. It began publishing condensed versions of current books in 1934. Later, Wallace began to develop articles for *Reader's Digest* by commissioning them first and then offering the completed articles to other publications—from which the *Digest* would then reprint them, paying the other magazine a fee for reprint rights. This practice was attacked by some editors; however, the *Digest* moved gradually toward publishing original material under its own auspices most of the time. Although conceived by Wallace as an impartial journal, the *Digest* has occasionally been assailed for reflecting its publishers' generally conservative point of view. Its circulation, however, did not falter. By the late 20th century the *Digest* had a circulation of 30,000,000 in 16 languages plus a Braille version of English.

Reading, district (borough), county of Berkshire, England, on the Rivers Kennet and Thames. Its area is 14 sq mi (37 sq km).

Reading was a Danish encampment as early as 871. A Benedictine abbey, its site now turned over to public gardens, was founded in 1121. Between the 12th and 16th centuries Reading was dominated by a struggle for privileges between the abbey and the emergent merchants' guild. The town suffered severely in the English Civil War of the mid-17th century.

A university college was opened in 1892; it became an independent university in 1926. Its researches into agriculture, horticulture, and dairying are especially well known. Industries include biscuit making, printing, engineering, and malting and brewing. Pop. (1981 prelim.) town, 123,731; (1983 est.) district, 138,500.

Reading, city, seat (1752) of Berks County, southeastern Pennsylvania, U.S., on the Schuylkill River, 51 mi (82 km) northwest of Philadelphia. It is the centre of an urban industrial complex comprising 30 boroughs and more than 40 townships. Laid out in 1748 by Nicholas Scull on land owned by Thomas and Richard Penn (sons of William Penn, Pennsylvania's founder), it was built around Penn Common, a large open square, and named for the hometown of the Penn family in Berkshire, Eng. During the Revolutionary War, Reading



The Daniel Boone Homestead near Reading, Pa.
Jane Latta—Photo Researchers

served as a supply depot and manufacturer of cannon and in 1775 sent two infantry companies to serve under Gen. George Washington near Boston. It later maintained a prison camp for British and Hessians captured at the Battle of Trenton. At the outbreak of the Civil War the city responded to Lincoln's plea for troops to defend the federal capital by sending the locally recruited Ringgold Light Artillery, later called the First Defenders. Reading was the second city in the U.S. to elect a Socialist government (1929).

Industrial growth began in the late 18th century with the development of the iron and steel industries in Berks County. After the production of Upper Great Lakes ore overshadowed that of Pennsylvania ore, Reading shifted to the fabrication of iron and steel. The opening of the Schuylkill Canal to Philadelphia (1824) and the Union Canal to Lebanon and Middletown on the Susquehanna (1828) and the completion of the Philadelphia and Reading Railroad (1884) greatly stimulated industrial growth. In the 1890s, safety-bicycle manufacturing mushroomed, and from 1900 to 1912 Duryea and Reading Steamer automobiles were manufactured. Development of the textile and hosiery industry was started about 1900 by two German technicians, Ferdinand Thun and Henry Janssen. Modern industries include the manufacture of clothing, bricks, electronic equipment, specialty steels, paint, railroad equipment, candy, and automotive parts.

Reading is the seat of Albright College (1856), Alvernia College (1958), and the Berks campus of Pennsylvania State University (1958). Mt. Penn (1,140 ft [347 m]), with a curious pagoda and observation tower at its summit, is the centre of a 2,800-ac (1,100-ha) park system. Local historic landmarks include the Daniel Boone Homestead (where Boone was born in 1734), the Conrad Weiser farm, and Hopewell Village National Historic Site (an example of an early iron-making community). An annual folk festival at nearby Kutztown reflects the Pennsylvania Dutch (German) heritage of the area. Inc. borough, 1783; city, 1847. Pop. (1970) 87,643; (1980) 78,686; (1982 est.) metropolitan area (SMSA), 314,700.

Reading, Rufus Daniel Isaacs, 1st marquess of (b. Oct. 10, 1860, London—d. Dec. 30, 1935, London), politician, lord chief justice of England, and diplomat, who in 1926 became the first commoner, after Arthur Wellesley, marquess of Wellington (1812), to attain the rank of marquess.

Called to the bar in 1887, Isaacs built a prosperous practice, representing trade unions as well as large corporations. In 1904 he was elected to the House of Commons as a Liberal. Appointed solicitor general and later attorney general in 1910, he became the first attorney general to be given a Cabinet seat (1912). In 1913 a special committee of the Commons acquitted Isaacs, the future prime minister David Lloyd George, and other ministers of charges of corruption arising from transactions in the shares of the Marconi Wireless Telegraph Company of America, of which Isaacs' brother Godfrey was managing director.

As lord chief justice (1913–21), Isaacs presided over the trial for treason of the Irish patriot Sir Roger Casement (1916). During World War I he worked to strengthen Anglo-American relations, and he headed an Anglo-French delegation that negotiated a war loan of $500,000,000 from the U.S. Reading (who had been created baron in 1914, viscount in 1916, and earl in 1917) retained his lord chief justiceship while serving as ambassador to the U.S. (1918–19).

As viceroy of India during a period (1921–26) of turbulent Indian nationalism, Reading, although he preferred conciliation, increasingly resorted to summary measures. He imprisoned two Muslim leaders in 1921 and Mahatma Gandhi in 1922. He also used force against the Moplahs (Muslim separatists in the Madras Presidency) and against Sikh rebels in the Punjab (Pañjāb).

Reading's brief term (August–November 1931) as foreign secretary in James Ramsay MacDonald's coalition government was uneventful. *Rufus Isaacs, First Marquess of Reading*, 2 vol. (1942–45), was written by his son, Gerald Rufus Isaacs, the 2nd marquess.

Reading
By courtesy of Lady Reading

Reading Company, U.S. railroad in Pennsylvania, New York, and Delaware, absorbed into the Consolidated Rail Corporation (Conrail) in 1976. At its peak in the first half of the 20th century, it was the largest U.S. carrier of anthracite coal.

It began as the Philadelphia and Reading Railroad in 1833, taking over several already established lines. On one of these lines, the Philadelphia, Germantown, and Norristown, the inventor Matthias Baldwin had operated his first locomotive in 1832. The engine was called "Old Ironsides" and ran only in good weather. (An advertisement read, "On rainy days horses will be attached.")

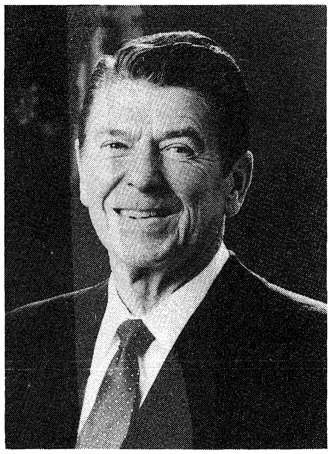
The Philadelphia and Reading developed as a carrier of coal from the anthracite mines of Pennsylvania. In the 1870s it acquired 30 percent of the state's anthracite lands, mainly in the Schuylkill and Western Middle coal districts. The burden of this investment forced it into receivership twice in the 1880s and again in 1896.

The Reading Company was organized in 1896 as a holding company of the Philadelphia and Reading Railway Company and the Philadelphia and Reading Coal and Iron Company. The Reading Company became an operating company in 1923, merging the Philadelphia and Reading with a number of subsidiary lines it had acquired. Subsequently it merged many other small Pennsylvania lines. By 1971 the Reading Company had been forced into receivership again. In 1974 a federal court found against reorganization, and most of its rail properties were purchased by the federally chartered Consolidated Rail Corporation (Conrail) in 1976.

ready-made, everyday object selected and designated as art; the name was coined by the French artist Marcel Duchamp. Duchamp's first ready-made, "Bicycle Wheel" (1913), consisting of a wheel mounted on a stool, was his way of protesting the excessive importance attached to works of art. By selecting mass-produced, commonplace objects, Duchamp attempted to destroy the notion of the uniqueness of the art object. These antiaesthetic gestures made Duchamp one of the leading Dadaists of his day, and his ready-made technique was adapted by such contemporary artists as Robert Rauschenburg, Andy Warhol, and Jasper Johns.

Reagan, Ronald W(ilson) (b. Feb. 6, 1911, Tampico, Ill.), 40th president of the United States (1981–89), noted for his conservative Republicanism.

The son of a shoe salesman, Reagan graduated from Eureka College, Illinois, in 1932. He then became a radio sports announcer in Iowa. In 1937 he began a long career as a motion-picture actor, eventually appearing in about 50 films, notably including *Knute Rockne—All American* (1940), *Kings Row* (1942), and *The Hasty Heart* (1950). From 1947 to 1952 and again during 1959–60, he served as president of the Screen Actors Guild, cooperating with efforts to combat alleged communist influences in the American motion-picture industry.



Reagan, 1981
AP/Wide World Photos

When his movie career declined in the 1950s, Reagan became a traveling spokesman for the General Electric Company as well as the host of *General Electric Theater* on television (1954–62). During that time he changed from a liberal and a Democrat to a conservative Republican.

In 1966 he ran for governor of California as a Republican. He won the election and was reelected in 1970. During his two terms (1967–74), he had only moderate success in promulgating his programs.

Reagan made a halfhearted bid for the Republican presidential nomination in 1968 and seriously, but unsuccessfully, attempted to take the nomination away from President Gerald Ford in 1976. In 1980 he won the Republican presidential nomination. In the ensuing campaign he combined a conservative platform with an optimistic and genial celebration of traditional American values. He achieved a landslide victory over Jimmy Carter. Reagan received 51 percent of the popular vote to 41 percent for Carter.

Reagan fell victim to an assassination attempt shortly after taking office. On March 30, 1981, a 25-year-old drifter named John W. Hinckley, Jr., shot and seriously wounded the president, but Reagan made a remarkably speedy and complete recovery.

Adopting supply-side economic policies, Reagan proposed to greatly increase military expenditures and sharply reduce nondefense spending while simultaneously lowering taxes, thinking that all this would produce rapid economic growth and that the resulting increase in government revenues (through expansion of the base of taxable income) would ultimately balance the federal budget. In 1981 Congress passed most of the president's proposals, drastically cutting nondefense spending and approving a reduction in personal income taxes as well as speedier business depreciation tax write-offs.

The results were mixed. A recession in 1982 was followed by several years of growth. Inflation dropped to about 3.5 percent during Reagan's tenure, but massive budget deficits resulted from the tax cuts; the national debt consequently doubled in size during the period 1981–86.

Reagan launched the largest peacetime military buildup in American history. In 1983 he proposed the construction of a U.S. strategic defense system under a controversial program known as the Strategic Defense Initiative. In foreign affairs he took a strongly anticommunist stance. Arms-control negotiations with the Soviet Union were undertaken with reluctance and extreme caution. The major foreign-policy successes were the U.S. military invasion of the tiny Caribbean island of Grenada to oust a Marxist government in 1983 and Reagan's summit meeting with Soviet leader Mikhail S. Gorbachev in 1988, when they signed the Intermediate-Range Nuclear Forces Treaty (INF Treaty) limiting intermediate-range nuclear missiles.

President Reagan and his second wife, Nancy Davis Reagan (born Anne Frances Robbins), were generally popular with the American public during his terms in office. His appealing personality reinforced his evident talent for communicating with the public.

Reagan ran for reelection in 1984 against the liberal Democrat Walter Mondale. Reagan achieved a landslide victory, winning 59 percent of the popular vote to Mondale's 41 percent. In 1985 he signed legislation making cuts in government spending mandatory in order to balance the federal budget by 1991. He continued to press for increases in defense spending while resisting proposals for tax increases to reduce the government's continuing deficits. His proposals to simplify and overhaul the federal tax codes, drastically modified by Congress, were passed in 1985–86.

In late 1986 it was learned that the Reagan administration had shipped arms to the radical Islāmic fundamentalist government of Iran in an apparent effort to obtain the release of Americans being held hostage by Iranian-influenced terrorists in Beirut, Lebanon. It soon became known that high officials on the National Security Council (a White House advisory agency) had secretly diverted some of the profits from the Iranian arms deals to the U.S.-supported insurgency against the Marxist Sandinista government of Nicaragua. These revelations for a time significantly weakened both Reagan's popularity and his governing authority.

reagin, also called HOMOCYTOTROPIC ANTIBODY, or PRAUSNITZ-KÜSTNER ANTIBODY, type of antibody found in the serum and skin of allergically hypersensitive persons and in smaller amounts in the serum of normally sensitive persons. Most reaginic antibodies are the immunoglobulin E (IgE) fraction in the blood. Reagins are easily destroyed by heating, do not pass the placental barrier (*i.e.,* an allergic mother cannot passively make her child allergic), and have a much longer life-span than other types of antibodies. Reaginic antibodies can be transferred passively to a second person; thus, blood transfusions from allergic donors have occasionally produced temporary identical allergies in the nonallergic recipient for a brief time. *See also* allergy; atopy.

Real, Cordillera, also called CORDILLERA ORIENTAL, major mountain system, the easternmost of the two in Bolivia. It extends generally north-south for about 750 miles (1,200 km) through the length of the country. The Cordillera Real separates the lowlands of the Amazon River basin to the east from the high plateaus of the Altiplano to the west. The Cordillera Real contains within its ranges two characteristic physiographic regions, the Valles, or higher (8,200 to 11,500 feet [2,500 to 3,500 m]) intermontane valleys, and the Yungas, or lower (3,300 to 6,600 feet [1,000 to 2,000 m]) valleys. From the massif of Vilcanota in the north to the pass of San Francisco in the south, the main cordillera is composed of six lesser ranges: the Cordillera de La Paz; the Cordillera Tres Cruces; two parallel ranges, the Azanaques (east) and the Frailes (west); the Chichas; and the Lípez, extending southwestward to connect the Cordillera Real with the Cordillera Occidental, Bolivia's other, more westerly mountain system. The Cordillera de La Paz is the highest portion of the system, with elevations ranging downward from 21,067 feet (6,421 m) at Illampu.

real and personal property, a basic division of property in English common law, roughly corresponding to the division between immovables and movables in civil law. At common law most interests in land and fixtures (such as permanent buildings) were classified as real-property interests. Leasehold interests in land, however, together with interests in tangible movables (goods, animals, money) and most interests in intangibles (such as stocks, bonds, or bank accounts) were classified as personal-property interests. Personal property, also known as "chattels," could be further subdivided into chattels personal (interests in tangible movables and in intangibles) and chattels real (personal property interests in land, of which leaseholds were the most important). Chattels personal could be further subdivided into choses in possession (interests in tangible movables, including animals, merchandise, goods) and choses in action (interests in intangibles, including promissory notes and rights of action). The distinction between real and personal property, though still observed today, is of less significance in Anglo-American legal systems than it once was.

Real Cuerpo de Minería (Spanish: "Royal Mining Company"), guild of mine owners in the Spanish colonies in the Americas. The guild was set up by royal decree in 1777 in the Viceroyalty of New Spain (Mexico) to reorganize and to provide capital for technological improvements in the mining industry. The guild drew up new mining ordinances that were approved by King Charles III in 1783 and were applied to mining activities in Guatemala, New Granada (Colombia, Venezuela, and Ecuador), Peru, and Chile.

The Ordenanzas de Minería of 1783 remained the foundation of the mining codes of the majority of Spanish-American nations until the late 19th century. The codes covered the operational, fiscal, and juridical aspects of the mining industry. The central tribunal of the Cuerpo de Minería sat in Mexico City and consisted of a director general, an administrator general, and three deputies general, all of whom were chosen for specified terms by delegates from the *reales de minas* (mining districts). In each district sat a *disputación territorial* (provincial court of delegation) made up of delegates elected by the owners and operators of the mines.

The central tribunal had executive responsibility for the entire Spanish colonial mining industry, was the board of directors of a bank set up to lend money to mine owners for improvements after inspection by competent engineers, and from 1793 heard appeals in mining cases from the provincial courts.

Privileges granted to guild members included immunity from arrest for debt and preferment for themselves and their direct descendants in civil and ecclesiastical appointments. Mine owners were also provided with necessary materials at low cost. They could press into service in the mines any unemployed persons; the burden of this fell mainly on blacks, lower-class mestizos (people of mixed Spanish and Indian ancestry), and criminals.

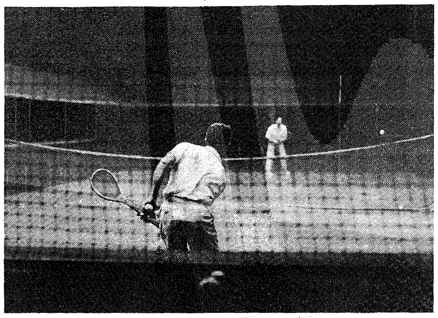
The *cuerpo* set up a school of mines to promote mining and metallurgical knowledge. The graduates of this school were well-trained but often found themselves opposed by owners prejudiced against theoretical learning. The school produced many who were to become leaders in independent Mexico. Because of the importance of mining in New Spain, the *cuerpo* became very influential and thus excited the animosity of those associated with the more traditional organs of government. Although the *cuerpo* was not ineffectual, the technological and operational improvements hoped for did not fully materialize, largely because of lack of cooperation among its members.

real number, in mathematics, a quantity that can be expressed as an infinite decimal expansion. Real numbers are used in measurements of continuously varying quantities such as size and time, in contrast to the natural numbers 1, 2, 3, . . . , arising from counting. The word real distinguishes them from the complex numbers involving the symbol i, or $\sqrt{-1}$, used to simplify the mathematical interpretation of effects such as those occurring in electrical phenomena. The real numbers include the positive and negative integers and fractions (or rational numbers) and also the irrational numbers. The irrational numbers have decimal expansions that do not repeat themselves, in contrast to the rational numbers, the expansions of which always contain a digit or group of digits that repeats itself, as $1/6 = .16666$ etc. or $2/7 = .285714285714$ etc. The decimal formed as .42442444244442 etc. has no regularly repeating group and is thus irrational.

The most familiar irrational numbers are algebraic numbers, which are the roots of algebraic equations with integer coefficients. For example, the solution to the equation $x^2 - 2 = 0$ is an algebraic irrational number, indicated by $\sqrt{2}$. Some numbers, such as π and e, are not the solutions of any such algebraic equation and are thus called transcendental irrational numbers. These numbers can often be represented as an infinite sum of fractions determined in some regular way.

The real numbers can be characterized by the important mathematical property of completeness, meaning that every set that has an upper bound has a smallest such bound, a property not possessed by the rational numbers. For example, the set of all rational numbers the squares of which are less than 2 has no smallest upper bound, because $\sqrt{2}$ is not a rational number. The irrational and rational numbers are both infinitely numerous, but the infinity of irrationals is "greater" than the infinity of rationals, meaning that the rationals can be paired off with a subset of the irrationals, while the reverse pairing is not possible. The class of real numbers is generally extended to include the first transfinite number (*q.v.*), which is symbolized by the Hebrew letter *aleph* and that is identified with the number of integers.

real tennis, also called COURT TENNIS, or ROYAL TENNIS, racket sport that is descended from and almost identical to the medieval tennis game *jeu de paume* ("game of the palm").



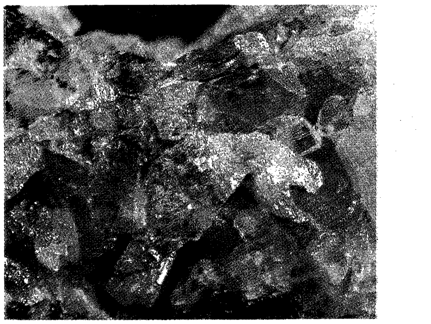
Henry Leaf Cup real tennis match at the Queen's Club, London

By courtesy of the Sport and General Press Agency Ltd., London

Real tennis has been played since the Middle Ages, but the game has become almost completely obscured by its own descendant, lawn tennis. Although real tennis contributed its name and scoring system to lawn tennis, real tennis is now played at fewer than 30 courts in the world. The court at Hampton Court palace, where Henry VIII played, is still used occasionally.

Real tennis is played on an indoor court with four irregularly sized walls, using pear-shaped, lopsided rackets to hit cloth balls that are much harder than those used in lawn tennis. Roofs to the court slope over a net that is 1.5 m (5 feet) high at its sides and 0.9 m (3 feet) in the middle. The construction of a court is complex and difficult, and the declining number of players discourages the building of new courts. The world real tennis championship is decided by challenge match, in which a player challenges the champion to defend his title. Pierre Etchebaster held the world title from 1938 to 1954, when he retired at the age of 61.

realgar, an important ore of arsenic, a red or orange mineral containing both arsenic and sulfur. Typically it is a minor constituent of ore veins in association with orpiment (into which it disintegrates on long exposure to light). Realgar has been used by the Chinese



Realgar from Getchell, Nev.

By courtesy of the Field Museum of Natural History, Chicago; photograph, John H. Gerard—EB Inc.

for carvings, but these also deteriorate under light. It forms prismatic crystals of monoclinic symmetry. For detailed physical properties, *see* sulfide mineral (table).

realism, in the arts, the accurate, detailed, unembellished depiction of nature or of contemporary life. Realism rejects imaginative idealization in favour of a close observation of outward appearances. As such, realism in its broad sense has comprised many artistic currents in different civilizations. In the visual arts, for example, realism can be found in ancient Hellenistic Greek sculptures accurately portraying boxers and decrepit old women. The works of such 17th-century painters as Caravaggio, the Dutch genre painters, the Spanish painters José de Ribera, Diego Velázquez, and Francisco de Zurbarán, and the Le Nain brothers in France are realist in approach. The works of the 18th-century English novelists Daniel Defoe, Henry Fielding, and Tobias Smollett may also be called realistic.

Realism was not consciously adopted as an aesthetic program until the mid-19th century in France, however. Indeed, realism may be viewed as a major trend in French novels and paintings between 1850 and 1880. One of the first appearances of the term realism was in the *Mercure français du XIX^e^ siècle* in 1826, in which the word is used to describe a doctrine based not upon imitating past artistic achievements but upon the truthful and accurate depiction of the models that nature and contemporary life offer the artist. The French proponents of realism were agreed in their rejection of the artificiality of both the Classicism and Romanticism of the academies and on the necessity for contemporaneity in an effective work of art. They attempted to portray the lives, appearances, problems, customs, and mores of the middle and lower classes, of the unexceptional, the ordinary, the humble, and the unadorned. Indeed, they conscientiously set themselves to reproducing all the hitherto-ignored aspects of contemporary life and society—its mental attitudes, physical settings, and material conditions.

Realism was stimulated by several intellectual developments in the first half of the 19th century. Among these were the anti-Romantic movement in Germany, with its emphasis on the common man as an artistic subject; Auguste Comte's Positivist philosophy, in which sociology's importance as the scientific study of society was emphasized; the rise of professional journalism, with its accurate and dispassionate recording of current events; and the development of photography, with its capability of mechanically reproducing visual appearances with extreme accuracy. All these developments stimulated interest in accurately recording contemporary life and society.

Painting. Gustave Courbet was the first artist to self-consciously proclaim and practice the realist aesthetic. After his huge canvas "The Studio" (1854–55; Louvre, Paris) was rejected by the Exposition Universelle of 1855, the artist displayed it and other works under the label "Realism, G. Courbet" in a specially constructed pavilion. Courbet was strongly opposed to idealization in his art, and he urged other artists to instead make the commonplace and contemporary the focus of their art. He viewed the frank portrayal of scenes from everyday life as a truly democratic art. Such paintings as his "Burial at Ornans" (1849; Louvre) and the "Stone Breakers" (1849; private collection, Milan), which he had exhibited in the Salon of 1850–51, had already shocked the public and critics by the frank and unadorned factuality with which they depicted humble peasants and labourers. The fact that Courbet did not glorify his peasants but presented them boldly and starkly created a violent reaction in the art world.

The style and subject matter of Courbet's work were built on ground already broken by the painters of the Barbizon School. Théodore Rousseau, Charles-François Daubigny, Jean-François Millet, and others in the early 1830s settled in the French village of Barbizon with the aim of faithfully reproducing the local character of the landscape. Though each Barbizon painter had his own style and specific interests, they all emphasized in their works the simple and ordinary rather than the grandiose and monumental aspects of nature.

They turned away from melodramatic picturesqueness and painted solid, detailed forms that were the result of close observation. In such works as "The Winnower" (1848), Millet was one of the first artists to portray peasant labourers with a grandeur and monumentality hitherto reserved for more important persons.

Another major French artist often associated with the realist tradition, Honoré Daumier, was the quintessential urban artist in his satirical caricatures of French society and politics. He found his working-class heroes and heroines and his villainous lawyers and politicians in the slums and streets of Paris. Like Courbet he was an ardent democrat, and he used his skill as a caricaturist directly in the service of political aims. Daumier used energetic linear style, boldly accentuated realistic detail, and an almost sculptural treatment of form to criticize the immorality and ugliness he saw in French society.

Pictorial realism outside of France was perhaps best-represented in the 19th century in the United States. There, Winslow Homer's powerful and expressive paintings of marine subjects and Thomas Eakins' portraits, boating scenes, and other works are frank, unsentimental, and acutely observed records of contemporary life.

Realism was a distinct current in 20th-century art and usually stemmed either from artists' desire to present more honest, searching, and unidealized views of everyday life or from their attempts to use art as a vehicle for social and political criticism. The rough, sketchy, almost journalistic scenes of seamy urban life by the group of American painters known as The Eight fall into the former category. The German art movement known as the Neue Sachlichkeit (New Objectivity), on the other hand, worked in a realist style to express the cynicism and disillusionment of the post-World War I period in Germany. The Depression-era movement known as Social Realism adopted a similarly harsh and direct realism in its depictions of the injustices and evils of American society during that period.

Socialist Realism, which has been the officially sponsored Marxist aesthetic in the Soviet Union since the early 1930s, actually has little to do with realism, though it purports to be a faithful and objective mirror of life. Its "truthfulness" must accord with the ideology and the propagandistic needs of the state, and Socialist Realism generally uses techniques of naturalistic idealization to create portraits of dauntless workers and engineers who are strikingly alike in both their heroic positivism and their lack of lifelike credibility.

The novel. In literature, the novelist Honoré de Balzac was the chief precursor of realism, given his attempt to create a detailed, encyclopaedic portrait of the whole range of French society in his *La comédie humaine.* But a conscious program of literary realism did not appear until the 1850s, and then it was inspired by the painter Courbet's aesthetic stance. The French journalist Champfleury, who had popularized Courbet's painting style, transferred the latter's theories to literature in *Le Réalisme* (1857). In this influential critical manifesto Champfleury asserted that the hero of a novel should be an ordinary man rather than an exceptional figure. In 1857 Gustave Flaubert's novel *Madame Bovary* was published. This unrelentingly objective portrait of the bourgeois mentality, with its examination of every psychological nuance of an unhappy and adulterous middle-class wife, was both the principal masterpiece of realism and the work that established the movement on the European scene. Flaubert's *L'Éducation sentimentale* (1870), with its presentation of a vast panorama of France under Louis-Philippe, was another principal realist work. The brothers Jules and Edmond Goncourt were also important realist writers. In their masterpiece, *Germinie Lacerteux* (1864), and in other works they covered a variety of social and occupational milieus and frankly described social relations among both the upper and the lower classes.

Realist tenets entered the mainstream of European literature during the 1860s and '70s. Realism's emphasis on detachment, objectivity, and accurate observation, its lucid but restrained criticism of social environment and mores, and the humane understanding that underlay its moral judgments became an integral part of the fabric of the modern novel during the height of that form's development. Charles Dickens, Anthony Trollope, and George Eliot in England, Ivan Turgenev, Leo Tolstoy, and Fyodor Dostoyevsky in Russia, William Dean Howells in the United States, and Gottfried Keller and the early Thomas Mann in Germany all incorporated realist elements in their novels. A significant offshoot of literary realism was Naturalism (*q.v.*), a late 19th- and early 20th-century movement that aimed at an even more faithful and unselective representation of reality. The French novelist Émile Zola was the leading exponent of Naturalism.

Theatre. Realism in the theatre was a general movement in the later 19th century that steered theatrical texts and performances toward greater fidelity to real life. The realist dramatists Henrik Ibsen and August Strindberg in Scandinavia and Anton Chekhov and Maksim Gorky in Russia, among others, rejected the complex and artificial plotting of the well-made play and instead treated themes and conflicts belonging to a real, contemporary society. They dispensed with poetic language and extravagant diction, instead using action and dialogue that looked and sounded like everyday behaviour and speech. Realism had no use for the declamatory delivery and the overblown virtuosity of past acting and replaced this style with one demanding natural movements, gestures, and speech. Realist drama also used stage settings that accurately reproduced ordinary surroundings.

Motion pictures. Like 20th-century drama and literature, the art of cinema has depended heavily on the 19th-century realist tradition for thematic material and often for structure. The nature of film, however, has lent itself to a kind of realism halfway between life and fiction. Such films, called Neorealism in Italy and sometimes *cinéma vérité* in France, tried to achieve a documentary-like objectivity by using non-actors in leading roles and incorporating segments of actual documentary footage into the story. The post-World War II films of Roberto Rossellini (such as *Open City* and *Paisan*) and Vittorio De Sica (*The Bicycle Thief*) best exemplify this genre.

Realism, in philosophy, the conception that objects of sensory perception or of cognition in general are real in their own right and exist independently of their being known or related to mind. Though of modern origin, the term Realism is freely applied today to certain aspects of Greek and medieval philosophy, as well as to modern tenets.

A brief treatment of Realism follows. For full treatment, *see* MACROPAEDIA: Philosophical Schools and Doctrines, Western.

In the history of philosophy the most persistent and profound Realist concern is that of the reality of "universals," or principles and rules governing the classification of things. It seems essential to believe that one is doing something rightly when, for instance, one classifies a new object as a chair (if that is what it is) rather than as an elephant. However, the nature of this rightness itself remains elusive. Realists assert that such classification reflects distinctions inherent in the world; conceptualists, by contrast, grant universals reality only as categorial concepts within the mind; and Nominalists restrict the reality of the so-called natures of things even further, to mere names. The first of these views was embraced by Plato, who considered correct classification to involve apprehending a real common "form" which items classified together shared; the second is the view propounded in the *Essay* of John Locke (1632–1704); and the last appears in writers ranging from William of Ockham (1285–1309) to Ludwig Wittgenstein (1889–1951). In light of the Nominalist assertion, it would seem that uttering words would not consist in making judgments at all, for nothing would count as correctness or incorrectness (Wittgenstein struggled hard to avoid this consequence). It is necessary, according to the Realists, to arrive at some conception of the further fact that makes talk of correctness appropriate. Realists believe that such a fact resists both reduction and the attribution of any Idealist, mind-dependent status, the two positions most favoured by opponents of Realism. This dispute underlies any analysis of the judgment of truth or falsehood and thus infuses virtually all philosophical issues.

Another issue central to the Realist–anti-Realist debate is that of the status of immediate, individual objects of perception. Realists, as opposed primarily to the Idealists and Phenomenalists, hold that the senses afford knowledge of the distinct, real existence of independent objects in space and time. The difficulty for the Realist is that the experiences on the basis of which one knows about such objects are themselves apparently private and dependent for their existence and nature upon the mind. The Realist therefore seeks a link that permits knowledge of one kind of thing on the basis of another, and opponents charge that this leads inevitably to skepticism. This standard philosophical pattern is the usual source of reductionist and instrumentalist programs.

realschule, plural REALSCHULEN, German secondary school with an emphasis on the practical that evolved in the mid-18th century as a six-year alternative to the nine-year gymnasium. It was distinguished by its practical curriculum (natural science and chemistry) and use of chemistry laboratories and workshops for wood and glass. The realschule became the model for educational reformers in other countries.

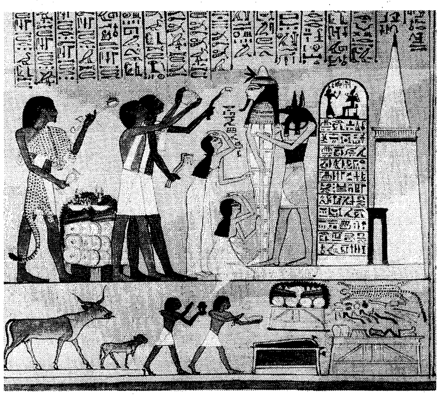
In 1859 realschulen were divided into first and second types, according to length of attendance and comprehensiveness of curriculum. The first type had a nine-year course of religion, Latin and modern languages, history and geography, and mathematics and science. It entitled its students to serve only one year of military service and made them eligible for some civil service appointments, but not until 1870 did it qualify them for university entrance. In 1882 the name of this school was officially changed to realgymnasium. The second type of realschule offered a six-year course and did not include Latin. With the creation of the realgymnasium, the course was expanded to nine years, and the prefix *ober* (high) was added (oberrealschule). In Germany, realschulen are also known as *Mittelschulen.*

reamer, rotary cutting tool of cylindrical or conical shape used for enlarging and finishing to accurate dimensions holes that have been drilled, bored, or cored. A reamer cannot be used to originate a hole. All reamers are provided with longitudinal flutes or grooves (eight are commonly used) that may be straight or helical; cutting may be done on the sides of the tool, using the sharpened edges of the apexes between the flutes, or cutting may take place on chamfered edges at the reamer's tip. The flutes permit passage of chips and allow cooling and lubricating fluid to reach the cutting edges. The two main classes of reamers are machine, or chucking, reamers and hand reamers. Machine reamers are used on machine tools such as drill presses, lathes, and screw machines. They have either straight or tapered shanks; hand reamers are slightly tapered to facilitate entry of the reamer and have a straight shank with a square end to fit a wrench. When it is necessary to enlarge reamed holes slightly, expansion reamers are available. These are split longitudinally, and their diameter can be adjusted by turning an end screw that expands internal cones. Reamers are made from high-carbon steel, high-speed steel, and cemented carbides.

Reaney, James Crerar (b. Sept. 1, 1926, near Stratford, Ont., Can.), Canadian poet and playwright whose works, dealing with Ontario small-town life, transcend their manifest content to move into areas of symbol and dream.

Reaney received his Ph.D. from the University of Toronto (1959), and in 1960 he founded *Alphabet,* a literary magazine, and became professor of English at the University of Western Ontario. His works include *The Red Heart* (1949), lyric poems; *A Suit of Nettles* (1958), 12 pastoral eclogues; *The Killdeer, and Other Plays* (1962), verse plays; *The Dance of Death at London, Ontario* (1963), a poetic satire of that town; and *Poems* (1972). *Apple Butter and Other Plays* (1973) is a collection of plays for children. Later he wrote *Fourteen Barrels from Sea to Sea* (1977), a commentary on Canadian theatrical life, written in the form of a travel diary.

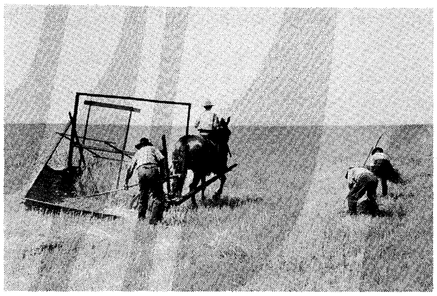
reanimation rite, in Egyptian religion, rite to prepare the deceased for afterlife, performed on statues of the deceased, the mummy itself, or statues of a god located in a temple. An important element of the ceremony was the ritual opening of the mouth so the mummy



Reanimation rite, from the Book of the Dead, Hunefer Papyrus; in the British Museum
By courtesy of the trustees of the British Museum

might breathe and eat. The rite, which symbolized the death and regeneration concept of the Osiris myth (in which the dismembered god Osiris was pieced together again and infused with life), was performed on a statue in the sculptor's workshop, but on a mummy it was performed at the tomb entrance. By this rite the statue or mummy was believed to be endowed with life and power so that he might enjoy the daily funeral service conducted before his tomb. In the case of temple statues, the ceremony was included in the daily temple ritual.

reaper, any farm machine that cuts grain. Early reapers simply cut the crop and dropped it unbound, but modern machines include harvesters, combines, and binders, which also perform other harvesting operations. A patent for a reaper was issued in England to Joseph Boyce in 1800. In the 1830s Jeremiah Bailey of the United States patented a mower-reaper, and Obed Hussey and Cyrus McCormick developed reapers with guards and reciprocating (back-and-forth-moving) cutting blades. Hussey was the first to obtain a patent (1833), but McCormick's reaper had the advantages of a divider to separate cut and standing grain and a revolving reel to topple the cut grain onto the rear of the machine, where it could be raked off onto the ground and later tied.



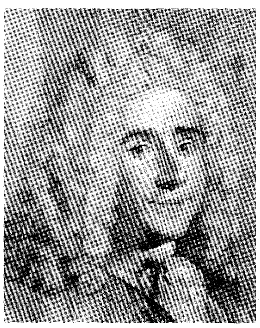
An early reaper
By courtesy of International Harvester Co.

C.W. and W.W. Marsh patented the forerunner of the first successful harvester in 1858. Their machine swept the cut grain onto a canvas conveyor that carried it to a box for binding, but it had no mechanical binding device. *See also* binder; combine.

reason, in philosophy, the faculty or process of drawing logical inferences. The term "reason" is also used in several other, narrower senses. Reason is in opposition to sensation, perception, feeling, desire, as the faculty (the existence of which is denied by empiricists) by which fundamental truths are intuitively apprehended. These fundamental truths are the causes or "reasons" of all derivative facts. According to the German philosopher Immanuel Kant, reason is the power of synthesizing into unity, by means of comprehensive principles, the concepts that are provided by the intellect. That reason which gives a priori principles Kant calls "pure reason," as distinguished from the "practical reason," which is specially concerned with the performance of actions. In formal logic the drawing of inferences (frequently called "ratiocination," from Latin *ratiocinari,* "to use the reasoning faculty") is classified from Aristotle on as deductive (from generals to particulars) and inductive (from particulars to generals).

In theology, reason, as distinguished from faith, is the human intelligence exercised upon religious truth whether by way of discovery or by way of explanation. The limits within which the reason may be used have been laid down differently in different churches and periods of thought: on the whole, modern Christianity, especially in the Protestant churches, tends to allow to reason a wide field, reserving, however, as the sphere of faith the ultimate (supernatural) truths of theology.

Réaumur, René-Antoine Ferchault de (b. Feb. 28, 1683, La Rochelle, Fr.—d. Oct. 17, 1757, Saint-Julien-du-Terroux), French scientist and foremost entomologist of the early 18th century who conducted research in widely varied fields.



Réaumur, detail of an engraving by J. Blanchon
Giraudon—Art Resource/EB Inc.

In 1710 King Louis XIV put Réaumur in charge of compiling a description of the industry and natural resources of France. Réaumur devised the thermometric scale bearing his name, improved techniques for making iron and steel, and discovered the phenomenon of the regeneration of lost appendages among crayfish. The cupola furnace, still the most economical and generally used process for melting gray iron, was first built by Réaumur in 1720. In 1734 he published the first volume of his *Mémoires pour servir à l'histoire des insectes* (1734–42; "Memoirs Serving as a Natural History of Insects"). Five more volumes were published, and, though unfinished, his work was a milestone in entomological history.

He investigated the chemical composition of Chinese porcelain and, in 1740, devised his own formula for the so-called Réaumur porcelain. In 1752 he isolated gastric juice and investigated its role in the digestion of food.

Réaumur temperature scale, scale established in 1730 by the French naturalist René-Antoine Ferchault de Réaumur, with its zero set at the freezing point of water and its 80° mark at the boiling point of water at normal atmospheric pressure. Use of the Réaumur scale was once widespread, but by the late 20th century it had practically disappeared.

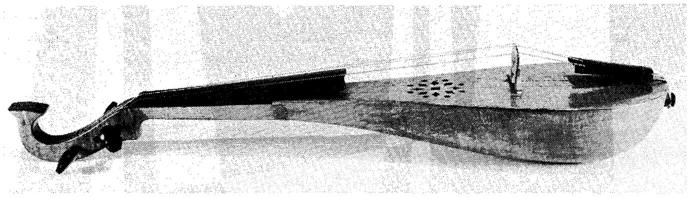
Rebaptizer: *see* Anabaptist.

rebate, retroactive refund or credit given to a buyer after he has paid the full list price for a product or for a service such as transportation. Rebating was a common pricing tactic during the 19th century and was often used by large industrialists to preserve or extend their power by undercutting competition. Important customers were granted refunds in secret so that less influential buyers would know nothing of them. Rebates were often used by the 19th-century railroad industry as a means of price discrimination. The motive for rebating among railroad firms lay in their chronically underutilized capacity; secret rebates seemed a small price to pay for the capture of large freight orders. Rebating was so universally practiced by American and European railroad firms that published tariffs were applied only to shippers who were unsophisticated enough to pay them without bargaining for a refund. In U.S. history the rebates received by the Standard Oil Company were a major factor in that company's attainment of a monopolistic position in the oil industry.

On the other hand, some rebates have been used as justifiable incentives to stimulate desirable action on the part of the customers. For example, real estate firms in Europe gave rebates to buyers to encourage land improvements that would increase the value of adjoining unsold land. So-called deferred, or exclusive patronage, rebates are popular for large vendors of perishables, of certain services, and of consumer durable goods. To receive a rebate the purchaser must agree to buy certain goods or services exclusively from a particular vendor for a fixed period, usually ranging from 6 to 12 months. Such rebates can be justified on economic grounds if they are open to all customers and if they result in lower production costs.

rebato (collar): *see* rabato.

rebec, bowed, stringed musical instrument of European medieval and early Renaissance music. It was originally called a *rubebe,* developed about the 11th century from the similar Arab *rabāb,* and was carried to Spain with Muslim culture. Like the *rabāb,* the rebec had a shallow, pear-shaped body, but on the rebec the *rabāb*'s skin belly was replaced by wood and a fingerboard was added. The rebec was held against the chest or chin or, occasionally, with the bottom of the instrument resting on the seated player's left thigh. The three strings were tuned in fifths (*e.g.,* g–d′–a′).



Modern rebec made by Arnold Dolmetsch, Ltd., 1962
By courtesy of Howard M. Brown; photograph, EB Inc.

The medieval rebec was apparently a treble instrument, but by the late 15th century rebecs were made in sizes from treble to bass. The family of rebecs was superseded by the viols during the 16th century. The treble rebec survived into the 18th century as the kit, the dancing master's fiddle. The lira and its Balkan folk variants, the *gusla* and *gadulka,* are closely related to the rebec.

Rebelo, Jorge (b. 1940, Lourenço Marques, Portuguese East Africa), African poet, lawyer, and journalist.

Rebelo studied at the University of Coimbra in Portugal, was secretary for information for the Mozambican anti-Portuguese guerilla group Frelimo, and edited the magazine *Mozambique Revolution.* Though José Craveirinha is called the "poet of Mozambique," Rebelo is known as the "poet of the Mozambican revolution."

Rebelo's poetry is didactic and single purposed: he is a poet of and for the Mozambican freedom fighters. Indeed, Rebelo's poetry can be seen as a chronicle of the fight for Mozambican independence, a call to arms, and a rationale for the bloodshed and hardships of war.

As praise singer, more specifically a guerilla poet in praise of a just war, Rebelo soothes, exhorts, and rallies his comrades. His poetry is included in such selected anthologies as Mario de Andrade's *Literatura Africana de Expressao Portuguesa* (1967) and Margaret Dickinson's *When Bullets Begin to Flower* (1972).

Reber, Grote (b. Dec. 22, 1911, Wheaton, Ill., U.S.), U.S. astronomer and radio engineer who built the first radio telescope and was largely responsible for the early development of radio astronomy, which opened an entirely new research front in the study of the universe.

When a radio engineer, Karl Jansky, announced his discovery of radio signals from the stars in 1932, Reber tried to adapt his shortwave radio receiver to pick up interstellar radio waves. He failed, but in 1937 he built a bowl-shaped antenna 9.4 metres (31 feet) in diameter that served as the only radio telescope in the world until after World War II. By 1942 he had completed the first preliminary radio maps of the sky, concentrating on high-frequency shortwave signals, and discovered that in certain regions radio signals are particularly strong but apparently are unrelated to any visible celestial object.

In 1947 Reber moved his radio telescope to Sterling, Va., and in Washington, D.C., he served as chief of the Experimental Microwave Research Section. In 1951 in Hawaii he built a new radio telescope and concentrated on mapping celestial sources of low-frequency long-wave signals, 5.5 to 14 metres in wavelength. In 1954 he joined the Commonwealth Scientific and Industrial Research Organization in Tasmania, Australia, one of the few places on the surface of the Earth at which the atmosphere is occasionally transparent to electromagnetic radiation more than 30 metres in wavelength. Although he accepted a position in 1957 at the National Radio Astronomy Observatory, Green Bank, W.Va., where a radio telescope 43 metres (140 feet) across had just been completed, he returned to Bothwell, Tasmania, in 1961 to help complete the mapping of sources of radio waves of 270-metre wavelength.

Rebmann, Johannes (b. Jan. 16, 1820, Gerlingen, Württemberg—d. Oct. 4, 1876, Korntal, near Stuttgart), German missionary and explorer, the first European to penetrate Africa from its Indian Ocean coast. Rebmann and his associate, Johann Ludwig Krapf, also were the discoverers of Kilimanjaro and Mt. Kenya and paved the way for the great East African explorations of the Britons Sir Richard Burton, John Hanning Speke, and David Livingstone.

Rebmann arrived in East Africa in 1846 and began missionary work among the coastal tribes. Though he felt he was only incidentally an explorer, he began expeditions into the interior and, in May 1848, was the first European to see Kilimanjaro. Krapf first sighted Mt. Kenya in December 1849. At first the existence of these mountains was not believed in Europe, but Rebmann's accounts, together with his sketch map of an enormous lake (Nyasa) in the interior, stimulated scientific exploration of the sources and drainage system of the Nile.

rebus, representation of a word or syllable by a picture of an object the name of which resembles in sound the represented word or syllable. Several rebuses may be combined—in a single device or successively—to make a phrase or sentence. Literary rebuses use letters, numbers, musical notes, or specially placed words to make sentences. Complex rebuses combine pictures and letters. Rebuses may convey direct meanings, especially to inform or instruct illiterate people; or they may deliberately conceal meanings, to inform only the initiated or to puzzle and amuse.

An early form of rebus occurs in picture writings, where abstract words, difficult to portray, were represented by pictures of objects pronounced the same way. These are common in Egyptian hieroglyphs and early Chinese pictographs. Rebus pictures were used to convey names of towns on Greek and Roman coins or names of families in medieval heraldry and for instructional symbols in religious art and architecture. In the Far East, especially in China and Korea, rebus symbols were commonly employed to carry auspicious wishes.

In Europe, literary rebuses often appeared on family mottoes, personal seals, ciphers, bookplates, and ultimately in games or riddles. A familiar English rebus is the debtor's "IOU," for "I owe you."

Popular in the United States after the mid-19th century were rebus picture puzzles in which the indicated addition or subtraction of letters in illustrated words produced another word or name. Such picture riddles have been widely used in advertising promotional contests.

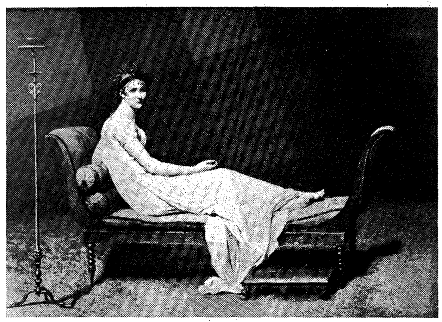
Recaizade Mahmud Ekrem (Turkish author): *see* Ekrem Bey, Recaizade Mahmud.

recall, also called RETRIEVAL, in psychology, the spontaneous remembering or repetition of something learned earlier, such as a poem, the image of an old friend, or a free association of words, ideas, and images. Tests of recall have long been a primary method used by experimental psychologists in the study of human memory processes. *See also* eidetic image; recognition.

Récamier, (Jeanne-Françoise) Julie(-Adélaïde), dame de, *née* BERNARD, byname MADAME DE RÉCAMIER (b. Dec. 4, 1777, Lyon—d. May 11, 1849, Paris), French hostess of great charm and wit whose salon attracted most of the important political and literary figures of early 19th-century Paris.

She was the daughter of a prosperous banker and was convent educated. In 1792 she joined her father in Paris and within the year married a wealthy banker.

Mme de Récamier began to entertain widely, and her salon soon became a fashionable gathering place for the great and near-great in politics and the arts. Its habitués included many former Royalists and others, such as Bernadotte (later Charles XIV of Sweden and Norway) and Gen. Jean Moreau, who were opposed to the government of Napoleon. In 1805 Napoleon's policies caused her husband major financial losses, and in the same year Napoleon ordered her exiled from Paris. She stayed with her good friend Mme de Staël



"Portrait de Mme Récamier," oil painting by Jacques-Louis David, 1800; in the Louvre, Paris
Giraudon—Art Resource/EB Inc.

in Geneva and then went to Rome (1813) and Naples. A literary portrait of Mme de Récamier can be found in the novel *Corinne,* written by Mme de Staël during this period.

She returned to Paris following Napoleon's defeat at Waterloo in 1815 but again suffered financial losses. Despite her reduced circumstances after 1819, she maintained her salon and continued to receive visitors at the Abbaye-aux-Bois, an old Paris convent in which she took a separate suite. In her later years the French author and political figure François Chateaubriand became her constant companion, as well as the central figure in her salon, where he read from his works. While her admirers had included many famous and powerful men, none obtained so great an influence over her as Chateaubriand. There are two well-known portraits of Mme de Récamier, by J.-L. David and François Gérard.

recapitulation theory: *see* biogenetic law.

receivership, in law, the judicial appointment of a person, a receiver, to collect and conserve certain assets and to make distributions in accordance with judicial authorization. A receivership is properly an intermediate or incidental step toward some other principal objective and not generally the object of litigation. The principal objective may be the preservation of the assets pending a decision as to who should receive the property, or it may be liquidation of the assets and the distribution of the proceeds to the parties entitled to them.

A receivership may be general in character in that it comprises all the assets of the individual, partnership, or corporation, or it may be special, involving only the property subject to litigation. As a general rule, even if the receivership is a general one, it will not terminate a corporate charter.

The powers of the receiver—syndic and administrator in France and Germany respectively—in dealing with the assets are based on statutory provisions or judicial decrees. As a practical matter, however, the extent of the receiver's powers are often determined by the nature of the assets. If the asset, for instance, is unimproved real estate, the receiver's powers may involve simply the payment of taxes. If the asset is an apartment building, the receiver's powers could include management, collecting rents, and signing leases.

If the court feels that in the best interest of the parties involved the assets should be liquidated, the court will authorize the receiver to sell the assets at a judicial sale, which is conducted in the form of an auction. *See also* liquidation.

receptor, in biology, a specialized cell or group of cells that translates a certain type of stimulus, received from the environment or from within the organism, into nerve impulses that aid the organism in effecting future behavioral or physiological changes.

Receptors are commonly provided with accessory structures that enable them to perform their function effectively; receptor and accessory structures constitute a sense organ. The eye of vertebrates is an organ of light reception (photoreception); the rod and cone cells of the retina are individual photoreceptors.

A given receptor usually reacts only to stimuli of one general type (*e.g.*, sound, light) and often only to a narrow range within the general type. An insect chemoreceptor may be stimulated by only one chemical compound. Sensory receptors are broadly classified by the types of stimuli to which they respond (photoreceptor, chemoreceptor, etc.). More broadly, they are sometimes categorized by the source of their stimuli, exteroceptors reacting to stimuli from outside the organism, enteroceptors to stimuli from within.

recession, in economics, a downward trend in the business cycle characterized by a decline in production and employment, which in turn causes the incomes and spending of households to decline. Even though not all households and businesses experience actual declines in income, their expectations about the future become less certain during a recession and cause them to delay making large purchases or investments.

In recessions, the decline in output can be traced to a reduction in purchases of durable household goods by consumers and of machinery and equipment by businesses, and a reduction in additions of goods to stocks or inventories. The greatest effect is probably on inventory; businessmen stop adding to their inventories and become more willing to draw on them to fill production orders. Inventory declines thus have a double impact on production volume.

Whether a recession develops into a severe and prolonged depression depends on a number of circumstances. Among them are the extent and quality of credit extended during the previous period of prosperity, the amount of speculation permitted, the ability of government monetary and fiscal policies to reverse the downward trend, and the amount of excess productive capacity in existence. *Compare* depression; panic.

recessiveness, in genetics, the failure of one of a pair of genes (alleles) present in an individual to express itself in an observable manner because of the greater influence, or dominance, of its opposite-acting partner. Both alleles affect the same inherited characteristic, but the presence of the recessive gene cannot be determined by observation of the organism; *i.e.*, although present in the organism's genotype, the recessive trait is not evident in its phenotype. The term recessive is applied both to the organism having the alleles of a gene pair in the recessive condition and to the allele whose effect can be masked by another allele of the same gene. *See also* dominance.

Rechabite, member of a conservative, ascetic Israelite sect that was named for Rechab, the father of Jehonadab. Jehonadab was an ally of Jehu, a 9th-century-BC king of Israel, and a zealous antagonist against the worshippers of Baal, a Canaanite fertility deity. Though of obscure origin, the Rechabites apparently were related to the Kenites, according to I Chron. 2:55, a tribe eventually absorbed into Judah in the 10th century BC.

The Rechabites were separatists who refused to participate in agricultural pursuits, drink wine, or engage in other practices associated with the Canaanites. Believing that the seminomadic way of life was a religious obligation, they herded their flocks over much of Israel and Judah. They were fervent followers of Yahweh, the God of Israel, and are best known for their connection with the slaughter of the worshippers of Baal during the revolt led by Jehu. According to later Jewish tradition, the Rechabites intermarried with the Levites, the priestly class.

Articles are alphabetized word by word, not letter by letter

Rechitsa, also spelled REČICA, city and centre of Rechitsa *rayon* (district), Gomel *oblast* (administrative region), Belorussian Soviet Socialist Republic, a port on the Dnepr River. The city dates from at least the 12th century, and it became an administrative centre in 1796. Rechitsa has furniture and engineering industries, including the manufacture of nails and pipes. Since 1964 it has been a centre of the petroleum industry based on the oil field on the left bank of the Dnepr. In the late 1970s, oil production from this field began to decline. Pop. (1983 est.) 66,000.

recidivism, tendency toward chronic criminal behaviour leading to numerous arrests and reimprisonment. Studies of the yearly intake of prisons, reformatories, and jails in the United States and Europe show that from one-half to two-thirds of those imprisoned have served previous sentences in the same or in other institutions. The conclusion is that the criminal population is made up largely of those for whom criminal behaviour has become habitual; moreover, penal institutions appear to do little to change their basic behaviour patterns.

Though the percentage of recidivists runs high for all offenders, it is greatest among those convicted of such minor charges as vagrancy, drunkenness, prostitution, and disturbing the peace. These are more likely than serious criminal charges to result from, and to be bound up in, an entire way of life. Accordingly, their root causes are rarely susceptible to cure by jailing.

Recife, capital of Pernambuco state, northeastern Brazil, and centre of an area that includes several industrial towns. It is an Atlantic seaport located at the confluence of the Capibaribe and Beberibe rivers. Recife has been called the Venice of Brazil because the city is crossed by waterways and its component parts are linked by numerous bridges.

In the second quarter of the 16th century wealthy Portuguese colonists of the captaincy of Pernambuco lived in splendour at Olinda. Recife was then merely an anchorage that handled their exports of sugar and their imports. It was raided by French pirates in 1561 and by the English in 1595. In 1630 it was captured by the Dutch, who held it for 24 years. The town prospered under the governorship of Count John Maurice of Nassau. In 1710 the inhabitants revolted against the magnates of Olinda in what is now called the War of the Mascates (*i.e.*, "peddlers") because the small tradesmen of Recife tried to organize a municipality of their own. In 1823 Recife became the official capital of the province of Pernambuco.

Recife has shared in the prosperity of northeastern Brazil that resulted from development promoted by Sudene (Superintendência para o Desenvolvimento do Nordeste), a federal organization. Although its retail and wholesale trade have grown in response to the region's increases in population and wealth, the market area and the walkways of the city's bridges are crowded with vendors selling small items. Branches of the major banks of Rio de Janeiro, of São Paulo, and of Minas Gerais do considerable business in Recife, and there also are U.S., French, and Italian concerns.

Railroads, highways, airlines, and shipping connect Recife with other parts of Brazil. Guararapes Airport serves international and domestic flights. Transportation within the city is chiefly provided by bus and trolley.

Institutions of higher learning in Recife include the Federal University of Pernambuco (founded 1946), the Federal Rural (Agricultural) University of Pernambuco (1954), the Catholic University of Pernambuco (1951), and the numerous research institutes attached to them. The independent Joaquim Nabuco Institute of social researches, which is distinguished for its anthropological studies, is also located there. Besides the State Museum, there are museums of sugarcane and of popular art.

Recife has a symphony orchestra, a conservatory of music, and several theatrical companies, including the nationally famous Pernambuco Amateur Theatre and the Popular Theatre of the Northeast. Reflecting the area's distinctive cultural composition are the folklore festivals: the Xangô is typically African, while Carnival time is vibrant with the compulsive music of the *passo,* an emotionally and physically exacting dance. Other popular entertainments include the fandango dance, the *bumba-meu-boi* (a pageant with dancing), the *pastoris* (open-air plays), and the *lapinhas* (Nativity scenes). Pop. (1980) city, 1,183,391; (1980 prelim.) metropolitan area, 2,348,362.

reciprocity, in international trade, the granting of mutual concessions in tariff rates, quotas, or other commercial restrictions. Reciprocity implies that these concessions are neither intended nor expected to be generalized to other countries with which the contracting parties have commercial treaties. Reciprocity agreements may be made between individual countries or groups of countries.

The logical extension of reciprocity is the development of a full customs union (*e.g.*, the European Economic Community) that eliminates by progressive mutual concessions all tariffs and other restrictions between participating countries.

Membership in the General Agreement on Tariffs and Trade (*q.v.*; GATT) to some extent precludes the establishment of reciprocity treaties because GATT nations assume the obligation to grant to all other members most-favoured-nation treatment (*q.v.*; extension to member countries of every trade concession made to nonmember countries).

recitative, style of monody (accompanied solo song) that emphasizes the rhythms and accents of spoken language. The earliest significant form of monody, recitative developed in the late 1500s in opposition to the polyphonic, or many-voiced, style of 16th-century choral music.

The earliest operas, such as Jacopo Peri's *Euridice* (1600), consisted almost entirely of recitativo arioso, a lyric form of recitative intended to communicate the emotion of the text. In operas of the late 17th century the expression of emotion was left to the lyric outpouring of the aria, and the recitative was used to carry the dialogue and to advance the action of the plot. In oratorios and cantatas it often serves the similar function of advancing the narrative.

Two principal varieties developed. Recitativo secco ("dry recitative") is sung with a free rhythm dictated by the accents of the words. Accompaniment, usually by continuo (cello and harpsichord), is simple and chordal. The melody approximates speech by using only a few pitches. The second variety, recitativo stromentato, or accompanied recitative, has stricter rhythm and more involved, often orchestral accompaniment. Used at dramatically important moments, it is more emotional in character. Its melody is more lyric, and it frequently leads into a formal aria.

Recklinghausen, city, North Rhine-Westphalia *Land* (state), western Germany. The city is situated on the northern edge of the Ruhr industrial region and has port facilities on the Rhine-Herne Canal. Originally a Saxon settlement that became an imperial town under Charlemagne, it passed to the archbishops of Cologne in 1197, was chartered in 1236, and joined the Hanseatic League in 1316. After 1802, it became the property of the dukes of Arenberg, who held it as a fief of Prussia from 1815. The discovery of coal in the locality during the 19th century led to rapid industrial development, but the old town centre and numerous park areas were preserved. Historic landmarks include St. Peter's Church (founded 1276, mainly 16th-century); Engelsburg (1702), the former ducal seat; and remains of medieval fortifications. The Ruhrfestspiele (festivals of art, music, and drama) are held annually in June and July. Coke, chemicals, machinery, metals, and textiles are produced. Pop. (1989 est.) 121,666.

Recklinghausen, Friedrich Daniel von (b. Dec. 2, 1833, Gütersloh, Ger.—d. Aug. 26, 1910, Strasbourg), German pathologist, best known for his descriptions of two disorders, each called Recklinghausen's disease: multiple neurofibromatosis (1882), characterized by numerous skin tumours associated with areas of pigmentation, and osteitis fibrosa cystica (1891), a degeneration of the skeleton caused by a tumour of the parathyroid gland.

A student of the noted German pathologist Rudolf Virchow at the University of Berlin (1855–61), Recklinghausen served as professor of pathology at the universities of Königsberg (1865), Würzburg (1866–72), and Strasbourg (1872–1906). He also rendered excellent descriptions of the smallest lymph channels in connective tissue (canals of Recklinghausen; 1862) and stones found in the pancreas in cases of diabetes (1864). In 1889 he gave the name hemochromatosis to a metabolic disorder characterized by deposition of excess iron in the tissues, especially in the liver.

Reclus, (Jean-Jacques-) Élisée (b. March 15, 1830, Sainte-Foy-la-Grande, Fr.—d. July 4, 1905, Thourout, near Bruges), French geographer and anarchist who was awarded the gold medal of the Paris Geographical Society in 1892 for *La Nouvelle Géographie universelle.*

He was educated at the Protestant college of Montauban and studied geography under Carl Ritter in Berlin. Having identified himself with the republicans of 1848, he was obliged to leave France after the coup d'etat of 1851. He spent the years 1852–57 visiting the British Isles, the United States, Central America, and Colombia. Returning to France, he applied himself to geography, publishing *La Terre, description des phénomènes de la vie du globe,* 2 vol. (1867–68; *The Earth: A Descriptive History of the Phenomena of the Life of the Globe,* 4 vol., 1871–73) and *Histoire d'un ruisseau* (1869; "History of a Brook"). During the German siege of Paris (1870–71) he participated in Nadar's balloon ascents. Serving in the National Guard in defense of the Commune, he was taken prisoner in April 1871; but his sentence of transportation for life was commuted in January 1872 to one of perpetual banishment after European scientists had appealed to the government on his behalf. After a visit to Italy, he settled at Clarens, Switz.

His great work, *La Nouvelle Géographie universelle, la terre et les hommes,* 19 vol. (1875–94; *The Earth and Its Inhabitants,* 1878–94), is profusely illustrated with maps, plans, and engravings and characterized by a brillance of exposition that gives his work permanent scientific value.

Though benefitting under the amnesty of 1879, Reclus had meanwhile lost none of his revolutionary enthusiasm. When proceedings were instituted at Lyon against the International Workingmen's Association, Peter Kropotkin and Reclus were designated as leading promoters of anarchism; but Reclus, as domiciled in Switzerland, escaped imprisonment. In 1892 he was appointed professor of comparative geography in Brussels.

recognition, in psychology, a form of remembering characterized by a feeling of familiarity when something previously experienced is again encountered; in such situations a correct response can be identified when presented but may not be reproduced in the absence of such a stimulus. Recognizing a familiar face without being able to recall the person's name is a common example. Recognition seems to indicate selective retention and forgetting of certain elements of experience. Controlled tests of recognition have been used by experimental psychologists since the late 19th century to give insight into the processes of human memory.

recognizance, in Anglo-American law, obligation entered into before a judge or magistrate whereby a party (the recognizor) binds himself to owe a sum of money in the event that he does not perform a stipulated act. If he fails to perform the required act, the money may be collected in an appropriate legal proceeding.

The most common use of the recognizance is in connection with bail in criminal cases. By filing in court a bail bond, a person arrested for a crime may generally secure his release from imprisonment pending his trial or sometimes pending his appeal after conviction. Generally he posts money or property as surety. When no surety is required, the accused is said to be released "on his own recognizance." *See also* bail.

In civil litigation the recognizance of a party may be required to ensure the payment of costs (*i.e.,* amounts of money losing parties must pay to winning parties for the expenses of litigation).

recoilless rifle, any of several antitank weapons developed during World War II. They are lightweight and can be operated by one or two men. Recoil was eliminated by allowing part of the propelling blast to escape to the rear. Disadvantages are a low muzzle velocity and consequent short range. *See* bazooka.

recombination, in genetics, regrouping of the maternal and paternal genes during the formation of gametes (sex cells). Recombination occurs randomly in nature as a normal event of meiosis, the process by which gametes are produced. Recombination is enhanced by the phenomenon of crossing over, in which gene sequences called linkage groups are disrupted, resulting in an exchange of segments between paired chromosomes that are undergoing separation. Thus, although a normal daughter cell produced in meiosis always receives half of the genetic material contained in the parent cell (*i.e.,* is haploid), recombination acts to ensure constant variability: no two daughter cells are identical, nor are any identical in genetic content to the parent cell.

Laboratory study of recombination has contributed significantly to the understanding of genetic mechanisms, allowing scientists to map chromosomes, identify linkage groups, isolate the causes of certain genetic anomalies, and manipulate recombination itself by transplantation of genes from one chromosome to another. Because of its potential for creating new—and possibly pathogenic—organisms, experimental recombination is viewed by some scientists as both dangerous and unethical.

recompression chamber (medical technology): *see* hyperbaric chamber.

Reconquista, English RECONQUEST, in medieval Spain and Portugal, a series of campaigns by Christian states to recapture territory from the Muslims (Moors), who had occupied most of the Iberian Peninsula in the early 8th century.

Though the traditional beginning of the Reconquista goes back to *c.* 718, when the Christian Asturians opposed the Moors at the Battle of Covadonga, the impulse toward reconquest was not strong during the first three centuries of Muslim hegemony. It was in the 11th century, when Moorish unity broke down and the Christian kingdoms of northern Spain began to be affected by an aggressive, anti-Muslim, crusading spirit, that the movement began in earnest. A series of wars followed, and by the mid-13th century most of the peninsula had been subjected to Christian rule, though the continued existence of a Moorish enclave around Granada in southern Spain served to keep the spirit of the Reconquista alive until the end of the 15th century.

Many historians believe that subsequent Spanish emphasis on religious uniformity, evidenced by the strong influence of the Inquisition and the expulsion of people of Moorish and Jewish descent, can be traced back to this crusading struggle of the Middle Ages.

Reconstruction (1865–77), in U.S. history, period during and after the American Civil War in which attempts were made to solve the political, social, and economic problems arising from the readmission to the Union of the 11 Confederate states that had seceded at or before the outbreak of war.

As early as 1862, Pres. Abraham Lincoln had appointed provisional military governors for Louisiana, Tennessee, and North Carolina. The following year, initial steps were taken to reestablish governments in newly occupied states in which at least 10 percent of the voting population had taken the prescribed oath of allegiance. Aware that the presidential plan omitted any provision for social or economic reconstruction, the Radical Republicans in Congress resented such a lenient political arrangement under solely executive jurisdiction. As a result, the stricter Wade–Davis Bill (*q.v.*) was passed in 1864 but pocket vetoed by the President.

After Lincoln's assassination (April 1865), Pres. Andrew Johnson further alienated Congress by continuing Lincoln's moderate policies. The Fourteenth Amendment, defining national citizenship so as to include blacks, passed Congress in June 1866 and was ratified, despite rejection by most Southern states (July 28, 1868). In response to Johnson's intemperate outbursts against the opposition as well as to several reactionary developments in the South (*e.g.,* race riots and passage of the repugnant black codes severely restricting rights of blacks), the North gave a smashing victory to the Radical Republicans in the 1866 congressional election.

That victory launched the era of congressional Reconstruction (usually called Radical Reconstruction), which lasted 10 years starting with the Reconstruction Acts of 1867. Under that legislation, the 10 remaining Southern states (Tennessee had been readmitted to the Union in 1866) were divided into five military districts; and, under supervision of the U.S. Army, all were readmitted between 1868 and 1870. Each state had to accept the Fourteenth or, if readmitted after its passage, the Fifteenth Constitutional Amendment, intended to ensure civil rights of the freedmen. The newly created state governments were generally Republican in character and were governed by political coalitions of blacks, carpetbaggers (Northerners who had gone into the South), and scalawags (Southerners who collaborated with the blacks and carpetbaggers). The Republican governments of the former Confederate states were seen by most Southern whites as artificial creations imposed from without, and the conservative element in the region remained hostile to them. Southerners particularly resented the activities of the Freedmen's Bureau (*q.v.*), which Congress had established to feed, protect, and help educate the newly emancipated blacks. This resentment led to formation of secret terroristic organizations, such as the Ku Klux Klan and the Knights of the White Camelia. The use of fraud, violence, and intimidation helped Southern conservatives regain control of their state governments, and, by the time the last Federal troops had been withdrawn in 1877, the Democratic Party was back in power.

About 1900, many U.S. historians espoused a theory of racial inferiority of blacks. The Reconstruction governments were viewed as an abyss of corruption resulting from Northern vindictiveness and the desire for political and economic domination. Later, revisionist historians noted that not only was public and private dishonesty widespread in all regions of the country at that time but also that a number of constructive reforms actually were introduced into the South during that period: courts were reorganized, judicial procedures improved, public-school systems established, and more feasible methods of taxation devised. Many provisions of the state constitutions adopted during the postwar years have continued in existence.

The Reconstruction experience led to an increase in sectional bitterness, an intensification of the racial issue, and the development of one-party politics in the South. Scholarship has suggested that the most fundamental failure of Reconstruction was in not effecting a distribution of land in the South that would have offered an economic base to support the newly won political rights of black citizens.

Reconstruction Finance Corporation (RFC), U.S. government agency established by Congress on Jan. 22, 1932, to provide financial aid to railroads, financial institutions, and business corporations. With the passage of the Emergency Relief Act in July 1932, its scope was broadened to include aid to agriculture and financing for state and local public works.

The RFC made little use of its powers under the Herbert Hoover administration but was more vigorously utilized during the New Deal years and contributed greatly to the recovery effort. During World War II the agency was enormously expanded in order to finance the construction and operation of war plants and to make loans to foreign governments.

The RFC was intended to be an independent, nonpolitical agency, and during its early years it operated without much interference. As the functions of the RFC grew, however, and as it began to assume responsibility for disbursing huge sums of money, it tended to become involved in politics. Beginning in 1948 various congressional investigations of the RFC revealed widespread corruption, and, on the recommendation of the Senate Committee on Banking and Currency, the agency was reorganized in 1952.

The RFC was finally dismantled under the Dwight D. Eisenhower administration, which sought to limit government involvement in the economy. The 1953 RFC Liquidation Act terminated its lending powers, and by 1957 its remaining functions had been transferred to other agencies.

Reconstructionism, in American Judaism, movement and ideology founded in 1922 that holds that Judaism is in essence a religious civilization the religious elements of which are purely human, naturalistic expressions of a specific culture. Because Reconstructionism rejects the notion of a transcendent God who made a covenant with his chosen people, it does not accept the Bible as the inspired word of God.

The principles of Reconstructionism were first publicly enunciated by Rabbi Mordecai M. Kaplan (1881–1983) in his book *Judaism as a Civilization* (1934). Kaplan felt that for Jews to survive in modern times, especially in the United States, it was necessary for them to reconstruct their lives on the cultural foundation of a historical peoplehood. This new covenant would serve to unite all Jews, regardless of individual religious beliefs and practices. Because cultural bonds are more fundamental to Judaism than are religious doctrines, all Jews can live a distinctive Jewish life without necessarily being religiously Judaic.

To maintain and strengthen their identity Jews should, according to Kaplan, cherish all elements of their history (*e.g.,* language, arts, ritual) that underscore their common heritage. Jews must, however, also learn to respect diversity as an enrichment of Jewish life. They must be willing to accept constant change and creativity as normal signs of vitality and growth. In such a context, all Jews can actively participate in Jewish life while freely mingling with other peoples. They can, moreover, inspire others with such traditional ideals as the unity of all mankind and thus promote the cause of universal freedom, justice, and peace. Reconstructionism strongly supports the State of Israel, not as an ideal home for all Jews, but as the cradle of Jewish civilization and as a focal point for Jews throughout the world.

Though Kaplan's views were, in some respects, more extreme than those advocated by Reform Judaism, he was long associated with Conservative Judaism at the Jewish Theological Seminary of America, in New York City, and was highly respected by his colleagues. Orthodox rabbis, however, could not abide his teachings, and the Union of Orthodox Rabbis declared Kaplan's views totally unacceptable.

Reconstructionists, who numbered about 60,000 in the late 20th century, come mostly from the ranks of the Conservative and Reform movements. Their liturgy resembles that of the Conservatives except for the addition of certain supplementary medieval and modern elements. The biweekly *Reconstructionist,* published by the Jewish Reconstructionist Foundation, has been the main voice of the movement since 1935.

record office: *see* archives.

record player (sound reproduction): *see* phonograph.

Recorde, Robert (b. *c.* 1510, Tenby, Pembrokeshire, Wales—d. 1558, London, Eng.), physician and the foremost mathematician of 16th-century England.

Recorde was appointed a fellow of All Souls College, Oxford, in 1531. He later taught at the University of Cambridge, and, after earning his medical degree there in 1545, he served as physician to King Edward VI and Queen Mary.

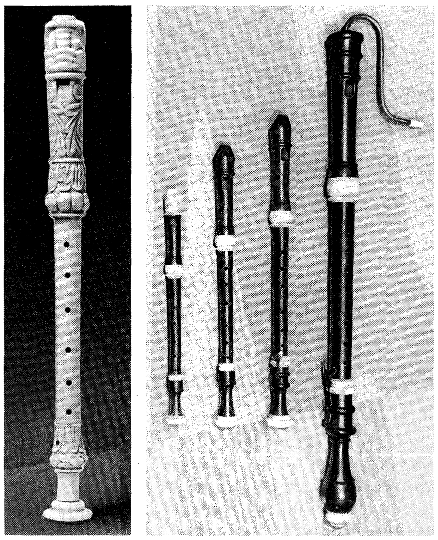
Recorde virtually established the English school of mathematics and first introduced algebra into England. He was the first to write mathematical and astronomical works in English; and his mathematics texts were used in England for more than a century. His first known work was a popular arithmetic, *The Ground of Artes* (*c.* 1542). In his astronomy text, *The Castle of Knowledge* (1551), he wrote favourably of Copernicus' theory that the Earth revolves around the Sun. His *Pathewaie to Knowledge* (1551) was an abridged version of Euclid's *Elements.* Perhaps his most noted work was *The Whetstone of Witte* (1557), in which he first proposed the use of the equals sign (=).

Recorde died in prison. The reason for his imprisonment is not known.

recorder, in Anglo-American judicial systems, an officer appointed by a city, county, or other administrative unit to keep legal records. In England and Wales the recorder, in the course of time, came to be a locality's chief legal officer and sole judge at quarter sessions. When the quarter sessions courts were abolished by the Courts Act of 1971, the recorder's jurisdiction moved to the Crown Court.

Prior to 1971, recorders in England and Wales were required to be barristers of five years' standing; after that date they could be either barristers or solicitors, but they were required to have 10 years' standing.

recorder, in music, wind instrument of the fipple, or whistle, flute class, closely related to the flageolet. Most recorders made since their revival in 1919 by the English instrument maker Arnold Dolmetsch follow the early 18th-century Baroque design: the cylindrical head joint is partly plugged to direct the wind against the sharp edge below, the plug being known as the block, or fipple; the body tapers, and its lowest part is usually made as a separate foot joint; and there are seven finger holes and one thumbhole. Often the lowest two holes are arranged as a pair, so that when one is left open it produces the semitone above the note made when both are covered. The



(Left) French recorder, ivory, 17th century, in the Metropolitan Museum of Art, New York City; (right) set of recorders by P.J. Bressan, 18th century, in the Grosvenor Museum, Chester, Cheshire, Eng.

By courtesy of (left) the Metropolitan Museum of Art, New York City, the Crosby Brown Collection of Musical Instruments, 1889, (right) the Grosvenor Museum, Chester, Cheshire, Eng.

upper register, at the octave, is obtained by "pinching" the thumbhole (flexing the thumb to make a narrow opening above the thumbnail). Larger recorders may have one or more keys.

Most recorders are made in the following sizes (note names referring to the lowest note; c′ = middle C): descant (soprano) in c″; treble (alto) in f′; tenor in c′; and bass in f. Other, less commonly used recorders include the *gar klein Flötlein* in C‴; sopranino in f″; great bass in c; and the contra bass in F. The treble and tenor recorders sound at written pitch; the sopranino and descant, an octave higher; the bass, the music for which is written in the bass staff, also sounds an octave higher.

The recorder is a 14th-century improvement upon earlier kindred instruments. The first instruction books were written by the German theorist Sebastian Virdung (1511) and the Italian instrumentalist Silvestro Ganassi (1535). The Baroque repertory is almost exclusively for treble recorder (then called flute, or common flute). After the mid-18th century the instrument became obsolete until its modern revival.

records: *see* archives.

rectifier, device that converts alternating electric current into direct current. It may be an electron tube (either a vacuum or a gaseous type), vibrator, solid-state device, or mechanical device. Direct current is necessary for the operation of many devices such as radio and television receivers and certain power tools.

If only one polarity of an alternating current is used to produce a pulsating direct current, the process is called half-wave rectification. When both polarities are used, producing a continuous train of pulses, the process is called full-wave rectification.

Recto, Claro Mayo (b. Feb. 8, 1890, Tiaong, Phil.—d. Oct. 2, 1960, Rome), statesman and leader of the "Filipino-first" movement that attacked U.S. "neo-colonialism" in the Philippines.

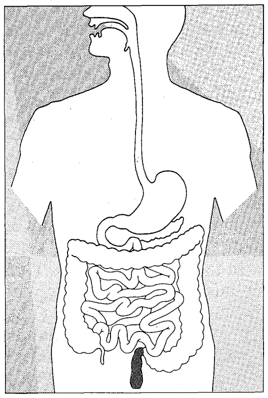
Recto graduated with a law degree from the University of Santo Tomás in 1913. He was elected in 1919 to the Philippine House of Representatives and served for three terms as floor leader for the minority Demócrata Party. Elected to the Senate in 1931, he switched his allegiance two years later to the Nacionalista Party. He was a member of a mission to Washington, D.C., led by Manuel Quezon, which secured passage by Congress of the Philippine Independence and Commonwealth Act (1934; Tydings–McDuffie Act). Recto was appointed president of the convention charged with drafting a constitution for the new Commonwealth government. He served as associate justice of the Supreme Court (1935–36) and was reelected to the Senate in 1941.

During the Japanese occupation in World War II, Recto served in the government of José Laurel. After the war he was elected for two terms, in 1949 and 1955, to the Senate of the, by then, independent Philippines. During the presidency of Ramon Magsaysay (1953–57) he became prominent in the struggle against excessive U.S. influence on the islands. He campaigned for repudiation of the Bell Act, which gave the U.S. unequal trade advantages; demanded acknowledgment of Philippine ownership of U.S. military bases on the islands; and proposed the Omnibus Nationalization Act to nationalize practically every large economic enterprise, including those that were foreign owned. Recto accused Magsaysay of being unduly subservient to U.S. interests in foreign policy because he brought the Philippines into the Southeast Asia Treaty Organization and recognized Ngo Dinh Diem's anti-Communist government in South Vietnam.

In 1957 Recto broke away from the Nacionalistas and joined the new Nationalist Citizens' Party, advocating neutrality in foreign relations and economic independence from U.S. interests. He ran unsuccessfully as its candidate for president in 1957.

rectocele, medical disorder in which the rectum bulges into the back wall of the vagina. It is caused when the muscles and connective tissues supporting the rectum and back wall of the vagina are weakened, usually owing to repeated childbirth or to aging, and the rectum sags until it abuts the vagina. A rectocele often occurs together with enterocele, which is a bulge of the small intestine into the vagina. Women with small rectoceles or enteroceles may go for many years without feeling much distress; a larger and more serious rectocele can cause pelvic discomfort, a sagging sensation in the pelvic area, and difficulty in emptying the lower bowel. Both conditions can be corrected by surgery in which the small intestine and rectum are pushed back into place and held there by reconstructed pelvic muscles while the walls of the vagina are also restored to their normal shape.

rectum, terminal segment of the digestive system in which feces accumulate just prior to discharge. The human rectum is continuous with the sigmoid colon and extends 5 to 6 inches (13 to 15 cm) to the anal canal (*q.v.*).



Rectum

A muscular sheet called the pelvic diaphragm runs perpendicular to the juncture of the rectum and anal canal and maintains a constriction between these two segments of the large intestine. The internal cavity of the rectum is divided into three or four chambers; each chamber is partly segmented from the others by permanent transverse folds (valves of Houston) that apparently help to support the rectal contents. A sheath of longitudinal muscle surrounds the outside wall of the rectum, making it possible for the rectum to shorten in length.

Food wastes remain in the sigmoid colon until they are ready to be excreted from the body. As the fecal material enters the rectum, the walls distend to accommodate the material. When sufficient pressure occurs within the distended rectal cavity, the urge to eliminate wastes begins. When receptors of the nervous system within the rectal wall are stimulated by its stretching, they send impulses to the anal canal, chest and abdominal-wall muscles, and to the medulla of the brain, which makes the individual conscious of the need to defecate. *See also* defecation.

For a depiction of the rectum in human anatomy, shown in relation to other parts of the body, *see* the colour Trans-Vision in the PROPAEDIA: Part Four, Section 421.

Recuay, pre-Columbian culture and site near present-day Recuay in the Callejón de Huaylas Valley of the northern highlands of Peru. Recuay culture dates to the Early Intermediate Period (*c.* 200 BC–AD 600) and was contemporaneous with the Moche culture of the neighbouring northern coast. Recuay is known best for its distinctive pottery, which features a type of decoration in three colours and a style of modeling in which small figures of men, jaguars, llamas, and other animals are affixed to the vessel. Recuay stone carving is related to that of the Pucará and Tiahuanaco cultures.

recursive function, in logic and mathematics, a type of function or expression predicating some concept or property of one or more variables, which is specified by some procedure that yields values or instances of that function by repeatedly applying some given relation or routine operation to known values of the function. The theory of recursive functions was developed by the 20th-century Norwegian Thoralf Albert Skolem, a pioneer in metalogic, as a means of avoiding the so-called paradoxes of the infinite that arise in certain contexts when "all" is applied to functions that range over infinite classes; and it does so by specifying the range of a function without any reference to infinite classes of entities.

Recursion can be intuitively illustrated by taking some familiar concept such as "human"—or the function "*x* is human." Instead of defining this concept or function by its qualities and dispositions, one might say: "Adam and Eve are human; and any offspring of theirs is human; and any offspring of offspring . . . of their offspring is human." Here two values of the function "*x* is human" are mentioned, and a familiar relationship in which they stand to other entities is given. Through this relationship all things that are to be values of "*x* is human" are selected by a back reference, or "recursion," by many steps, to Adam and Eve.

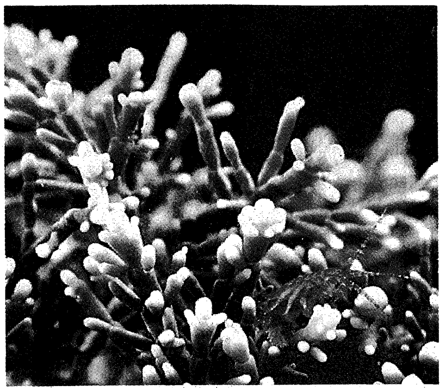
This sort of recursiveness in a function or concept is closely related to the procedure known as mathematical induction and is mainly of importance in logic and mathematics. For example, "*x* is a formula of logical system *L*," or "*x* is a natural number," is frequently defined recursively. These functions are correlated with purely routine operations that may be repeatedly applied to given formulas or numbers, eventually relating them to certain listed values of the functions—*e.g.*, to "*P* and *Q*" as one formula or to zero as one natural number—thus avoiding functions that range over infinite classes with the risk of incurring paradoxes. *See* decision problem.

Recurvirostridae, bird family (order Charadriiformes) composed of seven species of moderately large (11–19 inches [29–48 cm]) wading birds characterized by extremely long legs, a relatively small head, and a long, slender bill. Better-known members of the family include the avocet, ibisbill, and stilt (*qq.v.*).

red algae, members of the division Rhodophyta (about 3,000 species), predominately marine algae often found attached to other plants near tropical and subtropical shores. Their morphological range, though not so extensive as that of the brown algae, includes filamentous, branched, feathered, and sheetlike thalli. Thin protoplasmic connections provide continuity between cells. Their usual red or blue colour is the result of a masking of chlorophyll by the phycobilin pigments (phycoerythrin and phycocyanin).

The reproductive bodies of red algae are nonmotile. The female sex organ, called a carpogonium, consists of a uninucleate region that functions as the egg and a trichogyne or projection that acts as the sperm receptacle. Nonmotile male gametes (spermatia) are produced singly in the male sex organ, the spermatangium.

Red algae are important food plants (*e.g.*, laver, dulse) and retain both their colour and



Corallina
William H. Amos—Helen Wohlberg, Inc.

gelatinous nature when cooked. Industrially, Irish moss (*Chondrus*) is used as a gelatin substitute in puddings, toothpaste, ice cream, and preserves. Some species of *Corallina* are important, along with animal corals, in forming coral reefs and islands. Agar, an amorphous gelatin-like substance prepared primarily from *Gracilaria* and *Gelidium* species, is important as a culture medium for bacteria and fungi.

Red Army, Russian KRASNAYA ARMIYA, Soviet army created by the Communist government after the Bolshevik Revolution of 1917. The name Red Army was abandoned in 1946.

The Russian imperial army and navy, together with other imperial institutions of tsarist Russia, disintegrated after the outbreak of the revolutions of 1917. By a decree of Jan. 28 (Jan. 15, Old Style), 1918, the Council of People's Commissars created a Workers' and Peasants' Red Army on a voluntary basis. The first units, fighting with a revolutionary fervour, distinguished themselves against the Germans at Narva and Pskov on Feb. 23, 1918, which became Soviet Army Day. On April 22, 1918, the Soviet government decreed compulsory military training for workers and peasants who did not employ hired labour, and this was the beginning of the Red Army. Its founder was Leon Trotsky, people's commissar for war from March 1918 until he lost the post in November 1924.

The Red Army was recruited exclusively from among workers and peasants and immediately faced the problem of creating a competent and reliable officers' corps. Trotsky met this problem by mobilizing former officers of the imperial army. Up to 1921 about 50,000 such officers served in the Red Army and with but few exceptions remained loyal to the Soviet regime. Political advisers were attached to all army units to watch over the reliability of officers and to carry out political propaganda among the troops. As the Russian Civil War continued, the short-term officers' training schools began to turn out young officers who were regarded as more reliable politically.

The number of Communist Party members increased among the Red Army's ranks from 19 to 49 percent during 1925–33, and among officers this increase was much higher. Only a handful of officers left over from the imperial army continued on active service. Moreover, all commanders were graduates of Soviet military academies and officers' training schools, admission to which was limited to those recommended by the Communist Party.

In May 1937 a drastic purge, affecting all who opposed Joseph Stalin's leadership, decimated the officer corps and greatly reduced the morale and efficiency of the Red Army. On June 12, Marshal Tukhachevsky, first deputy people's commissar of war, and seven other Red Army generals were found guilty of plotting to betray the Soviet Union to Japan and Germany, and all were shot. Many other generals and colonels were either cashiered or sent to forced-labour camps, or both. At this time the Soviet government, disturbed by Japanese intervention in China and by German rearmament, began increasing its armed forces.

By the end of World War II the Soviet armed forces numbered 11,365,000 officers and men. Demobilization, however, started toward the end of 1945, and in a few years the armed forces fell to fewer than 3,000,000 troops.

In 1946 the word Red was removed from the name of the armed forces. Thus, a Soviet soldier, hitherto known as a *krasnoarmiich* ("Red Army man"), was subsequently called simply a *ryadovoy* ("ranker"). Discipline in the Soviet forces was always strict and punishments severe; during World War II, penal battalions were given suicidal tasks. In 1960, however, new regulations were introduced making discipline, and certainly punishments, less severe. Officers were to use more persuasion and were charged with developing their troops' political consciousness, thus ending the dual control of military commanders and political commissars. The era of the revolutionary "Red Army" ended in fact as well as in name.

Red Army, in full UNITED RED ARMY, Japanese RENGO SEKIGUN, Japanese terrorist group that was formed in 1969 in the merger of two far-left factions. Beginning in 1970, the Red Army undertook several major terrorist operations, including the hijacking of several Japan Air Lines airliners, a massacre at Tel Aviv's Lod Airport (1972), and the seizure and occupation of embassies in various countries. The Red Army underwent severe factional infighting that led in 1972 to its militants executing 14 of their fellow members. The Red Army's organization remained quite small, but it continued to undertake terrorist acts intermittently into the 1990s.

Red Army Faction, byname BAADER-MEINHOF GANG, German ROTE ARMEE FRAKTION, or BAADER-MEINHOF GRUPPE, West German leftist terrorist group formed in 1968 and popularly named after two of its early leaders, Andreas Baader (1943–77) and Ulrike Meinhof (1934–76). From its early years, the members supported themselves by robberies of banks and other businesses and engaged in terrorist bombings and arson, especially of West German corporations and businesses and of West German and U.S. military installations in West Germany. They also engaged in kidnappings and assassinations of prominent political and business figures. By the mid-1970s they had become internationalist and occasionally allied with Palestinian terrorist groups; two Baader-Meinhof guerrillas took part in a Palestinian hijacking of an Air France jetliner in 1976, which led to the Israeli raid on the Entebbe airport in Uganda; the Germans were killed.

The groups included at least 22 core members in the early 1970s, most of whom, including Ulrike Meinhof, had been jailed by the summer of 1972; Baader, escaping one imprisonment in 1970, was arrested again in 1976. Meinhof hanged herself in her cell in 1976. Three others, including Baader, were found shot in their cells on Oct. 18, 1977, presumably suicides; their deaths came a day after West German commandos stormed a hijacked Lufthansa plane in Mogadishu, Somalia, and blocked a ransom attempt to free the terrorists. The Red Army Faction thereafter continued its terrorist activities and bore a number of splinter groups.

After the collapse of communism in East Germany in 1989–90, it was discovered that many fugitive members of the Red Army Faction had been given sanctuary there by the Stasi, the secret police of the old communist regime. Several were arrested.

Red Baron, The: *see* Richthofen, Manfred, Freiherr von.

Red Basin (China): *see* Szechwan Basin.

red bat (genus *Lasiurus borealis*), solitary North American bat of the common bat family, Vespertilionidae, found primarily in wooded areas. It is about 10 cm (4 inches) long, including a 5-centimetre tail, weighs 10–15 g (0.33–0.5 ounce), and has narrow wings and short, rounded ears. The fur is fairly long, chestnut to rusty, and tipped with white. The red bat is a strong, swift flier. At times it spirals down from heights or lands among leaves to hunt insects. It is migratory. Unlike most other bats, it bears as many as four young in a single litter.

red-billed quelea (bird): *see* quelea.

red blood cell: *see* erythrocyte.

Red Bluff, city, seat (1857) of Tehama county, northern California, U.S. It lies along the Sacramento River, 115 miles (185 km) north-northwest of Sacramento and 50 miles (80 km) west of Lassen Volcanic National Park. Settled in the 1840s, it was known as Leodocia until renamed for the reddish sand and low bluffs on which it stands. In the 1850s it was a busy port for paddle-wheel steamers, but river traffic declined when the water level fell because of irrigation. The city remains a marketing centre for the livestock and farm produce of the upper Sacramento River valley; it is the home of the Elberta peach. Lumbering and wood industries are also important. The annual (January) Red Bluff Bull Sale and (April) Roundup are well-known. Inc. 1876. Pop. (1988 est.) 12,480.

Red Brigades, Italian BRIGATE ROSSE, extreme left-wing secret terrorist organization in Italy that gained notoriety for kidnappings, murders, and sabotage, beginning in the 1970s. Its self-proclaimed aim was to undermine the Italian state and pave the way for a Marxist upheaval led by a "revolutionary proletariat."

The reputed founder of the Red Brigades was Renato Curcio (b. 1945), who first set up a leftist think-group at the University of Trento in 1967, dedicated to studying such figures as Karl Marx, Mao Zedong, and Che Guevara. Marrying a fellow radical, Margherita Cagol, in 1969, he moved with her to Milan and gathered a coterie of zealots. They proclaimed the existence of the Red Brigades in November 1970 in the firebombing of various factories and warehouses in Milan. In 1971 they began kidnappings and in 1974 began the first murders, killing, among others, the chief inspector of Turin's antiterrorist squad.

In 1978 the Red Brigades kidnapped and murdered former prime minister Aldo Moro; and, in spite of the efforts of the authorities, who arrested and jailed hundreds of alleged terrorists throughout the country (including Curcio, who had been captured in 1974, had escaped in 1975, and had been recaptured in 1976), the random murders continued. In December 1981 a U.S. officer with NATO, Brigadier General James Dozier, was abducted and held captive by the Red Brigades for 42 days before Italian policemen rescued him unharmed from a hideout in Padua.

At their height in the 1970s, the Red Brigades were believed to consist of 400 to 500 full-time members, another 1,000 members who helped periodically, and a few thousand supporters who provided funds, avenues of communication, and shelter. Careful, systematic police work led to the arrest and imprisonment of many of the Red Brigades' leaders and ordinary members from the mid-1970s on, and by the late 1980s the organization had been greatly weakened.

red bug, also called STAINER, FIREBUG, or PYRRHOCORID BUG, any insect of the family Pyrrhocoridae (order Heteroptera), which contains more than 300 species. The red bug—

a fairly common, gregarious, plant-feeding insect found mostly in the tropics and subtropics—is oval in shape and brightly coloured with red. It ranges in length from 8 to 18 mm (0.3 to 0.7 inch). Dimorphism, a condition

Red bug (*Pyrrhocoris apterus*)
Sven Samelius

in which two or more visibly different forms exist, may occur in some species (*e.g., Pyrrhocoris apterus* can be winged or wingless).

The genus *Dysdercus* is one of the most destructive cotton pests in North America and India. This cotton stainer damages cotton plants by sucking the sap and destroys the cotton bolls by staining them with excrement. At one time small piles of sugarcane were put between rows of cotton and orange trees to attract the red bugs; they were then destroyed with hot water. Now dusts and sprays are used for control. Not all red bugs are destructive. In India *Dindymus* larvae feed on termites, and the adults prey on flies.

Red Bull Theatre, London public playhouse in Upper Street, Clerkenwell, built in about 1600–05 by Aaron Holland and noted for the vulgarity and obstreperousness of its patrons. The Red Bull was frequented by rowdy neighbourhood theatregoers, and several were called before Middlesex justices in 1610, charged with committing a "notable outrage" at the theatre. Such disturbances there appear to have been common.

The first troupe to play at the Red Bull was Queen Anne's Men, who began when the theatre opened and occupied it until 1617, when they left for the Cockpit. In 1619, after the death of Queen Anne, who had been the troupe's patron, some members of the company returned to the Red Bull while others joined Prince Charles's Men at the Cockpit. In 1625 the Red Bull was renovated and modified, but little is known about the companies that played there after that. The theatre continued to be used until the Commonwealth, during which time it may have been used for puppet plays and occasional clandestine activities. It reopened at the Restoration, when Thomas Killigrew's company played there, but by 1663 the theatre was no longer in use and by 1665 had been torn down.

red cedar, common name for many evergreen trees of the cypress family (Cupressaceae), especially western red cedar, also known as giant arborvitae (*q.v.*); and eastern red cedar (*q.v.*), a species of juniper.

Red Cloud, Indian name MAHPIUA LUTA (b. 1822, on the Platte River, Nebraska Territory, U.S.—d. Dec. 10, 1909, Pine Ridge Agency, S.D.), a principal chief of the Oglala Teton Dakota (Sioux), who successfully resisted (1865–67) the U.S. government's development of the Bozeman Trail to newly discovered goldfields in Montana Territory.

Red Cloud had no hereditary title of his own but emerged as a natural leader and spokesman of his people through the force of his own character and through bravery in battle. Determined to protect the Indians' prime hunting grounds, Red Cloud in 1865 led the opposition of both Sioux and Cheyenne when the U.S. government began to build and fortify a road from Fort Laramie, in present Wyoming, by way of the Powder River to Montana. He intercepted the first contingents of army construction troops on the Bozeman Trail that summer, holding them prisoner for more than two weeks. Thereafter, he refused all offers to negotiate and relentlessly attacked workers along the route. The two-year harassment came to be known as Red Cloud's War and did not end until the United States agreed to abandon all posts and to desist from any further effort to open the road. When the garrisons had finally been withdrawn and the forts burned, Red Cloud signed the Second Treaty of Fort Laramie (April 29, 1868), laid down his arms, and allowed himself to be settled on the Red Cloud Agency, in Nebraska.

Many of Red Cloud's followers, however, including his own son, scorned his accommodation with the white man and left the agency to pursue the war. While he kept his pledge of peace, Red Cloud defended Indian culture and continued to criticize the policies of the federal government. In 1878 he and his people moved to Pine Ridge Agency, whence he made several trips to Washington, D.C., to publicize his views. He and his wife were baptized as Christians and took the names John and Mary a few years before his death.

Red Cloud, city, seat of Webster County, southern Nebraska, U.S. It lies along the Republican River, east of Harlan Reservoir, near the Kansas line. First settled by Captain Silas Garber (state governor, 1874–76), it was incorporated in 1872 and named for the last warrior-chief of the Teton-Sioux Indians. The community became a service point for a dairying area and has cheese- and meat-processing plants. The city is best known, however, as the home of Willa Cather (1873–1947), the novelist who was noted for her portrayals of frontier life on the Great Plains. She used Red Cloud as the setting for many of her novels, including Hanover in *O Pioneers!* (1913), Black Hawk in *My Antonia* (1918), and Sweet Water in *A Lost Lady* (1923). The Willa Cather Pioneer Memorial and Educational Foundation Museum contains her letters, first editions, and family memorabilia, and her childhood home has been restored as a national historic landmark. Pop. (1984 est.) 1,265.

red corpuscle (biology): *see* erythrocyte.

red crab, Pacific crab species closely related to the Dungeness crab (*q.v.*).

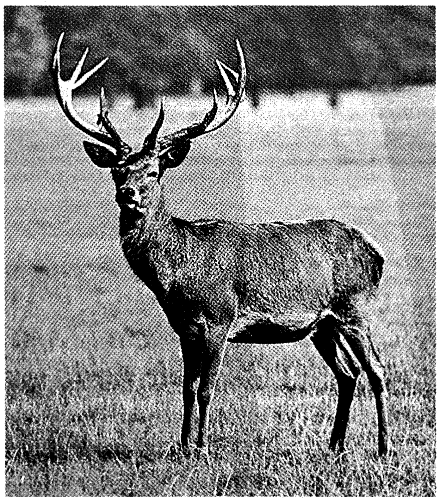
Red Cross and Red Crescent, in full INTERNATIONAL MOVEMENT OF THE RED CROSS AND RED CRESCENT, formerly (until 1986) INTERNATIONAL RED CROSS, humanitarian agency with national affiliates in almost every country in the world, first established to care for victims of battle in time of war but later aiding in the prevention and relief of human suffering generally. Its peacetime activities include first aid, accident prevention, water safety, training of nurses' aids and mothers' assistants, and maintenance of maternal and child welfare centres and medical clinics, blood banks, and numerous other services. The Red Cross is the name used in countries under nominally Christian sponsorship; Red Crescent (adopted on the insistence of the Ottoman Empire in 1906) is the name used in Muslim countries.

The Red Cross arose out of the work of Jean-Henri Dunant, a Swiss humanitarian, who, at the Battle of Solferino, in June 1859, organized emergency aid services for Austrian and French wounded. In his book *Un Souvenir de Solferino* (1862; "A Memory of Solferino") he proposed the formation in all countries of voluntary relief societies, and in 1864 the first societies came into being.

The Geneva Convention of 1864, the first multilateral agreement on the Red Cross, committed signatory governments to care for the wounded of war, whether enemy or friend. Later, this convention was revised, and new conventions were adopted to protect victims of warfare at sea (1907), prisoners of war (1929), and civilians in time of war (1949).

The worldwide structure of the Red Cross and Red Crescent consists of the International Committee of the Red Cross (Comité International de la Croix-Rouge); the League of Red Cross and Red Crescent Societies (Ligue des Sociétés de la Croix-Rouge et du Croissant-Rouge); and the national Red Cross and Red Crescent societies. The international committee is an independent council of 25 Swiss citizens with headquarters at Geneva. During wartime the committee acts as an intermediary among belligerents and also among national Red Cross societies. It also visits prisoners in war camps and provides relief supplies, mail, and information for their relatives. The League of Red Cross and Red Crescent Societies, which has a secretariat in Geneva, helps provide relief after natural disaster and aids in the development of national societies.

red deer (*Cervus elaphus*), well-known deer, family Cervidae (order Artiodactyla), native to Europe, Asia, and northwestern Africa and introduced into New Zealand. The red deer has long been hunted both for sport and food. Found primarily in woodlands, it lives in sexually segregated herds except during the breeding season, when the males (harts) fight for harems of females (hinds). A large animal, the red deer stands about 1.2 m (4 feet) at the



Red deer stag (*Cervus elaphus*)
Leonard Lee Rue III—Annan Photo Features

shoulder. Its coat is reddish brown, darkening to grayish brown in winter, with lighter underparts and a light rump. The hart has long, regularly branched antlers bearing a total of 10 or more tines; an animal with 12 tines is known as a "Royal," one with 14 tines is a "Wilson." The species *Cervus elaphus* includes a number of subspecies, all listed as critically endangered in the *Red Data Book*.

Red Deer, city, central Alberta, Canada, on the Red Deer River, midway between Calgary (90 miles [145 km] south) and Edmonton. Original settlement began around a ford where the trail from Calgary to Edmonton crossed the river (Red Deer Crossing), a few miles west of the present site. In 1891 the railway reached the river, and a community developed around the railway station. It grew as a processing and distribution centre for dairy produce; oil and gas wells are in the vicinity, and there is planned industrial development. Red Deer

College was established in 1964. The city is a gateway to the Sylvan Lake resort area, and the Gaetz Lakes are in the city. Inc. city, 1913. Pop. (1981) 46,393.

Red Deer River, river in southern Alberta, Canada, a major tributary of the South Saskatchewan River. Rising in the Canadian Rocky Mountains in Banff National Park near Lake Louise, the river flows northeast and then southeastward for 450 mi (724 km) before entering the South Saskatchewan River at a point 5 mi across the Saskatchewan border. The Red Deer (misnamed by early Scottish settlers, who confused elk that inhabited the area with red deer of Scotland) flows through the cities of Red Deer and Drumheller and through Dinosaur Provincial Park (34 sq mi [88 sq km]), a site where remains of extinct giant reptiles have been found.

red dog (mammal): *see* dhole.

Red Dog, also called HIGH CARD POOL, fast-moving card game, particularly popular in the United States. It involves little skill, for the only decision a player must make is how much to bet on each hand. Two to ten can play, using a standard deck. Ace is high.

Each player antes an agreed sum into the pot, and the dealer, chosen by cutting the cards or by others means, gives each player four cards, one at a time. The player to the dealer's left looks at his cards and places a bet, which must be at least the amount of the ante but may rise as high as the total amount in the pot. The dealer then exposes the top card. If the player holds a higher card in the suit of the turned card, he wins the amount of his bet. If not, his losing bet augments the pot. The dealer proceeds clockwise, repeating the procedure for each player in turn and for himself. At the end of the hand, the deal passes clockwise. If the pot grows beyond the ability of any player to bet it or if a maximum size is predetermined, the pot may be split and a new pot established.

A similar game, Polish Red Dog, also called Stitch, or Polski Rachuk, evidently was first played in Poland. In it, the banker puts up a sum of money as the pot and players bet against it. Each player gets three cards.

Red Earl: *see* Gloucester, Gilbert de Clare, 8th earl of.

Red Eminence, The: *see* Richelieu, Armand-Jean du Plessis, cardinal et duc de.

red-figure pottery, type of Greek pottery that flourished from the late 6th to the late 4th century BC. During this period most of the more important vases were painted in this style or in the earlier, black-figure style. In the latter, figures were painted in glossy black pigment in silhouette on the orange-red surface of the vase; details were added largely by incising. In the red-figure style, decoration was also outlined in black, but the background outside the outline was filled in with black, leaving the figures red. Details were painted rather than incised, thus allowing more flexibility in the rendering of human form, movements, and, above all, expressions, and allowing scope for shading and a more satisfactory kind of perspective. Since most of the ornamentation on Greek pottery was narrative rather than purely decorative, such technical advantages were of utmost importance.

Athenian red-figure cup, detail of a bearded reveller by the Brygos Painter, *c.* 490 BC; in the Louvre, Paris
J.E. Bulloz

Red-figure pottery can be roughly divided into two periods: the first from around 530 to 480 BC, the second from around 480 to 323 BC. In the early vases—the subjects of which included heroic and Dionysiac scenes as well as scenes from daily life—the details are added in black pigment or in dilutions of black that appear brown. The artists had mastered foreshortening and could convey the illusion of a third dimension without violating the two-dimensional surface of the vase. The figures were decorative rather than naturalistic. The most important artists from this period are Oltos, Epictetus, Euphronius, Euthymides, Onesimos, Douris, and the Brygos Painter. The vases characteristic of the second period are gaudier, with details added in white and sometimes in yellow-brown, gold, and blue. The subjects and treatment are often trivial and sentimental; and attempts at naturalism and depth perspective violated the intrinsic nature of the pottery shape, reducing the vessel to a mere support for the painting, of no more intrinsic aesthetic value than a wall for a fresco painting or a piece of canvas for an easel painting. By the end of this second period, the figured decoration of pottery, having become a degenerate art, died out in Attica.

Red Flag Canal (China): *see* Hung-ch'i Canal.

red flyer, one of the largest species of kangaroo (*q.v.*).

Red Fort, also called LĀL QALʿAH, also spelled LĀL KILA, Mughal fort in Old Delhi, India. It was so called because of its red sandstone walls, which enclosed palaces, gardens, barracks, and other buildings. It was built by Shāh Jahān in the mid-17th century and remains a main tourist attraction.

An earlier Red Fort had been built in Old Delhi in the 11th century by the Tomara king Anangapala. The Quṭb mosque now stands on the site.

Red Guards, Wade–Giles romanization HUNG-WEI PING, Pinyin HONGWEI BING, in China, groups of militant, aggressive college and high school students formed into paramilitary units as part of the Cultural Revolution (1966–69). The Red Guards were allegedly created to help Chinese Communist Party chairman Mao Tse-tung combat the revisionists that he felt had infiltrated the party. Taking the name of the real army units organized by Mao in 1927, however, the Red Guards fancied themselves as new revolutionary rebels pledged to eliminating all remnants of the old culture in China as well as purging all supposedly bourgeois elements within the government. They published their own newspapers, put up wall posters to publicize their program, and zealously ridiculed or disgraced various individuals of intellectual or traditional persuasions.

Red Guards and Chinese revolutionary youth embarking on long march to Peking, 1966
Eastfoto

Journeying to Peking to meet with Chairman Mao in eight massive demonstrations late in 1966, the several million Red Guard units soon put a tremendous strain on the city's transportation and accommodation facilities. In addition, their increasing factionalism, their attacks on foreign diplomats, and their disruption of production in the factories, all carried out under the slogan of furthering the thought of Chairman Mao, caused the government by early 1967 to urge the Red Guards to retire into the countryside. By the fall of 1967, the various educational institutions that had been closed as a result of the Cultural Revolution began to be reopened, and the Red Guard movement gradually subsided.

red heifer, Hebrew PARA ADUMMA, in Jewish history, unblemished, never-before-yoked animal that was slaughtered and burned to restore ritual purity to those who had become unclean through contact with the dead (Num. 19). Certain spoils of war and captives were also purified in this way. After the blood of the red heifer had been sprinkled by a priest, the carcass was totally immolated with cedarwood, hyssop, and a scarlet thread. The ashes were then carried to a clean spot and mixed with fresh water in an earthen vessel. A sprinkling of the mixture restored purity to all who had taken part in the ritual.

The significance of the ceremony has been related analogously to the scapegoat, to the heifer sacrificed near the scene of a murder (Deut. 21:3), and to the idolatrous worship of the golden calf (Ex. 32). In synagogues the command to sacrifice a red heifer to restore ritual purity is read on *Shabbat Para,* a special sabbath that precedes by a few weeks the festival of Passover (Pesaḥ).

Red Jacket, original name OTETIANI, also called SAGOYEWATHA (b. 1758?, Canoga, N.Y.—d. Jan. 20, 1830, Seneca Village, Buffalo, N.Y., U.S.), Seneca chief whose magnificent oratory masked his schemes to maintain his position despite double-dealing against his people's interests. His first Indian name was Otetiani, and he assumed the name Sagoyewatha upon becoming a chief. "Red Jacket" was his English name, bestowed as a result of the succession of red coats he wore while on the British side during the U.S. War of Independence.

Red Jacket retreated at the approach of Gen. John Sullivan's U.S. troops in 1779. And he even attempted to conclude a separate peace with the Americans. For these actions, Red Jacket was considered a coward by many of his own people. But he put his splendid oratorical skills to protesting the inevitable peacemaking with the United States at an Indian council in 1786, and his oratory succeeded in sustaining him as a Seneca chief.

Red Jacket constantly sought to portray himself as a bitter enemy of the whites. Yet, while he publicly opposed land sales in 1787, 1788, and 1790, he secretly signed the property cessions to protect his prestige with the Americans. Later, however, he seems to have become more sincere in protesting white influence on Seneca customs, religion, and language. He vehemently opposed missionaries' living on Indian lands, and he vainly attempted to preserve Indian jurisdiction over criminal acts committed on Indian property.

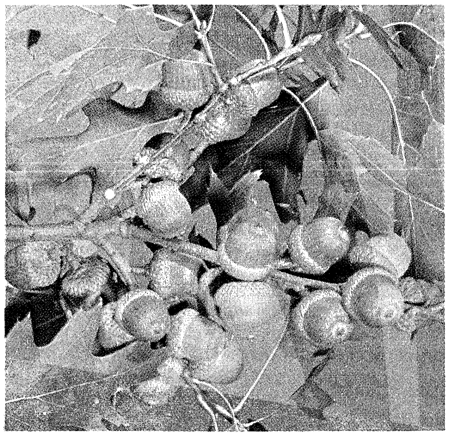
During the 1820s, Red Jacket lost prestige as his drinking and general dissipation became evident. In 1827 he was deposed as chief by a council of tribal leaders—only to be reinstated following a personal effort at reform and the intercession of the U.S. Office of Indian Affairs.

red maple, also called SWAMP MAPLE, or SCARLET MAPLE (*Acer rubrum*), large, irregularly narrow tree of the maple family (Aceraceae), cultivated for its shade and spectacular autumn colour. It is one of the commonest trees in eastern North America, where it is native.

The red maple grows to a height of 27 metres (90 feet) or more on a straight trunk; the crown bears upright to spreading branches that become reddish brown with age. Young bark is smooth and gray, gradually becoming ridged, scaly, and dark. Reddish colour characterizes the flowers, which precede the leaves, the leaf stalks, the fall foliage, and the winter buds. The leaf is three to five lobed, paler beneath. The small paired, winged fruits are yellow to red. Squirrels consume the seeds; deer and rabbits eat the young shoots and leaves. The wood is used in furniture, flooring, and veneer. Syrup, in small amounts, can be prepared from the sap. Because it tolerates compact, wet soils and city pollution, the red maple is often planted in urban environments. Several cultivated varieties are useful in the landscape for their special growth habit (pyramidal, globe-shaped, and columnar) and for especially brilliant fall colour.

red munia (bird): *see* avadavat.

red oak, any member of a group or subgenus (*Erythrobalanus*) of North American ornamental and timber shrubs and trees of the genus *Quercus*, in the beech family (Fagaceae),



Northern red oak (*Quercus rubra*)
Karl Maslowski—Photo Researchers

which have bristle-tipped leaves, acorns with hairy shell linings, and bitter seeds that mature in two seasons. Black oak, live oak, willow oak (including water oak, laurel oak, shingle oak), and pin oak (*qq.v.*) are members of this group.

More specifically, red oak refers to two important timber trees, the northern red oak (*Quercus rubra*) and the southern red oak, or Spanish oak (*Q. falcata*). The northern red oak is often cultivated as an ornamental; it grows rapidly into a round-headed, wide-spreading tree about 25 metres (80 feet) tall, occasionally to 45 m. Its oblong leaves have 7 to 11 lobes, are 20 centimetres or more long, dull green above and yellowish green and hairy beneath; they turn red-orange in autumn and persist into winter. The acorn is about three centimetres long and held at the base in a shallow cup.

The southern red oak, also planted as an ornamental, has a deeper root system, a shorter trunk, and two types of leaves: one with three apical lobes, the other with five to seven deep lobes, with the terminal lobe further divided. Both types are about 18 cm long, glossy dark green above and rusty and hairy below; they turn orange to orange-brown in autumn.

Cherry-bark oak, or swamp red oak, a valuable timber tree also used as an ornamental, is a variety of the southern red oak. It is a larger tree, up to 36 metres, with more uniform, 5- to 11-lobed leaves, often 23 cm (9 in.) long. The gray-brown to black scaly bark resembles that of black cherry.

The scarlet oak (*Q. coccinea*), Nuttall oak (*Q. nuttallii*), and Shumard oak (*Q. shumardii*) are other valuable timber trees of eastern and southern North America. The scarlet oak has a short, rapidly tapering trunk and leaves with nearly circular sinuses; it is a popular ornamental because of its scarlet autumn foliage. The Nuttall oak is a slender, often pyramidal tree, similar to the scarlet oak except for its oblong, often striated acorns. The Shumard oak is a tall (up to 23 m) bottomland tree with an open crown, long, clear trunk and seven- to nine-lobed leaves.

The Texas red oak (*Q texana*), about 10 m tall, is sometimes considered a shorter variety of the Shumard oak.

The blackjack oak (*Q. marilandica*), a cover tree on sandy soils in eastern North America, is about 9 to 15 m tall, with leaves that bear three lobes at the wide apex; they are glossy and dark green above, rusty and hairy below.

Timber from all members of the red oak group is known as "red oak" in the lumber trade.

Red Party (Canadian history): *see* Parti Rouge.

Red River, also called RED RIVER OF THE SOUTH, navigable river rising in the high plains of eastern New Mexico, U.S., and flowing southeast across Texas and Louisiana to a point north of Baton Rouge, where it enters two distributaries: the Atchafalaya River (*q.v.*), which flows south to the Gulf of Mexico, and the Old River, which connects with the Mississippi. Though the Red is considered a Mississippi tributary, much of its normal discharge flows into the Gulf via the Atchafalaya. It drains an area of 93,244 sq mi (241,501 sq km).

The Red River is 1,270 mi (2,044 km) long; for about half this distance it serves as the Texas–Oklahoma boundary. Its principal tributaries are the North Fork of the Red, the Kiamichi, Little, Black (Ouachita), Pease, Sulphur, Wichita, and Washita rivers, and Bodcau and Cypress bayous.

Early navigation above Natchitoches, La., was impeded by jams of driftwood. A 160-mi log jam was cleared in 1837 and a second one in 1873. Though southwestern Arkansas, about 450 mi upstream, is now considered the head of navigation, vessels drawing more than 4 ft (1.2 m) can reach that far only a few months of the year. Most of the traffic is in the lower 35-mi portion. Denison Dam (1944), 726 mi above the river's mouth, forms Lake Texoma. Many reservoirs have been built on tributaries of the Red River in Texas, Oklahoma, Arkansas, and Louisiana as part of a flood-control and river-development program.

In the American Civil War a Union expedition (March 10–May 22, 1864) under Gen. Nathaniel Banks and Adm. David Dixon Porter made an unsuccessful attempt to open a route to Texas via the river. The expedition was defeated at Sabine Crossroads, La.

Red River, Vietnamese SONG HONG, Chinese YÜAN CHIANG, principal river of northern Vietnam, rising in central Yunnan Province, southwestern China, and flowing southeast in a deep, narrow gorge, across the Tonkin region, through Hanoi, to enter the Gulf of Tonkin after a course of 750 mi (1,200 km). Its two major tributaries, the Song Lo (Rivière Claire, or Clear River) on the left bank and the Black River (Rivière Noire, or Song Da) on the right bank boost the flow of water, which during the rainy season may reach as much as 335,500 cu ft (9,500 cu m) per second. The Red River has a very irregular volume throughout the year and carries enormous quantities of silt because of the large proportion of easily crumbled soil in its basin, especially in the red lands from which its name is derived. This material is deposited in the river's delta, a flat, triangular region of about 2,700 sq mi (7,000 sq km), which extends 93 mi inland and 50 mi along the coast. The delta constitutes a large part of northern Vietnam and is densely populated and intensively cultivated. Haiphong, the outport of Hanoi, is on a northern arm of the delta.

Red River Campaign (1864), in the American Civil War, unsuccessful Union effort to seize control of the important cotton-growing states of Louisiana, Arkansas, and Texas. In the spring of 1864, Union Gen. Nathaniel Banks led an expedition up the Red River and, supported by a river fleet, took Ft. DeRussy and the town of Alexandria, La.; however, Confederate troops under Gen. Richard Taylor confronted the Federal forces at Sabine Crossroads, near Mansfield, and defeated them on April 8. Shortly afterward the Union withdrew from the area, though the fleet barely escaped capture by the Confederates and destruction in the rapids. The failure of the Red River Campaign ended any significant trans-Mississippi Union operations, and the Confederates, under Gen. Edmund Kirby-Smith, succeeded in holding the area until the end of the war.

red river hog, African hoofed mammal, a subspecies of bush pig (*q.v.*).

Red River Indian War (1874–75), uprising of warriors from several Indian tribes thought to be peacefully settled on Oklahoma and Texas reservations, ending in the crushing of the Indian dissidents by the United States. Presumably the Treaty of Medicine Lodge (Kansas, October 1867) had placed a number of Southwestern tribes on area reservations: the Arapaho, Cheyenne, Comanche, Kiowa, and Kataka. Many braves were unwilling to accept this life of confinement, however, and broke out repeatedly to raid white travelers and settlers. Encouraged by chiefs Big Tree and Satanta, an 1874 Indian attack cost 60 Texans their lives and launched the war. About 3,000 federal infantry and cavalry, under the overall command of Gen. W.T. Sherman, converged in the fall of 1874 upon the Indians concentrated in the Red River Valley, Texas. Resistance was so determined that 14 pitched battles were required to curb the Indian power by mid-November. The half-starved survivors surrendered the following summer and returned to their reservations.

Red River of the North, river flowing through the northern United States and southern Manitoba, Can. It is formed by the confluence of the Bois de Sioux and Otter Tail rivers at the twin cities of Wahpeton (N.D.) and Breckenridge (Minn.). It flows northward, forming for 440 mi (710 km) the North Dakota–Minnesota border, before entering Manitoba and emptying into Lake Winnipeg after a course of 545 mi. Its drainage area is 40,200 sq mi (104,118 sq km). Its valley at one time was the floor of glacial Lake Agassiz, and the silty loam that accumulated there has formed one of North America's most fertile farming regions. After it was explored in 1732–33 by the French voyageur Pierre Gaultier de Varennes, sieur de La Vérendrye, the river, so named because of the reddish-brown silt it carries, served as a transportation link between Lake Winnipeg and the Mississippi River system. Its basin's great fertility was first realized in 1811 by the Red River Settlement, an agricultural colony founded near Winnipeg by Lord Selkirk. The river valley produces cereals, potatoes, sugar beets, and livestock. Locks near the river's mouth enable ships to navigate to the major riparian cities of Winnipeg (Man.) and Grand Forks and Fargo (N.D.). The Wild Rice, Sheyenne, Pembina, and Assiniboine rivers are among its major tributaries.

Red River Settlement (1811–36), colony in Canada on the banks of the Red River near the mouth of the Assiniboine River (in present-day Manitoba). The colony was founded in 1811–12 by Thomas Douglas, 5th earl of Selkirk, a Scottish philanthropist, who obtained from the Hudson's Bay Company a grant of 116,000 square miles (300,000 square kilometres) in the Red and Assiniboine river valleys. The official name of the settlement was Assiniboia (*q.v.*).

In the summer of 1811 Lord Selkirk sent a group of Scottish and Irish colonists to the Red River region by way of Hudson Bay, under Miles Macdonnell, the first governor of the colony; the party reached its destination in 1812. Subsequent parties of colonists followed in 1812, 1813, 1814, and 1815.

The Hudson's Bay Company's rival, the North West Company, induced a number of colonists to desert in 1815; the remainder were intimidated and driven from the settlement. The Hudson's Bay Company quickly restored the colony, but it was broken up by the Nor'Westers a second time as a result of the Seven Oaks Massacre (*q.v.*) of 1816. In 1817 the colony was again reestablished by Lord Selkirk, who arrived with a force of military veterans recruited from former regiments. The colony survived thereafter without attack from the Nor'Westers, who merged with the Hudson's Bay Company in 1821.

The Red River Settlement was administered by a governor and council appointed by Lord Selkirk and his heirs until 1836, when the Hudson's Bay Company purchased the colony from the Selkirk estate and created the District of Assiniboia. The region became part of the province of Manitoba in 1870.

Red Rock River (Montana, U.S.): *see* Jefferson River.

Red Rum (foaled 1965), steeplechase horse who won the Grand National at Aintree, Eng., an unprecedented three times, in 1973, 1974, and 1977.

Bought as a crippled seven-year-old, he was reconditioned by his trainer Donald McCain who ran him on the sand and in the sea. In 1973, ridden by Brian Fletcher, Red Rum won his first Grand National by spurting ahead in the last 100 yards of the course to pass Crisp, who had held the lead during most of the race, and beating him by ¾ length in the record time of 9:01⁹⁄₁₀ sec. The next year, with 11 to 1 odds against repeating his victory, Red Rum completely upset the bookmakers by outdistancing his nearest rival, L'Escargot, by seven lengths, the only horse to win two times in a row since Reynoldstown won in 1935 and 1936. Only three weeks later, ridden by Fletcher, he entered and won the Scottish Grand National at Ayr, beating Proud Tarquin by four lengths after taking the lead with three barriers yet to go and pulling ahead in the stretch. For the next two years, he placed second in the English Grand National, coming in behind L'Escargot in 1975 and behind Rag Trade in 1976. Then in 1977 the twelve-year-old gelding came back to achieve a stunning third victory in the historic race. Ridden by Tommy Stack, and carrying 162 pounds, Red Rum won by an astonishing 25 lengths. His owner, millionaire Noel Le Mare, won $193,800 by his horse's three triumphs. Red Rum was retired from racing in 1978 and in the remainder of the year earned $100,000 appearing at openings of pubs, supermarkets, and horticultural shows.

red salmon: *see* sockeye salmon.

Red Sea, Arabic AL-BAḤR AL-AḤMAR, narrow strip of water separating northeast Africa from the Arabian Peninsula, occupying an area of approximately 169,000 sq mi (438,000 sq km).

The following article summarizes information about the Red Sea; for full details, *see* MACROPAEDIA: Asia.

The Red Sea extends southeastward from Suez, Egypt for about 1,300 mi (2,100 km) to the Straits of Bāb el-Mandeb, which connect with the Gulf of Aden and thence with the Indian Ocean; the sea's maximum width is 190 mi. It is bounded by the coasts of Egypt, The Sudan, and Ethiopia to the west and those of Saudi Arabia and Yemen (San'ā') to the east. At its northern end the sea splits into two parts: the shallow Gulf of Suez to the northwest and the Gulf of Aqaba, reaching a depth of 5,500 ft (1,676 m), to the northeast.

The Suez Canal connects the Gulf of Suez with the Mediterranean Sea to the north, enabling the Red Sea waterway to carry traffic between Europe and Asia. The topography of the sea floor is most rugged in its central section between the latitudes of 25° and 16° N. Here the main trough is sinuous, following irregularities of the shoreline, and reaches the sea's maximum depth of 9,580 ft (2,920 m). The extensive growth of coral reefs south of 16° N has made the navigable channel very narrow and has blocked some harbour facilities. At Bāb el-Mandeb the channel is kept open by blasting and dredging. No water enters the Red Sea from rivers, and rainfall in the desert climate is scant; but the evaporation loss, in excess of 80 in. (2,000 mm) a year, is made up by an inflow of water through the eastern channel of the Straits of Bāb el-Mandeb from the Gulf of Aden. Three major types of mineral resources are found in the Red Sea region: petroleum deposits, evaporite deposits (sediments such as salt, gypsum, and dolomite laid down as a result of evaporation), and more recently discovered, but unexploited, heavy metal deposits in the bottom oozes of the deep main trough.

Red Sea (province, The Sudan): *see* Baḥr al-Aḥmar, al-.

red shift, displacement of the spectrum of an astronomical object toward longer (red) wavelengths. It is generally attributed to the Doppler effect, a change in wavelength that results when a given source of waves (*e.g.,* light or radio waves) and an observer are in rapid motion with respect to each other.

The U.S. astronomer Edwin Powell Hubble reported in 1929 that the distant galaxies were receding from the Milky Way system, in which the Earth is located, and that their red shifts increase proportionally with their increasing distance. This generalization became the basis for what is called Hubble's law, which correlates the recessional velocity of a galaxy with its distance from the Earth. That is to say, the greater the red shift manifested by light emanating from such an object, the greater the distance of the object and the larger its recessional velocity (*see also* Hubble's constant). This law of red shifts has been confirmed by subsequent research and provides the cornerstone of modern relativistic cosmological theories that postulate that the universe is expanding.

Since the early 1960s astronomers have discovered cosmic objects known as quasars that exhibit larger red shifts than any of the remotest galaxies previously observed. The extremely large red shifts of various quasars suggest that they are moving away from the Earth at tremendous velocities (*i.e.,* approximately 90 percent the speed of light) and thereby constitute some of the most distant objects in the universe. *See also* quasar.

Red Shirt Movement, byname of KHUDAI KHITMATGAR (Persian: Servants of God), an action in support of the Indian National Congress started by Abdul Ghaffar Khan of the North-West Frontier Province of India in 1930. Ghaffar Khan was a Pashtun who greatly admired Mahatma Gandhi and his nonviolent principles and saw support for the Congress as a way of pressing his grievances against the British frontier regime. He was called the Frontier Gandhi. His followers were pledged to nonviolence, and they derived their popular title from the red colour of their shirts.

In the 1937 election under the new Government of India Act, the Congress Party, supported by the Red Shirts, won a majority and formed a ministry under Ghaffar Khan's brother, Khan Sahib, which, with interludes, remained in office until the 1947 partition. In that year the Frontier Province, faced with the choice of India or Pakistan, opted for Pakistan in a plebiscite. Ghaffar Khan then advocated Pakhtunistan—the concept of an independent Pashtun state, drawn from both the Pakistan and Afghan frontier districts. The Pakistan government suppressed both this movement and the Red Shirts.

red snow, snow or ice surfaces coloured rose to blood red by algae such as *Chlamydomonas, Raphidonema,* and diatoms. During seasons when there is little sunlight and temperatures are much lower than the freezing point, the algae are dormant. Red snow is the best known and most widely distributed of all snow flora.

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red spider, also called SPIDER MITE, any of the plant-feeding mites of the family Tetranychidae (subclass Acarina). Red spiders feed on house plants and agriculturally important plants, including the foliage and fruit of orchard trees. The life cycle from egg to adult takes about three weeks. Adult mites measure about 0.5 millimetre (about .02 inch) in length. Contrary to what their name suggests, all species are not red in colour; some are green or brown. The mites are sometimes mistaken for small spiders because of their habit of spinning a loose silk webbing on infested plants. A heavy infestation can cause complete defoliation. Spider mites have become difficult to control because of their increasing resistance to pesticides. Various alternative methods of treating infestations have been investigated, the most effective of which involves the use of the predatory mite *Phytoseiulus similis.*

Red Square, Russian KRASNAYA PLOSHCHAD, open square in Moscow. Dating from the late 15th century, just after the Kremlin walls were completed, Red Square has long been a focal point in the social and political history of Russia and the Soviet Union. It has had several names, but the present name has been used consistently since the latter part of the 17th century. The Russian word *krasnaya* (now translated "red") also means "beautiful." Always a market area, the square has also housed, at various times, churches, Moscow's first public library and university, a public theatre, and a printing house.

Red Square has been the scene of executions, demonstrations, riots, parades, and speeches. Its almost 800,000 sq ft (73,000 sq m) is directly east of the Kremlin and north of the Moskva River. A moat that separated the square from the Kremlin was paved over in 1812. The State Historical Museum, built 1875–81, stands at the northern end of the square. Directly opposite, at its southern end, is the eight-towered St. Basil's Cathedral (originally Cathedral of the Intercession), built 1555–60. GUM, the State Department Store (1889–93), is on the east side, while Lenin's tomb, completed in 1930, is on the west. Other graves near Lenin's tomb flank the Kremlin walls.

In 1930 the cobblestone paving of Red Square was replaced with stone, and a monument to Minin and Pozharsky, erected in the centre of the square in 1818, was moved to its present location in front of St. Basil's to facilitate parades and demonstrations. The annual May Day and November 7 Day (The Great October Socialist Revolution) anniversary parades are probably the best known celebrations held in Red Square.

red-tailed black shark, fish of the carp family, Cyprinidae; a species of labeo (*q.v.*).

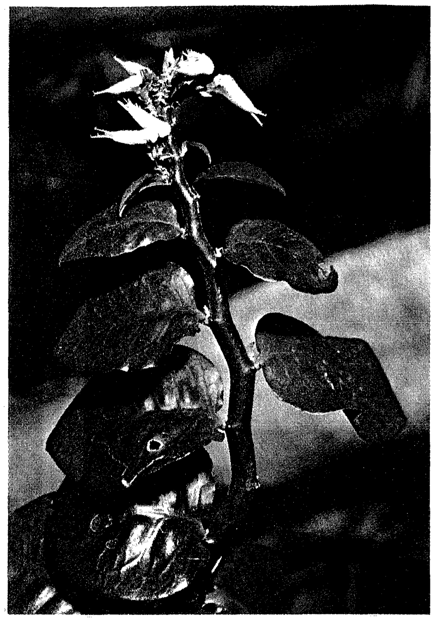
red tide, discoloration of sea water caused by dinoflagellates (phylum Protozoa), during periodic blooms (or population increases). Toxic substances released by these organisms into the water may be lethal to fish and other marine life. Red tides, or red waters, occur worldwide in warm seas. Up to 50,000,000 individuals per litre (quart) of the species *Gymnodinium brevis* caused a red tide off the Florida coast in 1947 and turned the water from green to yellow to amber; thousands of fishes died. The red tide along the Northumberland coast in England in 1968 was the cause of the death of many sea birds. Similar red tides, caused by *Gonyaulax polyedra,* have occurred off the California and Portuguese coasts. Toxins released into the water are irritating to the human respiratory system; coastal resorts sometimes close when breaking waves release the toxic substances into the air.

Red Volta River, French VOLTA ROUGE, river in West Africa, rising in Burkina Faso (formerly Upper Volta) northwest of Ouagadougou. It flows about 200 mi (320 km) south-southeast to join the White Volta (Volta Blanche) near the Gambaga scarp in the Upper Region of Ghana. The combined rivers then turn southwestward as the White Volta. The gradient of the Red Volta is relatively gentle (about 2 ft per mi [40 cm per km]), and the rainfall in its river valley is likewise relatively small. The Red Volta's chief riparian town is Kagao, about 40 mi south-southwest of Ouagadougou, Burkina Faso.

redback, name in Australia for the black widow (*q.v.*) spider.

redbird: *see* cardinal.

redbird cactus, also called DEVIL'S BACKBONE or SHOE FLOWER (*Pedilanthus tithymaloides*), succulent plant, of the spurge family (Euphorbiaceae), native from Florida to Venezuela and sometimes grown in tropical rock gardens or as a pot plant in the north. (It is not a true cactus.) It is called devil's backbone, for the zigzag form some varieties exhibit, or shoe flower, for the shape of the red, birdlike whorl of bracts (leaflike structures located just below flowers) that are located at the tip of the 1.2–1.8-metre (4–6-foot), mostly leafless stems. The stems bleed copious amounts of



Redbird cactus (*Pedilanthus tithymaloides*)
G.R. Roberts

milky latex if broken. There are varieties with variegated or reddish leaves.

Redbridge, outer borough of Greater London, part of the city's northeastern perimeter. It is mainly residential, with 730 ac (295 ha) of Epping Forest within its boundaries, and there are extensive university residence halls in Woodford. The River Roding, which flows south through Woodford toward the Thames, was once crossed by the Red Bridge. The borough includes in Ilford one of Greater London's major suburban shopping centres. The Wanshead and Woodford parliamentary constituency was represented from 1924 to 1964 by Sir Winston Churchill, who is commemorated by a statue (1959) on Woodford Green. The borough has an area of 22 sq mi (56 sq km). Pop. (1981 prelim.) 225,019.

redbud (*Cercis*), any of a genus of shrubs to small trees, in the pea family (Fabaceae), native to North America, southern Europe, and Asia, and widely planted for their showy early

Eastern redbud (*Cercis canadensis*)
Kenneth & Brenda Formanek—EB Inc.

spring flowers. Clusters of small purplish-pink flowers appear on old stems and branches before the leaves. The heart-shaped to roundish leaves are bronzy as they unfurl but soon become bright green, turning to yellow in fall.

The eastern redbud (*Cercis canadensis*), up to 12 metres (40 feet) tall, is the hardiest species. It is cultivated for its rosy-purple spring flowers and interesting branch patterns; a white-flowered variety is available. The Chinese redbud (*C. chinensis*) is often shrubby in cultivation.

Another redbud, *C. siliquastrum*, from the Mediterranean region, is often called Judas tree, for the betrayer of Christ, who is said to have hanged himself from such a tree, after which the white flowers turned red with blood or shame.

Redcliffe, residential and resort city, southeastern Queensland, Australia, on Redcliffe Peninsula, a 15-sq-mi (39-sq-km) promontory bounded on the south, east, and north by Bramble, Moreton, and Deception bays. Originally called Humpybong, derived from the Aboriginal *umpi bong,* meaning "dead houses," the peninsula's name was changed in 1799 by the English navigator Matthew Flinders. In 1824 the governor of New South Wales, Sir Thomas Brisbane, called for a penal colony to be established there; after three months, due to the hostility of the local Aborigines, the site was changed to what is now Brisbane, 22 mi (35 km) southwest. A settlement was subsequently reestablished, and Redcliffe was proclaimed a town in 1921 and declared a city in 1959. It is linked to Brisbane by rail and the Hornibrook Highway, with one of Australia's longest ($1\frac{2}{3}$ mi) causeways over Bramble Bay, and is one of several resort towns on the beach-ringed peninsula. Redcliffe is the base for fishing fleets that catch prawns, cod, whiting, and snapper. Pop. (1981) 42,223.

Reddie, Cecil (b. Oct. 10, 1858, London—d. May 1932, England), educational reformer, important in the development of progressive education in England.

Reddie was educated in Göttingen, Ger., where he was greatly impressed by the progressive educational theories being applied there. In 1883 he joined the radical Fellowship of the New Life in England and decided to establish a school for boys based on socialist principles. Although the school that he established in 1889, Abbotsholme in Derbyshire, was never specifically socialist, its curriculum set a new standard for progressive education. Reddie combined intensive studies and close individual instruction with a program of physical exercise, manual labour, recreation, and arts. Abbotsholme was imitated throughout Europe and was particularly influential in Germany. *Abbotsholme,* which contained Reddie's recollections and educational theories, was published in 1900.

Redding, city, seat (1888) of Shasta County, northern California, U.S., in the northern Sacramento Valley. Founded (1872) on land called Poverty Flat by the California and Oregon Railroad, it was named for B.B. Redding, a railroad land agent, and developed as a shipping point for minerals and agricultural produce. After World War II lumbering and tourism became the economic mainstays. As headquarters of the Shasta-Trinity National Forest, it became a service centre for an extensive recreational area around Shasta–Whiskeytown–Clair Engle lakes and dams, Trinity Alps Primitive Area, and Lassen Volcanic National Park. Redding is the home of Shasta College (1948). The old ghost mining town of Shasta is 6 mi (10 km) west. Inc. 1887. Pop. (1980) city, 41,995; (1982 est.) metropolitan area (SMSA), 121,600.

Redditch, district, county of Hereford and Worcester, England, in the valley of the River Arrow, a tributary of the River Avon. The district is known for its needle, fishhook, and spring trades. Bicycles and motorcycles are also produced. In 1965 it was designated by British planners as a new town for Birmingham's overspill population. It has an area of 21 sq mi (54 sq km). Pop. (1983 est.) 70,500.

redemption: *see* salvation.

Redemptorist, member of CONGREGATION OF THE MOST HOLY REDEEMER (C.SS.R.), a community of Roman Catholic priests and lay brothers founded by St. Alfonso Maria de'Liguori at Scala, Italy, a small town near Naples, in 1732. The infant community met an obstacle in the royal court of Naples, which tried to exercise complete control over the order. Only after steps were taken to settle in the Papal States and after papal approval was granted by Pope Benedict XIV in 1749 was the success of the congregation assured. St. Clement Mary Hofbauer extended the congregation into northern Europe in 1785; and in 1832 Redemptorists came to the United States, principally to undertake the care of German Catholic immigrants.

In the early 1970s the congregation was established throughout the world. Its special concern is the preaching of the word of God, especially to the poor, through various means, but particularly parish missions and retreats. The Redemptorists also administer parishes and foreign missions, serve as chaplains in military forces, and foster scholarship in the field of moral theology.

rederijkerskamer (Dutch: "chamber of rhetoric"), medieval Dutch dramatic society. Modelled after contemporary French dramatic societies (*puys*), such chambers spread rapidly across the French border into Flanders and Holland in the 15th century. At first they were organized democratically; later they acquired sponsorship by the nobility and had a designated leader, assistants, a paid manager, and a jester. Like guilds, they had their own names, slogans, and emblems and were commissioned by the towns that protected them to provide the ceremonial at local festivals.

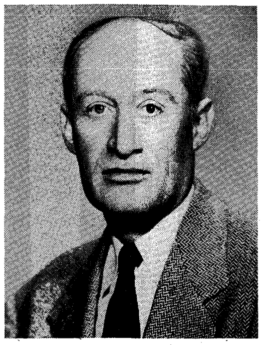
Drama by this time had largely passed from the hands of the clergy into the hands of the laity; the introduction of secular themes had necessitated the use of stages or carts outside religious buildings. The *rederijkerskamers* organized national festivals (*landjuwelen*) during which were held competitions that awarded prizes for poetry and drama. One of the finest plays of this period, *Elckerlyc*, a morality play of *c.* 1485 attributed to Pieter Doorlant, won a prize at a *landjuweel* and became well known in England as *Everyman.* The miracle play *Mariken van Nieumeghen* (*c.* 1500) is remarkably modern both in its psychological insight and in its technique. The "miracle" of the renegade's conversion is achieved through the simple and realistic device of her confrontation with a topical "pageant" street play, a theme within a theme. It was also within the *rederijkerskamers* that the farce thrived in the 15th century; the romantic play, too, was a popular genre, although *Spiegel der Minnen* by Colijn van Rijssele is the only text extant.

In poetry, although the *rederijkers* often overemphasized complex forms and metres, they laid the foundation for later Dutch dramatic and heroic verse by perfecting the rhymed alexandrine couplet. They also developed a new poetic form, the *referein*, seen at its best in the poetry of Anna Bijns.

By the end of the 16th century many of the *kamers* had degenerated into mutual admiration societies for poetasters; this, coupled with the new laws against public assemblies and the religious upheavals, led to their decline. The Egelantier (Dutch: Wild Briar) and the Wit Lavendel (Dutch: White Lavender), however, remained popular into the 17th century because of the leading Renaissance poets associated with them in Amsterdam.

Redfield, Robert (b. Dec. 4, 1897, Chicago—d. Oct. 16, 1958, Chicago), U.S. cultural anthropologist who was the pioneer and, for a number of years, the principal ethnologist to focus on those processes of cultural and social change characterizing the relationship between folk and urban societies.

A visit to Mexico in 1923 drew Redfield from law to the study of anthropology, and in 1926 he returned to Mexico for fieldwork. He



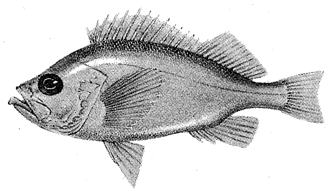
Robert Redfield

By courtesy of the Office of Public Relations, the University of Chicago

joined the faculty of the University of Chicago in 1927, receiving his Ph.D. in 1928. Results of his field endeavours appeared in *Tepoztlán, a Mexican Village* (1930), which gained prompt recognition as an innovative work. In 1930 he became a research associate of the Carnegie Institution, Washington, D.C., for which he conducted field study over the next 16 years in the Yucatán and Guatemala. In 1934 he was appointed professor of anthropology and dean of social sciences at Chicago. With Alfonso Villa Rojas, who became one of Mexico's foremost anthropologists, he wrote *Chan Kom: A Maya Village* (1934), which contained observations of contemporary Maya culture and considered a new question for anthropology in the 1930s, acculturation. A comparison of a tribal community, a peasant village, a provincial town, and Mérida, the Yucatán capital, formed the basis of *The Folk Culture of the Yucatán* (1941). This work elaborated a hypothetical continuum indicating how the growth of a small, isolated community into a large, heterogeneous society involves progressive degrees of social change and cultural disorganization. Returning to Chan Kom in 1948, he observed changes that had taken place since his earlier work there and wrote *A Village That Chose Progress* (1950).

Redfield's later study of the civilizations of China and India, which he visited, suggested his concept of civilizations as cultural systems of interdependent, coexisting "great" and "little" traditions. He dealt with these concepts in *The Little Community* (1955) and *Peasant Society and Culture* (1956). Associated with the University of Chicago until his death, in his later years he launched an interdisciplinary comparative study of civilizations. His wife, Margaret Park Redfield, survived him and edited his *Papers,* 2 vol. (1962–63).

redfish (*Sebastes marinus*), commercially important food fish of the scorpion fish family, Scorpaenidae (order Scorpaeniformes), found in the North Atlantic along European and North American coasts. Also known as ocean



Redfish (*Sebastes marinus*)

Painted especially for *Encyclopaedia Britannica* by Tom Dolan, under the supervision of Loren P. Woods, Chicago Natural History Museum

perch or rosefish in North America and as Norway haddock in Europe, the redfish is one of a number of red-coloured scorpion fish. Perchlike in form, it has a large mouth, large eyes, and a number of spines on its head and cheeks. A common fish, it may grow to about 1 metre (39 inches) long. Related species include *S. owstoni,* a food fish of the Orient, and the Norway haddock (*S. viviparus*) of Europe. Both are red and grow to about 25 centimetres (10 in.) long.

Redgrave, Sir Michael (Scudamore) (b. March 20, 1908, Bristol, Gloucestershire, Eng.—d. March 21, 1985, Denham, Buckinghamshire), British stage and film actor.

Following a short tenure as a schoolmaster, Redgrave began his stage career in 1934 with the Liverpool Repertory Theatre. He went on to the Old Vic, Stratford-upon-Avon, and the National Theatre playing classic roles from the works of Shakespeare, Ibsen, and Chekhov, as well as starring in such modern works as *Family Reunion* (1939) and *Tiger at the Gates* (1955). Redgrave used his refined good looks and resonant, expressive voice to good effect in his highly cerebral, technically perfect interpretations of introverted or reserved characters on both stage and screen. His film career began in 1938 with Hitchcock's *The Lady Vanishes* and continued with roles in *Dead of Night* (1945) and *The Browning Version* (1951). One of Redgrave's most highly acclaimed roles was as Orin Mannon in *Mourning Becomes Electra* (1947). Other of his films included *The Importance of Being Earnest* (1952), *Goodbye Mr. Chips* (1969), and *Nicholas and Alexandra* (1971). Redgrave was the author of several theoretical works about the acting profession, and he was knighted in 1959 for his services to the theatre.

He married the actress Rachel Kempson in 1935, and his two daughters, Vanessa and Lynn Redgrave, also became notable actresses.

redhead (*Aythya americana*), North American diving duck (family Anatidae), a popular game bird. The redhead breeds in marshes from British Columbia to Wisconsin and winters as far south as the Yucatán Peninsula. Breeding males have a round, red-brown head, gray back, and dark breast and tail; females are uniformly brown. Both sexes have light gray bands visible on the rear of the wings when in flight. The population has declined in the east as a result of destruction of the brackish marshes that provide its preferred forage plants. Redheads nest in tall vegetation quite close to water, although some females parasitize the nests of other ducks. Not easily disturbed, the redhead benefits from the wariness of the American wigeon, with which it often feeds.

Redi, Francesco (b. Feb. 19, 1626, Arezzo, Italy—d. March 1, 1697, Pisa), Italian physician and poet who demonstrated that the presence of maggots in putrefying meat does not result from spontaneous generation but from eggs laid on the meat by flies.

He read in the book on generation by William Harvey a speculation that vermin such as insects, worms, and frogs do not arise spontaneously, as was then commonly believed, but from seeds or eggs too small to be seen. In 1668, in one of the first examples of a biological experiment with proper controls, Redi set up a series of flasks containing different meats, half of the flasks sealed, half open. He then repeated the experiment but, instead of sealing the flasks, covered half of them with gauze so that air could enter. Although the meat in all of the flasks putrefied, he found that only in the open and uncovered flasks, which flies had entered freely, did the meat contain maggots. Though correctly concluding that the maggots came from eggs laid on the meat by flies, Redi, surprisingly, still believed that the process of spontaneous generation applied in such cases as gall flies and intestinal worms. Redi is known as a poet chiefly for his *Bacco in Toscana* (1685; "Bacchus in Tuscany").

Reding, Aloys (b. 1765—d. 1818, Schwyz, Switz.), Swiss politician and military hero who was for a time (1801–02) head of state of the short-lived Helvetic Republic.

After some years in the armies of Spain, Reding returned to Switzerland, where he joined the native struggle against the invading French. On May 2–3, 1798, he led the stubborn Swiss defense at Schindellegi and Rotenturm but was ultimately forced to capitulate. In the politics of the new French satellite state—the Helvetic Republic—he sided with the partisans of the old federalism and steadily opposed French influence. Only a reluctant participant in politics, Reding was nonetheless elected head *Landammann* (chief executive) after the coup in October 1801. As *Landammann,* he pressed for federalist constitutional revision, but in this effort he met the resistance of the controlling Napoleonic veto. Replaced by another coup (April 17, 1802), he was named to head a rival insurrectionary government (August–September 1802) but was subsequently imprisoned upon the restoration of order by French troops. Later, under the government of Napoleon's new Swiss Confederation, Reding generally confined himself to the cantonal politics of Schwyz.

Reding, Ital (d. 1447), Swiss politician who led hostilities against Zürich during the first civil wars of the Swiss Confederation (1439–40; 1443–50).

As *Landammann* (chief executive) of Schwyz (1412–44), Reding virtually controlled political life in the canton for over 30 years. In the affairs of the confederation he took an active role, often as an arbitrator. In 1415 he obtained for Schwyz juridical rights in Waldstatt, the March, and Küssnacht from the emperor Sigismund of Austria. His quarrel on behalf of Schwyz and Glarus with Rudolf Stüssi of Zürich over the landed inheritance of the last count of Toggenburg, Frederick VII, led ultimately to civil war within the confederation. In 1440 and again in 1443 Reding directed the war policy of the united cantons against Zürich and, despite his advanced age, saw service on the battlefield as well. He headed the siege of the fortress at Greifensee (May 1444) and is considered to have been primarily responsible for the infamous massacre of its surviving defenders.

redingote, fitted outer garment. The man's redingote, worn at the close of the 18th and the beginning of the 19th centuries, was a full-skirted, short-waisted, double-breasted overcoat adapted from the English riding coat. The woman's redingote of the same period

Man wearing a redingote, illustration from *La Galerie des Modes*, 1783

Prints Division, The New York Public Library, Astor, Lenox and Tilden Foundations

was a close-fitting dress that was fastened down the front to the hem.

In the mid-19th century, redingote referred to a woman's day dress, at first worn specifically for the promenade. This redingote had a tightly fitting bodice; long, full skirt; and either lapels, pleats, or a large flat collar. Redingote also applied to a garment that gave the appearance of closing to the hem in front.

rediscount rate (banking): *see* discount rate.

Redjang (people): *see* Rejang.

Redjedef (king of Egypt): *see* Djedefre.

Redl, Alfred (b. March 14, 1864, Lemberg, Austria—d. May 25, 1913, Vienna), chief of intelligence for the Austrian Army from 1907 to 1912 and at the same time the chief spy for Tsarist Russia in Austria.

Born into a poor family, Redl travelled widely as a young man and learned many languages. His ability and intelligence won him a commission in the Austrian Army, where he became a protégé of General von Giesl. In 1900 he was promoted to chief of the counterintelligence corps under von Giesl, who was in charge of all intelligence activities.

In 1902 he became a spy for Russia. The details of this transformation have never been revealed. Between 1902 and 1913 Redl gave the Russians codes, ciphers, letters, maps, photographs, army orders, mobilization plans, and reports on the conditions of roads and railways within Austria. At the same time he established a brilliant reputation for counterintelligence work by falsifying evidence against fellow officers and by exposing low-level Russian agents.

In 1912 von Giesl was promoted to the command of the 8th Army Corps in Prague, and Redl went with him as chief of staff. He was succeeded in the intelligence post by Maximilian Ronge, whose postal censors intercepted in March 1913 two envelopes containing a substantial amount of cash and nothing else. A check of the registration receipts identified their point of origin as addresses known to be those of the Russian and French intelligence organizations in another country. The money was delivered under surveillance and was eventually claimed by Redl. Confronted by his astounded colleagues, Redl confessed his treason and asked to be left alone with a revolver. His request was granted and after writing short notes to his brother and von Giesl, he took his own life.

Redlands, city, San Bernardino County, southern California, U.S., in the southwestern corner of the San Bernardino Valley, surrounded by peaks more than 10,000 ft (3,000 m) high. Deriving its name from the red soil of the region, it was founded in 1881 and developed as a citrus packing and distribution point. It is now part of the San Bernardino–Riverside–Ontario residential-industrial complex. The University of Redlands was founded in 1907. The San Bernardino Asistencia (chapel of Mission San Gabriel; 1819) has been restored. Inc. 1888. Pop. (1980) 43,619.

Redlich, Joseph (b. June 18, 1869, Göding, Bohemia—d. Nov. 12, 1936, Vienna), Austrian statesman and historian who was an influential politician before and during World War I (1914–18) and wrote important works on local government and parliamentary institutions.

Redlich, the son of a prominent Jewish industrialist, studied law and history at the University of Vienna, after which he was appointed professor of constitutional law there in 1906. He served as a German Liberal representative in the imperial Austro-Hungarian Reichsrat (1907–18) and in June 1917 he was asked to head a reform cabinet in the vain hope of establishing a constitutional democracy within the empire as a precondition for a peace settlement. His hopes for democratic reform were crushed with an imperial reorganization after the war. He remained in Vienna as an Austrian citizen, refusing further political participation except for brief service as finance minister in 1931.

Redlich's best known work on Austria was his uncompleted *Das österreichische Staats- und Reichsproblem* (1920–26; "Austrian State and Imperial Problems"), an extremely valuable history of Austrian domestic policy after 1848. His political diaries are entitled *Schicksaljahre Österreichs, 1908–1919* ("Austria's Fateful Years, 1908–1919"); also important is his biography of the emperor Francis Joseph (1929).

Redmond, John (Edward) (b. Sept. 1, 1856, Ballytrent, County Wexford, Ire.—d. March 6, 1918, London), Irish Nationalist Party leader who devoted his life to negotiating Home Rule for Ireland.

After he was elected to the House of Commons for New Ross, Wexford (1881), Redmond set a record by taking his seat, making

Redmond, print by J. Day

By courtesy of the National Portrait Gallery, London

his maiden speech, and being suspended, all within 24 hours. On missions to Australia (1882) and the United States (1884) he collected money to further the Irish cause.

As a fervent admirer of Charles Stewart Parnell, Redmond became his party whip. When the Irish Nationalists split after the Parnell divorce scandal (November 1890), Redmond became the leader of the minority Parnellite faction. He was elected to Parliament for Waterford (1891), which he represented until his death. His eloquence and arguments converted many in England to Home Rule.

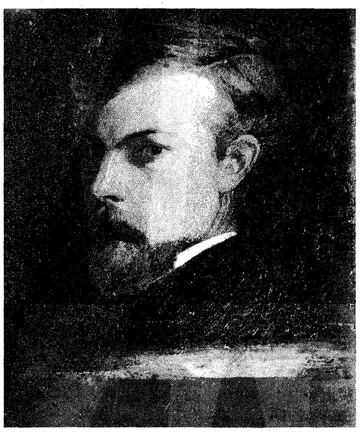
When a Liberal ministry dependent on Irish Nationalist support was seated at Westminster (1910), Redmond established a balance of power favourable to the Irish. In 1912 he saw the introduction of a third Home Rule Bill, and passage seemed assured. In the northern Irish counties, however, pro-English sentiment was high among the Ulster Unionists, and an armed opposition to the bill began to form. When a counteropposition began to take up arms in Dublin (November 1913), Redmond feared civil war. By March 1914 he reluctantly agreed that those northeastern counties voting against Home Rule could be excluded from it briefly, but the Unionists demanded exclusion for all nine Ulster counties.

Redmond promised full Irish support to the Allies in World War I, but his proposal that the home defense of Ireland be entrusted to the southern Irish, as well as to the Ulster Volunteers, was ignored, and his efforts to recruit southern brigades for service overseas were hampered in London. The Dublin insurrection on Easter Monday, 1916, took Redmond by surprise and shattered his policy. He served in the Irish constitutional convention (July 1917), but it became virtually deadlocked by early 1918. He went to London, where, in broken health, he resigned from party leadership.

Redon, Odilon (b. April 20, 1840, Bordeaux, Fr.—d. July 6, 1916, Paris), French Symbolist painter, lithographer, and etcher of considerable poetic sensitivity and imagination, whose work developed along two divergent lines. His prints explore haunted, fantastic, often macabre themes and foreshadowed the Surrealist and Dadaist movements. His oils and pastels, chiefly still lifes with flowers, won him the admiration of Henri Matisse and other painters as an important colourist.

Redon studied under Jean-Léon Gérome; mastered engraving from Rodolphe Bresdin, who exerted an important influence; and learned lithography under Henri Fantin-Latour. His aesthetic was one of imagination rather than visual perception. His imagination found an intellectual catalyst in his close friend, the Symbolist poet Stéphane Mallarmé. Redon was also associated with the group of Symbolist painters.

Redon produced nearly 200 prints, beginning in 1879 with the lithographs collectively titled "In the Dream." He completed another series (1882) dedicated to Edgar Allan Poe, whose poems had been translated into French with great success by Mallarmé and Charles Baudelaire. Rather than illustrating Poe, Redon's lithographs are poems in visual terms,



Redon, self-portrait, 1904; in a private collection

Archives Photographiques, Paris

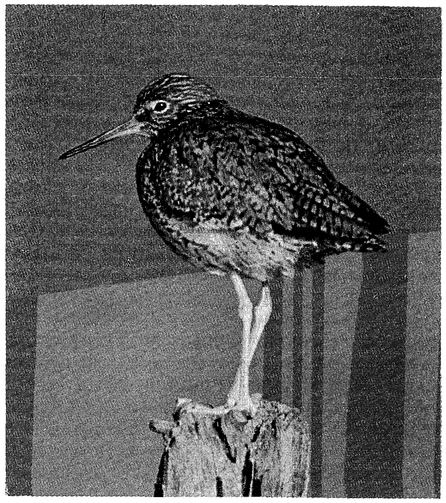
themselves evoking the poet's world of private torment. There is an evident link to Goya in Redon's imagery of winged demons and menacing shapes, and one of his series was the "Homage to Goya" (1885).

About the time of the print series "The Apocalypse of St. John" (1889), Redon began devoting himself to painting and colour drawing—sensitive floral studies, and heads that appear to be dreaming or lost in reverie. He developed a unique palette of powdery and pungent hues. Though there is a relationship between his work and that of the Impressionist painters, he opposed both Impressionism and Realism as wholly perceptual.

Redondo Beach, city, Los Angeles County, southern California, U.S., adjacent to Palos Verde Peninsula (south) and Hermosa Beach (north), on Santa Monica Bay. A former commercial port for Los Angeles (before development of San Pedro Harbor), it grew as a beach resort near the site of Rancho Sausal Redondo ("round willow grove") and was incorporated in 1892. King Harbor, protected by a breakwater, has modern marina facilities. Pop. (1980) 57,102.

redox reaction (chemistry): *see* oxidation-reduction reaction.

redshank, either of two species of Old World shorebirds of the family Scolopacidae (order Charadriiformes), characterized by its long, reddish legs. In the common redshank (*Tringa totanus*), about 30 centimetres (12 inches)

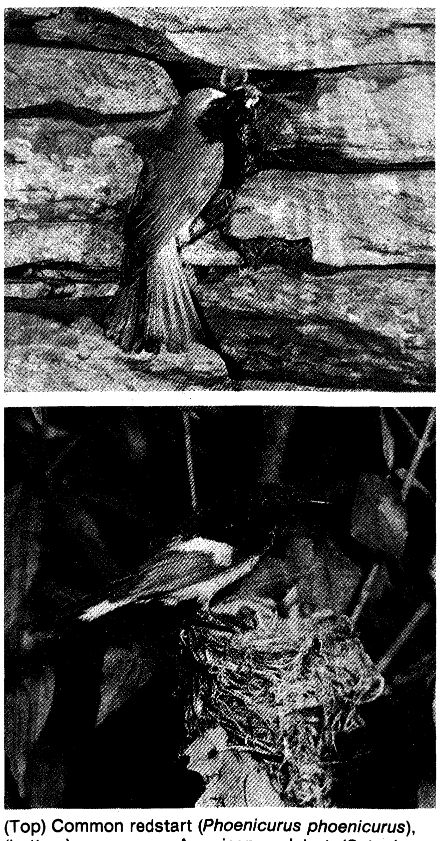


Common redshank (*Tringa totanus*)

Ingmar Holmasen

long, the legs are orange red, the upper parts are brownish or gray, the rump and hind edge of the wing are white, and the upturned bill is reddish with a black tip. The common redshank nests in wet meadows in Iceland, Britain, much of Europe, the Middle East, and temperate Asia (to 4,500 metres, about 15,000 feet, in the Himalayas), and it winters from Africa to the Philippines. The slightly larger spotted redshank (*T. erythropus*), also called dusky or black redshank, has reddish-brown legs and a straight bill, red with a brown tip. In breeding season, its plumage is black; in winter, gray. It breeds across sub-Arctic Eurasia and winters from the Mediterranean region into southern Asia.

redstart, any of about 11 bird species of the Old World chat-thrush genus *Phoenicurus*



(Top) Common redstart (*Phoenicurus phoenicurus*), (bottom) common, or American, redstart, (*Setophaga ruticilla*)

(Top) Stephen Dalton—Natural History Photographic Agency, (bottom) Hal H. Harrison from Grant Heilman—EB Inc.

(family Turdidae), or any of a dozen New World birds of vaguely similar appearance and behaviour. The Old World redstarts, 14 centimetres (5½ inches) long, are named for their tail colour (Middle English *stert,* "tail"). They constantly flirt or shiver their tails and have flycatcher-like habits. The common redstart (*P. phoenicurus*) breeds across temperate Eurasia; the male is gray, with black face and throat, reddish breast, and red-brown tail.

New World redstarts are woodwarblers (*q.v.*; family Parulidae). The common, or American, redstart (*Setophaga ruticilla*) breeds from Canada to the southern United States and winters in tropical America; the male is mostly black, with red wing and tail markings. Another strikingly marked form is the painted redstart (*S. picta*), found from southern Arizona to Nicaragua. Both sexes are primarily black, with large white patches on the wings and the sides of the tail and a bright red belly. Its grassy, cuplike nest is built on the ground, usually on a steep bank. Similarly handsome tropical forms are the 10 species of *Myioborus,* into which genus the painted redstart is now placed.

reducción (Spanish), Portuguese REDUÇÃO, in colonial Latin America, an Indian community set up under ecclesiastical or royal authority to facilitate the conversion of Indians to Christianity, to protect them, to teach them better farming methods and simple crafts, and in the case of civil *reducciones* (ruled locally by Indian *caciques,* or chiefs) to make them readily available for labour. The Indians, in turn, had to live under a strict regimen and were required to contribute their labour to various agricultural enterprises. The term implies "reducing" Indians to one place; another term used was *congregaciones* ("congregating centres").

The best known *reducciones* were those established by Jesuit missionaries in Paraguay. In the region between the Paraguay and Paraná rivers, and in the Argentine Misiones and Corrientes provinces, between the Paraná and Uruguay rivers, the Jesuits converted an estimated 700,000 Indians between 1610 and 1767; about 150,000 of them lived in 30 *reducciones.*

The Jesuits tried to preserve their territory from outside interference, especially from Spaniards in search of Indian labourers. After their order was suppressed in 1767, most of their settlements went to ruin; some, however, eventually became cities, such as Encarnación and Villarrica. In Brazil there were similar settlements in and to the south of the São Paulo region.

reduced mass, in physics and astronomy, value of a hypothetical mass introduced to simplify the mathematical description of motion in a vibrating or rotating two-body system. The system may be on a macroscopic scale, such as that of the Earth-Moon, or on a microscopic scale, as for example a diatomic gas molecule. Each of the two bodies in the system has its own unique centre of mass (*see* gravity, centre of), but mutual gravitational attraction between them creates a balanced inertial system with a third centre of mass located somewhere between the two centres of mass of the orbiting bodies. This common centre of mass is the reduced mass and it is measured as a hypothetical value. Always smaller than the value of the less massive body, the reduced mass is equal to the product of the two masses divided by their sum.

reductio ad absurdum (Latin: "reduction to absurdity"), in logic, a form of refutation showing contradictory or absurd consequences following upon premises as a matter of logical necessity. A form of the reductio ad absurdum argument known also as indirect proof is one that proves a proposition by showing that its denial conjoined with other propositions previously proved or accepted leads to a contradiction. In common speech the term refers to anything pushed to absurd extremes.

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reduction: *see under* descriptive word (*e.g.*, eidetic reduction; phenomenological reduction), except as below.

reduction, in syllogistic, or traditional, logic, method of rearranging the terms in one or both premises of a syllogism, or argument form, to express it in a different figure; the placement of the middle, or repeated, term is altered, usually to a preferred pattern. Aristotle took as primary the first figure, in which the middle term (M) is in the pattern

$$M = P$$
$$S = M$$
$$S = P$$

S and P being the subject term and predicate term, respectively, of the conclusion; he therefore reduced syllogisms of the second, third, and fourth figures to the first figure. For example, the second figure syllogism

No A is B
Every C is B

No C is A

can be reduced to a first figure syllogism by simply converting the first premise to the equivalent "No B is A."

The desire to perform reductions was based on the notion that only syllogisms of the first figure were self-evident. Reduction to other figures, however, could also have been chosen.

reduction, any of a class of chemical reactions in which the number of electrons associated with an atom or a group of atoms is increased. The electrons taken up by the substance reduced are supplied by another substance, which is thereby oxidized. *See* oxidation.

reduction division (biology): *see* meiosis.

reductionism, in philosophy, a view that asserts that entities of a given kind are collections or combinations of entities of a simpler or more basic kind or that expressions denoting such entities are definable in terms of expressions denoting the more basic entities. Thus, the ideas that physical bodies are collections of atoms or that thoughts are combinations of sense impressions are forms of reductionism.

Two very general forms of reductionism have been held by philosophers in the 20th century: (1) Logical Positivists have maintained that expressions referring to existing things or to states of affairs are definable in terms of directly observable objects, or sense-data, and, hence, that any statement of fact is equivalent to some set of empirically verifiable statements. In particular, it has been held that the theoretical entities of science are definable in terms of observable physical things, so that scientific laws are equivalent to combinations of observation reports. (2) Proponents of the unity of science have held that the theoretical entities of particular sciences, such as biology or psychology, are definable in terms of those of some more basic science, such as physics; or that the laws of these sciences can be explained by those of the more basic science.

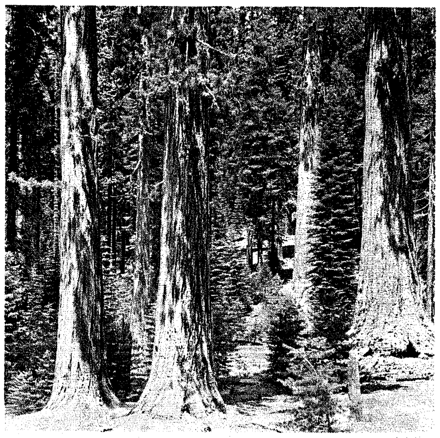
The Logical Positivist version of reductionism also implies the unity of science insofar as the definability of the theoretical entities of the various sciences in terms of the observable would constitute the common basis of all scientific laws. Although this version of reductionism is no longer widely accepted, primarily because of the difficulty of giving a satisfactory characterization of the distinction between theoretical and observational statements in science, the question of the reducibility of one science to another remains controversial.

Redwald (Anglo-Saxon ruler): *see* Raedwald.

redwood (*Sequoia sempervirens*), coniferous evergreen timber tree of the deciduous cypress family (Taxodiaceae), found in the fog belt of the coastal range from southwestern Oregon to central California, at elevations up to one kilometre (3,300 feet) above sea level. It is sometimes called coast redwood to distinguish it from the Sierra redwood, or big tree (*q.v.*), and the Japanese redwood, or Japanese cedar (*q.v.*). The redwood of European commerce is the Scots pine.

Redwoods are the tallest living trees; they often exceed 90 metres (300 feet). The leaves on main shoots are spirally arranged, scalelike, and closely appressed to the branches; those of the lateral shoots are spreading, needlelike, and arranged in two rows. As the tree ages, the lower limbs fall away, leaving a clear, columnar trunk. When a tree is cut, sprouts arise from the sapwood below the cut surface. Natural reproduction occurs through seed production, although only a small percentage of the seeds germinate.

The insect-, fungus-, and fire-resistant bark is reddish brown, fibrous, deeply furrowed, and 30 centimetres (12 inches) or more thick on an old tree. The base of the tree forms massive buttresses, and hemispherical burls may occur on the trunk.



Redwood (*Sequoia sempervirens*)
Shostal—EB Inc.

Redwood timber is used in carpentry and general construction, as well as for furniture, shingles, fence posts, and panelling. Burls cut from the trunk are made into bowls, trays, turned articles, and veneer.

Redwood City, city, seat (1856) of San Mateo County, California, U.S., on the western shore of San Francisco Bay, at the mouth of Redwood Creek. Once part of the Rancho de las Pulgas and called Embarcadero until 1858, it was an early port and had shipbuilding, lumber, and tannery industries. Laid out in 1854 by Simon M. Mezes as Mezesville, it was incorporated in 1866 and named for its redwood-timber business. Stimulated by modern deepwater harbour facilities, its growth has corresponded with the development of the bay area.

The city is known for its cut-flowers, especially chrysanthemums. Other industries include cement, salt, rubber, and electronics. Cañada College opened there in 1968. Pop. (1980) 54,965.

Redwood National Park, national park in the northwestern corner of California, U.S., established in 1968, with a boundary change in 1978. Preserving virgin groves of ancient redwood trees, including the world's tallest at $367\frac{1}{2}$ ft (112 m), the park also includes 40 mi (65 km) of scenic Pacific coastline. It covers an area of 109,027 ac (44,140 ha), including land held in three state parks: Jedediah Smith Redwoods, Del Norte Coast Redwoods, and Prairie Creek Redwoods.

reed, in botany, any of several species of large aquatic grasses, especially the four species comprising the genus *Phragmites* of the grass family (Poaceae). The common or water reed

Common reed (*Phragmites australis*)
Grant Heilman—EB Inc.

(*Phragmites australis*) occurs along the margins of lakes, fens, marshes, and streams from the Arctic to the tropics. It is a broad-leafed grass, about $1\frac{1}{2}$ to 5 metres (5 to $16\frac{1}{2}$ feet) tall, with feathery flower clusters and stiff, smooth stems. Other plants of the family Poaceae known as reeds are giant reed (*Arundo donax*), sea reed (*Ammophila arenaria*), reed canary grass (*Phalaris*), and reedgrass, or bluejoint (*Calamagrostis*). Bur reed (*Sparganium*) and reed mace (*Typha*) are plants of other families.

Dried reed stems have been used for centuries as thatching and construction material, in basketry, for arrows and pens, and in musical instruments (*see* reed instruments). They also are harvested for their cellulose content.

Reed, Sir Carol (b. Dec. 30, 1906, London—d. April 25, 1976, London), one of the most prominent of Great Britain's post-World War II motion-picture directors. He was knighted in 1952.

After attending King's School, Canterbury, Kent, Reed entered the theatre as an actor (1924). Within three years he was a theatrical director, staging Edgar Wallace's detective thrillers. He became a film-dialogue director in 1930 and was a full director by 1935. *The Stars Look Down* (1939), based on A.J. Cronin's novel about the life of coal miners, and the mystery adventure *Night Train* (1939) established his reputation. It was further enhanced during World War II by award-winning semi-documentary films, such as *The True Glory* (1945), constructed from millions of feet of actual combat film.

Reed's greatest successes date from the late 1940s: *Odd Man Out* (1947), a moving adaptation of F.L. Green's novel, and two adaptations of Graham Greene's novels, *The Fallen Idol* (1948) and *The Third Man* (1949). His later works include *Outcast of the Islands* (1951), *The Key* (1958), *Our Man in Havana* (1959), and *Oliver!* (1968), the last of which won an Academy Award.

Reed, John (b. Oct. 22, 1887, Portland, Ore., U.S.—d. Oct. 19, 1920, Moscow), U.S.

poet-adventurer whose short life as a revolutionary writer and activist made him the hero of a generation of radical intellectuals.

Reed, a member of a wealthy Portland family, was graduated from Harvard in 1910 and began writing for a Socialist newspaper, *The Masses,* in 1913. In 1914 he covered the revolutionary fighting in Mexico and recorded his impressions in *Insurgent Mexico* (1914). Frequently arrested for organizing and defending strikes, he rapidly became established as a radical leader and helped form the Communist Party in the United States.

He covered World War I for *Metropolitan* magazine; out of this experience came *The War in Eastern Europe* (1916). He became a close friend of Lenin and was an eyewitness to the 1917 Bolshevik Revolution in Russia, recording this event in his best known book, *Ten Days That Shook the World* (1919).

When the U.S. Communist Party and the Communist Labor Party split in 1919, Reed became the leader of the latter. Indicted for treason, he escaped to the Soviet Union and died of typhus; he was subsequently buried with other Bolshevik heroes beside the Kremlin wall. Following his death the Communist Party formed many John Reed clubs, associations of writers and artists, in U.S. cities.

Reed, Stanley F(orman) (b. Dec. 31, 1884, Maysville, Ky., U.S.—d. April 3, 1980, Huntington, N.Y.), associate justice of the United States Supreme Court (1938–57).

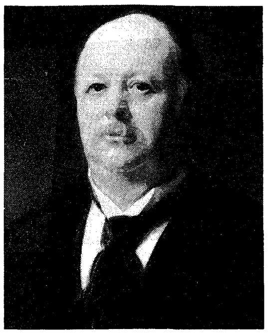
Reed studied law at the University of Virginia and at the Sorbonne in Paris. He served in the Kentucky legislature from 1912 to 1916 and in army intelligence during World War I. In 1929 he was appointed by Pres. Herbert Hoover to the Federal Farm Board and in 1932 by Pres. Franklin D. Roosevelt as counsel for the Reconstruction Finance Corporation, where he was involved with emergency New Deal financial measures. In 1935 he became U.S. solicitor general, in which capacity he was responsible for presenting the government's arguments on contested New Deal programs to the U.S. Supreme Court. He was elevated to the court in 1938.

Reed sided with the liberal majority on the court in the economic issues of the time but was a traditionalist in his construction of the division of powers. He voted with the majority in *Wolf* v. *Colorado* (1949) and *Irvine* v. *California* (1954) that illegally obtained evidence is admissible, and his opinion in *Adamson* v. *California* marked the last time that the Bill of Rights guarantees would be held to be applicable to the federal government but not to the states.

Reed, Thomas B(rackett) (b. Oct. 18, 1839, Portland, Maine, U.S.—d. Dec. 7, 1902, Washington, D.C.), vigorous U.S. Republican Party leader who, as speaker of the U.S. House of Representatives (1889–91, 1895–99), introduced significant procedural changes (the Reed Rules) that helped ensure legislative control by the majority party in Congress.

After he was admitted to the bar in 1865, Reed began his law practice in Portland and was elected to the Maine House of Representatives in 1868 and to the state Senate two years later. He was elected to Congress on the Republican ticket in 1877 and served continuously until the end of the century. In 1882 he was appointed to the House Committee on Rules, and when the Republicans regained control of the House in 1889, Reed was elected speaker. As a strong speaker, he arranged for the control of the Rules Committee by the majority party in Congress.

The Reed Rules, adopted in February 1890, provided that every member present in the House must vote unless financially interested in a measure; that members present and not voting be counted for a quorum; and that no dilatory motions be entertained by the chair.



Thomas B. Reed, detail of a portrait by John Singer Sargent; in the U.S. Capitol, Washington, D.C.

By courtesy of the Library of Congress, Washington, D.C.

Reed claimed these innovations enhanced legislative efficiency and helped ensure democratic (majority) control of the House; many thought they made a major contribution to the U.S. political system by establishing the principle of party responsibility. His dictatorial methods were bitterly attacked by the opposition, however, who called him Czar Reed. Nevertheless, the Reed Rules and methods were adopted by the Democratic leadership in 1891–95, and the power of the Rules Committee was increased.

Though denied the 1896 presidential nomination he had sought, Reed nonetheless supported the domestic programs of Pres. William McKinley and exercised a powerful influence in guiding bills through Congress. In 1899, however, he broke with the Republican administration over what he considered its expansionist policy toward Cuba and Hawaii. He resigned from the House in protest and retired to New York to practice law and to write.

Reed, Walter (b. Sept. 13, 1851, Belroi, Va., U.S.—d. Nov. 22, 1902, Washington, D.C.), U.S. Army pathologist and bacteriologist who led the experiments that proved that yellow fever is transmitted by the bite of a mosquito. The Walter Reed Hospital, Washington, D.C., was named in his honour.

Walter Reed

The Bettmann Archive

Reed was the youngest of five children of Lemuel Sutton Reed, a Methodist minister, and his first wife, Pharaba White. In 1866 the family moved to Charlottesville, where Walter intended to study classics at the University of Virginia. After a period at the university he transferred to the medical faculty, completed his medical course in nine months, and in the summer of 1869, at the age of 18, was graduated as a doctor of medicine. To obtain further clinical experience he matriculated as a medical student at Bellevue Medical College, New York, and a year later took a second medical degree there. He held several hospital posts as an intern and was a district physician in New York. He decided against general practice, however, and for security chose a military career. In February 1875 he passed the examination for the Army Medical Corps and was commissioned a first lieutenant.

After marrying Emilie Lawrence in April 1876, Reed was transferred to Fort Lowell in Arizona, where his wife soon joined him. During the next 18 years—changing stations almost every year—Reed was on garrison duty, often at frontier stations. His letters provide vivid pictures of the rigours of frontier life. In 1889 he was appointed attending surgeon and examiner of recruits at Baltimore. He had permission to work at the Johns Hopkins Hospital, where he took courses in pathology and bacteriology. In 1893 Reed was assigned to the posts of curator of the Army Medical Museum in Washington and of professor of bacteriology and clinical microscopy at the newly established Army Medical School. During the Spanish-American War of 1898 he was appointed chairman of a committee to investigate the spread of typhoid fever in military camps. Its report, not published until 1904, revealed new facts regarding this disease. On the completion of the committee's work in 1899, he returned to his duties in Washington. Almost immediately he became involved in the problem of yellow fever. The result was a brilliant investigation in epidemiology.

During most of the 19th century it had been widely held that yellow fever was spread by fomites—*i.e.,* articles such as bedding and clothing that had been used by a yellow-fever patient. As late as 1898, a U.S. official report ascribed the spread to this cause. Meanwhile, other methods of transmission had been suggested. In 1881 the Cuban physician and epidemiologist Carlos Juan Finlay began to formulate a theory of insect transmission. In succeeding years he maintained and developed the theory but did not succeed in proving it. In 1896 an Italian bacteriologist, Giuseppe Sanarelli, claimed that he had isolated from yellow-fever patients an organism he called *Bacillus icteroides.* The U.S. Army now appointed Reed and army physician James Carroll to investigate Sanarelli's bacillus. It also sent Aristides Agramonte, an assistant surgeon in the U.S. Army, to investigate the yellow-fever cases in Cuba. Agramonte isolated Sanarelli's bacillus not only from one-third of the yellow-fever patients but also from persons suffering from other diseases. Reed and Carroll published their first report in April 1899 and in February 1900 submitted a complete report for publication. It showed that Sanarelli's bacillus belonged to the group of the hog-cholera bacillus and was in yellow fever a secondary invader.

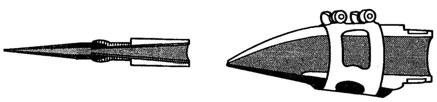
Before this report had actually been published, an outbreak of yellow fever occurred in the U.S. garrison at Havana, and a commission was appointed to investigate it. The members of the commission were Reed, who was to act as chairman, Carroll, Agramonte, and a bacteriologist, Jesse W. Lazear. In the summer of 1900, when the commission investigated an outbreak of what had been diagnosed as malaria in barracks 200 miles (300 kilometres) from Havana, Reed found that the disease was actually yellow fever. Of the nine prisoners in the prison cell of the post, one contracted yellow fever and died, but none of the other eight was affected. Reed and his colleagues thought it possible that this patient, and only he, might have been bitten by some insect. Reed therefore decided that the main work of the commission would be to prove or disprove the agency of an insect intermediate host.

On August 27, 1900, an infected mosquito was allowed to feed on Carroll, and he developed a severe attack of yellow fever. Shortly afterward Lazear was bitten, developed yellow fever, and died. In November 1900 a small hutted camp was established, and controlled experiments were performed on volunteers. Reed proved that an attack of yellow fever was caused by the bite of an infected mosquito, *Stegomyia fasciata* (later renamed *Aëdes aegypti*) and that the same result could be obtained by injecting into a volunteer blood drawn from a patient suffering from yellow fever. Reed found no evidence that yellow fever could be conveyed by fomites, and he showed that a house became infected only by the presence of infected mosquitoes. In February 1901 official action in Cuba was begun by U.S. military engineers under Major W.C. Gorgas on the basis of Reed's findings, and within 90 days Havana was freed from yellow fever.

On his return to Washington in February 1901, Reed continued his teaching duties. He died following an operation for appendicitis the next year. (E.A.U.)

BIBLIOGRAPHY. William B. Bean, *Walter Reed: A Biography* (1982), is scholarly and well-written.

reed instrument, in music, any of several wind instruments (aerophones) that sound when the player's breath or air from a wind chamber causes a reed (a thin blade of cane or metal) to vibrate, thereby setting up a sound wave in an enclosed air column (in reed pipes) or in the open air (usually free reeds). Reed pipes have single or double reeds. Double reeds (as in the shawm) are believed to be older. They were originally tubes of cane pinched flat to form a slit whose edges vibrated in and out under the player's breath. Later, two blades were tied together, or (in Europe) one was doubled back and slit. Single reeds may hit against a frame (beating reeds), as in a clarinet mouthpiece, or may vibrate freely through a closely fitting frame (free reeds), as in an accordion; the term single reed usually refers to a beating reed.



Comparison of the cane reeds (black) in the mouthpieces of (left) the oboe and (right) the clarinet
From A.H. Benade, "Physics of Wood Winds." Copyright © 1960 by Scientific American, Inc.

Reed pipes, such as clarinets and oboes, follow the acoustical principles of pipes, the pipe length determining pitch and the shape of its bore strongly affecting timbre (tone colour). An exception is a regal pipe of an organ, which is built so that the pipe acts solely as a timbre-influencing resonator; the beating reed itself determines the pitch, as with free reeds.

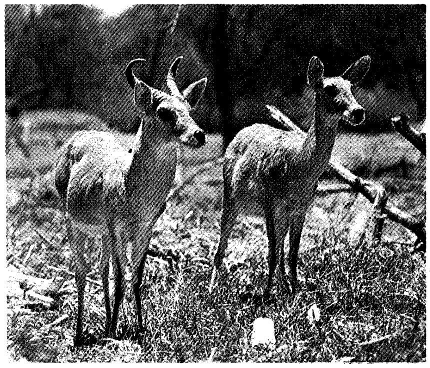
A free reed may be carefully cut from the material of its frame, leaving one end attached (as in southeast Asia), or may be a separate blade attached to the frame (as in Europe). Its thickness and length determine its pitch. The simplest example is a ribbon reed—a blade of grass or bark held taut in front of the player's mouth and vibrated by his breath. Its use in sophisticated instruments originated in ancient southeast Asia and reached Europe during the Crusades. Because free-reed instruments cause sound vibrations in unenclosed air, they are classified as free aerophones (as opposed to pipes). But in southeast Asia, free-reed pipes are also made.

The ancient beating reed continues to be used in peasant reed pipes and hornpipes in Europe and Asia and in the bagpipe. Its use in European art music, apart from the medieval regal, dates from the late 17th century, in experiments leading to the clarinet. The ancient double reed was used in the Greek aulos and its precursors and later in the shawm and its relatives, which were played from Mediterranean lands eastward to China. The clarinet, oboe, and other reed pipes, together with the flutes, are referred to as woodwind instruments. *See also* wind instrument; woodwind.

reed organ, any keyboard instrument sounded by vibration of metal reeds under wind pressure. "Reed organ" commonly refers to instruments having free reeds (vibrating through a slot with close tolerance) and no pipes.

Such instruments include the harmonium, melodeon, and regal (*qq.v.*) and are distinct from organs proper (*i.e.,* pipe organs). A type of small pipe organ describable as a reed organ is the regal, which has beating reeds (vibrating against a frame) and pipe resonators.

reedbuck (*Redunca*), any of three graceful antelopes, family Bovidae (order Artiodactyla), found in open and lightly wooded areas over much of sub-Saharan Africa. Reedbucks live



Bohor reedbucks (*Redunca redunca*)
Norman Myers—Photo Researchers/EB Inc.

alone or in small groups. When running, they raise their tails to expose the bushy white undersides. The common, or southern, reedbuck (*R. arundinum*), along with the bohor reedbuck (*R. redunca*), generally remains near water; the mountain reedbuck (*R. fulvorufula*) usually lives in rocky, hilly areas. Reedbucks stand 60–90 cm (2–3 feet) at the shoulder. They have a bare, glandular area beneath each ear, and males have horns that curve backward and then sharply forward at the ends. The coat of the reedbuck is short and gray to brown above, paler below.

reedfish, eellike African fish related to the bichir (*q.v.*).

reedling, also called BEARDED TIT (*Panurus biarmicus*), songbird often placed in the family Panuridae (order Passeriformes) but of uncertain relationships (*see* Muscicapidae). It

Reedling (*Panurus biarmicus*)
Ardea Photographics

lives in reedy marshes from England to eastern Asia. About 16 cm (6.5 inches) long, the male wears subtle reddish, yellowish, and gray colours and has black moustaches, which are erectile (hence, "bearded"); the female is duller and lacks the black. The bill is small—quite different from those of the related parrotbills.

Reeds, Plain of (Vietnam): *see* Thap Muoi, Dong.

reef, coral: *see* coral reef.

Reefsen, Jacob van: *see* Revius, Jacobus.

reel, in motion pictures, a light circular frame with radial arms and a central axis, originally designed to hold approximately 1,000 feet of 35-millimetre motion-picture film. In the early days of motion pictures, each reel ran about 10 minutes, and the length of a picture was indicated by the number of its reels. A film was a "one-reeler," a "two-reeler," or longer.

The number of reels in a motion picture became a point of controversy when the Motion Picture Patents Company (1909–17), a trust of major film producers and distributors who attempted a monopoly of the industry from 1909 to 1912, limited the length of films to one or two reels because the viewing audience was considered incapable of appreciating motion pictures of greater duration. The word reel has lost its original meaning in terms of time, since a modern projector accommodates reels holding from 2,000 to 3,000 feet of 35-millimetre film, while the so-called mini-theatres often mount an entire movie on a single reel.

Articles are alphabetized word by word, not letter by letter

reel, genre of social folk dance, Celtic in origin. It is a variety of country dance in which the dancers perform traveling figures alternat-

"The Shamit Reel," detail of an engraving by Joshua Gleadah after a drawing by J. Grant from J. Grant's "Penny Wedding," 1836
J.R. Freeman & Co. Ltd.

ing with "setting" steps danced in one place. Reels may be for sets of two or more couples. The music is in quick $\frac{2}{4}$ or $\frac{4}{4}$ time and usually has an insistent 16th-note motion.

Scottish reels are mentioned as early as the 16th century. Except in the Scottish Highlands, they disappeared under the influence of the Presbyterian Church in the 17th century; they reappeared in the Scottish Lowlands after 1700. The Irish reel, or *cor,* is distinguished by more complex figurations and styling and may be either a solo or a set dance to reel music. Reels are danced, less commonly, in England and Wales and, as the *ril,* in Denmark. Popular reels include the Irish Sixteenhand Reel and the Scottish reels Mairi's Wedding and the Duke of Perth.

Reelfoot Lake, shallow lake on the boundary between Lake and Obion counties in northwestern Tennessee, U.S., near Tiptonville. It was formed by earthquakes that occurred in 1811–12. In the upheaval, land on the east side of the Mississippi River sank, creating a depression that the Mississippi rushed in to fill. It is about 20 mi (32 km) long, 5 mi wide, and 2 to 9 ft (0.5 to 3 m) deep. The lake and the surrounding wooded area have been set aside as a state park and wildlife refuge area supporting numerous species of fish and fowl. Reelfoot River flows through the lake, joining the Obion River in Dyer County, which, in turn, joins the Mississippi. The lake's name comes from a 19th-century Chickasaw Indian chief who was supposedly clubfooted.

Reeve, Tapping (b. October 1744, Brookhaven, N.Y.—d. Dec. 13, 1823, Litchfield, Conn., U.S.), U.S. legal educator and jurist.

In 1784 Reeve founded the Litchfield Law School, which was the first of its kind in the United States. (Previously, legal training could be acquired in the United States only by apprenticeship.) He was the school's sole teacher until 1798, when he took on an associate. Before it closed in 1833 the school trained about 1,000 men in the law, among them the statesman John C. Calhoun, the educator Horace Mann, and the U.S. Supreme Court justice Levi Woodbury. An ardent Federalist, Reeve wrote articles for a Federalist newspaper; one led to his indictment (eventually dismissed) for libelling Pres. Thomas Jefferson. Reeve was a judge of the Connecticut Superior Court (1798–1814) and chief justice of the state supreme court (1814–16).

Reeves, William Pember (b. Feb. 10, 1857, Lyttelton, N.Z.—d. May 16, 1932, London), New Zealand statesman who, as minister of labour (1891–96), wrote the influential Industrial Conciliation and Arbitration Act (1894) and introduced the most progressive labour code in the world at that time.

After working as a lawyer and newspaper reporter, Reeves became editor of the *Canterbury Times* in 1885 and of the *Lyttelton Times* (1889–91). He entered Parliament in 1887 and was named minister of education, justice, and labour in New Zealand's first Liberal Party administration (1891–93), headed by John Ballance. In the next five years, Reeves sponsored 14 measures regulating factory and mine conditions, working hours, wages, and child and female labour. His Industrial Conciliation and Arbitration Act was the first legislation to provide for compulsory arbitration of labour-management disputes and influenced similar legislation in Australia. The act stimulated the growth of unions by limiting labour representation at the arbitration court to registered unions.

Ballance's successor, Richard John Seddon, was less tolerant of Reeves's advanced ideas on labour, and Reeves resigned in 1896 to become agent general in London. He wrote *The Long White Cloud* (1898), a history of New Zealand, and *State Experiments in Australia and New Zealand* (1902). After serving as high commissioner for New Zealand (1905–08) and director of the London School of Economics and Political Science (1908–19), he served as chairman of the board of New Zealand's National Bank from 1917 to 1931.

reference frame, also called FRAME OF REFERENCE, in dynamics, system of graduated lines symbolically attached to a body that serve to describe the position of points relative to the body. The position of a point on the surface of the Earth, for example, can be described by degrees of latitude, measured north and south from the Equator, and degrees of longitude, measured east and west from the great circle passing through Greenwich, Eng., and the poles.

The reference frames used in dynamics are known as coordinate systems with axes (lines) emanating from a point known as the origin. The position of a point moving parallel to a plane (plane motion) can be described by two numbers: (1) either the distances of the point from two lines at right angles to one another on the plane (rectangular coordinates), or (2) the length of a line with one end fixed at the origin and the other end at the moving point and the angle that the line makes with a fixed axis (polar coordinates). Motion in three dimensions can be described by three rectangular coordinates or by the length of a line emanating from the origin and two angles (spherical coordinates); one of these angles is equivalent to degrees of longitude and the other to degrees of latitude. In all cases a line from the origin to the point is known as the position vector for the point. As the point moves, the position vector changes in both magnitude and direction, and the velocity of the point is defined in terms of these changes.

Strictly speaking, Newton's laws of motion are valid only in a coordinate system with origin at the centre of the solar system, which is based on the "fixed" stars. Such a system is known as a Newtonian, or inertial reference, frame. The laws are also valid in any set of rigid axes moving with constant velocity and without rotation relative to the inertial frame; this concept is known as the principle of Newtonian relativity. A coordinate system attached to the Earth is not an inertial reference frame because the Earth rotates and is accelerated with respect to the Sun. Although the solutions to most engineering problems can be obtained to a satisfactory degree of accuracy by assuming that an Earth-based reference frame is an inertial one, there are some applications in which the rotation of the Earth cannot be neglected; among these is the operation of a gyroscopic compass.

To describe the position of a point that moves relative to a body that is moving relative to the Earth, it is usually convenient to use a reference frame attached to the moving body. The motion of the piston in the engine of a moving automobile, for example, is of more interest relative to the block than relative to the ground, whereas the motion of the moving parts of the engine relative to one another may be more important than their motions relative to the block.

Reference frames on bodies that rotate relative to the Earth are noninertial, and, in order to apply Newton's laws, additional fictitious forces must be introduced; among these are centrifugal force and Coriolis force.

referendum and initiative, electoral devices by which voters may express their wishes with regard to government policy or proposed legislation. They exist in a variety of forms.

The referendum may be obligatory or optional. Under the obligatory type, a statute or constitution requires that certain classes of legislative action be referred to a popular vote for approval or rejection. For example, constitutional amendments proposed by legislatures in most of the states of the United States are subject to obligatory referendum. Under the optional (or facultative) referendum, a popular vote on a law passed by the legislature is required whenever petitioned by a specified number of voters. By this means actions of a legislature may be overruled. Obligatory and optional referenda should be distinguished from the voluntary referenda that legislatures submit to the voters to decide an issue or test public opinion.

Through the initiative a specified number of voters may petition to invoke a popular vote on a proposed law or an amendment to a constitution. An initiative may be direct (a proposal supported by the required number of voters is submitted directly to a popular vote for decision) or indirect (the proposal is submitted to the legislature). If an indirect initiative is rejected, the proposition is submitted to a popular vote, sometimes accompanied on the ballot by the legislature's alternative proposal or a statement of the reasons for the rejection. The referendum for constitutional ratification was first used in the state of Massachusetts in 1778. Other forms of referendum and initiative were first used in Swiss cantonal government: the facultative referendum was used in the canton of Sankt Gallen in 1831, the initiative in Vaud in 1845, and the obligatory referendum in its modern form in rural Basel in 1863 (though it had appeared in earlier forms in 1852 and 1854). Both institutions have since been used freely in federal and cantonal matters.

The Swiss experience with the devices of direct legislation was influential in the adoption of the initiative and the optional referendum in U.S. states and municipalities. The obligatory referendum on amendments to state constitutions proposed by state legislatures was first adopted by Connecticut in 1818 and has become the prevailing method for the amendment of all state constitutions. Some states require a referendum on bond issues; and among local governments, the obligatory referendum is widespread for bond issues, tax questions, and related matters. In the United States, these devices were adopted principally to curb the rule of political party machines and to correct the abuses and inadequacies of inflexible legislatures by granting the people a means to overrule legislative action and to initiate popular votes on legislation.

Although the referendum and the initiative find most widespread use in the United States and the Swiss cantons, they are also provided for in the constitutions of several European and Commonwealth countries. The post-World War II constitutions of France and Italy made popular referenda obligatory for constitutional amendments. In Ireland and Australia, referenda are compulsory for all constitutional change. The constitutions of several states of Africa and Asia incorporate provisions intended to promote closer citizen participation in government, but generally what is called for is not true referendum or initiative, but rather some form of plebiscitary device to support regimes or policies.

reflection, abrupt change in the direction of propagation of a wave that strikes the boundary between different mediums. At least part of the oncoming wave disturbance remains in the same medium. Regular reflection, which follows a simple law, occurs at plane boundaries. The angle between the direction of motion of the oncoming wave and a perpendicular to the reflecting surface (angle of incidence) is equal to the angle between the direction of motion of the reflected wave and a perpendicular (angle of reflection). Reflection at rough, or irregular, boundaries is diffuse. The reflectivity of a surface material is the fraction of energy of the oncoming wave that is reflected by it. *See also* total internal reflection.

reflex, in biology, a type of action consisting of comparatively simple segments of behaviour that usually occur as direct and immediate responses to particular stimuli uniquely correlated with them. Reflex actions have a widespread occurrence among complex animals.

Many reflexes of placental mammals appear to be innate. They are transmitted by heredity and are the common property of the species, and often of the genus. They include not only such simple acts as mastication, swallowing, the blink reflex, the knee jerk, and the scratch reflex, but also stepping, standing, the cat's righting reflex, basic sexual acts, etc. Built up into complex patterns of many coordinated muscular actions, reflexes form the basis of much instinctive behaviour in animals.

Humans also exhibit a variety of innate reflexes, which are variously concerned with adjusting the musculature for optimum performance of the body's distance receptors (the eye and the ear), with orienting parts of the body in spatial relation to the head, and with managing the complicated acts involved in ingesting food. Among the innate reflexes concerning just the eyes, for example, are: (1) paired shifting of the eyeballs, often combined with turning of the head, to perceive some interesting object in the field of vision; (2) contraction of the intraocular muscles to adjust the focus of the retina for the viewing of near or far objects; (3) constriction of the pupil of the eye to reduce excessive illumination of the retina; and (4) blinking due to intense light or touching of the cornea.

In its simplest and most elementary form, a reflex is now viewed as a function of an idealized mechanism called a reflex arc. The primary components of the reflex arc have been identified as the sensory-nerve cell (or receptor) that receives the stimulation, in turn connecting to another nerve cell that activates the muscle cell (or effector), which thus performs the reflex action. In most cases, however, the basic physiological mechanism is more complicated than this simple arc theory would suggest. Additional nerve cells capable of communicating with other parts of the body (beyond the receptor and effector) are invariably present in reflex circuits. As a result of the integrative action of the nervous system in higher animals, the behaviour of such organisms is more than the simple sum of their reflexes; it is a unitary whole that exhibits coordination between many individual reflexes and is characterized not by inherited, stereotyped responses but by flexibility and adaptibility to circumstances. Many automatic, unconditioned reflexes can thus be modified by or adapted to new stimuli, making possible the conditioning of reflex responses. The experiments of the Russian physiologist I.P. Pavlov, for example, showed that if an animal salivates at the sight of food while another stimulus, such as the sound of a bell, occurs simultaneously, the sound alone can induce salivation after several trials. The animal's behaviour is no longer limited by fixed, inherited reflex arcs but can be modified by experience and exposure to an unlimited number of stimuli.

The reflex concept has exerted a great influence on psychological thinking, and initially led to premature attempts to develop a psychology based on reflexes. Pavlov's groundbreaking work gave rise to an enormous spate of research in the early 20th century on the physiology of behaviour, and for a long time the conditioned reflex provided the best technique for enabling at least a part of the learning process to be investigated quantitatively and to be subjected to an exact analysis. The principles proposed by such behaviourists as E.R. Guthrie, C.L. Hull, and B.F. Skinner to explain psychological actions as conditioned or learned responses to external and internal stimuli were based in part on earlier reflex notions and upon the fundamental model of the conditioned reflex as demonstrated by Pavlov. It is now generally recognized, however, that the reflex relationship between stimulus and response is not nearly as simple as was previously thought. It has become evident that the use of the conditioned reflex as a model for learning in classical-conditioning experiments artificially isolates, to an extreme degree, part of the total learning process in higher animals, and is by itself inadequate in attempting to analyze the complex physiological and mental interactions that ultimately determine the behaviour of humans and other mammals.

Reform, Hundred Days of: *see* Hundred Days of Reform.

Reform Bill, any of the British parliamentary bills that became acts in 1832, 1867, and 1884–85, and which expanded the electorate for the House of Commons and rationalized the representation of that body. The first Reform Bill primarily served to transfer voting privileges from the small boroughs controlled by the nobility and gentry to the heavily populated industrial towns. The two subsequent bills provided a more democratic representation by expanding voting privileges from the upper levels of property holders to less wealthy and broader segments of the population.

The first Reform Bill was necessitated chiefly by glaring inequalities in representation between traditionally enfranchised rural areas and the rapidly growing cities of newly industrial England. For example, such large industrial centres as Birmingham and Manchester were unrepresented, while Parliamentary members continued to be returned from numerous so-called "rotten boroughs," which were virtually uninhabited rural districts, and from "pocket boroughs," where a single powerful landowner or peer could almost completely control the voting. The sparsely populated county of Cornwall returned 44 members while the City of London, with a population exceeding 100,000, returned only 4 members.

The first Reform Bill was authored by then-prime minister Charles Grey, 2nd Earl Grey, and was introduced into the House of Commons in March 1831 by John Russell; it passed by one vote but did not pass in the House of Lords. An amended Reform Bill passed the Commons without difficulty the following October but again failed to pass the House of Lords, creating a public outcry in favour of the bill. When a third Reform Bill passed the Commons but was thrown out in the Lords on an amendment, Grey in desperation proposed in May 1832 that King William IV grant him authority for the creation of 50 or more Liberal peers—enough to carry the bill in the still-obstinate House of Lords. William refused, and when Grey threatened to resign as prime minister, the King called in the Duke of Wellington to try to form a new government. When Wellington tried and failed, the King yielded to Grey and pledged the authority for the creation of new peers. The threat was enough. The bill passed in the House of Lords (those who objected abstaining), and the bill became law June 4, 1832.

The First Reform Act reformed the antiquated electoral system of Britain by redistributing seats and changing the conditions of the franchise. Fifty-six English boroughs lost their representation entirely; Cornwall's representation was reduced to 13; 42 new English boroughs were created; and the total electorate was increased by 217,000. Electoral qualifications were also lowered to permit many smaller property holders to vote for the first time. Although the bill left the working classes and large sections of the lower middle classes without the vote, it gave the new middle classes a share in responsible government and thus quieted the political agitation that might have led to revolution. The Second Reform Act, 1867, largely the work of the Tory Benjamin Disraeli, gave the vote to many workingmen in the towns and cities and increased the number of voters to 938,000. The Third Reform Act of 1884–85 extended the vote to agricultural workers, while the Redistribution Act of 1885 equalized representation on the basis of 50,000 voters per each single-member legislative constituency. Together these two acts tripled the electorate and prepared the way for universal male suffrage.

Reform Judaism, a religious movement that has modified or abandoned many traditional Jewish beliefs, laws, and practices in an effort to adapt Judaism to the changed social, political, and cultural conditions of the modern world. Reform Judaism sets itself at variance with Orthodox Judaism by challenging the binding force of ritual, laws, and customs set down in the Bible and in certain books of rabbinic origin (*e.g.,* the Talmud).

The movement began early in the 19th century, in Germany, with appeals from laymen for an updating of the Jewish liturgy and other rituals. With the liberation of Jews from their ghettos, many Jews began to question their allegiance to such traditions as restrictive dietary laws, prayers in Hebrew, and the wearing of special outfits that set them apart as Jews. Many felt that Judaism would lose Jews to other religions if steps were not taken to bring Judaism into the 19th century.

Israel Jacobson (1768–1828), a Jewish layman, established an innovative school in Seesen, Brunswick, in 1801. There he held the first Reform services in 1809, attended by adults as well as children. Jacobson's liturgy was in German rather than Hebrew; men and women were allowed to sit together; organ and choir music were added to the service; and Jacobson instituted confirmation for both boys and girls to replace the traditional boys' Bar Mitzvah ceremony. The liturgy omitted all references to a personal messiah who would restore Israel as a nation. Jacobson held Reform services in Berlin in 1815; and from there Reform practices spread to Denmark, Hamburg, Leipzig, Vienna, and Prague.

Although the Prussian government issued prohibitions under pressure from Orthodox leaders, the movement could not be stifled. Reform worshippers were no longer required to cover their heads or wear the prayer shawl (*ṭallit*). Daily public worship was abandoned; work was permitted on the sabbath; and dietary laws (*kashrut*) were declared obsolete.

Rabbi Abraham Geiger (1810–74) was one of the leading ideologists of the Reform movement. He concluded that the essence of Judaism is belief in the one true God of all mankind, the practice of eternally valid ethical principles, and the communication of these truths to all nations of the world. Samuel Holdheim (1806–60) rejected Jewish marriage and divorce laws as obsolete, arguing that such codes fell outside the ethical and doctrinal functions of Judaism and were superseded by the laws of the state. He agreed with Geiger that monotheism and ethics are the principal criteria of authentic Judaism. Both felt that Judaism must be a living, constantly developing faith, compatible with the spirit of the times.

Rabbi Isaac Mayer Wise (1819–1900), a German emigrant, was a central figure in the remarkable success of Reform Judaism in the United States, where it had begun in 1841 when a congregation in Charleston, S.C., joined the Reform movement. Wise not only issued a widely influential prayer book (1857) but eventually established the Union of American Hebrew Congregations (1873), the Hebrew Union College (1875) for the education of Reform rabbis, and the Central Conference of American Rabbis (1889).

Two other emigrants, David Einhorn (1809–79) and Samuel Hirsch (1815–89), provided the theoretical foundations of American Reform. Hirsch was chairman of the first conference of American Reform rabbis, which met in Philadelphia in 1869. It declared that Jews should no longer look forward to a return to Palestine, and it rejected belief in bodily resurrection after death. The question of Zionism, support for an independent Jewish nation, was controversial within the Reform movement until the establishment of Israel in 1948.

In 1937 several fundamental principles of earlier Reform Judaism were dramatically revised. In that year an important conference of Reform rabbis issued the Columbus (Ohio) Platform, supporting the use of traditional customs and ceremonies and the liturgical use of Hebrew. In the late 20th century the

Central Conference of American Rabbis continued to debate how best to continue the spirit of the Reform movement. It issued several new prayer books for the modern age and considered such issues as inclusion of single parents in the congregation, the position of women in the congregation and in the rabbinate, and homosexuality.

Reform Party, also called REFORM MOVEMENT, political movement in Upper Canada (now in Ontario) and the Maritime Provinces that came into prominence shortly before 1837. Reformers in Lower Canada (now in Quebec) were known as Patriotes.

The Reformers urged that the provincial legislative councils—and by implication even the governors and other officials—be made elective; they also proposed that the officials and advisers (*i.e.,* the executive council) of the governors be made responsible or accountable to such elective legislative assemblies.

Some Reformers were active in the rebellions of 1837 against the existing systems of government. William Lyon Mackenzie, after suffering defeat in a provincial election in 1836, became the chief organizer of the rebellion in Upper Canada. In Lower Canada, Louis Joseph Papineau led his Patriote Party on a course that resulted in armed conflict with the government, although he himself took little part in the rebellion. On the other hand, some Reformers did not support the rebellion at all.

In 1842–43 and 1848–54 Reform premiers were in power in what was then the Province of Canada (the union of Upper and Lower Canada into Canada West and Canada East). In the late 1840s, however, the party was split by a rising tide of radicalism, and by the 1850s the Reformers had divided into a moderate group and a more radical group, the latter known as the Clear Grits (*q.v.*). Eventually, John Macdonald won many moderate Reformers over to his Liberal-Conservative Party (the name by which the Conservative Party in Canada was known until the 1940s), while the Clear Grits provided the nucleus of what came to be the Liberal Party.

Reform Party (New Zealand): *see* New Zealand Political Reform League.

Reforma, La (Spanish: The Reform), liberal political and social revolution in Mexico between 1854 and 1876 under the principal leadership of Benito Juárez.

La Reforma period began with the issuance in 1854 of the Plan de Ayutla, a liberal pronouncement calling for the removal of the dictator Antonio López de Santa Anna. After Santa Anna's fall in 1855, Juárez and the liberals enacted the Ley Juárez, abolishing the *fueros* (special privileges of the clergy and the military); the Ley Lerdo (1856) ordered the sale of all church lands not used for specifically religious purposes. In 1857 the congress, in which the moderate liberals held sway, drafted a liberal, federalist constitution; it ended special jurisdiction for the clergy, placed the army under ultimate civilian control, and abolished hereditary titles and imprisonment for debt.

In 1858 the conservative clergy, military, and landowners precipitated a civil war, which was won by the liberal government by 1860. By the Laws of La Reforma (1859) church property, except for places of worship, was to be confiscated without compensation, monasteries were suppressed, cemeteries nationalized, and civil marriage instituted. Confiscated church property was to be allotted in small parcels to the landless; the land policy of La Reforma was its outstanding failure, however, because by the end of the period the number and wealth of large landholders increased, while the condition of impoverished, landless peasants worsened.

In 1862 Juárez' government was attacked from without: Napoleon III sought to establish French power in Mexico by siding with Mexican conservatives to restore the old order. The brief reign of Napoleon's protegé, the Habsburg emperor Maximilian, ended when the French withdrew under pressure from the United States. Juárez was reelected president in 1867 and, until he died in 1872, tried to implement his program in the face of insufficient revenues and the discontent of many liberals who opposed his increasingly authoritarian methods, including his unconstitutional reelection to the presidency in 1871. His successor, Sebastián Lerdo de Tejada, faced mounting conservative opposition, which culminated in the military coup of Porfirio Díaz in 1876.

Reformation, the religious revolution that took place in the Western church in the 16th century; its greatest leaders were Martin Luther and John Calvin. Having far-reaching political, economic, and social effects, the Reformation became the basis for the founding of Protestantism, one of the three major branches of Christianity.

A brief treatment of the Reformation follows. For full treatment, *see* MACROPAEDIA: Protestantism.

The world of the late medieval Catholic Church from which the 16th century reformers emerged was a complex one. Over the centuries, the church, particularly in the office of the papacy, had become deeply involved in the political life of western Europe. The resulting intrigues and political manipulations, combined with the church's increasing power and wealth, contributed to the bankrupting of the church as a spiritual force. Abuses such as the sale of indulgences (or spiritual privileges) and relics and the corruption of the clergy exploited the pious and further undermined the church's spiritual authority.

The Reformation of the 16th century was not unprecedented. Reformers within the medieval church such as St. Francis, Peter Waldo, John Huss, and John Wycliffe addressed abuses in the life of the church in the centuries before 1517. In the 16th century, Erasmus of Rotterdam, a great Humanist scholar, was the chief proponent of liberal Catholic reform that attacked moral abuses and popular superstitions in the church and urged the imitation of Christ, the supreme teacher. These movements reveal an ongoing concern for reform within the church in the years before Luther posted his Ninety-five Theses on the door of All Saints Church, Wittenberg, on Oct. 31, 1517, the eve of All Saints' Day—the traditional date for the beginning of the Reformation.

Martin Luther claimed that what distinguished him from previous reformers was that while they attacked corruption in the life of the church, he went to the theological root of the problem—the perversion of the church's doctrine of redemption and grace. Luther, a pastor and professor at the University of Wittenberg, deplored the entanglement of God's free gift of grace in a complex system of indulgences and good works. In his Ninety-five Theses, he attacked the indulgence system, insisting that the pope had no authority over purgatory and that the doctrine of the merits of the saints had no foundation in the gospel. Here lay the key to Luther's concerns for the ethical and theological reform of the church; Scripture alone is authoritative (*sola sciptura*) and justification is by faith (*sola fide*), not by works. While he did not intend to break with the Catholic Church, a confrontation with the papacy was not long in coming. In 1521, Luther was tried before the Imperial Diet of Worms and was eventually excommunicated; what began as an internal reform movement had become a fracture in western Christendom.

The Reformation movement within Germany diversified almost immediately, and other reform movements arose independently of Luther. Huldrych Zwingli built a Christian theocracy in Zürich in which church and state joined for the service of God. Zwingli agreed with Luther in the centrality of the doctrine of justification by faith, but he espoused a much more radical understanding of the Eucharist. Luther had rejected the Catholic Church's doctrine of transubstantiation, according to which the bread and wine in the Eucharist became the actual body and blood of Christ. According to Luther's doctrine of consubstantiation, the body of Christ was physically present in the elements because Christ is present everywhere, but Luther was not willing to go as far as Zwingli, who claimed that the Eucharist was simply a memorial of the death of Christ and a declaration of faith by the recipients.

From the group surrounding Zwingli emerged those more radical than himself. These Radical Reformers, part of the so-called left wing of the Reformation, insisted that the principle of scriptural authority be applied without compromise. Unwilling to accept what they considered violation of biblical teachings, they broke with Zwingli over the issue of infant baptism, thereby receiving the nickname "Anabaptists" on the grounds that they rebaptized adults who had been baptized as children. The Swiss Anabaptists sought to follow the example of Jesus found in the gospels. They refused to swear oaths or bear arms, taught the strict separation of church and state, and insisted on the visible church of adult believers—distinguished from the world by its disciplined, regenerated life.

Another important form of Protestantism (as those protesting against Rome were designated by the Diet of Speyer in 1529) is Calvinism, named for John Calvin, a French lawyer who fled France after his conversion to the Protestant cause. In Basel, Calvin brought out the first edition of his *Institutes of the Christian Religion* in 1536, the first extensive, systematic, theological treatise of the new reform movement. Calvin agreed with Luther's teaching on justification by faith. However, he found a more positive place for law within the Christian community than Luther did in his concern to distinguish sharply between law and gospel. In Geneva, Calvin was able to experiment with his ideal of a disciplined community of the elect. Under Calvin's forceful leadership, church and state were united for the "glory of God."

The Reformation spread to other European countries over the course of the 16th century. By mid-century, Lutheranism dominated northern Europe. Eastern Europe offered a seedbed for even more radical varieties of Protestantism, because kings were weak, nobles strong, and cities few, and because religious pluralism had long existed. Spain and Italy were to be the great centres of the *Counter-Reformation* (*q.v.*), and Protestantism never gained a strong foothold there.

In England the Reformation's roots were primarily political rather than religious. Henry VIII, incensed by Pope Clement VII's refusal to grant him a divorce, repudiated papal authority and in 1534 established the Anglican Church with the king as the supreme head. In spite of its political implications, Henry's reorganization of the church permitted the beginning of religious reform in England, which included the preparation of a liturgy in English, *The Book of Common Prayer*. In Scotland, John Knox, who spent time in Geneva and was greatly influenced by John Calvin, led the establishment of Presbyterianism, which made possible the eventual union of Scotland with England.

Reformation Day, anniversary of the day Martin Luther posted his Ninety-five Theses on the door of the church in Wittenberg, Ger.

(Oct. 31, 1517), later identified by Protestants as the beginning of the Reformation. The European Lutheran territorial churches at first commemorated the Reformation on various days, among them the anniversary of Luther's birth (November 10), his death (February 18), and presentation of the Augsburg Confession (June 25). The centennial celebrations of 1617 focussed attention on October 31; in the sesquicentennial year (1667) Elector John George II decreed this date as annual Reformation Day in Saxony. German Lutheran and Union territorial churches have come gradually to follow this example and specify October 31 or the Sunday following (or preceding).

Among English-speaking Lutherans, the churches that use the *Lutheran Liturgy* (1948) keep October 31 as Reformation Day; those using the *Service Book and Hymnal* (1958) observe October 31 as Reformation Day and may keep the preceding Sunday as Reformation Sunday. The liturgical colour is red. Many churches in the Reformed and the Evangelical traditions also mark the day, often with special services focussed on the Reformation and its effects.

reformatory, correctional institution for the treatment, training, and social rehabilitation of youth. Institutions designated as reformatories are of two general types: residential training schools for school-age delinquents and facilities for the confinement of youthful offenders between the ages of 16 and 25 who have been convicted of criminal acts. The early reformatories, originally intended to reform criminal youth, did not fulfill the enthusiastic expectations for them; many still resemble junior prisons, with rigid discipline and little treatment.

Reformatories, or "correctional training schools," as they are often called, have been operated according to various theories of treatment. The earlier ones aimed to reform the offender through discipline. More recent approaches have emphasized education, individual psychotherapy, group therapy, and resocialization. Although the older systems, with their emphasis on military drill, punitive calisthenics, and "cadet officers," have fallen into disrepute, there is little agreement among current schools of thought as to the effectiveness of any approach. They generally concur, however, in the importance of some form of aftercare for inmates upon their release.

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

Reformed church, any of several major representative groups of classical Protestantism that arose in the 16th-century Reformation. Originally, all of the Reformation churches used this name (or the name Evangelical) to distinguish themselves from the "unreformed" or unchanged Roman Catholic Church. After the great controversy among these churches over the Lord's Supper (after 1529), the followers of Luther began to use the name Lutheran as a specific name, and the name Reformed became associated with the Calvinistic churches (and also for a time with the Church of England). Eventually the name Presbyterian, which denotes the form of church polity used by most of the Reformed churches, was adopted by the Calvinistic churches of British background. The modern Reformed churches thus trace their origins to the Continental Calvinistic churches that retained the original designation.

The Reformed and Presbyterian churches are treated jointly in MACROPAEDIA: Protestantism. *See also* articles on individual Reformed churches in the MICROPAEDIA. *See also* Calvinism.

Reformed Church in America, church that developed from the Dutch settlements in New Netherlands (New York) in the 17th century. The Dutch Reformed Church was the first Reformed church of continental European background in North America. During the period of Dutch sovereignty over New Netherlands, it was the established church of the colony. When the English seized the colony in 1664, they gave assurances that the Dutch Reformed Church would be allowed freedom from English control and that it would be permitted to continue under the ecclesiastical jurisdiction of the classis (church governing body) of Amsterdam. Under this control the church grew slowly. In 1679 the classis of Amsterdam allowed a colonial classis to form, but with restricted powers.

Early in the 18th century new movements influenced the church: colonial self-consciousness, declining interest in things Dutch, the Great Awakening religious revival, and increasing interest in cooperating with other churches, especially the Presbyterians. The Dutch Church split into two factions. One, a colonial party, desired greater freedom from the classis of Amsterdam, free use of the English language in worship, a local college for the training of ministers, and support of revivals in the churches. The conservative Dutch party, however, wished to retain Dutch authority and influence, including pastors trained in the Netherlands and the use of the Dutch language in worship services. The colonial party soon predominated. In 1766 it founded Queen's College, later Rutgers University, at New Brunswick, N.J. The two factions reunited in 1771 under a plan that left ultimate authority in Holland but gave great local autonomy. After the American Revolution, the church became wholly independent under a new constitution (drafted 1784–92). The name Reformed Protestant Dutch Church was changed in 1867 to Reformed Church in America.

A large migration of Dutch people to the United States in the mid-19th century increased church membership. Most of the immigrants settled in Michigan and other midwestern areas, and the church, therefore, had two integrally related though rather distinct groups centred in New York and New Jersey and in the Middle West. The older, eastern section of the church was more removed from its ethnic origins and was much less conservative than the newer, midwestern section.

Several attempts at union between the Reformed Church in America and other Reformed or Presbyterian groups in the United States were made between the early 19th and mid-20th century, none successfully.

Reformed Church of France, French ÉGLISE REFORMÉE DE FRANCE, church organized in 1938 by merging several Reformed groups that had developed in France during and after the 16th-century Protestant Reformation. During the early part of the Reformation, Protestant movements made slow progress in France. Yet reforming movements within the Roman Catholic Church had appeared early. Before Martin Luther had emerged as a Reformer in Germany, French Humanists had created much interest in biblical studies and had aroused a concern for a purer type of Christianity. Margaret of Angoulême, a sister of King Francis I, became the centre of a Humanistic group known as the group of Meaux, which created great interest in reform. Its members contributed much by their writings to biblical and theological studies that were used by the Protestants. Several members of the group left it and became Protestants. Not until 1555, however, was there any attempt made to organize Protestant congregations in France. The Reformation movement then gained rapidly in France until 1562, when a long series of civil wars began in France and the Huguenots (French Protestants) alternately gained and lost. During this period of strife the Massacre of St. Bartholomew's Day occurred (1572), and several thousand Huguenots were murdered.

Peace was restored when the Huguenot leader, Henry of Navarre, became king of France (Henry IV; reigned 1589–1610) and accepted Roman Catholicism. This satisfied the Roman Catholics, and Henry in 1598 promulgated the Edict of Nantes, which guaranteed the Huguenots virtual freedom of religion. French Protestantism then made a good recovery from the persecutions it had endured, but the Edict of Nantes was revoked by Louis XIV in 1685. Protestants again suffered persecutions before and after this act, and despite laws against emigration, more than 250,000 Huguenots fled to Germany, Holland, England, Switzerland, and America. Those who remained in France persisted as a virtual underground movement and did not regain their full rights until the French Revolution in 1789.

After 1848 the union of Reformed churches in France ceased to exist. Schisms occurred because of disagreements between the orthodox and the liberals. The orthodox maintained strict loyalty to the confessions of the church, while the liberals encouraged individual liberty of conscience and were hostile to any obligatory confession of faith. By the early 20th century these disputes had resulted in the formation of four major Reformed groups in France. In 1905 a French law separated all religious groups from the state, and the churches provided their own support from that time.

Efforts to unite the Reformed churches caused the national synods of the four Reformed groups to enter into negotiations in 1933 and to vote a common declaration of faith in 1936. As a result the Reformed Church of France was organized in 1938.

The Reformed and Lutheran churches of Alsace-Lorraine are established and supported by the French state. This is a continuation of the situation of the churches in France at the time Alsace-Lorraine was annexed to Germany after the Franco-German War of 1870–71. The area was returned to France after World War I ended in 1918.

Reformed Church of Hungary, Hungarian MAGYARORSZÁGI REFORMÁTUS EGYHÁZ, Reformed church that developed in Hungary during and after the 16th-century Protestant Reformation. The influence of the Reformation was felt early in Hungary. A synod at Erdod adopted the Lutheran Augsburg Confession in 1545, and by 1567 the Synod of Debrecen adopted the Reformed Heidelberg Catechism and the Second Helvetic Confession.

Except for minor reverses, the Protestants made progress in Hungary for many years. The Roman Catholic Counter-Reformation, however, began in the 17th century, and most of the Hungarian nobles were reconverted to Roman Catholicism by the mid-17th century. The Protestants suffered persecutions and difficulties until 1781, when Joseph II, the Holy Roman emperor, promulgated the Edict of Toleration, which granted religious liberty to the Protestants.

The Magyars (Hungarians) spread rather widely through the Holy Roman Empire, taking their Reformed faith with them. Within the empire they built up a large system of schools, elementary through university, and did much for Hungarian cultural life.

The Treaty of Versailles (1919) following World War I shattered the Hungarian Reformed Church. Only half of the church remained within the new nation of Hungary. The other half was represented by minority groups in countries that were unfriendly or even hostile to them. The largest segment, in Romania, suffered considerably for both religious and cultural reasons. As the nation became somewhat more stable, however, the church was able to regain its strength.

For many years after the Treaty of Versailles, the Magyar people, split between Hungary, Romania, and other countries, had hoped that eventually they would be reunited in one political unit and that their church would also be reunited. All hope of reunion was lost after World War II. When the Communists gained power in Hungary in 1948, the Reformed Church did not resist the new government and submitted to its restrictions.

Reformed Churches in The Netherlands, Dutch GEREFORMEERDE KERKEN IN NEDERLAND, second largest Protestant church in The Netherlands, organized in 1892 by a merger of the Christian Reformed Church and a group of Reformed churches that were followers of Abraham Kuyper, a Dutch theologian and statesman.

The Christian Reformed Church was organized by seceders who left The Netherlands Reformed Church (*q.v.*) in 1834 because of disagreements over church organization and religious orthodoxy. It adopted the name Christian Reformed Church in 1869. It generally held a strict interpretation of Reformed doctrine. Many members of this church migrated to America, where they became members of the Christian Reformed Church, a U.S. denomination. In The Netherlands a small group refused to accept the merger of 1892 and continued as the Christian Reformed Church.

The followers of Abraham Kuyper were conservatives who left The Netherlands Reformed Church in 1886. They disagreed with the liberalism in that church that had caused controversies for several years.

After the merger in 1892, the Reformed Churches in The Netherlands experienced growth and was influential in the country through political activities and its educational and publishing programs.

Reformed League, German REFORMIERTER BUND, voluntary association of German Reformed churches founded at Marburg in 1884 to aid Reformed churches and to conserve the Reformed heritage in Germany. It was organized by Reformed pastors and elders who met to commemorate the 400th anniversary of the birth of the Reformer Huldrych Zwingli.

The Reformed League founded religious journals and institutions for the education of Reformed clergy. During the National Socialist (Nazi) era (1933–45) and World War II, it worked with the Confessing Church, the organization set up by German Protestants to resist the attempts made by the National Socialists to control the churches. After World War II, the Reformed League adopted a new constitution and continued as an important influence in the Reformed churches.

Most of the Reformed congregations of the Evangelical Church in Germany are members of the Reformed League.

reforming, in chemistry, processing technique by which the molecular structure of a hydrocarbon is rearranged to alter its properties. The process is frequently applied to low-quality gasoline stocks to improve their combustion characteristics. Thermal reforming alters the properties of low-grade naphthas by converting the molecules into those of higher octane number by exposing the materials to high temperatures and pressures. Catalytic reforming uses a catalyst, usually platinum, to produce a similar result. Mixed with hydrogen, naphtha is heated and passed over pellets of catalyst in a series of reactors, under high pressure, producing high-octane gasoline.

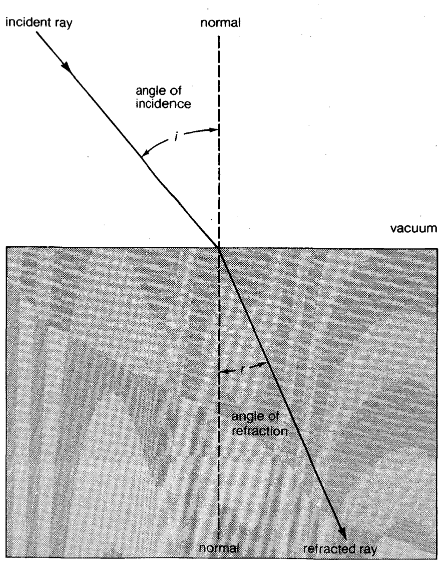
refraction, in physics, the change in direction of a wave passing from one medium to another caused by its change in speed. For example, waves in deep water travel faster than in shallow; if an ocean wave approaches a beach obliquely, the part of the wave farther from the beach will move faster than that closer in, and so the wave will swing around until it moves in a direction perpendicular to the shoreline. The speed of sound waves is greater in warm air than in cold; at night, air is cooled at the surface of a lake, and any sound that travels upward is refracted down by the higher layers of air that still remain warm. Thus, sounds, such as voices and music, can be heard much farther across water at night than in the daytime.

The electromagnetic waves constituting light are refracted when crossing the boundary from one transparent medium to another because of their change in speed. A straight stick appears bent when partly immersed in water and viewed at an angle to the surface other than 90°. A ray of light of one wavelength, or colour (different wavelengths appear as different colours to the human eye), in passing from air to glass is refracted, or bent, by an amount that depends on its speed in air and glass, the two speeds depending on the wavelength. A ray of sunlight is composed of many wavelengths that in combination appear to be colourless; upon entering a glass prism, the different refractions of the various wavelengths spread them apart as in a rainbow.

refraction, double (optics): *see* double refraction.

refractive index, also called INDEX OF REFRACTION, measure of the bending of a ray of light when passing from one medium into another. If i is the angle of incidence of a ray in vacuum (angle between the incoming ray and the perpendicular to the surface of a medium, called the normal; *see* figure), and r is the angle of refraction (angle between the ray in the medium and the normal), the refractive index n is defined as the ratio of the sine of the angle of incidence to the sine of the angle of refraction; *i.e.,* $n = \sin i / \sin r$. Refractive index is also equal to the velocity c of light of a given wavelength in empty space divided by its velocity v in a substance, or $n = c/v$.

Some typical refractive indices for yellow light (wavelength equal to 589 nanometres [10^{-9} metre]) are the following: air, 1.0002; water, 1.333; crown glass, 1.517; dense flint glass, 1.655; and diamond, 2.417. The variation of refractive index with wavelength is the source of chromatic aberration in lenses. The refractive index of X-rays is slightly less than 1.0, which means that an X-ray entering a piece of glass from air will be bent away from the normal, unlike a ray of light, which will be bent toward the normal. The equation $n = c/v$ in this case indicates, correctly, that the velocity of X-rays in glass and in other materials is greater than its velocity in empty space.



Refractive index

refractory, material not deformed or damaged by high temperatures, used to make crucibles, incinerators, insulation, and furnaces, particularly metallurgical furnaces. Refractories are produced in several forms: molded bricks of various shapes (*see* firebrick); bulk granular materials; plastic mixtures consisting of moistened aggregate that are rammed into place; castables composed of dry aggregates and a binder that can be mixed with water and poured like concrete; and mortars and cements for laying brickwork.

Refractories may be chemically acid, basic, or neutral, depending on the application. Silica (made from sand or quartzite), zircon (for extreme heat resistance), and fireclay (made by baking kaolin) are acid; magnesite and dolomite are alkaline; high-alumina refractories, mullite, chromite, silicon carbide, and carbon are neutral. Carbon is an excellent refractory in places where no oxygen can contact it, as in the hearth of a blast furnace. A smelting-furnace lining must be acid if the slag is acid and basic if the slag is basic, so that it will not react and be eroded.

Magnesite and dolomite are the most important refractory materials; their oxides are used in open-hearth steel furnaces and in portland-cement kilns. In fact, most refractories are oxides; others include silica, alumina, chromite, and zirconia. Fireclay is a mixture of silica and alumina, with impurities that soften the bricks at high temperatures. Silicon carbide (not an oxide) has a high strength at elevated temperatures, but both silicon and carbon burn in oxidizing atmospheres if the protective skin of silica flakes off. The ideal refractory material has a high compressive strength at furnace temperatures, a low thermal conductivity, and a low coefficient of expansion. Refractory insulating bricks approach this ideal.

Special types of refractories are required in nuclear power plants. Various materials that have outstanding chemical and physical stability at high temperatures have been tested and adopted. They include high-melting oxides, carbides, sulfides, and nitrides, none of which has been widely employed as refractories.

refractory brick: *see* firebrick.

refrain, a phrase, line, or group of lines repeated at intervals throughout a poem, generally at the end of the stanza. Refrains are found in the ancient Egyptian Book of the Dead and are common in primitive tribal chants. They appear in literature as varied as ancient Hebrew, Greek, and Latin verse, popular ballads, and Renaissance and Romantic lyrics. Three common refrains are the chorus, recited by more than one person; the burden, in which a whole stanza is repeated; and the repetend, in which the words are repeated erratically throughout the poem. A refrain may be an exact repetition, or it may exhibit slight variations in meaning or form as in the following excerpt from "Jesse James":

> Jesse had a wife to mourn him all her life,
> The children they are brave.
> 'Twas a dirty little coward shot
> Mister Howard,
> And laid Jesse James in his grave.
>
> . . . .
>
> It was Robert Ford, the dirty little coward,
> I wonder how he does feel,
> For he ate of Jesse's bread and he slept in
> Jesse's bed,
> Then he laid Jesse James in his grave.
>
> (Anonymous)

refrigeration, the process of removing heat from an enclosed space or a substance for the purpose of lowering the temperature.

In the industrialized nations and affluent regions in the developing world, refrigeration is chiefly used to store foodstuffs at low temperatures, thus inhibiting the destructive action of bacteria, yeast, and mold. Many perishable products can be frozen, permitting them to be kept for months and even years with little loss in nutrition or flavour or change in appearance. Air-conditioning, the use of refrigeration for comfort cooling, has also become widespread in more developed nations. For these reasons, the design and manufacture of refrigeration equipment is an important industry throughout the world.

Before mechanical refrigeration systems were introduced, ancient peoples, including the Greeks and Romans, cooled their food with ice transported from the mountains. Wealthy families made use of snow cellars, pits that were dug into the ground and insulated with wood and straw, to store the ice. In this manner, packed snow and ice could be preserved for months. Stored ice was the principal means of refrigeration until the beginning of the 20th century, and it is still used in some less-developed countries.

In India and Egypt evaporative cooling was employed. If a liquid is rapidly vaporized (boiled), it expands quickly. The rising molecules of vapour abruptly increase their kinetic energy. Much of this increase is drawn from the immediate surroundings of the vapour, which are therefore cooled. Thus, if water is placed in shallow trays during the cool tropical nights, its rapid evaporation can cause ice to form in the trays, even if the air does not fall below freezing temperatures. By controlling the conditions of evaporation, it is possible to form even large blocks of ice in this manner.

Cooling caused by the rapid expansion of gases is the primary means of refrigeration today. The technique of evaporative cooling, as described heretofore, has been known for centuries, but the fundamental methods of mechanical refrigeration were only discovered in the middle of the 19th century. The first known artificial refrigeration was demonstrated by William Cullen at the University of Glasgow in 1748. Cullen let ethyl ether boil into a partial vacuum; he did not, however, use the result to any practical purpose. In 1805 an American inventor, Oliver Evans, designed the first refrigeration machine that used vapour instead of liquid. Evans never constructed his machine, but one similar to it was built by an American physician, John Gorrie, in 1844.

Commercial refrigeration is believed to have been initiated by an American businessman, Alexander C. Twinning, in 1856. Shortly afterward, an Australian, James Harrison, examined the refrigerators used by Gorrie and Twinning and introduced vapour-compression refrigeration to the brewing and meat-packing industries. A somewhat more complex system was developed by Ferdinand Carré of France in 1859. Unlike earlier vapour-compression machines, which used air as a coolant, Carré's equipment contained rapidly expanding ammonia. (Ammonia liquefies at a much lower temperature than water and is thus able to absorb more heat.) Carré's refrigerators were widely used, and vapour-compression refrigeration became, and still is, the most widely used method of cooling.

In spite of the successful use of ammonia, that substance had a severe disadvantage: if it leaked, it was unpleasant as well as toxic. Refrigeration engineers searched for acceptable substitutes until the 1920s, when a number of synthetic refrigerants were developed. The best-known of these substances was patented under the brand name of Freon. Chemically, Freon was created by the substitution of two chlorine and two fluorine atoms for the four hydrogen atoms in methane (CH_4); the result, dichlorofluoromethane (CCl_2F_2), is odourless and is toxic only in extremely large doses. Once the basic patents expired, Freon and other artificial refrigerants were manufactured throughout the world.

The basic components of a modern vapour-compression refrigeration system are a compressor; a condenser; an expansion device, which can be a valve, a capillary tube, an engine, or a turbine; and an evaporator. The gas coolant is first compressed, usually by a piston, and then pushed through a tube into the condenser. In the condenser, the winding tube containing the vapour is passed through either circulating air or a bath of water, which removes some of the heat energy of the compressed gas. The cooled vapour is passed through an expansion valve to an area of much lower pressure; as the vapour expands, it draws the energy of its expansion from its surroundings or the medium in contact with it. Evaporators may directly cool a space by letting the vapour come into contact with the area to be chilled, or they may act indirectly, *i.e.,* by cooling a secondary medium such as water. In most domestic refrigerators, the coil containing the evaporator directly contacts the air in the food compartment. At the end of the process, the hot gas is drawn toward the compressor.

In the 1960s certain characteristics of semiconductors began to be utilized for commercial refrigeration. Chief among these was the Peltier effect, named after the French chemist Jean Peltier, who observed in 1834 that electric currents passing through the junction of two different metals sometimes caused the junction to cool. When the junction is made from semiconductors such as bismuth telluride, the Peltier effect is of magnitude sufficient to permit its commercial use.

refugee, any uprooted, homeless, involuntary migrant who has crossed a frontier and no longer possesses the protection of his former government. Prior to the 19th century the movement from one country to another did not require passports and visas; the right to asylum was commonly recognized and honoured. Although there have been numerous waves of refugees throughout history, there was no refugee problem until the emergence of fixed and closed state frontiers in the late 19th century. By the 1920s and '30s the tradition of political asylum had deteriorated considerably, partly because of growing insensitivity to human suffering and partly because of unprecedented numbers of refugees.

For many centuries, refugee movements were a result of religious and racial intolerance. Entire groups were uprooted, exiled, or deported by secular or religious authorities in an effort to enforce conformity. Examples of such action include the expulsion of Jews from Spain in the late 15th century, the exodus of Huguenots from France after the revocation of the Edict of Nantes in 1685, and the eviction of Jews from Germany, Austria, and Sudetenland (now in Czechoslovakia) in the 1930s.

Politically motivated refugee movements, frequent in modern times, have occurred intermittently since the development of governments powerful enough to oppress nonconformist minorities. The Russian Revolution of 1917 and the postrevolutionary civil war (1917–21) caused the exodus of 1,500,000 opponents of communism. Between 1915 and 1923 more than 1,000,000 Armenians left Turkish Asia Minor, and several hundred thousand Spanish Loyalists fled to France to escape the newly established regime of General Franco in the wake of the 1936–39 civil war. When the People's Republic of China was established in 1949, more than 2,000,000 Chinese fled to the island of Taiwan and to the British Crown Colony of Hong Kong. The 1950s were marked by the Korean War (1950–53), the Hungarian Revolution (1956), the Cuban revolution (1959), and the Chinese take-over of Tibet (1959), all of which resulted in the flight of more than 1,000,000 refugees. Between 1945 and 1961, the year that the communist regime erected the Berlin Wall (opened 1989), more than 3,700,000 refugees from East Germany found asylum in West Germany.

Several major refugee movements have also been caused by territorial partition. After the defeat of Germany in World War II, for example, the Potsdam Conference of 1945 authorized the transfer of German minorities from a number of European countries, and 12,000,000 Germans were dumped on the truncated territory of Germany, which was split into east and west regions. The partition of the Indian subcontinent in 1947 resulted in the exchange of 18,000,000 Hindus from Pakistan and Muslims from India—the greatest population transfer in history. Some 8,000,000–10,000,000 persons were also temporarily made refugees by the creation of Bangladesh in 1971.

Palestine's partition in 1948 triggered an almost wholesale exodus of Palestinian Arabs in the wake of a military confrontation between the newly established state of Israel and neighbouring Arab countries. The disintegration of the vast European colonial empires also brought about the return of thousands of British subjects from all parts of Africa and Asia, of French refugees from North Africa and Indochina, of Italians from Libya, and of the Dutch from Indonesia.

Since the 1960s the largest concentrations of refugees have been located in Africa and Asia. Black Africa's peoples had moved freely within their tribal areas for centuries, but, with the emergence of sovereign African states beginning in the 1950s, national boundaries became barriers to population movements. As a result of internal and external power struggles, as well as tribal animosities within these new states, the number of refugees in Africa increased from 860,000 in 1968 to more than 4,000,000 by 1980. Large numbers of Vietnamese refugees came into existence after 1975, when South Vietnam fell to communist forces.

International action for refugees did not start until the 1920s. In 1921 Fridtjof Nansen of Norway was appointed by the League of Nations as high commissioner for refugees and devised a so-called League of Nations Passport ("Nansen Passport"), a travel document that gave the owner the right to move more freely across national boundaries. After Nansen's death in 1930, the protection of refugees was entrusted to the Nansen International Office for Refugees, but this office accomplished little before its mandate expired in 1938. Other refugee-assistance organizations have included the Intergovernmental Committee on Refugees (1938–47), the United Nations Relief and Rehabilitation Refugee Organization (1947–52), and the Office of the United Nations High Commissioner for Refugees, established in 1950. The Intergovernmental Committee for European Migration (renamed the Intergovernmental Committee for Migration in 1980) was founded in 1951. Several nongovernmental and voluntary agencies have also been established throughout the world in an effort to coordinate the resettlement of refugees.

refuse disposal system, technique for the collection and disposal of the solid wastes of a community. The development and operation of these systems is often called solid-waste management.

A brief treatment of refuse disposal systems follows. For full treatment, *see* MACROPAEDIA: Public Works.

Although all societies have had some systematic form of refuse disposal, it was not until relatively recent times that the modern concept of solid-waste management became recognized as an essential health and welfare service.

Carelessly deposited garbage was for centuries a prime source of disease, whether through the infection of water supplies or as a breeding ground and food source for flies, rats, and other carriers of disease. Because pigs were often permitted to feed on raw garbage, they contracted such diseases as trichinosis, which was then passed along to humans. In the early 20th century Britain began heat treatment of garbage to prevent the transmission of such diseases.

The industrialization of modern societies resulted in a vast increase in the amount of refuse generated per person. In the late 1970s between 50,000 and 58,000 pounds (22,700 and 26,300 kilograms) of refuse per person per year was produced in the United States alone. Industry has created new types of waste, especially toxic chemicals and radioactive materials, that are highly dangerous to public health and safety if they are disposed of improperly. There have already been several instances of entire communities being contaminated and evacuated because of careless handling or decomposition of toxic chemicals.

Individuals share in the carelessness by littering roads and highways with trash and indiscriminately dumping such items as wrecked cars and old refrigerators. Estimates for the United States have put the bulk amount of these materials at 20,000,000 cubic yards (15,300,000 cubic metres) per year.

Refuse is generally collected either by manually picking up trash bags from individual households or by mechanically emptying large community trash containers into trucks equipped with compactors to maximize their capacities. The refuse is then taken to a disposal site, of which the favoured design site is a sanitary landfill. Refuse of a landfill—as opposed to garbage in an open dump which is left exposed—is dumped into trenches, levelled and compacted with a bulldozer, and then covered with a layer of soil. When the landfill has reached its full capacity after a period of years, it may be used as a recreational area. Many cities have begun to run short of landfill space, however, and have begun to transport refuse to areas with sparse populations.

Incineration has proved to be a satisfactory means of refuse disposal in areas where there is little or no landfill capacity. Combustible refuse is brought to a plant that is, in effect, an enormous furnace. There it is burned thoroughly by putting it through two combustion stages, and to protect air quality, the exhaust gases are cleansed. The expense of such a system can sometimes be reduced by putting the heat energy to use; plants of this type are in operation in Munich, Frankfurt, Paris, and Montreal.

Disposal of refuse in water often creates pollution that can be a hazard for living things; for this reason the long-practiced method of dumping garbage at sea from scows has been greatly restricted. A relatively effective and safe method of disposing of organic refuse in water is the use of a food grinder attached to the sewage system of a household or food-handling establishment. Although these devices add only a small quantity of water to the community sewage system, they do increase the amount of solid material that must be handled at the treatment plant.

The practice of recycling such salvageable materials as metal, glass, and newsprint began in earnest during World War II and has been revived to some extent since the early 1970s. Several states have passed laws requiring deposits on beverage containers (refundable with the return of the containers), which has resulted in reduced roadside litter. A variety of salvage companies have been established; products made of recycled paper, for example, have become common.

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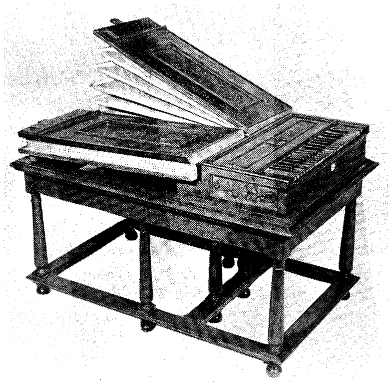
regal, also called REED ORGAN, a small, easily portable pipe organ usually having only a single set, or rank, of reed pipes. The beating reeds are surmounted by small resonators, producing a nasal, buzzing tone. Wind under pressure to sound the pipes is supplied by one or two bellows attached to the instrument and operated by the player or an assistant. The so-called bible regal, of the 16th century and later, can be folded up into the shape of a large book when not in use, hence its name. Regals, widely played in Europe during the Renaissance and Baroque eras, gained popularity as both solo and ensemble instruments. A regal is the instrument specified by Claudio Monteverdi to accompany brass instruments in an infernal scene in his music drama *Orfeo* (1607), and King Henry VIII of England evidently owned 17 regals of various sizes and pitches.

Regal pipes of varying tone colours found their way into larger pipe organs despite their instability of tuning, caused by the shortness of the resonators. Often the regal stop played a solo line. The vox humana ("human voice") rank, known in early Baroque organs as well as in organs that were built throughout the 19th and 20th centuries, belongs to the regal family.

Regals are being made in the second half of the 20th century in small numbers to satisfy demands of ensembles devoted to authentic performance of early music. Although the sound reproduction of these reconstructions is considered to be quite authentic, the contemporary regals generally are supplied with electric blowers instead of hand bellows.

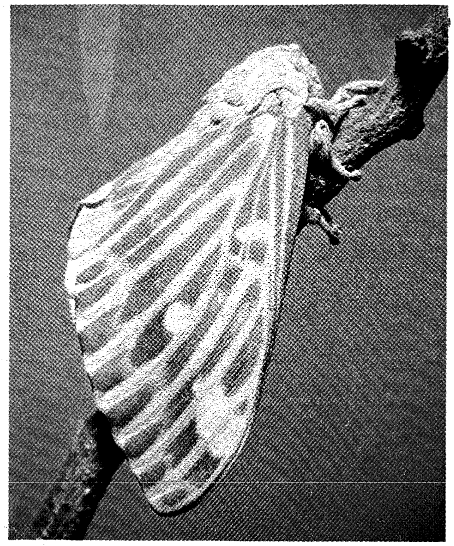


Swiss regal, 17th century; in the Musée Instrumental du Conservatoire Royal, Brussels

By courtesy of the Musee Instrumental, Brussels; photograph, © A.C.L., Brussels

regal moth, also called ROYAL MOTH, any member of the insect family Citheroniidae (order Lepidoptera), occurring only in the New World. Although sometimes classified as the subfamily Citheroniinae of the giant silkworm moth family (Saturniidae), regal moths differ. The antennae of the male regal moth are partially, rather than completely, feathery as in the saturniids, and the wing pattern and venation differ.

The ferocious-looking but harmless hickory horned devil caterpillar (larva of the royal walnut moth, *Citheronia regalis*) has a black-spined, green body and black-tipped red spines behind its head. It eats principally walnut, hickory, and persimmon leaves. The adult has yellow-spotted, olive-gray forewings with red veins; its reddish-orange hindwings have yellow markings. The imperial moth (*Eacles imperialis*) has yellow wings and body with purple to brown markings. The green body of the larva has a sparse covering of long white hairs and yellow horns; the head is brown. Striped *Anisota* larvae—*e.g.,* the green-striped mapleworm, *A. rubicunda;* the pink-striped oakworm, *A. virginiensis;* and the orange-striped oakworm, *A. senatoria*—cause much damage, particularly to maple, oak, and box elder trees.



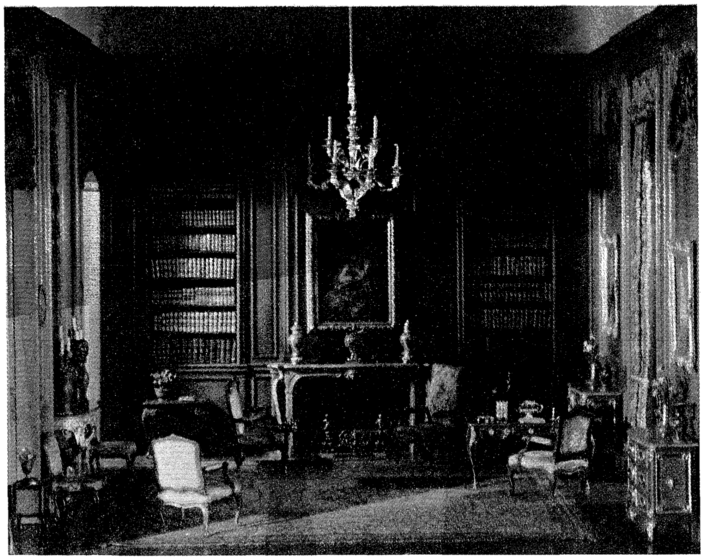
Royal walnut moth (*Citheronia regalis*)

Ray Glover—The National Audubon Society Collection/Photo Researchers

Régence style, transition in the decorative arts from the massive rectilinear forms of Louis XIV furniture to those prefiguring the Rococo style of Louis XV. The style encompasses about the first 30 years of the 18th century, when Philippe II, duc d'Orléans, was regent of France. The restraint arrived at during this period resulted from a strong reaction against the pomposity of the court under Louis XIV. The evolution of the intimate *petit salon* as opposed to the formal, ceremonial state apartments of the past brought with it a penchant for graceful, easily movable furniture, designed for execution in impeccable craftsmanship.

At Versailles, where furniture had formerly represented the firmly placed hierarchy of the court, rooms were divided into smaller, more intimate spaces calling for new style. The aristocracy made the decoration of their Parisian homes a lifetime occupation. Jean Berain, Charles Cressent, Robert de Cotte, and the painter Antoine Watteau, whose pictures were painted on the panelled salon walls to harmonize with the gentle spirit of the period, are among the important names connected with the new delicacy. Régence furniture did away with heavy, carved ornamentation and substituted flat, curving motifs—characteristically foliage and bouquets framed by flowing ribbons and bows.

The intricate tracery in brass and tortoiseshell marquetry on ebony was adapted to the new taste. Woods such as walnut, rosewood, and mahogany were in use for rich but tasteful contrasts in veneering. A sculptural form in the shape of a female bust, called an "espagnolette," made its appearance as a gently curved ornamental mount for chair and table legs. The commode and writing table, both representing the new, intimate style of life, were introduced during this period.



Model of a Régence style library, *c.* 1720; in the Art Institute of Chicago

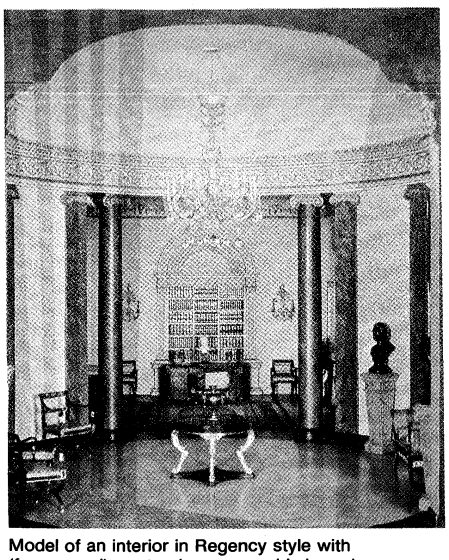
By courtesy of Thorne Rooms in Miniature, the Art Institute of Chicago

Regency style, decorative arts produced during the regency of George, prince of Wales, and the opening years of the 19th century as well as his entire reign as King George IV of England, ending in 1830. The major source of inspiration for Regency taste was found in Greek and Roman antiquity, from which designers borrowed both structural and ornamental elements. The classical revival of Regency style, emphasizing purity of detail and structure, adhered to a stricter archaeological interpretation of antique modes than either the Neoclassicism of the 18th century or the concurrent French Empire style.

An exuberant taste for Egyptian motifs resulted from the Napoleonic expeditions to Egypt in 1798 and became part of the Regency fashion. Variations in the Regency period also produced a resurgence of the Chinese theme seen in imitation bamboo and in painted and "japanned" black and gold lacquer pieces, most notably at Brighton Pavilion, where the Prince ordered its use. Another royal inclination produced the taste for French furniture, especially the type ornamented with brass inlay marquetry. A later trend foreshadowed the Victorian styles to follow.

The elaboration of ornament on the flat surfaces of Regency furniture derived from the rich contrast of exotic wood veneers and application of metals or painting rather than extensive carving or complicated contours. A strong feeling for utility combined with visually pleasing elements and an integration of architecture, interior design, and furniture is characteristic.

Architects John Nash, Henry Holland, Charles H. Tatham, and Thomas Hope were the principal arbiters of Regency taste. Hope, Thomas Sheraton and George Smith published designs for Regency furniture.



Model of an interior in Regency style with (foreground) a rotunda, presumably based on a design by Sir John Soane, and (background) library, adapted from designs made in 1767 by Robert Adam for Kenwood House, London; in the Art Institute of Chicago

By courtesy of Thorne Rooms in Miniature, the Art Institute of Chicago

regeneration, in biology, the process by which some organisms replace or restore lost or amputated body parts.

A brief treatment of regeneration follows. For full treatment, *see* MACROPAEDIA: Growth and Development, Biological.

Most organisms have a capacity for regeneration, although the extent of their abilities varies from that of simple planarian flatworms, which can grow an entire new body from a small strip of tissue, to the limited capacity of higher vertebrates to regenerate epidermal and other tissues in wound healing. Regeneration may occur in response to traumatic injury, as in human scar formation, or may be part of an animal's defense against predators (*e.g.,* some lizards can release their tails when threatened and grow new ones). It may also be part of the seasonal turnover of certain structures, as in the molting of birds.

Regeneration is closely related to vegetative reproduction, an important reproductive mechanism in plants and many lower animals. In most cases, cells that have already been differentiated into bone, muscle, skin, and other tissues lose their specialized nature and begin rapid growth once again, proliferating to form sufficient tissue to replace the missing part. After this proliferative phase, the cells again differentiate to form new cartilage, bone, muscle, and so on.

A number of regenerative mechanisms have been evolved by different species. Autotomy, the spontaneous loss and replacement of a body part, occurs in many insects and crustaceans, and enables them to shed a crippled leg or claw. The discarded body part usually breaks off at a predetermined site; in some, the new part is an exact replica of the lost structure, while in others, as in the lizard, the new part is functionally similar but anatomically different from the lost part.

Compensatory hypertrophy, in which the tissues that are left behind grow larger to overcome the handicap of the loss, also occurs in a variety of species. An example is the ability of the human liver to grow larger when one or more of the lobes is lost to surgery, disease, or injury; the regenerating liver does not duplicate the missing lobes but creates sufficient tissue in the remaining lobes to replace the lost function. Some part of the original organ must remain for this process to take place.

In a third type of regeneration, metaplasia, tissues that have been adapted to one function become altered to fulfill the function of the lost structure. There may be no remnant of the original organ, so that nearby structures must take its place; an example is the conversion of pigmented iris tissues to replace the loss of the lens in certain amphibians.

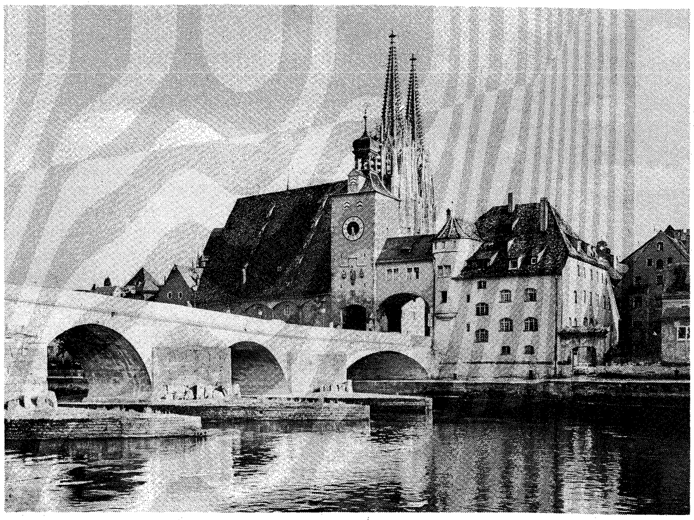
Regeneration is considerably more common in lower plants and simple multicellular animals. Plant regeneration usually takes place by morphallaxis, in which neighbouring cells multiply and reorganize to take the place of the missing tissue. In most multicellular animals that regenerate, the first step is the formation of a blastema, a bud of relatively undifferentiated cells that gradually develops into the replacement part. If this blastema is moved or otherwise manipulated in the laboratory, it is possible to form an abnormal structure (*e.g.,* two heads on a flatworm).

The causes of regeneration in particular species and the inability of some closely related organisms to regenerate lost tissues are still not clear. In higher animals it appears that nerves supplying the missing structure must be present to stimulate regrowth; thus it appears that regeneration serves functional needs, occurring only when the physiological or structural function of a body part must be replaced. On the other hand, complete loss of the structure may not be necessary, although some injury must have occurred to stimulate regeneration. In some animals a limb may be partially severed, causing a second complete limb to grow next to the injured one.

Regenerating tissues also apparently follow a strict polarity, growing back in the proper orientation to the rest of the body. Since the most commonly lost structures are limbs and tails, the pattern of growth is usually outward from the body, suggesting that tissues more proximal than the injury contain all the necessary information to replace the lost part, but not those closer to the main trunk of the body. In some cases, however, as in fish fins, regeneration may occur in both directions.

Regeneration is most common in invertebrates, occurring in almost all coelenterates and planarians, most annelids (segmented worms), and many insects. Among vertebrates, limited regeneration of limbs occurs in most fishes and salamanders, and tail regeneration takes place in larval frogs and toads (but not adults) and several reptile species. Although feather replacement may be considered a form of regeneration, few birds have the capacity to regenerate more complex structures. No mammals have the ability to regrow lost limbs or tails, but some species can regenerate other peripheral appendages, (*e.g.,* a deer's antlers) or internal organs (*e.g.,* the human liver).

Regensburg, also called RATISBON, city, Bavaria *Land* (state), southeastern Germany, on the right bank of the Danube River at its most northerly course, where it is joined by the Regen River. In the area of the old city was a Celtic settlement (Radasbona), which later



Steinerne Brücke (Stone Bridge) over the Danube and the Cathedral of St. Peter, Regensburg, Ger.
Toni Schneiders—Bruce Coleman Inc./EB Inc.

became the site of a Roman stronghold and legionary camp, Castra Regina (founded AD 179). The Roman north gate (Porta Praetoria) and parts of the walls survive. The capital of the dukes of Bavaria from 530, it was made a bishopric in 739 and shortly afterward became a capital of the Carolingians. The only imperial free city in the Duchy of Bavaria from 1245, Regensburg was exceedingly prosperous in the 12th–13th century. It was taken by the Swedes and later by imperial troops in the Thirty Years' War (17th century) and was destroyed by the French in 1809. It passed to Bavaria in 1810. The astronomer Johannes Kepler died there (1630), and the painter Albrecht Altdorfer (d. 1538) was both a city architect and counselor.

Despite repeated bombings in World War II, Regensburg sustained little damage and most of its medieval buildings survived. Its imposing patricians' houses (12th–14th century) are unique in Germany; and the Steinerne Brücke (Stone Bridge; 1135–46) across the Danube is a medieval constructional marvel that was repaired after the war. The Cathedral of St. Peter (1275–1524) is one of the most important Gothic churches in Bavaria, with 14th-century stained-glass windows and two Romanesque chapels in the adjoining cloisters; its Boys' Choir (Regensburger Domspatzen) is well known. Other notable churches include the Romanesque St. Emmeram's, parts of which date to the 8th century (interior remodelled in the Baroque style); the Alte Kapelle (Old Chapel), the earliest parts of which date from *c.* 1000, with an elaborate Rococo interior; the 12th-century Romanesque Schottenkirche St. Jakob, founded by Irish monks; the 13th-century Dominican Church; and the Minorite Church (*c.* 1250–1350), incorporated in the town museum. The buildings of St. Emmeram's Abbey (founded 7th century) have been the palace of the princes of Thurn and Taxis since 1812 and there are remains of the 13th-century Herzogshof, the residence of the Bavarian dukes. The town hall (14th–15th century with a Baroque extension) contains the Reichssaal (*c.* 1350), in which the Imperial Diet was held from 1663 to 1806.

The city is an important cultural, industrial, and commercial centre, a road and rail junction, and a head of navigation on the Danube with a busy port area. Manufactures in the area include electronics, steel and motor vehicles, and wood. Regensburg is also a tourist base for excursions into the Bavarian Forest. The University of Regensburg was founded in 1962. Pop. (1989 est.) 119,078.

Regent diamond, also called PITT DIAMOND, a brilliant-cut stone with a slight blue tinge that once was the outstanding gem of the French crown jewels; it was discovered in India in 1701 and weighed 410 carats in rough form. It was purchased by Sir Thomas Pitt, British governor in Madras, who published a letter in the London *Daily Post* to counter rumours that he had stolen the gem. The stone was cut to a 141-carat cushion brilliant called the Pitt diamond and was purchased in 1717 by the Duke of Orléans, regent of France—hence its present name. In 1792 it was stolen along with other crown jewels but was recovered. Napoleon I wore the stone in the pommel of his sword. It has been on display in the Louvre since 1887.

Regent's Park, park in London, occupying an area of 464 ac (188 ha). Originally a part of Henry VIII's hunting forest, Regent's Park was developed and landscaped (in the 1810s and 1820s) by the city planner and architect John Nash as an area of private leisure for the royal family. It was opened to the public in 1838 and is one of the main parks of central London. Its Inner Circle and Outer Circle drives are surrounded by elegant row houses and mansions, now largely government offices or institutions affiliated with the University of London (including Bedford College and the Institute of Archaeology). Within the Inner Circle drive are the Queen Mary's Gardens (roses) and an open-air theatre. The Zoological Society of London exhibit on the north side of the park was opened in 1828. Much of Regent's Park is used for various sports events, particularly cricket. The London Mosque and a lake popular with boaters are located along the park's western boundaries.

Reger, Max, byname of JOHANN BAPTIST JOSEPH MAXIMILIAN REGER (b. March 19, 1873, Brand, Bavaria, Ger.—d. May 11, 1916, Leipzig), German composer and teacher noted for his organ works, which use Baroque forms; he was one of the last composers to infuse life into 19th-century musical traditions.

Reger studied at Weiden. In 1888 he heard *Die Meistersinger* and *Parsifal* at Bayreuth, but Wagnerian influence on his music was short-lived. From 1890 to 1893 he studied at Sondershausen and Wiesbaden and taught piano, organ, and theory. About this time he became friends with Busoni and with the organist Straube, who introduced Reger's organ music. By 1901, despite opposition to his traditional methods, he had established himself in Munich as a composer, pianist, and teacher. In 1907 he became professor of composition at the Leipzig Conservatory and musical director at the University of Leipzig. He took on the post of conductor of the court orchestra at Meiningen in 1911.

In addition to organ works, Reger also composed choral and orchestral works, chamber music, and songs. Among his leading orchestral works are the *Böcklin Suite*, the *Variations and Fugue on a Theme by Mozart*, the *Suite in the Old Style*, and variations on themes of Beethoven and Hiller. There are also a piano concerto, sonatas for unaccompanied violin, three suites for solo viola, and other works. His organ works include the fantasy on *Ein feste Burg; Phantasie und Fuge über B-A-C-H;* the fantasy on the chorale *Wachet auf! ruft uns die Stimme;* and the *Sonata in F Sharp Minor.*

Reger influenced such composers as Arthur Honegger and Paul Hindemith.

reggae, Jamaican popular musical and dance style originating in the mid-1960s. Traditional Afro-Jamaican reggae is further compounded of Afro-American and North American popular and rock and roll musical elements.

Reggae originated as a music of the Jamaican poor, reflecting social discontent and the Rastafarian movement, which emphasizes return to Africa, deification of the Ethiopian emperor Haile Selassie (whose precoronation name was Ras [prince] Tafari) and the sacramental use of marijuana.

The instrumentation of reggae is characterized by an electric bass played at high volume as a lead instrument. Around this an ensemble of organ, piano, drums, and lead and rhythm electric guitars play short ostinato phrases, subdividing the beat in patterns of alternating tension and release.

Reggae was popularized in the United States in the film *The Harder They Come* (1973), starring singer Jimmy Cliff, and through tours by Bob Marley and the Wailers, an international attraction until the leader died in 1981, and by Toots (Hibbert) and the Maytals. Reggae is played wherever Jamaicans have migrated. The influence of reggae also was evident among more mainstream white rock musicians.

Reggio, Nicolas-Charles Oudinot, duc de (duke of): *see* Oudinot, Nicolas-Charles.

Reggio di Calabria, Latin RHEGIUM, city, capital of Reggio di Calabria province and former capital (until 1971) of Calabria region, southern Italy. It is a port on the Strait of Messina, opposite the city of Messina, Sicily.

The original settlement of Rhegion (Latin Rhegium) was founded *c.* 720 BC by Greek colonists from Chalcis as a daughter city to Zankle (ancient name of Messina, *q.v.*). Under the tyrant Anaxilas, who also ruled Zankle, it prospered, but in 387 BC it was captured by Dionysius I the Younger, of Syracuse. Later it suffered under the Mamertini (mercenaries from Campania) until it fell in 270 BC to Rome, to which it was faithful throughout the Punic Wars. Occupied successively by the Visigoths, Goths, Byzantines, and Saracens, it was conquered by the Norman leader Robert Guiscard in 1060 and was subsequently included in the kingdoms of Sicily and (after 1282) Naples. Destroyed many times by Saracen invaders and by earthquakes, Reggio has been repeatedly reconstructed, experiencing alternate periods of splendour and decadence. Razed by an earthquake in 1908, it was afterward rebuilt with wide streets and low, reinforced concrete buildings. The transfer of the provincial capital to Catanzaro in 1971 resulted in widespread riots in Reggio di Calabria. Following a compromise, Reggio remained the Regional Assembly's permanent seat.

Reggio is an archiepiscopal and metropolitan see, and its cathedral was reconstructed in Romanesque-Byzantine style. There are Greek and Roman remains, and the Museo

Nazionale della Magna Grecia has a splendid archaeological collection.

Reggio is linked by steamer and ferry with Messina, by rail with Naples, and by air with Rome and Palermo. A tourist resort and seaport, it supplies the perfume and pharmaceuticals industries with essences of bergamot and jasmine. Although its industries are small, they are varied, including fruit canning, silk milling, olive-oil extraction, and the manufacture of furniture and machinery. Pop. (1988 est.) mun., 178,714.

Reggio nell'Emilia, Latin REGIUM LEPIDI, city, capital of Reggio nell'Emilia *provincia,* Emilia-Romagna *regione,* northern Italy, on the Crostolo River near the southern edge of the Po Plain, southeast of Parma.

Founded in the 2nd century BC on the Roman road Via Aemilia by Marcus Aemilius Lepidus as Regium Lepidi, it was later the seat of a Lombard duchy and then was ruled by its bishops. Under the protection of the counts of the nearby castle of Canossa from the 10th century, it became an independent commune early in the 12th. From 1409 to 1796 it was ruled by the Este family, and it was annexed to Piedmont in 1859.

Notable landmarks include the cathedral (rebuilt 13th century), the Church of Madonna della Ghiara (1597–1619), the Parmeggiani Gallery, the civic museum, the house where the poet Ludovico Ariosto was born in 1474, and numerous 15th- and 16th-century palaces.

An important agricultural centre, Reggio nell'Emilia specializes in the production of wine, Parmesan cheese, and meats and manufactures electrical apparatus, cement, and pharmaceuticals. It is also a rail and road centre on the routes from Rimini and Bologna to Milan. Pop. (1988 est.) mun., 130,015.

regiment, in most armies, a body of troops headed by a colonel and organized for tactical control into companies, battalions, or squadrons. French cavalry units were called regiments as early as 1558. The word is derived from the Latin *regimen,* a rule or system of order, and describes the regiment's functions of raising, equipping, and training troops. As a regiment acquired individuality, colours, coat of arms, distinctive uniform and insignia, and achievements in battle, it also became a central object of loyalty, pride, and esprit de corps of its soldiers.

In early U.S. service, as in European armies up to that time, the usual number of companies in a regiment was 10. Early in the 19th century Napoleon organized the regiments of the French army into three battalions or squadrons, of which two were in the field and one was in quarters recruiting and training additional troops. Later, Edward Cardwell reorganized the British infantry into two-battalion regiments, each having one battalion at home and one stationed overseas. The U.S. Army adopted a three-battalion infantry regimental organization in 1901 and incorporated it into the divisions employed in World Wars I and II and in the Korean War.

Regina, capital and largest city of Saskatchewan, Canada, on Wascana Creek, in the south-central part of the province. It originated as a hunters' camp and was known as Pile O'Bones for the heaps of bones left there after skinning and cutting buffalo. Captain John Palliser, the explorer, visited the site in 1857 and called it Wascana (derived from its Cree Indian name, Oskana); with the arrival of the Canadian Pacific Railway in 1882, it was renamed Regina (Latin: "queen," in reference to Victoria). The settlement served as the administrative headquarters of the Northwest Territories from 1882 until 1905, when it was selected as capital of the newly formed

The provincial Legislative Building in Wascana Centre, Regina, Sask.
George Hunter

province of Saskatchewan. Louis Riel, leader of the Métis rebels, was tried for high treason and hanged (1885) in the prison courtyard of the North West (later Royal Canadian) Mounted Police who were headquartered in Regina (1882–1920); the police training barracks and a museum and chapel (reflecting the history of the "Mounties") remain in the city. After World War II, Regina expanded rapidly to become an important transportation, manufacturing, and distributing centre of a vast agricultural area. The main Canadian railroads, several highways (including the Trans-Canada), and a major airport serve the city. Local mineral resources and fertile prairies support an economy based largely upon oil, natural gas, potash refining, and food processing. The Saskatchewan Wheat Pool, one of the world's largest cooperative grain-handling organizations, is headquartered in Regina. Other industries include steel fabricating and the manufacture of farm implements, communications equipment, paints, and building materials.

The focus of Regina is Wascana Centre, a parklike development around Wascana Lake (an artificial widening of Wascana Creek) that includes some of the most important civic buildings, including the domed Legislative Building, the Museum of Natural History, the Norman Mackenzie Art Gallery, the Diefenbaker Homestead (home of Canadian prime minister John Diefenbaker, which was moved from Borden in 1967), and the University of Regina (incorporated 1974; formerly a branch of the University of Saskatchewan). City colleges associated with the university are Campion (1918), Luther (1926), Canadian Theological (1941), and the Saskatchewan Indian Federated College (1976). Piapot and several other Indian reservations are in the vicinity, and the Last Mountain Lake resort area is 20 miles (30 km) northwest. Inc. 1903. Pop. (1986) city, 175,064; metropolitan area, 186,-521.

Reginald OF CHÂTILLON, Reginald also spelled RAYNALD, or REYNALD, French RENAUD DE CHÂTILLON (b. Châtillon-sur-Loing, Fr.—d. July 4, 1187, Galilee, Palestine [now in Israel]), prince of Antioch (1153–60), one of the leading military figures of the Crusades between 1147 and 1187, whose reckless policy in raiding Muslim caravans during periods of truce led to the virtual destruction of the Latin Kingdom of Jerusalem and the loss of most of its territory.

Reginald left for the Holy Land in 1147 and put himself at the service first of King Baldwin III of Jerusalem and then of Constance of Antioch. Constance, whose first husband had died in 1149, fell in love with Reginald and married him in 1153.

As prince of Antioch, Reginald was courageous but violent. He treated the patriarch Aimery with outrageous cruelty to extort money from him. At the instigation of the Byzantine emperor Manuel I Comnenus, he attacked Armenian Cilicia (southeastern Anatolia), but subsequently he made peace with Thoros II of Cilicia and joined him in an invasion of Byzantine Cyprus. Manuel had his revenge in 1159 when Reginald was obliged to acknowledge himself as his vassal. The following year Reginald was taken prisoner by the Muslims and held captive until 1176.

Meanwhile, Constance had died (1163), leaving Antioch to Bohemond III, son by her first husband. Reginald therefore returned to Jerusalem and in 1177 married Stephanie, widow of the Lord of Outre-Jourdain (east and south of the Dead Sea), thus becoming prince of Krak du Désert (Kerak) and of Montréal. Reginald's new strongholds controlled Muslim trade routes, and in the summer of 1181 he plundered a Muslim caravan, thus violating the truce of 1180. When Saladin asked the king of Jerusalem to make Reginald restore the plunder, Reginald refused and war broke out. Reginald launched five galleys on the Red Sea: they not only blockaded the Muslim port of Eilat (Elath), but also harassed shipping, raided other ports, and even threatened Mecca until an Egyptian fleet destroyed them. On land, King Baldwin IV's army relieved Krak from two sieges by Saladin (1183 and 1184).

In 1186 Reginald was instrumental in upsetting arrangements for the succession to Baldwin V and in securing the coronation of Sibyl (sister of Baldwin IV) and her husband, Guy of Lusignan, as sovereigns of Jerusalem. At the end of 1186 Reginald again broke a truce with Saladin by plundering a caravan in which a sister of Saladin was traveling. When King Guy asked Reginald to return the stolen property, he refused, and war broke out again. Reginald was taken prisoner in the Battle of the Horns of Ḥaṭṭin (July 4, 1187) and conducted to Saladin's tent. Saladin upbraided him for his truce-breaking in violation of his oath, and, when Reginald refused to become a Muslim, he was beheaded on the spot, perhaps by Saladin himself.

Regino VON PRÜM, also called REGINON (b. Altriys, near Speyer, Upper Lorraine [Germany]—d. *c.* 915, Trier), cleric and chronicler who composed several ecclesiastical works and a chronicle covering the period from Christ's birth to the early 10th century.

Born to a noble family, Regino joined the Benedictine monastic order at the flourishing Abbey of Prüm and studied theology and canon law. He was elected abbot in 892 but was forced to abdicate in 899 because of intrigue and slander. He was then given direction of the monastery at Saint-Martin by Ratbod, archbishop of Trier; he restored the monastery and remained there until his death.

Regino's most famous work is his *Chronicon* in two books: the first, covering the period from Christ's birth to the year 718, comprises excerpts from previous chronicles, including that of Bede; the second, covering the period from the death of Charles Martel (741) to the year 907, was written by Regino himself, based on material from annals, letters, oral tradition, and personal memory. The *Chronicon* was continued after his death up to the year 967 and was first published in 1521. Regino's other works include a treatise on canon law and a proposal for reform of church music.

Regiomontanus, pseudonym of JOHANN MÜLLER (b. June 6, 1436, Königsberg, Archbishopric of Mainz [Germany]—d. July 6, 1476, Rome [Italy]), German astronomer and mathematician who was chiefly responsible for the revival and advancement of trigonometry in Europe.

He took the name Regiomontanus from the Latinized form of Königsberg ("King's Mountain"). He entered the University of Leipzig at the age of 11 and in 1450 went to Vienna to study under the Austrian mathematician Georg von Peuerbach. He assisted Peuerbach in preparing a work on Ptolemaic astronomy.

Regiomontanus, engraving

By courtesy of Bildarchiv Preussischer Kulturbesitz BPK, Berlin

Because of the profusion of errors in the Latin translations of Ptolemy's works from the Arabic, Peuerbach began a new translation from the original Greek manuscripts. After Peuerbach's death, Regiomontanus continued his efforts and in 1461 went to Rome to learn Greek and collect manuscripts from the Greeks who had fled Constantinople after it fell to the Turks in 1453. He also consulted a Greek text of the *Almagest,* Ptolemy's major work. In 1463 he completed the work started with Peuerbach, and five years later he returned to Vienna. From there the king of Hungary, Matthias Corvinus, summoned him to court to collate Greek manuscripts.

Three years later Regiomontanus settled in Nürnberg, where a rich patrician, Bernhard Walther, had offered him a house, a tool shop, an observatory, and a printing press. Walther became his pupil as well as his patron and in 1472 helped him complete observations of the bright comet of that year.

Primarily an advanced mathematician, in 1464 he wrote *De triangulis omnimodis libri quinque* (1533; "Five Books on Triangles of All Kinds"); it was the first modern exposition of plane and spherical trigonometry. The work uses methods of presentation applicable to general classes of problems on triangles and uses algebraic techniques to simplify their solutions. Regiomontanus was also among the first in Europe to discuss the algebra of Diophantus of Alexandria (flourished *c.* AD 250), and in 1474 he published his *Ephemerides,* navigational tables showing the daily positions of the heavenly bodies for several years.

Pope Sixtus IV summoned Regiomontanus to Rome the next year (1475) to advise on the needed reform of the Julian calendar and appointed him bishop of Regensburg. Before he could take office he died, either from the plague or, as has been suggested, from poison at the hands of his enemies.

region, in the social sciences, a cohesive area that is homogeneous in selected defining criteria and is distinguished from neighbouring areas or regions by those criteria. It is an intellectual construct created by the selection of features relevant to a particular problem and the disregard of other features considered to be irrelevant. A region is distinguished from an area, which is usually a broader concept designating a portion of the surface of the Earth. Area boundaries are arbitrary, established for convenience. Regional boundaries are determined by the homogeneity and cohesiveness of the section.

Regions may be nodal, defined by the organization of activity about some central place (*e.g.,* a town and its hinterland, or tributary area), or uniform, defined by the homogeneous distribution of some phenomena within it (*e.g.,* a tropical rain forest).

Regions may be defined in terms of single or multiple features or in terms that approach the total content of human occupancy of an area. The most common features in social science are ethnic, cultural, or linguistic (Provence), climatic or topographical (the Tennessee Valley), industrial or urban (the Ruhr), economic specialization (the cotton belt of North America), administrative units (standard government regions in Great Britain), and international political areas (the Middle East).

The concept of region is currently used in analysis, planning, and administration of many national and international public programs. Regionalism, or regional consciousness, the ideological correlate of the concept that develops from a sense of identity within the region, is important in many historical, political, and sociological analyses.

regional development program, any government program designed to encourage the industrial and economic development of regions that are stagnant or in which a large portion of the population is experiencing prolonged unemployment. The measures taken may include loans, grants, and tax incentives to private industries relocating in such areas; assistance in developing power, light, transportation, and sanitation facilities; and various degrees of central control over the location of plant construction and expansion. Most of the more industrialized countries have adopted some type of regional development program since World War II. An alternative approach to the problem, also widely practiced, is to retrain and relocate workers. Regional development may be favoured if the inhabitants have a strong attachment to the area or if the population density in cities where they might relocate is already unmanageably great.

The most common method of encouraging industry to enter such areas is to offer grants, loans, and loan guarantees to companies relocating or expanding in such areas. France, for example, has given subsidies related to the amount of investment and the number of new jobs created, as well as loans, interest subsidies, and free land sites. Japan has made state-owned land available for private industrial development. Loan and interest assistance have been elements in area development plans in Germany, The Netherlands, the United States, Great Britain, and Japan.

Great Britain, Sweden, and France have maintained some central control over the selection of sites for industrial construction and expansion. British Board of Trade approval, for example, is necessary for new large industrial project sites. The Economic and Social Development Fund of France has exercised negative sanctions by withholding building permits for unapproved sites. Sweden's Labour Market Board, by refusing to approve loans, can direct new business investment out of labour-shortage areas.

France and Japan are among countries that have extended various tax incentives to companies investing in depressed or rural areas. In Great Britain the Board of Trade can offer assistance in developing the regional organization necessary to economic expansion; this help is also an element in some American programs. Another measure to facilitate economic development is the provision of low-cost housing. *See also* development bank.

Regionalism (visual arts): *see* Social Realism.

régisseur (French: "manager"), theatrical director or stage manager, especially in France, the Soviet Union, Germany, and Italy, whose duties encompass the artistic interpretation and integration of a play, the guided rehearsal of the actors, and the overall responsibility for the technical and economic aspects of the production. The position is similar to that of the director in the American theatre and the producer in that of England. In ballet a régisseur coordinates the activities of the producer, stage technicians, and orchestra; handles the finances of the company; and makes all the arrangements for tours. In the cinema a régisseur's duties—much like those of the assistant director in the British and American systems—chiefly involve the management of costumes, sets, and props.

The régisseur originally functioned as a stage manager. By the end of the 19th century, with the increased complication of stage apparatus and the tendency of actors and playwrights not to direct their own plays, the stage manager became a separate officer under the régisseur, who took on the broader duties of directing and overseeing the production.

Registan (Afghanistan): *see* Rīgestān.

regium donum (Latin: "royal gift"), annual grant made from public funds to Presbyterian ministers in Ireland and to Nonconformist ministers (those not part of the Church of England) in Great Britain. It originated in Ireland in 1690, when the English king William III made a grant to Presbyterian ministers in Ulster as a reward for their services during his struggles with former king James II. The grant was discontinued in 1869.

In England the *regium donum* was begun in 1723 with an annual grant paid to nine Nonconformists who divided it among needy Presbyterian, Baptist, and Independent ministers and widows of ministers. Each individual received only a small sum, but some dissenters from the Church of England believed political implications were attached to this royal charity, which they attacked. It was finally discontinued in 1851.

Regla, city, northern Ciudad de la Habana *provincia,* west-central Cuba. Situated on the southeastern shore of La Habana Bay, Regla was a centre for smuggling activities in the 19th century. It is now an industrial suburb of Havana, with which it is linked by ferry as well as by land. Its foundries, petroleum refineries, shipyards, docks, and warehouses suggest its importance as both port and railhead. Manufactures include shoes, soap, foods, and soft drinks. Pop. (1981) 38,491.

Règlement Organique, English ORGANIC STATUTE, Russian ORGANICHESKY REGLAMENT, Romanian REGULAMENTUL ORGANIC, or (plural) REGULAMENTELE ORGANICE, 19th-century constitution, imposed under a Russian protectorate, that introduced elected political institutions in the principalities of Moldavia and Walachia (later the nucleus of Romania) but also created oligarchies there and vested political and economic power in the boyar class (*i.e.,* the landed gentry). Russia occupied Moldavia and Walachia (which were nominally subject to the Ottoman Empire) in 1829 and the following year convened a boyar commission that wrote the new constitution. The Règlement became the basic law of Walachia in July 1831 and of Moldavia in January 1832; it was ratified by the Turkish government in 1834.

Among its chief innovative provisions was the establishment in each principality of a special commission, composed mainly of boyars with some members of the middle class, that was to elect a prince from among the native upper nobility. The Règlement also created legislative assemblies, which were to be composed of boyars elected by their peers. In addition to placing the bulk of the political power in the boyars' hands, the Règlement Organique designated the boyars as owners of the land and reduced the amount of land made available for peasant use. The peasants were also effectively bound to remain in their villages.

Although the Règlement was challenged during the uprisings in Moldavia and Walachia in 1848, it was reaffirmed after their suppression; the boyars remained in power until Russia's protectorate over the principalities was ended (1856), and a divan ad hoc (assembly), representing all social classes, met in each principality and voted to unite the two into the single, autonomous state of Romania.

Regnar LODBROG, Lodbrog also spelled LODBROK, or LOTHBROK (Viking hero): *see* Ragnar Lothbrok.

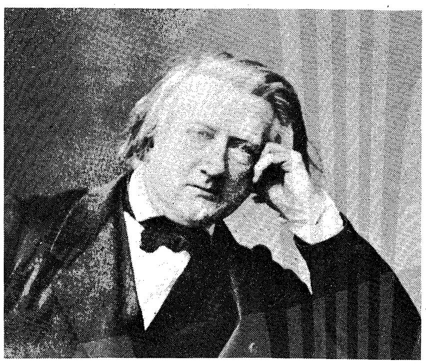
Regnard, Jean-François (b. Feb. 8, 1655, Paris—d. Sept. 4, 1709, Château de Grillon, Fr.), French dramatist, one of the most successful of the successors of Molière, whose wit and style he openly imitated.

Regnard, detail of an engraving by P.A. Tardieu after a portrait by Hyacinthe Rigaud
H. Roger-Viollet

Born into a wealthy family, Regnard travelled extensively as a young man. On one of his trips he was captured by Algerian pirates and imprisoned for seven months until ransomed by his family in 1679. His experiences and impressions provided material for a series of books.

In 1683 Regnard was named treasurer of France, a profitable post that he held for 20 years. From 1688 on, however, he devoted most of his time to writing, first for the Italian comedians in Paris and then for the Comédie-Française. He depicted a brilliant but decadent society in a light and facile style, free of moralizing. His prime concern was to make an audience laugh as often as possible. His best known plays are *Le Joueur* (1696; "The Gamester"), *Le Légataire universel* (1708; "The Heir"), and *La Sérénade* (1694). He died suddenly under mysterious circumstances at the family château.

Regnault, Henri-Victor (b. July 21, 1810, Aix-la-Chapelle, Fr.—d. Jan. 19, 1878, Auteuil), French chemist and physicist noted for his work on the properties of gases.



Henri-Victor Regnault
Boyer—H. Roger-Viollet

After studying with Justus von Liebig, in Giessen, Regnault became professor of chemistry successively at the University of Lyon, the École Polytechnique (1840), and the Collège de France (1841). His four-volume work on chemistry appeared in 1847. While director of the porcelain factory at Sèvres (from 1854), he continued his work in science. During the Franco-German War (1870–71) his laboratory there was destroyed, and his son Henri, the painter, was killed.

Regnault designed apparatus for a large number of physical measurements and carefully redetermined the specific heats of many solids, liquids, and gases. He showed that no two gases have precisely the same coefficient of expansion and proved that Boyle's law of the elasticity of a "perfect gas" is only approximately true for real gases. In introducing his air thermometer he determined the absolute expansion of mercury. He also devised a hygrometer.

Regnault de Saint Jean d'Angély, Michel-Louis-Étienne, Comte (Count), Regnault also spelled REGNAUD (b. Nov. 3, 1761, Saint-Fargeau, Puisaye, Fr.—d. March 11, 1819, Paris), administrator under the French Directory and Napoleon I's Empire. He persuaded Napoleon, at the end of the Hundred Days (1815), to abdicate for the second time.

Elected to the States General in 1789, Regnault was an inconspicuous member of the National Constituent Assembly formed later that year. As an anti-Jacobin he was arrested (1793) during the Terror but escaped. He later (1796–99) held French administrative posts in Italy and on Malta. Having aided Bonaparte in the coup d'etat of 18 Brumaire (Nov. 9, 1799), he was minister of the interior under the empire and helped to prepare the commercial code of law of 1807. During the Hundred Days he was vice president of the Conseil d'État and encouraged Napoleon to adopt liberal policies. After the Second Restoration he spent most of his remaining years in exile.

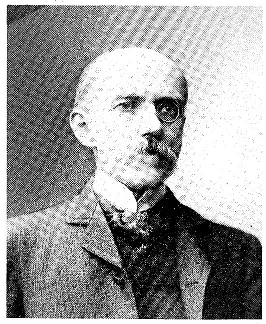
Michel-Louis-Étienne Regnault, lithograph by J.-N. Lerouge after a drawing by Lanbert
By courtesy of the Bibliotheque Nationale, Paris

Regner LODBROG, Lodbrog also spelled LODBROK, or LOTHBROK (Viking hero): *see* Ragnar Lothbrok.

Régnier, Henri(-François-Joseph) de (b. Dec. 28, 1864, Honfleur, Fr.—d. May 23, 1936, Paris), foremost French poet of the first decade of the 20th century.

Born of an old Norman family, Régnier began to prepare for a career as a diplomat, but while studying law in Paris he came under the influence of the Symbolist poets and published his first volume of poems, *Lendemains* ("Tomorrows"), in 1885. Other volumes followed: *Les Jeux rustiques et divins* (1897; "Games—Tough and Divine"), *Les Médailles d'argile* (1900; "Clay Medals"), and *La Sandale ailée* (1906; "The Winged Sandal").

In 1896 Régnier married Marie de Heredia, daughter of an eminent poet, José María de Heredia. She later became a poet in her own right, publishing under the name of Gérard d'Houville. Influenced by his father-in-law, Régnier abandoned his earlier free and relatively uncontrolled writing style in favour of more classical forms. For his themes, however, he continued to draw on the concerns of the Symbolists. He also wrote a number of novels, generally evoking a time and place in the past, particularly 14th- and 18th-century Italy and France: *La Double Maîtresse* (1900), *La Peur de l'amour* (1907; "Fear of Love"), *La Pécheresse* (1912; "The Sinner"), and *Le Voyage d'amour* (1930).



Henri de Régnier
H. Roger-Viollet

A man of aristocratic bearing and tastes, Régnier became an important figure in French intellectual society in the years following the turn of the century. In 1911 he was elected to the Académie Française.

Régnier, Mathurin (b. Dec. 21, 1573, Chartres, Fr.—d. Oct. 22, 1613, Rouen), French satiric poet whose works recall those of Horace, Juvenal, Ariosto, and Ronsard in free and original imitation, written in vigorous, colloquial French. Writing about typical characters of his time with verve and realism, in alexandrine couplets, he fully displayed his talents in *Macette* (1609), a work that has been compared to Molière's *Tartuffe*. An acute critic, Régnier castigated François de Malherbe in an attack on the theory that poetry must conform to precise classical and intellectual standards (Satire IX, *À Monsieur Rapin*).

Nephew of the poet Philippe Desportes, he became secretary to Cardinal François de Joyeuse and accompanied him to Rome in 1583; his dissolute ways, however, impeded his advancement. Returning to France about 1605, he accepted the protection of Desportes. In 1609 he became canon of Chartres and spent many of his remaining years at the Abbey of Royaumont, near Asnières-sur-Oise.

Rêgo Cavalcanti, José Lins do (Brazilian writer): *see* Lins do Rêgo Cavalcanti, José.

regressive tax, tax levied at a rate that decreases as its base increases. Regressivity is considered undesirable in taxation because it forces poorer persons to pay a greater percentage of their income in tax than wealthier persons. Despite efforts to avoid regressivity, certain taxes, especially proportional taxes, tend to become regressive in practice.

Consumption tax and sales tax, for instance, are usually considered regressive because of their set rate structures. The percentage of tax paid to income level will rise as income drops. Tobacco, gasoline, and liquor sales taxes, all major sources of tax revenue, are considered the most heavily regressive taxes. Upper income groups can also avoid sales tax by buying merchandise wholesale, thus making a regressive sales tax even more regressive. In an effort to mitigate this regressivity, a number of states in the United States, for example, exempted from sales tax medicine and/or food to be consumed off the premises.

Property tax is often considered regressive because poorer individuals tend to spend a larger portion of their income on housing and are taxed proportionately, while wealthier individuals spend a lesser portion of their income in this way and therefore pay a lower percentage rate. It is also common for property assessors to underevaluate higher-priced property more than they do lower-priced property, thus increasing regressivity.

Regulators of North Carolina (1764–71), in American colonial history, vigilance society dedicated to fighting exorbitant legal fees and the corruption of appointed officials in the frontier counties of North Carolina. Deep-seated economic and social differences had produced a distinct east-west sectionalism in North Carolina. The colonial government was dominated by the eastern areas, and even county governments were controlled by the royal governor through his power to appoint local officers. Back-country (western) people who suffered from excessive taxes, dishonest officials, and exorbitant fees also became bitter about multiple office holdings. They formed an association called the Regulators, which sought vainly to obtain reforms. They then refused to pay taxes or fees, punished public officials, and interfered with the courts. Finally, the Regulator insurrection was crushed by Governor William Tryon at the Battle of Alamance (May 16, 1771). Many frontiersmen fled to Tennessee, but the legacy of bitterness induced many Regulators to side with the Loyalists during the U.S. War of Independence, in addition to continuing their own futile agitation for five more years.

regulatory agency, independent governmental commission established by legislative act in order to set standards in a specific field of activity, or operations, in the private sector of the economy and to then enforce those standards. Regulatory agencies function outside executive supervision. Because the regulations that they adopt have the force of law, part of these agencies' function is essentially legislative; but because they may also conduct hearings and pass judgments concerning adherence to their regulations, they also exercise a judicial function—often carried out before a quasi-judicial official called an administrative law judge, who is not part of the court system. Regulatory agencies have become popular means of promoting fair trade and consumer protection as problems of commerce and trade have become more complex, particularly in the 20th century.

The idea of the regulatory agency was first advanced in the United States, and it has been largely an American institution. The first agency was the Interstate Commerce Commission (ICC), established by Congress in 1887 to regulate the railroads (and, later, motor carriers, inland waterways, and oil companies). It remains the prototype of such an agency. It was organized in the belief that a commission of specialists would know more about the railroads and their unique problems than Congress would, that a permanent commission could provide a more unbroken line of policy than could an elected body, and that it could combine the two functions of legislative and judicial that are necessary for effective regulation. Originally, the ICC was to serve only as an advisory body to Congress and the courts, but it was soon granted these powers itself. Also, an independent commission could be impartial and nonpartisan, a necessity for equitable regulation. The ICC was the first step taken to regulate an entire class of industries, rather than taking each on a case-by-case basis, as had been previously done.

The ICC's functions illustrate those of regulatory agencies in general. It oversees trucking, railroads, water-borne shipping, pipelines, and express companies and freight forwarders. It applies broadly stated legislative policies to concrete cases of interstate commerce by a procedure patterned after that of the courts. It grants licenses to those seeking to engage in interstate transportation, and it fixes reasonable rates and ensures that they are observed. It also regulates routes, services, and mergers, and it exercises an injunctive power over companies using discriminatory or monopolistic practices. It also promulgates safety and other regulations.

The assertion of governmental control in other industries led to the creation of many other regulatory agencies modeled upon the ICC, chief among these being the Federal Trade Commission (FTC, 1914), Federal Communications Commission (FCC, 1934), and Securities and Exchange Commission (SEC, 1934). In addition, regulatory powers were conferred upon the ordinary executive departments; the Department of Agriculture, for example, was given such powers under the Stockyards and Packers Act (1938). Much of President Franklin D. Roosevelt's New Deal program of the 1930s was carried out through administrative regulation. During the same period a comparable development took place in state and municipal government. Other, more recent agencies include the Equal Employment Opportunity Commission (EEOC, 1964), Environmental Protection Agency (EPA, 1970), Occupational Safety and Health Administration (OSHA, 1971), Consumer Product Safety Commission (CPSC, 1972), and Nuclear Regulatory Commission (NRC, 1975).

Regulatory agencies use a commission system of administration, and their terms of office are fixed and often very long. Federal Reserve Board members, for instance, serve for 14 years. Regulatory agency commissions are appointed by the president, but their terms are staggered, so that no one president is able to drastically change the nature of the agency by the appointments he might make.

In almost all other countries outside the United States, the role of regulatory agencies is taken by the regular administrative departments of government and, in the case of utilities and public transportation, often by means of state ownership.

Regulus, also called ALPHA LEONIS, brightest star in the zodiacal constellation Leo and one of the brightest in the entire sky, having an apparent visual magnitude of about 1.35. The name Regulus, derived from a Latin word for king, reflects an ancient belief in the astrological importance of the star.

Regulus, Marcus Atilius (fl. 3rd century BC), Roman general and statesman whose career, greatly embellished by legend, was seen by the Romans as a model of heroic endurance.

Regulus served as consul in 267 and 256. In the latter year (during the First Punic War, 264–241) he and his colleague Lucius Manlius Vulso defeated the Carthaginian fleet off Mount Ecnomus, in southeast Sicily, and landed an army in Africa. Vulso was then recalled, leaving Regulus to finish the war. Regulus severely defeated the enemy at Adys, near Carthage. His demands for an unconditional surrender, however, angered the Carthaginians, who in turn resolved to continue the struggle, and in 255 they defeated and seized the Roman general.

According to tradition, Regulus remained in captivity at Carthage until he was sent to Rome on parole to negotiate either a peace or an exchange of prisoners. He is supposed to have urged the Roman Senate to refuse the proposals and then, over the protests of his own people, to have fulfilled the terms of his parole by returning to Carthage. His captors, it was said, promptly tortured him to death. Since there is no firm evidence to substantiate Regulus' heroism, many scholars have suggested that the story of his mission to Rome and subsequent martyrdom was invented to excuse the mistreatment of Carthaginian prisoners held at Rome.

Rehnquist, William Hubbs (b. Oct. 1, 1924, Milwaukee, Wis., U.S.), 16th chief justice of the United States (from 1986).

Rehnquist graduated from Stanford University in 1948. He earned a law degree from Stanford Law School in 1952 and then served as a law clerk to Supreme Court Justice Robert H. Jackson. He practiced law in Phoenix, Ariz., from 1953 to 1969, becoming active in the conservative wing of the Republican Party during those years. In 1969 President Richard M. Nixon appointed him assistant attorney general of the Office of Legal Counsel for the Department of Justice. In that post Rehnquist showed himself to be a staunch advocate of greatly enlarged police powers and proved generally hostile to civil-rights legislation.

In October 1971 President Nixon nominated Rehnquist to a seat on the U.S. Supreme Court. After extended Senate committee hearings in which liberals tried to defeat the nomination, he was finally confirmed by the Senate by a vote of 68–26 in December 1971. He took his seat on the court in January 1972. The vigorous and articulate Rehnquist formed the anchor of the court's conservative minority bloc during the 1970s and into the '80s. His polished legal opinions and consistently conservative stance on almost all legal issues prompted President Ronald W. Reagan in June 1986 to nominate him to replace Warren E. Burger as chief justice of the Supreme Court upon the latter's retirement that year. His nomination was confirmed by the Senate that same year.

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Rehoboth, town, central Namibia. The town is located about 52 miles (84 km) south of Windhoek, the national capital, and lies on the banks of the dry, sandy bed of the Rehoboth River at an elevation of 4,544 feet (1,385 m). Rehoboth is situated in an arid, sparsely populated region within the Central Highland, the physiography of which is characterized by rugged, stony hills and sand-filled valleys. Different areas around Rehoboth are well suited for the grazing of Karakul sheep and dairy cattle; limited amounts of corn (maize), wheat, and other grains are sometimes grown.

Originally a site inhabited by the Nama group of Khoikhoin (Hottentot) peoples, it was given the biblical name of Rehoboth in 1844 by a missionary who built a church there as a mission station of the Rhenish (German Lutheran) Missionary Society. The mission was abandoned in 1864 because of drought, famine, and internecine warfare but was resettled in 1870 by people of mixed European and Nama ancestry (called Basters) who emigrated from the Cape Colony. After Germany seized the entire region as a colony in 1884, German troops won the help of the Rehoboth Basters in putting down resistance by native ethnic groups. During World War I Rehoboth was occupied by South African troops who invaded and claimed the entire territory. In 1924–25 the Rehoboth Basters and other tribal groups declared themselves independent of South African rule, but the revolt was quickly suppressed.

Namibia's main north-south road passes through Rehoboth. The town is a local market centre for dairy cattle and sheep, and Karakul wool is processed locally. Pop. (1988 est.) 15,000.

Reḥovot, city, central Israel, on the coastal plain south-southwest of Tel Aviv–Yafo, in the centre of the country's most productive citrus belt. The name (Hebrew: "broad places," or "room") is from the biblical allusion in Genesis 26:22. Founded in 1890 by Warsaw Jews, Reḥovot soon became economically self-sufficient, owing to its prosperous citrus groves, and absorbed many immigrant agricultural labourers. Under Ottoman rule before World

War I, it was the first town to dismiss its Arab guards and to employ ha-Shomer, the Jewish settlement police.

Chaim Weizmann (1874–1952), Zionist leader and first president of Israel, built a house in Reḥovot in 1936; it and his gardens (where he is buried) are a national memorial. Weizmann, a well-known chemist, founded a research institute there in 1934, which was renamed the Weizmann Institute of Science in 1944. The Hebrew University of Jerusalem has its Faculty of Agriculture in the city.

Reḥovot's industries include the processing of citrus by-products (juices, oils, concentrates) and production of plastics, pharmaceuticals, and metal goods. Inc. 1950. Pop. (1987 est.) 71,000.

Reich (German: "Empire"), any of the empires of the Germans or Germany: the Holy Roman Empire (*q.v.*); the Second Reich, led by the Prussian Hohenzollerns (1871–1918); or the Third Reich of Nazi Germany (1933–45). *See* Germany.

Reich, Wilhelm (b. March 24, 1897, Dobrzcynica, Galicia, Austria-Hungary—d. Nov. 3, 1957, Lewisburg, Pa., U.S.), Viennese psychologist who developed a system of psychoanalysis that concentrated on overall character structure, rather than on individual neurotic symptoms. His early work on psychoanalytic technique was overshadowed by his involvement in the sexual-politics movement and by "orgonomy," a pseudoscientific system he developed.

Reich was trained at the Berlin Psychoanalytic Institute and joined the faculty of the Vienna Psychoanalytic Institute in 1924. In *The Function of Orgasm* (1927), he argued that the ability to achieve orgasm, called orgastic potency, was an essential attribute of the healthy individual; failure to dissipate pent-up sexual energy by orgasm could produce neurosis in adults. This work led him into the sexual-politics movement, an attempt to combine radical left-wing politics with the advocacy of sexual education and freedom. Reich left Germany in 1933 and taught in Scandinavian countries until settling in the United States in 1939.

In *Charakteranalyse* (1933; *Character Analysis*), Reich called attention to the use of character structure as a protective armour to keep the individual from discovering his own underlying neuroses. He believed that repressed feelings were also manifested as muscular tension and that this mental and physical armour could be overcome by direct manipulation and by making the individual aware of the tension. Reich used this approach to treat patients whose neuroses had proved resistant to more orthodox psychoanalytical techniques.

Reich's political and sexual ideas led to a break with the psychoanalytic movement in 1934, after which he devoted himself to orgonomy, an attempt to measure "orgones," units of cosmic energy Reich believed energized the nervous system. He conceived of mental illness as an orgone deficiency, which he attempted to treat by placing the patient in a specially constructed cabinet called the orgone box. He leased orgone boxes as a therapy for many illnesses, including cancer, though patients were instructed to inform their physicians that they were using the devices. His experiments and the commercialization of the orgone box brought him into conflict with American authorities in the early 1950s; he was convicted of contempt of court and died in prison.

Reichenau, island in the Untersee, the western arm of Lake Constance (Bodensee) in Baden-Württemberg *Land* (state), southwestern Germany. Belonging to the city of Konstanz, it is 3 miles (5 km) long and 1 mile (1.6 km) wide and is connected to the mainland by a causeway 1.25 miles (2 km) long. Reichenau is known for the richly endowed Benedictine monastery founded there in 724 and secularized in 1803; it was the artistic and literary centre of southwestern Germany during the 9th to 11th centuries and had an important college that produced many archbishops and bishops of the period. The abbey church at Mittelzell (10th–11th century, with a late Gothic choir) contains the tomb of Charles III the Fat (d. 888), who retired to Reichenau after being dethroned. A lake resort, the *reiche Au* ("rich pasture" cultivated by the medieval monks) still supports flowers, fruit, and grapes. Pop. (1989 est.) 4,355.

Reichenau, Walther von (b. Oct. 8, 1884, Karlsruhe, Ger.—d. Jan. 17, 1942, in flight near Poltava, Ukraine, U.S.S.R.), German field marshal who commanded the army that captured Warsaw (1939) and the 6th Army in its encircling movement through Belgium (1940) on the Western front during World War II.

The son of a general of the artillery, von Reichenau followed his father's career, joining an artillery unit in 1903. During World War I he served on the German general staff, and in the early days of the Nazi regime he was regarded as one of Hitler's favourites. He was raised to the rank of lieutenant general in the Polish campaign in 1939 and was made a field marshal in July 1940 in recognition of his generalship in the French blitzkrieg a month earlier. Marshal von Reichenau was in command of the German army that scored initial successes against Marshal S.M. Budenny's Russian forces in the Ukraine campaign in the fall of 1941. In November 1941 von Reichenau's armies met defeat at the hands of Marshal S.K. Timoshenko, and he was driven out of Rostov. A Bern dispatch Jan. 17, 1942, said Marshal von Reichenau died of apoplexy while flying back to Germany "for reasons of health."

Reichenbach (Poland): *see* Dzierżoniów.

Reichenbach, Georg von (b. Aug. 24, 1772, Durlach, Baden [Germany]—d. May 21, 1826, Munich), German maker of astronomical instruments who introduced the meridian, or transit, circle, a specially designed telescope for measuring both the time when a celestial body is directly over the meridian (the longitude of the instrument) and the angle of the body at meridian passage. By 1796 he was engaged in the construction of a dividing engine, a machine used to mark off equal intervals accurately, usually on precision instruments. In 1804 he was one of the founders of an instrument-making business in Munich, and in 1809 he helped establish at Benediktbeuern an optical works that was later moved to Munich.

In 1819 he built for the German astronomer Friedrich Bessel a transit circle, combining the transit, an instrument used for determining longitude and time, with the mural circle, an instrument mounted on a wall for zenith measurement. This combination had been introduced earlier but had not been adopted. Reichenbach's form of the instrument came into general use.

Reichenbach, Hans (b. Sept. 26, 1891, Hamburg, Ger.—d. April 9, 1953, Los Angeles, Calif., U.S.), philosopher and educator (University of Berlin; University of California) who was a leading representative of the Vienna Circle and founder of the Berlin school of logical positivism, a movement that viewed logical statements as revealing only the basic structure of a priori mental categories and language, but not essentially descriptive of the physical world. He contributed significantly to logical interpretations of probability theories, theories of induction, and the philosophical bases of science. He went to the United States in 1938, where he helped edit the *Journal of Unified Science* (formerly *Erkenntnis* [German: "Perception"]), and wrote *Elements of Symbolic Logic* (1947) and *The Rise of Scientific Philosophy* (1951).

Reichenbach Falls, German REICHENBACHFÄLLE, falls on the Reichenbach (creek) in Bern *canton,* central Switzerland, one of the highest falls in the Alps. There are five cascades with an overall height of 650 feet (200 m); best known are Upper and Lower Reichenbach Falls, with a drop of about 300 feet (90 m). Much of Reichenbach's beauty has been marred by a hydroelectric development.

Reichenberg (Czechoslovakia): *see* Liberec.

Reichskammergericht (German: "Imperial Chamber of Justice"), the supreme court of the Holy Roman Empire between 1495 and the dissolution of the empire in 1806. From the early Middle Ages the supreme court had been the Hofgericht, in which the emperor himself presided and a body of assessors sat in judgment. The Hofgericht was connected with the person of the emperor; it ceased to act when he was abroad and was dissolved upon his death. In the 15th century, when the emperor ceased to command respect, his court lost the confidence of his subjects and after 1450 ceased to sit.

In 1415 the Kammergericht appeared side by side with the Hofgericht and in 1450 replaced it. The king or his deputy presided in the Kammergericht, which was the king's personal court; all members of the new chamber, however, were now officials—the *consiliarii* of the imperial Aulic Council. Generally, those members of the council who had legal backgrounds sat in the Kammergericht. As they were usually doctors of civil (Roman) law, the court tended to act according to that law and thus contributed to the reception of Roman law into Germany toward the end of the 15th century.

Even the Kammergericht, however, fell into disuse in the later years of the reign of Frederick III (d. 1493). The creation of a new and more efficient court became a matter of pressing necessity; as a result, the Reichskammergericht was created at the Imperial Diet of Worms in 1495. It was distinguished from the old Kammergericht by the fact that it was not the personal court of the emperor but the official court of the empire; it was paid by the empire and thus was not dependent on the will or money of the emperor. The emperor appointed the chief justice, who had to be a high aristocrat, and two (later four) presidents of court senates. The emperor nominated a certain number of members, while the rest of the judges, who formed the majority, were nominated by the various component states of the empire. Initially, half of the members were to be doctors of Roman law and half were to be knights; after 1555, however, it became necessary for the latter to be learned in Roman law as well. The court resided first at Speyer, until 1693, and later at Wetzlar.

As a result, the final reception of Roman law into Germany was achieved. The composition of the court made it inevitable that it should administer Roman law. This composition was imitated in the various states of the empire, and Roman law became the local (it being already the central) law of the land.

The province of the Reichskammergericht was gradually defined by statute and use. It covered breaches of the public peace, cases of arbitrary imprisonment, pleas that concerned the treasury, violations of the emperor's decrees or laws passed by the Diet, disputes about property between immediate tenants of the empire or the subjects of different rulers, and finally suits against immediate tenants of the empire—with the exception of criminal charges and matters relating to imperial fiefs, which went to the Aulic Council. The Reichskammergericht acted as a court of appeal from territorial courts in civil and, to a small extent, in criminal cases, except in territories that enjoyed privileges of nonappeal, such as the territories of the electors.

Reichstadt, Napoléon-François-Charles-Joseph Bonaparte, Herzog von (duke of), PRINCIPE (prince) DI PARMA, PIACENZA, E GUASTELLA, also called KING OF ROME, or NAPOLEON II, byname L'AIGLON (French: The Eaglet) (b. March 20, 1811, Paris—d. July 22, 1832, Schönbrunn, Austria), only son of Emperor Napoleon I and Empress Marie-Louise; at birth he was styled king of Rome.

Three years after his birth, the French empire to which he was heir collapsed, and he was taken by the Empress to Blois (April 1814). Upon Napoleon's abdication in his son's name as well as his own, Marie-Louise rejected appeals by his uncles Jérôme and Joseph Bonaparte to leave her son in France as figurehead for resistance (as Napoleon II) and took him to the court of her father, the Austrian emperor Francis I. Excluded from succession to his mother's Italian dominions by the Treaty of Paris (1817), he received the Austrian title of duke of Reichstadt (1818). Allowed no active political role, he was instead used by Metternich, the Austrian statesman, in bargaining with France; and his name was also used by Bonapartist insurgents. In 1830, when Charles X of France was overthrown, Reichstadt was already ill with tuberculosis and was unable to take advantage of events.

Reichstag: *see* Diet.

Reichstag fire, burning of the Reichstag (parliament) building in Berlin, on the night of Feb. 27, 1933, a key event in the establishment of the Nazi dictatorship and widely believed to have been contrived by the newly formed Nazi government itself to turn public opinion against its opponents and to assume emergency powers. Hitler had secured the chancellorship after the elections of November 1932, but his Nazi Party had not won an overall majority. He therefore obtained Cabinet consent to fix new elections for March 5, 1933. Meanwhile, his propaganda minister, Joseph Goebbels, is supposed to have devised the scheme whereby 10 agents led by Karl Ernst were to gain access to the Reichstag through a tunnel leading from the official residence of Hermann Göring, Reichstag president and Hitler's chief minister, who was then to conduct an official investigation, which would fix responsibility for the fire on the Communists. The supposed arsonist was a Dutchman, Marinus van der Lubbe, whom some have claimed was brought to the scene of the crime by Nazi agents. Others have contended that there was no proof of Nazi complicity in the crime, but that Hitler merely capitalized on van der Lubbe's independent act. The fire is the subject of continued debate and research.

On Feb. 28, 1933, the day after the fire, Hitler's dictatorship began with the enactment of a decree "for the Protection of the People and the State," which dispensed with all constitutional protection of political, personal, and property rights. Though the ensuing elections still did not give the Nazis an outright majority, they were able to persuade the Reichstag to pass an Enabling Act (March 23) whereby all its legislative powers were transferred to the Reich Cabinet by a vote of 444 to 94, so sanctioning the dictatorship. A feature of the ensuing arson trial, at which van der Lubbe was convicted, was the acquittal of the Bulgarian Communist Georgi Dimitrov after a strong defense.

Reichstein, Tadeus (b. July 20, 1897, Włocławek, Pol.), Swiss chemist who, with Philip S. Hench and Edward C. Kendall, received the Nobel Prize for Physiology or Medicine in 1950 for discoveries concerning hormones of the adrenal cortex, their structure, and their effects. Reichstein's researches on steroids, particularly on hormones of the adrenal cortex, paralleled those of Kendall in the United States; his "substance F," described and named by him in 1936, proved identical to Kendall's "compound E," or cortisone.

Educated in Zurich, he held posts in the department of organic chemistry at the Federal Institute of Technology, Zurich, from 1930. From 1946 to 1967 he was professor of organic chemistry at the University of Basel. Apart from hormone research, Reichstein is also known for his synthesis of ascorbic acid, a feat achieved about the same time (1933) in England by Sir Walter N. Haworth and co-workers. He was awarded the Copley Medal of the British Royal Society in 1968.

Reid, Forrest (b. June 24, 1875, Belfast, Ire.—d. Jan. 4, 1947, Warrenpoint, County Down), Irish novelist and critic who early came under the influence of Henry James; he is best known for his romantic and mystical novels about boyhood and adolescence and for a notable autobiography, *Apostate* (1926).

After taking his degree at the University of Cambridge, Reid settled down in Belfast, where he spent most of his life. His novels include *The Bracknels* (1911; completely rewritten as *Denis Bracknel,* 1947); *Following Darkness* (1912; revised as *Peter Waring,* 1937); *The Spring Song* (1916); *Pirates of the Spring* (1919); *Uncle Stephen* (1931), which with *The Retreat* (1936) and *Young Tom* (1944) forms a trilogy; and *Brian Westby* (1934). He also wrote studies of William Butler Yeats (1915) and Walter de la Mare (1929).

Reid, Sir George Houston (b. Feb. 25, 1845, Johnstone, Renfrew, Scot.—d. Sept. 12, 1918, London), statesman and prime minister of Australia (1904–05) who as premier of New South Wales (1894–99) directed an economic recovery program, maintained free trade, and introduced a tax to break up land monopolies.

Reid, whose family had emigrated to Melbourne in 1852, served in the colonial Treasury (1864–78) and began a law practice in Sydney in 1879. Elected to the New South Wales Parliament in 1880, he became minister of public instruction (1883–84) and introduced pioneer bills for technical education and evening university lectures.

Becoming premier in 1894, Reid implemented close financial accounting and removed the civil service from political control. After equivocating on the issue, he helped win New South Wales's approval of Australian federation, established in 1901.

Reid led the pro-free traders' opposition in the first federal Parliament (1901–04). In April 1904 he combined with the Australian Labor Party to defeat the Liberal ministry of Alfred Deakin, and then in August he joined with Deakin to defeat Labor and to form a coalition ministry (1904–05). He led the opposition in Parliament from 1905 until his retirement from Australian politics in 1908. He was knighted in 1909 and served as high commissioner in London (1910–16) and as a member of the British Parliament (1916–18). His autobiography, *My Reminiscences,* was published in 1917.

Articles are alphabetized word by word, not letter by letter

Reid, Harry Fielding (b. May 18, 1859, Baltimore—d. June 18, 1944, Baltimore), U.S. seismologist and glaciologist who in 1911 developed the elastic rebound theory of earthquake mechanics, still accepted today.

Reid was professor of dynamic geology at Johns Hopkins University, Baltimore, from 1896 until he became emeritus professor in 1930. His early career was mainly concerned with the study of the structure, composition, and movement of glaciers. Later he became involved in the study of earthquakes and earthquake-recording devices. He was first to develop a formula that showed that earthquakes were a result of faulting and not the reverse. He wrote an analysis of the San Francisco earthquake as part of the report of the California State Earthquake Investigation Commission report, *Mechanics of the Earthquake.*

Reid, Thomas (b. April 26, 1710, Strachan, Kincardineshire, Scot.—d. Oct. 7, 1796, Glasgow), Scottish philosopher who rejected the skeptical Empiricism of Hume in favour of a "philosophy of common sense," later espoused by the Scottish School.

Thomas Reid, drawing by James Tassie, 1789; in the Scottish National Portrait Gallery, Edinburgh
By courtesy of the Scottish National Portrait Gallery, Edinburgh

Reid studied philosophy at Marischal College, Aberdeen, before serving as Presbyterian pastor at New Machar (1737–51). A life-long interest in Hume dated from this period. His first critique of Hume, *An Inquiry into the Human Mind on the Principles of Common Sense* (1764), written during his tenure (1751–64) at King's College, Aberdeen, was an amplification of four previous graduation addresses (first edited by W.R. Humphries as *Philosophical Orations,* 1937).

Lengthy studies convinced Reid that Hume's Skepticism was incompatible with common sense, for both human behaviour and the use of language provide overwhelming evidence to support such truths as the existence of a material world and the retention of personal identity in the midst of continuous change. Unable to find fault with Hume's argumentation, Reid settled on Hume's "theory of ideas" as the prime source of error. Rejecting the notion that ideas are the direct object of the mind's awareness, Reid substituted a view of perception in which sensations "suggest" material objects. For him, this ambiguous assertion solved the problem.

Essays on the Intellectual Powers of Man (1785) further extended Reid's criticism of Hume's epistemology, and *Essays on the Active Power of Man* (1788) defended rationalistic ethics against a current of subjectivism. Both these books influenced British philosophers of the 20th century.

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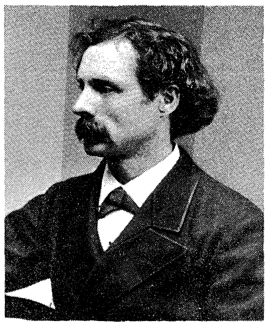
Reid, Whitelaw (b. Oct. 27, 1837, near Xenia, Ohio, U.S.—d. Dec. 15, 1912, London), U.S. journalist, diplomat, and politician, successor to Horace Greeley in 1872 as editor in chief (until 1905) and publisher (until his death) of the *New York Tribune,* which, during much of that period, was perhaps the most influential newspaper in the United States. He was minister to France from 1889 to 1892, unsuccessful candidate for vice president on the Republican ticket with Benjamin Harrison in 1892, and ambassador to Great Britain from 1905 to 1912.

Early in the American Civil War, Reid served as war correspondent for the *Cincinnati Gazette* and as aide-de-camp to the Union



Whitelaw Reid
By courtesy of the Library of Congress, Washington, D.C.

generals Thomas A. Morris and William S. Rosecrans. From 1862 to 1868 he was Washington (D.C.) correspondent for the *Gazette* and simultaneously (1863–66) was librarian of the House of Representatives. Hired by Greeley for the *Tribune* in 1868, he was responsible for the paper's exceptional coverage of the Franco-German War (1870–71) and secured free-lance contributions from Mark Twain and Bret Harte. Although Reid's editorial policy was, uncharacteristically for the period, antisensationalist, he became an advocate of U.S. territorial expansion. As one of the peace commissioners at the end of the Spanish–American War, he successfully urged that the United States retain all of the Philippines.

Reidy, Affonso (Eduardo) (b. Oct. 26, 1909, Paris—d. Aug. 11, 1964, Rio de Janeiro), Brazilian architect, a pioneer of the modern architectural movement in Brazil.

Reidy graduated from the Escola Nacional de Belas Artes, Rio de Janeiro, in 1930. He was one of the team of architects, which included Le Corbusier, that designed the Ministry of Education and Health in Rio de Janeiro (1937–43), a classic example of modern architecture in Latin America. Reidy's work consisted mainly of large projects: theatres, museums, schools, and blocks of office buildings. Among his most admired works are the Pedregulho Residential Neighborhood (1947–55), notable for its use of the curving contours of the site, and the Marechal Hermes Theatre (1950), also in Rio de Janeiro, which had an inverted, double-slope roof and a garden designed by the Brazilian landscape architect Roberto Burle Marx.

The Museum of Modern Art in Rio de Janeiro, begun in 1954, is perhaps Reidy's most striking design: rows of angled concrete ribs support and enclose the gallery spaces. Another important work was the Rio City Employees Insurance Fund Building (1957–62), which had a particularly attractive facade: a reinforced concrete grid was used in combination with adjustable aluminum blinds to achieve sunlight control.

Reigate and Banstead, district (borough), county of Surrey, southern England, occupying an area of 50 sq mi (129 sq km) immediately south of Greater London. Named after the two principal locales of the district, Reigate and Banstead extends across the North Downs, a range of low chalk hills trending east–west. The district is residential and yet contains extensive areas of open space and parkland; recreational and outdoor sports facilities are commonplace throughout. Diverse industrial estates produce chemicals, leather, and pharmaceuticals. Man-made tunnels probably associated with a medieval castle at Reigate, the district seat, were used as air raid shelters and for storage during World War II. Pop. (1984 est.) 117,000.

Reign of Terror (France): *see* Terror, Reign of.

Reilly, Sidney (George), original name SIGMUND ROSENBLUM (b. March 24, 1874, Odessa, Ukraine, Russian Empire—d. Nov. 25, 1925, Moscow?), spy who obtained Persian oil concessions and German naval secrets for Britain. Many of the romanticized stories about him may have been inventions of his own.

Born the illegitimate son of a Jewish doctor in Odessa, he studied chemistry in Vienna (1890–93) before going to Brazil. There he befriended British Army officers in the Amazon and was recommended to British intelligence in London (1896). He changed his name to Sidney George Reilly in 1899.

Attached to Britain's Secret Intelligence Service, he allegedly over the years reported on Russian oil developments at Baku, the progress of the Trans-Siberian Railroad, Dutch aid to the South African Boers (1899), oil developments in Persia (1902), and Russian naval fortifications in Port Arthur, Manchuria. In 1905, as the story goes, he disguised himself as a priest on the French Riviera and inveigled the Persian oil-concession holder, William Knox D'Arcy, into selling oil concessions to Britain against fierce French competition, greatly benefiting Britain's future energy supplies.

As manager of a German shipbuilder's agency in St. Petersburg, Russia, he seems to have gained access to details of Germany's five-year naval-development plan, which he reported to London over a three-year period prior to the outbreak of World War I. In New York City from 1914, he bought munitions and helped counter German sabotage of American factories supplying the Allies. Returning to Europe, he made frequent missions behind the German lines, on one occasion (by his own account) attending a General Staff meeting in the presence of Kaiser William II.

In May 1918 Reilly went to Moscow, intent on toppling the Bolshevik regime, but his plans were betrayed, and he had to flee. He is thought to have made a series of other trips to Russia, and in September 1925 he crossed the Russian frontier once more, but he was arrested and reportedly executed.

Reimarus, Hermann Samuel (b. Dec. 22, 1694, Hamburg—d. March 1, 1768), German philosopher and man of letters of the Enlightenment who is remembered for his Deism, the doctrine that human reason can arrive at a religion more certain than religions based on revelation.

Appointed professor of Hebrew and Oriental languages at the Hamburg *Gymnasium,* or preparatory school, in 1727, Reimarus made his house a cultural centre and meeting place for learned and artistic societies. His first important philosophical work was *Abhandlungen von den vornehmsten Wahrheiten der natürlichen Religion* (1754; "Treatises on the Principal Truths of Natural Religion"), a Deistic discussion of cosmological, biological–psychological, and theological problems. In *Die Vernunftlehre* (1756; "Doctrine of Reason") he combated traditional Christian belief in revelation.

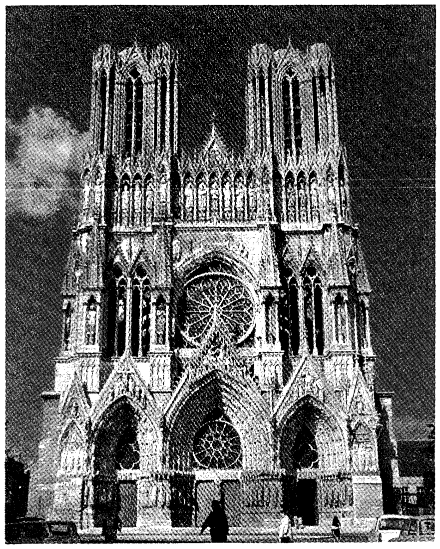
Reimarus' major work, *Apologie oder Schutzschrift für die vernunftigen Verehrer Gottes* ("Apologia or Defense for the Rational Reverers of God"), required 20 years to complete and was deliberately left unpublished until after his death. Gotthold Lessing obtained

Reimarus, copperplate engraving by Christian Fritzsch, 1752
Archiv fur Kunst und Geschichte, West Berlin

fragments of the work from Reimarus' children for publication under the title *Wolfenbütteler Fragmente* in his own *Zur Geschichte und Literatur* (1774 and 1777). The appearance of the fragments aroused a controversy known as the *Fragmentenstreit* (German *Streit,* "quarrel") that provoked both liberal and conservative criticism. Other fragments were published by several writers between 1787 and 1862, occasionally under pseudonyms.

Reimarus also became known for his treatment of the life of Jesus. Jesus, he claimed, was a mere human afflicted by messianic illusions; after his death his body was stolen and hidden by his disciples to maintain his resurrection. Reimarus consistently denied miracles except for creation itself and claimed that the ethical doctrines necessary for the survival of human society were accessible to reason without the aid of revealed principles.

Reims, also spelled RHEIMS, city, Marne *département,* Champagne-Ardenne region, northeastern France, east-northeast of Paris. On the Vesle River, a tributary of the Aisne, and the Marne–Aisne canal, the city is situated in vine-growing country in which champagne wine is produced. It is overlooked from the



The cathedral of Notre-Dame, Reims, Fr.
Paul Almasy

southwest by the Montagne de Reims. The 13th-century cathedral of Notre-Dame, greatly damaged during World War I but admirably restored, ranks as one of the most beautiful Gothic churches in France. Although its building took more than a century, it has a remarkable unity of style. It has a harmonious facade with graceful and expressive statues;

fine 13th-century stained-glass windows (restored); and a collection of reliquaries. The basilica and abbey of Saint-Rémi, begun in the 11th century, was also damaged in World War I, but its interior, with a narrow nave, an early Gothic choir, and 12th-century windows, is still striking. An imposing 3rd-century triumphal arch is one of the city's few remains dating from Roman times.

Reims has a good road network, and its river port is one of the most important in France. Together with Épernay, it forms the industrial centre of the champagne wine district. The wine is stored in large cellars tunneled in the chalk that underlies the district. The nature of the soft stone, however, has led to collapse of some surface structures into the caves, endangering the town's architectural heritage. Other industries include the manufacture of aircraft and automobile equipment, food processing, and clothing manufacturing. The university was established in 1962.

The Gallic tribe of the Remi (from which Reims derives its name) was conquered without difficulty by the Romans, and the town flourished under their occupation. In the 5th century, Clovis, the Frankish king, was baptized at Reims by Bishop Remigius (Rémi), and in memory of this occasion most French kings were subsequently consecrated there. (Charles VII, for example, was crowned there in 1429 in the presence of Joan of Arc.) The traditional wool industry was stimulated in the 17th century by King Louis XIV's finance minister, Jean-Baptiste Colbert, who was a native of Reims. During World War I, the town was occupied briefly by the Germans in their offensive of September 1914, and after evacuating it they held the surrounding heights, from which they subjected the city to intermittent bombardment during the next four years. In World War II Reims was again almost completely destroyed, although the cathedral escaped damage. The act of Germany's capitulation in World War II was signed at Reims in May 1945. Pop. (1982) 176,419.

Reims-Douai Bible: *see* Douai-Reims Bible.

rein orchid, also called REIN ORCHIS, FRINGED ORCHID, or FRINGED ORCHIS, any of about 100 species of terrestrial orchids of the genus *Habenaria,* family Orchidaceae, found in grasslands, bogs, forests, and sand dunes in

Rein orchid (*Habenaria*)
Clarence Postmus—Root Resources

subtropical and warm temperate areas of both hemispheres. All rein orchids have a spur at the base of the flower lip. In many species, the lip is fringed.

Rein orchid roots are tuberous or fleshy. A bud forms on one root and grows slowly for a year. The old plant then dies, and the bud becomes a mature plant in its second season. North American species of *Habenaria* are usually known as fringed orchids and bog orchids.

reincarnation, also called TRANSMIGRATION, or METEMPSYCHOSIS, in religion and philosophy, rebirth of the soul in one or more successive existences, which may be human, animal, or, in some instances, vegetable. While belief in reincarnation is most characteristic of Asian religions and philosophies, it also appears in the religious and philosophical thought of primitive religions, in some ancient Middle Eastern religions (*e.g.,* the Greek Orphic mystery, or salvation, religion), Manichaeism, and Gnosticism, as well as in such modern religious movements as theosophy.

In primitive religions, belief in multiple souls is common. The soul is frequently viewed as capable of leaving the body through the mouth or nostrils and of being reborn, for example, as a bird, butterfly, or insect. The Venda of southern Africa believe that, when a person dies, the soul stays near the grave for a short time and then seeks a new resting place or another body—human, mammalian, or reptilian.

Among the ancient Greeks, Orphism held that a preexistent soul survives bodily death and is later reincarnated in a human or other mammalian body, eventually receiving release from the cycle of birth and death and regaining its former pure state. Plato, in the 5th–4th century BC, believed in an immortal soul that participates in frequent incarnations.

The major religions that hold a belief in reincarnation, however, are the Asian religions, especially Hinduism, Jainism, Buddhism, and Sikhism, all of which arose in India. They all hold in common a doctrine of karma ("act"), the law of cause and effect, which states that what one does in this present life will have its effect in the next life. In Hinduism the process of birth and rebirth—*i.e.,* transmigration of souls—is endless until one achieves moksha, or salvation, by realizing the truth that liberates—*i.e.,* that the individual soul (atman) and the absolute soul (Brahman) are one. Thus, one can escape from the wheel of birth and rebirth (samsara).

Jainism, reflecting a belief in an absolute soul, holds that karma is affected in its density by the deeds that a person does. Thus, the burden of the old karma is added to the new karma that is acquired during the next existence until the soul frees itself by religious disciplines, especially by ahimsa ("nonviolence"), and rises to the place of liberated souls at the top of the universe.

Although Buddhism denies the existence of an unchanging, substantial soul, it holds to a belief in the transmigration of the karma of souls. A complex of psycho-physical elements and states changing from moment to moment, the soul, with its five skandhas ("groups of elements")—*i.e.,* body, sensations, perceptions, impulses, and consciousness—ceases to exist; but the karma of the deceased survives and becomes a *vijñāna* ("germ of consciousness") in the womb of a mother. This *vijñāna* is that aspect of the soul reincarnated in a new individual. By gaining a state of complete passiveness through discipline and meditation, one can leave the wheel of birth and rebirth and achieve nirvana, the state of the extinction of desires.

Sikhism teaches a doctrine of reincarnation based on the Hindu view but in addition holds that, after the Last Judgment, souls—which have been reincarnated in several existences—will be absorbed in God.

reindeer, also called CARIBOU (*Rangifer*), Arctic deer, family Cervidae (order Artiodactyla), domesticated in some polar regions. Reindeer until recently ranged from Spitsbergen and Scandinavia to eastern Siberia. They are also native to North America and are divisible into two types: the northern, or barren ground, caribou of the tundra and taiga, and the woodland caribou of Canadian forests. Both types of reindeer are game animals valued for meat, hide, and antlers. Sportsmen recognize

Caribou bull (*Rangifer*)
Jen and Des Bartlett—Bruce Coleman Inc./EB Inc.

a third type, mountain caribou. Some authorities consider all reindeer to be a single species, *R. tarandus;* others assign them to several separate species.

Reindeer differ from all other living deer in that both sexes have antlers; those of the females are smaller and simpler. The antlers themselves are long, with moderate branching on both the main beams and forwardly pointing brow tines. Reindeer stand 0.7–1.4 m (2.3–4.6 feet) at the shoulder and weigh as much as 300 kg (660 pounds). Small, domesticated races are about the size of donkeys. Stockily built animals, reindeer have large lateral hooves that allow the feet to spread on snow or soft ground. Colour varies from whitish to nearly black but in general is grayish or brownish with lighter underparts; the coat is thick and consists of hard, brittle outer hairs covering a dense underfur.

Reindeer are strong swimmers and are always found in herds, famous for their seasonal migration between summer and winter ranges. Their numbers are now greatly reduced. They breed in fall, and males fight fiercely for harems. One or two calves are born after gestation of seven and one half months. The staple winter food is a lichen (*Cladonia*), popularly called reindeer moss, which the animals reach by scraping the snow away with their feet. In summer the diet also includes grasses and saplings. The main enemies of reindeer are humans, wolves, lynx, and wolverines. The reindeer of the Lapps is kept as a draft and pack animal, for its meat and milk, and for its hide, used in tents, boots, and clothing. In Siberia reindeer are also used as pack animals and as mounts.

Reindeer Lake, lake in northern Canada, straddling the Saskatchewan-Manitoba border, near the northern limit of the coniferous forest. At an elevation of 1,106 feet (337 m), it is 2,568 square miles (6,650 square km) in area, 152 miles (245 km) long and up to 35 miles (56 km) wide, irregular in shape, and island-dotted. The lake is fed by numerous streams, and it drains southward over a control dam into the Reindeer River, a tributary of the Churchill. An important transportation link in fur-trade days, it is now a major commercial- and sport-fishing lake. Riparian settlements include Brochet (Manitoba) and Southend and Kinoosao (Saskatchewan); the last is connected to the mining town of Lynn Lake, Manitoba, by road.

reindeer moss (*Cladonia rangiferina*), a fruticose (bushy, branched) lichen found in great abundance in Arctic lands. It is an erect, many-branched plant that grows up to eight centimetres high, covers immense areas, and serves as pasture for reindeer, moose, caribou, and musk-oxen. In Scandinavia it has been used in the manufacture of alcohol, but difficulties in obtaining reindeer moss arise because of its slow growth rate (three to five millimetres per year). Its periods of most rapid growth are spring and fall when high humidity and cool temperatures prevail.

reindeer sacrifice, magico-religious practice observed by various Upper Paleolithic and Mesolithic northern European and Asian peoples. The rite, which inaugurated their annual hunting season, consisted primarily of submerging a young doe in a lake or pond or burying it in the ground in sacrifice to their god of the hunt. The submerging or burial of these reindeer may indicate that prehistoric man believed that the god of the hunt resided underground. Other personal possessions often were found to have been thrown into the water or buried near the reindeer, probably the results of daily sacrificial acts. On special occasions, Mesolithic hunters set up the skull and antlers of an older reindeer on a ritual pole at the edge of the pool of sacrifice.

Reinecke, Carl (Heinrich Carsten) (b. June 23, 1824, Altona, near Hamburg—d. March 10, 1910, Leipzig), German pianist, composer, conductor, and teacher who sought, in his works and teaching, to preserve the Classical tradition in the late 19th century.

After study with his father he made several concert tours. He taught counterpoint and piano at the Cologne Conservatory (1851–54), and was music director first at Barmen (1854–59), then at Breslau University (1859–60). He held the important posts of conductor of the Gewandhaus Orchestra (1860–95) and teacher of piano and composition at the Leipzig Conservatory from 1860, while he continued to make annual concert tours. He became the Conservatory's director in 1897. He was one of the most influential musicians of his time, counting among his students Grieg, Hugo Riemann, Arthur Sullivan, and Felix Weingartner. He wrote works for orchestra (symphonies, overtures, concertos), piano, and voice, as well as chamber music and works for the stage.

Reiner, Fritz (b. Dec. 19, 1888, Budapest—d. Nov. 15, 1963, New York City), Hungarian-born U.S. conductor known for his technical precision and control, both in symphonic music and opera. He is especially known for his work with the Chicago Symphony Orchestra, of which he was music director from 1953 to 1962.

Reiner studied at the Budapest Royal Academy of Music, was associated with various small European opera houses, and (1914–21) was conductor of the Dresden Royal Opera. He went to the United States as principal conductor of the Cincinnati (Ohio) Symphony (1922–31) and from 1931 to 1941 was head of the opera and orchestral departments at the Curtis Institute of Music in Philadelphia.

Before going to Chicago he was music director of the Pittsburgh Symphony (1938–48) and of the Metropolitan Opera (1948–53). Despite his despotic approach to orchestras, he was respected by orchestra members for his musicianship and mastery of conducting. He especially excelled in performances of works by German classical and Romantic composers, notably Brahms and Richard Strauss.

Reinhard, Hans (b. Feb. 20, 1755, Zürich—d. Dec. 23, 1835, Zürich), statesman and burgomaster of Zürich who headed the federal government six times and led the Swiss delegation at the Congress of Vienna (1814–15).

Before 1802 Reinhard had occupied only local political offices: secretary of state for Zürich (1787–95), bailiff for the town of Baden (1795–98), member (1796–1801), then president (1800–01), of the new municipal government of Zürich under the Helvetic Republic. Delegated by Zürich to Paris to discuss with Napoleon the problem of Swiss federal reorganization in November 1802, he subsequently signed the Act of Mediation (Feb. 19, 1803), which marked a return to a national confederate model of government after the unitary experiment of the Helvetic Republic.

During the period of French domination, Reinhard was twice *Landammann* (chief executive) of Switzerland (1807, 1813) and four times president of the Swiss Diet after liberation (1814–1815, 1816, 1822, 1828). Between 1803 and 1830 he was named burgomaster of Zürich each biennium and concurrently served on the cantonal council. With the fall of Napoleon impending, he convoked a national Diet at Zürich (October 1813), which provided the groundwork for the future independent confederation. He headed the official Swiss delegation to the Congress of Vienna, at which he championed the cause of a fully independent Switzerland.

Reinhardt, Ad(olf Frederick) (b. Dec. 24, 1913, Buffalo—d. Aug. 30, 1967, New York City), U.S. painter who sought to remove all self-expression, content, and meaning from his work by restricting it to monochrome canvases. He greatly influenced the Minimal artists of the 1960s.

Reinhardt first became interested in art as a young child while copying comic strips from newspapers, and he continued to make caricatures throughout most of his career. His first paintings exhibit a style based on brightly coloured geometric designs evenly distributed over the canvas. By the early 1950s, however, he had restricted his works to monochrome paintings—at first red, later blue, and finally black—incorporating only barely perceptible abstract images in an effort to eradicate all content and meaning from his work.

Reinhardt influenced the subsequent course of painting probably more through his activities as a polemicist than as a painter. In 1957 he published "Twelve Rules for a New Academy," urging painters to avoid the use of texture, brushwork, drawing forms, design, colour, light, space, time, scale, movement, and subject. In his own work, such aesthetics led him to the virtual abandonment of easel painting as an art form, a fact he underscored by titling his last works "Ultimate Paintings." *The Selected Writings of Ad Reinhardt* was published in 1976.

Reinhardt, Django, original name JEAN-BAPTISTE REINHARDT (b. Jan. 23, 1910, Liberchies, Belg.—d. May 16, 1953, Fontainebleau, Fr.), guitarist who is generally considered one of the few European jazz musicians of true originality.

Django Reinhardt, 1947
By courtesy of *down beat* magazine

Reinhardt, who was of gypsy parentage, travelled through France and Belgium as a boy and young man learning to play the violin, guitar, and banjo. The loss of the use of two fingers of his left hand after a caravan fire in 1928 did not impair his remarkable aptitude for the guitar. In 1934 he became co-leader, with violinist Stéphane Grappelli, of the Quintette du Hot Club de France, a group whose many records are greatly prized by connoisseurs. In his only U.S. visit, in 1946, Reinhardt toured with the Duke Ellington orchestra.

For most of his career Reinhardt played in the swing style that reached its peak of popularity in the 1930s. Perhaps his most lasting influence on jazz was the introduction of solos based on melodic improvisation, at a time when guitarists generally played chorded solos. His inimitable improvisations, particularly those in slow tempos, were often a curious but beguiling blend of gypsy and jazz sounds. Among his guitar compositions transposed into orchestral works are "Nuages" and "Manoir des mes rêves." A biography by C. Delauney, *Django Reinhardt,* was published in 1961.

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

Reinhardt, Max, original name MAX GOLDMANN (b. Sept. 9, 1873, Baden, near Vienna—d. Oct. 31, 1943, New York City), one of the first theatrical directors to achieve widespread recognition as a major creative artist, working in Berlin, Salzburg, New York City, and Hollywood. He helped found the annual Salzburg Festival.

Max Reinhardt
By courtesy of the Theatre Collection, The New York Public Library at Lincoln Center, Astor, Lenox and Tilden Foundations

Discovery of the theatre. Reinhardt was the oldest of the seven children born to Wilhelm and Rose Goldmann, an orthodox Jewish couple. With his equally introverted only brother, Edmund, young Max played long hours with puppets and from their balcony watched the real puppets in the streets.

Though his parents were remote from theatrical life, they were sympathetic to his fascination with the actors of the Vienna Burgtheater, and, at the urging of one of these, they allowed their son to exchange his boredom as a bank clerk for the excitement of drama school. Although he proved to be an inhibited actor, needing a beard and heavy makeup to release his talents, Reinhardt won local fame and friends in Salzburg. In 1894 he succumbed to an invitation from Otto Brahm, who had brought the drama of Henrik Ibsen to Germany, to join his Deutsches Theater in Berlin. He had assumed the stage name Reinhardt some time prior to moving to Berlin.

Reinhardt learned much from Brahm but was never wholeheartedly committed to the naturalism of his productions. He tired of "sticking a beard . . . and eating noodles and sauerkraut on stage every night," which latter activity was required by Brahm's notion of realism, in which nothing was to be simulated. This was not to be his direction in theatre. Quick to make friends despite his shyness, he met other young artists in cafés. From their gatherings there emerged a lighthearted revue, *Schall und Rauch* (*Sound and Smoke*), to which Reinhardt contributed sketches. Playing before invited audiences, it was so successful that it was transformed into a serious work and settled into the Kleines Theater in 1902. He planned a full season and directed his first play, Oscar Wilde's *Salome*.

Career in full flower. Reinhardt exhibited his ability to make the right contact at the right time when he produced 14,000 marks to placate Brahm, who was furious over his breach of contract. He took over the Neues Theater in 1903, and his career moved ahead rapidly. By the end of 1904, he had directed 42 plays, but his early landmark of genius was the production in 1905 of William Shakespeare's *A Midsummer Night's Dream*. Reinhardt's staging was swift, light, and joyous, capturing for audiences the theatrical brilliance that had been buried for so long beneath productions devoted to a ponderous, reverent delivery of Shakespeare's words.

The young director became famous overnight. Offered the artistic directorship of the Deutsches Theater, he would settle for nothing less than ownership. He purchased it for 1,000,000 marks, and at age 32 he had reached the pinnacle of his profession. He completely rebuilt the theatre, introducing the latest technological innovations in scenic design, and started a school. Purchasing a tavern next door, Reinhardt remodeled it into a small theatre for plays that needed intimacy with the audience. He summarized his new concept in theatre with the word *Kammerspiele,* "chamber plays."

In his success, Reinhardt remained close to his family. He brought his brother, Edmund, who suffered from depressions, to Berlin and acted almost as his psychiatrist, setting him to work in the theatre to regain his confidence. Beginning in 1907, the Deutsches Theater toured throughout Europe and the United States. The production of *The Miracle,* which premiered in 1911 in London and played subsequently in New York City and European cities, was Reinhardt's most spectacular work and, at the same time, probably the most characteristic. Reinhardt was fascinated by the sensuous quality of Roman Catholic rites and Gregorian chants. *The Miracle,* a work involving more than 2,000 actors, musicians, dancers, and other personnel and without dramatic dialogue, was a modern-day reunification of drama and ritual. It was pure theatre in the most archetypal sense.

If in *The Miracle* he re-created an ancient unity, Reinhardt was equally important in giving new life to many of the great dramas from the theatre's past. His staging of Sophocles' *Oedipus Rex* in 1910 initiated the first large-scale revival of classical Greek drama in more than 2,000 years. During the 1913–14 season he mounted new productions of 10 of the 22 Shakespearean plays he had directed, using few, or no, settings and creating a major Shakespearean revival. In 1911 he brought a modern point of view to opera with his direction of the premiere of Richard Strauss's *Rosenkavalier,* with a libretto by Hugo von Hofmannsthal. After many years he succeeded in helping to establish the Salzburg Festival, staging Hofmannsthal's *Jedermann* (*Everyman*) in the city's cathedral square in 1920. With his support the Salzburg Festival became an annual event, bringing about a new interest in the dramas of the European Middle Ages from which *Jedermann* was adapted.

Return home and exile. Reinhardt had continued his work throughout World War I with no lessened sense of duty toward his art and his audience. In 1920, save for occasional engagements, he gave up direction of the Deutsches Theater. Retiring to a castle that he had purchased in Austria, he attempted to find in his native country the regard he had been accorded abroad. His home was a meeting place for international celebrities, but enemies prevented him from feeling at home in his hometown. He commuted in a circuit of Berlin, Vienna, and Salzburg. When the Nazis assumed power in Germany in 1933, Reinhardt was luckily abroad. In a letter to the Nazi government that was a typical blend of conceit, irony, rejection of politics, and prophetic perception, he left his theatrical empire to the German people. The era of private management of such institutions as the theatre is past, he wrote, and he foresaw that in the future it would be impossible to manage any such cultural undertakings without state backing.

After further work in Europe, Reinhardt moved to the United States in 1938. He opened a workshop in Hollywood, where he had made a film of *A Midsummer Night's Dream* in 1934–35. His staging of *Everyman* in modern dress was followed by an unrealized plan for an all-black production of it. The final years of his life were filled with lesser fortunes and poor health, and he died speechless.

Assessment. A man of few words and little inclination or ability to develop or expound a dramatic theory, Reinhardt was a pragmatist whose instinctual feelings for the rightness of things transformed theatrical production in the 20th century. Before him, the idea of the director as a creative artist in his own right had been barely embryonic. With his work, the director emerged as the dynamic formative mind behind the production of a dramatic work.

Like the plots of the tragedies he so loved, Reinhardt's life was a rise to the heights of success and a fall to a life of uprooted exile. With his first wife, Else Heims, a beautiful and sensual actress, he had two sons. His second wife, Helene Thimig, was also a beautiful actress but, like Reinhardt, a shy person moved by an immense inner force and alive with conflicting appearances. He was an introvert capable of extreme extroversion and Falstaffian laughter. He disliked sentimentality in others yet was himself filled with romantic sentiments, a combination of Viennese sensitivity and German discipline with cosmopolitanism. His work summed up all theatre before him and opened new vistas for the theatre that followed. (Ho.I.P.)

BIBLIOGRAPHY. Huntly Carter, *The Theatre of Max Reinhardt* (1914, reissued 1964), attempts to define the nature of Reinhardt's work. Oliver M. Sayler (ed.), *Max Reinhardt and His Theatre* (1924, reprinted 1968), contains personal accounts, profusely illustrated, and a chronology of his productions. Gottfried Reinhardt, *The Genius: A Memoir of Max Reinhardt* (1979), by his son, offers both personal recollections and a look at the contemporary cultural milieu. J.L. Styan, *Max Reinhardt* (1982), surveys his work.

Reinheim, small village near Saarbrücken in Saarland, Ger. It is particularly famous for an unusually rich Celtic grave found there in 1954. The grave, which may have belonged to local princesses, is one of the most notable of the Early La Tène burials (*see* La Tène). Within the wooden funerary chamber were found numerous bronze and gold objects, including bracelets, rings, neck torcs, and a variety of other accessories such as flagons and masks. The grave and its contents, which probably date from the early 4th century BC, indicate that Celtic women were able to attain positions of wealth and honour.

Reinkens, Joseph Hubert (b. Jan. 3, 1821, Burtscheid, Prussia [now Aachen, Ger.]—d. April 1, 1896, Bonn, Ger.), German bishop, historical scholar, and a leader of the Old Catholics (Altkatholiken), a dissident group that separated from the Roman Catholic church because of opposition to the doctrine of papal infallibility pronounced by the First Vatican Council (1869–70). After his excommunication by Rome, Reinkens joined in the promulgation of the Nuremberg Declaration (1871), the constitution of the Old Catholic church in Germany, and was elected its first bishop.

Reinmar VON HAGENAU, byname REINMAR THE ELDER, German REINMAR DER ALTE (d. *c.* 1205), German poet whose delicate and subtle verses constitute the ultimate refinement of the classical, or "pure," minnesang (Middle High German love lyric).

A native of Alsace, Reinmar became court poet of the Babenberg dukes in Vienna. Among his pupils was Walther von der Vogelweide, who later became his rival. The purity of Reinmar's rhymes, the evenness of his rhythms, and the fastidious taste that rejected any phrase or emotion that might offend courtly sensibilities made him idolized by his contemporaries as the "nightingale" of his day. His constant theme was unrequited love. Of the numerous songs attributed to him, only 30 are now considered authentic.

Reinsurance Treaty (June 18, 1887), a secret agreement between Germany and Russia arranged by the German chancellor Otto von Bismarck after the collapse of the German-Austrian-Russian Dreikaiserbund, or Three Emperors' League, in 1887 because of competition between Austria-Hungary and Russia for spheres of influence in the Balkans. The treaty provided that each party would remain neutral if the other became involved in a war with a third great power and that this would not apply if Germany attacked France or if Russia attacked Austria. Bismarck showed the Russian ambassador the text of the German-Austrian alliance of 1879 to drive home the last point. Germany paid for Russian friendship by agreeing to the Russian sphere of influence in Bulgaria and Eastern Rumelia (now part of southern Bulgaria) and by agreeing to support Russian action to keep the Black Sea as its own preserve. When the treaty was not renewed in 1890, a Franco-Russian alliance rapidly began to take shape.

Reis, Johann Philipp (b. Jan. 7, 1834, Gelnhausen, Hesse-Kassel [Germany]—d. Jan. 14, 1874, Friedrichsdorf, Ger.), German physicist who constructed the first electric telephone.

Reis was educated at Frankfurt am Main, became a merchant for a few years, and in 1858 began teaching in Friedrichsdorf. While there he experimented with electricity and worked on the development of hearing aids. This research led to his interest in the electrical transmission of sound. By 1861 Reis had designed a telephone capable of transmitting musical tones. This early attempt to convert acoustic energy to electrical energy and back again was further advanced by Alexander Graham Bell, who solved the problem of the electric transmission of speech by 1876.

Reischauer, Edwin O(ldfather) (b. Oct. 15, 1910, Tokyo, Japan—d. Sept. 1, 1990, La Jolla, Calif., U.S.), American historian, diplomat, and educator and a leading expert on Asian, particularly Japanese, affairs.

Reischauer was born in Japan to American missionary parents. Living there until the age of 17, he gained complete fluency in the Japanese language, as well as an intimate knowledge of Japanese culture and customs. Returning to the United States for further schooling, he attended Oberlin College (B.A., 1931) and Harvard (M.A., 1932). He did postgraduate work at the Sorbonne (1933–35), at the universities of Tokyo (1935–36) and Kyōto (1937–38), and in China. He received his Ph.D. in Far Eastern languages from Harvard in 1939. An instructor at Harvard from 1939 to 1942, he then worked for the War Department (1942–43) and U.S. Military Intelligence (1943–45). After the war he worked with the State Department in the Office of Far Eastern Affairs. He returned to Harvard as a professor of Far Eastern languages (1946–50) but was soon made a professor of Japanese history (1950–61, 1966–81) and achieved national acclaim as an educator.

Long an outspoken critic of U.S. cultural ignorance of Asia, especially of Japan, which he felt was of central importance to the West, Reischauer produced scholarly works and conducted educational seminars that were directed at improving U.S. cultural understanding of Japan. This failure to understand Asian affairs, he contended, led directly to U.S. political failures in the area. The academician had a chance to put his theories into practice when, in 1961, Pres. John F. Kennedy appointed him ambassador to Japan in the wake of the riots that had greeted the U.S.–Japan Mutual Security Treaty of 1960. His appointment was an enormous success, owing in no small measure to his personal popularity with the Japanese. By the time that he resigned (1966), he had done much to improve relations between the two countries.

Reischauer wrote many books, including translations of Chinese and Japanese works. Among his works are *East Asia: The Great Tradition* (1960; with John King Fairbank), a work regarded as a classic; *The Modern Transformation* (1965); *Japan, The Story of a Nation* (1970; rev. ed. 1981); *The Japanese* (1977); and *Japan Society 1907–1982* (1982).

Reiske, Johann Jakob (b. Dec. 25, 1716, Zörbig, Prussia—d. Aug. 14, 1774, Leipzig), preeminent 18th-century European scholar of Arabic literature whose commentary to his *Abulfedae Annales Moslemici,* 5 vol. (1754; "Abulfeda Muslim Annals"), laid the foundation for Arabic historical scholarship.

Reiske was esteemed by his sovereign Frederick the Great, by the German dramatist and critic Gotthold Lessing, and by many foreign scholars, but seems to have provoked animos-

Reiske, engraving, 1770
Archiv fur Kunst und Geschichte, West Berlin

ity from patrons and potential colleagues and was confined to poorly paid literary hackwork until given a rectorate at Leipzig (1758). Reiske was as steeped in Greek literature, including Byzantine, as he was in Arabic and prepared many voluminous editions, among them one of Plutarch (1774–79). His Greek commentaries, however, are considered to outweigh the editions in importance. He is also credited with establishing the science of Arabic numismatics.

Reisner, George Andrew (b. Nov. 5, 1867, Indianapolis, Ind., U.S.—d. June 6, 1942, Cairo), U.S. archaeologist who directed many excavations in Egypt and Nubia (Nilotic Sudan) and discovered the tomb of Queen Hetepheres, mother of King Khufu (Cheops), builder of the Great Pyramid at Giza.

Reisner served with an international group of experts in classifying the great Egyptology collection of the Egyptian Museum in Cairo (1897–99). From 1899 to 1905 he led the Hearst Expedition of the University of California, exploring predynastic and early dynastic burial grounds at Qift and elsewhere and editing *The Hearst Medical Papyrus* (1905). As assistant professor (1905–14) and professor (1914–42) of Egyptology at Harvard and curator of the Egyptian collection at the Boston Museum of Fine Arts (1910–42), he conducted studies for both institutions.

He also directed the archaeological survey of Nubia for the Egyptian government (1907–09). At Giza he explored mastaba (truncated-pyramid) tombs and the pyramid of Menkaure (Mycerinus), discovered many sculptures of the king, and wrote *Mycerinus* (1931). He and his staff were able to reconstruct numerous pieces of wooden furniture with gold and faience inlays from the tomb of Queen Hetepheres. In Nubia (1916–23) he explored the pyramids of Meroe and dug out the temple at Napata and the tombs of the 25th (Nubian) dynasty of Egypt. His final published work was *A History of the Giza Necropolis* (1942).

Reith (of Stonehaven), John Charles Walsham Reith, 1st Baron (b. July 20, 1889, Stonehaven, Kincardineshire, Scot.—d. June 16, 1971, Edinburgh), a principal architect of the modern pattern of publicly owned but independent corporations in Great Britain.

During World War I Reith was engaged in the United States with the supply of munitions to the United Kingdom. As general manager of the British Broadcasting Company (BBC) from 1922 and director general from 1927 to 1938, he developed radiobroadcasting throughout the British Isles and inaugurated the empire shortwave broadcasting service and the first regular high-definition television service in the world (1936). He was knighted in 1927.

In 1938 Reith became chairman of Imperial Airways Ltd. and the following year merged it with British Airways, forming the British Overseas Airways Corporation (BOAC), of which he became chairman. He was made a peer in 1940. During World War II he held ministerial and other appointments and was director of Combined Operations Material at the Admiralty (1943–45). As chairman of the new Commonwealth Telecommunications Board (1946–50), he reorganized the cable and wireless system of the Commonwealth. From 1950 to 1959 he was chairman of the Colonial Development Corporation and served on other commercial and industrial boards. He was lord rector of Glasgow University (1965–68) and lord high commissioner to the General Assembly of the Church of Scotland (1967–68). His autobiography, *Into the Wind* (1949), was followed by *Wearing Spurs* (1966).

In the peerage, Reith was succeeded by his son, Christopher John, who, however, disclaimed the title in 1972.

Reitsch, Hanna (b. March 29, 1912, Hirschberg, Ger.—d. Aug. 24, 1979, Frankfurt am Main), aviator who was the leading female German pilot in the 20th century.

Reitsch originally trained in the 1930s as a flying missionary. She became the first German woman to win a captain's license, the first female helicopter pilot, and the first female test pilot in her country. In World War II she served as a test pilot for all types of German aircraft, including the rocket-firing jet fighter Me 262 and the prototype for the V-1 rocket. She did everything but fly combat missions during the war and was the first German woman to be awarded the Iron Cross (1942). Assigned to a voluntary suicide squad of aviators near the end of the war, Reitsch was one of the last persons to see Hitler alive in the underground bunker in Berlin, and she flew the last German warplane out of Berlin in late April 1945. She was then captured by the U.S. Army and interned for 15 months, during which time she gave detailed testimony as to the "complete disintegration" of Hitler's personality that she had observed during her time spent in the Berlin bunker.

Reitsch eventually set more than 40 endurance and altitude records for powered and motorless flight. She was the first person to fly a glider over the Alps, and her last gliding record was made in the United States in 1979. From 1962 to 1966 she directed the national school of gliding in Accra, Ghana. She published an autobiography entitled *Fliegen, mein Leben* (1951; *Flying Is My Life*).

Reiyū-kai (Japanese: Association of the Friends of the Spirit), Japanese lay religion based on the teachings of the Nichiren school of Buddhism. The Reiyū-kai was founded in 1925 by Kubo Kakutarō, a carpenter, and Kotani Kimi, who took over its leadership in 1944 on the death of Kubo. It achieved its peak of influence during the years before and after World War II and was the parent organization for seven new religions that subsequently split off from it, the most successful of these being the Risshō-Kōsei-kai.

The Reiyū-kai stresses devotion to ancestors and the efficacy of the *honzon* (the diagram of the name of the *Lotus Sūtra,* the central scripture of Nichiren Buddhism). The Reiyū-kai has no clergy but relies on volunteer lay teachers who lead informal discussion groups (*hōza*) that meet in members' homes.

Reizei Saburō (Japanese painter): *see* Okada Tamechika.

Rejang, also spelled REDJANG, tribe inhabiting Bengkulu province, southern Sumatra, Indonesia, on the upper course of the Musi River. Of Proto-Malay stock and numbering about 238,000 in the late 20th century, they speak a Malayo-Polynesian dialect called Rejang, whose written form is of Indian origin, predating Islāmization and its introduction of Arabic characters. Organized into four major patriclans having a common mythical origin, the Rejang belong to localized, kin-based communities. In addition, village communities, each led by an elected headman, today belong to regional committees, each with an elected chief recognized by the Indonesian administration. Rejang relationships are determined by alternating unilateral kinship, in which the form of marriage determines whether a child will belong to his mother's or father's clan. Patrilineal kinship is slightly more common; an illegitimate child belongs to neither parental clan. Marriage is clan exogamic; polygamy is no longer practiced.

The Rejang cultivate wet and dry rice, tobacco, and coffee. Some work in local gold and silver mines. Originally practicing animism, they have converted to Islām. Food and rice are still offered to venerated volcanos on certain occasions.

Rejlander, Oscar G(ustav) (b. 1813—d. Jan. 18, 1875, London), Swedish painter and photographer who, in his efforts to elevate photography to the status of an art, made photographs in imitation of the painting of the day.

Rejlander received his general education in Sweden, and he studied painting and sculpture in Rome. After considerable travel he settled in England and from 1853 practiced photography there. Many of his works achieved the painterly effect he sought by combination printing. His most famous work, "The Two Ways of Life," a sentimental allegory done in 1857, was made by combining more than 30 negatives. Shown in the Manchester Art Treasures Exhibition of 1857, the photograph was purchased by Queen Victoria for Prince Albert. A series of photographs of facial expressions and gestures made by Rejlander was used by Charles Darwin in his *Expression of the Emotions in Man and Animals* (1872). Although he had a period of critical acclaim, he died impoverished.

Rejment, Władysław Stanisław: *see* Reymont, Władysław Stanisław.

rejoneo, a form of bullfighting in which the principal fighter, the *rejoneador,* is mounted on a highly trained horse and uses a *rejón,* a short, broad blade fixed to a pole, to kill the bull. *Rejoneo* is sometimes called the Portuguese style, since fighting on horseback is a central feature of Portuguese bullfighting.

The *rejoneo* usually precedes the conventional fights in a program and follows a similar pattern. The bull is let into the ring and worked with a cape by the *rejoneador*'s assistant on foot. The *rejoneador* himself then leads the bull about the ring, performing daring and intricate feats of horsemanship while placing first the *rejones de castigo* and then the *banderillas* (barbed darts) in the shoulders and neck of the animal. This is similar to the performance of the picadors in a conventional fight, but the *rejoneador*'s horse wears no padding.

The horseman tries to work as close as possible to the bull's horns, which are often blunted but nevertheless quite dangerous, and still keep both his mount and himself from injury. The *banderillas,* similar to the barbed darts used in fights on the ground, are placed by leaning from the saddle with two in one hand or one in each hand. In the latter instance the horse is guided only by the horseman's knees. Occasionally the horseman will use a dart about 6 inches (15 cm) long, the *rejoncillo de la rosa,* so called because of a cloth rose at one end. It is placed by leaning far out of the saddle and reaching over the bull's horns, which pass very close to the horse—a dangerous and spectacular maneuver.

For the kill, *rejones de muerte* are used, with blades about twice the length of those used earlier. They are thrust between the bull's shoulder blades, just as the matador uses his sword. The kill from horseback is difficult, and the *rejoneador* or his assistant may be forced to finish the bull on the ground with sword and cape.

relapsing fever, infectious disease characterized by recurring fever symptoms and caused by spirochetes that have been given a number of conflicting genus and species designations: *Borrelia* (*Treponema*) *recurrentis* (*obermeieri, duttoni, et al.*). The spirochetes are transmitted from one person to another by lice of the genus *Pediculus* and from animals to humans by ticks of the genus *Ornithodoros.* The human disease has a sudden onset with violent febrile symptoms, which persist for about a week in cases contracted from lice and usually for a shorter period in the tick-transmitted disease. The attack ends by a crisis with profuse sweating, after which the patient is fairly well until, about a week later, febrile symptoms return. Additional relapses may follow—rarely more than one or two in the louse-borne disease but up to 12 (usually decreasing in severity) in cases contracted from ticks. The mortality is variable, ranging from nil in some tick-transmitted varieties to 6 percent or as high as 30 percent in some louse-borne epidemics associated with famine conditions. The spirochetes may invade the central nervous system and cause a variety of usually mild neurological symptoms.

Relapsing-fever spirochetes were the first microscopic organisms to be associated clearly with serious human disease. The German bacteriologist Otto Obermeier observed these organisms in the blood of relapsing-fever patients in 1867–68 and published his observations in 1873. They are easily seen in dark-field microscopic preparations of the patient's blood collected during the height of the febrile attack but disappear from the blood during the intervals between attacks. These observations, as well as the relapsing symptoms, have been related to changes in the immunological (antigenic) characteristics of the spirochetes, which cause each attack and relapse. As the patient develops immunity to the prevailing immunological type and recovers from the attack, a new (mutant) immunological type of the spirochete develops and produces the relapse. Because neither the bite nor the excreta of the louse is infectious, human infections usually result from crushing the louse on the skin while scratching.

The adult ticks may live and remain infectious for as long as five years without feeding. The spirochetes frequently invade the eggs of infected female ticks and survive in the body of the developing larvae and nymphs. All developmental stages of the tick, therefore, may transmit the infection by bite or otherwise.

Penicillin and other antibiotics have proved effective against the disease. Inadequate therapy commonly results in relapse after treatment, probably because of the persistence of live spirochetes in the brain, where the drug concentration does not reach curative levels. After treatment these protected spirochetes may reinvade the bloodstream.

relative aperture, the measure of the light-gathering power of an optical system. It is expressed in different ways according to the instrument involved. The relative aperture for a microscope is called the numerical aperture (NA) and is equal to the sine of half the angle subtended by the aperture at an object point times the index of refraction of the medium between the object and the objective lens. For binoculars, telescopes, and photographic lenses in which the object may be distant, the relative aperture is taken as the ratio of focal length of the objective to the diameter of the entrance pupil. The relative aperture of a camera lens is sometimes expressed as a simple ratio—*e.g.,* 1:4.5—or more commonly as its *f*-number, *f*/4.5. In either case, a lens of 180-millimetre focal length set at this relative aperture would have a pupil diameter (effectively, the lens diaphragm opening) of 40 mm.

relative density: *see* specific gravity.

relative humidity, ratio of the actual vapour pressure of water in the air to that in air saturated with water vapour; it is often expressed as a percentage. *See* humidity.

relativistic mass, in the special theory of relativity, the mass that is assigned to a body in motion. In physical theories prior to special relativity, the momentum p and energy E assigned to a body of mass m and velocity v were given by the formulas $p = mv$ and $E = E_0 + \frac{1}{2}mv^2$, where the value of the "rest energy" E_0 was undetermined. In special relativity the corresponding formulas for p and E, respectively, are $p = mv/\sqrt{(1 - v^2/c^2)}$ and $E = mc^2/\sqrt{(1 - v^2/c^2)}$, where c equals the speed of light (300,000 kilometres [186,000 miles] per second) and m is the "rest mass" of the body (*i.e.,* its mass as determined when the body is at rest). It is convenient for certain purposes to define the relativistic mass m_R of a body by the formula $m_R = m/\sqrt{(1 - v^2/c^2)}$. Then, for all velocities we have the simple formulas $p = m_R v$ and $E = m_R c^2$ for the momentum and energy of a body. The relativistic mass m_R becomes infinite as the velocity of the body approaches the speed of light, so, even if large momentum and energy are arbitrarily supplied to a body, its velocity always remains less than c.

relativity, in physics, the problem of whether and how physical laws and measurements change when considered by observers in various states of motion. Specifically the term appears in the work of the German physicist Albert Einstein, whose special theory of relativity (1905) and general theory of relativity (1916) are major milestones in the history of modern physics.

A brief treatment of relativity follows. For full treatment, *see* MACROPAEDIA: Relativity.

The classic illustration of relativity uses the example of a railway train in motion. Suppose a train is traveling in a straight line at 100 km per hour, relative to a fixed point on the ground, and that a passenger is walking forward through the train at 3 km per hour, relative to the train. What is the passenger's speed relative to a point on the ground? The obvious, almost intuitive, answer is 103 km per hour. In classical mechanics, quantities such as speed and distance may be transformed from one frame of reference to another, provided that the frames are in uniform motion with respect to one another, by very simple operations known as Galilean transformations. In electrodynamics, such is not the case.

If the passenger is replaced by a ray of light traveling through the train, the speed of the light ray with respect to a point on the ground is not simply the sum of its speed with respect to the train and the train's speed with respect to the ground; in fact, it is the same with respect to both frames of reference. The first empirical demonstration of this fact was made by A.A. Michelson and Edward Williams Morley in a famous set of experiments in 1887 that showed that the speed of light is the same in all directions and the same with respect to any frame of reference regardless of its state of motion. This startling fact has several important implications. Just as in Galilean transformations, there is no "true" or preferred frame of reference ("frame of absolute rest"). But in order for the speed of light in empty space to be the same for all unaccelerated observers, rather more complex operations are required to transform measures in one unaccelerated frame of reference to another frame; these operations, which involve explicit references to the speed of light, are called Lorentz transformations. They imply that clocks moving relative to an observer appear to be running more slowly than they do to an observer with respect to whom they are at rest. The dimensions of a moving object appear foreshortened in the direction of motion if the length is, for instance, determined by the time elapsed between the passages of two marks on the object past one point at rest relative to the observer.

These last effects are vanishingly small when speeds of everyday objects or even of most astronomical bodies are being considered, but they become significant—and have been confirmed—in the realm of subatomic particles. Such particles also exhibit another relativistic effect: as they are accelerated to an appreciable fraction of the speed of light, their mass increases. This effect derives from the limiting character of the speed of light, and it implies the most familiar conclusion of special relativity, the equivalence of matter and energy, expressed in the well-known formula $E = mc^2$, where the energy equivalent of a mass is equal to the mass times the speed of light squared.

Another implication of special relativity is that the universe must be thought of as a continuum with both spatial and temporal dimensions. In other words, in the space-time continuum, the notion of a purely spatial separation between events is ambiguous; any such distance will be measured differently by observers in different states of motion. Similarly, the time elapsed between two events will depend on the observer's motion and will not be a fixed datum. A measure of separation called interval, involving both spatial and temporal terms, will however, be invariant, *i.e.*, will be calculated to be the same by all observers regardless of motion.

These basic notions essentially comprise the special theory of relativity, which provides a framework for translating physical events and laws into forms appropriate for any frame of reference in uniform motion, or, as they are also called, inertial frames of reference. When the speeds involved are very small compared with the speed of light, the Lorentz transformations simplify to the Galilean formulas, and the laws of classical Newtonian mechanics hold sway.

The general theory of relativity addresses the problem of gravity and that of nonuniform, or accelerated, motion. In one of his famous thought-experiments, Einstein showed that it is not possible to distinguish between an inertial frame of reference in a gravitational field and an accelerated frame of reference. That is, an observer in a closed space capsule who found himself pressing down on his seat could not tell whether he and the capsule were at rest in a gravitational field, or whether he and the capsule were undergoing acceleration. From this principle of equivalence, Einstein moved to a geometric interpretation of gravitation. The presence of mass or concentrated energy causes a local curvature in the space-time continuum. This curvature is such that the inertial paths of bodies are no longer straight lines but some form of curved (orbital) path, and this acceleration is what is called gravitation.

Einstein was able to construct a single field equation capable of describing the curvature of space at and the energy or mass of any point in space-time. With each such point he associated a set of 10 functions—the metric tensor—that characterize the geometrical properties of space, including curvature, at the point, and a second set of 10—the energy-stress tensor—that specify the material contents of space at the point. This equation, together with the rule that freely falling bodies follow geodesic paths (essentially, the shortest distance between two points, which, where space-time is curved, is not a straight line), constitutes the general theory. With suitable simplifying assumptions, Einstein's field equation reduces to Newton's law of gravitation, which can be considered a special case for relatively slow speeds and weak fields.

The general theory has been confirmed experimentally in a number of ways. One of its predictions, that a ray of light passing near a very massive object such as the Sun will be bent, was confirmed as early as 1919, during a solar eclipse. It also succeeded in accounting for an anomaly in the motion of the planet Mercury that had defied explanation by Newtonian theory. Other predictions of the general theory that await complete confirmation include the existence of gravity waves and of black holes formed by the collapse of massive stars into extremely small, dense objects whose gravitational fields are so intense that not even light can escape.

relaxation phenomenon, in physics and chemistry, an effect related to the delay between the application of an external stress to a system and its response. It may occur in nuclear, atomic, and molecular systems.

A brief treatment of relaxation phenomena follows. For full treatment, *see* MACROPAEDIA: Chemical Reactions.

Chemists and physicists use relaxation effects to study processes that take only a fraction of a second. When an equilibrated nuclear, atomic, or molecular system is subjected to an abrupt physical change such as a sudden rise in temperature or pressure, it takes time for the system to re-equilibrate under the new conditions. This period, known as the relaxation time, can provide insights into atomic and molecular structures and into the rates and mechanisms of chemical reactions. Relaxation phenomena are caused by redistribution of energy among the nuclear, electronic, vibrational, and rotational energy states of the atoms and molecules that constitute the system. In addition, the relaxation may involve a shift in the ratio of concentrations of reactants and products.

A typical reaction that may be studied by measuring relaxation effects is that in which one molecule of the gas dinitrogen tetroxide breaks into—or is formed from—two molecules of the gas nitrogen dioxide, as represented by the equation $N_2O_4 \rightleftharpoons 2NO_2$. At standard pressure and temperature, a system composed of these two gases will contain approximately 80 percent (by mass) dinitrogen tetroxide. But when the system is disturbed by a sudden change in temperature or pressure, the gases eventually reach new equilibrium concentrations to suit the new conditions. By determining the relaxation time, it is possible to derive the rate at which nitrogen dioxide combines to form dinitrogen tetroxide, and also the rate of the reverse reaction.

An important technique used in relaxation studies is the temperature-jump method. The equilibrium of a system is disrupted by suddenly changing the temperature and observing the concentrations of the reactants as a function of time. One way of raising the temperature is to discharge an electric current through a sample; another method is to apply ultrasonic radiation to the system.

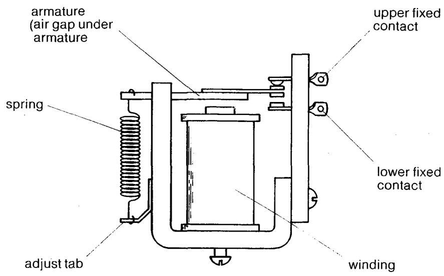
Relaxation phenomena also have important implications in nuclear magnetic resonance (NMR) spectrometry, an analytical technique used by chemists to identify and probe the molecular structure of substances. When examined by this technique, a sample is placed in a powerful magnetic field. Certain nuclei in the test material behave as tiny bar magnets and line up with the field. But when more energy is added to the system, in the form of radio waves, for example, the nuclei "flip" into a different, higher energy orientation. This phenomenon is useful to the chemist because nuclei in different structural arrangements within a molecule accept different and discrete frequencies of radio waves in order to flip, and so by applying a whole range of radio wave frequencies to the sample it is possible to correlate the absorbed frequencies with the structural features of the material under test.

The sensitivity of the technique is dictated by the time and route taken for excited nuclei to dissipate their excess energy and revert to low-energy orientations, lined up with the applied magnetic field.

The results of an NMR scan are charted as a radio wave spectrum showing which frequencies were absorbed or emitted, and hence which structural groups and atoms are present in the sample. Similar effects govern the performance of electron spin resonance (ESR), another analytical technique widely used by chemists.

relaxin, a hormone produced by the ovaries during pregnancy that causes pelvic and cervical expansion and relaxation. It inhibits muscular contractions of the uterus that would cause natural abortion of the developing child, stimulates the growth of the glands in the breasts that are responsible for milk production, and increases the amount of water in the uterus. The hormone is found only in pregnant females, and its activities last only for 24 hours after birth.

relay, in electricity, electromagnetic device for remote or automatic control of current in one (relay) circuit, using the variation in current in another (energizing) circuit. For example, in a solenoid (*q.v.*) the core will move when energized to open or close a switch or circuit breaker. Many relays are protective in function. Probably the earliest was the old telegraph relay, in which the energizing cur-



General-purpose relay

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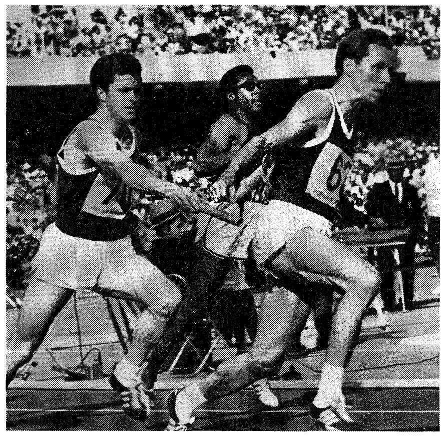
rent moved an armature carrying a contact point to close a sounder circuit. Relays were important in early computer designs before they were replaced by the faster vacuum tubes and, later, by transistors. They are also used in railway block signalling, the energized relay being de-energized by shorting through car axles. Currently in wide use are telephone relays. The illustration shows the essentials of a typical general-purpose relay.

relay race, also called RELAY, a track-and-field sport consisting of a set number of stages (legs), usually four, each run by a different member of a team. The runner finishing one leg is usually required to pass on a baton to the next runner while both are running in a marked exchange zone. In most relays, team members cover equal distances: Olympic events for both men and women are the 400-



Passing the baton

AP/Wide World

metre (4 × 100-metre) and 1,600-metre (4 × 400-metre) relays. In the less frequently run medley relays, however, the athletes cover different distances in a prescribed order—as in a sprint medley of 440, 220, 220, and 880 yards, which from 1911 to 1926 was the only relay event included in the English national championships. There are also relay races in swimming, wherein successive swimmers start after the preceding swimmer has made the touch.

The relay method of racing was started in the United States about 1890. The original method was for the men running the second quarter of the course each to take over a small flag from the first man as he arrived, before departing on their own stage of the race, at the end of which they, in their turn, handed on their flags to the awaiting next runners.

The flags, however, were considered cumbersome, and for a time it was sufficient for the outgoing runner to touch or be touched by his predecessor. The baton, a hollow cylinder of wood or plastic, was introduced at the 1912 Olympics. It is carried by the runner and must be exchanged between lines drawn at right angles to the side of the track 10 m or 11 yards on each side of the starting line for each leg of the relay. In sprint relays (400 and 800 metres; 440 and 880 yards) a 1964 rule change permitted the runner receiving the baton to start his run 10 m or 11 yards before the zone, but he had to take the baton within the zone itself.

Swimming competitions also use relays, as, for instance, the freestyle relay race at 4 × 100 m and 4 × 200 m and the medley relay of 4 × 100 m. A swimmer on a relay team finishes his leg by touching the starting edge of the pool, upon which his next teammate dives into the water to begin his leg. *See* Sporting Record: *Athletics; Swimming. See also* Olympic Games.

Reles, Abe, byname KID TWIST (b. *c.* 1907, East New York, N.Y., U.S.—d. Nov. 12, 1941, Coney Island, Brooklyn), American killer and gangster who became a celebrated police informer in 1940–41.

The son of Austrian-Jewish immigrants, Reles stole his nickname of Kid Twist from a gangster idol and pursued a life of crime. By the age of 34 in 1940, he had been arrested 42 times (six times for murder) and had served six prison terms. In jail again and fearing prosecution for murder, he began talking to Brooklyn district attorney William O'Dwyer on March 23, 1940. He told about a national organization (popularly dubbed Murder, Inc.) to which he belonged and which dealt in murder for hire; its leaders included Louis "Lepke" Buchalter and Albert Anastasia. He supplied dozens of dates, persons, and places—providing the authorities with information on some 70 unsolved murders that had been performed by "contract."

Prosecutions began, and several gunmen went to the electric chair. In 1940 Buchalter was convicted, but before Anastasia could be brought to trial, Reles' usefulness ended. He had been lodged in Coney Island's Half Moon Hotel, guarded by 18 policemen in three shifts round the clock. Nevertheless, on the morning of Nov. 12, 1941, he fell from a window to his death. The official verdict was that, while alone, he had tried to escape and accidentally fell. But an informer of a later day, Joseph Valachi, would suggest, "I never met anybody who thought Abe went out that window because he wanted to."

Articles are alphabetized word by word, not letter by letter

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relic, in religion, strictly, the mortal remains of a saint; in the broad sense, the term also includes any object that has been in contact with the saint. Among the major religions, Christianity, almost exclusively in Roman Catholicism, and Buddhism have emphasized the veneration of relics.

The basis of Christian cult veneration of relics is the conception that reverence for the relics redounds to the honour of the saint. While expectation of favours may accompany the devotion, it is not integral to it. The first Christian reference to relics speaks of handkerchiefs carried from the body of St. Paul to heal the sick. During the 2nd century AD, in the *Martyrdom of Polycarp,* the bones of the martyred bishop of Smyrna are described as "more valuable than precious stones." The veneration of relics continued and grew in Christianity. Generally, the expectation of miracles increased during the Middle Ages, while the flood of Oriental relics into Europe during the Crusades raised serious questions as to their authenticity and ethical procurement. St. Thomas Aquinas, the great Roman Catholic theologian, however, considered it natural to cherish the remains of the saintly dead and found sanction for the veneration of relics in God's working of miracles in the presence of relics.

Roman Catholic thought, defined in 1563 at the Council of Trent and subsequently affirmed, maintained that relic veneration was permitted and laid down rules to assure the authenticity of relics and exclude venal practices. Among the most venerated of Christian relics were the fragments of the True Cross (*q.v.*).

In the Eastern Orthodox churches, devotion is focused on icons rather than upon relics, though the antimension (the cloth upon which the divine liturgy is celebrated) always contains a relic. The attitude of the 16th-century Protestant Reformers toward relics was uniformly negative, and the veneration of relics has not been accepted in Protestantism.

Like Christianity, Islām has had a cult of relics associated with its founder and with saints. In Islām, however, the use of relics has had no official sanction; indeed, Muslim theologians have frequently denounced the veneration of relics and the related practice of visiting the tombs of saints as conflicting with the prophet Muḥammad's insistence on his own purely human, nondivine nature and his stern condemnation of idolatry and the worship of anyone other than God himself.

Relic worship was canonically established in Buddhism from its earliest days. Tradition (*Mahāparinibbāna Sutta*) states that the cremated remains of the Buddha (d. *c.* 483 BC) were distributed equally among eight Indian tribes in response to a demand for his relics. Commemorative mounds (*stūpa*s) were built over these relics, over the vessel from which the bones were distributed, and over the collective ashes of the funeral pyre. The emperor Aśoka (3rd century BC) is said to have redistributed some of the relics among the innumerable *stūpas* he had erected. Such shrines became important and popular centres of pilgrimage.

According to legend, seven bones (the four canine teeth, the two collarbones, and the frontal bone) were exempted from the primary distribution, and these have been the object of widespread devotion, with a number of shrines dedicated to them throughout Asia. Most famous of these *sarīra* ("corporeal relics") is the left canine tooth, honoured at the Temple of the Tooth at Kandy, Sri Lanka. Other shrines reportedly have housed certain personal possessions of the Buddha, such as his staff or alms bowl. The alms bowl (*pātra*), particularly, is associated with a romantic tradition of wanderings and, in different historical periods, has been variously reported as located in Peshāwar or in Ceylon (Sri Lanka). In addition, the bodily remains and personal effects of the great Buddhist saints and heroes are also venerated. In Tibetan Buddhism, worship is accorded the carefully preserved bodies of the deceased priest kings (the Dalai Lamas), who in their lifetimes are regarded as reincarnations of a heavenly being, the bodhisattva Avalokiteśvara.

Although the primary objective of Buddhist relic worship is the engendering of faith and the acquisition of spiritual merit, popular legends of miraculous powers have sprung up around the relics and the places in which they are deposited.

In Hinduism, although images of divine beings have a major place in popular devotion, the veneration of relics as found in Christianity, Islām, and Buddhism is largely absent. This is probably a result of two facts: Hinduism has no historical founder, as do the other three religions, and it tends to regard the world of physical, historical existence as ultimately an illusion. Thus the mortal remains and earthly possessions of religious heroes or holy men are not generally regarded as having particular spiritual value.

relict landform (geology): *see* residual landform.

relief, in European feudalism, in a form of succession duty paid to an overlord by the heir of a deceased vassal. It became customary on the Continent by the Carolingian period (8th–9th century AD). The sum required was either fixed arbitrarily by the lord or agreed between the parties. Gradually, a concept of what constituted a just and reasonable sum emerged, usually the equivalent of one year's revenue from the fief. This was standardized in England at £100 for a barony or honour (large landed fief) and 100 shillings for a knight's fee. Heirs to smaller fiefs might give a knight's horse and equipment.

relief, in finance, public or private aid to persons in economic need because of natural disasters, wars, economic upheaval, chronic unemployment, or other conditions that prevent self-sufficiency.

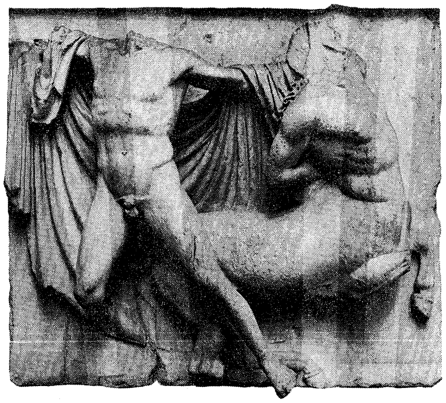
Through the 19th century, disaster relief consisted largely of emergency grants of food, clothing, and medical care and the provision of mass shelter through hastily organized local committees, often with the aid of voluntary contributions of money or supplies from other communities or countries. In the 20th century, disaster relief became one of the chief activities of the International Red Cross, originally organized in the 1860s to aid the victims of war.

Public programs of relief from economic need due to other than natural factors date from the Elizabethan period in England; these early provisions for assistance to the needy from public funds were characterized by strict limitations. Beginning in early times and persisting into the 20th century, there was a strong aversion to giving assistance to able-bodied workers. In England, after the Poor Law Reform Act of 1834, people able to work could receive public assistance only if they entered a workhouse.

The modern practice of work relief is in part a manifestation of this attitude; the United States work relief programs (notably the Works Progress Administration, later named the Work Projects Administration) in the 1930s were designed to give employment to all needy persons who could work, thus separating them from the unemployable poor. By the late 20th century the work requirement had been abandoned in most countries. In contemporary terminology, relief generally refers to public assistance, comprising benefits, either in money or in kind, given to the indigent who do not qualify for specific assistance programs or social insurance benefits. *See* social welfare program.

relief, also called RELIEVO (from Italian *relievare,* "to raise"), in sculpture, any work in which the figures project from a supporting background, usually a plane surface. Reliefs are classified according to the height of the figures' projection or detachment from the background. In a low-relief, or bas-relief (basso-relievo), the design projects only slightly from the ground and there is little or no undercutting of outlines. In a high-relief, or alto-relievo, the forms project at least half or more of their natural circumference from the background and may in parts be completely disengaged from the ground, thus approximating sculpture in the round. Middle-relief, or mezzo-relievo, falls roughly between the high and low forms. A variation of relief carving, found almost exclusively in ancient Egyptian sculpture, is sunken relief (also called incised relief), in which the carving is sunk below the level of the surrounding surface and is contained within a sharply incised contour line that frames it with a powerful line of light and shade. Intaglio, likewise, is a sunken relief but is carved as a negative image like a mold instead of a positive (projecting) form.

Reliefs on the walls of stone buildings were common in ancient Egypt, Assyria, and other Middle Eastern cultures. The Egyptians depicted carefully modeled figures standing out from the ground in very low relief; figures are shown standing sideways and are contained within a sharply incised outline. High reliefs first became common in the sculpture of the ancient Greeks, who fully explored the artistic potentialities of the genre. Attic tomb reliefs



Relief sculpture
(Top) Athena mourning, mezzo-relievo from the Acropolis, 5th century BC, in the Acropolis Museum, Athens; (bottom) Lapith and centaur, high relief from the Parthenon, Athens, 5th century BC, in the British Museum

By courtesy of (bottom) the trustees of the British Museum; photograph (top), Alinari—Art Resource/EB Inc.

from the 4th century BC showing individual figures or family groups are notable examples, as are the sculptured friezes used in the decoration of the Parthenon and other classical temples. Relief sculptures were prominent in the sarcophagi of Roman art during the 2nd and 3rd centuries AD.

During the European Middle Ages the emphasis in sculpture was definitely on relief work. Some of the most outstanding examples decorate the Romanesque portals (tympana) of churches in France, England, and other countries. The Gothic period continued this tradition but often preferred a higher relief, in accordance with the renewed interest in statuary that characterized the late Middle Ages.

During the Italian Renaissance the qualities of relief work began to change, as is evident in the famous bronze doors that Lorenzo Ghiberti created for the baptistry of the Cathedral of Florence. The free play between high and low relief and the strikingly illusionistic style of composition in these reliefs show Renaissance artists' new interest in and understanding of space as a subjective visual experience that could be faithfully reproduced. Figures in the foreground of the composition were done in high relief, thus appearing close at hand, while background features were done in low relief, thus approximating distance. Donatello further exploited these experiments, adding textural contrasts between rough and smooth surfaces to the interplay between high and low relief and completely modeling some forms while leaving others in an almost painterly state of incompleteness. Two different trends subsequently became apparent in Italian relief sculpture: delicate and low reliefs in marble and terra-cotta by Desiderio da Settignano and Mino da Fiesole, for example, and the more robust and sculptural relief style used by Bertoldo di Giovanni and later by Michelangelo.

Baroque sculptors continued these illusionistic experiments, often on a very large scale. Their large relief compositions became a kind of painting in marble, being set off by deep boxlike frames and special stagelike conditions of lighting. Lorenzo Bernini's "Ecstasy of Santa Theresa," with figures carved almost fully in the round but encased in a marble altar, offers a most impressive example. Neoclassical artists of the early 19th century temporarily revived experimentation with low reliefs in pursuit of what they saw as classical rigour and purity; such works relied on fine surface modeling and clarity of design for their effect. The works of Antonio Canova and Bertel Thorwaldsen are typical in this regard. But on the whole the Renaissance concept of relief prevailed, and its dramatic and emotive possibilities were keenly and vigorously employed by such subsequent 19th-century sculptors as François Rude in "The Marseillaise" (decorating the Arc de Triomphe in Paris) and by Auguste Rodin in his famous "Gates of Hell" and other reliefs. Relief techniques came to be used in modern 20th-century art for abstract compositions that emphasized spatial recession and contrasts of light and shade. Reliefs were also a feature in Pre-Columbian and Asian Indian sculpture.

relief etching: *see* anastatic printing.

relief printing, in art printmaking, a process consisting of cutting or etching a printing surface in such a way that all that remains of the original surface is the design to be printed. Examples of relief-printing processes include woodcut, anastatic printing (also called relief etching), linocut, and metal cut (*qq.v.*).

relief printing (commercial printing): *see* letterpress printing.

religion, human beings' relation to that which they regard as holy, sacred, spiritual, or divine. Religion is commonly regarded as consisting of a person's relation to God or to gods or spirits. Worship is probably the most basic element of religion, but moral conduct, right belief, and participation in religious institutions are generally also constituent elements of the religious life as practiced by believers and worshipers and as commanded by religious sages and scriptures.

The subject of religion is treated in a number of articles in the MACROPAEDIA. For treatment of particular religious systems, as well as founders, reformers, and other religious personages, *see* Biblical Literature and Its Critical Interpretation; Buddhism, The Buddha and; Calvinism, Calvin and; Christianity; Confucianism, Confucius and; Eastern Orthodoxy; European Religions, Ancient; Hinduism; Islām, Muḥammad and the Religion of; Jainism; Jesus: The Christ and Christology; Judaism; Luther; Middle Eastern Religions, Ancient; Moses; Mystery Religions; Protestantism; Roman Catholicism; Shintō; Sikhism; Taoism; Zoroastrianism and Parsiism. For cross-cultural discussion of religious beliefs and practices, *see* Doctrines and Dogmas, Religious; Myth and Mythology; Religious and Spiritual Belief, Systems of; Religious Experience; Religious Symbolism and Iconography; Rites and Ceremonies, Sacred; Theology. For philosophical and ethical aspects, *see* Ethics; Metaphysics; Philosophies of the Branches of Knowledge. For a review of the efforts to systematically study the nature and classify the forms of religious experience, *see* Religions, The Study and Classification of.

For the place of religion in the circle of learning and for a list of both MACROPAEDIA and MICROPAEDIA articles on the subject, *see* PROPAEDIA: Part Eight.

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

Religious Science, religious movement founded in the United States by Ernest Holmes (1887–1960). Holmes and his brother Fenwicke were drawn to New Thought teachings and to a belief in the power of the mind for healing and fulfillment of life. In 1926 Holmes's major work, *The Science of Mind,* was published. In 1927 he established the Institute of Religious Science and Philosophy in Los Angeles to teach his principles. Some of the graduates established churches based on Holmes's teachings, and in 1949 he reluctantly agreed to the establishment of a Religious Science denomination. There are now two branches: the United Church of Religious Science and the smaller Religious Science International, which prefers a less centralized polity. The two organizations have identical doctrines. The United Church publishes the magazine *Science of Mind.*

Like the New Thought tradition, Religious Science is basically monistic. The individual human mind is an expression of the Universal Mind, and the universe is its material manifestation. Man and nature are, therefore, like the God who is their true being, considered to be fundamentally good, and apparent evil stems from ignorance of the highest identity. The mind, working with creative faith and knowledge of its identity with the infinite, draws on infinite resources in what is called "affirmative prayer." When directed to a particular end, such as healing of mind or body, this employment of mind is called "spiritual mind treatment" and its results a "demonstration." Religious Science trains both ministers and practitioners, who are qualified to give spiritual mind treatments. Services are generally similar in format to those of mainstream Protestant churches, but with an especially affirmative, optimistic tone.

religious syncretism, the fusion of diverse religious beliefs and practices. Instances of religious syncretism—as, for example, Gnosticism (a religious dualistic system that incorporated elements from the Oriental mystery religions), Judaism, Christianity, and Greek religious philosophical concepts—were particularly prevalent during the Hellenistic period (*c.* 300 BC–*c.* AD 300). The fusion of cultures that was effected by the conquest of Alexander the Great (4th century BC), his successors, and the Roman Empire tended to bring together a variety of religious and philosophical views that resulted in a strong tendency toward religious syncretism. Orthodox Christianity, although influenced by other religions, generally looked negatively upon these syncretistic movements.

Syncretistic movements in the Orient, such as Manichaeism (a dualistic religion founded by the 3rd-century-AD Iranian prophet Mani, who combined elements of Christianity, Zoroastrianism, and Buddhism) and Sikhism (a religion founded by the 15th–16th-century Indian reformer Guru Nānak, who combined elements of Islām and Hinduism), also met with resistance from the prevailing religions of their respective areas.

In the 17th century a movement led by the German Protestant theologian George Calixtus aimed at reconciling the differences between the Protestants in Germany, but his efforts were disparaged by orthodox Christian leaders as syncretistic.

relish, vegetable side dish that is eaten in small quantities with a blander main dish to pique the appetite by its contrasting texture and spicy or piquant taste. Relishes are frequently finely cut vegetables or fruit in sour, sweet-sour, or spicy sauce. The Indonesian and Malaysian sambal (*q.v.*), Indian chutney (*q.v.*), achar, and *raita,* and Korean kimchi are relishes that accompany virtually every meal in their respective cuisines. Lombardy in Italy specializes in *mostarda di frutta,* a melange of fruits preserved in a sweet syrup, sharp with mustard. In the Pennsylvania Dutch cuisine of the United States, "seven sweets and seven sours" traditionally were served, among them many that are favourites throughout the country: pickled cucumbers, onions, beets, crabapples, watermelon rind, and such mixtures of chopped vegetables as piccalilli and chow chow.

Relizane, also called IGHIL IZANE, town, northwestern Algeria, near Wadi Mîna which is a tributary of the Chelif River. Built near the ruined Roman settlement of Mina, modern Relizane is a typical French-style town of wide streets and parks. It is surrounded by orchards and gardens, and 30,000 acres (12,000 hectares) are irrigated with waters from the Wadi Mîna via the Bakhadda Dam. Cereals, grapes, and cotton are grown in the surrounding area, and there is trade in livestock and wool. The famous Kalaa Oriental carpets are also marketed in the town. The town is the feeder point of the Hassi R'Mel natural-gas pipeline to the coastal cities and is a road and railway junction. Pop. (1987 prelim.) mun., 83,864.

Relizian Stage, major division of Miocene rocks and time on the Pacific coast of North America (the Miocene epoch began 23.7 million years ago and ended 5.3 million years ago). The Relizian Stage, which overlies the Saucesian Stage and precedes the Luisian Stage, was named for exposures studied in Reliz Canyon in California. Two subdivisions, or zones, within the Relizian are recognized, representing shorter spans of time and characterized by the presence of distinctive foraminiferan microfossils. The Relizian Stage is correlated with the Burdigalian Stage recognized in Europe and elsewhere.

rem, unit of radiation dosage (such as from X rays) applied to humans. Derived from the phrase "Roentgen equivalent man," the rem is now defined as the dosage in rads that will cause the same amount of biological injury as one rad of X rays or gamma rays. Formerly poorly defined, the rem was redefined in 1962 to clarify the usage of the term relative biological effectiveness (RBE) in both radiobiology and radiation protection.

A rem is equal to 0.01 sievert in the International System (SI) system of measurement. *See also* roentgen.

Rema: *see* Isserles, Moses ben Israel.

Remagen, city, Rhineland-Palatinate *Land* (state), western Germany. It lies on the left bank of the Rhine River, southeast of Bonn. It originated as the Roman fortress Ricomagnus and has some Roman remains and a 12th-century gate. In World War II it figured in the Anglo-American advance into Germany in March 1945; the 9th Armoured Division of the U.S. 1st Army found the Remagen railway bridge across the Rhine to Erpel damaged but still usable. A crossing was promptly forced, establishing the first Allied bridgehead across the Rhine. Remagen now has a series of hotels along the Rhine waterfront and exports the well-known Apollinaris mineral water obtained from a local spring. Pop. (1989 est.) 14,375.

remainder, in Anglo-American law, a future interest held by one person in the property of another, which, upon the happening of a certain event, will become his own. The holder of this interest is known in legal terms as a remainderman.

The law recognizes two types of remainder interests: the vested remainder and the contingent remainder. A remainder vests if, at the time it is created, the remainderman exists and is ascertainable, and no condition need first occur to identify him. Thus, when property is given to one person for his life and, at his death, the property is to go to a living third person, that third person has a vested remainder in the property. If, however, property is given to one for his life, the property to go to his heirs at his death, the interest in the property given to his heirs is a contingent remainder, because his heirs will not definitely be known until his death.

Remak (Hebrew grammarian): *see* Kimhi, Moses.

Remak, Robert (b. July 26, 1815, Posen, Prussia [now Poznań, Pol.]—d. Aug. 29, 1865, Kissingen, Bavaria [Germany]), German embryologist and neurologist who discovered and named (1842) the three germ layers of the early embryo: the ectoderm, the mesoderm, and the endoderm. He also discovered nonmedullated nerve fibres (1838) and the nerve cells in the heart (1844) called Remak's ganglia, and he was a pioneer in the use of electrotherapy for the treatment of nervous diseases.

Remak studied under the eminent physiologist Johannes Müller at the University of Berlin and earned his M.D. degree (1838) with an important dissertation on the fine structure of nerve tissue. Barred from teaching by Prussian law, which closed that profession to Jews, he continued his research as an unpaid assistant in Müller's laboratory and supported himself by his medical practice. In 1843 Remak petitioned directly to Friedrich Wilhelm IV for a teaching position, but he was refused. That November he entered the laboratory of Johann Lukas Schönlein at the Charité Hospital, Berlin, where he continued his research on nerve tissue and also began his investigations into the role of the germ layers in the development of tissues and organs. In 1847, having by then acquired considerable eminence, Remak finally obtained a lectureship at the University of Berlin, becoming the first Jew to teach there. He was promoted to assistant professor in 1859 in belated, though quite inadequate, recognition of his extraordinary body of neurological and embryological research.

remanent magnetism, also called PALEOMAGNETISM, or PALAEOMAGNETISM, the permanent magnetism in rocks, resulting from the orientation of the Earth's magnetic field at the time of rock formation in a past geological age. It is the source of information for the paleomagnetic studies of polar wandering and continental drift. Remanent magnetism can derive from several natural processes, generally termed natural remanent magnetism, the most important being thermo-remanent magnetism. This arises when magnetic minerals forming in igneous rocks cool through the Curie point and when the magnetic domains within the individual minerals align themselves with the Earth's magnetic field, thus making a permanent record of its orientation.

A second mechanism operates when small grains of magnetic minerals settle into a sedimentary matrix, producing detrital remanent magnetism. It is hypothesized that the tiny grains orient themselves in the direction of the Earth's magnetic field during deposition and before the final consolidation of the rock. The magnetism thus introduced appears to persist through later alteration and compaction of the rock, although the details of these processes have not been fully studied.

Rocks may acquire remanent magnetism in at least two other ways: (1) rocks made up of nonmagnetic minerals may be chemically altered to yield magnetic minerals, and these newly formed minerals will acquire remanent magnetism in the presence of the Earth's magnetic field; and (2) igneous rocks already cooled may ultimately acquire remanent magnetism by a process called viscous magnetization. The difference between these several types of remanent magnetism can be determined, and the magnetic history of a particular rock can therefore be interpreted.

Remarque, Erich Maria (b. June 22, 1898, Osnabrück, Ger.—d. Sept. 25, 1970, Locarno, Switz.), novelist who is chiefly remembered as the author of *Im Westen nichts Neues* (1929; *All Quiet on the Western Front*), which became perhaps the best-known and most representative novel dealing with World War I.

Remarque
Bavaria-Verlag

Remarque was drafted into the German army at the age of 18 and was wounded several times. After the war he worked as a racing-car driver and as a sportswriter while working on his novel.

The events of *All Quiet on the Western Front* are those in the daily routine of soldiers who seem to have no past or future apart from their life in the trenches. Its title, the language of routine communiqués, is typical of its cool, terse style, which records the daily horrors of war in laconic understatement. Its casual amorality was in shocking contrast to patriotic rhetoric. The book was an immediate international success, as was the American film made from it in 1930. It was followed by a sequel, *Der Weg zurück* (1931; *The Road Back*), dealing with the collapse of Germany in 1918.

Remarque left Germany for Switzerland in 1932. His books were banned by the Nazis in 1933. In 1939 he went to the United States where he was naturalized in 1947. After World War II he settled in Porto Ronco, Switz., on Lake Maggiore, where he lived with his second wife, the American film star Paulette Goddard, until his death. He wrote several other novels, most of them dealing with victims of the political upheavals of Europe during World Wars I and II. Some had popular success and were filmed (*e.g., Arc de Triomphe,* 1946), but none achieved the critical prestige of his first book.

Rembang, city and *kabupaten* (regency), Jawa Tengah *propinsi* (Central Java province), Java, Indonesia, located about 100 mi (160 km) northwest of Surabaya. A major port on the Java Sea, it is linked by road and railway with Kudus and Semarang to the southwest and with Cepu and Surabaya to the southeast. Exports include petroleum products, teak, rubber, peanuts (groundnuts), rice, and cassava. Most of the population is Javanese, together with some Madurese; Islām is the dominant religion. Chinese settlers are mostly traders and merchants. Industries are rice milling, peanut shelling, soapmaking, and oil refining. Crafts include wood carving, weaving, plaiting, and mat and basket making. Near Rembang is the grave of Raden A. Kartini, Indonesia's first feminist; it is now a national place of pilgrimage. Pop. city, (1980) 63,151; regency, 442,594.

Rembrandt HARMENSZOON VAN RIJN (b. July 15, 1606, Leiden, Neth.—d. Oct. 4, 1669, Amsterdam), Dutch painter, draftsman, and etcher of the 17th century, a giant in the history of art. His paintings are characterized by luxuriant brushwork, rich colour, and a mastery of chiaroscuro. Numerous portraits and self-portraits exhibit a profound penetration of character. His drawings constitute a vivid record of contemporary Amsterdam life.

A brief account of the life and works of Rembrandt follows; for a full biography, *see* MACROPAEDIA: Rembrandt.

Rembrandt left Leiden University to study painting, first under Jacob van Swanenburch in Leiden, and then in Amsterdam under Pieter Lastman. By 1627 he had returned to Leiden to work with another pupil of Lastman, Jan Lievens.

Rembrandt was initially influenced by the pictorial innovations of Caravaggio, who had exploited in his paintings the dramatic possibilities of extreme contrasts of light and shadow. Rembrandt, however, adapted this forceful chiaroscuro to depict his figures' mood and inner mental life by a selective accentuation of physical textures, modelling, facial expression, and pose. Such early group compositions as "Supper at Emmaus" (1630) show Rembrandt's acute sense of drama, as well as his growing ability to portray subtle psychological reactions. Rembrandt's work included portraits (both formal and informal), self-portraits, and Biblical, mythological, and historical subjects. He also produced a steady stream of drawings and etchings.

In 1631 Rembrandt moved to Amsterdam, and in 1634 he married Saskia van Uylenburgh. His growing skill and reputation enabled him to take on students, and the many lucrative commissions he received made him a prosperous and successful artist. Innovative group compositions, such as "The Anatomy Lesson of Dr. Nicolaes Tulp" (1632), secured his reputation as a brilliant, if somewhat unconventional, painter. Rembrandt's paintings of the 1630s reveal his unrivalled technical facility in the use of light and shadow and the sensuous depiction of texture. His figurative compositions are exuberant emulations of the Baroque style, portraying dramatic action within dynamic compositions. Rembrandt's portraits, on the other hand, are models of a dignified and searching presentation of character and are carried out with a scrupulous attention to realistic detail and with highly accurate and naturalistic drawing.

The early 1640s marked a turning point in both Rembrandt's material fortunes and in the direction of his art. In 1642 Saskia died, being survived only by Rembrandt and one of their four children, Titus. Meanwhile, Rembrandt was unable to retain the full extent of his popularity with the public in the face of the changing tastes in Dutch painting. This shrinking of Rembrandt's material horizons was, however, compensated by a deepening and enrichment of the content of his art. His depictions of Biblical subjects took on new qualities of solemnity, tenderness, and introspective depth. His portraits acquired a tragic and contemplative quality, with the physical details of countenance and dress now carefully orchestrated to convey essential qualities of character and outlook.

In 1649 Rembrandt began a relationship with Hendrickje Stoffels that was to last until her death in 1663. Rembrandt's heavy expenses and debts compelled him to declare bankruptcy in 1656, after which his financial affairs were managed by Titus and Hendrickje. His work in the 1650s is highlighted by a series of masterful self-portraits that mark perhaps the high point of achievement in that particular genre of Western painting. The artist took his own visage as the hallmark of tragic resignation to life's misfortunes. In these late works he used thick, carefully built-up impastos and multiple glazes of transparent colour to communicate the palpable physical reality of the human form, minutely reproducing every wrinkle and indentation of the flesh, every gleam and highlight of clothing, armour, and jewelry. His formal portraits communicate the qualities of wisdom and moral stamina that Rembrandt saw as the enduring traits of human character. In his later depictions of Biblical subjects, Rembrandt used his complete mastery of the technical aspects of his craft to express such intangible values as humility, love, and the philosophical acceptance of human frailty.

The death of his son Titus in 1668 was followed by the aging Rembrandt's own death the following year. Although he died in comparative obscurity, Rembrandt's reputation began to revive in the 18th century, and it continued to rise until, in the late 20th century, he was regarded as one of the greatest painters in history.

Remembrance, Day of (Judaism): *see* Rosh Hashana.

remembrancer, English official who from medieval times compiled memorandum rolls and thus "reminded" the barons of the Exchequer (one of the king's courts) of business pending. There were at one time three clerks of the remembrance, with distinct duties, but two of the offices were abolished in the early 19th century, and only the office of king's (or queen's) remembrancer now survives. The king's remembrancer originally dealt with the recovery of penalties and debts due to the crown. After 1859 he was required to be a master of the Court of Exchequer, and by the Judicature Act (1873) he was attached to the Supreme Court, after 1879 as a master. Since 1925 the office of king's remembrancer has been held by the senior master of the Supreme Court (Queen's Bench Division). The duties include functions connected with the selection of sheriffs, swearing in the lord mayor of London, and the Trial of the Pyx (the annual examination of coins issued by the mint).

Remigius OF REIMS, SAINT, French SAINT REMI, or REMY, DE REIMS, byname APOSTLE OF THE FRANKS (b. *c.* 437—d. Jan. 13, *c.* 533, Reims, Fr.; feast day October 1), bishop of Reims who greatly advanced the cause of Christianity in France by his conversion of Clovis I, king of the Franks.

According to tradition, Remigius was the son of Count Emilius of Laon and St. Celina (Cilinia). Noted in his youth for his eloquence and scholarship, he was consecrated bishop of Reims at the age of 22. He is known to have corresponded with Clovis, but the King, although married to a Christian, Clotilda of Burgundy (later St. Clotilda), remained indifferent to religion until two incidents changed his mind. First, the couple's infant son was cured of an illness; then, in 496, Clovis' army, near defeat in a campaign against the invading Alemanni, won a sudden and decisive victory. Convinced that these favourable events were evidence of the power of Christ, Clovis sought to be converted. Along with his leading warrior chiefs, he was subsequently baptized by Remigius at Reims.

With the encouragement of Clovis and Clotilda, Remigius founded several sees and many churches and is said to have baptized more than 3,000 of the King's soldiers. He was also credited with many miracles.

Remington, Eliphalet (b. Oct. 28, 1793, Suffield, Conn., U.S.—d. Aug. 12, 1861, Ilion, N.Y.), U.S. firearms manufacturer and inventor.

In 1800 his family settled near Utica, N.Y., where his father built a smithy and forge powered by a waterwheel. In 1816 Remington constructed a flintlock rifle at the forge; its accuracy led neighbours to order similar guns. Soon, manufacture of sporting guns and rifle barrels became the main business of the forge.

In 1828 Remington built a large factory beside the Erie Canal at the present site of Ilion. He and his son Philo pioneered many improvements in arms manufacture, including the reflection method of straightening gun barrels, a lathe for cutting gunstocks, and the first successful cast-steel, drilled rifle barrel manufactured in the United States.

In 1847 Remington supplied the U.S. Navy with its first breech-loading rifle (Jenks carbine). The company he founded, the Remington Arms Company, supplied a large proportion of the small arms used by the U.S. government in the Civil War (1861–65) and in World Wars I and II.

Remington, Frederic (b. Oct. 4, 1861, Canton, N.Y., U.S.—d. Dec. 26, 1909, near Ridgefield, Conn.), U.S. painter, illustrator, and sculptor noted for his realistic portrayals of life in the American West.

He studied at Yale University art school and the Art Students League of New York. Thereafter he devoted himself primarily to illustrative work. He travelled widely, spending much time west of the Mississippi River, and made a specialty of depicting Indians, cowboys, soldiers, horses, and other aspects of life on the Plains. He also published a number of books and articles that served mainly as vehicles for his illustrations. During the Spanish–American War he was a war corre-

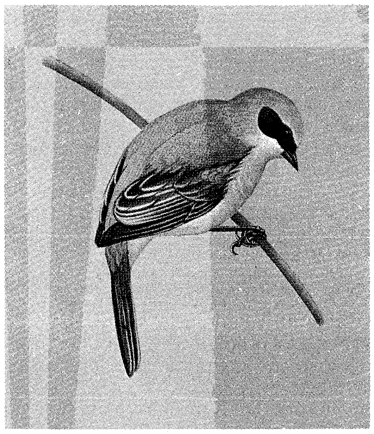
"Bronco Buster," bronze statue by Frederic Remington, 1895; in Joslyn Art Museum, Omaha, Neb.

By courtesy of Joslyn Art Museum, Omaha, Neb.

spondent and artist. Remington was primarily a reporter, recording the image of the thing seen; his work is notable for its rendering of swift action and its accuracy of detail. The Remington Art Memorial, Ogdensburg, N.Y., contains an important collection of his paintings, illustrations, and bronze statuettes.

Remiremont, town, Vosges *département,* Franche-Comté region, eastern France. It lies along the Moselle River near the latter's confluence with the Moselotte and is surrounded by wooded heights. Remiremont (Romaraci Mons) is named after St. Romaric, a companion of St. Columban at Luxeuil, who in the 7th century founded a monastery and a convent on the hills above the present town. In 910 an invasion of the Hungarians drove the convent's nuns down to Remiremont, which had grown around a villa of the Frankish kings. Settling there, the nuns (called the Ladies of Remiremont) were enriched by European rulers and attained great power, with their abbess becoming a princess of the Holy Roman Empire. Their dominion was not terminated until the War of the Escutcheons (1564) between the duke of Lorraine and the abbess. The monastery and nunnery were suppressed during the French Revolution. The abbey church, dating mainly from the 14th to 15th century, has an 11th-century crypt. The former palace of the abbesses, which now contains the town hall, was rebuilt in 1752 and again in 1871. Remiremont's industries include textile and clothing manufacturing, embroidering, iron and copper founding, and brewing. Pop. (1982) 9,797.

Remizidae, bird family (order Passeriformes) that contains the penduline tits and, usually, the verdin. Some authorities class the eight species of these birds as a subfamily of the titmouse family, Paridae. Remizids are much like long-tailed tits (Aegithalidae) but have shorter tails and thinner bills and are usually found near water.



Penduline tit (*Remiz pendulinus*)
Painting by Murrell Butler

The penduline tit (*Remiz pendulinus*) is irregularly distributed in river scrub and marshes across Eurasia. An 11-centimetre- (4.5-inch-) long brownish bird with a black mask on its whitish head, it is named for its two-chambered nest (built by the male), which consists of a finely felted bag of plant down or wool, suspended from the tip of a branch (sometimes in reeds).

The verdin (*Auriparus flaviceps*), a 10-centimetre (4-inch) grayish songbird with a yellowish head, is found in dry brushlands of southwestern North America; it makes a large globular nest of thorny twigs.

Remizov, Aleksey Mikhaylovich (b. July 6 [June 24, Old Style], 1877, Moscow—d. Nov. 26, 1957, Paris), Symbolist writer whose works had a strong influence on Russian writers before and after the 1917 Revolution.

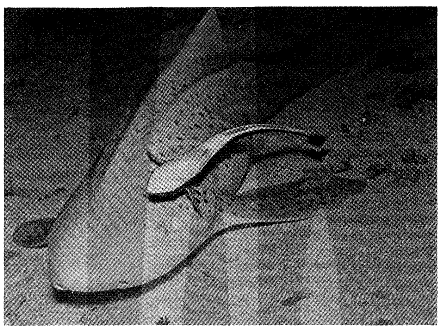
Born into a poor family of merchant ancestry, Remizov gained his early experiences in the streets of Moscow. He attended the University of Moscow but was expelled in 1897 for participation in student riots, put in prison, and exiled to the provinces. In 1905 he settled in St. Petersburg (now Leningrad), where he immediately began to frequent literary circles, particularly the Symbolist group. His works had begun to appear in various modernist periodicals, but his fame and popularity did not come until the publication in 1909 of *Istoriya Ivana Semyonovicha Stratilatova* ("The Story of Ivan Semyonovich Stratilatov"). This story of provincial life is among his best works, and it embodies many of the characteristics often found in his writing: elements of the weird, the grotesque, and the whimsical. He produced many stories of city and provincial life, others based on folklore and legend, and some using dreams, memoirs, and diaries. Remizov's prose, unlike that of many other Symbolist writers, was primarily colloquial; he strove to write in a homespun Russian, eliminating foreign influences such as Latin and French.

Remizov remained aloof from politics, though his works during the Revolution and civil war showed deep emotional involvement, as in *Slovo o pogibeli zemli Rossii* (1921; "The Lay of the Destruction of the Land of Russia"). In 1921 he was permitted to leave the U.S.S.R. because of ill health. He went first to Berlin and then, in 1923, to Paris, where he continued to write until his death.

Remonstrant, any of the Dutch Protestants who, following the views of Jacobus Arminius, presented to the States-General in 1610 a "remonstrance" setting forth their points of divergence from stricter Calvinism. The Remonstrants, assailed on all sides, were expelled from the Netherlands by the Protestant Synod of Dort (1618–19), which declared Remonstrant theology contrary to Scripture. Allowed back in the Netherlands by 1630, they were officially recognized in 1798. The movement is still strong, and its liberal school of theology has reacted powerfully on the Dutch state church and on other Christian denominations.

remora, also called SHARKSUCKER, or SUCKERFISH, any of 8–10 species of marine fishes of the family Echeneidae (order Perciformes) noted for attaching themselves to, and riding about on, sharks, other marine animals, and oceangoing ships. Remoras adhere by means of a flat, oval sucking disk on top of the head. The disk, apparently derived from the spiny portion of the dorsal fin, contains a variable number of paired, crosswise plates.

Remoras are thin, elongated, rather dark fishes from 30 to 90 cm (1 to 3 feet) long; they live in warmer waters and are found around the world. Remoras feed on the leavings of their hosts' meals or, in some instances, act as cleaners by eating the external parasites of their transporters.



A remora (*Echeneis naucrates*) and its host, a leopard shark
Douglas Faulkner

Remscheid, city, North Rhine-Westphalia *Land* (state), northwestern Germany. It lies along the Wupper River, in the heart of the Bergisches Land, a hilly, wooded district in the lower Rhine River valley. Mentioned in the late 11th century as an estate given to the Knights of St. John by the count of Berg, it was chartered in 1808 and absorbed the neighbouring towns of Lennep and Lüttringhausen in 1929. Remscheid has interesting slate houses, one of which (Haus Cleff) serves as the local museum. Lennep, the birthplace of Wilhelm Conrad Röntgen, the discoverer of X rays, has a Röntgen museum. Southeast on the Alt River is the oldest dam for the supply of drinking water in Germany (1891). Remscheid has a substantial iron industry and specializes in tool manufacture. Pop. (1989 est.) 120,979.

Remsen, Ira (b. Feb. 10, 1846, New York City—d. March 4, 1927, Carmel, Calif., U.S.), American chemist and university president, codiscoverer of saccharin.

After studying at Columbia University (M.D., 1867) and at the universities of Munich and Göttingen in Germany (Ph.D., 1870), Remsen began his investigations into pure chemistry at the University of Tübingen, where he was assistant (1870–72) to Rudolf Fittig. Returning to the United States, he became one of the original faculty of Johns Hopkins University, Baltimore, where he was professor of chemistry (1876–1913), director of the chemical laboratory (1876–1908), secretary of the Academic Council (1887–1901), and president of the university (1901–13). He introduced many German laboratory methods into Johns Hopkins and emphasized the university's function as a research centre. Remsen founded and edited the *American Chemical Journal* (1879–1913), in which he first published a description of a new sweetening compound (later known as saccharin), which he and a student discovered.

Remus (Roman mythology): *see* Romulus and Remus.

Remy, SAINT: *see* Remigius of Reims, Saint.

Renaissance, literally "rebirth," the period in European civilization immediately following the Middle Ages, conventionally held to have been characterized by a surge of interest in classical learning and values. The Renaissance also witnessed the discovery and exploration of new continents, the substitution of the Copernican for the Ptolemaic system of astronomy, the decline of the feudal system and the growth of commerce, and the invention or application of such potentially powerful innovations as paper, printing, the mariner's compass, and gunpowder. To the scholars and thinkers of the day, however, it was primarily a time of the revival of classical learning and wisdom after a long period of cultural decline and stagnation.

A brief treatment of the Renaissance follows. For full treatment, *see* MACROPAEDIA: European History and Culture.

The term Middle Ages was coined by scholars in the 15th century to designate the interval between the downfall of the classical world of Greece and Rome and its rediscovery at the beginning of their own century, a revival in which they felt they were participating. Indeed, the notion of a long period of cultural darkness had been expressed by Petrarch even earlier. Events at the end of the Middle Ages, particularly beginning in the 12th century, set in motion a series of social, political, and intellectual transformations that culminated in the Renaissance. These included the increasing failure of the Roman Catholic Church and the Holy Roman Empire to provide a stable and unifying framework for the organization of spiritual and material life, the rise in importance of city-states and national monarchies, the development of national languages, and the breakup of the old feudal structures.

While the spirit of the Renaissance ultimately took many forms, it was expressed earliest by the intellectual movement called Humanism. Humanism was initiated by secular men of letters rather than by the scholar-clerics who had dominated medieval intellectual life and had developed the Scholastic philosophy. Humanism began and achieved fruition first in Italy. Its predecessors were men like Dante and Petrarch, and its chief protagonists included Gianozzo Manetti, Leonardo Bruni, Marsilio Ficino, Pico della Mirandola, Lorenzo Valla, and Coluccio Salutati. The fall of Constantinople in 1453 provided Humanism with a major boost, for many eastern scholars fled to Italy, bringing with them important books and manuscripts and a tradition of Greek scholarship.

Humanism had several significant features. First, it took human nature in all of its various manifestations and achievements as its subject. Second, it stressed the unity and compatibility of the truth found in all philosophical and theological schools and systems, a doctrine known as syncretism. Third, it emphasized the dignity of man. In place of the medieval ideal of a life of penance as the highest and noblest form of human activity, the Humanists looked to the struggle of creation and the attempt to exert mastery over nature. Finally, Humanism looked forward to a rebirth of a lost human spirit and wisdom. In the course of striving to recover it, however, the Humanists assisted in the consolidation of a new spiritual and intellectual outlook and in the development of a new body of knowledge. The effect of Humanism was to help men break free from the mental strictures imposed by religious orthodoxy, to inspire free inquiry and criticism, and to inspire a new confidence in the possibilities of human thought and creations.

From Italy the new Humanist spirit and the Renaissance it engendered spread north to all parts of Europe, aided by the invention of printing, which allowed literacy and the availability of classical texts to grow explosively. Foremost among northern Humanists was Desiderius Erasmus, whose *Praise of Folly* (1509) epitomized the moral essence of Humanism in its insistence on heartfelt goodness as opposed to formalistic piety. The intellectual stimulation provided by Humanists helped spark the Reformation, from which, however, many Humanists, including Erasmus, recoiled. By the end of the 16th century the battle of Reformation and Counter-Reformation had commanded much of Europe's energy and attention, while the intellectual life was poised on the brink of the Enlightenment.

It was in art that the spirit of the Renaissance achieved its sharpest formulation. Art came to be seen as a branch of knowledge, valuable in its own right and capable of providing man with images of God and his creations as well as with insights into man's position in the universe. In the hands of men like Leonardo da Vinci it was even a science, a means for exploring nature and a record of discoveries. Art was to be based on the observation of the visible world and practiced according to mathematical principles of balance, harmony, and perspective, which were developed at this time. In the works of painters such as Masaccio, the brothers Lorenzetti, Fra Angelico, Botticelli, Perugino, Piero della Francesca, Raphael, and Titian; sculptors such as Pisano, Donatello, Verrocchio, Ghiberti, and Michelangelo; and architects such as Alberti, Brunelleschi, Palladio, Michelozzo, and Filarete, the dignity of man found expression in the arts.

In Italy the Renaissance proper was preceded by an important "proto-renaissance" in the late 13th and early 14th centuries, which drew inspiration from Franciscan radicalism. St. Francis had rejected the formal Scholasticism of the prevailing Christian theology and gone out among the poor praising the beauties and spiritual value of nature. His example inspired Italian artists and poets to take pleasure in the world around them. The work of the most famous artist of the proto-renaissance period, Giotto (1266/67 or 1276–1337), reveals a new pictorial style that depends on clear, simple structure and great psychological penetration rather than on the flat, linear decorativeness and hierarchical compositions of his predecessors and contemporaries, such as the Florentine painter Cimabue and the Siennese painters Duccio and Simone Martini. The great poet Dante lived at about the same time as Giotto, and his poetry shows a similar concern with inward experience and the subtle shades and variations of human nature. Although his *Divine Comedy* belongs to the Middle Ages in its plan and ideas, its subjective spirit and power of expression look forward to the Renaissance. Petrarch and Boccaccio also belong to this proto-renaissance period, both through their extensive studies of Latin literature and through their writings in the vernacular. Unfortunately, the terrible plague of 1348 and subsequent civil wars submerged both the revival of humanistic studies and the growing interest in individualism and naturalism revealed in the works of Giotto and Dante. The spirit of the Renaissance did not surface again until the 15th century.

In 1401 a competition was held at Florence to award the commission for bronze doors to be placed on the baptistery of San Giovanni. Defeated by the goldsmith and painter Lorenzo Ghiberti, Filippo Brunelleschi and Donatello left for Rome, where they immersed themselves in the study of ancient architecture and sculpture. When they returned to Florence and began to put their knowledge into practice, the rationalized art of the ancient world was reborn. The founder of Renaissance painting was Masaccio (1404–28). The intellectuality of his conceptions, the monumentality of his compositions, and the high degree of naturalism in his works mark Masaccio as a pivotal figure in Renaissance painting. The succeeding generation of artists—Piero della Francesca, Pollaiuolo, and Verrochio—pressed forward with researches into linear and aerial perspective and anatomy, developing a style of scientific naturalism.

The situation in Florence was uniquely favourable to the arts. The civic pride of Florentines found expression in statues of the patron saints commissioned from Ghiberti and Donatello for niches in the grain-market guildhall known as Or San Michele, and in the largest dome built since antiquity, placed by Brunelleschi on the Florence cathedral. The cost of construction and decoration of palaces, churches, and monasteries was underwritten by wealthy merchant families, chief among whom were the Medici family (*q.v.*).

The Medici traded in all of the major cities in Europe, and one of the most famous masterpieces of Northern Renaissance art, *The Portinari Altarpiece*, by Hugo van der Goes (*c.* 1476; Uffizi, Florence), was commissioned by their agent, Tommaso Portinari. Instead of being painted with the customary tempera of the period, the work is painted with translucent oil glazes that produce brilliant jewel-like colour and a glossy surface. Early Northern Renaissance painters were more concerned with the detailed reproduction of objects and their symbolic meaning than with the study of scientific perspective and anatomy even after these achievements became widely known. On the other hand, central Italian painters began to adopt the oil medium soon after *The Portinari Altarpiece* was brought to Florence in 1476.

High Renaissance art, which flourished for about 35 years, from the early 1490s to 1527, when Rome was sacked by imperial troops, revolved around three towering figures: Leonardo da Vinci (1452–1519), Michelangelo (1475–1564), and Raphael (1483–1520). Each of the three embodied an important aspect of the period: Leonardo was the ultimate Renaissance man, a solitary genius to whom no branch of study was foreign; Michelangelo emanated creative power, conceiving vast projects that drew for inspiration on the human body as the ultimate vehicle for emotional expression; Raphael created works that perfectly expressed the classical spirit—harmonious, beautiful, and serene.

Although Leonardo was recognized in his own time as a great artist, his restless researches into anatomy, the nature of flight, and the structure of plant and animal life left him little time to paint. His fame rests on a few completed works; among them are the "Mona Lisa" (1503–05, Louvre), "The Virgin of the Rocks" (*c.* 1485, Louvre), and the sadly deteriorated fresco "The Last Supper" (1495–98, Santa Maria delle Grazie, Milan).

Michelangelo's early sculpture, such as the "Pietà" (1499, St. Peter's, Rome) and the "David" (1501–04, Accademia, Florence), reveals a breathtaking technical ability in concert with a disposition to bend rules of anatomy and proportion in the service of greater expressive power. Although Michelangelo thought of himself first as a sculptor, his best known work is the giant ceiling fresco of the Sistine Chapel in the Vatican, Rome. It was completed in four years, from 1508 to 1512, and presents an incredibly complex but philosophically unified composition that fuses traditional Christian theology with Neoplatonic thought.

Raphael's greatest work, "The School of Athens" (1508–11), was painted in the Vatican at the same time that Michelangelo was working on the Sistine Chapel. In this large fresco Raphael brought together representatives of the Aristotelian and Platonic schools of thought. Instead of the densely packed, turbulent surface of Michelangelo's masterpiece, Raphael placed his groups of calmly conversing philosophers and artists in a vast court with vaults receding into the distance. Raphael was initially influenced by Leonardo, and he incorporated the pyramidal composition and beautifully modelled faces of "The Virgin of the Rocks" into many of his own paintings of the Madonna. He differed from Leonardo, however, in his prodigious output, his even temperament, and his preference for classical harmony and clarity.

The creator of High Renaissance architecture was Donato Bramante (1444–1514), who came to Rome in 1499, when he was 55. His first Roman masterpiece, the Tempietto (1502) at S. Pietro in Montorio, is a centralized dome structure that recalls classical temple architecture. Pope Julius II (reigned 1503–13) chose Bramante to be papal architect, and together they devised a plan to replace the 4th-century Old St. Peter's with a new church of gigantic dimensions. The project was not completed, however, until long after Bramante's death.

Humanistic studies continued under the powerful popes of the High Renaissance, Julius II and Leo X, as did the development of polyphonic music. The Sistine Choir, which performed at services when the pope officiated, drew musicians and singers from all of Italy and northern Europe. Among the most famous composers who became members were Josquin des Prez (1445–1521) and Palestrina (1525–84).

The Renaissance as a unified historical period ended with the fall of Rome in 1527. The strains between Christian faith and classical humanism led to Mannerism in the latter part of the 16th century. Great works of art animated by the Renaissance spirit, however, continued to be made in northern Italy and in northern Europe.

Seemingly unaffected by the Mannerist crisis, northern Italian painters such as Correggio (1494–1534) and Titian (1488/90–1576) continued to celebrate both Venus and the Virgin Mary without apparent conflict. The oil medium, introduced to northern Italy by Antonello da Messina and quickly adopted by Venetian painters who could not use fresco because of the damp climate, seemed particularly adapted to the sanguine, pleasure-loving culture of Venice. A succession of brilliant painters—Giovanni Bellini, Giorgione, Titian, Tintoretto, and Veronese—developed the lyrical Venetian painting style that combined pagan subject matter, sensuous handling of colour and paint surface, and a love of extravagant settings. Closer in spirit to the more intellectual Florentines of the Quattrocento was the German painter Albrecht Dürer (1471–1528), who experimented with optics, studied nature assiduously, and disseminated his powerful synthesis of Renaissance and Northern Gothic styles through the Western world by means of his engravings and woodcuts.

Renaissance man, also called UNIVERSAL MAN, Italian UOMO UNIVERSALE, an ideal that developed in Renaissance Italy from the notion expressed by one of its most accomplished representatives, Leon Battista Alberti (1404–72), that "a man can do all things if he will." The ideal embodied the basic tenets of Renaissance Humanism, which considered man the centre of the universe, limitless in his capacities for development, and led to the notion that men should try to embrace all knowledge and develop their own capacities as fully as possible.

Thus the gifted men of the Renaissance sought to develop skills in all areas of knowledge, in physical development, in social accomplishments, and in the arts. The ideal was most brilliantly exemplified in Alberti—who was an accomplished architect, painter, classicist, poet, scientist, and mathematician and who also boasted of his skill as a horseman and in physical feats—and in Leonardo da Vinci (1452–1519), whose gifts were manifest in the fields of art, science, music, invention, and writing.

renal artery, one of the pair of large blood vessels that branch off from the abdominal aorta (the abdominal portion of the major artery leading from the heart) and enter into each kidney. (The kidneys are two bean-shaped organs that remove waste substances from the blood and aid in fluid conservation and in stabilization of the chemical composition of the blood.) At the inner concavity of each kidney there is an opening, known as the hilum, through which the renal artery passes. After passing through the hilum, the renal artery divides ordinarily into two large branches, and each branch divides into a number of smaller arteries, which bring blood to the nephrons, the functioning units of the kidney. Blood that has been processed by the nephrons ultimately reaches the renal vein, which carries it back to the inferior vena cava and to the right side of the heart.

The renal arteries deliver to the kidneys of a normal person at rest 1.2 litres of blood per minute, a volume equivalent to approximately one-quarter of the heart's output. Thus, a volume of blood equal to all that found in the body of an adult human being is processed by the kidneys once every four to five minutes. Although some physical conditions can inhibit blood flow, there are certain self-regulatory mechanisms inherent to the arteries of the kidney that allow some adaptation to stress. When the total body blood pressure rises or drops, sensory receptors of the nervous system located in the smooth muscle wall of the arteries are affected by the pressure changes, and, to compensate for the blood pressure variations, the arteries either expand or contract to keep a constant volume of blood flow.

For a depiction of the renal arteries in human anatomy, shown in relation to other parts of the body, *see* the colour Trans-Vision in the PROPAEDIA: Part Four, Section 421.

renal calculus: *see* kidney stone.

renal capsule, thin membranous sheath that covers the outer surface of each kidney. The capsule is composed of tough fibres, chiefly collagen and elastin (fibrous proteins), that help to support the kidney mass and protect the vital tissue from injury. The number of elastic and smooth muscle fibres found in the capsule tends to increase with the individual's age. The capsule receives its blood supply ultimately from the interlobar arteries, small vessels that branch off from the main renal arteries; these vessels travel through the cortex of the kidney and terminate in the capsule. The maximum thickness of the membrane is usually 2 to 3 millimetres (0.08–0.12 inch). The capsule surrounds the outer walls and enters into a hollow region of the kidney known as the sinus. The sinus contains the major ducts that transport urine and the arteries and veins that supply the tissue with nutrients and oxygen. The capsule connects to these structures within the sinus and lines the sinus wall.

In a normal person, the capsule is light reddish-purple in colour, translucent, smooth, and glistening; it can usually be easily stripped from the rest of the kidney's tissue. A diseased kidney frequently sends fibrous connections from the main body of tissue to the capsule, which makes the capsule adhere more strongly. Difficulty in removing a capsule is noted at autopsy as an indication that the kidney was diseased.

renal carcinoma, also called CLEAR-CELL CARCINOMA, HYPERNEPHROID TUMOUR, or HYPERNEPHROMA, malignant tumour affecting the epithelial (covering and lining) cells of the kidney.

Most renal carcinomas appear in persons past 40 years of age, with peak incidence around the sixth or seventh decade. They tend to arise in persons with vascular disorders of the kidneys; because they are in close proximity to the bloodstream, they frequently send secondary tumours to other organs of the body such as the lungs, liver, brain, and bone tissue.

The renal carcinoma forms a large rounded mass in one or both of the kidneys. It is chiefly yellow in colour because of the large amount of lipid (fat) substances present. There are also reddened areas, where blood vessels have bled, and cysts containing watery fluids. The body of the tumour generally shows numerous large blood vessels, the walls of which are composed of tumour cells.

Renal carcinomas are frequently not recognized until they manifest themselves in other parts of the body. Painless bleeding into the urine may occur early in the disease but is usually disregarded by the person afflicted. Pain is uncommon until late in the development of the disease. The tumour causes deformity in one or more of the cavities in the kidney at an early stage; if tumours are suspected, a specialized X-ray will show these distortions.

Renal carcinoma may spontaneously regress. After a tumour has been surgically removed there may be no recurrence, or there may be a recurrence as much as 20 years later.

renal collecting tubule, also called DUCT OF BELLINI, any of the long narrow tubes in the kidney that concentrate and transport urine from the nephrons, the chief functioning units of the kidneys, to larger ducts that connect with the renal calyces, cavities in which urine gathers until it flows through the renal pelvis and the ureter to the urinary bladder. The collecting tubules connect with the nephron tubules in the outer layer of the kidney known as the cortex.

Each collecting tubule is about 20–22 millimetres (about 0.8 inch) long and 20–50 microns in diameter. The walls of the tubules are composed of cells with hairlike projections, flagellae, in the tube's channel. Motions of the flagellae help to move secretions through the tubes. As the collecting tubes become wider in diameter, the cells increase in height so that the wall becomes thicker.

The functions of the collecting tubes are transportation of urine and absorption of water. It is thought that the tissue of the kidney's medulla, or inner substance, contains a high concentration of sodium. As the collecting tubules travel through the medulla, the concentration of sodium causes water to be extracted through the tubule walls into the medulla. The water diffuses out between the collecting wall cells until the concentration of sodium is equal in the tubes and outside them. Removal of water from the solution in the tubes serves to concentrate the urine content and conserve body water.

Pathologic changes that can afflict the tubules include degeneration or atrophy of the tube walls; deposition of calcium compounds; infection by viruses, bacteria, fungi, or parasites; presence of crystals; dilatation or blockage of the tubes; and malignant tumours.

renal corpuscle, also called MALPIGHIAN BODY, filtration unit of vertebrate nephrons, functional units of the kidney. It consists of a knot of capillaries (glomerulus) surrounded by a double-walled capsule (Bowman's capsule) that opens into a tubule. Blood pressure forces plasma minus its macromolecules (*e.g.,* proteins) from the glomerular capillaries into the Bowman's capsule. This filtrate, called capsular urine, then passes into the tubule for further processing.

renal cyst, cyst in the kidney. A cyst is an enclosed sac or pouch that usually contains liquid or semisolid material. Several different types of cysts develop in the kidneys. Solitary cysts contain liquids and may be partially filled with blood. They vary widely in size. Some are present at birth, and others are caused by tubular obstructions. If sufficiently large, they can cause backaches and a dragging sensation. In kidney vascular diseases numerous small cysts may be formed by the dilatation of blood vessels. Obstruction of the lymphatic vessels leading to the kidney may result in cysts; these are generally small and relatively harmless except when they exert pressure upon a nearby blood vessel. Tapeworms may cause cysts in the kidneys. Symptoms include pain, difficulty in urination, blood in the urine, and the excretion of tapeworm eggs and segments in the urine. Usually, because of the possibility of a tumour, cysts require surgical exploration and removal.

Polycystic disease is a congenital defect in which one or both of the kidneys have numerous large cysts. In medullary cystic diseases, also thought to be congenital in origin, cysts form in the small collecting tubules that transport urine from the nephrons, the urine-producing units of the kidney. The disease generally does not have warning symptoms, but affected persons become anemic and have low salt concentrations and high levels of nitrogenous substances in the bloodstream. The kidneys shrink, have a granular surface, show many small cysts, and have large areas of scar tissue. The most common victims are older children and young adults. *See also* urogenital malformations.

renal failure (medicine): *see* kidney failure.

renal osteodystrophy, also called RENAL RICKETS, or SECONDARY PARATHYROID HY-

PERPLASIA, chronic, probably hereditary disorder characterized by kidney dysfunction, bone-mineral loss and rickets-type deformities, calcifications in abnormal places, and overactivity of the parathyroid glands. Loss of calcium and retention of phosphorus occur because of the malfunctioning kidneys; this induces an overproduction of parathormone, which results in the demineralization of well-formed bones and an inability to calcify newly developing bone. The bone abnormalities develop more slowly than kidney insufficiency; if the latter is severe, death may occur in childhood before the skeletal abnormalities become apparent. If the kidney insufficiency is not total, it may cause dwarfing and frequent fractures in children; adults experience gradual softening and bowing of bones. Treatment of the disorder depends on the state of chemical balance of the patient. Kidney transplant has been successful in some cases involving severe kidney dysfunction, and removal of the malfunctioning parathyroids is sometimes effective in controlling symptoms.

renal pelvis, enlarged upper end of the ureter, the tube through which urine flows from the kidney to the urinary bladder. The pelvis, which is shaped somewhat like a funnel that is curved to one side, is almost completely enclosed in the deep indentation on the concave side of the kidney, the sinus. The large end of the pelvis has roughly cuplike extensions, called calyces, within the kidney—these are cavities in which urine collects before it flows on into the urinary bladder.

Like the ureter, the renal pelvis is lined with a moist mucous-membrane layer that is only a few cells thick; the membrane is attached to a thicker coating of smooth muscle fibres, which, in turn, is surrounded by a layer of connective tissue. The mucous membrane of the pelvis is somewhat folded so that there is some room for tissue expansion when urine distends the pelvis. The muscle fibres are arranged in a longitudinal and a circular layer. Contractions of the muscle layers occur in periodic waves known as peristaltic movements. The peristaltic waves help to push urine from the pelvis into the ureter and bladder. The lining of the pelvis and of the ureter is impermeable to the normal substances found in urine; thus, the walls of these structures do not absorb fluids.

renal pyramid, any of the triangular sections of tissue that constitute the medulla, or inner substance, of the kidney. The pyramids consist mainly of tubules that transport urine from the cortical, or outer, part of the kidney, where urine is produced, to the calyces, or cup-shaped cavities in which urine collects before it passes through the ureter to the bladder. The point of each pyramid, called the papilla, projects into a calyx. The surface of the papilla has a sievelike appearance because of the many small openings from which urine droplets pass. Each opening represents a tubule called the duct of Bellini, into which collecting tubules within the pyramid converge. Muscle fibres lead from the calyx to the papilla. As the muscle fibres of the calyx contract, urine flows through the ducts of Bellini into the calyx. The urine then flows to the bladder by way of the renal pelvis and a duct known as the ureter.

Between the pyramids are major arteries termed the interlobar arteries. Each interlobar artery branches over the base of the pyramid. Smaller arteries and capillaries divide off from the interlobar arteries to supply each pyramid and the cortex with a rich network of blood vessels. Blockage of an interlobar artery can cause degeneration of a renal pyramid.

Some animals, such as rats and rabbits, have a kidney composed of only one renal pyramid. In humans each kidney has a dozen or more pyramids.

renal transplant: *see* kidney transplant.

Renamo, byname of MOZAMBICAN NATIONAL RESISTANCE, Portuguese RESISTÊNCIA NACIONAL MOÇAMBICANA, guerrilla organization that sought to overthrow the government of Mozambique beginning in the late 1970s. Renamo was formed in 1976 by white Rhodesian officers who were seeking a way to keep newly independent Mozambique from supporting black guerrillas who were trying to overthrow the white Rhodesian government. These officers recruited disaffected guerrillas who had belonged to Mozambique's successful independence movement, Frelimo. The sponsorship of Renamo was soon taken over by the South African armed forces. Renamo opposed the Marxist-leaning Mozambican central government, and Renamo's guerrillas sought to disrupt the nation's economy and infrastructure by cutting railway and power lines, destroying roads and bridges, and sabotaging oil-storage depots. In their raids on towns and villages, the guerrillas sometimes engaged in wholesale massacres of civilians. By the late 1980s, Renamo's insurgency had caused the deaths of at least 100,000 people and the creation of more than 1,000,000 refugees. Mozambique's economy was brought to a standstill, and the government was unable to keep the country's railroad network functioning without the help of Zimbabwean, Zambian, and Tanzanian troops.

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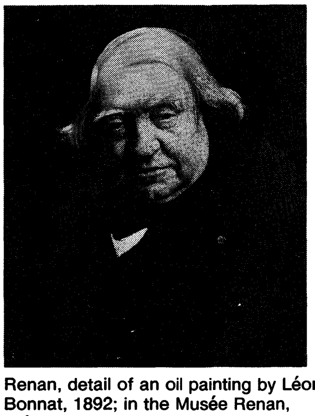
Renan, (Joseph-)Ernest (b. Feb. 28, 1823, Tréguier, Fr.—d. Oct. 2, 1892, Paris), French philosopher, historian, and scholar of religion, a leader of the school of critical philosophy in France.

Early career. Renan was educated at the ecclesiastical college in his native town of Tréguier. He began training for the priesthood, and in 1838 he was offered a scholarship at the seminary of Saint-Nicolas-du-Chardonnet. He later went on to the seminary of Saint-Sulpice, where he soon underwent a crisis of faith that finally led him, reluctantly, to leave the Roman Catholic church in 1845. In his view, the church's teachings were incompatible with the findings of historical criticism; but he kept a quasi-Christian faith in God.

Early works. For Renan, the February revolution of 1848 in France and other parts of Europe was a religion in the making. Sometimes enthusiastic, sometimes critical, he participated in the revolution's messianic expectations and carried this ambiguous attitude over into *L'Avenir de la science* (1890; *The Future of Science*). The main theme of this work is the importance of the history of religious origins, which he regarded as a human science having equal value to the sciences of nature. Though he was now somewhat anticlerical, the French government sent him in 1849 to Italy, where the papacy was still politically important, to help classify manuscripts previously inaccessible to French scholars.



Renan, detail of an oil painting by Léon Bonnat, 1892; in the Musée Renan, Tréguier, Fr.
Archives Photographiques

Renan returned to Paris in 1850 to live with his sister, Henriette, on her savings and the small salary attached to his own post at the Bibliothèque Nationale. He began to make a name for himself with his doctoral thesis, *Averroès et l'Averroïsme* (1852; "Averroës and Averroism"), concerning the thought of that medieval Muslim philosopher. He continued his scholarly writings with two collections of essays, *Études d'histoire religieuse* (1857; *Studies of Religious History*) and *Essais de morale et de critique* (1859; "Moral and Critical Essays"), first written for the *Revue des Deux Mondes* and the *Journal des Débats.* The *Études* inculcated into a middle-class public the insight and sensitivity of the historical, humanistic approach to religion. Many of the *Essais* denounce the materialism and intolerance of the Second Empire (1852–70) in the name of Renan's aristocratic ideal: intellectuals, acting as "bastions of the spirit," must, he affirms, resist tyranny by intellectual and spiritual refinement.

In 1856 Renan married Cornélie Scheffer, niece of the painter Ary Scheffer. In October 1860 Renan was entrusted with an archaeological mission to Lebanon. The Phoenician inscriptions that he discovered were published in his *Mission de Phénicie* (1864–74; "Phoenician Expedition"). They were later included in the *Corpus Inscriptionum Semiticarum* ("Corpus of Semitic Inscriptions"), which he helped to bring out through the Académie des Inscriptions et Belles-Lettres. But archaeology was not his main interest. In April 1861, with his wife and sister, he visited the Holy Land in search of materials and inspiration concerning a life of Jesus that he was bent on writing. He finished a first draft of it in Lebanon but at tragic cost, for Henriette died of malaria at ʿAmshīt on Sept. 24, 1861, while he himself fell desperately ill.

Religious controversies. Renan had counted on the writing of his life of Jesus to secure election to the chair of Hebrew at the Collège de France. He was elected, before the book was ready, on Jan. 11, 1862. But in his opening lecture, on February 21, he referred to Jesus in the words of Jacques Bossuet, a French bishop and historian of the 17th and 18th centuries, as "an incomparable man." Though this was, in his eyes, the highest praise one could bestow on a man, it was not sufficient for the clericals, who took advantage of its implied atheism and the uproar caused by the lecture to have Renan suspended. Contemptuously refusing an appointment to the Bibliothèque Imperiale (June 1864), Renan decided to live by his pen for the next few years. He had to wait until 1870, however, before the chair was restored to him. He was thus pushed into opposition to the church but had already begun to frequent such dissident salons as that of Princess Mathilde, niece of Napoleon Bonaparte, and to associate with such literary notables as Gustave Flaubert, Charles-Augustin Sainte-Beuve, Hippolyte Taine, and the Goncourt brothers.

When the *Vie de Jésus* (*Life of Jesus*) did appear in 1863, it was virulently denounced by the church. Though not Renan's best historical work, it can still claim the attention of 20th-century readers because it presents a "mythical" account of the making of Christianity by the popular imagination and thus has a place, like his other historical works, in the literature of messianism. After a journey in Asia Minor in 1864–65 with his wife, he published *Les Apôtres* (1866; *The Apostles*) and *Saint Paul* (1869), to follow the *Vie de Jésus* as parts of a series, *Histoire des origines du christianisme* (*The History of the Origins of Christianity*). Both these volumes, containing brilliant descriptions of how Christianity spread among the rootless proletariat of the cities of Asia Minor, illustrate his preoccupation with the question: would the intellectuals of the 19th century lead the masses toward a new enlightenment?

Interest in politics. Renan began to interest himself increasingly in politics. In 1869, at the beginning of the "liberal" phase of the Second Empire, he stood unsuccessfully for Parliament. In the same year he defended constitutional monarchy in an article, "La Monarchie constitutionnelle en France" ("Constitutional Monarchy in France"). Thus far he was a liberal. In the same spirit he tried, during the Franco-German War of 1870–71, to work across frontiers: he corresponded with David Friedrich Strauss, a German theologian, and tried to persuade the Prussian crown prince (later German emperor as Frederick III) to stop the war. But the bitterness of France's defeat and his anger with democracy caused him to become authoritarian. Thus, *La Réforme intellectuelle et morale* (1871), concerning intellectual and moral reform, argues that France, to achieve national regeneration, must follow the example set by Prussia after the Battle of Jena in 1806. By taking his advice, however, France would have become the sort of clerical monarchy that Renan soon found he did not want. He had to resign himself to accepting the Third Republic (1870–1940), but he withdrew from public life. Though he continued to travel zestfully all over Europe, visiting surviving Bonapartists, such as Prince Jérôme Napoléon, his life became more and more identified with his writings. He was elected to the Académie Française in 1878.

Later writings. Renan's ironical yet imaginative vision of the "festival of the universe" found expression in *L'Antéchrist* (1873; *The Antichrist,* 1896; vol. iv of the *Histoire des origines*), with its satirical portrait of Nero and its apocalyptic atmosphere—replete with expectations of a cataclysmic consummation of history—assuredly the most impressive of his historical narratives. The "festival of the universe" provides a visionary end to the *Dialogues et fragments philosophiques* (1876; *Philosophical Dialogues and Fragments,* 1899). In the first of these, however, Renan is more ironically skeptical about the hidden God than he had been. In fact, the Epicureanism of his later years masks an anxiety about death and the hereafter. His more superficial side is illustrated in the "philosophic dramas" (collected edition 1888), which trace his acceptance of the Republic, especially *Caliban* (written 1877) and *L'Eau de jouvence* (written 1879; "The Water of Youth"). In the former, the aristocracy (Prospero and Ariel) loses to democracy (Caliban) because alchemical spells (traditional sanctions) are powerless against a people infected by positivism; scientific power politics would be an effective answer, but this is out of the question because in practice it would mean a clerical monarchy.

As to the remaining volumes of the *Histoire des origines,* if Renan's Epicureanism is hard to find in *Les Évangiles* (1877; *The Gospels,* 1889), it is present in *L'Église chrétienne* (1879; "The Christian Church") in the portrait of the Roman emperor Hadrian; but in *Marc-Aurèle* (1882; *Marcus Aurelius,* 1904), the study of Marcus Aurelius, again a self-portrait, is dominated by the author's preoccupation with death. Since 1876 Renan had been working on his memoirs, *Souvenirs d'enfance et de jeunesse* (1883; *Recollections of My Youth,* 1883), in which he reconstructs his life so as to show that he was predestined to become a *prêtre manqué* (failed priest) and that, in spite of heavy odds, his wager on the hidden God had paid off in terms of happiness.

In the *Souvenirs* Renan is too serene for some tastes, though his irony keeps his complacency in check. In *L'Ecclésiaste* (1882; "Ecclesiastes") and two articles on Amiel (1884), he is above all an ironist combatting the Pharisees (religious legalists). On the other hand, in some of his speeches at the Académie Française, on Claude Bernard, a French physiologist (1879), and Paul-Émile Littré, a French philologist (1882), he reveals his anguish in moments of doubt. Thus, he manifests a baffling variety of characteristics, but the moral heart of the man is to be found in one of the later dramas, *Le Prêtre de Nêmi* (1885; "The Priest of Nêmi"), and above all in his *Histoire du peuple d'Israël* (1887–93; *History of the People of Israel,* 1888–96). For him, the history of Jewish messianism bore witness to man's capacity for faith when the odds are against him. Thus, it revived his own faith. He could therefore hope that, though Judaism would disappear, the dreams of its prophets would one day come true, so that "without a compensatory Heaven justice will really exist on earth." Having exhausted himself in an effort to finish the work, he died shortly after its completion in 1892.

With his leanings toward liberalism and authoritarianism in politics and faith and skepticism in religion, Renan embodied the contradictions of the middle class of his time. Politically, his influence after his death was far-reaching, on nationalists, such as Maurice Barrès and Charles Maurras, on republicans, such as Anatole France and Georges Clemenceau. He succeeded in assuaging one of the great anxieties of his time, the antagonism between science and religion, but he very much felt this anxiety. (H.W.W.)

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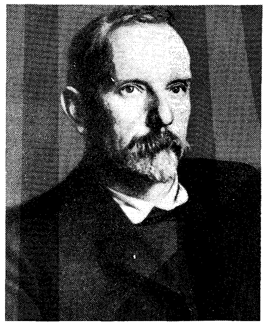
Renard, Charles (b. 1847, France—d. 1905, France), French military engineer, chief builder of the first true dirigible; *i.e.,* an airship that could be steered in any direction irrespective of wind and could return under its own power to its point of departure. In 1884 Renard and Arthur Krebs, French Army captains at the Aérostation Militaire, Chalais-Meudon, completed the dirigible "La France," which on August 9 of that year made its first flight, a circular journey of 7 or 8 kilometres (about 4 to 5 miles). Earlier (1871) Renard had flown a pilotless heavier-than-air craft, a 10-winged model glider.

Renard, Jules (b. Feb. 22, 1864, Châlons-sur-Mayenne, Fr.—d. May 22, 1910, Paris), French writer best known for *Poil de carotte* (1894; *Carrots,* 1946), a bitterly ironical account of his own childhood, in which a grim humour conceals acute sensibility. All his life, although happily married and the father of two children, Renard was haunted by and tried to hide the misery he had suffered as a child from lack of affection. His prose, stripped of superfluous words, influenced later French writers who found in it a corrective to the indiscriminate accretion of detail that was a tendency of the Naturalists who preceded him.

Renard was educated at Nevers and in Paris. After his marriage in 1888, he devoted himself



Jules Renard
H. Roger-Viollet

to writing. Above all an artist (he described himself as a "hunter of images"), he used acutely observed detail in his descriptive writing. His sketches of animal life in *Histoires naturelles* (1896) are models of their kind. Although he spent most of his life in Paris, he never lost touch with his native countryside; and in *Les Philippe* (1907), *Nos frères farouches,* and *Ragotte* (both 1908), he depicted rural life with amused penetration and cruel realism. He also wrote plays, including a dramatized version of *Poil de carotte* (1900). He was a founder member of the *Mercure de France* (1890) and was elected to the Académie Goncourt (1907). His *Journal,* in 17 volumes (1925–27), was translated into English in 1964.

Renart, Jean (fl. 1200–22), French poet, author of romances of adventure, whose work rejected the fey atmosphere and serious morality that had distinguished the poetry of his predecessor Chrétien de Troyes in favour of a half-nostalgic, half-flippant portrayal of high society—the idyllic picnic, the bathing in the spring, the exchange of girdles and rings, the tourneying, and the lute playing far into the night.

Almost nothing is known of Renart, although he is associated with the village of Dammartin en Goële, near Meaux, a few miles east of Paris. His known works are *L'Escoufle,* a picaresque novel in verse about the adventures of Guillaume and Aelis, betrothed children who flee to France; *Guillaume de Dôle,* the story of a calumniated bride who cunningly defends her reputation; and the *Lai de l'ombre,* about a knight who presses a ring on his lady and, when she refuses it, throws it to her reflection in a well—a gesture that persuades her to accept him. Renart's authorship of the first two works, which had each survived only in a single copy, was first proposed late in the 19th century and was confirmed in 1910, when anagrams of the name Renart were discovered in the final lines of both romances.

Renata (Italian personal name): *see under* Renée.

Renatus, Flavius Vegetius: *see* Vegetius.

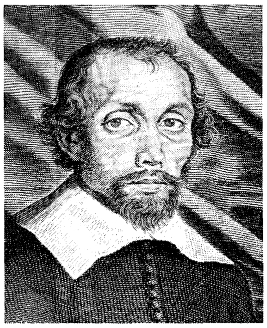
Renaud (French personal name): *see under* Reginald, except as below.

Renaud DE MONTAUBAN, hero of an Old French chanson de geste of the same name (also known as *Les Quatre Fils Aymon* ["The Four Sons of Aymon"]), whose story may contain elements of prehistoric myth and whose theme long survived in folktale and ballad throughout western Europe. Renaud slays Charlemagne's nephew after a quarrel over chess, and, mounting his marvellous steed Bayard (which understands human speech), he barricades himself with his brethren in the rock fortress of Montessor (at the confluence of the rivers Semoy and Meuse). Their father, Aymon, helps to besiege them. They later hold out in Montauban as the allies of King Yon of Gascony and finally escape to Dortmund in Westphalia. Renaud turns to a life of religion and helps in the building of Cologne cathedral, for which he will accept no wages. His envious fellow workmen murder him and throw his body into the Rhine River, where it is conducted upstream by choirs of angels and buried in state at Dortmund.

The French poem, dating from the late 12th or early 13th century, was more than 18,000 lines long; a Middle Dutch version was the ancestor of an early 17th-century *Volksbuch* ("chapbook") version. Spanish "Reinalte," or "Reinaldos," versions (including a play by Lope de Vega) derive partly from French sources, partly from Italian "Rinaldo" poems, which proliferated from the 14th century up to the composition of Torquato Tasso's first epic poem, *Rinaldo,* in the second half of the 16th century.

Renaudot, Théophraste (b. 1586?, Loudun, Fr.—d. Oct. 25, 1653, Paris), physician and social-service administrator who, as the founder of France's first newspaper, is considered the father of French journalism.

In 1612 Renaudot traveled to Paris, where he became a protégé of Armand (later Cardinal) de Richelieu, who obtained his appointment



Renaudot, detail of an engraving
H. Roger-Viollet

as physician to King Louis XIII and commissary general of the poor, with the task of organizing a program of public assistance. Not until 1630, however, was he able to open in Paris a *bureau d'adresse,* combining the services of a labour bureau, intelligence department, and charity organization that directed sick persons to physicians prepared to give them free treatment.

The following year, under the supervision and patronage of Richelieu, Renaudot founded *La Gazette* (later *La Gazette de France*), a weekly sheet relating government-sanctioned news, which he edited and published until his death. In 1635 he established a free dispensary and two years later added France's first pawnbroking shops to the bureau's activities. His installation of public-health services aroused opposition from the medical faculty of Paris, led by the conservative physician Guy Patin; after the deaths of Richelieu (1642) and Louis XIII (1643), Renaudot was denied the right to practice medicine in Paris (1644). He was appointed historiographer to Louis XIV by the king's principal minister, Jules Mazarin, in 1646.

Renault, in full RÉGIE NATIONALE DES USINES RENAULT, major French automobile and motor carrier manufacturer. Owned by the French government, it is the country's largest manufacturer and exporter of motor vehicles. Headquarters are in Boulogne-Billancourt.

The original firm, Société Renault Frères (Renault Brothers), was founded in October 1898 by Louis Renault and two brothers after the young mechanic had built his first minicar at home. That first model incorporated direct transmission, then an automotive novelty. Early cars built by the Renault brothers won many prestigious competitions. By 1905 the Renault line had grown to five models (including a taxicab), and in 1906 the company's 21-seat buses were introduced in Paris.

During World War I the company was active in the war effort, producing shells, airplane engines, and light tanks. Early in World War II, however, the factories were brought under German control, and a number of plants were heavily damaged by Allied bombings. By the end of the war more than 80 percent of the facilities had been destroyed. The remaining industrial property was confiscated by the French government, which set up the state-controlled Régie Nationale des Usines Renault in 1945.

In 1979 Renault signed an agreement with American Motors Corporation that called for AMC dealers to sell Renault cars in the United States while Renault would market AMC cars in Europe. A year later Renault became the principal stockholder in AMC. In 1982 AMC began producing Renault-designed cars in the United States, sharply cutting back on production of its own models. In 1987, however, Renault announced that it would withdraw from the American automobile market, and the company made a buyout agreement with Chrysler Corporation. Renault acquired the heavy-truck subsidiary of Citroën, Automobiles M. Berliet, in 1974 and from 1983 held a controlling interest in Mack Trucks Inc. of the United States. Renault also makes a variety of industrial products. Certain foreign sales and operations are handled by the Renault-Peugeot Association, formed in 1966 for this purpose.

Renault, Louis (b. May 21, 1843, Autun, Fr.—d. Feb. 8, 1918, Barbizon), French jurist and educator, cowinner in 1907 (with Ernesto Teodoro Moneta) of the Nobel Prize for Peace.

From 1868 to 1873 Renault was professor of Roman and commercial law at the University of Dijon. From 1873 until his death he was professor in the faculty of law at the University of Paris, where in 1881 he became professor of international law. In 1890 he was appointed jurisconsult of the Ministry of Foreign Affairs, a post specially created for him in which he scrutinized French foreign policy in the light of international law. He served at numerous conferences in this capacity, notably at the two Hague conferences in 1899 and 1907 and the London naval conference of 1908–09.

Renault was prominent as an arbitrator, his more famous cases including the Japanese House Tax case of 1905, the Casa Blanca case of 1909, the Sawarkar of 1911, the Carthage of 1913, and the Manouba of the same year. Among his writings are numerous articles and monographs on the specialized topics of international law. Together with his friend and colleague C. Lyon-Caen, he produced several works on commercial law, including a compendium in two volumes, a treatise in eight volumes, and a manual that ran to many editions.

In 1879 Renault published his *Introduction to the Study of International Law* and in 1917 *First Violations of International Law by Germany,* concerning the invasion of Belgium and Luxembourg in breach of Germany's treaty obligations.

Renault, Louis (b. 1877, Paris, Fr.—d. Oct. 24, 1944, Paris), manufacturer who built the largest automobile company in France.

Renault built his first automobile in 1898. He and his brothers Fernand and Marcel then built a series of small cars and in October 1898 formed the Société Renault Frères. Renault vehicles attracted much attention by winning numerous road races until Marcel was killed during a Paris-Madrid run in 1903. Renault then abandoned racing and concentrated on manufacturing. In 1918 he produced the Renault tank, which was often used as a troop-escort vehicle in the last months of World War I. He continued to increase the productive capacity of his Boulogne-Billancourt works and after the war extended his production to include farm equipment, marine and industrial machinery, and diesel motors.

His continued production of military equipment under the German occupation in World War II led to his being incarcerated after liberation on charges of collaboration. He died while awaiting trial; the Renault company was subsequently nationalized. *See also* Renault.

Renault, Mary, pseudonym of MARY CHALLANS (b. Sept. 4, 1905, London, Eng.—d. Dec. 13, 1983, Cape Town, S.Af.), British-born South African novelist, best known for her scholarship and her skill in re-creating classical history and legend.

Mary Renault graduated from St. Hugh's College and Radcliffe Infirmary, Oxford, completing her training as a nurse in 1937. She had begun to write novels but worked as a nurse during World War II. After the war she settled in South Africa.

Renault's best-known sequence of Greek historical novels soon appeared: *The Last of the Wine* (1956), *The King Must Die* (1958), and *The Bull from the Sea* (1962)—all praised for their attention to historical detail. The novels also caused some controversy because of their sympathetic handling of male homosexuality. In *Fire from Heaven* (1970), *The Persian Boy* (1972), and *Funeral Games* (1981), Renault retold the history and legend surrounding Alexander the Great; she also examined his psychological background in the biography *The Nature of Alexander* (1975).

Rendsburg, town, Schleswig-Holstein *Land* (state), northern Germany, on the Eider River and the Kiel Canal (there bridged), west of Kiel. An old fortress town on the Schleswig and Holstein border, it was first mentioned in 1199 as Reinoldesburg. Chartered in 1253, it was often an object of dispute between the Danish kings and the counts of Schleswig and Holstein. It served as a German centre of operations in the revolt of Schleswig and Holstein against Denmark in 1848–50, and, after the German-Danish and Austro-Prussian wars (1864–66), it passed to Prussia. Commercial development was stimulated by the opening of the Kiel Canal in 1895, which made it an inland seaport. Rendsburg is divided by the Eider River into the Altstadt (Old Town) on an island in the Eider, the Neuwerk district to the south, and the industrial suburbs to the north. Historic landmarks include St. Mary's Church (1287–93), the town hall (1566), and Christ Church (1696). Many medieval houses have survived.

An important centre of water, road, and rail traffic, Rendsburg developed an economy based on marketing agricultural products, shipbuilding, ironworking, and the manufacture of textiles, fertilizer, and machinery. Pop. (1989 est.) 30,752.

Rendsburg faience, German tin-glazed earthenware produced between 1764 and 1772 in the town of Rendsburg, Holstein, at a factory founded by Caspar Lorenzen and Christian Friedrich Clar. The few surviving examples of this ware are mainly ornamental rather than utilitarian (cane handles and snuffboxes, for example) and are decorated with Chinese floral designs painted in manganese or blue.

René I, byname RENÉ OF ANJOU, French RENÉ D'ANJOU (b. Jan. 16, 1409, Angers, Fr.—d. July 10, 1480, Aix-en-Provence), duke of Bar (from 1434), duke of Anjou (from 1430), and count of Provence and of Piedmont. He was also titular king of Naples from 1435 to 1442 and duke consort of Lorraine from 1431 to 1453. He was the second son of Louis II, duke d'Anjou, and Yolanda of Aragon.

René I, detail of a portrait by Nicolas Froment, 1475–76; in the Cathedral of St. Saviour, Aix-en-Provence
Giraudon Art Resource/EB Inc.

On his father's death (1417), René's elder brother, Louis III, succeeded to Anjou, Maine, and Provence; but in 1419 his maternal granduncle, Duke Louis of Bar, named René as his successor. In 1420, moreover, René married Isabella, elder daughter of Charles II of Lorraine. Sole ruler of Bar from 1430, he claimed Lorraine by right of his wife on Charles II's death (1431). King Charles VII of France supported this claim, but Antony of Vaudémont contested it.

Antony defeated René at Bulgnéville (July 2, 1431), took him prisoner, and handed him over to Philip the Good, duke of Burgundy. Released on parole (May 1432) after giving his sons John and Louis as hostages, René in 1433 agreed that his elder daughter Yolande (1428–83) should marry Antony's son Ferry; but in 1434, when the Holy Roman emperor Sigismund had recognized René as duke of Lorraine (April) and when René had also inherited Anjou and Provence from Louis III (November), Philip took umbrage and, in December, summoned René back into captivity. René finally obtained his discharge in 1437, promising a heavy ransom and making territorial concessions.

Meanwhile Joan II of Naples, who died in February 1435, had made René her heir. After further conciliating Burgundy by the marriage of his son John to Philip's niece, René in spring 1438 sailed for Naples, which his wife Isabella had been defending against his rival Alfonso V of Aragon. Besieged in Naples by Alfonso from November 1441, he abandoned the city in June 1442. In October he was back in Provence.

From the 1420s the English had been occupying Maine. To recover it for his younger brother Charles, René took part in the Anglo-French negotiations begun at Tours in April 1444. These led to the marriage of his younger daughter Margaret to the English king Henry VI in 1445, but Maine had eventually to be won back by force of arms (1448). Meanwhile Charles VII of France had helped René to pacify Lorraine, and the long-planned marriage of Yolande and Ferry had been solemnized (summer 1445). René accompanied Charles VII on his victorious campaigns of 1449–50 against the English in Normandy. On Isabella's death (1453), her duchy of Lorraine passed to René's son John.

Thereafter, apart from important measures for the economic development of Provence, which also benefited from legal reforms under him, René concerned himself more with the arts and literature in Anjou and Provence than with dynastic ambitions. In 1466, however, he accepted the title of king of Aragon and count of Barcelona from the Catalan rebels against John II of Aragon—but without result. With Louis XI of France his relations were generally strained, and Louis forced him to yield Anjou to the French crown.

René has been credited with numerous paintings, often simply because they bear his arms. These works, generally in the Flemish style, were probably executed at his behest by the painters maintained at his court, together with sculptors, goldsmiths, and tapestry workers. His writings, or works inspired by him (collected edition, 1843–46), include a treatise on tournaments, an idyllic poem on his courtship of Jeanne de Laval, a mystical dialogue, and an allegorical romance.

Renée OF FRANCE, French RENÉE DE FRANCE, Italian in full RENATA DI FRANCIA, DUCHESSA (duchess) DI FERRARA (b. Oct. 25, 1510, Blois, Fr.—d. June 12, 1574, Montargis), duchess of Ferrara (from 1534), an important figure in the history of the Protestant Reformation both in Italy and in France.

The second daughter of Louis XII of France and Anne of Brittany, Renée was married in 1528 to Ercole d'Este, who became duke of Ferrara in 1534. In return for renouncing her claims on Brittany, she was granted the duchy of Chartres by Francis I of France.

Renée's court at Ferrara became a meeting place for liberal thinkers and a refuge for French Protestants. The humanist Olympia Morata was brought up there; the French poet Clément Marot found shelter there in 1535; and John Calvin himself visited Renée in 1536. Under his influence she ceased practicing Roman Catholicism in 1540. Although she received certain exemptions from Pope Paul III in 1543, her husband took her children away from her and allowed her to be sentenced to imprisonment for heresy (1554). Within a few days, however, she was released after signing a form of recantation.

Renée of France, portrait after a painting by F. Clouet; in the Bibliothèque du Protestantisme, Paris
Giraudon—Lauros from Art Resource/EB Inc.

A widow from 1559 and on bad terms with her son Alfonso II of Ferrara, Renée returned to France in 1560 and settled in Montargis, which she made a centre of Protestant propaganda. During the Wars of Religion (1562–98), her château was besieged by her son-in-law François, duke de Guise (1562), and she was harassed by Roman Catholic troops.

Renfrew, district, Strathclyde region, southwestern Scotland; it was created by the reorganization of 1975 from part of the former county of Renfrewshire. The district covers an area of 119 square miles (309 square km) adjoining the city of Glasgow on the east and bounded by the River Clyde on the north. Although it is one of the most highly industrialized areas in Scotland, agriculture is also important, and fresh milk and vegetable crops are produced for the Glasgow market. The traditional but now declining heavy industries of the district are shipbuilding, marine engineering, and textiles. Manufacture of heavy machine tools remains important at Johnstone; sanitary ware has replaced textile printing at Barrhead; and an automobile-assembly plant has been established at Linwood (1963) to alleviate unemployment caused by the continued decline of the traditional heavy industries. Paisley (*q.v.*), the largest town and seat of the district authority for Renfrew and Eastwood districts, has a more diversified industrial structure. Textiles and thread continue to be produced along with chemicals; food processing, engineering, and shipbuilding are also important. Pop. (1987 est.) 201,295.

Renfrew, small royal burgh, Renfrew district, Strathclyde region, southwestern Scotland, near the right bank of the River Clyde, in the northwest portion of the metropolitan complex centred in Glasgow. A burgh in the 12th century, it received its charter in 1396. In 1164 Somerled, lord of the Western (Scottish) Isles, was defeated and killed there by the Scottish monarch Malcolm IV. Modern industries include large shipbuilding works, engineering, the manufacture of rubber and paint, and the largest boilermaking works in Britain. Pop. (1981) 21,459.

Renfrewshire, also called RENFREW, former maritime county, southwestern Scotland, that was bounded by Dunbartonshire and River Clyde (north), Lanarkshire (east), Ayrshire (south), and the Firth of Clyde (west). It had an area of 225 square miles (582 square km). In the reorganization of 1975 the county was divided into the districts of Eastwood, Renfrew, and Inverclyde (*qq.v.*), of Strathclyde region.

At the time of the Roman advance from the Solway Firth, the land was peopled by the British tribe of Damnonii. Forts at Bishopton and near Greenock were built by the Romans to prevent the outflanking of the Antonine Wall; but after the Romans retired (410), the territory was overrun by Cumbrian Britons and formed part of the kingdom of Strathclyde, extending from the River Derwent in Cumberland to the Clyde. It continued so until 1124, when Strathclyde was finally united to the Scottish crown under King David. In 1314 Walter Fitzalan, high steward of Scotland, who was settled in Renfrew, married Marjory, daughter of King Robert the Bruce and mother of Robert II. In 1404 Robert III erected the barony of Renfrew and the Stuart estates into a separate county, which, along with the earldom of Carrick and the barony of King's Kyle (both in Ayr), was bestowed upon his son, afterward James I. From their grant are derived the titles of earl of Carrick and baron of Renfrew, borne by the eldest son of the sovereign.

Apart from isolated incidents, the history of the county is scarcely separable from that of Paisley or the neighbouring county of Lanark.

Rengao language, also called RÔNGAO, or RANGAO, language of the North Bahnaric category of the Bahnaric languages, in the Mon-Khmer subgroup of the Austro-Asiatic language family. Rengao is the language of a comparatively small population, probably between 10,000 and 15,000 speakers, in south-central Vietnam.

Renger-Patzsch, Albert (b. June 22, 1897, Würzburg, Bavaria [Germany]—d. Sept. 27, 1966, Wamel Dorf, Über Soest, W.Ger.), German photographer whose works showed his desire to treat photography as a medium in its own right. He espoused straight photography, rejecting both the romanticism of the photographers who tried to imitate painting and the photography that tried to gain its effects through startling techniques. His book *Die Welt ist schön* (1928; "The World Is Beautiful") was closely related to the movement known as the New Objectivity (Neue Sachlichkeit), a term initially applied to a group of German painters whose detached and literal rendering of reality was so extreme that it produced an eerie effect, which is known in the United States as Magic Realism.

Renger-Patzsch photographed landscapes, forests, and industrial subjects in a straightforward way but went far beyond simple documentation. His later subjects included landscapes, trees, and stones.

Reni, Guido (b. Nov. 4, 1575, Bologna, Papal States [Italy]—d. Aug. 18, 1642, Bologna), early Italian Baroque painter noted for the classical idealism of his renderings of mythological and religious subjects.

"Madonna of the Rosary," painting by Guido Reni, c. 1630; in the Pinacoteca Nazionale, Bologna, Italy
SCALA—Art Resource/EB Inc.

First apprenticed to the Flemish painter Denis Calvaert at the age of 10, Reni was later influenced by the novel naturalism of the Carracci, a Bolognese family of painters. In 1599 he was received into the guild of painters, and after 1601 he divided his time between his studios in Bologna and Rome. Upon gaining prominence Reni surrounded himself with helpers—such as Giovanni Lanfranco, Francesco Albani, and Antonio Carracci—who were fascinated by his noble if somewhat tyrannical personality.

In his early career Reni executed important commissions for Pope Paul V and Scipione Cardinal Borghese, painting numerous frescoes in chapels for these and other patrons. Among these works is the celebrated fresco "Aurora" (1613–14). In his religious and mythological paintings, Reni evolved a style that tempered Baroque exuberance and complexity with classical restraint. Such compositions as "Atalanta and Hippomenes" (1625) show his preference for gracefully posed figures that mirror antique ideals. In the later part of his career, Reni employed lighter tones, softer colours, and extremely free brushwork.

Except for the work of the Carracci family, the frescoes of Raphael and ancient Greek sculptures were the main inspiration for Guido's art. He strove toward a classical harmony in which reality is presented in idealized proportions. The mood of his paintings is calm and serene, as are the studied softness of colour and form. His religious compositions made him one of the most famous painters of his day in Europe, and a model for other Italian Baroque artists.

renin, enzyme secreted by the kidney (and also, possibly, by the placenta) that breaks down protein and produces a rise in blood pressure. In the blood, renin acts on a fraction of the plasma proteins and releases angiotensin I. Angiotensin II is formed by the action of converting enzyme, which splits off two amino acids from the 10-amino-acid chain of angiotensin I. The resultant octapeptide (previously called hypertensin, or angiotonin) constricts arterioles, causing a rise in both systolic and diastolic blood pressure. It is one of the most active vasoconstrictors known; on a weight basis it is about six times as potent as norepinephrine. It also increases the secretion of cortisol and aldosterone by a direct action on the adrenal cortex.

Renkum, *gemeente* (commune), Gelderland *provincie,* central Netherlands. Renkum is situated on the Lower Rhine (Neder Rijn) River, immediately west of Arnhem, and comprises the communities of Oosterbeek (the local government centre), Renkum, Doorwerth, Heelsum, and Wolfheze. The locality was especially associated with the Battle of Arnhem in World War II; on the Oosterbeek village green is a memorial erected by the Dutch in memory of the British airborne forces. The Arnhem-Oosterbeek War Cemetery is outside the town, and Castle Doorwerth is now the Airborne Museum. Oosterbeek is a residential town dating back to Roman times; Renkum, formerly a royal country seat, is now industrialized. Pop. (1987 est.) 33,911.

Renmark, town, on the Murray River, southeastern South Australia, 130 miles (210 km) northeast of Adelaide. The site was first settled in 1887 by George and William Chaffey, Canadian-born irrigation engineers who had come to Australia via California. They received a land grant of 250,000 acres (100,000 hectares) for an irrigation project. The program, after a near failure in 1893, was successfully managed by an elected Irrigation Trust. The original open irrigation channels were replaced with a sealed underground-pipeline complex; the Irrigation Trust also supplies water on a volume basis to landholders in the district. The district supports dairying and the cultivation of grapes, citrus and stone fruit, and olives. Wine making and fruit packing and canning provide seasonal employment in the town. Renmark was proclaimed a municipality in 1935. Most of Renmark's civic functions were controlled by the Irrigation Trust until 1960. The Chowilla Dam site and a koala sanctuary on Goat Island are nearby. Pop. (1986) 3,489.

renmin gongshe (Chinese agricultural unit): *see* commune.

Renmin ribao, Wade-Giles romanization JEN-MIN JIH-PAO (Chinese: "People's Daily"), daily newspaper published at Peking as the official organ of the Central Committee of the Chinese Communist Party. The paper was established in 1948 in Yenang, Hopei province, toward the end of China's civil war. It was moved to Peking in 1949.

Renmin ribao carries serious, politically oriented articles and numerous speeches and reports by government or party leaders. An occasional piece of fiction or a poem may also appear in the paper's four to eight pages but never without making an appropriate political point. The newspaper's contents reflect official policy exactly, and it is read respectfully throughout China by many times its circulation. Copies of the paper are posted for public view in display cases at street intersections and are frequently read at local party meetings or quoted in Radio Peking programs. Village schools place quotations from the paper on bulletin boards.

Renmin ribao editorials deal with such subjects as politics and culture, communist theory and philosophy, and Marxist economics. In the days of the Cultural Revolution, they reflected the anti-intellectual climate of that period; after Mao Zedong's death, the editorials exposed the activities of the Gang of Four and pointed the way to the pragmatic policies of Mao's successors.

Renn, Ludwig, pseudonym of ARNOLD FRIEDRICH VIETH VON GOLSSENAU (b. April 22, 1889, Dresden, Ger.—d. July 21, 1979, East Berlin, E.Ger.), German novelist, best known for *Krieg* (1928; *War*), a novel based on his World War I battle experiences, the narrator and principal character of which was named Ludwig Renn. The stark simplicity of the novel emphasizes the uncompromising brutality of combat.

Born a Saxon nobleman, Renn himself served as an officer in the Saxon Guards from 1911 through World War I and then studied law, economics, and Russian and was briefly a police officer. Inflation in the 1920s wiped out his fortune, and his experience with nascent fascism in Italy led to his becoming a communist in 1928. He was editor of *Linkskurve,* the journal of the Union of Proletarian-Revolutionary Writers (1929–32), of which he was also secretary. He also taught war history during that period at the Marxist Workers' School in Berlin. His *Nachkrieg* (1930; *After War*), a novel about the postwar Weimar Republic, mirrors Renn's political beliefs. For his teaching at the Marxist school, he suffered two months' detention. He was arrested by the Nazis on the night of the Reichstag fire, which was blamed on the communists, and served two and a half years in prison, until 1935.

After his release he escaped in 1936 to Switzerland, where he published the novel *Vor grossen Wandlungen* (1936; *Death Without Battle*). He was leader of the Thälmann Battalion and chief of staff on the Loyalist side in the Spanish Civil War (1936–37). The novel *Der spanische Krieg* (1956; "The Spanish War") is his account of it. After lecturing in the United States, Canada, and Cuba (1937–38), he was director of the Officers College in Spain in 1938. Interned in a French camp in 1939, he was liberated, and from 1939 to 1947 he resided in Mexico, teaching and serving as president of the Bewegung Freies Deutschland ("Free Germany Movement").

Renn returned after World War II to East Germany and taught at various universities (1947–51). His later books included children's books, an autobiography, and more novels about war and the military, *Adel im Untergang* (1944; "Aristocracy in Decline"), *Krieg ohne Schlacht* (1957; "War Without Battle"), and *Auf den Trümmern des Kaiserreichs* (1961; "On the Ruins of the Empire").

Rennell, James (b. Dec. 3, 1742, Chudleigh, Devon, Eng.—d. March 29, 1830, London), the leading British geographer of his time.

Rennell, detail from a pencil sketch by G. Dance, 1794; in the National Portrait Gallery, London
By courtesy of the National Portrait Gallery, London

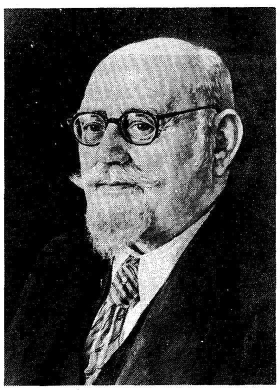
Rennell constructed the first nearly accurate map of India and published *A Bengal Atlas* (1779), a work important for British strategic and administrative interests.

While serving in the Royal Navy (1756–63), he became an expert surveyor. In 1762 he accompanied the Scottish geographer Alexander Dalrymple to the Philippines, later joined the East India Company, and became surveyor general of Bengal (1764–77).

After returning to London, Rennell devoted himself to geography and gained international eminence, his residence becoming a gathering place for travellers from around the world. When the famed explorer Mungo Park returned from West Africa in 1797, Rennell, as adviser to the African Association, organized the notes and provided the illustrations and route map for Park's classic work, *Travels in the Interior Districts of Africa.* Three editions of Rennell's *Memoir of a Map of Hindoostan* appeared between 1783 and 1793. His plan for a comprehensive study of western Asia resulted in a two-volume study of the geography of Herodotus and *A Treatise on the Comparative Geography of Western Asia* (1831), among other works. He also wrote on oceanography.

Rennell Island, also called MU NGGAVA, southernmost of the Solomon Islands in the southwestern Pacific Ocean, 130 mi (209 km) south of Guadalcanal. An atoll 50 mi long and 8 mi wide, it comprises raised coral limestone (400 to 500 ft [120 to 150 m] above sea level) and some low-grade phosphate rock. Te Nggano is a large lake in the southern part of the island. Rennell was annexed by Great Britain in 1899. Its Polynesian inhabitants cultivate yams and taro. Bauxite deposits have been found on the island and offer its best prospect for development. Pop. (1976) 1,132.

Renner, Karl (b. Dec. 14, 1870, Unter-Tannowitz, Bohemia, Austria-Hungary—d. Dec. 31, 1950, Doebling, Austria), Social Democratic statesman, chancellor (1918–20, 1945) and president (1945–50) of Austria, who, after



Renner, detail from a portrait by Robert Fuchs, 1950; in the Bild-Archiv, Österreichische Nationalbibliothek, Vienna

By courtesy of the Bild-Archiv, Osterreichische Nationalbibliothek, Vienna

World War I, advocated the *Anschluss* (union) between Germany and Austria; he played a major role in reestablishing Austrian home rule after the end of the German occupation in 1945.

Of peasant stock, Renner studied law at the University of Vienna and became a member of the moderate wing of the Austrian Social Democratic Party. A deputy to the Reichsrat (lower house of parliament) from 1907, Renner became the first chancellor of the new Austrian republic after the collapse of the monarchy in November 1918 at the end of World War I. He proved unable to prevent sizable territorial losses to Italy, Czechoslovakia, and Yugoslavia and on September 10 signed the Treaty of Saint-Germain, which further prohibited Austria's union with Germany, a project Renner had supported. As chancellor from November 1918 to October 1919 and October 1919 to June 1920, Renner advocated Austrian entry into the League of Nations, a policy of fulfillment of treaty obligations, and strict neutrality in foreign affairs. The leader of the Social Democratic Party's right wing during the 1920s, he served as president of the Nationalrat (parliament) from 1930 to 1933. In 1938 he supported Nazi Germany's annexation of Austria.

With the collapse of Germany in 1945 and the occupation of Austria by Soviet troops, Renner worked with Soviet officials to reconstitute an Austrian government, formed a provisional regime, and became the first chancellor of the reborn Austria in April 1945. On Dec. 20, 1945, the Reichsrat unanimously elected him president of the republic.

Renner published a number of works, the most significant of which were *Österreichs Erneuerung* (3 vol., 1916–17; "Austria's Renewal") and his memoirs, *An der Wende zweier Zeiten* (1946; "At the Junction of Two Eras").

Rennes, city, capital of Ille-et-Vilaine *département,* Bretagne region, western France. Situated at the confluence of the Ille and Vilaine rivers, the town was almost completely destroyed by fire in 1720 and was rebuilt from a plan that gave it wide, regular streets. The few surviving buildings, on the northern side of the canalized Vilaine, include the imposing Palais de Justice, which was the House of Parliament of Brittany from 1618 to 1655. Its Grand Chambre, where the Parliament sat, is a magnificent hall with fine decorations. The railway and most of the modern districts are on the south side of the Vilaine.

The cathedral, completed in 1844, has two towers belonging to an earlier edifice destroyed in the 1720 fire. The 18th-century town hall was designed by Jacques V Gabriel in typical Louis XV style. The Jardin du Thabor, a pleasant park, has a French classical garden, a rose garden, and a botanical garden. The museum, largely destroyed during World War II, has been rebuilt and has a large collection of paintings (16th–20th century).

The city's name is derived from the Redones, a Celtic tribe that established its capital there. Under Roman occupation the town became the centre of communications of the province of Armorica. In the Middle Ages it vied with Nantes as capital of the dukes of Brittany. The rivalry continued when a Parliament of Brittany was created in 1551; the Parliament finally settled at Rennes 10 years later. During the French Revolution, the town became the headquarters of the Republican Army in the fighting with the Vendéens (royalist insurgents). Rennes was bombed and partly destroyed in World War II.

Rennes is the seat of an archbishopric, and the Universités des Rennes I and II have made the city the intellectual centre of Brittany. The city has good road, rail, and air communications. Traditionally an important market town, it developed industrially after World War II, with plants manufacturing railway equipment, automobiles, agricultural machinery, and chemicals; there is also some food processing and printing and, more recently, electronics. There is a petroleum refinery at nearby Vern-sur-Seiche. Pop. (1982) 190,861.

Rennes faience, French tin-glazed earthenware, produced in Rennes, distinguished by the use of manganese purple. Most original products have an extreme rocaille shape decorated with many naturalistic flowers. But the majority of the ware produced in the numerous factories of this Breton centre in the 18th century, however, show the strong influence of both Marseille and Rouen, though Rennes never used red.

Rennie, John (b. June 7, 1761, Phantassie, East Lothian, Scot.—d. Oct. 4, 1821, London), outstanding Scottish civil engineer who built or improved canals, docks, harbours, and bridges throughout Britain. Three of his spans were built across the Thames at London.

He began his career as a millwright, and his first major project was the machinery for the Boulton and Watt Albion mills in London. Rennie greatly extended the use of iron for gears and other parts of machinery.

In the 1790s Rennie began work on canals in Kennet and Avon, Rochdale, Lancaster, and elsewhere. From about 1800 he worked on extensive drainage projects in the Lincolnshire fens; constructed or improved harbours, including Wick, Grimsby, Holyhead, and Hull; built the London and East India docks on the Thames; improved naval dockyards at Plymouth, Portsmouth, Chatham, and Sheerness; and began the breakwater that shelters Plymouth Sound.

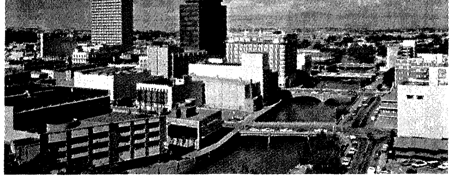
Rennie is best known, however, for his London bridges: Waterloo Bridge of masonry arches (replaced 1937–45); the old Southwark Bridge (1814–19), composed of three cast-iron arches; and the New London Bridge of multiple masonry arches (completed 1831 and moved more than 130 years later to Lake Havasu City, Ariz.).

After Rennie's death his sons divided his business. George, the elder, ran the mechanical engineering side, and John (later Sir John) ran the civil side, including the completion of London Bridge and Plymouth breakwater.

rennin, protein-digesting enzyme that curdles milk by transforming caseinogen into insoluble casein; it is found only in the stomachs of cud-chewing animals, such as cows. Its action extends the period in which milk is retained in the stomach of the young animal. In animals that lack rennin, milk is coagulated by the action of pepsin (*q.v.*), as is the case in man. Rennin is thought to be produced by cells in the gastric glands.

Rennyo, posthumous name KENJU DAISHI, assumed name SHINSHŌ-IN (b. April 4, 1415, Kyōto—d. May 5, 1499, Kyōto), Japanese Buddhist leader and eighth patriarch of the Hongan-ji (Hongan Temple) in Kyōto, the centre of reformed Japanese Buddhism. He furthered the anti-institutional Buddhist reform initiated by Shinran (13th century) that created the Jōdo Shinshū (True Pure Land sect) and inspired the Ikkō rebellions, 15th-century uprisings by militant, religious–political Buddhist societies against Japanese feudal lords. Rennyo, generally regarded as the restorer of the Jōdo Shin sect, undertook the compilation of the *Sanjō wasan*—three of the volumes of Buddhist poems and hymns (*wasan*) written by Shinran to expound his religious views—and oversaw the rebuilding of the Hongan-ji at Yamashina, on the outskirts of Kyōto.

Reno, city, seat (1871) of Washoe County, western Nevada, U.S., on the Truckee River, near the California border and the Sierra Nevada foothills, amid magnificent and varied scenery. Adjacent to Reno is the city of



The Truckee River flowing through Reno, Nev.

Donald Dondero

Sparks. The first settler was C.W. Fuller, who built a toll bridge of logs across the river about 1860. The site was acquired by M.C. Lake in

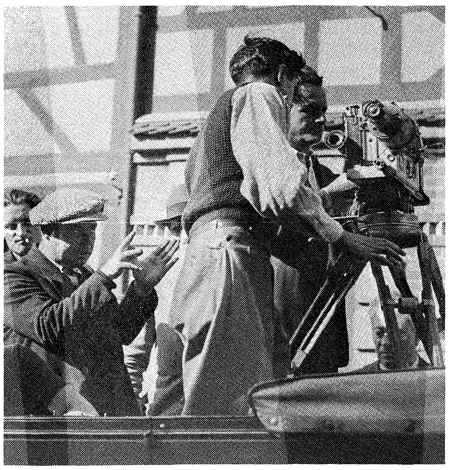
1863 and was called Lake's Crossing. When the Central Pacific Railroad reached the site in 1868, a land auction was held, and homes were built almost overnight. The town was renamed for Gen. Jesse Lee Reno of Virginia, a Union officer who was killed in the Civil War.

Until 1900 Reno served mainly as a distribution point, but, after several well-known people were granted divorces or were quickly married under liberal state laws, the city became famous as a busy divorce and marriage centre. Being close to the Sierra Nevada Range and Lake Tahoe, Reno is a year-round vacation centre. It is also the headquarters of the Toiyabe National Forest, and skiing, hunting, and fishing are nearby. When gambling was legalized in Nevada (1931), Reno began to attract tourists to its many casinos. There are some small manufacturing plants in the area, and Reno is an important warehousing and distribution centre because of Nevada's Free Port Law, under which merchandise moving in interstate commerce may be stored and assembled in transit free of taxation.

The University of Nevada was established in 1864 and was moved from Elko to Reno in 1886. The Mackay School of Mines Museum at the university has exhibits of the area's mining history. The Desert Research Institute was organized at the university in 1960. Reno is the seat of the Nevada Historical Society. Inc. 1879. Pop. (1980) city, 100,756; (1982 est.) metropolitan area (SMSA), 208,200.

Renoir, Jean (b. Sept. 15, 1894, Paris—d. Feb. 12, 1979, Los Angeles), French film director, son of the Impressionist painter Pierre-Auguste Renoir. His films, in both silent and later eras, were noted for their realism and strong narrative and include such classics as *Grand Illusion* (1937), *The Rules of the Game* (1939), and *The River* (1951).

Early years. Jean was born in the Montmartre section of Paris; in an environment in which art predominated, among painters and their models, he spent a happy childhood,



Jean Renoir (left) directing *Madame Bovary* in 1933
H. Roger-Viollet

which was richer in the carefree appreciation of beauty than in formal studies. Nevertheless, he received a degree in 1913 from the University of Aix-en-Provence, where he wrote poetry, and joined the cavalry to begin a military career.

World War I broke out in 1914, and Renoir was wounded in the leg. During his convalescence, he spent his time in Paris movie houses, where he discovered the serials and Charlie Chaplin. After he recovered he rejoined the service in the air force and finished the war with the rank of lieutenant.

Undecided on a career, he studied ceramics with his brother at Cagnes-sur-mer, near Nice, where his family had settled. Early in 1920 he married one of his father's models, Andrée Heurschling, a few months after the painter's death, and went with her to live in Marlotte, a village near Paris in which his father had once painted.

Intending to set up a ceramics factory, Jean Renoir was joined by his friend Paul Cézanne, the son of the painter. Having come into contact with theatrical circles through his sister-in-law, the actress Vera Sergine, Renoir was attracted by the evolving art of the film and decided to write a screenplay. It was made into the film *Catherine,* or *Une Vie sans joie,* in 1923, with his wife appearing under the name of Catherine Hessling. Another film was made on Cézanne's property, *La Fille de l'eau* (released 1924), which again starred Renoir's wife. All of his early films were produced in a makeshift way, with technical clumsiness, a lack of means, and a certain amateurishness. Nevertheless, the instinctive genius of the filmmaker found expression in them. These early films, which reveal a strong pictorial influence, have taken on with time a particular charm. In the late 1920s he found his inspiration in the writings of Émile Zola, Hans Christian Andersen, and others but made of them personal films in the style of the French avant-garde of the period.

These films had no commercial success, and Renoir and his backers were almost ruined. The advent of sound in motion pictures brought new difficulties, but Renoir passed the test with *On purge bébé* (1931) and proved himself with *La Chienne* (1931), a fierce and bitter film adapted from a comic novel by Georges de la Fouchardière.

During the 1930s Jean Renoir produced many of his most notable works, but their freedom of composition was confusing to critics of the period, and the films achieved only middling success. These films include *La Nuit du carrefour* (1932), based on a novel by Georges Simenon; *Boudu sauvé des eaux* (1932), an anarchistic and unconstrained comedy; *Madame Bovary* (1934), based on Flaubert's classic novel; and *Le Crime de M. Lange* (1936), which, in contrast to the rather stilted manner of the first years of sound films, foretells a reconquest of the true moving-picture style, especially in use of improvisation and of montage—the art of editing, or cutting, to achieve certain associations of ideas.

In 1936, in sympathy with the social movements of the French Popular Front, Renoir directed the Communist propaganda film *La Vie est à nous,* but the film was not commercially successful. The same year he recaptured the flavour of his early works with a short film, *Une Partie de campagne* (released 1946), which he finished with great difficulty. A masterpiece of impressionist cinema, this film presents all the poetry and all the charm of the pictorial sense that is, far more than is his technique, the basis of his art as a filmmaker. The late 1930s saw such major works as *La Grande Illusion* (1937), a moving story of World War I prisoners of war; *La Bête humaine* (1938), an admirable free interpretation of Zola; and especially *La Règle du jeu; (*1939*; The Rules of the Game*), his masterpiece. Cut and fragmented by the distributors, this classic film was also regarded as a failure until it was shown in 1965 in its original form, which revealed its astonishing beauty.

Later years. During World War II, at the time of the Nazi invasion of France in 1940, Jean Renoir, like many of his friends, went to Hollywood and continued his career there. His American period includes films of varying merit, which mark a departure from his previous style: *Swamp Water* (1941), *The Southerner* (1945), *Diary of a Chambermaid* (1946), and *The Woman on the Beach* (1947). In 1944, after being divorced from Catherine Hessling, he married Dido Freire, the daughter of the Brazilian filmmaker Alberto Cavalcanti. He made *The River* (1951) in India, his first colour film.

Now in full command of a mature style that reflected the qualities of the man himself—sensitivity, fervour, and humanity—he returned to Europe by way of Italy, where he made *Le Carrosse d'or* (released 1952). A sumptuous work, combining the talents of both a painter and a dramatist, this film shows Renoir's love of actors and their profession. He often played roles in his own films, and he allowed his actors a great deal of initiative. Subsequently, he made *French-Cancan* (1955), a fabulous evocation of the Montmartre of the 18th century, and *Eléna et les hommes* (1956), a period fantasy swept along in a prodigious movement. His last works, from the 1960s, do not achieve the same beauty, nor does the work he produced for television.

A powerful personality, having been deeply impressed by the artistic environment of his youth, Renoir was also extremely open to later influences both in his art and in his ideas. A naturalized American citizen and settled in Los Angeles, he nevertheless kept his French nationality and maintained connections in Paris. In addition to his films, Renoir also wrote a play, *Orvet* (first performed 1955), which was presented in Paris; a novel, *Les cahiers du capitaine Georges* (1966); and an invaluable book of memories about his father, *Renoir* (1962). (P.Le.)

MAJOR WORKS. *La Chienne* (1931); *Boudu sauvé des eaux* (1932; *Boudu Saved from Drowning*); *La Nuit du carrefour* (1932); *Toni* (1934); *Le Crime de M. Lange* (1936; *The Crime of Monsieur Lange*); *Une Partie de campagne* (made in 1936, released in 1946; *A Day in the Country*); *La Grande Illusion* (1937; *Grand Illusion*); *La Bête humaine* (1938); *La Règle de jeu* (1939; *The Rules of the Game*); *The River* (1951); *Le Carrosse d'or* (1953; *The Golden Coach*); *French-Cancan* (1955).

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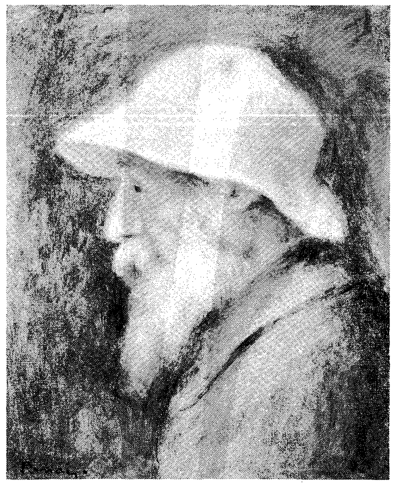
Renoir, Pierre-Auguste (b. Feb. 25, 1841, Limoges, Fr.—d. Dec. 3, 1919, Cagnes), French painter originally associated with the Impressionist movement. His early works were typically Impressionist snapshots of real life, full of sparkling colour and light. By the



Pierre-Auguste Renoir, self-portrait, oil painting, 1910; in the Durand-Ruel Collection, Paris

Photograph Durand-Ruel; permission S.P.A.D.E.M. 1971, by French Reproduction Rights, Inc.

mid-1880s, however, he had broken with the movement to apply a more disciplined, formal technique to portraits and figure paintings, particularly of women (*e.g.*, "Bathers," 1884–

87). Chronic rheumatism eventually forced him to paint with the brush tied to his fingers.

Early years. Renoir was born into a family of artisans. His father, a tailor who had seven children, moved with his family to Paris about 1845. Renoir demonstrated his talent for painting at an early age. Quickly recognizing his talents, his parents apprenticed him, at the age of 13, to work in a porcelain factory, where he learned to decorate plates with bouquets of flowers. Shortly after that, he was painting fans and then cloth panels representing religious themes for missionaries to hang in their churches. His skill and the great pleasure he took in his work soon convinced him to study painting in earnest. Having saved a little money, he decided, in 1862, to take evening courses in drawing and anatomy at the École des Beaux-Arts as well as painting lessons at the studio of Charles Gleyre, a Swiss painter who had been a student of the 19th-century Neoclassical painter J.-A.-D. Ingres. Although the academic style of his teacher did not suit Renoir, he nevertheless accepted its discipline in order to acquire the elementary knowledge needed to become a painter.

Renoir felt a much greater affinity with three students who entered the studio a few months later: Alfred Sisley, Claude Monet, and Frédéric Bazille. All four students dreamed of an art that was closer to life and free from past traditions. The shared ideals of the four young men quickly led to a strong friendship. At the same time in another workshop at the Académie Suisse, the young artists Paul Cézanne and Camille Pissarro were preoccupied with the same problems. With Bazille as the intermediary, the two groups met frequently.

Association with the Impressionists. Circumstances encouraged Renoir to attempt a new freedom and experimentation in his style. The tradition of the time was that a painting—even a landscape—had to be executed in the studio. In the spring of 1864, however, Gleyre's four students moved temporarily to the forest of Fontainebleau, where they devoted themselves to painting directly from nature. The Fontainebleau forest had earlier attracted other artists, among them Théodore Rousseau and Jean-François Millet, who demanded that art represent the reality of everyday life, even though they had not yet completely renounced the constraints imposed by the traditional school. In 1863 Édouard Manet took a much bolder step: his picture, "Le Déjeuner sur l'herbe" ("Luncheon on the Grass"; Louvre, Paris), provoked a violent scandal because its subject and technique affirmed the need for a revival of painting through the observation of reality. Manet's daring made him the leader of a new movement in the eyes of these young artists.

Conditions were ripe for the birth of a new pictorial language, and Impressionism, bursting upon the scene, made quite a scandal in the first Impressionist exposition of 1874, held independently of the official Salon exhibition. It took 10 years for the movement to acquire its definitive form, its independent vision, and its unique perceptiveness. But one can point to 1874 as the year of departure for the movement that subsequently spawned modern art.

Renoir's work is a perfect illustration of this new approach in thought and in technique. Better than any other artist, he suggested by small multicoloured strokes the vibration of the atmosphere, the sparkling effect of foliage, and especially the luminosity of a young woman's skin in the outdoors. Renoir and his companions stubbornly strove to produce light-coloured paintings from which black was excluded, but their pursuits led to many disappointments: their paintings, so divergent from traditional formulas, were constantly rejected by the juries of the Salon and were extremely difficult to sell. On the other hand, despite the continuing criticisms, some of the Impressionists were making themselves known, as much among art critics as among the lay public. Renoir, because of his interest in the human figure, separated himself from the others who were more tempted by landscape. Thus he obtained several orders for portraits and was introduced, thanks to the publisher Georges Charpentier, to an upper middle-class society, whose women and children he painted.

Renoir was now a master of his craft, and his paintings showed great vitality despite the grave financial worries that troubled him. Several of his masterpieces date from this period: "La Loge," "Le Moulin de la galette," "The Luncheon of the Boating Party," "Mme Charpentier and Her Children." Charpentier organized a personal exposition for the works of Renoir in 1879 in the gallery La Vie Moderne.

Rejection of Impressionism. In 1881 and 1882 Renoir made several trips to Algeria, Italy, and Provence, which eventually had a considerable effect on his art and on his life. He became convinced that the systematic use of the Impressionistic technique was no longer sufficient for him and that small brush strokes of contrasting colours placed side by side did not allow him to convey the satiny effects of the skin. He also discovered that black did not deserve the opprobrium given to it by his comrades and that, in certain cases, it had a striking effect and gave a great intensity to the other colours. During his journey to Italy, he discovered Raphael and the fascinations of classicism: the beauty of drawing, the purity of a clear line to define a form, and the expressive force of smooth painting to enhance the suppleness and modelling of a body. At this same time, he happened to read *Il libro dell'arte* (1437; *A Treatise on Painting,* 1844) by Cennino Cennini, which confirmed his new ideas. What he learned from all of these revelations was so powerful, brutal, and unexpected that it provoked a crisis, and he was tempted to break with Impressionism, which he had already begun to doubt. He felt that until now he had been mistaken.

Most of his works executed from 1883 to 1884 on are so marked by a new discipline that art historians have grouped them under the title "the Ingres period" to signify their vague similarity with the technique of Ingres. Renoir's experiments with Impressionism were not wasted, however, because he retained a palette that was bursting with colours.

His strong reaction against Impressionism continued until around 1890. During these years he made several trips to southern France: Aix-en-Provence, Marseille, and Martigues. The nature of this sunlit region gave greater encouragement to his separation from Impressionism, which to him was associated with the landscapes of the valley of the Seine. Southern France offered him scenes bursting with colour and sensuality. At the same time, the seemingly joyous spontaneity of nature gave him the desire to depart from the very strict rules of classicism. While in southern France, he recovered the instinctive freshness of his art; he painted women at their bath with the same healthful bloom he would give to bouquets of flowers.

His financial situation was appreciably improved; he was married in 1890 to Alice Charigot, and the exposition that was organized for him in 1892 by Durand-Ruel was a great success. Renoir's future was assured, and his work of that period reflected his new security and also his confidence in the future.

Later years. Two years later, he had his first attack of rheumatism, and, as the attacks became more and more frequent, he spent more and more time in southern France where the climate was better for his health. About 1899 he sought refuge in the small village of Cagnes; in 1907 he settled there permanently, buying the estate of Les Collettes, where he spent the rest of his life. In 1910 he was no longer able to walk. But in spite of his infirmity, which was more and more constraining, Renoir never ceased to paint; when his fingers were no longer supple, he continued by attaching his paintbrush to his hand.

In spite of his misfortune, his paintings still embodied a cheerful attitude toward life. He was no longer satisfied with topical themes or with smiling portraits of the Parisian bourgeoisie but turned instead to portraits of his wife, his children, and of Gabrielle, his maid, who often also posed for his nude paintings. His still lifes were composed of flowers and fruits from his own garden, and the landscapes were those that surrounded him. The nudes, especially, reflect the serenity that he found in the joy of working throughout his life. He attempted to embody his admiration for the female form in sculpture, with the assistance of young Richard Guino. Since Renoir was no longer able to do sculpture himself, Guino became, about 1913, the skillful instrument who willingly followed his directions. He yielded before the personality of Renoir and succeeded so well that the works have all the qualities of Renoir's style.

His wife died in 1915, after having returned from Gérardmer, where she had gone to see their son Jean, who had been seriously wounded in the war. Renoir survived her for four years. Several months before his death he was able to go to Paris to see his "Portrait de Mme Georges Charpentier," which had been recently acquired by the state. On that occasion, several friends wheeled him for the last time to view the Louvre's masterpieces that he had venerated throughout his life.

(R.Cog.)

MAJOR WORKS. "Le Cabaret de la mère Anthony" (1866; Nationalmuseum, Stockholm); "Diana" (1867; National Gallery of Art, Washington, D.C.); "Portrait du peintre Bazille" (1867; Louvre, Paris); "Lise" (1867; Museum Folkwang, Essen, Ger.); "The Painter Sisley and His Wife" (1868; Wallraf-Richartz-Museum, Cologne); "La Grenouillère" (1869; Nationalmuseum); "Chalands sur la Seine" ("Barges on the Seine," *c.* 1869; Louvre); "Odalisque" (1870; National Gallery of Art, Washington, D.C.); "Captain Darras" (1871; Gemäldegalerie, Dresden, Ger.); "The Breakfast" (1872; Barnes Foundation, Merion, Pa.); "Monet Painting in His Garden" (1873; Wadsworth Atheneum, Hartford, Conn.); "Horsewoman in the Bois de Boulogne" (1873; Hamburger Kunsthalle, Hamburg); "Dancer" (1874; National Gallery of Art, Washington, D.C.); "La Loge" ("The Theatre Box," 1874; Courtauld Institute Galleries, London); "Mme Chocquet" (1875; Staatsgalerie, Stuttgart, Ger.); "La Café-Concert (La Première Sortie)" (1875–76; National Gallery, London); "Le Moulin de la galette" (1876; Louvre); "Mme Charpentier and Her Children" (1878; Metropolitan Museum of Art, New York City); "Oarsmen at Chatou" (1879; National Gallery of Art, Washington, D.C.); "Little Blue Nude" ("Petit Nu Bleu," 1879–80; Albright-Knox Art Gallery, Buffalo); "The Luncheon of the Boating Party" ("Le Déjeuner des canotiers," 1881; Phillips Collection, Washington, D.C.); "Bather" (1881; Sterling and Francine Clark Art Institute, Williamstown, Mass.); "Le Bal à Bougival" ("The Dance at Bougival," 1883; Museum of Fine Arts, Boston); "Les Parapluies" (*c.* 1883; National Gallery, London); "Bathers" (1884–87; Mrs. C.S. Tyson Collection, Philadelphia); "Mount Sainte-Victoire" (1889; Barnes Foundation); "Bather" (1892; Robert Lehman Collection, New York); "Young Girl Reading" (1892; Durand-Ruel Collection, Paris); "Berthe Morisot and Her Daughter" (1894; Mme Ernest Rouart Collection, Paris); "After the Bath" (*c.* 1895; E.C. Vogel Collection, New York); "The Artist's Family" (1896; Barnes Foundation); "Sleeping Bather" (1897; Sammlung Oskar Reinhart Collection, Winterthur, Switz.); "Le Lever" (1899; Barnes Foundation).

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Renos (river, Europe): *see* Rhine River.

Renouvier, Charles-Bernard (b. Jan. 1, 1815, Montpellier, Fr.—d. Sept. 1, 1903, Prades), French neocritical Idealist philosopher who rejected all necessary connection between universal laws and morality. Never an academic, Renouvier wrote prolifically and with great influence. He accepted Kant's critical philosophy as a starting point but drew vastly different conclusions. He held, for example, that phenomena are appearances of themselves only, not of things in themselves that lie beyond or beneath appearances. Since relationship pervades all categories of knowledge, each phenomenon is apprehended in relation to other phenomena.

Renouvier's mathematical background (École Polytechnique, 1834–36) prompted his "law of numbers." He saw each number as unique, distinctly itself, irreducible, but related to all other numbers. By applying this principle of uniqueness to human beings, he thereby precluded their absorption into a group consciousness or absolute mind. Having rejected the notion of infinite numbers, he moved on to a denial of all infinity, including infinity of space and time. He viewed God not as a substance or an absolute but as the moral order itself, capable of limitless perfection.

Renouvier identified human individuality with self-determination and free will, necessary postulates for morality and certitude in knowing. He made no distinction between knowledge and belief. Renouvier explained the consistency of human behaviour by pointing to the homogeneity of mankind.

Renovated Church, Russian OBNOVLENCHESKAYA TSERKOV, federation of several reformist church groups that took over the central administration of the Russian Orthodox Church in 1922 and for over two decades controlled a large number of religious institutions in the Soviet Union. The term Renovated Church is used most frequently to designate the movement, though it is sometimes referred to as the Living Church movement (Zhivaya Tserkov), the name of one of the member groups.

The Revolution of February 1917 gave the Orthodox Church of Russia an opportunity for the reform long hoped for by many churchmen but delayed by the tsarist regime. In a church council convened in Moscow on Aug. 15, 1917, the patriarchate, abolished by Peter the Great, was restored. The newly elected patriarch, Tikhon, adopted an attitude of total independence, if not hostility, toward the Communist regime that had overthrown the provisional government. In 1922, however, the government unilaterally decided to confiscate all church valuables, under the official pretext that there was general starvation in large sections of the country. When the Patriarch insisted on some church control over the confiscated property, he was placed under house arrest and the offices of the patriarchate were closed.

Seizing the opportunity for a revolution in the church, a group of priests, notably Alexander Vvedensky and Vladimir Krasnitsky, organized a Temporary Higher Church Administration, which rapidly evolved into a general movement aimed at deposing the Patriarch and introducing radical church reforms. The Temporary Administration found support among some bishops, but it was particularly popular with the "white," or married, clergy, who were excluded from promotion into the episcopacy by canon law and who resented the supremacy of unmarried monastics. The movement was also supported by progressive intellectuals and enjoyed the sympathy of the government. In a series of councils, the Renovated Church, after deposing Tikhon, reestablished a Holy Synod of bishops, priests, and laymen, originally proclaimed by Peter the Great in 1721 to replace the patriarchate, to rule the church. It introduced controversial reforms in the episcopate and in the liturgy, but the movement was compromised by the clearly fraudulent character of the takeover: in their struggle against the Patriarch and his followers, its leaders cooperated with the secret police, and hundreds of Tikhonite clergy were shot by firing squads as counterrevolutionaries.

The Patriarch himself, after publicly "repenting" his anti-Soviet actions, was set free on June 25, 1923. Worshippers flocked to the churches that had remained faithful to him, and the Renovated schism lost much ground. It survived in the following years mainly through government support. At the beginning of 1925, it claimed to have 17,650 priests and 13,650 churches, but the vast majority of Russian faithful remained loyal to the patriarchal church. The schism collapsed completely during World War II, when Joseph Stalin changed his religious policies and allowed the election of a successor to Tikhon. Except for Vvedensky, the leaders of the Renovated Church repented, and its churches returned to the patriarchal fold.

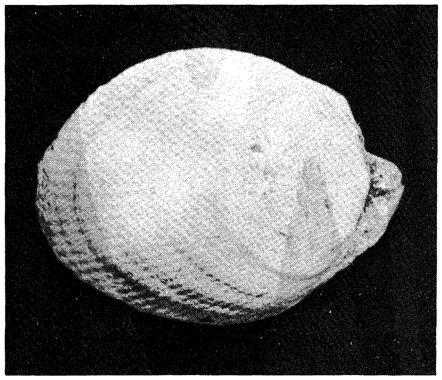
Renshaw, William and Ernest (respectively b. Jan. 3, 1861, Cheltenham, Gloucestershire, Eng.—d. Aug. 12, 1904; b. 1861, Cheltenham, Gloucestershire—d. 1899), twin English brothers who dominated Wimbledon tennis competition in the 1880s. With their warm personalities and exciting, competitive play, the Renshaws are often credited with transforming tennis into a spectator sport.

William won the Wimbledon singles championship seven times (1881–86 and 1889), on three occasions defeating his brother in the finals. Ernest was victorious in 1888, and together they won the British doubles championship seven times. They introduced hard serves and volleys to the game when they first appeared together at Wimbledon in 1880 and repeated their victory in 1881, 1884–86, 1888, and 1889. In 1883 they played two exhibition matches at Wimbledon against the U.S. brothers Joseph and Clarence Clark and defeated them decisively. In 1888 William was elected the first president of the British Lawn Tennis Association.

Rensselaer, city, Rensselaer County, eastern New York, U.S., on the east bank of the Hudson River, opposite Albany. Settled by the Dutch in the 17th century, it was the site of the most successful of the patroonships (estates) under Kiliaen van Rensselaer, an Amsterdam diamond merchant. The city was formed through the amalgamation of the villages of East Albany, Greenbush, and Bath-on-the-Hudson and was incorporated in 1897. Ft. Crailo, built *c.* 1642 as protection from the Indians, is allegedly where the British surgeon, Dr. Richard Shuckburgh, composed "Yankee Doodle," adopted as a popular song during the American Revolution. The fort has been restored as a museum.

Part of the Port of Albany, Rensselaer is now a railroad division point with light industry producing textiles, chemicals, dyes, and leather goods. Pop. (1980) 9,047.

Rensselaeria, genus of extinct brachiopods (lamp shells) found as fossils in Lower Devonian marine rocks (the Devonian Period began 395,000,000 years ago and lasted 50,000,000 years). The shell is large and elongated. Surface markings include fine costae, lines radiating from the narrow apex of the shell to the distal, or terminal margins, and arcuate (bowlike) growth lines. Because of its restricted time range, relative abundance, and ease of recognition, *Rensselaeria* serves as a reliable guide, or index, fossil for the Lower Devonian.



Rensselaeria

By courtesy of the trustees of the British Museum (Natural History); photograph, Imitor

rent, in modern economic usage, the difference between the total return to a factor of production (land, labour, capital) and its supply price, the minimum amount necessary to attain its services. In classical economics, rent was the income derived from the ownership of land and other natural resources in fixed supply. This definition originated in the 18th century as part of the explanation of the distribution of income within society. It was observed that the demand for the product of land would make it profitable to extend cultivation to soils of lesser and lesser fertility so long as the addition to the value of output covered the costs of cultivation on the least fertile acreage cultivated. On land of greater fertility the costs of cultivation per unit of output would be below that price. This difference between cost and price could be appropriated by the owners of land as rent.

The modern extension of this view is that the return to any other component in production may also contain elements of rent, consisting of the difference between the income of a productive factor and its real supply price or cost. Because the supply of land is fixed, the supply price of land is effectively zero and the whole of its return is rent. The supplies of labour and capital, on the other hand, are responsive to the prices offered for them, and the portion of their return regarded as cost will be greater for those with many alternative uses. The rent portion of a productive factor's return also decreases as the analysis is shifted to the long run because there are more alternative uses open to economic resources in the long run.

Renton, city, King county, western Washington, U.S., on the flats of the Cedar River at its mouth on Lake Washington, 20 miles (32 km) southeast of Seattle. Settled in the 1850s and platted in 1876, it was named for William Renton, an industrial pioneer. Coal deposits nearby, exploited since the 1870s, played a significant role in the city's development. Renton maintains lumber, steel, and clay industries and is the site of a large Boeing aircraft plant and a railroad-car foundry. It is served by ocean transportation via Puget Sound, Ballard Locks, and Lake Washington. The area supports truck and poultry farms. Inc. 1901. Pop. (1988 est.) 35,767.

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Renville Agreement (Jan. 17, 1948), treaty between The Netherlands and the Republic of Indonesia concluded on the U.S. warship *Renville,* anchored in the harbour of Djakarta (now Jakarta). It was an attempt, albeit unsuccessful, to mediate disputes left unresolved by an earlier Dutch-Indonesian settlement, the Linggadjati Agreement of 1946.

After the Linggadjati Agreement—under which a federal United States of Indonesia was to be formed—conflicts between the Dutch and the republicans had continued. Each side accused the other of violating the agreement. The Dutch continued their military operations, moving into the republic's territory in Java and Madura, while the republicans sought help abroad. The Security Council of the United Nations offered its mediation, which led to the formation of the Good Offices Committee (GOC), consisting of three members: Australia (chosen by the republic), Belgium (chosen by the Dutch), and the United States (chosen by both). The GOC assured that the internal powers of the republic would not be reduced in the interim period pending the transfer of Dutch sovereignty to a federal Indonesia and that the republic would get a fair representation in the future federal government.

The cease-fire agreement, known as the Renville Agreement, confirmed Dutch territorial gains and also granted the Dutch de jure sovereignty until the formation of the United States of Indonesia was completed. On the Indonesian side, the republic's sole gain was the promise of a plebiscite in the Dutch-occupied parts of Java, Madura, and Sumatra, to determine whether they would join the republic or become separate states.

The Dutch soon declared that they had established a state in Sumatra, which incorporated part of the republican territories. They also convoked a conference at which the republic was represented as a minority partner. In December 1948, the Dutch launched a military operation and captured the republican capital of Jogjakarta (Yogyakarta). The Indonesians waged guerrilla war against the Dutch, however, until the Dutch were finally expelled in 1949.

Renwick, James (b. Feb. 15, 1662, Moniaive, Dumfries, Scot.—d. Feb. 17, 1688, Edinburgh), last of the prominent Covenanter martyrs of Scotland.

Educated at Edinburgh University, Renwick joined (*c.* 1681) the group of Covenanters known as the Cameronians (those who adhered to the perpetual obligation of the covenants of 1638 and 1643) and soon became prominent among them. At their direction, he studied theology at the University of Groningen and was ordained a minister in 1683. Returning to Scotland, he became one of the field preachers of the Covenanters and was declared a rebel by the Privy Council. He was largely responsible for the "apologetical declaration" of 1684, by which he and his followers disowned the authority of Charles II; the Privy Council replied by ordering repudiation of the declaration on pain of death. Unlike some of his associates, Renwick refused to join the rebellion under the Earl of Argyll in 1685. In 1687, when the declarations of indulgence allowed some liberty of worship to the Presbyterians, he and his followers, often called Renwickites, continued to hold illegal meetings in the fields. A reward was offered for Renwick's capture, and early in 1688 he was seized in Edinburgh. Tried and found guilty of disowning the royal authority and other offenses, he refused to apply for a pardon and was hanged.

Renwick, James, (Jr.) (b. Nov. 1, 1818, New York, N.Y., U.S.—d. June 23, 1895, New York City), one of the most successful, prolific, and versatile American architects in the latter half of the 19th century.

Renwick studied engineering at Columbia College (later Columbia University), and upon graduating in 1836 he took a position as structural engineer with the Erie Railroad and subsequently was a supervisor on the Croton Reservoir construction project in Manhattan. He was largely self-taught as an architect.

In 1843 the Gothic design submitted by Renwick won the competition for a new Grace Church to be built in New York City (1843–46). This prominent structure, which was one of the first American designs to show a true understanding of the Gothic style, led to many more ecclesiastical commissions for Renwick, culminating with that for St. Patrick's Cathedral (begun 1858) in New York City, an immense and eclectic twin-spired structure that mixed German, French, and English Gothic influences.

Because of the stylistic variety evident in his works, Renwick is not considered exclusively a Gothic Revivalist. For example, the main building of the Smithsonian Institution, Washington, D.C. (1847–55), was built in a modified Romanesque style, while the Corcoran Gallery, Washington, D.C. (1859), now called the Renwick Gallery, was designed in the Second Empire style Renwick favoured for hospitals, mansions, and other nonecclesiastical structures in the 1850s and '60s. Many of the churches he designed from the 1850s on, notably Saint Bartholomew's Church (1871–72) and All Saints' Roman Catholic Church (1882–93), both in New York City, feature Gothic-Romanesque forms built with stonework of contrasting colours and textures to produce effects of dazzling richness.

Renwick's extreme eclecticism was his alert response to changes in public taste and architectural fashion. But his buildings were elegant and well planned, and he was progressive in his use of iron as a structural material and in his innovative use of terra-cotta and coloured stone for striking decorative effects. He trained several younger architects who achieved subsequent prominence, most notably John Wellborn Root.

Reorganized Church of Jesus Christ of Latter-day Saints, a church that claims to be the legal continuation of the church founded by Joseph Smith at Fayette in Seneca County, N.Y., in 1830. World headquarters are in Independence, Mo. The church's members number about 190,000 with congregations in more than 30 countries in addition to the United States and Canada. The Reorganized Church does not accept the appellation Mormon because of the association with polygamy.

After Joseph Smith's death in 1844, the church that he founded broke into factions following various leaders. Rejecting the leadership of Brigham Young, who led the majority group to Utah, a number of the members, holding that the son of the founder had been designated his successor, reorganized under the original name, the Church of Jesus Christ of Latter Day Saints, at Beloit, Wis., in 1852. The word *Reorganized* was added to the title in 1869. Joseph Smith III accepted the leadership of this body in 1860 and was elected president. He was succeeded by his sons, and all of the successors were descendants of the founder.

The Reorganized Church rejects the doctrine of polygamy and denies that it was taught and practiced by Joseph Smith. It claims that polygamy was introduced by Brigham Young and his associates and that the revelation on polygamy, which was made public in 1852 by Young in Utah and attributed to Smith, was not in harmony with the original tenets of the church or with the teachings and practices of Smith.

Its system of belief is based upon the teachings of the Bible, the Book of Mormon, and the *Doctrine and Covenants,* a book of revelations received by the prophets of the Latter Day Saints and accepted by the vote of the general conference.

The Reorganized church believes in the Trinity; the doctrines of faith in God, repentance of sin, baptism by immersion, laying on of hands, and resurrection of the dead; graded reward or punishment after death according to conduct in this life; the continuity of divine revelation and the open canon of scripture; the restoration of Christ's church on the New Testament pattern; and the doctrine of stewardship in personal and economic life. It anticipates the return of Christ and a millennial reign.

Local congregations are grouped for administrative purposes into two forms of area organizations, districts and stakes. The district organization ties the individual congregations of an area into a fellowship presided over by officers elected at district conferences. The stake organization consists of a number of congregations administered by a central authority, the stake presidency, stake bishopric, and stake high council. Business of the stake is conducted in conferences at which all members of the stake have a right to vote.

The World Conference, which meets biennially in Independence, is the supreme legislative body of the church, and all general administrative officers, including those of the first presidency, must receive its endorsement. The presiding bishop, who is in charge of the exchequer of the church, presents his financial report to the conference for endorsement and for appropriations. Missions are sponsored in various parts of the world.

The church conducts Graceland College in Lamoni, Iowa, and Park College in Kansas City, Mo. Temple School, a ministerial and leadership seminary, is in Independence.

reovirus, any of a group of ribonucleic acid (RNA) viruses constituting the family Reoviridae, a small group of animal and plant viruses. The virions of reoviruses (the name is a shortening of respiratory enteric orphan viruses) lack an outer envelope, appear spheroidal, measure about 70 nanometres (nm; 1 nm $= 10^{-9}$ metre) across, have two icosahedral capsids, and contain a core of segmented, double-stranded RNA. Characteristic features of structure, preferred hosts, and chemistry are the basis for dividing reoviruses into several genera, of which *Orthoreovirus, Orbivirus, Rotavirus,* and *Phytoreovirus* are among the best known. Although orthoviruses have been found in the respiratory and enteric tracts of animals, they are not generally pathogenic in adults. Some orbiviruses cause disease in mammals (for example, blue-tongue disease in sheep); rotaviruses have been implicated in infective infantile diarrhea; and phytoreoviruses can destroy rice, corn, and other crops.

repartimiento (from Spanish: "partition," or "distribution"), also called MITA, or CUATEQUIL, in colonial Spanish America, a system by which the crown allowed certain colonists to recruit Indians for forced labour. The *repartimiento* system, frequently called the *mita* in Peru and the *cuatequil* in New Spain (Mexico), was in operation as early as 1499 and was given definite form around 1575. About 5 percent of the Indians in a given district might be subject to labour in mines and about 10 percent more for seasonal agricultural work. A colonist who wanted a *repartimiento* had to apply to the viceroy or the *audiencia* (provincial appeals court), stating that the Indian labour required on his plantation, ranch, or mine would provide the country with essential food and goods.

Legally, the work period was not to exceed two weeks (five in the mines), three or four times annually, and wages were to be paid. These requirements were practically ignored, however, and, because the Indians were often brutally treated, the Spanish government modified the system in 1601 and 1609; under the new arrangement, 25 percent of the Indians in a given district were required to work for the Spaniards, but they were free to choose their own employer and term of service. The former system was permitted to continue in the mines until the owners could purchase enough Negro slaves to replace the Indians. The new system remained legally in force down to the end of the colonial period (*c.* 1820). In practice, however, impressment of Indian labourers under the earlier system continued in spite of additional royal prohibitive legislation in the 17th and 18th centuries. *See also* encomienda.

repeating rifle, also called REPEATER, firearm designed for use with a magazine of cartridges, each of which is fed into the chamber or breech by lever or bolt action or other means. Before the invention of the cartridge that contained powder, ball, and primer, a repeater had to have separate magazines for powder and ball. Alternative arrangements were multiple barrels; multiple breeches; and the loading of several shots into one barrel and igniting the outermost charge, which would eject its ball and ignite the next charge, and so on. The first effective breech-loading and repeating flintlock firearms were developed in the early 1600s. One early magazine repeater has been attributed to Michele Lorenzoni, a Florentine gunmaker. In the same period the faster and safer Kalthoff system—named for a family of German gunmakers—introduced a ball magazine located under the barrel and a powder magazine in the butt. By the 18th century the Cookson repeating rifle was in use in America, using separate tubular magazines in the stock for balls and powder and a lever-activated breech mechanism that selected and loaded a ball and a charge, also priming the flash pan and setting the gun on half-cock.

Some historic military rifles were magazine repeaters. They include the Ferguson, Hall, Dreyse, and Sharps rifles, each contributing something to the evolution of repeaters. The perfection of the revolver by Samuel Colt broke new ground. But the development of the brass cartridge made safe and efficient breech-loading repeaters possible, and by 1900 most nations had adopted repeating rifles of one kind or another as basic infantry weapons. All were bolt-action rifles with magazines holding five or six cartridges.

repertory theatre, system of play production in which a resident acting company keeps a repertory of plays that are always ready for performance, often presenting a different one each night of the week, supplemented by the preparation and rehearsal of new plays. Repertory in its true form has existed in state-supported theatres in France, Germany, and the Soviet Union; but, as it is rather expensive and difficult to maintain, most modern repertory companies use a modification of the system, usually presenting fewer and longer-running plays, either alternately or successively, in one season. Repertory theatre has proved to be effective in supporting both commercially successful and experimental drama. It has served as a showcase for the early work of playwrights such as Eugene O'Neill and John Millington Synge and as a training ground for young actors.

In Great Britain the name repertory theatre came to designate an important movement, begun in the early 1900s, to make quality theatre available throughout the country. Repertory companies were established in such cities as Manchester, Birmingham, and Liverpool, producing new plays every week or two (called "weekly rep"). Although they maintained permanent companies, these were not at first true repertory theatres because they presented a series of short, continuous runs rather than keeping a repertory of plays ready for production. They began receiving government aid in 1946 and by the 1960s had developed "true rep" much like the state-supported theatre of other European countries. Major English companies using the repertory system include the Royal Shakespeare Theatre in Stratford-upon-Avon and London and the National Theatre Company. Attempts to establish repertory theatres in the United States, which have generally won less acceptance, include the American Conservatory Theatre, San Francisco.

Repin, Ilya Yefimovich (b. Aug. 5 [July 24, old style], 1844, Chuguyev, Russia—d. Sept. 29, 1930, Kuokkala, Fin.), painter of historical subjects known for the power and drama of his works.

"Zaporozhian Cossacks," oil painting by Repin, 1891; in the State Russian Museum, Leningrad
Novosti Press Agency

Repin, born to a poor family near Kharkov, learned his trade from a painter of icons named Bunakov and earned his living for three years at the craft. In 1863 he became a student at the Academy of Fine Arts at St. Petersburg, where he remained for six years, winning a gold medal and a scholarship that enabled him to visit France and Italy. He returned to Russia to devote himself to depicting episodes from Russian history. In 1894 he became professor of historical painting at the academy in St. Petersburg. His most important pictures are "Religious Procession in Kursk Gubernia" (1880–83; State Tretyakov Gallery, Moscow), "Ivan Grozny and His Son Ivan, November 16, 1581" (1885; State Tretyakov Gallery, Moscow), and, his best known, "Zaporozhian Cossacks" (1891; State Russian Museum, Leningrad).

replacement deposit, in mineralogy, body of ore or mineral formed in rock by chemical processes that consume part or all of the original material and produce another at the same location. *See* hydrothermal ore deposit; metasomatic replacement.

replevin, also called REVENDICATION, a form of lawsuit in common-law countries, such as England, Commonwealth countries, and the United States, for return of personal property wrongfully taken and for compensation for resulting loss. Replevin is one of the oldest legal actions, dating to the 14th century. It is now called "claim and delivery."

The form arose to protect tenants from landlords who abused their "distress of rent" rights. The landlord was entitled to seize a tenant's goods for nonpayment of rent; often goods more valuable than the unpaid rent were taken. Replevin allowed the tenant to recover such goods. The remedy was later invoked for wrongful taking generally.

Replevin is one of a group of remedies for conversion, the wrongful taking or withholding of personal property. Its significant feature is the return of the item itself, not just its money value—useful in instances in which, for example, a family heirloom is taken (*compare* trover).

There are limits on the types of personal property recoverable by replevin. The object must be tangible (*e.g.,* one cannot replevin an idea) but may be merely paper (*e.g.,* a stock certificate). It must be identifiable and separable so that it can be seized.

Repnin, Nikolay Vasilyevich, Knyaz (Prince) (b. March 22 [March 11, old style], 1734—d. May 24 [May 12, O.S.], 1801, Moscow), diplomat and military officer who served Catherine II the Great of Russia by greatly increasing Russia's influence over Poland before that country was partitioned and who later distinguished himself in Russia's wars against the Turks.

The grandson of Anikita Ivanovich Repnin, who had been a noted general during the reign of Peter I the Great, N.V. Repnin entered the army and in 1762 was appointed ambassador to Berlin by Peter III.

In November 1763 Catherine (who had overthrown Peter in mid-1762) transferred him to Warsaw, where he tried to assert Russia's dominance over the weak Polish government. In pursuit of this goal he encouraged the formation of the Confederation of Radom (June 1767), an armed league of pro-Russian Polish nobles who opposed their king. When the confederation seized Warsaw and summoned a Sejm (parliament or diet; 1768), Repnin with the aid of Russian troops compelled the Sejm to accept the principle of Russia's right to intervene in Polish internal affairs.

As a consequence, civil war broke out in Poland, and the Ottoman Empire declared war on Russia. Repnin was removed from his Warsaw post and sent to fight the Turks

(1768). After military successes in Moldavia and Walachia, he was made supreme commander of the Russian armies in Walachia (1771) and defeated the Turks at Bucharest.

Assigned to the post of ambassador to the Ottoman Empire (1775–76), Repnin later served as plenipotentiary at the Congress of Teschen (March–May 1779), which ended the War of the Bavarian Succession. When war again broke out between Russia and the Turks (1787), he distinguished himself as an outstanding commander. Succeeding to the post of commander in chief in 1791, Repnin routed the grand vizier at Machin and thereby forced the Turks to accept the truce of Galați (Aug. 11, 1791).

In 1794 Repnin was appointed governor-general of the Lithuanian provinces, which Russia had acquired in the partitions of Poland. Subsequently, the emperor Paul I promoted him to the rank of field marshal (1796) and sent him on diplomatic missions to Austria and Prussia (1798) in an attempt to draw them into an alliance against revolutionary France. Unsuccessful, Repnin was dismissed from the service upon his return to Russia.

repoussé, method of decorating metals in which parts of the design are raised in relief from the back or the inside of the article by means of hammers and punches; definition and detail can then be added from the front by chasing or engraving. The name *repoussé* is derived from the French *pousser,* "to push forward." This ancient technique, which has been used extensively throughout the history

Repoussé Chinese sleeve weight, Chou dynasty (c. 1111–255 BC); in the Freer Gallery of Art, Washington, D.C.

By courtesy of the Smithsonian Institution, Freer Gallery of Art, Washington, D.C.

of metalworking, achieved widespread popularity in Europe during the 16th, 17th, and 18th centuries.

representation, in government, method or process of enabling the citizenry, or some of them, to participate in the shaping of legislation and governmental policy through deputies chosen by them.

The rationale of representative government is that in large modern countries the people cannot all assemble, as they did in the marketplace of democratic Athens or Rome; and if, therefore, the people are to participate in government, they must select and elect a small number from among themselves to represent and to act for them. In modern polities with large populations, representation in some form is necessary if government is to be based on the consent of the governed. Elected representatives are also less likely to reflect the transitory political passions of the moment than are the people, and thus they provide greater stability and continuity of policy to a government.

Through the course of long historical evolution, various methods and devices have been developed in attempts to solve the many problems that have arisen in connection with representation. These problems include the qualifications of electors (*see* suffrage); the apportionment of constituencies (*see* constituency); apportionment (electoral); the basis of election (*see* plurality system; proportional representation); methods of nominating candidates (*see* primary election); and means of ascertaining the wishes of electors (*see* referendum and initiative). Because of the need to formulate systematically the demands of citizens, political parties have come to act as intermediaries between the citizens and their representatives. Political debate along party lines has thus become a characteristic feature of most representative systems of government.

How answerable a representative should be to his electors is an issue that has long been debated. The basic alternatives are that the representatives of the people act as delegates carrying out instructions or that they are free agents, acting in accordance with their best ability and understanding.

The representative principle is not limited to government: it is applied in electing executive officers of large social organizations such as trade unions and professional associations.

representationism, also called REPRESENTATIONALISM, philosophical theory of knowledge based on the assertion that the mind perceives only mental images (representations) of material objects outside the mind, not the objects themselves. The validity of human knowledge is thus called into question because of the need to show that such images accurately correspond to the external objects. The doctrine, still current in certain philosophical circles, has roots in 17th-century Cartesianism, in the 18th-century empiricism of John Locke and David Hume, and in the idealism of Immanuel Kant.

Representatives, House of, one of the two houses of the U.S. Congress, established in 1789 by the Constitution.

The first Congress had 59 members in the House; membership reached 435 in 1912. Two additional representatives were added after the admission of Alaska and Hawaii as states in 1959, but at the next reapportionment membership returned to 435, the number authorized by a law enacted in 1941. The allocation of seats is based on population within the states; membership is reapportioned every 10 years, following the decennial census. House members are elected every two years from one-member districts of approximately equal population created for this purpose.

The House of Representatives shares with the Senate equal responsibility for lawmaking within the United States. As conceived by the Founding Fathers, the House was to represent the popular will, and its members were to be directly elected by the people, rather than indirectly, as originally provided for the Senate.

The Constitution vests certain exclusive powers in the House of Representatives, among the most important of which are the right to initiate impeachment proceedings and the right to originate revenue bills.

The organization and character of the House of Representatives have evolved under the influence of political parties, which provide a means of controlling proceedings and mobilizing the necessary majorities. Party leaders, such as the speaker and the majority and minority leaders, came to play a central role in the operations of the House. Party discipline is not always strong, however, in a body whose members stand for reelection every two years and who tend to look toward their districts rather than to parties for support.

A further dominating element of House organization is the committee system, under which the membership is broken up into smaller groups for such purposes as selecting agenda, preparing bills for the consideration of the whole House, and regulating House procedure. Each committee is controlled by the majority party. Almost all bills are first referred to a committee; the House ordinarily cannot act on a bill until the committee has "reported" it for floor action. There are more than 20 standing committees, organized mainly around major policy areas, each one having staffs, budgets, and subcommittees. They may hold hearings on questions of public interest, propose legislation that has not been formally introduced as a bill or resolution, and conduct investigations. Among important standing committees are those on appropriations, on ways and means, and on rules. Select and special committees are also appointed, usually for a specific project and for a limited period.

The committees also play an important role in the control exercised by Congress over governmental agencies. Departmental heads and other responsible officials are frequently summoned before the committees to explain policy. The Constitution (Article I, section 6) prohibits members of Congress from holding offices in the executive branch of government—a chief distinction between parliamentary and congressional forms of government.

One important result of population changes in the United States in the decade 1970–80 was the gain under reapportionment of 17 congressional seats in states of the South and West; states of the Northeast lost 9 and those of the North Central region 8. For the first time in the 20th century, the majority in the House of Representatives was not based in the traditional North.

The constitutional provisions regarding eligibility for membership of the House of Representatives specify a minimum age of 25, U.S. citizenship for at least seven years, and residence within the state from which a member is elected.

repression, in metabolism, a control mechanism in which a protein molecule, called a repressor, prevents the synthesis of an enzyme by binding to—and thereby impeding the action of—the deoxyribonucleic acid that controls the process by which the enzyme is synthesized. Although the process has been most-studied in microorganisms, it is believed to occur in a similar way in higher organisms. *See also* induction.

reproduction, the process by which all organisms replicate themselves and perpetuate their species.

A brief treatment of reproduction follows. For full treatment, *see* MACROPAEDIA: Reproduction and Reproductive Systems.

For a depiction of some of the structures that make up the human reproductive system, shown in relation to other parts of the gross anatomy, *see* the colour Trans-Vision in the PROPAEDIA: Part Four, Section 421.

The characteristics that an organism inherits are controlled by its genes, which are arrayed along one or more chromosomes. Genes consist of deoxyribonucleic acid (DNA), the molecular structure of which determines the genetic code.

There are two basic types of reproduction: asexual and sexual. Asexual reproduction gives rise to an offspring that is genetically identical to its single parent. In one-celled organisms (*e.g.,* bacteria and protozoa), reproduction is usually by fission, an asexual process in which the parent organism splits into two identical "daughters." Other forms of asexual reproduction include spore formation, in which a reproductive cell gives rise to a new organism; budding (*e.g.,* hydra and yeast), as when a small protuberance on the parent grows into a new individual; regeneration (*e.g.,* flatworms), whereby an organism can be divided into two or more pieces, each of which grows into a new individual; and vegetative reproduction, the formation of new individuals by nonreproductive parts of an organism (*e.g.*, rhizomes, bulbs, and tubers in plants).

Sexual reproduction involves the creation of a new individual through the union of special sex cells called gametes; usually the gametes come from different parents. Gametes result from meiosis, a type of cell division that produces cells with half the number of chromosomes of the original cell (haploidy). During fertilization, two haploid gametes unite to form a zygote, the first cell of a new organism. The zygote has the full number of chromosomes typical of the species (diploidy). Sexual reproduction ensures that each offspring is genetically unique (except in cases of multiple offspring derived from divisions of one zygote). Most animals reproduce sexually; among vertebrates, it is the only form of reproduction. Higher plants also reproduce sexually, but among plants there is a regular alternation of sexual (gametophyte) and asexual (sporophyte) generations in the life cycle.

The reproductive systems of land vertebrates include elaborate structures to assure union of the gametes and to nourish and protect the embryo as it develops. Fertilization is usually internal. The development of the embryo may occur primarily outside the female or within her body. In birds, for example, the new organism develops externally, sheltered in a hard-shelled egg. In mammals the embryo grows inside the mother's body and, after birth, is fed on milk from the mammaries.

In females, eggs are produced in the paired ovaries. Other sexual organs in the female are the oviducts, in humans called the fallopian tubes, one extending from each ovary to the uterus (where the embryo develops), and the vagina, or birth canal. In males, gametes called sperm are produced in the two testes. A system of tubules conveys the sperm from the testes to the penis; along the way, various glands (including the prostate) secrete seminal fluid into the tubules.

In a mature female an egg is released from one of the ovaries about every four weeks. After copulation the sperm move up into the uterus and fallopian tubes, where, if an egg is present, fertilization may occur. The zygote lodges itself in the lining of the uterus, where it is sheltered and nourished by the maternal blood supply until birth about nine months later. If fertilization does not occur, the egg degenerates, and the uterine lining, which has thickened in preparation for pregnancy, is shed in menstruation.

The human reproductive system may be adversely affected by abnormal hormone secretions. Disorders of the reproductive system may also be caused by genetic abnormalities, congenital defects, sexually transmitted infections, and tumours.

reproductive behaviour, any activity directed toward perpetuation of a species. The enormous range of animal reproductive modes is matched by the variety of reproductive behaviour.

A brief treatment of reproductive behaviour follows. For full treatment, *see* MACROPAEDIA: Behaviour, Animal.

Sexual reproduction is by far the most common mode of reproductive behaviour. The mixing of genes, which occurs when an egg unites with one sperm, produces a greater variation of characteristics in the next generation. This genetic variety enables the offspring to adapt to a wider scope of fluctuating environmental conditions than the offspring of asexual reproduction, which are primarily duplicates of the solitary parent.

Millions of eggs must often be fertilized to produce just a few adults, even though a variety of behaviour patterns have been developed to protect the eggs, larvae, and young in their process of growth. In some cases, nature provides a specially large yolk in the egg; in others, parents or groups of adults care directly for the young. In social parasitism, the young are left in the care of other species (*e.g.*, the cuckoo), and they will push the adopted species' offspring out of the nest in order to monopolize the food supply.

Most one-celled organisms reproduce by splitting in two (fission), which is the basic form of asexual reproduction. In multicellular animals, reproduction may be asexual, sexual, or a combination of different forms at different times. In some cases (*e.g.*, male bees), an egg will develop an embryo without fertilization (parthenogenesis). Another form of asexual reproduction is by budding, in which the larvae remain inside the adult until a wall is developed to separate the new animal from the original parent. Some species are hermaphrodites and can either split in two or copulate; each member usually produces sperms or eggs, but not both simultaneously, thus preventing self-fertilization.

The stages of approach, identification, and copulation in sexual reproduction have been developed to avoid predators or even, as with spiders, to avoid being eaten by their own kind, as well as to avoid wasting eggs and sperm. These stages may or may not include courtship with its attendant displays, dances, and attractants, which vary from olfactory chemicals called pheromones to sounds that are specific for a species. Elaborations such as displays, crests, and pheromones are all forms of behaviour that maximize the survival of the species. The evolution of antlers and horns in some mammals, for example, is the result of their usefulness in territorial dominance and the consequent possession of females.

reptile, class name REPTILIA, any member of a group of air-breathing vertebrates that have internal fertilization and scaly bodies. These animals occupy an intermediate position in evolutionary development between the amphibians and the birds and mammals. Living reptiles include the snakes, crocodiles, lizards, turtles, and tuatara. Extinct reptiles include the dinosaurs, pterosaurs, and ichthyosaurs.

A brief treatment of reptiles follows. For full treatment, *see* MACROPAEDIA: Reptiles.

There are about 6,000 species of living reptiles widely distributed throughout the warm and temperate regions, although they are most abundant and diversified in the tropics. They range in size from a species of gecko that measures about 34 millimetres (1.3 inches) in length to the anaconda snake, which can exceed 9 metres (30 feet). The largest turtle, the marine leatherback, weighs about 680 kilograms (1,500 pounds).

The skin of reptiles is characteristically dry and has few or no glands. Except for snakes, reptiles have four limbs, which project to the side. This causes both lateral and forward thrusts when the animal walks, but crocodiles and lizards can lift their bodies and run. Most snakes move by pushing backward against a solid object. Climbing mechanisms include claws or scales that contain tiny hooks, as in geckos, and tails that can cling to branches. Marine reptiles rely mostly on their lashing tails while swimming. Reptiles are also cold-blooded; *i.e.*, their body temperatures vary with external temperature, making them dependent on the heat of the surrounding air.

Except for the tuatara, males of all species have copulatory organs. Female reptiles generally lay eggs, but some species bear live young. In a few species, the young inside the female are nourished by an organ similar to the mammalian placenta. Eggs may be laid in a nest or beneath cover; the amnion, a thin sac holding a watery fluid, protects the embryo from drying out or being damaged. The allantois, another sac, covered by a shell, functions as a respiratory organ. Some turtles can lay up to 200 eggs at a time; the gecko usually lays two, and the crocodile bears from 20 to 70 eggs.

In certain parts of the world, reptiles are hunted for food, and their skins are valued for leather products. As a result, many species have become extinct. Venomous species cause little harm to humans except in a few rural areas.

Repton, parish, South Derbyshire district, county of Derbyshire, England. The famous independent boys' school of Repton was founded in 1556, and its buildings incorporate parts (restored) of an Augustinian priory established in 1172. Pop. (1971) 2,471.

Repton, Humphry (b. April 21, 1752, Bury St. Edmunds, Suffolk, Eng.—d. March 24, 1818, London), English landscape designer who became the undisputed successor to Lancelot Brown as improver of grounds to the landed gentry of England. Of a well-to-do

Repton, portrait by an unknown artist
Country Life

family, he was intended for a mercantile career but, failing in that, retired to the country, where he learned something of the management of land and had an opportunity to develop his talent as an amateur painter of watercolour landscapes.

In 1788 he set himself up as a landscape designer and wrote to his friends, who included the Duke of Portland and Coke of Norfolk, inviting their support. Contributing largely to his success was his method of making watercolour drawings of the grounds upon which he was asked to advise, with his proposed alterations displayed on an overlay. Like other landscape designers, Repton also tried his hand at architecture but usually worked in association with others who had the necessary professional qualifications. He quarrelled with one of these, John Nash, who, he claimed, stole from him the idea of using a Mughal style of architecture for the Royal Pavilion at Brighton and who in large part used his design. Later he collaborated with his own son, John Adey Repton, a trained architect.

Repton's landscapes, seldom as large as those designed by Brown, were usually more thickly planted. Repton advocated a gradual transition between house and grounds by means of terraces, balustrades, and steps. He was influenced by the Picturesque movement, which admired wild landscapes.

Many of Repton's grounds survive at least in part as he laid them out. Uppark in Sussex and Sheringham Hall, Norfolk, are admirable examples of house and grounds designed by both Reptons and of which the authenticity in their present condition is guaranteed by the existence of Repton's original plans. In addition to several essays and a short play, Repton published three major books on landscape gardening: *Sketches and Hints on Landscape Gardening* (1795), *Observations on the Theory and Practice of Landscape Gardening* (1803), and *Fragments on the Theory and Practice of Landscape Gardening* (1816).

The Red Books of Humphry Repton, 4 vol. (1976) are, in three volumes, facsimiles of manuscripts with illustration for the plans of Sheringham in Norfolk, Antony House in Cornwall, and Attingham in Shropshire; volume 4 has the comment of the editor, Edward Malins.

Republic of ———: *see under* substantive word (*e.g.,* Philippines, Republic of the).

Republican Party, French PARTI RÉPUBLICAIN (PR), French political party formed in May 1977 when the former National Foundation of Independent Republicans (Fédération Nationale des Républicains Indépendents)—founded in 1966 by Valéry Giscard d'Estaing—was merged with other small groups. It is conservative in domestic social and economic policies but internationalist in being pro-NATO and pro-European.

After Pres. Georges Pompidou's death, Giscard was elected president in May 1974 and tried to govern with a coalition of members of his own party and Gaullists, Radical-Socialists, and other centre-left groups. Eventually, personality and policy conflicts between the Gaullists and Giscardians resulted in the resignation of the Gaullist premier, Jacques Chirac, in 1976 and in an outright battle in the elections of 1978, in which the Republicans and their non-Gaullist allies achieved a modest victory. In a 10-candidate race for the presidency in 1981, however, Giscard lost in a runoff with the Socialist candidate, François Mitterrand.

Republican Party, unofficial English name of the Irish political party Fianna Fáil (*q.v.*).

Republican Party (Italy): *see* Italian Republican Party.

Republican Party, byname JEFFERSONIAN REPUBLICANS, first opposition political party in the United States. Its members held power nationally between 1801 and 1825. Organized in the early 1790s, it became the direct antecedent of the present Democratic Party.

Many former Anti-Federalists (*q.v.*), who had resisted adoption of the new federal Constitution (1787), began to unite during the two administrations of Pres. George Washington in opposition to the forceful fiscal program of Alexander Hamilton, secretary of the treasury. When the proponents of a strong central government and loose constitutional interpretation organized as the Federalist Party in 1791, those who favoured states' rights and a strict construction of the Constitution rallied under the leadership of Thomas Jefferson, who had served as Washington's first secretary of state. The term republican was used to underscore the antimonarchical emphasis of the group, which was deeply influenced by the ideals of the French Revolution. The American Republicans feared the aristocratic attitudes of the Federalists (certain that Washington's governmental habits and techniques smacked of royalty), too much centralization at the seat of power, and the fact that Hamilton's fiscal policies tended to benefit the affluent at the expense of the common man. The Republican (Jeffersonian) coalition gained strength in support of the French during the European war that broke out in 1793. Opposition to monarchist Great Britain remained a dynamic unifying issue throughout the 1790s as the party fought the Federalist-sponsored Jay Treaty (1795) and the Alien and Sedition Acts (1798).

Ironically, the first three Republican presidents were all wealthy, aristocratic Southern planters—Jefferson (served 1801–09), James Madison (1809–17), and James Monroe (1817–25)—but all three shared the same liberal political philosophy. Though the vote was close when Jefferson overthrew the Federalists in the election of 1800, the political victory of the loyal opposition party proved that power could be transferred peacefully under the experimental government in the New World and, through an expanded franchise, could be shared with a rural majority of small landholders. Once in office the Republicans attempted to trim Federalist programs but actually overturned few of the criticized institutions (*e.g.,* the national bank was retained until its charter expired in 1811). Nevertheless, Jefferson made a genuine effort to lend an aura of democracy to his administration: he walked to the Capitol for his inauguration rather than ride in a coach-and-six, and he sent his annual message to Congress by messenger, rather than reading it personally. Federal excises were repealed, the national debt was retired, and the size of the armed forces was greatly reduced. The demands of foreign relations (such as the Louisiana Purchase in 1803), however, often forced Jefferson and his successors into a nationalistic stance reminiscent of the Federalists.

In the 20 years after 1808 the party existed less as a united political group than as a loose coalition of personal and sectional factions. During the 1820s the Republicans divided into two factions. One took the name National Republicans and was led by such expansionists as John Quincy Adams and Henry Clay as well as a number of former Federalists such as Daniel Webster. That faction became the nucleus of the Whig Party (*q.v.*) in the next decade. The opposition, organized by Martin Van Buren, called itself the Democratic-Republicans and was composed of diverse elements that emphasized local and humanitarian concerns, states' rights, agrarian interests, and democratic procedures. In keeping with the egalitarian spirit of the times, that faction adopted the name Democratic Party in the presidency of Andrew Jackson (1829–37).

Republican Party, byname GRAND OLD PARTY (GOP), one of the two major political parties of the United States. Its symbol is the elephant.

The party originated in July 1854 at Jackson, Mich., when a group of former Whigs, Democrats, and Free-Soilers adopted the name Republican. The name appealed to those who recalled Jeffersonian "republicanism" and generally placed the national interest above sectional interest and above states' rights. The party's founders were firmly linked in common opposition to slavery, particularly to the Kansas–Nebraska Act of 1854, which would have extended slavery into those newly created territories. The platform adopted at the party's first national convention in 1856 denied that Congress had the right to recognize slavery in a territory and held that Congress had the right to abolish slavery in the territories and ought to do so. This view was representative of widespread sentiment in the North.

During its first four years the party rapidly displaced the Whigs in the North as the main opposition to the Democrats, and in 1856 the party's first candidate, John C. Frémont, carried 11 states in his unsuccessful bid for the presidency. In 1860 the electoral votes of the 18 Northern states gave the presidency to the party's second candidate, Abraham Lincoln.

The secession of the Southern states gave the Republicans absolute control of the federal government. The prolonged agony of the Civil War, however, weakened Lincoln's prospects for reelection in 1864, and to broaden his base of support he took as a vice presidential candidate the prowar Democrat Andrew Johnson. After the war's end and the death of Lincoln, Radical Republican (*q.v.*) members of Congress were able to assert congressional rather than presidential control of Reconstruction in the defeated South after nearly impeaching President Johnson.

The end of the Civil War began a long period of Republican domination. The party's close identification with the Union victory in the war secured it the allegiance of most Northern and Midwestern farmers, while its support of protective tariffs and its accommodating attitude toward big business eventually gained it the support of many Northern urban areas and of powerful industrial and financial circles. Of the 18 presidential elections held between 1860 and 1932, 14 were won by Republicans. Within the party itself, however, there were protests against the rigidity of party control and against a small, self-perpetuating, oligarchic leadership. A splinter group named the Liberal Republicans left the party in 1872 in protest against the corrupt Republican administration of Pres. Ulysses S. Grant.

After a number of close electoral contests with the Democrats during the 1880s and the early '90s, the Republicans won the presidency and control of both houses of Congress in the 1896 elections. With the Democrats' adoption of economic radicalism under the sway of free-silver and Populist advocates, the Republicans emerged as the nation's majority party and managed to control both houses of Congress until 1910.

In 1901 the assassination of the Republican Pres. William McKinley gave the presidency to the vice president, Theodore Roosevelt, who became the leader of the party's progressive wing. Roosevelt launched an attack on monopolistic and exploitative business practices, adopted a more conciliatory attitude toward labour, and urged the conservation of natural resources. But Roosevelt became dissatisfied with the conservative policies of his Republican successor to the presidency, William Howard Taft, and in 1912 he bolted the Republicans and formed the Progressive Party, on whose ticket he ran for the presidency. This divided the Republican vote and gave the presidency and control of both houses of Congress to the Democrats. The Republicans regained the presidency in 1920 and rode to victory in the elections of 1924 and 1928 on the wave of economic prosperity of the 1920s. Their policies during this time were notably conservative and pro-business. The Great Depression that began in 1929 had severe consequences for the party, however. The Republicans' unwillingness to combat the effects of the Depression through government action led to Republican incumbent Pres. Herbert Hoover's overwhelming defeat by the Democrat Franklin D. Roosevelt in the 1932 election. Roosevelt's three reelections, the succession of Harry S. Truman upon Roosevelt's death in 1945, and Truman's election in 1948 kept the Republicans out of power for 20 years. During this time they generally lacked control of either house of Congress and had in effect become the minority party in the nation. For many years most Republicans vehemently opposed Roosevelt's New Deal policies, but by the 1950s the party had largely accepted the federal government's expanded role and regulatory powers.

In 1952 the Republican Party returned to power with the election of Dwight D. Eisenhower as president. Eisenhower's candidacy marked the dominance of the party's liberal-moderate wing, as opposed to its conservative wing led by Sen. Robert A. Taft. But the Republican platform remained a conservative one, calling for a strong anti-Communist stance in foreign affairs, a reduction of government regulation of the economy, lower taxes for the rich, and a resistant attitude toward calls for civil-rights legislation. The party retained its longtime support among both big and small business and gained new support from growing numbers of middle-class suburbanites and, perhaps most significantly, among white Southerners disturbed by the integrationist stance of the Democrats during the 1960s. Eisenhower was reelected in 1956, but the 1960 moderate Republican candidate, Richard M. Nixon, lost narrowly to Democrat John F. Kennedy. Conservative Republicans gained control of the party at the 1964 convention, but their presidential candidate, Barry M. Goldwater, lost that year's election by an overwhelming landslide. By 1968 the party's moderate faction had regained control and again nominated Nixon, who narrowly won the presidency that year. Nixon was reelected by a landslide in 1972, but in congressional, state, and local elections the party made few gains, and it failed to win control of Congress. As a result of the Watergate scandal, Nixon resigned the presidency in August 1974 and was succeeded by the first appointed vice president, Gerald R. Ford. In 1976 Ford was defeated by a Southern Democrat, Jimmy Carter, but in 1980 Carter was in turn defeated by Ronald W. Reagan, who had assumed the leadership of the conservative wing of the Republican Party after Goldwater's defeat in the 1964 elections. Reagan's personal popularity with the voters secured him a stunning reelection victory over the Democratic candidate in 1984. Reagan's electoral appeal was interpreted by some observers as a sign of both a renewed conservatism in American politics and an opportunity for the Republican Party to capture the permanent allegiance of larger numbers of centrist voters.

Republican River, river formed by the confluence of the North Fork of the Republican River and the Arikaree River near Haigler, Neb., U.S. It flows eastward through Swanson Lake (behind Trenton Dam) past the towns of McCook, Red Cloud, and Superior and then turns southeastward through Kansas to unite with the Smoky Hill River at Junction City, in Geary County, to form the Kansas River after a course of 445 mi (716 km). The river is part of the Missouri River Basin flood-control and land-reclamation project. Its dams include the Harlan County Dam (1948) near Alma, Neb., and the Milford Dam (1965) near Junction City; those on Republican tributaries include the Bonny Dam (1951), Enders (1951), Medicine Creek (Harry D. Strunk Lake; 1949), and Lovewell (1957).

Requesens y Zúñiga, Luis de, Requesens also spelled REQUESSENS (b. Aug. 25, 1528, Barcelona—d. March 5, 1576, Brussels), Spanish governor of the Netherlands during one phase (1573–76) of the Dutch revolt called the Eighty Years' War. Succeeding the tyrannical Duke of Alba, he tried unsuccessfully to compromise with the rebellious provinces.

His early career was as a government official and diplomatist. In 1563 he gained King Philip II's confidence as his representative at Rome. In 1568 he was made lieutenant general to Don Juan de Austria during the suppression of the Morisco revolt in Granada. He also accompanied Don Juan in the Lepanto campaign, his function being to control his nominal commander in chief, whose excitable temperament was distrusted by the King. Philip then named him viceroy in Milan, where he was credited with having shown moderation though he came into sharp collision with the archbishop Charles Borromeo.

Requesens arrived in Brussels on Nov. 17, 1573, having been sent to govern the Spanish Netherlands because the King wished to pursue a more conciliatory policy after the disastrous policy of repression of the Duke of Alba. Requesens urged a general pardon, the dissolution of the Council of Troubles, and the abolition of the sales tax; he also wanted to call the States-General in order to negotiate with the rebels. Philip, however, refused to yield any of the essential points in dispute between him and the rebels; and the Netherlanders themselves were scarcely in a conciliatory mood. Thus, although Requesens did publish a general pardon (June 5, 1574) and offered to exchange the sales tax for a subsidy, he ultimately fell back again on the army, with considerable success, though the Spanish troops themselves, frequently left unpaid, were inclined to mutiny and to plunder the civilian population. Requesens died exhausted by trying to do the impossible.

Requests, Court of, in England, one of the prerogative courts that grew out of the king's council in the late 15th century, with the particular function of dealing with civil petitions from poor people. Until 1529 it was known as the Court of Poor Men's Causes, and it remained a popular court because of the limited expense of bringing suit before it. The Court of Requests, which was modeled after the French Chambre des Requêtes, was concerned chiefly with civil matters, such as title to land, covenants, annuities, and debt, but it sometimes handled criminal cases such as forgery. Its procedures were similar to those used in the Court of Chancery, another prerogative court, which dealt with cases of equity.

The Court of Requests was presided over by the lord privy seal with the assistance, after 1550, of two masters of requests. Under Elizabeth I the court enlarged its jurisdiction to cover admiralty cases, involving mercantile as well as prize conflicts. After 1590 a series of prohibitions from the Court of Common Pleas, a common-law court, reduced the business in the Court of Requests. Unlike the prerogative courts of Star Chamber and High Commission, however, the Court of Requests was not abolished in 1642. The masters, however, ceased to sit at that point, and the court itself was used after the Restoration only for the purpose of assessing compensations due to royalists; it did not survive into the 18th century.

The name of court of requests was also given to inferior local courts established by special acts of Parliament to deal with small debts. These were abolished in the mid-19th century along with the London Court of Requests.

Requêtes, Chambre des (French judiciary): *see* Chambre des Requêtes.

requiem mass, musical setting of the Mass for the Dead (*missa pro defunctis*), named after the beginning of the Latin of the Introit "Requiem aeternam dona eis Domine" ("Give them eternal rest, O Lord"). The polyphonic composition for the requiem mass differs from the normal mass in that it not only includes certain items of the Ordinary, *e.g.,* Kyrie, Sanctus, Agnus Dei (the joyful portions, Gloria and Credo, are omitted), but also the Introit and Gradual from the Proper. A tract, followed by the sequence "Dies irae" ("Day of Wrath"), is substituted for the Alleluia and often is a major dramatic element in the composition. Sometimes responses and other text are added from the burial service, which follows the mass. Outstanding treatments of the requiem are those of Berlioz, Cherubini, Dvořák, Verdi, Bruckner, and Fauré in the 19th century; and those of Maurice Durufle and Benjamin Britten in the 20th. The latter's *War Requiem* is based on Latin prayers and also on war poems by Wilfred Owen; the famous *Ein deutsches Requiem* (*German Requiem*) of Brahms does not recite the mass text but is based on scriptural passages.

Rerek (Egyptian god): *see* Apepi.

Rerum Novarum, encyclical issued by Pope Leo XIII in 1891 and considered by many conservative Catholics to be revolutionary. It enunciated the late-19th-century Roman Catholic position on social justice, especially in relation to the problems created by the Industrial Revolution, and it emphasized the church's right to make pronouncements on social issues in their relationship to moral questions.

res judicata, in law, "a thing adjudged." The term is often used in reference to the maxim that repeated reexamination of adjudicated disputes is not in any society's interest.

It has long been held that one judicial contest is enough for the litigants on a particular claim or defense. As the volume of judicial work has risen, the need to limit litigants to a single contest about a single controversy has become more urgent. The concept of res judicata has expanded in scope and power as the courts have refined its operation.

Resad, Mehmed (Ottoman sultan): *see* Mehmed V.

resale price maintenance: *see* price maintenance.

Reschenscheideck (Italy): *see* Resia Pass.

research, marketing: *see* market research.

research and development, abbreviation R AND D, or R & D, in industry, two intimately related processes by which new products and new forms of old products are brought into being through technological innovation.

A brief treatment of research and development follows. For full treatment, *see* MACROPAEDIA: Industrial Engineering and Production Management.

The direct relationship of science and industry began in the mid-19th century when scientists and inventors were called on to supervise or consult on industrial production. Several industries in Germany and the United States established laboratories by 1900, but modern R and D emerged from the demands made on military technology during World Wars I and II. This government-sponsored military R and D led to "spin-off" civilian industrial developments in areas such as aircraft engines, nuclear power, and computer electronics.

Government agencies are still the principal sponsors of R and D, contracting projects either to directly owned laboratories or to independent, company, or university laboratories. Research associations, which pool the R and D resources of an entire industry, have proved particularly effective in Japan and western Europe.

Modern R and D programs carry out two types of research: basic research, which is directed toward a generalized goal within an industry (for example, genetic research in a pharmaceutical laboratory); and applied research, which directs the results of basic research toward the needs of a specific industry and results in the development of new or modified products or processes. In addition to carrying out basic and applied research and developing prototypes, the laboratory staff may also evaluate the efficiency and cost of the product.

Research Department Explosive: *see* RDX.

Resende, city, western Rio de Janeiro state, eastern Brazil, on the Rio Paraíba do Sul, opposite Agulhas Negras, at 1,296 ft (395 m) above sea level. Dairying, meat and coffee processing, and talc pulverizing are the principal economic activities. A marble quarry is located nearby, as is a military school. Resende, on the Presidente Dutra Highway between the cities of Rio de Janeiro and São Paulo, is also easily accessible by railroad. Pop. (1980 prelim.) 36,633.

Resende, Garcia de (b. *c.* 1470, Évora, Port.—d. Feb. 3, 1536, Évora), Portuguese poet, chronicler, and editor, whose life was spent in the service of the Portuguese court.

He began to serve John II as a page at the age of 10, becoming his private secretary in 1491. He continued to enjoy royal favour under King Manuel and later under John III. In 1498 he accompanied Manuel to Castile and in 1514 went to Rome with the admiral Tristão da Cunha, as secretary and treasurer of the famous embassy sent by the King of Portugal to offer the tribute of the East at the feet of Pope Leo X.

Resende's *Crónica de D. Joao II* (1545), though largely plagiarized from a work by Rui de Pina (*c.* 1440–*c.* 1523), contains personal anecdotes that give it special interest. Much of his work provides insight into the social life and manners of the period. In the 300 stanzas of his *Miscelânea* he surveys with wonder and pride—and not without social criticism—some of the notable events (including the great Portuguese discoveries) of the age in which he lived. The *Cancioneiro Geral* (1516), a vast anthology edited by Resende, also containing compositions of his own, is the chief source of knowledge of late medieval Portuguese verse.

reserpine, antihypertensive and tranquillizing drug derived from the roots of certain species of *Rauwolfia*, tropical and semitropical plants. The powdered whole root of *Rauwolfia serpentina* has been used for centuries in India for its tranquillizing effect upon the mentally disturbed. Reserpine, isolated in 1952, was the first of many *Rauwolfia* alkaloids found in the crude drug. Use of the powdered root in Western medicine began in 1953, and reserpine became generally available for medical use by the middle of the decade. The drug produces profound and prolonged tranquillizing action. Once used as a central nervous system depressant in treating psychoses, reserpine has been replaced in psychiatric therapy by the phenothiazines (such as chlorpromazine; *q.v.*).

Reserpine remains of value in treating hypertension (high blood pressure), in which low doses are effective. Its tranquillizing action contributes to its effectiveness in reducing high blood pressure.

Although reserpine has been synthesized, the drug used for medical purposes is still obtained from plant sources. Various crude, pure, or partially purified preparations are employed.

reservoir, artificial lake where water is collected and kept in quantity so that it may be drawn off for use.

Changes in weather cause the natural flow of streams and rivers to vary greatly with time. Periods of excess flows and valley flooding may alternate with low flows or droughts. The role of water-storage reservoirs, therefore, is to impound water during periods of higher flows, thus preventing flood disasters, and then permit gradual release of water during periods of lower flows. Simple storage reservoirs were probably created early in human history to provide drinking water and water for irrigation. From southern Asia and northern Africa the use of reservoirs spread to Europe and the other continents.

Reservoirs ordinarily are formed by the construction of dams across rivers, but off-channel reservoirs may be provided by diversion structures and canals or pipelines that convey water from a river to natural or artificial depressions.

When streamflow is impounded in a reservoir, the flow velocity decreases and sediment is deposited. Thus, streams that transport much suspended sediment are poor sites for reservoirs; siltation will rapidly reduce storage capacity and severely shorten the useful life of a small reservoir. Even in larger reservoirs sedimentation is a common and serious problem. Because removal of the deposited sediments from reservoirs is generally too costly to be practical, reservoirs on a sediment-laden stream are usually planned to provide a reserve of storage capacity to offset the depletion caused by sedimentation. Despite this, the life expectancy of most reservoirs does not exceed 100 years at present sedimentation rates.

An associated problem is erosion of the stream channel below a reservoir when water is released. Because the sediment load is deposited in the reservoir, the released water has renewed transporting capacity and channel erosion results.

Water may be lost from storage reservoirs by surface evaporation, by seepage into the surrounding soil or rocks, and by seepage through dam foundations. Seepage losses ordinarily can be reduced, but evaporation losses are often of major consequence. Gross evaporation from water surfaces in the temperate and tropical climates may amount to a few metres a year. In humid regions this loss is offset by direct precipitation and the net surface loss may be moderate or negligible; but in regions of lower rainfall, the net loss may be substantial, amounting to 1½ metres (5 feet) or more annually in some desert areas. Considerable success has been achieved in experimental programs for reducing evaporation losses, notably in Australia, Africa, and the United States, by the application on the water surface of a liquid monomolecular layer of a saturated, long-chain fatty alcohol such as hexadecanol.

Water reservoirs range in size and complexity from small single-purpose impoundments of only a few acre-feet (1 acre-foot = 1,233 cubic metres, or 43,560 cubic feet) to tremendously large and complex multiple-purpose impoundments of millions of acre-feet. A single-purpose reservoir is designed to fulfill only one function, such as irrigation, power generation, navigation, flood control, water supply, recreation, or low-flow regulation. The prevailing trend in the 20th century has been toward construction of multiple-purpose reservoirs that are designed to serve at least two principal functions.

Resheph (from Hebrew *reshef,* "the burner" or "the ravager"), ancient West Semitic god of the plague and of the underworld, the companion of Anath, and the equivalent of the Babylonian god Nergal. He was also a war god and was thus represented as a bearded man, brandishing an ax, holding a shield, and wearing a tall, pointed headdress with a goat's or gazelle's head on his forehead. Resheph was worshipped especially at Ras Shamra, Byblos, and Arsūf (later Apollonia, near Tel Aviv-Yafo); under the title Mikal (or Mekal) he was also worshipped at Beth-shean in eastern Palestine and at Ialium in Cyprus. Resheph was usually believed to be related to Mot, the god of sterility and death, but he also seems to have been a god of well-being, plenty, and fertility, and in that respect he may have been a form of the god Baal.

Resheph, bronze figurine from Megiddo, Israel, Late Bronze Age (*c.* 1550–*c.* 1200 BC); in the Rockefeller Museum, Jerusalem

By courtesy of the Israel Department of Antiquities and Museums

Reshevsky, Samuel Herman (b. Nov. 26, 1911, Ozorkow, near Lodz, Pol., Russian Empire), U.S. Chess master who was an outstanding player though he never won a world championship.

Reshevsky learned to play Chess when he was about 4 years old. A child prodigy, he gave exhibitions at age 6 and achieved master strength by the time he was about 9. He was brought with his family to the United States in 1920; shortly thereafter his Chess activity was restricted until he had completed his formal education. In 1933 he received a degree in accounting from the University of Chicago, and in 1935 he resumed serious international Chess. His style of play was tenacious and resourceful, particularly on defense. He wrote two major books, *Reshevsky on Chess* (1948) and *How Chess Games are Won* (1962).

Reshid Pasha, Mustafa: *see* Reşid Paşa, Mustafa.

Resht (Iran): *see* Rasht.

Resia Pass, Italian PASSO DI RESIA, German RESCHENPASS, or RESCHENSCHEIDECK, pass (4,947 ft [1,508 m]) about 1 mi (1.6 km) south of the Austrian–Italian border and just east of the Swiss frontier; it separates the Unterengadin section of the Inn River Valley, Austria, from the Val Venosta, or Val d'Adige (Adige River Valley), Italy. The pass marks the divide between the watersheds of the Adriatic and Black seas and between the Rhaetian and Ötztal Alps (*qq.v.*). Just below the pass lie the Italian hamlet and Lago (Lake) di Resia, a man-made lake created in 1949 by joining two smaller lakes. The old, abandoned refuge of San Valentino alla Muta (Sankt Valentin auf der Heide) near Resia village was mentioned as early as 1140. The Resia Road cuts away from the Inn River near Pfunds, Austria, and rises slowly to the Finstermünz Pass (3,900 ft) above the Inn Gorge. Continuing past the village of Nauders to Resia Pass, the road then descends to Bolzano, where it joins the Brenner Pass road and railway.

Reşid Paşa, Mustafa, also spelled MUSTAFA RESHID PASHA (b. March 13, 1800, Constantinople—d. Dec. 17, 1858), Ottoman statesman and diplomat, grand vizier (chief minister) on six occasions, who took a leading part in initiating, drafting, and promulgating the first of the reform edicts known as the Tanzimat (Reorganization).

A protégé first of his uncle Ispartalı Ali Paşa and later of the statesman Pertev Effendi, Reşid entered government service at an early age and thereafter rose rapidly in the service of the Turkish government, becoming ambassador to France in 1834. During his stay in western Europe he studied the French language and Western civilization and developed friendly relations with French and British statesmen. He supported the westernizing reforms of the Sultan Mahmud II, who appointed him his foreign minister. Mahmud's successor, Sultan Abdülmecid I, determined to continue his father's programs, entrusted Reşid with the preparation of new reform measures. Elaborated in the form of a rescript or decree (*hatt-ı şerif*), this program was proclaimed on Nov. 3, 1839, from the royal court at Gülhane Gardens, guaranteeing to Ottoman subjects equality and security of life and property, without distinction of race and religion. Although not all these provisions were carried out, Reşid became the symbol of westernizing reforms. Between 1839 and 1858 he was twice appointed minister of foreign affairs and six times grand vizier.

Reşid's reforms included the abolition of the slave trade, the introduction of new codes of commercial and criminal law, and the reform of administrative regulations to end nepotism and traffic in favours and appointments. A supporter of France and Britain in his foreign policy, he was grand vizier at the outbreak of the Crimean War (1853–56).

residence, in anthropology, location chosen by a couple as their postnuptial domicile. In primitive societies, such residence choices frequently follow rules; and in social systems of wide kinship ties, a new place of residence after marriage means the potential severance of old alignments and the establishment of new ones. Since rights, obligations, succession, and inheritance tend to follow the line of descent and since the obligations to and from one's consanguineal kin (*i.e.,* the kin of one's lineage or descent group) tend to predominate over the rights and duties between married persons, at least one member of the newly married pair will be separated from his (or her) more important kin of the family of orientation (*i.e.,* the family with whom one is reared). If this move requires the person to live with affinal kin (relatives through marriage), the new residence may put him (or her) at least temporarily at an emotional disadvantage.

If a new couple establishes a new home independent of the location of either set of parents, they are said to establish neolocal residence. If they live with or near the kin of the husband, they follow the rule of virilocal residence; if with or near the kin of the wife, the residence is said to be uxorilocal. When the couple alternates between the wife's group and the husband's group, their household arrangements are called bilocal residence.

Some matrilineal peoples live in avunculocal residence. Under this system, boys leave their natal home during adolescence and join the household of one of their mother's brothers, whom the boy refers to as "father." When he marries, his wife comes to live with him.

residencia, in colonial Spanish America, judicial review of an official's acts, conducted at the conclusion of his term of office. Originating in Castile in the early 15th century, it was extended to the government of Spain's colonial empire from the early 16th century. In Spain it was applied mainly to the *corregidores* (local administrative and judicial officials). In the New World all major and minor officials were subject to it. The first use of it there was in 1501, when Nicolás de Ovando reviewed the administration of his predecessor as governor of the Indies, Francisco de Bobadilla.

The *residencia* was conducted in the chief town of the official's district by an especially appointed judge, after due notice had been given. Anyone, including Indians, was entitled to testify before him. The judge gathered specific information about the official in question and the general condition of his district. After all testimony had been gathered, the official (*residenciado*) then testified in his own behalf, and the judge drew up a report, which was forwarded to the Council of the Indies, in Madrid, or, in the case of minor offices, to the local *audiencia* (court). The judge ruled in cases of misconduct.

Undue delays that occurred sometimes in the completion of *residencias* prompted the issuance of a royal decree, in 1667, by which the time limit on the *residencia* of viceroys was set at six months, on other officials at two months. Sentences could be appealed to local *audiencias* or, in the case of royally appointed officials, to the Council of the Indies. A royally appointed official's successor was sometimes appointed to conduct the *residencia* of the person he was succeeding in spite of repeated royal decrees barring the practice; this was apparently done to save the expense of sending someone from Madrid just to conduct the investigation. Thus, officials often were examined by those who had special reason to embarrass them.

The effectiveness of the *residencia* as a means of royal control over colonial officials was limited by corruption among judges and favouritism in Madrid.

residential architecture, also called DOMESTIC ARCHITECTURE, that aspect of architecture which deals with structures for human habitation, particularly single-family units. The dwelling is the oldest form of architecture, and the building technology dates from prehistoric man's first crude solutions for his most pressing problems: protection from the elements, wild animals, and human enemies.

Separate dwellings developed in three principal types: in hot climates the rooms usually were open or they surrounded an open-air courtyard; in colder regions the rooms generally were placed together in a compact block to facilitate heating. The third was informal: the rooms were strung in rows at will. Bricks appeared with the beginning of civilization in Mesopotamia. Wood, however, was the staple residential building material; brick and stone were employed in more luxurious houses.

Two distinct methods of construction developed: one used the solid load-bearing wall, originally of rock or adobe, and later of masonry or reinforced concrete; the other method employed a framework of wood or, later, metal, with a covering of such materials as reeds, bark, hides, wooden boards, or, eventually, composite materials. After the middle of the 19th century more glass and metal were introduced into the domestic structures, and by the mid-20th century mechanical and electrical labour-saving devices were added to the ordinary house throughout the world, especially in urban areas.

Public buildings and palaces, monuments on which a higher art of architectural design was concentrated, were emulated on a smaller scale in private dwellings. Residential design followed the main stream of public architecture through historic periods and styles but was always slightly more inclined to place convenience before effect. In the West from the time of the Renaissance, the house came to be thought of as a vehicle of self-expression and attracted the attention of architects seeking recognition for their unique talents. Especially during the first half of the 20th century, modern residential architecture often was more innovative than other forms of architectural design.

residual landform, also called RELICT LANDFORM, landform that was produced as the remains of an ancient landscape, escaping burial or destruction to remain as part of the present landscape. Residual landforms are often the result of changed climatic conditions, but they may be due to volcanism or to crustal uplift and downwarping. Examples of residual landforms are extinct volcanic cones, inactive stone rivers from climates on the fringe of glaciers, disconnected and abandoned parts of drainage systems, abandoned strandlines from more humid climates, fixed sand dunes from drier climates, marine terraces from high sea levels, and plunging sea cliffs from lower sea levels. The percentage of residual landforms in a given landscape and the importance placed on relict landforms by different geomorphologists may vary tremendously.

resin, any natural or synthetic organic compound consisting of a noncrystalline or viscous liquid substance. Synthetic resins are not clearly differentiated from plastics.

A brief treatment of resins follows. For full treatment, *see* MACROPAEDIA: Industries, Chemical Process.

Most natural resins are exuded from trees, especially pines and firs. Resin formation occurs as a result of injury to the bark from wind, fire, lightning, or other cause. The fluid secretion ordinarily loses some of its more volatile components by evaporation, leaving a soft residue at first readily soluble, but becoming insoluble as it ages. The ancient Chinese, Japanese, Egyptians, and others used resins in preparation of lacquers and varnishes.

Natural resins may be classified as spirit-soluble and oil-soluble. Among the former are balsams, long popular as a healing agent; turpentines used as solvents; mastics, dragon's blood, dammar, sandarac, and the lacs, all used as components of varnishes. The oil-soluble resins include rosin, derived along with turpentine from the long-leaf pine and long used for a variety of applications, including soap-making; copals, used in varnishes; amber, the hardest natural resin, fabricated into jewelry; Oriental lacquer, derived from a tree native to China; and cashew-nutshell oil, derived from cashew nuts.

In modern industry natural resins have been almost entirely replaced by synthetic resins, which are divided into two classes, thermoplastic resins, which remain plastic after heat treatment, and thermosetting resins, which become insoluble and infusible on heating. *See also* plastic.

Resina (Italy): *see* Ercolano.

resist printing, any of various methods of colouring cloth in a pattern by pretreating designed areas to resist penetration by the dye. To obtain a two-colour pattern on goods already dyed in one colour, a dye paste is applied in the desired design; the paste contains a substance resistant to a second dye, which is then applied to the cloth, developing colour only in the areas not covered by the paste. Batik and tie-dyeing (*qq.v.*) are examples of resist printing.

Resist-printed linen showing Joshua and Caleb returning from the Promised Land, German, late 17th century

Jack Skeel—EB Inc.

In stencil printing, the design parts not intended to take colour are covered with paper, woven fabric, or metal while the dye is passed over the surface. *See also* discharge printing; roller printing.

Resistance, various underground groups that sprang up throughout German-occupied Europe during World War II to oppose Nazi rule. The exact number of those who took part is unknown, but they included civilians who worked secretly against the occupation as well as armed bands of partisans or guerrilla fighters. Their activities ranged from publishing clandestine newspapers and assisting the escape of Jews and Allied airmen shot down over enemy territory to committing acts of sabotage, ambushing German patrols, and conveying intelligence information to the Allies.

The Resistance was by no means a unified movement. Rival organizations were formed, and in several countries deep divisions existed between Communist and non-Communist groups. Initially, the Communists took a pacifist line, but after Hitler's invasion of the Soviet Union in June 1941, they joined the underground and in some areas became dominant. In Yugoslavia the Serbian nationalist "Chetniks" under Dragoljub Mihajlović and the Communist Partisans under Tito fought each other as well as the Germans, and the two major Greek movements, one nationalist and one Communist, were able to cooperate in only one significant military enterprise, blowing up a railroad bridge in 1942. A similar division emerged in Poland where, late in the war, the Soviet Union backed a provisional government in opposition to the government-in-exile in London. In the Ukraine, where the Germans were at first welcomed as liberators, Hitler's treatment of the Slavic peoples as inferior races provoked a national resistance movement that fought not only the Germans but also the Partisans organized by the Soviets to harass the long German supply lines to the Eastern Front, and, eventually, the Red Army.

In Belgium the strong Communist-dominated movement was opposed by a group constituted by former army officers. The main Norwegian and Dutch organizations, on the other hand, were closely linked with the royal governments-in-exile. The Germans' dismissal of the legal Danish government in 1943 gave rise to a unified council of resistance groups that was able to mount considerable interference with the retreat of German divisions from Norway the following winter. Communists dominated the Resistance movement in northern (occupied) France, although both there and in southern France (ruled by the puppet Vichy regime) groups were formed by former army officers, Socialists, labour leaders, intellectuals, and others. In 1943 the clandestine Conseil National de la Résistance was established as the central organ of coordination. Early the following year, various belligerent forces known as *maquis* (French: "brushwood-covered heath," which served as their cover) were formally merged into the Forces Françaises de l'Intérieur (FFI).

Many of the Resistance groups were in contact with the British Special Operations Executive, which was in charge of subversive activities in Europe, and the British and Americans supported guerrilla bands in Axis-dominated territories by providing arms and air-dropping supplies. After the Allied landing in France on June 6, 1944, the FFI launched extensive operations, and it participated in the August uprising in Paris. Resistance forces in other northern European countries also undertook military actions to assist the Allied forces.

resistance, in electricity, property of an electric circuit or part of a circuit that transforms electric energy into heat energy in opposing electric current. Resistance involves collisions of the current-carrying charged particles with fixed particles that make up the structure of the conductors. Resistance is often considered as localized in such devices as lamps, heaters, and resistors, in which it predominates, although it is characteristic of every part of a circuit, including connecting wires and electric transmission lines.

The dissipation of electric energy in the form of heat, even though small, affects the amount of electromotive force, or driving voltage, required to produce a given current through the circuit. In fact, the electromotive force V (measured in volts) across a circuit divided by the current I (amperes) through that circuit defines quantitatively the amount of electrical resistance R. Precisely, $R = V/I$. Thus, if a 12-volt battery steadily drives a 2-ampere current through a length of wire, the wire has a resistance of 6 volts per ampere, or 6 ohms. Ohm is the common unit of electrical resistance, equivalent to one volt per ampere and represented by the capital Greek letter omega, Ω. The resistance of a wire is directly proportional to its length and inversely proportional to its cross-sectional area. Resistance also depends on the material of the conductor. *See* resistivity.

The resistance of a conductor, or circuit element, generally increases with increasing temperature. When cooled to extremely low temperatures, some conductors have zero resistance. Currents continue to flow in these substances, called superconductors, after removal of the applied electromotive force.

The reciprocal of the resistance, $1/R$, is called the conductance and is expressed in units of reciprocal ohm, called mho.

Resistencia, city, capital of Chaco province, northeastern Argentina, on the Barranqueras stream, which flows into the Río Paraná at the river port of Barranqueras, 4 mi (6 km) southeast. Originally founded in the mid-18th century as San Fernando del Río Negro (a Jesuit *reducción* [work mission] abandoned in

Governor's Palace, Resistencia, Arg.
Art Resource—EB Inc.

1773 after the order was suppressed), it was later reestablished in 1878 as a frontier colony settled by Italian agriculturists following the defeat of Paraguay in the War of the Triple Alliance (1864–70). Renamed Resistencia, it was declared capital of the Chaco national territory (now province) in 1884. The processing of cotton, quebracho (from which tannin is extracted), lumber, cattle, and sugarcane forms the basis of the city's economy. The only bridge (completed, 1973) along a 500-mi stretch of the Paraná and Paraguay rivers connects Resistencia to the city of Corrientes. Pop. (1980 prelim.) Greater Resistencia (including Barranqueras and Puerto Vilelas), 218,438.

resistivity, electrical resistance of a conductor of unit cross-sectional area and unit length. A characteristic property of each material, resistivity is useful in comparing various materials on the basis of their ability to conduct electric currents. High resistivity designates poor conductors.

Resistivity, commonly symbolized by the Greek letter rho, ρ, is quantitatively equal to the resistance R of a specimen such as a wire, multiplied by its cross-sectional area A, and divided by its length l; $\rho = RA/l$. The unit of resistance is the ohm. In the metre–kilogram–second (mks) system the ratio of area in square metres to length in metres simplifies to just metres. Thus, in the metre–kilogram–second system the unit of resistivity is ohm-metre. If lengths are measured in centimetres, resistivity may be expressed in units of ohm-centimetre.

The resistivity of an exceedingly good electrical conductor, such as hard-drawn copper, at 20° C (68° F) is 1.77×10^{-8} ohm-metre, or 1.77×10^{-6} ohm-centimetre. At the other extreme, electrical insulators have resistivities in the range 10^{12} to 10^{20} ohm-metres.

The value of resistivity depends also on the temperature of the material; tabulations of resistivities usually list values at 20° C. Resistivity of metallic conductors generally increases with a rise in temperature; but resistivity of semiconductors, such as carbon and silicon, generally decreases with temperature rise.

Conductivity is the reciprocal of resistivity, and it, too, characterizes materials on the basis of how well electric current flows in them. The metre–kilogram–second unit of conductivity is mho per metre, or ampere per volt-metre. Good electrical conductors have high conductivities and low resistivities. Good insulators, or dielectrics, have high resistivities and low conductivities. Semiconductors have intermediate values of both.

resistor, electrical component that opposes the flow of either direct or alternating current, employed to protect, operate, or control the circuit. Voltages can be divided with the use of resistors, and in combination with other components resistors can be used to make electrical waves into shapes most suited for the electrical designer's requirements. Resistors can have a fixed value of resistance or they can be made variable or adjustable within a certain range, in which case they may be called rheostats, or potentiometers (*qq.v.*).

Reşiţa, city, capital of Caraş-Severin *judeţ* (district), southwestern Romania, near the Yugoslavian border. In a coal- and metal-mining region, it is a long-established metal-working centre. After World War II the ironworks and steelworks of Reşiţa were modernized, and there are several associated heavy-engineering works and a factory producing diesel engines for railway locomotives. The city is close to the coalfield centred on Anina and uses local iron ore from Dognecea and Ocna de Fier. Manganese mined in the area produces a small margin for export. Formerly an important Roman settlement, the city has a museum that contains Neolithic remains, Roman coins and arms, ancient books, and exhibits of city history. Highways and a railway connection extend through the city. Pop. (1982 est.) 95,-308.

A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

Resnais, Alain (b. June 3, 1922, Vannes, Fr.), French motion-picture director, a leader of the Nouvelle Vague (New Wave) of unorthodox, influential film directors appearing in France in the late 1950s. His major works include *Hiroshima mon amour* (1959) and *L'Année dernière à Marienbad* (1961; *Last Year at Marienbad*).

Resnais was the son of a well-to-do pharmacist. A victim of chronic asthma, he spent a solitary childhood marked by intense interest in creative activity, characteristics that would remain salient through his adult life. While still a boy, he was given a movie camera, and at the age of 14 he directed his classmates in a film version of a popular thriller, *Fantômas.*

His illness exempted him from military service in World War II; and in 1940 he went to Paris, where he studied cinema at the Institute of Advanced Cinematographic Studies. During the German occupation of France, he became interested in theatre; later he would

Resnais

By courtesy of the French Film Office, New York

reproach himself for having become too immersed in it to join the underground resistance movement, but his brief stage career helped develop his sensitivity to actors and his technique of rehearsing them for his films.

Despite his interest in theatre, films remained his first love (along with comic strips, which he considers a kindred medium); and in 1947 he initiated a series of short films devoted to the visual arts with *Chateaux de France,* which he made by cycling and camping through the country. Having little interest in the French commercial-film industry of the time, he continued making shorts—on Vincent van Gogh, Paul Gauguin, and Pablo Picasso's painting "Guernica," among others—for the next nine years. Even in such documentary-like works, Resnais's profound vision of man's ominous alienation from his own humanity began to be expressed. He received commissions for political and propaganda films, whose immediate purpose he fulfilled but also transcended artistically. Thus, his documentary about concentration camps, *Nuit et brouillard* ("Night and Fog"), with a commentary by a former inmate, the contemporary poet Jean Cayrol, stressed "the concentrationary beast slumbering within us all." *Le Chant du styrène* ("The Song of Styrene"), written by author and critic Raymond Queneau, nominally publicizing the versatility of the plastic polystyrene, became a meditation on the transformation of matter from amorphous nature into bright, banal household implements.

The postponement of popular success in his career permitted his art to mature all the more intensively. The solitude he experienced in childhood reappeared thematically in his sensitivity to the evanescence of experience, to the passing of time, and to the discrepancies between individual consciousnesses—themes that inspired comparisons to the philosophy of Henri Bergson and to the novels of Marcel Proust.

With *Hiroshima mon amour,* his first feature-length motion picture, Resnais attained preeminence among the innovative New Wave directors, particularly for the finesse with which he combined a traditional form and a radical content. In his preference for elaborate rehearsals of his actors, Resnais belongs to the classical cinema; but his social, political, and spiritual milieu is that of the "Left Bank" school of filmmakers, so called for their political philosophy as well as for a formidable intellectuality related to the cosmopolitan bohemianism of the Saint-Germain-des-Prés district, on the Left Bank of the Seine, in Paris. The orientation of this group is opposite to that of the *Cahiers du Cinéma* subsection of the New Wave, which tended toward a politically quietist anarchism and drew upon a deliberately conventional, often Roman Catholic, bourgeois culture—and whose editorial offices were in the fashionable Champs-Élysées across the Seine. Though less well publicized and far less prolific, the "Left Bank" group (of whom Resnais was the spearhead) anticipated the political upheavals of Paris in 1968 and has dominated French cinema culture from the late 1960s.

In his films Resnais shows man at his most sensitive, confronting his own devious barbarism—in the form of the atom bomb in *Hiroshima mon amour,* of a sumptuous but chilling dreamworld in *L'Année dernière à Marienbad,* of police torture in *Muriel* (1963). He repeatedly presents human relationships that are characterized by reticence, modesty, immaculate courtesy, and a stimulating respect for others, together with overtones of solitude. Resnais has regularly worked with such distinguished French literary figures as Marguerite Duras and Alain Robbe-Grillet, encouraging them to write the script as a piece of literature rather than as a screenplay. He then transposes their vision into cinematic terms, in a style richly impregnated with his own sensibility. Notable among his later works are *Stavisky* (1974), *Providence* (1977), and *Mon oncle d'Amérique* (1980), winner of a special jury prize at the Cannes (Fr.) film festival.

A resident of Paris, Resnais numbered among his close friends many lesser known actors and technicians he worked with. His films epitomized the unusual blend of circumspection and commitment in his own personality. Although he dealt regularly with problems of personal and political action, his radical commitment has often been underestimated by critics mesmerized by his immaculate style. His short films had several brushes with government censorship. *Les Statues meurent aussi* (1953; "Statues Also Die"), his study of African art, was banned for 12 years for references to colonialism that he refused to alter. Some critics condemned *Hiroshima mon amour* for its sympathetic treatment of the heroine, once a wartime collaborationist and later an interracial adulteress who advocated internationalism and the "New Morality." Even when Resnais deals explicitly with political figures, however, as in *La Guerre est finie* (1966; "The War Is Over"), his scrupulosity and tragic humanism are so much in evidence that his work transcends partisan feelings.

(R.Du./Ed.)

BIBLIOGRAPHY. Roy Armes, *The Cinema of Alain Resnais* (1968), provides a useful general survey. John Ward, *Alain Resnais; or, The Theme of Time* (1968), is a thoughtful study, preoccupied with Resnais as Bergsonian.

resolution, in chemistry, any process by which a mixture called a racemate (*q.v.*) is separated into its two constituent enantiomorphs. (Enantiomorphs are pairs of substances that have dissymmetric arrangements of atoms and structures that are nonsuperposable mirror images of one another.) Two important methods of resolution were employed by Louis Pasteur. The first of these, known as the method of spontaneous resolution, can be used if the racemic substance crystallizes as a conglomerate composed of observably different particles of the two enantiomorphs, which can be physically sorted. Only a few instances of this condition have been reported; consequently, this method, although of historical and theoretical interest, seldom is applicable. Pasteur's second method, however, is of much greater practicality: it is based upon the conversion of the mixture of enantiomorphs into a mixture of diastereoisomers (optical isomers that are not mirror images of one another), which differ in physical properties and therefore can be separated. This transformation requires the use of a previously obtained optically active substance. For example, Pasteur showed in 1853 that, when racemic acid is mixed with a naturally occurring base, such as cinchonine, the resulting salt is a mixture of diastereoisomers and no longer one of enantiomorphs. The two salts present in the mixture, therefore, have different solubilities and so are separable.

resonance, in particle physics, an extremely short-lived phenomenon associated with subatomic particles called hadrons that decay via the strong nuclear force. This force is so powerful that it allows resonances to exist only for the amount of time it takes light to cross each such "object." A resonance occurs when the net energy of the colliding subatomic particles is just enough to produce its rest mass, which the strong force then causes to disintegrate within 10^{-23} second.

resonance, in physics, relatively large selective response of an object or a system that vibrates in step or phase, with an externally applied oscillatory force. Resonance was first investigated in acoustical systems such as musical instruments and the human voice. An example of acoustical resonance is the vibration induced in a violin or piano string of a given pitch when a musical note of the same pitch is sung or played nearby.

The concept of resonance has been extended by analogy to certain mechanical and electrical phenomena. Mechanical resonance, such as that produced in bridges by wind or by marching soldiers, is known to have built up to proportions large enough to be destructive, as in the case of the destruction of the Tacoma Narrows Bridge (*q.v.*) in 1940. Spacecraft, aircraft, and surface vehicles must be designed so that the vibrations caused by their engines or by their movement through air are kept to a safe minimum.

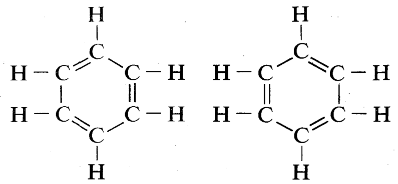
Resonance in electrical systems is of a somewhat different nature. Its occurrence in frequency-sensitive (alternating-current) circuits makes it possible for communication devices equipped with such circuits to accept signals of certain frequencies while rejecting others. In a television receiver, for example, resonance occurs when the frequency of one of the incoming signals reaching the circuit is near the natural frequency of the circuit, which then responds by absorbing maximum energy from the signal as the current within the circuit surges back and forth in step with the very weak current in the antenna.

A form of resonance somewhat analogous to a certain kind of mechanical resonance has been detected on the nuclear scale. This phenomenon, called magnetic resonance, occurs when atoms or their nuclei respond to the application of various magnetic fields by emitting or absorbing electromagnetic radiation of radio and microwave frequencies. *See also* magnetic resonance.

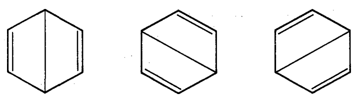
Where the same name may denote a person, place, or thing, the articles will be found in that order

resonance, theory of, in chemistry, theory by which the actual normal state of a molecule is represented not by a single valence-bond structure but by a combination of several alternative distinct structures. The molecule is then said to resonate among the several valence-bond structures or to have a structure that is a resonance hybrid of these structures. The energy calculated for a resonance hybrid is lower than the energies of any of the alternative structures; the molecule is then said to be stabilized by resonance. The difference between the energies of any one of the alternative structures and the energy of the resonance hybrid is designated resonance energy.

The classic example of the application of the theory of resonance is the formulation of the structure of benzene. The structure of benzene as a six-membered ring of carbon atoms was introduced by the German chemist F.A. Kekule in 1865. To make the structure compatible with the quadrivalence of carbon, he introduced alternating single and double bonds in the ring, and in 1872, in order to account for the fact that no isomers of benzene (no isomeric orthosubstituted benzenes differing in having single or double bonds between the substituted carbon atoms) had been observed, he introduced the idea of an oscillation between structures of the form:



In the years following 1920, several scientists proposed the idea that the true state of the molecule may be intermediate between those represented by several different valence-bond structures. Further clarification of the structure of benzene was provided by a U.S. chemist, Linus Pauling, in 1931 with the proposal that the normal state of the molecule can be represented as a hybrid of the two Kekule structures and the three structures of the form:



The actual configuration of the molecule is a suitable average of the configurations corresponding to the individual structures. Because of resonance the six carbon–carbon bonds are equivalent, in agreement with conclusions derived from experimental measurements. Furthermore, the energy of the resonance structure, calculated from quantum-mechanical considerations, is successfully predicted to be less than the energy of any one of the alternative structures.

The concept of resonance has similarly been used to formulate structures for polynuclear aromatic hydrocarbons, molecules containing conjugated systems of double bonds (*e.g.*, biphenyl, butadiene), free radicals, and other molecules to which no satisfactory single structure in terms of single bonds, double bonds, and triple bonds can be assigned (*e.g.*, carbon monoxide, oxygen). Some general rules are used in the selection of suitable resonance structures for a molecule. These rules are: the structures must have energies of similar magnitudes; the arrangement of the atoms must be approximately the same in all the structures; and the structures must have the same numbers of unpaired electrons.

The theory of resonance is based on the fundamental principle of quantum mechanics, which states that the wave function representing a stationary state of a system can be expressed as a weighted sum of the wave functions that correspond to several hypothetical structures for the system and that the proper combination is that sum which leads to a minimum calculated energy for the system.

resonator, acoustical device for reinforcing sound, as the sounding board of a piano, the "belly" of a stringed instrument, the air mass of an organ pipe, and the throat, nose, and mouth cavities of a vocal animal. In addition to augmenting acoustic power, resonators may also, by altering relative intensities of overtones, change the quality of a tone. *See also* soundboard. The Helmholtz resonator is an enclosed volume of air communicating with the outside through a small opening. The enclosed air resonates at a single frequency that depends on the dimensions of the containing vessel. The term resonator also denotes a system of electrons within a molecule or ion that absorbs electromagnetic waves of particular (resonance) frequencies (*see* chromophore).

resorcinol, also called *m*-DIHYDROXYBENZENE, phenolic compound used in the manufacture of resins, plastics, dyes, medicine, and numerous other organic chemical compounds. It is produced in large quantities by sulfonating benzene with fuming sulfuric acid and fusing the resulting benzenedisulfonic acid with caustic soda. Reaction with formaldehyde produces resins used to make rayon and nylon amenable to impregnation with rubber, and as adhesives. As a chemical intermediate, resorcinol is converted to dyes, explosives, and pharmaceuticals; it is also employed in photographic developers and cosmetics. In medicine it is used externally in ointments and lotions as an antifungal.

resources, allocation of, apportionment of productive assets among different uses. The choice among alternative uses determines the composition of the social product. Resource allocation arises as an issue because the resources of a society are in limited supply, whereas human wants are usually unlimited, and because any given resource can have many alternative uses.

In free-enterprise systems, the primary mechanism through which resources are distributed among the uses most desired by consumers is the price system. In planned economies and in the public sectors of mixed economies, the choice of how resources are distributed is a political one. Within the limits of existing technology, the aim of any economizing agency within a society is to allocate resources in such a way as to obtain the maximum possible output from a given combination of resources.

Respighi, Ottorino (b. July 9, 1879, Bologna, Italy—d. April 18, 1936, Rome), Italian composer who introduced Russian orchestral colour and some of the violence of Richard Strauss's harmonic techniques into Italian music. He studied at the Liceo of Bologna and later with Rimsky-Korsakov in St. Petersburg, where he was first violist in the Opera Orchestra. From his foreign masters Respighi acquired a command of orchestral colour and an interest in orchestral composition.

Respighi, 1935

By courtesy of Elsa Respighi; photograph, from Madeline Grimoldi

A piano concerto by Respighi was performed at Bologna in 1902; a "notturno" for orchestra was played at a concert in the Metropolitan Opera House that year. His comic opera *Re Enzo* and the opera *Semirama* brought him recognition and an appointment in 1913 to the Sta. Cecilia Academy in Rome as professor of composition. He became director of the conservatory in 1924 but resigned in 1926.

Respighi was drawn to the sensual, decadent climate of the Rome depicted by the poet D'Annunzio, and in his celebrated suites—*Pines of Rome* and *Fountains of Rome* especially—he sought to convey the subtlety and colour of the poet's imagination. Other suites include *Vetrate di chiesa* (*Church Windows,* 1927); *Gli ucelli* (*The Birds,* 1927); *Feste Romane* (*Roman Festival,* 1929); and *Trittico Botticelliano* (*Botticelli Triptych,* 1927, for chamber orchestra).

Respighi was also drawn to old Italian music, which he arranged in two sets of *Antique Dances and Arias* (transcribed for orchestra from lute pieces). One of his most popular scores was his arrangement of pieces by Rossini, *La Boutique fantasque,* produced by Diaghilev's Ballets Russes in London (1919). A later arrangement of Rossini piano pieces, *Rossiniana* (1925), also became a ballet.

As a composer of opera, Respighi had less success outside his own country. His best known works for the theatre were *Belfagor*, a comic opera produced at Milan in 1923, and *La fiamma* (Rome, 1934), which effectively transfers the gloomy Norwegian tragedy of H. Wiers Jenssen (known to English-speaking audiences in John Masefield's version as *The Witch*) to Byzantine Ravenna. In a different, more subdued vein are the "mystery," *Maria Egiziaca* (1932), and his posthumous *Lucrezia* (completed by his wife, Elsa, 1937), the latter showing Respighi's interest in the dramatic recitative of Claudio Monteverdi, of whose *Orfeo* he made a free transcription for La Scala, Milan, in 1935.

Respighi's wife and pupil, Elsa Olivieri-Sangiacomo Respighi (1894–), was a singer and a composer of operas, choral and symphonic works, and songs.

respiration, the process by which animals, including human beings, take in the oxygen required for survival and release carbon dioxide that accumulates in their bodies as a result of the expenditure of energy.

A brief treatment of respiration and respiratory systems follows. For full treatment, *see* MACROPAEDIA: Respiration and Respiratory Systems.

For a depiction of some of the structures that make up the human respiratory system, shown in relation to other parts of the gross anatomy, *see* the colour Trans-Vision in the PROPAEDIA: Part Four, Section 421.

Single-celled organisms (*e.g.*, amoebas) have no organs for respiration; they simply exchange carbon dioxide and oxygen across their cell membranes. Higher animals, however, have special respiratory mechanisms. Insects have a network of tubes (tracheae) that open to the outside and bring oxygen into the body. Fish and several aquatic invertebrates have gills, which permit the exchange of gases with the surrounding water; a pumping mechanism then carries the oxygenated blood through the animal's body. Some fish and amphibians use their thin, moist, vascular skin for respiratory exchange. Land-dwelling vertebrates have lungs that vary in complexity. The lungs are inflated by various types of pumping mechanisms, which cause oxygen to enter in response to a change in air pressure. Oxygen is transported throughout the body by bonding with hemoglobin pigments in red blood cells. Hemoglobin also acts to carry carbon dioxide from body tissues back to the lungs where it is exhaled.

The human respiratory system consists of the nasal cavity, throat (pharynx), voice box (larynx), windpipe (trachea), bronchi, and lungs. The ribs and muscles of the chest wall, as well as the diaphragm, help in the expansion and contraction of the lungs, although they are not considered part of the respiratory system. The pharynx and larynx are sections of the airway that leads to the lungs. The larynx is joined to the trachea, which in turn branches into the left and the right main bronchi. The bronchi continue to subdivide, finally terminating in the tiny alveolar ducts, which are filled with capillaries, or small blood vessels. Gases from the air in the alveoli are exchanged with gases contained in the pulmonary capillary blood by means of diffusion. Hemoglobin transports oxygen to the rest of the body and returns carbon dioxide to the lungs to be expired. Freshly oxygenated blood leaves the lungs through the pulmonary veins and is carried to the left atrium of the heart, where it is then pumped throughout the body. The movements of breathing are regulated by several nerve centres in the brain. Cells in the brainstem are believed to control the rhythm and depth of breathing, while the vagus, or 10th cranial, nerve controls the blood vessels and bronchi of the lungs.

Because the body stores practically no oxygen, any interference with ventilation that lasts more than a few minutes can cause death. Asphyxiation, drowning, and loss of chest muscle power brought on by drugs or disease can all cause acute respiratory failure and death.

Gas transport in the lungs depends on the relationship of the pressure of oxygen within the alveoli and the atmospheric pressure. At high altitudes, the atmospheric pressure is greatly reduced, and the delicate balance between oxygen and carbon dioxide in the body is often upset. The body gradually adapts to these changes, but the unacclimatized person who does physical work at a high altitude will experience dizziness, nausea and vomiting, and headaches.

The lungs are susceptible to a wide variety of diseases because they are constantly in contact with the external environment and the impurities it contains. General symptoms of lung diseases include coughing; production of sputum, which may be tinged with blood; chest pain; and shortness of breath. Colds and influenza are caused by viral infections. Bacterial diseases that attack the lungs include bacterial pneumonia and pulmonary tuberculosis. Both diseases were very serious until the discovery of antibiotic therapy brought them under control.

The lungs are particularly vulnerable to allergic diseases. When the smooth muscle of the bronchial tree comes into contact with foreign particles (*e.g.,* pollen), it releases histamine, which stimulates the muscle to contract. Also, any general allergic reaction causing inflammation of blood vessels is likely to be felt most severely in the highly vascular lungs. Asthma is an allergic disease characterized by contraction of the smooth muscle of the airway and an inability to clear mucus, resulting in difficult breathing.

Acute bronchitis (congestion of the bronchi) can be brought on by a virus or exposure to harmful gases. In its chronic form it results in obliteration and obstruction of the bronchi. Emphysema also causes destruction of alveoli. Both diseases are associated with cigarette smoking and air pollution. Lung cancer is also linked to cigarette smoking.

respiratory distress syndrome, also called IDIOPATHIC RESPIRATORY DISTRESS SYNDROME, or HYALINE MEMBRANE DISEASE, a common complication in infants, especially in premature newborns, characterized by extremely laboured breathing, cyanosis (a bluish tinge to the skin or mucous membranes), and abnormally low levels of oxygen in the arterial blood. Before the advent of effective treatment, respiratory distress syndrome was frequently fatal. Autopsies of children who had succumbed to the disorder revealed that the air sacs (alveoli) in their lungs had collapsed and a "glassy" (hyaline) membrane had developed in the alveolar ducts.

Although respiratory distress syndrome occurs mostly in premature, low-birth-weight infants (those weighing less than 2.5 kg, or about 5.5 pounds), it also sometimes develops in full-term infants, particularly those born to diabetic mothers. The disorder arises because of a lack of surfactant; this is a pulmonary substance that prevents the alveoli from collapsing after the infant's first breaths have been taken. The syndrome was formerly the leading cause of death in premature infants, but considerable success in saving affected infants has been achieved by using mechanical ventilators that deliver air under pressure into the alveoli. The continual air pressure provided by the ventilator prevents the collapse of the air sacs. As the infant's lungs mature and begin to produce surfactant—usually within three to five days after birth—the child is weaned from the ventilator. Most children who survive have no aftereffects.

respiratory therapy, also called INHALATION THERAPY, medical specialty primarily concerned with administering anesthesias and supporting respiration.

One of the conditions frequently dealt with is obstruction of breathing passages, in which therapy may consist of clearing the airway of mucus or liquid secretion by suction. Aerosol mists of water or medication may provide easier breathing and sometimes cure in some obstructive conditions. Postural drainage is a technique in which the forces of gravity are used to promote drainage in obstruction.

Aerosol and humidity treatments are used to relieve bronchospasm and mucous membrane swelling, mobilize secretions for easy removal, and administer antibiotics directly to the lungs. Water is a major therapeutic agent in bronchopulmonary disease and may be used in the form of cold steam, hot steam (vapour), or a fog (as in an oxygen or croup tent). Aerosol humidifiers called nebulizers may be powered by compressor machinery or by a hand squeeze bulb to project medication or water spray into the airway. Ultrasonic equipment may be used to propel very fine particles directly into the lungs, as in treatment of cystic fibrosis.

Therapy may also involve the use of gases, including those used for anesthesia during surgery. Oxygen may be administered to assist laboured breathing. A mixture of helium and oxygen is used to treat some diseases of obstruction, and a carbon dioxide and oxygen mixture is used to stimulate the cardiovascular brain centres, improve blood flow to the brain, overcome hypoventilation (slow, laboured breathing), prevent lung collapse, and treat hiccups.

Mechanical ventilation may be accomplished with negative pressure, as in the iron lung, or with positive pressure in the form of intermittent positive-pressure ventilation of breathing treatments, which are used extensively in hospitals. In the negative form the patient's trunk and lower body is placed in an airtight chamber in which a bellows creates a partial vacuum around the patient's chest, thus pulling air into the unenclosed nose and mouth of the patient. Positive pressure machinery delivers a breathing mixture under pressure to inflate the lungs and expand the chest. The former is used to treat patients with respiratory muscle paralysis, and the latter is used to treat bronchial asthma and bronchial spasm and to promote adequate lung expansion.

Procedures for the treatment of respiratory failure include insertion of airway tubes into the nose or mouth (intubation) or surgical insertion of a tube directly into the trachea (tracheostomy) to restore breathing in instances of accidental trauma that may have caused swelling or hemorrhage to the upper reaches of the respiratory tract.

responsa, Hebrew SHE'ELOT U-TESHUBOT ("questions and answers"), replies made by rabbinic scholars in answer to submitted questions about Jewish law. These replies began to be written in the 6th century after final redaction of the Talmud and are still being formulated. Estimates of the total number of published responsa, which range in length from a few words to lengthy monographs and compendia, vary from 250,000 to 500,000. These would probably fill more than 1,000 volumes if collected together. Responsa constitute a distinctive body of Jewish religious literature.

The questions and answers frequently deal with such practical matters as the determination of those activities that may or may not be done on the Sabbath. These questions often arise from changing social conditions and new technology. Nineteenth- and 20th-century responsa have decided such questions as whether electric appliances can be used on the Sabbath. Responsa therefore often provide an unintended historical record of cultural and technological change.

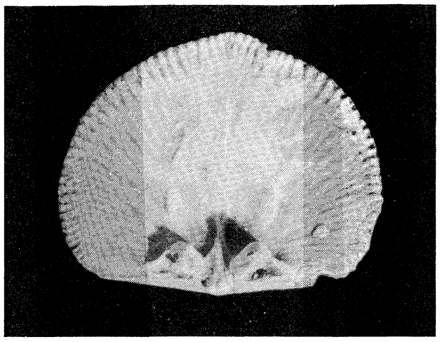
responsibility, diminished (law): *see* diminished responsibility.

responsorial singing, style of singing in which a leader alternates with a chorus. Responsorial singing is found in the folk music of many cultures—*e.g.,* American Indian, African, and Afro-American. One example from the rural United States is the lining out of hymns in churches: a leader sings a hymn line, which is then repeated by the congregation. Responsorial singing of the psalms was practiced in ancient Hebrew and early Christian liturgies. *Compare* antiphonal singing.

responsory, also called RESPOND, plainchant melody and text originally sung responsorially—*i.e.,* by alternating choir and soloist or soloists. Responsorial singing of the psalms was adopted into early Christian worship from Jewish liturgical practice. Most frequently the congregation sang a short refrain, such as *Amen* or *Alleluia,* between psalm verses sung by a cantor. As medieval plainchant developed, more elaborate refrains (R) were sung by a choir alternating with soloists singing psalm verses (V), producing a musical form $R\ V_1\ R\ V_2 \ldots R$. The responsory, or refrain, was frequently abbreviated on its repetition. Its text usually related to the meaning of the feast day or the content of the psalm. Only a few such chants survive in this long form, which is now normally curtailed.

The main places in which responsorial chants occur are the canonical hours, or divine office, and the Alleluia and Gradual of the mass. In most cases the basic pattern is R V R, with the V section being one or a few psalm verses. In the Gradual, the final refrain, or responsory, is usually omitted, making the form R V. In the earliest polyphony (music written in several parts, or voices), the solo sections of responsorial chants were generally set polyphonically and alternated with the original chant of the choral sections. In modern performances of responsorial chants, the traditional responsorial performance is not always maintained.

Resserella, extinct genus of brachiopods (lamp shells) that occurs as fossils in marine rocks of Middle Ordovician to Lower Silurian age (the Ordovician Period ended 430,000,000 years ago and was followed by the Silurian Period). *Resserella* has a dorsal shell the margin of which is horizontal and a distal, or upper, shell with an arcuate (bow-shaped) margin. Both valves are often gently convex.



Resserella

By courtesy of the trustees of the British Museum (Natural History); photograph, Imitor

Surface markings consist of fine lines, and the internal structure of *Resserella* is very distinctive.

restaurant, establishment where refreshments or meals may be procured by the public. The public dining room that came ultimately to be known as the restaurant originated in France, and the French have continued to make major contributions to the restaurant's development. The first restaurant proprietor is believed to have been one A. Boulanger, a soup vendor, who opened his business in Paris in 1765. The sign above his door advertised restoratives, or *restaurants,* referring to the soups and broths available within. The institution took its name from that sign, and "restaurant" now denotes a public eating place in the English, French, Dutch, Danish, Norwegian, Romanian, and many other languages with some variations. For example, in Spanish and Portuguese the word becomes *restaurante;* in Italian it is *ristorante;* in Swedish, *restaurang;* in Russian, *restoran;* and in Polish, *restauracia.*

Although inns and hostelries often served paying guests meals from the host's table, or table d'hôte, and beverages were sold in cafés, Boulanger's restaurant was probably the first public place where any diner might order a meal from a menu offering a choice of dishes.

Boulanger operated a modest establishment; it was not until 1782 that La Grande Taverne de Londres, the first luxury restaurant, was founded in Paris. The owner, Antoine Beauvilliers, a leading culinary writer and gastronomic authority, later wrote *L'Art du cuisinier* (1814), a cookbook that became a standard work on French culinary art. Beauvilliers achieved a reputation as an accomplished restaurateur and host, and the French aphorist and gastronomic chronicler Jean-Athelme Brillat-Savarin, a frequent guest, credited Beauvilliers with being

> the first to combine the four essentials of an elegant room, smart waiters, a choice cellar, and superior cooking.

Brillat-Savarin also noted that Beauvilliers would

> point out here a dish to be avoided, there one to be ordered instantly . . . ; and send, at the same time, for wine from the cellar, the key of which he produced from his own pocket; in a word, he assumed so gracious and engaging a tone, that all these *extra* articles seemed so many favours conferred by him.

Before the French Revolution, aristocratic French households maintained elaborate culinary establishments, but when the Revolution reduced the number of private households offering employment, many chefs and cooks found employment in restaurant kitchens or opened their own eating establishments. By 1804 Paris had more than 500 restaurants, producing most of the great chefs of history and creating many famous dishes.

French restaurants of the 19th century. During the Napoleonic era the Palais-Royal, the colonnaded, tree-lined area adjacent to the Louvre, became the location of many of the finest restaurants in Paris. The Véry, a leading restaurant of the era, was lavishly decorated and frequented by beautiful women escorted by dashing officers. The menu listed a dozen soups, two dozen fish dishes, 15 beef entrées, 20 mutton entrées, and scores of side dishes. The novelist Honoré de Balzac often dined at the Véry, consuming prodigious quantities of oysters, fish, meat dishes, fruits, wines, and liqueurs. It was a favourite haunt of gourmet-author Grimod de la Reynière, who considered it the finest restaurant in France.

The Véry was absorbed in 1869 by the neighbouring Le Grand Véfour. This restaurant was still in business in the mid-1980s and was regarded as one of the finest eating places in France. Another outstanding Paris establishment of the 19th century was the Café Foy, later called Chez Bignon, a favourite dining place of the English novelist William Makepeace Thackeray and of the Italian composer Gioacchino Rossini, who lived in the same building. The Café de Paris, on the Boulevard des Italiens, was the first of many restaurants in Paris and elsewhere that have operated under this name. Other favourite eating places were the Rocher de Cancale, on the rue Montorgueil, famous for its oysters and fish, and the Restaurant Durand, at the corner of the Place de la Madeleine and the rue Royale, a favourite gathering place of politicians, artists, and writers, including the authors Anatole France and Émile Zola.

The most illustrious of all 19th-century Paris restaurants was the Café Anglais, on the Boulevard des Italiens at the corner of the rue Marivaux, where the chef, Adolphe Dugléré, created classic dishes such as *sole Dugléré* (fillets poached with tomatoes and served with a cream sauce having a fish stock base) and the famous soup *potage Germiny.* On June 7, 1867, the Café Anglais served the now-famous "Three Emperors Dinner" for three royal guests visiting Paris to attend the Universal Exposition. The diners included Tsar Alexander II of Russia; his son the tsarevich (later the tsar Alexander III); and King William I of Prussia, later the first emperor of Germany. The meal included soufflés with creamed chicken (*à la reine*), fillets of sole, escalloped turbot, chicken *à la portugaise* (cooked with tomatoes, onions, and garlic), lobster *à la parisienne* (round, flat medallions glazed with a gelatin-mayonnaise mixture and elaborately decorated), ducklings *à la rouennaise* (the carcasses stuffed with liver and pressed, presented on a platter with boned slices of the breast and the grilled legs, and served with a red wine sauce containing pureed liver), ortolans (small game birds) on toast, and eight different wines.

Although the Café Anglais closed in 1913, when the building was demolished, the table setting for this dinner is now displayed at La Tour d'Argent, the oldest surviving restaurant in Paris.

Toward the end of the 19th century, in the gaudy and extravagant era known as *la belle époque,* the luxurious Maxim's, on the rue Royale, became the social and culinary centre of Paris. The restaurant temporarily declined after World War I but recovered under new management, to become an outstanding gastronomic shrine.

France produced many of the world's finest chefs, including Georges-Auguste Escoffier, who organized the kitchens for the luxury hotels owned by César Ritz, developing the so-called *brigade de cuisine,* or kitchen team, consisting of highly trained experts each with clearly defined duties. These teams included a chef, or *gros bonnet,* in charge of the kitchen; a sauce chef, or deputy; an *entremettier,* in charge of preparation of soups, vegetables, and sweet courses; a *rôtisseur* to prepare roasts and fried or grilled meats; and the *garde manger,* in charge of all supplies and cold dishes. In Escoffier's time, the duties and responsibilities of each functionary were sharply defined, but in modern times the rising labour costs and the need for faster service have broken down such rigidly defined duties. In the kitchens of even the leading modern restaurants, duties at the peak of the dinner-hour preparations are likely to overlap widely, with efficiency maintained amid seeming chaos and confusion.

French restaurants in the 20th century. In the 20th century, with the development of the automobile, country dining became popular in France, and a number of fine provincial restaurants were established. The Restaurant de la Pyramide, in Vienne, regarded by many as the world's finest restaurant, was founded by Fernand Point and after his death, in 1955, retained its high standing under the direction of his widow, Madame "Mado" Point. Other leading French provincial restaurants have included the Troisgros in Roanne; the Paul Bocuse Restaurant near Lyon; the Auberge de l'Ill in Illhaeusern, Alsace; and the hotel Côte d'Or, at Saulieu.

Selected restaurants throughout France are evaluated annually by the *Guide Michelin,* a publication devoted to surveying eating establishments and hotels in more than 3,400 towns and cities, and awarding one, two, or three stars, based upon quality.

French restaurants today are usually in one of three categories: the bistro, or brasserie, a simple, informal, and inexpensive establishment; the medium-priced restaurant; and the more elegant grand restaurant, where the most intricate dishes are executed and served in luxurious surroundings.

Other nations have also made many significant contributions to the development of the restaurant.

Other European restaurants. In Italy the *botteghe* (coffee shop) of Venice originated in the 16th century, at first serving coffee only, later adding snacks. The modern *trattorie,* or taverns, feature local specialities. The *osterie,* or hostelries, are informal restaurants offering homelike cooking. In Florence small restaurants below street level, known as the *buca,* serve whatever foods the host may choose to cook on a particular day.

Austrian coffeehouses offer leisurely, complete meals, and the diner may linger to sip coffee, read a newspaper, or even to write an article. Many Austrians frequent their own "steady restaurants," known as *Stammbeissl.*

In Hungary the *csárda,* a country highway restaurant, offers menus usually limited to meat courses and fish stews.

The beer halls of Czechoslovakia, especially in Prague, are similar to coffeehouses elsewhere. Food is served, with beer replacing coffee.

The German *Weinstube* is an informal restaurant featuring a large wine selection, and the *Weinhaus,* a food and wine shop where customers may also dine, offers a selection of foods ranging from delicatessen fare to full restaurant menus. The *Schenke* is an estate-tavern or cottage pub serving wine and food. In the cities a similar establishment is called the *Stadtschenke.*

In Spain the bars and cafés of Madrid offer widely varied appetizers, called *tapas,* including such items as shrimp cooked in olive oil with garlic, meatballs with gravy and peas, salt cod, eels, squid, mushrooms, and tuna fish. The tapas are taken with sherry, and it is a popular custom to go on a *chateo,* or tour of bars, consuming large quantities of tapas and sherry at each bar. Spain also features the *marisco* bar, or *marisqueria,* a seafood bar; the *asadoro,* a Catalan rotisserie; and the *tasca,* or pub-wineshop.

In Portugal, *cervejarias* are popular beer parlours also offering shellfish. Fado taverns serve grilled sausages and wine, accompanied by the plaintive Portuguese songs called *fados* (meaning "fate").

In Scandinavia sandwich shops offer open-faced, artfully garnished sandwiches called *smørrebrød.* Swedish restaurants feature the *smörgåsbord,* which literally means "bread and butter table," but actually is a lavish, beautifully arranged feast of herring, shrimp, pickles, meatballs, fish, salads, cold cuts, and hot dishes, served with aquavit or beer.

The Netherlands has sandwich shops, called *broodjeswinkels,* serving open-faced sandwiches, seafoods, hot and cold dishes, and cheeses from a huge table.

English city and country pubs have three kinds of bars: the public bar, the saloon, and the private bar. Everyone is welcome in the public bar or saloon, but the private bar is restricted to habitués of the pub. Pub food varies widely through England, ranging from sandwiches and soups, to pork pies, veal and ham pies, and steak and kidney pies, bangers (sausages) and a pint (beer), bangers and mash (potatoes), toad in the hole (sausage in a Yorkshire pudding crust), and Cornish pasties, or pies filled with meat and vegetables.

Middle Eastern restaurants. In the *tavérnas* of Greece, customers are served such beverages as retsina, a resinated wine, and ouzo, an anise-flavoured apéritif, while they listen to the music of the *bouzouki.* Like other Mediterranean countries, Greece has the grocery-*tavérna* where one can buy food or eat.

The Turkish *işkembeci* is a restaurant featuring tripe soup and other tripe dishes; *muhallebici* shops serve boiled chicken and rice in a soup and milk pudding.

Asian restaurants. In Japan, *tempura* bars offer fried shrimp at a counter. Other food bars serve *sushi,* raw fish fillets or other ingredients rolled in vinegared rice, and *sashimi,* raw fish slices. *Yu-dōfa* restaurants build their meals around a variety of bean curds, and the elegant tea houses serve formal Kaiseki table d'hôte meals.

In China, restaurants serving the local cuisine are found, and noodle shops offer a wide variety of noodles and soups. The *dim-sum* shops provide a never-ending supply of assorted steamed, stuffed dumplings and other steamed delicacies.

A common sight in most parts of Asia is a kind of portable restaurant, operated by a single person or family from a wagon or litter set up at a particular street location, where specialties are cooked on the spot. Food and cooking utensils vary widely in Asia.

American contributions to restaurant development. The cafeteria, an American contribution to the restaurant's development, originated in San Francisco during the 1849 gold rush. Featuring self-service, it offers a wide variety of foods displayed on counters. The customer makes his selections, paying for each item as he chooses it or paying for the entire meal at the end of the line. Other types of quick-eating places originating in the United States are the drugstore counter, serving sandwiches or other snacks; the lunch counter, where the diner is served a limited quick-order menu at the counter; and the drive-in, where patrons are served in their automobiles. So-called fast-food restaurants, usually operated in chains or as franchises and heavily advertised, offer limited menus—typically comprising hamburgers, hot dogs, fried chicken, or pizza and their complements—and also offer speed, convenience, and familiarity to diners who may eat in the restaurant or take their food home. Among fast-food names that have become widely known are White Castle (one of the first, originating in Wichita, Kan., in 1921), McDonald's (which grew from one establishment in Des Plaines, Ill., in 1955 to more than 6,000 internationally within 30 years), Kentucky Fried Chicken (founded in 1956), and Pizza Hut (1958). Many school, work, and institutional facilities provide space for coin-operated vending machines that offer snacks and beverages.

The specialty restaurant, serving one or two special kinds of food, such as seafood or steak, is another distinctive American establishment.

The Pullman car diner, serving full-course meals to long distance railroad passengers, and the riverboat steamers, renowned as floating gourmet palaces, were original American conceptions. They belong to an earlier age, when dining out was a principal social diversion, and restaurants tended to become increasingly lavish in food preparation, decor, and service.

In many modern restaurants customers now prefer informal but pleasant atmosphere and fast service. The number of dishes available, and the elaborateness of their preparation, has been increasingly curtailed as labour costs have risen and the availability of skilled labour decreased. The trend is toward such fast and efficient food operations as fast-food restaurants, snack bars, cafeterias, coffee shops, and drive-ins. The trend in elegant and expensive restaurants is toward smaller rooms and intimate atmosphere, with authentic, highly specialized and limited menus. (G.L./Ed.)

Restif, Nicolas-Edme, byname RESTIF DE LA BRETONNE (b. Oct. 23, 1734, Sacy, near Auxerre, Fr.—d. Feb. 3, 1806, Paris), French novelist whose works are remarkable for their lively, detailed accounts of the sordid aspects of French life and society in the 18th century. After serving his apprenticeship as a printer in Auxerre, Restif went to Paris, where he

Restif, engraving by L. Berthet after L. Binet, 1785; frontispiece to *Le Drame de la vie,* 1793

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

eventually set the type for some of his own works—books long prized by collectors for their rarity, quaint typography, and beautiful and curious illustrations.

His novels are rambling and carelessly written. While he parades his moralistic intentions and frequently airs his views on the reform of society, his preoccupation with eroticism, tinged with mysticism, has led to his being called "the Rousseau of the gutter." The author's life forms the basis of much of his writing, *e.g., La Vie de mon père* (1779; *My Father's Life*), a vivid picture of peasant life. But in this work, as in his autobiography, *Monsieur Nicolas* (1794–97), much of which is set in the Parisian underworld, Restif's vivid imagination has rendered it difficult to separate fact from fiction. Restif left another record of his observation of Parisian life in his own day in *Les Contemporaines* (1780–85; "The Modern Women"), while *Le Paysan perverti* (1776; "The Corrupted [Male] Peasant") and *La Paysanne pervertie* (1784; "The Corrupted [Female] Peasant") develop the theme of the demoralization of virtuous country folk in the metropolis.

BIBLIOGRAPHY. *Monsieur Nicolas: Or, The Human Heart Laid Bare* (1966), is a condensation and translation of Restif's voluminous autobiography, prepared by Robert Baldick. Alex Karmel, *My Revolution: Promenades in Paris, 1789–1794, Being the Diary of Restif de la Bretonne* (1970), is a fictionalized historical biography, using quotations from Restif's journals. Analytical examinations of Restif's literary writings include Charles A. Porter, *Restif's Novels: Or, An Autobiography in Search of an Author* (1967); and Mark Poster, *The Utopian Thought of Restif de la Bretonne* (1971).

resting potential, in biochemistry, the imbalance of electrical charge that exists between the interior of electrically excitable cells (primarily nerve cells) and their surroundings. The resting potential of electrically excitable cells lies in the range of 60 to 95 millivolts (1 millivolt = 0.001 volt), with the inside of the cell negatively charged. If the inside of a cell becomes more electronegative (*i.e.,* if the potential is made greater than the resting potential), the membrane or the cell is said to be hyperpolarized. If the inside of the cell becomes less negative (*i.e.,* the potential is decreased below the resting potential), the process is called depolarization.

During the transmission of nerve impulses, the brief depolarization that occurs when the inside of the nerve cell fibre becomes positively charged is called the action potential (*q.v.*). This brief alteration of polarization, believed to be caused by the shifting of sodium ions (charged atoms) from the outside to the inside of the cell, results in the transmission of nerve impulses. After depolarization (nerve stimulation), the cell membrane becomes relatively permeable to positively charged potassium ions, which diffuse outward from the inside of the cell, where they normally occur in rather high concentration. The cell then resumes the negatively charged condition characteristic of the resting potential.

Restionales, order of grasslike monocotyledonous flowering plants comprising four families, distributed mostly in the Southern Hemisphere, especially in southern Africa and Australia.

Nearly all plants in the group have reduced (simplified) flowers with a one- to three-chambered ovary containing only one pendulous ovule per chamber. There are one to three stamens (male pollen-producing structures) in all but the family Flagellariaceae, which has six. This family, which has two genera and about seven species, also differs in being composed of herbs and climbers with elongate leaves sometimes ending in a tendril, by which they climb. Pollination is mostly by wind.

The largest family is Restionaceae, which has 25 to 35 genera and about 350 species. In the genus *Restio* (120 species) the leaves are reduced to sheaths around the stems, which are green and perform the functions of photosynthesis.

The family Centrolepidaceae has about five or six genera and 35 or 40 species of small grasslike, sedgelike, or even mosslike plants. Two genera (*Trithuria* and *Hydatella,* with two species each) differ in being submerged aquatic plants.

The family Hanguanaceae, with one genus (*Hanguana*) and only one or two species of robust, erect herbs, is perhaps misplaced in this order, but its relationships are not clear.

The order is considered to represent an evolutionary condition somewhat between the lily order (Liliales) and the grass order (Poales).

Reston, urban community, an original concept in urban planning (the first of its kind in the United States), in Fairfax county, Va., adjacent to Herndon, 22 miles (35 km) west-northwest of Washington, D.C. It was developed after 1962 by Robert E. Simon whose initials form the first syllable of the community's name. Planning embraces a number of villages (separated by woodland tracts) each with a "town centre" serving as a retail area. The layout was designed to minimize road traffic by locating a variety of dwellings within a half-mile radius of each "town centre." The overall community aims to be self-sustaining with shopping centres, industries, schools, and recreational, cultural and medical facilities. Dulles International Airport is nearby. Pop. (1980) 36,407.

Reston, James B(arrett), byname SCOTTY RESTON (b. Nov. 3, 1909, Clydebank, Dumbartonshire, Scot.), Scottish-born U.S. columnist and editor of *The New York Times* who became one of the Unites States' most influential journalistic interpreters of national and world news.

Reston moved to the United States with his parents at the age of 10 and soon acquired the nickname Scotty. He attended public schools in Dayton, Ohio, and graduated from the University of Illinois in 1932. He worked for the *Springfield* (Ohio) *Daily News* and as Ohio State University's sports publicity director. He also wrote publicity for the Cincinnati Reds baseball team and joined the Associated Press (AP) as a sports writer. In 1937 he was assigned to AP's London bureau.

Reston became associated with *The New York Times* in 1939, when he went to work in the paper's London bureau. His many assignments with the *Times* included service in the Washington bureau beginning in 1941, in the London bureau as acting head (1943–45), as national correspondent and diplomatic correspondent (1945–46), as Washington bureau chief (1953–64), as associate editor (1964–68), as executive editor (1968–69), as vice president (1969–74), and as director and columnist starting in 1974.

He won a Pulitzer Prize in 1945 for his dispatches and interpretative articles on the Dumbarton Oaks Conference (1944) and another Pulitzer Prize in 1957 for a series of five articles on the devolution of executive power in the event of a president's disability.

Restoration literature, English literature written after the Restoration of the monarchy in 1660 following a period of Commonwealth. Some literary historians speak of the period as bounded by the reign of Charles II (1660–85), while others prefer to include within its scope the writings produced during the reign of James II (1685–88). The period led into England's "classical" Augustan age under Queen Anne (1702–14). Many typical literary forms of the modern world—including the novel, biography, history, travel writing, and journalism—gained confidence in themselves during the Restoration period, when new scientific discoveries and philosophic concepts as well as new social and economic conditions came into play. There was a great outpouring of pamphlet literature, too, much of it politico-religious, while John Bunyan's great allegory, *Pilgrim's Progress*, also belongs to this period. Much of the best poetry, notably that of John Dryden (the great literary figure of his time, in both poetry and prose), the Earl of Rochester, Samuel Butler, and John Oldham, was satirical and led directly to the later achievements of Alexander Pope, Jonathan Swift, and John Gay in the Augustan age. It was, above all, a great age of drama. Heroic plays, influenced by principles of French Neoclassicism, enjoyed a vogue, but the age is chiefly remembered for its glittering, critical comedies of manners by such playwrights as George Etherege, William Wycherley, Sir John Vanbrugh, and William Congreve.

Restormel, district (borough), county of Cornwall, extreme southwestern England, occupying an area of 174 sq mi (452 sq km) in the central part of the county. Restormel district spans the peninsular county and is thus bordered by St. George's Channel on the northwest and St. Austell Bay and the English Channel on the south. Gently rolling and elevated, the interior of Restormel is composed of hard sandstone soils. Inland from the south and dominating the landscape, however, is a granite intrusive called the Hensbarrow Downs, 600 to 1,000 ft (180 to 300 m) high. These bleak downs usually support only a grass cover. Even the lower-lying sandstone areas grazed by dairy and beef cattle are largely barren of trees because of the windswept environment.

The small ports of Fowey and Mevagissey on the south coast are adjacent to limited low-lying areas that support some fruits and market-garden produce. Sand dunes and ocean breakers below the cliffs at Newquay on the northern coast are popular with vacationers and surfers. Fowey was the principal port of Cornwall during the Middle Ages and later (like Mevagissey) was a centre for smuggling. Contemporary Fowey exports England's principal kaolin deposits quarried in the nearby Hensbarrow Downs. Mevagissey is a fishing port (primarily mackerel and pilchard). St. Austell, the processing center for the kaolin deposits, is the district seat. Pop. (1983 est.) 79,300.

restrictive covenant, in Anglo-American property law, agreement between two or more parties to a written instrument establishing limitations on the use and enjoyment of interests in real property. The restrictive covenant imposes a restraint on a person taking possession of property on his exercise of his full possessory rights, creating a duty to do or refrain from doing some act(s) relative to his possession. The restrictive covenant is as old as the law of property, certainly a legal concept well-established in Roman law. U.S. courts generally refrain from enforcing covenants that would unduly encumber land titles or would impose on the court the burden of supervision to insure enforcement. The use of restrictive covenants to exclude members of a particular race from the ownership of property was declared unconstitutional by the U.S. Supreme Court in 1945 and 1953. Although the term is most frequently employed in reference to real property, it may be applied generically to a restraint on the usage of any subject of property interests. *See also* servitude.

reststrahlen (German: "residual radiation"), light that is selectively reflected from the surface of a transparent solid when the frequency of the light is nearly equal to the frequency of vibration of the electrically charged atoms, or ions, constituting the crystalline solid. For many materials this selectively reflected light is in the infrared portion of the spectrum of electromagnetic waves with a wavelength approximately 100 times that of visible light. Reststrahlen is used to study the vibrations of ions in solids and to obtain infrared radiation of a narrow frequency range for experimental purposes.

Most of the light that strikes a transparent solid is transmitted through it, and some is absorbed within it. Some light of all frequencies is also reflected at its surface just as in the case of an ordinary mirror. Light of a specific frequency close to that of the frequency of vibration of the ions of the material about their regularly spaced positions in the solid, however, cannot travel far into the solid. Some of this light is absorbed near the surface, where the energy of the light is transferred to the vibration of the ions, and some is reflected as reststrahlen. More than 90 percent of the light of the correct frequency that falls on the surface of certain solids may be reflected in this selective way. After several reflections, the remaining radiation (hence the name residual radiation) is all nearly of the same frequency.

Resumption Act of 1875, in U.S. history, culmination of the struggle between "soft money" forces which advocated continued use of Civil War greenbacks and their "hard money" opponents who wanted to redeem the paper money and resume a specie currency.

By the end of the Civil War, more than $430 million in greenbacks were in circulation, made legal tender by congressional mandate. After the Supreme Court sanctioned the constitutionality of the greenbacks as legal tender, hard money advocates in Congress pushed for early resumption of specie payments and retirement of the paper money.

On Jan. 14, 1875, Congress passed the Resumption Act, which called for the secretary of the Treasury to redeem legal-tender notes in specie beginning Jan. 1, 1879. The bill also called for reducing the greenbacks in circulation to $300 million and for replacing the fractional paper currency ("shinplasters") with silver coins as rapidly as possible.

Members of the new Greenback Party were bitterly opposed to the Resumption Act, and in 1878 they succeeded in raising the amount of paper money allowed in circulation. Specie resumption proceeded on schedule, however, and Treasury secretary John Sherman accumulated enough gold to meet the expected demand. When the public realized that the paper money was "good as gold," there was no rush to redeem, and greenbacks continued as the accepted currency.

resurrection, the rising from the dead of a divine or human being who still retains his own personhood, or individuality, though the body may or may not be changed. The belief in the resurrection of the body is usually associated with Christianity, because of the doctrine of the Resurrection of Christ, but it also is associated with later Judaism, which provided basic ideas that were expanded in Christianity and Islām.

Ancient Near Eastern religious thought provided a background for belief in the resurrection of a divine being (*e.g.,* the Babylonian vegetation god Tammuz), but belief in personal resurrection of humans was unknown. In Greco-Roman religious thought there was a belief in the immortality of the soul, but not in the resurrection of the body. Symbolic resurrection, or rebirth of the spirit, occurred in the Hellenistic mystery religions, such as the religion of the goddess Isis, but postmortem corporeal resurrection was not recognized.

The expectation of the resurrection of the dead is found in several Old Testament works. In the Book of Ezekiel, there is an anticipation that the righteous Israelites will rise from the dead. The Book of Daniel further developed the hope of resurrection with both the righteous and unrighteous Israelites being raised from the dead, after which will occur a judgment, with the righteous participating in an eternal messianic kingdom and the unrighteous being excluded. In some intertestamental literature, such as *The Syriac Apocalypse of Baruch,* there is an expectation of a universal resurrection at the advent of the Messiah.

The Resurrection of Christ, a central doctrine of Christianity, is based on the belief that Jesus Christ was raised from the dead on the third day after his Crucifixion and that through his conquering of death all believers will subsequently share in his victory over "sin, death, and the devil." The celebration of this event, called Easter, or the Festival of the Resurrection, is the major feast day of the church. The accounts of the Resurrection of Jesus are found in the four Gospels—Matthew, Mark, Luke, and John—and various theological expressions of the early church's universal conviction and consensus that Christ rose from the dead are found throughout the rest of the New Testament, especially in the letters of the Apostle Paul (*e.g.,* I Cor. 15).

According to the Gospel accounts, certain woman disciples went to the tomb of Jesus, which was located in the garden of Joseph of Arimathea, a member of the Sanhedrin (the supreme Jewish religious court) and a secret disciple of Jesus; they found the stone sealing the tomb moved and the tomb empty, and they informed Peter and other disciples that the body of Jesus was not there. Later, various disciples saw Jesus in Jerusalem, even entering a room that was locked; he was also seen in Galilee. (Accounts of the locations and occasions of the appearances differ in various Gospels.) Other than such appearances noted in the Gospels, the account of the resurrected Lord's walking the Earth for 40 days and subsequently ascending into heaven is found only in the book of the Acts of the Apostles.

Islām also teaches a doctrine of resurrection of the dead prior to the time of judgment. A similar belief is found in Zoroastrianism.

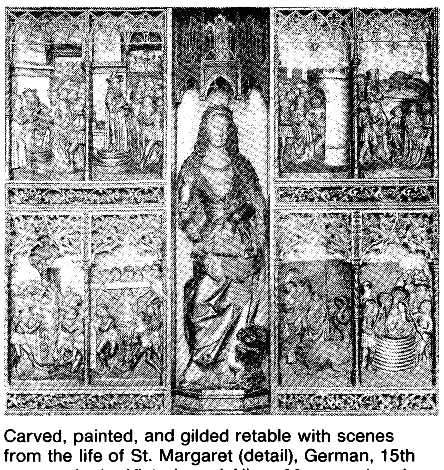
resurrection plant: *see* rose of Jericho.

Reszke, Jean de, also spelled JAN RETZSKÉ, original name JAN MIECZYSLAW (b. Jan. 14, 1850, Warsaw—d. April 3, 1925, Nice, Fr.), Polish operatic tenor, celebrated for his beautiful voice, phrasing, and enunciation as well as his charm and striking presence.

Of a musical family, de Reszke was first taught by his mother, then by vocal coaches in Warsaw and Paris. After an undistinguished early career as a baritone under the name Giovanni di Reschi in Italy, London, and Paris, he retrained as a tenor with Giovanni Sbriglia and in 1879 made an inauspicious debut in Madrid in Giacomo Meyerbeer's *Robert le diable.*

For the next few years de Reszke concentrated on concert performances, until persuaded to create John the Baptist in the Paris premiere of Jules Massenet's *Hérodiade* at the Paris Opéra in 1884. De Reszke's performance was a triumph, and for the next five years he was the leading tenor of the Paris Opéra, where in 1885 he created Rodrique in *Le Cid,* written for him by Massenet. He first sang Wagnerian roles in London, as Lohengrin in 1887 and as Walther in *Die Meistersinger* in 1888. In 1891 he made his U.S. debut in Chicago and was engaged by the Metropolitan Opera in New York City where he remained until 1901, winning great acclaim in Wagnerian roles, above all as Tristan. In 1902 he withdrew to Paris and teaching, and in 1919 he settled in Nice. He often performed with his brother Edouard and his sister Josephine, both eminent singers.

retable, ornamental panel behind an altar and, in the more limited sense, the shelf behind an altar on which are placed the crucifix, candlesticks, and other liturgical objects. The panel is usually made of wood or stone, though sometimes of metal, and is decorated with paintings, statues, or mosaic depicting the Crucifixion or a similar subject. Although frequently forming part of the architectural structure of the church, especially in the High Gothic period, retables can be detached and, sometimes, as in the case of the famous retable by Hubert and Jan van Eyck, "The Adoration of the Lamb" (1432; also known as the "Ghent Altarpiece," Cathedral of Saint-Bavon, Ghent), consist merely of a painting. Probably the most well-known retable is that in the basilica of St. Mark in Venice, which is one of the most remarkable examples in existence of the craft of the jeweller and goldsmith. Originally commissioned in 976, the St. Mark's retable was enlarged and enriched in the 13th century. With the development of freestanding altars, retables have become extinct in contemporary church architecture. *See also* altarpiece.



Carved, painted, and gilded retable with scenes from the life of St. Margaret (detail), German, 15th century; in the Victoria and Albert Museum, London

By courtesy of the Victoria and Albert Museum, London

retailing, the selling of merchandise and certain services to the consumer. It ordinarily involves the selling of individual units or small lots to large numbers of customers by a business set up for that specific purpose. In the broadest sense retailing can be said to have begun the first time one item of value was bartered for another. In the more restricted sense of a specialized, full-time commercial activity, retailing began several thousand years ago when peddlers first began hawking their wares and when the first marketplaces were formed.

As with most other business activities, retailing is extremely competitive, and the mortality rate of retail establishments is relatively high. The basic competition is price competition, but this is moderated somewhat by such non-price forms of competition as convenience of location, selection and display of merchandise, attractiveness of the retail establishment itself, and intangible factors such as reputation in the community. Competition for sales has led to a blurring of traditional product lines in retailing, and many establishments offer a much wider variety of merchandise than their basic classification would indicate (*e.g.,* drugstores may carry food, clothing, office supplies, hardware, etc.).

The diversity of retailing is evident in the many forms this commercial activity now takes, including vending machines, door-to-door sales, telephone sales, mail-order houses, specialty stores, department stores, supermarkets, discount houses, and consumer cooperatives. Whatever form it takes, however, the essence of good retailing remains the same: attractive, appropriate merchandise offered for sale in an attractive, eye-catching manner at a reasonable price at a convenient location.

For international statistical data on retail trade, see BRITANNICA WORLD DATA in the current *Britannica Book of the Year.*

retaining wall, also called REVETMENT, or BREAST WALL, freestanding wall either resisting some weight on one side or preventing the erosion of an embankment. It may also be "battered," that is, inclined toward the load it is bearing.

There are a number of methods employed to resist the lateral force against such a wall. The most basic type of reinforced retaining wall is the gravity wall, which is of massive concrete that is prevented from falling over by simple gravity. The cantilever retaining wall has cantilever footings, which have tie beams balancing the asymmetrical load. A counterfort retaining wall is a cantilever wall with counterforts or buttresses attached to the inside face of the wall to further resist lateral thrust.

Retalhuleu, department, southwestern Guatemala, bounded on the southwest by the Pacific Ocean. The northeastern portion of the territory of 717 sq mi (1,856 sq km) rises into the central highlands, in which coffee is grown on the mountain slopes and hardwoods are milled. The rest of Retalhuleu lies in the Pacific coastal lowlands, where there are plantations of sugarcane, cotton, rice, and cacao. Much of this portion of the territory's land is devoted to the feeding of beef cattle. Retalhuleu (*q.v.*), the departmental capital, lies near the Pacific Coast Highway and on the railroad linking Champerico, one of the nation's chief Pacific seaports, with Guatemala City. Pop. (1982 est.) 206,543.

Retalhuleu, capital, Retalhuleu department, southwestern Guatemala, on the Pacific piedmont 784 ft (239 m) above sea level. In addition to being an administrative centre, Retalhuleu is a commercial and manufacturing centre for the fertile agricultural hinterland. Coffee and sugarcane plantations are most prominent; but grains also are cultivated, and livestock and bees are raised. There is lumbering and liquor distilling in the vicinity. The city's customshouse serves its port, Champerico, 27 mi (47 km) by highway and railroad to the southwest. Retalhuleu is on the Pacific Coast Highway and is linked by highway to Quezaltenango; the city is also accessible by air. Pop. (1981 prelim.) mun., 45,977.

retardation, mental: *see* mental retardation.

Retford, East (England): *see* East Retford.

Rethel, Alfred (b. May 15, 1816, Aachen—d. Dec. 1, 1859, Düsseldorf), German artist who painted historical and biblical subjects on a heroic scale that was rare in the Germany of his time but who is best remembered for his vitriolic series of woodcuts, "The Dance of Death." Although a conservative, he used middle-class raillery against the Revolution of 1848 in woodcuts anticipating the often leftist vehemence of 20th-century German Expressionism.

Precocious in his art, Rethel entered the Düsseldorf Academy when he was 13 years old and proceeded in 1836 to Frankfurt am Main, where he was chosen to decorate the walls of the venerable Römer Hall. In 1841 he was prizewinner in a contest to decorate the Kaisersaal at Aachen with frescoes on the career of Charlemagne, a project that he was never to complete.

While in Rome in 1844, Rethel painted his "Hannibal Crossing the Alps" cycle, and then spent a few years in Dresden. Symptoms of mental disorder appeared during a second visit to Rome (1852–53). He died in a Düsseldorf asylum.

The youthful romanticism of such large-scale works as "Entry of Charlemagne into Pavia" presents a startling contrast to his sardonic, inventive "Dance of Death." The most famous of his series, "Death as Conqueror over the Barricades" (1848), shows a skeleton on horseback leading revolutionaries past corpses and mourners. In its precision of line and mood, it is reminiscent of Albrecht Dürer's drawings.

Réthimnon, historically RHITHYMNA, town and capital of the *nomós* (department) of Rethímni, north central Crete, Greece. A town and port on Almiroú Bay, Réthimnon trades in wheat, almonds, olive oil, and wine. Lying north of the ancient Mycenaean town of Rithymna, Réthimnon was also a stronghold during the Venetian period in the late Middle Ages, when it was called Retimo; its port shipped malmsey (malvasia) wine. The city was captured in 1645 by the Turks. West of Réthimnon is the small port of Yeoryioúpolis, which has sandy beaches on the east. Pop. (1981) 17,736.

List of Abbreviations

A.B.	bachelor of arts (Latin *artium baccalaureus*)
ac	acre(s)
Ac	actinium
AC	alternating current
A.C.T.	Australian Capital Territory
AD	in the year of the Lord (Latin *anno Domini*)
Adm.	Admiral
Afg.	Afghanistan
Ag	silver (Latin *argentum*)
AG	Limited-liability Company (German *Aktiengesellschaft*)
AH	in the year of the hijrah (hegira), or Muslim era (Latin *anno Hegirae*)
Al	aluminum, aluminium
Ala.	Alabama
Alb.	Albania
Alg.	Algeria
Alta.	Alberta
Am	americium
AM	before noon (Latin *ante meridiem*)
AM	amplitude modulation
A.M.	master of arts (Latin *artium magister*)
Ar	argon
Arg.	Argentina
Ariz.	Arizona
Ark.	Arkansas
As	arsenic
A.S.S.R.	Autonomous Soviet Socialist Republic
At	astatine
Au	gold (Latin *aurum*)
Aug.	August
b.	born
B	boron
Ba	barium
B.A.	bachelor of arts
BC	before Christ
B.C.	British Columbia
BCE	before the Christian era, or Common Era
Be	beryllium
B.Ed.	bachelor of education
Belg.	Belgium
Bi	bismuth
Bk	berkelium
Bol.	Bolivia
BP	before the present
B.Ph.	bachelor of philosophy
Br	bromine
Braz.	Brazil
Brig.	Brigadier
Brit.	British
B.S.	bachelor of science
B.Sc.	bachelor of science
Bulg.	Bulgaria
c.	about, approximately (Latin *circa*)
C	carbon; Celsius
Ca	calcium
Calif.	California
Can.	Canada
Capt.	Captain
Cb	columbium
C.B.	Companion of the Order of the Bath
C.B.E.	Companion of the Order of the British Empire
Cd	cadmium
Ce	cerium
CE	Christian era, Common Era
cf.	compare (Latin *confer*)
Cf	californium
cg	centigram(s)
ch.	chapter
C.H.	Member of the Order of Companions of Honour
Chron.	Chronicles (Bible)
Cia.	Company (Italian *Compagnia;* Portuguese *Companhia;* Spanish *Compañia*)
Cie.	Company (French *Compagnie*)
cl	centilitre(s)
Cl	chlorine
cm	centimetre(s)
Cm	curium
C.M.G.	Companion of the Order of St. Michael and St. George
CMSA	consolidated metropolitan statistical area
Co	cobalt
Co.	Company
Col.	Colonel; Colossians (Bible)
Colo.	Colorado
Colom.	Colombia
Comdr.	Commander
Comdt.	Commandant
Commo.	Commodore
Conn.	Connecticut
Cor.	Corinthians (Bible)
Corp.	Corporation
cos	cosine
cot	cotangent
Cr	chromium
Cs	cesium
csc	cosecant
cu	cubic
Cu	copper (Latin *cuprum*)
C.V.O.	Commander of the Royal Victorian Order
Czech.	Czechoslovakia
d.	died
Dan.	Daniel (Bible)
D.B.E.	Dame Commander of the Order of the British Empire
DC	direct current
D.C.	District of Columbia
D.C.M.G.	Dame Commander of the Order of St. Michael and St. George
D.C.V.O.	Dame Commander of the Royal Victorian Order
D.D.	doctor of divinity
Dec.	December
Del.	Delaware
Den.	Denmark
Deut.	Deuteronomy (Bible)
D.F.	Federal District (Spanish *Distrito Federal*)
D.Litt.	doctor of letters (Latin *doctor litterarum*)
Dom.Rep.	Dominican Republic
Dr.	Doctor
Dy	dysprosium
E	east
Eccles.	Ecclesiastes (Bible)
ed.	edited; edition; editor
Ed.B.	bachelor of education
eds.	editors
e.g.	for example (Latin *exempli gratia*)
E.Ger.	East Germany
Eng.	England; English
Eph.	Ephesians (Bible)
Er	erbium
Es	einsteinium
est.	estimate; estimated
Esth.	Esther (Bible)
et al.	and others (Latin *et alii,* or *aliae*)
et seq.	and following page(s) (Latin *et sequens, sequentes,* or *sequentia*)
etc.	and so forth (Latin *et cetera*)
Eth.	Ethiopia
Eu	europium
Ex.	Exodus (Bible)
Ezek.	Ezekiel (Bible)
F	Fahrenheit; fluorine
Fe	iron (Latin *ferrum*)
Feb.	February
ff.	and following pages
Fig.	Figure
Fin.	Finland
fl.	flourished (Latin *floruit*)
Fla.	Florida
Fm	fermium
FM	frequency modulation
Fr	francium
Fr.	France
ft	foot, feet
Ft.	Fort
g	gram(s)
Ga	gallium
Ga.	Georgia
gal	gallon(s)
Gal.	Galatians (Bible)
G.B.E.	Knight (or Dame) Grand Cross of the Order of the British Empire
G.C.B.	Knight (or Dame) Grand Cross of the Order of the Bath
G.C.M.G.	Knight (or Dame) Grand Cross of the Order of St. Michael and St. George
G.C.V.O.	Knight (or Dame) Grand Cross of the Royal Victorian Order
Gd	gadolinium
Ge	germanium
Gen.	General; Genesis (Bible)
Ger.	Germany
GmbH	Company with Limited Liability (German *Gesellschaft mit beschränkter Haftung*)
Guat.	Guatemala
h	hour
H	hydrogen
ha	hectare(s)
Ha	hahnium
Hab.	Habakkuk (Bible)
Hag.	Haggai (Bible)
He	helium
Heb.	Hebrews (Bible)
Hf	hafnium
Hg	mercury (Latin *hydrargyrum*)
HMS	His, or Her, Majesty's Ship, or Service
HMSO	His, or Her, Majesty's Stationery Office
Ho	holmium
Hos.	Hosea (Bible)
hr	hour(s)
Hung.	Hungary
I	iodine
ibid.	in the same place (Latin *ibidem*)
Ice.	Iceland
i.e.	that is (Latin *id est*)
Ill.	Illinois
in.	inch(es)
In	indium
Inc.	Incorporated
Ind.	Indiana
Indon.	Indonesia
Ir	iridium
Ire.	Ireland
Isa.	Isaiah (Bible)
Jam.	Jamaica
Jan.	January
Jer.	Jeremiah (Bible)
Josh.	Joshua (Bible)
Jr.	Junior
Judg.	Judges (Bible)
K	Kelvin; potassium (Latin *kalium*); Köchel catalog number
Kan.	Kansas
K.B.E.	Knight Commander of the Order of the British Empire
K.C.B.	Knight Commander of the Order of the Bath
K.C.M.G.	Knight Commander of the Order of St. Michael and St. George
K.C.V.O.	Knight Commander of the Royal Victorian Order
kg	kilogram(s)
KG	Limited Partnership (German *Kommandit Gesellschaft*)
K.G.	Knight of the Order of the Garter
KK	Limited-liability Company (Japanese *Kabushiki Kaisha*)
kl	kilolitre(s)
km	kilometre(s)
kph	kilometre(s) per hour
Kr	krypton
K.T.	Knight of the Order of the Thistle
Ky.	Kentucky
l	litre(s)
La	lanthanum
La.	Louisiana
Lam.	Lamentations (Bible)
lb	pound(s)
Lev.	Leviticus (Bible)
Li	lithium
Liech.	Liechtenstein
Lieut.	Lieutenant
LL.B.	bachelor of laws (Latin *legum baccalaureus*)
LL.D.	doctor of laws (Latin *legum doctor*)
log	logarithm
Lr	lawrencium
Ltd.	Limited
Lu	lutetium
Luxem.	Luxembourg
m	metre(s)
M.A.	master of arts
Maj.	Major
Mal.	Malachi (Bible)
Man.	Manitoba
Mass.	Massachusetts
Matt.	Matthew (Bible)
M.B.E.	Member of the Order of the British Empire
mbH	Limited, with Limited Liability (German *mit beschränkter Haftung*)
Md	mendelevium
Md.	Maryland
M.D.	doctor of medicine (Latin *medicinae doctor*)
Mex.	Mexico
mg	milligram(s)
Mg	magnesium
mi	mile(s)
Mic.	Micah (Bible)
Mich.	Michigan
Mij	Company (Dutch *Maatschappij*)
min	minute(s)
Minn.	Minnesota
Miss.	Mississippi
ml	millilitre(s)
Mlle	Mademoiselle
mm	millimetre(s)
Mme	Madame
Mn	manganese
Mo	molybdenum
Mo.	Missouri
Mong.	Mongolia
Mont.	Montana
Mor.	Morocco
MP	member of Parliament
mph	mile(s) per hour
Mr.	Mister
Mrs.	"Missus"
MS.	manuscript
M.S.	master of science
MSA	metropolitan statistical area
M.Sc.	master of science

Msgr.	Monsignor
MSS.	manuscripts
Mt.	Mount; Mountain(s)
mun.	municipality
MV	Motor Vessel
M.V.O.	Member of the Royal Victorian Order
N	nitrogen; north
Na	sodium (Latin *natrium*)
NA	National Association
Nah.	Nahum (Bible)
Nb	niobium
N.B.	New Brunswick
N.C.	North Carolina
n.d.	no date
Nd	neodymium
N.D.	North Dakota
Ne	neon
NE	northeast
Neb.	Nebraska
Neh.	Nehemiah (Bible)
Neth.	The Netherlands
Nev.	Nevada
Nfd.	Newfoundland
N.H.	New Hampshire
Ni	nickel
Nic.	Nicaragua
N.Ire.	Northern Ireland
N.J.	New Jersey
N.Kor.	North Korea
N.M.	New Mexico
no.	number
No	nobelium
Nor.	Norway
Nov.	November
Np	neptunium
NS	Nuclear Ship
N.S.	New Style (calendar); Nova Scotia
N.S.W.	New South Wales
N.Terr.	Northern Territory
Num.	Numbers (Bible)
NV	Limited-liability Company (Dutch *Naamloze Vennootschap*)
NW	northwest
N.W.Terr.	Northwest Territories
N.Y.	New York
N.Z.	New Zealand
O	oxygen
Obad.	Obadiah (Bible)
O.B.E.	Officer of the Order of the British Empire
Oct.	October
Okla.	Oklahoma
Ont.	Ontario
op.	opus
op. cit.	in the work cited (Latin *opere citato,* or *opus citato*)
Ore.	Oregon
Os	osmium
O.S.	Old Style (calendar)
oz	ounce(s)
p.	page
P	phosphorus
pA	Limited (Italian *per Azioni*)
Pa	protactinium
Pa.	Pennsylvania
Pak.	Pakistan
Pan.	Panama
Pb	lead (Latin *plumbum*)
Pd	palladium
P.E.I.	Prince Edward Island
Pet.	Peter (Bible)
pH	potential of hydrogen (acidity–alkalinity factor)
Ph.B.	bachelor of philosophy (Latin *philosophiae baccalaureus*)
Ph.D.	doctor of philosophy (Latin *philosophiae doctor*)
Phil.	Philippians (Bible); Philippines
Philem.	Philemon (Bible)
PLC	Public Limited Company
Pm	promethium
PM	afternoon (Latin *post meridiem*)
PMSA	primary metropolitan statistical area
Po	polonium
Pol.	Poland
pop.	population
Port.	Portugal
pp.	pages
Pr	praseodymium
P.R.	Puerto Rico
prelim.	preliminary
Pres.	President
Prov.	Proverbs (Bible)
Ps.	Psalms (Bible)
Pt	platinum
Pu	plutonium
qq.v.	which see (plural; Latin *quae vide*)
Que.	Quebec
Queen.	Queensland
q.v.	which see (singular; Latin *quod vide*)
R	Rankine
Ra	radium
Rb	rubidium
Re	rhenium
rev.	revised; revision
Rev.	Revelations (Bible); Reverend
Rf	rutherfordium
Rh	rhodium
R.I.	Rhode Island
Rn	radon
Rom.	Romania; Romans (Bible)
rpm	revolutions per minute
Rt. Rev.	Right Reverend
Ru	ruthenium
s	second
S	south; sulfur
S.	Saint (*san, santo, santa, sant'*)
S. of Sol.	Song of Solomon (Bible)
SA	Limited-liability Company (French *Société Anonyme;* Italian *Società Anònima;* Portuguese *Sociedade Anónima;* Spanish *Sociedad Anónima*)
S.Af.	South Africa
Sam.	Samuel (Bible)
Sask.	Saskatchewan
S.Aus.	South Australia
Sb	antimony (Latin *stibium*)
Sc	scandium
S.C.	South Carolina
Scot.	Scotland
SCSA	standard consolidated statistical area
S.D.	South Dakota
Se	selenium
SE	southeast
sec	secant; second(s)
Sept.	September
S.F.S.R.	Soviet Federated Socialist Republic
Si	silicon
sin	sine
S.Kor.	South Korea
Sm	samarium
SMSA	standard metropolitan statistical area
Sn	tin (Latin *stannum*)
SpA	Limited-liability Company (Italian *Società per Azioni*)
sq	square
Sr	strontium
Sr.	Senior
SS	Steamship
SS.	Saints; Saintliest, or Holiest (Italian *Santissimo, Santissima*)
S.S.R.	Soviet Socialist Republic
St.	Saint (*Sankt, Sint*)
Sta.	Saint (*Santa*)
Ste.	Saint (*Sainte*)
SW	southwest
Swed.	Sweden
Switz.	Switzerland
Ta	tantalum
tan	tangent
Tanz.	Tanzania
Tas.	Tasmania
Tb	terbium
Tc	technetium
Te	tellurium
Tenn.	Tennessee
Th	thorium
Thai.	Thailand
Thess.	Thessalonians (Bible)
Ti	titanium
Tim.	Timothy (Bible)
Tit.	Titus (Bible)
Tl	thallium
Tm	thulium
trans.	translated; translation; translator(s)
Tun.	Tunisia
Tur.	Turkey
U	uranium
U.A.E.	United Arab Emirates
U.A.R.	United Arab Republic
U.K.	United Kingdom
UN	United Nations
U.S.	United States
USGPO	United States Government Printing Office
USS	United States Ship
U.S.S.R.	Union of Soviet Socialist Republics
v.	versus (law)
V	vanadium
Va.	Virginia
Venez.	Venezuela
Vic.	Victoria
Vir.Is.	Virgin Islands
vol.	volume(s)
Vt.	Vermont
W	tungsten (wolfram); west
Wash.	Washington
W.Aus.	Western Australia
W.Ger.	West Germany
Wis.	Wisconsin
W.Va.	West Virginia
Wyo.	Wyoming
Xe	Xenon
Y	yttrium
Yb	ytterbium
yd	yard(s)
Yugos.	Yugoslavia
Zech.	Zechariah (Bible)
Zeph.	Zephaniah (Bible)
Zimb.	Zimbabwe
Zn	zinc
Zr	zirconium

Table of Measurement Conversions

To convert	Into	Multiply by
acres	hectares	0.40468564
Celsius (centigrade)	Fahrenheit	$(C° \times 9/5) + 32$
centimetres	inches	0.3937008
cubic feet	cubic metres	0.028316847
cubic metres	cubic feet	35.31467
Fahrenheit	Celsius (centigrade)	$5/9(F° - 32)$
feet	metres	0.3048
gallons (U.S. liquid)	litres	3.785412
grams	ounces (troy)	0.032150747
hectares	acres	2.471054
inches	centimetres	2.54
inches	millimetres	25.4
kilograms	pounds	2.2046226
kilometres	miles (nautical)	0.5399568
kilometres	miles (statute)	0.6213712
litres	gallons (U.S. liquid)	0.26417205
metres	feet	3.2808399
metres	yards	1.093613298
miles (nautical)	kilometres	1.852
miles (statute)	kilometres	1.609344
millilitres	ounces (U.S. fluid)	0.03381402
millimetres	inches	0.03937008
newtons	pounds (of force)	0.224809
ounces (troy)	grams	31.1034768
ounces (U.S. fluid)	millilitres	29.57353
pounds	kilograms	0.45359237
pounds (of force)	newtons	4.44822
square kilometres	square miles	0.38610216
square miles	square kilometres	2.58998811
yards	metres	0.9144